SURGEON GENERAL'S WORKSHOP

Health Promotion and Aging

Background Papers

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Note: *All opinions contained in these papers represent the viewpoint solely of the authors and do not necessarily represent the viewpoint of the Office of the Surgeon General, the Public Health Service and its constituent Agencies, or the Editors.*

Sponsors for this Workshop are Administration on Aging, Health Resources and Services Administration, Food and Drug Administration, National Institute on Aging, the Office of Minority Health, Office of Disease Prevention and Health Promotion, Centers for Disease Control, National Institute of Mental Health, National Institute on Alcohol Abuse and Alcoholism, the Brookdale Foundation, and the Henry J. Kaiser Family Foundation.

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DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

The Surgeon General of the
Public Health Service
Rockville MD 20857

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Dear Workshop Participant,

Change often offers opportunity! As our society changes and we have an older population, age has traditionally been equated with diminished capacity and ability. This does not necessarily have to be the expected outcome. The combined expertise of the scientific community, the interest of the aging network, and the will of older individuals to modify their way of living to accommodate healthful lifestyles, can allow later life to be both meaningful and active.

At my request, individuals who have expertise in various aspects of health promotion and aging have compiled a series of papers that seek to document what we know about health promotion research and activities. These papers are thus provided to you in preparation for the deliberation of the Workshop participants on Health Promotion and Aging. Though they may not offer answers, the papers will hopefully provide an overview of what is known and provoke thought on the topic areas prior to the meeting. In the same manner, the papers do not seek to provide answers, for in many instances we do not necessarily have these answers yet. We do have indicators and with the proper emphasis and encouragement, we hope to move forward into the arena of preventive activities and healthful lifestyles.

Please consider these papers as starting points for your further thought and deliberation, and more importantly, for our joint action in the application of health promotion to our aging society.

C. Everett Koop, M. D.
Surgeon General

Surgeon General's Workshop

Health Promotion and Aging

Background Papers

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Health Promotion and Aging
"Alcohol"

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Alcohol is here to stay. Older people probably have a better sense of the meaning of that statement than younger people since anyone over the age of 55 lived part of their life under Prohibition. Anyone over the age of 65 probably remembers at least fragments of the "roaring twenties", and anyone over seventy probably recalls Temperance slogans, speeches and rallies. Older people are also here to stay. With people over 65 representing approximately 12% of the population, they are the fastest growing segment of the society, and include many more people of increasingly advanced age. As the quality of life for these older people is strongly tied to the maintenance of health, it is appropriate that there should be a consideration of the relationship of age and alcohol from a health perspective.

Interest and concern about the incidence of alcohol use and abuse by the older portion of the population have increased dramatically over the last 20 years. This increase is evident in the core of alcohol literature, as well as in the publications of many disciplines, reflecting the multidisciplinary dimensions of the phenomenon. It is being addressed in professional journals, giving evidence that the problem is being encountered by the many systems and agencies that provide services to older people. Yet despite this tide of attention, the area of study and the level of response to the need do not seem to gain much headway. In view of all the needs of older people in our society, problems related to alcohol are relegated to a low place on the priority list. And in the alcohol field, the aged do not appear to generate the excitement and involvement of other population groups.

The society is becoming increasingly sensitive to the presence of elderly people. By sheer weight of numbers, it is becoming more imperative that issues related to their health and well-being be addressed. The pervasiveness of the use of alcohol as a societal practice, and the types of impact that this use can have on the individuals and the resources of the society, require that it be one of the areas addressed in relation to the older segment of the society.

BASIC DEMOGRAPHIC AND POPULATION DATA

Extent of drinking

In considering the data available that indicates the nature and the extent of the problem, it should be noted that the designations of the older age and the designations related to alcohol use and abuse are specific to the individual study, and become relative terms when used to discuss several studies that may not have the same specific criteria.

Cross sectional studies of the use of alcohol have provided information that, when compared to younger age groups, the rates of abstainers increase and the

percentage of drinkers decrease in the older age groups. Cahalan et al. (1969), using national household survey data, reported the percentage abstainers by age group: age 40-49, 29%; age 50-59, 40%; and age 60+, 47%. The proportion of heavy drinkers for the same age groups were 15%, 10% and 6%, respectively. For men, Cahalan reported that more than half of the men over 65 were not regular drinkers (54% being either abstinent or infrequent drinkers) and the lowest percentage of heavy drinkers were found in this age group. In the age group of 60-64, 20% were classified as heavy drinkers, representing 35% of those that drank. At age 65, this figure dropped to 7%, or 11% of those that drank. In the same study, for women, there was similar decline but evidenced at age 50. Two thirds of women aged 50 to 64 did not drink at all or infrequently. After age fifty, the percentage of heavy drinkers among women became inconsequential.

Similar tendencies were reported by Barnes (1979) from a general population survey in western New York state, by Christopherson et al. (1984) from a survey in rural Arizona, and by Meyers et al. (1981) from a household survey in Boston. Barnes noted that while the regional rates of heavy drinking are significantly higher than the national rates, the trends holds. Rates of abstinence increased from 13% for those age 50-59, to 31% for age 60-96. In addition, Barnes refined the age group of 60+ and reported that 24% of males age 60-69 were heavy drinkers; for those age 70-96, 6% were in that category. Among females, heavy drinkers accounted for none of those age 60-69, but 2% of those age 70-90.

The reasons for the decrease in the proportion of drinkers from the younger to the older age categories has been considered by several researchers. Items were included in several studies that inquired about previous drinking patterns or problems. Responses frequently mentioned concerns for health or health problems that were experienced as a reason to temper the quantity and/or the frequency of drinking. Other responses ranged from economic reasons, changing social opportunities, and changing response to the substance. Gomberg (1982) has summarized possible explanations for the decrease in social drinking as economic (decrease in drinking may result from lower income), physiology (change in obtained blood alcohol levels with physical aging), effects of alcohol (resulting impacts and behaviors are no longer worth the cost), life cycle differences (decrease a natural occurrence as cohorts ages), unique historical aspects (drinking habits of current generation influenced by Prohibition, Depression), and medical problems (health status, with increased medical problems, cause older people to limit or eliminate drinking).

Two additional items should be kept in mind when considering this data. The cohorts of older people that are reported in each of these studies are products of the social and historical influences of their time, which are then intertwined with an array of unique individual experiences. Subsequent generations of older people will, in many respects, be very different from the older people of these studies. Specifically, it should be remembered that cross sectional studies present data that evidence a lower percentage of abstainers and an increase in the level of drinking in the younger age groups.

There is also evidence in surveys that drinking practices remain consistent overtime with some people. Christopherson (1984) has presented data that there is a tendency for people to carry drinking patterns into old age as long as circumstances and health permit. Data from the Normative Drinking Study confirms this (Glynn et al. 1984). Men, originally surveyed in their 40's and 50's, ten years later reported consistent drinking habits. It would appear that future

generations of older people would present a larger proportion of drinkers and a potential of more people who continue to drink at higher levels into old age.

Problems with drinking

Evidence of problems related to alcohol use among older people comes from several types of sources with a range of criteria for the designation of a problem. Cahalan (1970) utilized the self reporting of eleven types of problems, including quantity/frequency and pattern of drinking, elements of physical and psychological dependency, and interpersonal, social, health, economic and legal problems. He reported that 12% of men age 60-69 had a current problem score of 7+. For age 70+, it was 1%. For women age 60-69, 1% had a current problem score of 7+; age 70+, less than one-half percent. These figures do represent a tapering off of drinking problems for men after age 50 but continuing until age 70. Further analysis involved the development of a social-psychological risk score which included attitude toward drinking, environmental support for heavy drinking, alienation and maladjustment, impulsivity and non-conformity, looseness of social controls, and unfavorable expectations. Data indicates that men 60+ of highest risk score show almost the same problem score as those of younger age groups.

A second community survey source of information on problems related to drinking is the Epidemiologic Catchment Area Study which utilizes the NIMH Diagnostic Interview Schedule. This schedule provides for assessment of alcohol abuse and dependence based on the American Psychiatric Association's Diagnostic and Statistical Manual, DSM-III (American Psychiatric Association 1980). Three sites of the five in the study have presented information related to alcohol abuse and dependence. The lowest rates of alcohol abuse and alcohol dependency were among those 65+, ranging from 4% to 8% at sometime in their life. In terms of the recent occurrence of problems (within the last 6 months), 3% of males reported a problem, 1% of females. Similar rates were found for blacks and whites, and social class did not appear to have a large effect (Robins, 1984).

Warheit and Auth (1984), investigating concurrent alcohol and mental health problems, found similar rates for alcohol problems within the older population. In looking at the correlation between mental health concerns and alcohol use, an alcohol risk score was developed and the sample divided into high and low alcohol risk groups. Items included were drinking in general, the frequency of intoxication, problems related to drinking (personal, social and family), self-perceptions regarding the appropriateness of alcohol use, and the use of alcohol to face daily problems. For the older segment of the sample, age 50+, the high risk group generally gave more indications of poor mental and physical health than the low alcohol risk group of the same age. Advancing age was highly associated the increasing feelings of helplessness among the high risk group. Self perception of poor health was more common in the alcohol high risk group. In reporting their present mental health, 39% of the high risk group responded fair or poor; among the low alcohol risk group, only 22.1% reported fair or poor mental health. Almost half (46.3%) of the high risk alcohol group reported at least one hospital stay in the last three years, 14.6% had three or more inpatient stays. This is contrasted with the low risk group that reported 28.7% had one or two stays, 4.7% had three or more. Generally, Warheit and Auth concluded that alcohol use rather than age alone seemed to a better predictor of the kinds of health problems that necessitate hospitalization.

Studies that report on the older population within institutions and medical settings provide additional information. McCusker et al. (1971) conducted a prevalence study of newly admitted patients to the medical wards of a New York City hospital serving a high proportion of blacks and Hispanics. Questionnaires were utilized to gather information to rate alcohol related problems over the past year. The moderate level of the scale, identified as the threshold for the diagnosis of alcoholic, identifed frequent intoxication up to one or two times per week and/or significant impairment in social, family, or occupational functioning, or evidence of physical impairment related to alcohol. In the age group 50-69, 63% of the males and 35% of the females met this criteria.

A study of 113 consecutive male admissions to acute medical wards was made by Schuckit and Miller (1976) in a Veterans Administration Hospital. Interviews established the patient's psychiatric diagnosis, organicity tests determined the presence of organic impairments, chart reviews provided basic demographic information, past and present physical and mental status, medication and drug and alcohol history. A resource person validated the patient information. Of these admissions, 18% (20) were diagnosed as alcoholic, with 55% (11) of these considered inactive, or having had no alcohol related problem in the 6 months prior to hospitalization, although 3 of the 11 still drank.

Data from psychiatric services provides other evidence: of 534 first admissions of patients age 60+, 28% had serious drinking problems (Simon et al. 1968); in an outpatient psychiatric program in Harlem Hospital, 12% of the elderly were noted as having a drinking problem (Zimberg 1969); in a county psychiatric screening ward, among 100 consecutive admissions of persons 60+, 44% were alcoholic (Gaitz and Baer 1971); and in a medical home care program, 13% of the elderly patients requiring psychiatric consultation were diagnosed as alcoholic (Zimberg 1971).

Although it is not possible to determine the actual prevalence, the fact remains that a sizable proportion of the elderly do evidence alcoholism and problem drinking. While recognizing that older people do drink less, an estimate of the prevalence of alcoholism among those who do drink approximates that of other adults, nearly 8% (Nace 1984). Estimated rates in clinical practice with older people ranges from 10 to 20% with a higher proportion among the elderly who are hospitalized and institutionalized (Schuckit and Pastor 1979, Zimberg 1982).

Different types of presentation

As early as 1968, there were attempts to develop a classification system of older alcoholics. It was recognized that there are sub-groups who presented similar histories and symptoms. Simon et al. (1968) reported that among a group of first admission psychiatric patients with serious drinking problems, age 60 and older, about 1/3 had become alcoholic after age 60, while about 2/3 had been alcoholic before age 60 and had a long history of alcohol abuse. He also noted that a little over 1/3 had chronic brain syndrome, but this diagnosis was not exclusive to either group. The proportion of 1/3 late life and 2/3 long standing was confirmed by Rosin and Glatt (1971) from studies of psychiatric home consultations and admissions to alcoholism units and hospital geriatric units. Schuckit and Miller (1976) also made a distinction between early-onset and late on-set, using age 40 as the demarcation. Among the persons ages 65+ being admitted to a medical ward, using this designation, the groups was almost equally

divided.

Carruth et al. (1973) noted three distinct types: individuals with no history of problem drinking until one developed in response to age related stress, a second group that had at times experienced problems but only developed severe and persistent problematic drinking in old age, and a third group who had a long history of alcoholism and continued to drink into old age. Gomberg (1982) also recognized three groups, the survivors: alcoholic persons who have grown older; those with intermittent histories of heavy drinking in response to severe stress; and the reactive problem drinkers who are responding to the stresses and losses of aging by drinking heavily.

The generally accepted division is that of early-onset and late-onset without a specific age of onset. The distribution of 2/3 early-onset vs. 1/3 late onset is generally confirmed by personnel in the field. Different terms are at times used. Geriatric alcoholics (early-onset) are the stereotypic chronic alcohol abusers who have continued to drink while aging, and geriatric problem drinkers (late-onset) include those who had no history of a problem and those who occasionally experienced problems, all of whom develop abusive patterns in response to the stresses of aging (Dupree and Zimberg, 1984).

Recognizing this general classification facilitates the process of identification and treatment. General characteristics of the early-onset individual include a medical history that indicates extended severe drinking, mental pathologies and personality characteristics related to chronic alcohol use, a social history that indicates the impact of alcohol, such as a poor work history, a disrupted or stressed social and family history, poor relationship skills, and fewer economic resources. Late-onset characteristics generally include alcohol related medical problems that may be acute but of shorter duration, better problem solving and relationship skills, and more stable job, family and social histories. Problems in these areas are usually of recent origin and of shorter duration. Psychological problems are generally more focused upon issues related to age, such as loneliness, depression, grief, boredom and pain.

The hidden older problem drinker

Observations have been made by several researchers that older problem drinkers are a hidden population. The high percentage of alcoholics among the older populations in acute medical and psychiatric institutions is probably more reflective of the debilitating and/or long term impact of alcohol on an older person than it is of the sensitivity of the intervention mechanisms that exist. Perceptions of service providers indicate that the older person is underrepresented in the alcohol treatment network. Many reasons are given for the inadequate level of identification. There is a more subtle presentation of symptoms of problem drinking and alcoholism in older people. Presenting symptoms are inaccurately identified as being related solely to medical or psychological problems associated with the aging process. Care providers, including medical personnel, are reluctant to become involved in the identification/intervention process. The elderly themselves may have a lack of awareness about the effects of alcohol and are reluctant to self disclose. Denial and enabling may exist within family units. Due to the life stage, there is a lack of social and occupational identifiers. Finally, significant others and care providers may have the inaccurate perception that the drinking is a rational choice of

behavior, and further, may believe that it is logical given the age of the person.

ALCOHOL, ALCOHOL USE AND HEALTH

The impact of alcohol and alcohol use on the health and well being of any one older person has many dimensions. Of primary importance is the quantity and the frequency of the drinking experiences. How much alcohol is taken into the system and how frequently these occasions occur generally provide information that allows for the description of light, moderate or heavy drinker. A second consideration is the pattern and the duration of the drinking history. Movement along the continuum of type of drinker at different periods in the life span provides a variable to the current impact. Cultural and social norms that influence the designation of appropriate drinking occasions, such as with meals, or at drinking oriented events, may ameliorate or exacerbate the effect of the alcohol on any one occasion, and cumulatively, the effect of the use of alcohol on the entire system. General physical condition, and all the elements that support that condition, such as genetic factors, nutrition, the balance of rest and physical activity, are important. The presence of chronic and acute medical conditions plays a role, as does the existence of drug regimens, whether monitored by a physician or self-prescribed. Generally, the more intense and prolonged the use of alcoholic beverages, the greater the impact the substance ethanol will have upon the health of the individual.

The general process of aging brings its own contribution to health implications for alcohol use. Response to the aging process is highly individual, in terms of persons and all of the components of each person. But there are general principles that apply. Advancing age witnesses a gradual lowering of the level of the homeostatic state. This is accompanied by a lessening of the physical reserve of the entire system and each of its parts. All body systems and organs tend to decrease in efficiency of operation and to loose resiliency. Stress, whether physical, emotional or environmental, has a greater impact upon the system and each of its parts. Returning to the pre-stress state or finding a new level of balance is more gradual, taking a longer period of time than when younger. Vulnerability to disease states increases with age and is compounded by stress. Disease states also increase the vulnerability of older people to the impact of alcohol.

It is particularly important to remember that, as an individual ages, there are greater mutual effects that operate between the physical, social and emotional health of an individual. The older age stage of life brings unique developmental tasks, stresses and age related life crises. In responding to these tasks, stresses and crises, the totality of the person is affected.

Of specific importance to the use of alcohol and other chemical substances are general physiological changes. With age there is a decrease in the lean body mass and an increase in fat storing tissue. Alcohol, being water soluble, is distributed through less lean tissue, resulting in higher concentrations within organs. Generally, when compared to younger people of equal weight and drinking the same amount, older people may be expected to evidence a higher blood alcohol level. Time and rate are also affected. Age has a tendency to slow both the process of metabolism and of elimination. The blood alcohol level may be held for a longer period of time. In addition, the elimination process may be

particularly affected by the presence of medications. The liver, being the principal organ involved, may be operating at a less efficient level and may be required to process multiple substances at the same time. All of these have impact upon the tolerance level, which is generally characterized as decreasing with age (Schuckit 1980, 1982, and Bosmann 1984).

There are medical and health and safety areas that need particular emphasis in the concern of health and alcohol use as related to older people. It must be emphasized that, although there is a wealth of material that addresses the relationships that exist between specific areas and alcohol, the particular emphasis upon the older person frequently has been inferred from other studies or has been inconclusively explored to date. It should also be noted that biomedical research has not thoroughly explored health problems in the older age group, or among segments within that group.

The cardiovascular system

The implications of alcohol use for cardiovascular disease are particularly important in relation to older people as hypertension and heart conditions account for two of the four most common chronic conditions of non-institutionalized elderly. Although the exact relationship between alcohol consumption and the development of cardiovascular diseases has not been determined, there are areas that are important to consider. Generally, alcohol can have a direct effect on the heart muscle leading to an increase in the cardiac rate and output. In older people this may produce stress on the organ itself and on the rest of the cardiovascular system because of a reduced level of physiological reserve. In individuals with impaired cardiac functioning, this may have the ultimate effect of decreased cardiac output and diminished efficiency of the system. Alcohol can directly affect the heart as a cardiac toxin and the cardiovascular system by increasing blood pressure. Excessive amounts of alcohol have been strongly linked with the development of hypertension, stroke, myocardial degeneration, arrhythmia, and cardiac failure. Alcohol can also mask the symptoms of a disease state, such as angina pectoris. Individuals frequently do not feel the associated pain in the chest while drinking but the medical indications are that the affected tissue continues to suffer from the lack of blood flow. Continued or increased activity may increase the stress level although no pain is felt. (Gambert et al. 1984, Hermos et al. 1984, Kannel 1986, Schuckit 1982.)

There is, however, evidence of lower rates of congestive heart disease in association with moderate alcohol intake. Regular use of alcohol appears to have the effect of increasing high density lipoprotein cholesterol which may retard the development of coronary artery disease (Barboriak et al. 1983, Kannel 1986). Non-drinkers had higher mortality rates than those who drank lightly (in reference to the Normative Aging Study) and non-drinkers had higher blood pressures than those who drank in small amounts (in reference to the Framingham Study) (Gordon 1984.)

The central nervous system

The relationship of the health of the central nervous system in the maintenance of autonomy and independence makes it a particularly sensitive area to consider

in relation to alcohol use and aging. There are changes that do take place with age that result in variations in functioning compared to the time when the individual was younger. But for healthy older people these changes do not necessarily have to exert a deleterious effect on the ability to manage their life or to cope with their environment. Age frequently brings an increase in reaction time and in the time needed to retrieve something from memory. With age, there is also an increased tendency to exhibit confusion when under physical, emotional or social stress. Cognitive processes may be slowed but seldom become impossible tasks for healthy older people. Educational gerontology has contributed much to the affirmation of the ability of older people to perform learning tasks provided that the information is well organized, presented in a way that compensates for sensory changes, that the stress of the learning situation is reduced, and the risks associated with performing incorrectly are minimized.

Ethanol affects the central nervous system. It may have the short-term effect of acting as a stimulant. However, the long-term effects are as a depressant. This may result in respiratory depression, sedative-hypnotic effect, ataxia, pronounced disinhibition, impaired motor skills, neuropathy, and unconsciousness. Age related metabolic changes are generally accompanied by an apparent increase in the sensitivity of the brain to all central nervous system depressing drugs, including alcohol. Very small amounts of alcohol can produce symptoms that are commonly identified as age-related mental decrements, or may exacerbate age related phenomenon. The mis-reading of the presentation of an older person is frequently responsible for non-identification of alcohol problems (Bosmann 1984, Schuckit 1982).

Much research has been conducted on the effect of alcohol upon the central nervous system. A prominent theme in that research is the question of accelerated or premature aging as an effect of alcohol use. Functional changes that are related to aging and functional changes that are the result of alcohol use are frequently very similar in their presentation. The processes of aging and of alcohol intoxication have much in common in the way that they affect memory, learning, recognition and organizational processes. In a "worst scenario" of the aging process or from long and intense use of alcohol, similar organic changes may take place in the brain and disease states occur. Current research outcomes do not seem to support the theory of premature aging. Although chronic alcoholic drinking appears to increase the behavior defects that accompany aging, as yet, a common pathology has not been identified. Alcohol use is responsible for some brain dysfunction, but the effects seem to be independent of and parallel to the effects of normal aging. Studies do suggest that people who use alcohol to excess appear to run an additional risk of neuropsychological impairment beyond what might be expected from the aging process. Further, since some of the deficits related to alcohol use are at least partially reversible, continued research may illicit some value in terms of therapies for age related problems. (Blusewicz 1982, Bosman 1984, Lowe 1985, Parsons and Leber 1982, Russell 1984.)

Medications and over-the-counter drugs

The use of alcohol combined with a regimen of over-the-counter or prescribed medications is a common but potentially lethal occurrence. As one grows older, the number of drugs one takes usually increase. A figure commonly cited is that

older people who are 12% of the population are using approximately 25% of the prescribed medications. Further, it has been estimated that over-the-counter preparations account for approximately 90% of all drugs taken by the elderly (Baker 1985).

The problem of drug use and misuse has many dimensions and is compounded when drugs are used with alcohol. Alcohol interacts adversely with many drugs, a situation that is particularly significant with other central nervous system depressants. Polypharmacy is not uncommon among older people. Frequently, the medical regimens are being prescribed by more than one physician, and older people often have difficulty in correctly self-administering the medications. The potential for drug interactions and adverse drug reactions is great under such circumstances, particularly in view of the changing physiology with age. All of these situations are intensified with the use of alcohol. Adverse drug and alcohol interactions can be potentially life threatening to older people because of the decrease in reserve in vital organs. Many older people have poor or incorrect conceptualizations of how their bodies handle substances and need education in order to practice healthful habits. Further, many professionals and para-professionals who work with older people are unaware of the seriousness or the extent of the problem. (Atkinson 1984, Glantz 1983, Schuckit 1980.)

Nutrition

Healthful nutritional practices among older people have been a concern of many who work and have contact with the elderly. Nutritional practices are affected by the totality of the life circumstances of older people. Social, psychological, economic and physical factors are important to consider. Changing circumstances within the family unit, such as the loss of a spouse, may affect the pattern of food preparation and may precipitate all but minimal attention to the activity. Depression, social isolation and physical incapacity can intensify and make insurmountable the problems related to the maintenance of a good diet. Life-long dietary practices, which may not have seemed problematic at a younger age, now become detrimental and debilitating. Physical changes that are age related, coupled with the use of medications, may require modification of these practices. The ability to make such changes may be limited by a lack of information, minimal economic resources or lack of access to appropriate facilities for shopping, storage or preparation of food.

Malnutrition has been long recognized as being caused by chronic alcohol use. The impact of the use of alcohol on nutrition is seen as a result of a change in ability to function as well as affecting the appetite, absorption, metabolism and excretion of nutrients. When compounded with physiological aging, with the reduction of functional reserves, the effect may be particularly detrimental. It is widely recognized that the elderly user is much more susceptible to the nutritional consequences of alcoholism. It is not as widely recognized that there may be nutritional consequences for the more social user, particularly if there are acute or chronic diseases present and medical drugs are being taken.

There are many specific nutrition-alcohol interrelationships that should be kept in mind both in the maintenance of healthful practices and in the treatment of alcoholism in elderly people. One will illustrate the weight of the area of consideration. The course of normal aging brings a reduction in bone mass as well as reduction of the capacity of the gastrointesinal tract to absorb calcium.

The presence of metabolic acidosis, a common result of consuming alcoholic beverages, may further aggravate a negative calcium balance. The development of osteoporosis, a frequently identified condition in older people, particularly women, may be aggravated by alcohol use. Adequate calcium levels are also required to maintain the transmission of nerve impulses at appropriate levels. These processes are also negatively affected by age and by the presence of ethanol, and may be subjected to a compounded effect. (Gambert 1984, Mishara and Kastenbaum 1980, Russell 1985.)

Carcinoma

The question of the carcinogenic effects of alcohol use have been of concern for several years. It does appear that there is a tendency for the chronic alcoholic to develop squamous cell carcinoma in the region of the pharynx. Carcinoma of the esophagus is frequently detected in those who are diagnosed as alcoholic, representing over half of all cases of esophageal cancer. There is some evidence that alcohol abuse may also be associated in the development of carcinoma in the mouth.

However, there are methodological problems in the research in this area. It becomes extremely difficult to distinguish between the effects of alcohol and other factors that are frequently present, such as smoking, exposure to pollutants and malnutrition. It has been estimated that approximately 90% of alcoholics are also smokers, and the role of smoking to the development of some kinds of carcinoma has been well documented. Research has also indicated that there may be carcinogenic implications related to the way cells respond to ethanol. It does not appear, however, that alcohol has an equal role in the development of all types of cancer, and where there does appear to be a relationship, additional research is still desired. (Bosmann 1984, Bambert 1984, Mishara and Kastenbaum 1980.)

Safety

Problems related to safety and alcohol use are many, from pedestrian accidents to the interference of an alcohol-induced state in performing simple chores in the kitchen. Stress for older people who are injured in accidents has the same ripple effect on their health and mental outlook as disease states. Older people seem particularly susceptible to falls. Hingson and Howland (1987) report figures from the Center for Disease Control, indicating that each year 200,000 older Americans experience hip fractures associated with falls. Older people are also disproportionately represented in deaths from falls, over one-half of fatal falls involve persons over 75 years of age. There is a strong link between the use of alcohol and falls. In fact, one of the items frequently included in a list of clues of a drinking problem is the experience of falling. Although there is substantial evidence that alcohol increases the risk of falls, studies have not yet provided information that is specific to the elderly. However, from a perspective of maintaining safe practices, the potential effect of the use of alcohol on the incidence of falls among older people should not be neglected (Hingson and Howland 1987).

In discussing burns of older persons, Anous and Heimback (1986) noted that frequently burns tend to be deeper because of delayed reaction times, impaired

senses and the fact that many older burn patients live alone. The reduced capacity of the older physical system has special import in dealing with the stress related to the burn experience as well as affecting the process and time of healing. It was also noted that older cases with documented alcohol problems tended to be loners and to have a higher percent TBSA (Total Body Surface Area) burn. (Anous and Heimbach 1986.)

Benefits from alcohol use

The beneficial use of alcohol with older persons has been a recurring theme in the literature that relates to aging and alcohol. Stories of the prescribing of spiritus frumenti have been documented in many case histories and in studies of practices within care facilities for older people. Common conditions that are addressed in this manner are loss of appetite, as an aid to digestion, as a nutritional supplement, as a relaxant, sedative and a sleeping aid. Most studies of the use of alcohol generally conclude that there is a therapeutic value to the serving of alcoholic beverages in institutional settings. Some note that, under such conditions, the medication levels may be reduced. In many of the studies, there was an effort to provide a varied or special setting for the events of drinking, as well as there being additional staff and others present who were involved in exchanges with the residents of the facility. These factors make it difficult to identify the exact source of the benefits observed (Mishara and Kastenbaum, 1980). In reporting on their own research, Mishara et al. (1975) stated that the amount of alcohol that was consumed was small and that there was an effect of the social setting that supported drinking. There was evidence of psychological benefits in terms of morale, improved sleep and a general sense of improved well-being. It was particularly noted that the participation in the study was voluntary and that a physician's approval had been obtained for each participant.

Other studies have been conducted with non-institutionalized older people. In his study, Kastenbaum reported on the effects of the use of one or two 3 ounce servings of wine on self-sufficient older people living in the community. It was noted that the changes, both those that were subjective and self-reported, and those that were determined by psychological assessment procedures, were generally in the positive direction. On the subjective items, participants reported improved subjective status in terms of morale, improved sleeping patterns, reduced chronic fatigue, anxiety and depression. In objective tests, there was a tendency for those with relatively better functioning to show improvement in behaviors and performances that have strong cognitive components. (Mishara and Kastenbaum 1980.)

Health issues in treatment

For the older person, entry into the treatment system is frequently through a health care agency, usually the acute care hospital. Compared to younger people the older person often presents in a more debilitated condition. Because of the number of pathological conditions that may develop as a result of long term alcohol use, it is not infrequent that the older persons enter the system for treatment of other diagnosed conditions, and then in the process of medical treatment, are encouraged to confront the reality of the relationship that alcohol use has to the current condition and to the prognosis for recovery.

While recognizing that all systems of the body are affected by the use of alcohol and have the potential of reacting adversely, there are certain medical conditions that are indicative of long term use. Cirrhosis of the liver, gastritis, chronic or acute pancreatitis, with accompanying abdominal pain, weight loss and diabetes are significant risks of long term use. Other conditions frequently associated are atrophy and weakness of the muscles, polyneuropathy, the inability of the body to fend off infections or to support healing, malnutrition and dehydration. Pneumonia and pulmonary tuberculosis also occur more frequently among alcoholics. In advanced cases, sever neurological damage may be seen as Korsakoff's psychosis and Wernicke's disease (Mishara and Kastenbaum, 1980). Generally, the late-onset individual presents with fewer and less severe medical complications, although Schuckit and Miller (1986) do point out that this type drinking is during the medically vulnerable years and may cause disproportionate medical problems.

Because of the greater likelihood of the older person entering treatment for related health conditions before entering alcoholism rehabilitation programs, the role of the health care professional in identification and intervention must be recognized. Most older people trust medical personnel and hold them in high regard. Being able to accurately access the situation, to interpret the presenting symptoms correctly and to use the medical record to facilitate breaking through the denial make the health professional a vital link in the network of treatment. The value that many older people place on their health often facilitates and provides motivation for engaging in the process. (Mishara and Kastenbaum 1980, Schuckit 1982, Sherouse 1983.)

There are many medical and health issues that need to be considered in the course of treatment. There is no agreement on the use of medications in the process of treatment, with particular concern focusing on minor tranquilizers and sedatives (Gomberg, 1982). Monitoring the physical conditions and the medication regimen is an ongoing process. In the course of treatment, with medical care, good nutrition including vitamin therapy, and appropriate rest, there is frequently an improvement in the physical well-being of the older person, and specific medical conditions may abate in their severity. However, a parallel situation may also develop. Conditions whose presence and pain are masked by the anesthetic quality of the alcohol become evident. After the alcohol is out of the system, dental problems, urinary tract infections, venereal disease and other conditions may be identified in the course of rehabilitation.

Because of poor physical condition and lack of reserve, older people may require more direct nursing care and help with meals, bathing and personal care. The daily schedule of the treatment program may tax their strength and endurance, and the requirements may have to be modified to allow for more rest. Attendence to medical needs, perhaps even readmittance to an acute care facility, may interrupt the treatment schedule and necessitate decisions or adjustments in administrative policies. The need for a wheel chair, crutches, or assistance in movement affects the participation of the client and requires additional concern on the part of the staff. Attention to hearing aids, teeth, eye glasses, and similar devices, facilitates the recovery process in terms of participation, self-image, and the development of good health habits (Williams 1985).

Other relevant treatment issues

The issue of the responsibility of providing treatment services for the older alcoholic generally focuses on the questions of which service system, age or alcohol treatment, should carry primary responsibility, and whether there should be specialized programs within existing systems. Little has been done to evaluate the effectiveness of different systems or different treatment modalities with older people. Treating within the alcohol service system has been the general approach, with the recommendation that there be some adaptations and a specialized outreach program to reach the older person (Janik and Dunham 1983). Emphasis upon social supports and peer groups appears to increase positive outcomes (Kofoed et al. 1987, Zimberg 1982).

Payment for treatment requires that there be an appropriate mesh between the treatment needs of the individual, the types of alcoholism services that are available and acceptable to that person, and the regulations that govern the resources that may be tapped, whether Medicare, Medicaid, private third party, veterans benefits or others. Working with an older person in need of treatment often requires unusual orchestration abilities on the part of the service provider in order that access to all phases of treatment becomes financially available.

Prevention

Opportunities for prevention programs do exist. Two excellent possibilities exist through the development of self-help groups for older people and the preretirement and retirement planning groups that are often a part of personnel services in industry and business, labor and professional groups and organizations (Gomberg, 1982). Such programs would be of primary benefit to individuals who may at be at risk for the development of late-onset problems. Self-help groups could be developed in the community under the sponsorship of senior centers, community mental health programs, voluntary organization and others. These groups would have the advantage of being holistic in their approach, providing life-coping skills and support systems. By including substance use within their concerns, but avoiding the label, these groups would be more appealing to older people who frequently feel stigmatized by the words problem drinker or alcoholic.

Secondary prevention services could be provided by the development of programs that would sensitize and provide skills to service providers of older people, whether in medical or social services. Intervention at the earliest possible stage precludes the further exacerbation of medical, psychological and social problems, optimizing the possibilities of successful treatment within the context of continuing support systems. Tertiary prevention is an integral part of treatment, targeted to the successful completion of treatment and the prevention of future problems. This approach must also include the development of life skills to help the older alcoholic successfully adjust to the realities of his/her life stage.

There are many programs that have been developed to address prevention issues on all levels. Only a few examples will be sited. The Senior Alcohol Services of Vancouver, Washington, provides community training and information as well as treatment that includes aftercare, couples' counseling and family groups. The Massachusetts Housing Finance Agency through its Tenant Assistant Program (TAP)

provides education, information and referral services in a program that concentrates on outreach to improve the quality of life of the tenants. Elements of the program address all three levels of prevention. The Michigan Office of Substance Abuse Services and the Michigan Office of Services to the Aging sponsored the development of a three volume guide, Older Adult Substance Abuse, designed to foster a team approach to prevention. The three volumes are A Resource Manual, Prevention Program Development, and Medications Information. (Resch and Christensen, 1983.) The Wisconsin Department of Health and Social Services issued a planning guide, Examination of Problems and Solutions Related to the Chronic "Revolving Door" Alcohol Abuser. The final report contains 26 recommendations to break the cycle and to provide for meaningful alternatives. (Wisconsin Department of Health and Social Services 1981) The AAA Foundation for Traffic Safety of Falls Church, VA, has developed a film with guide, Senior Adults, Traffic Safety and Alcohol, which provides information for older people about the substance and the effects of alcohol and problems that it may generate.

A SAMPLE OF NATIONAL EFFORTS

There have been efforts by several agencies and groups to address the concern of aging and alcohol use on a national level. The four that are mentioned are by no means the only efforts, but do illustrate the variety of the efforts that have been made, representing a public policy effort, research, and a treatment related project.

Blue Ribbon Study Commission on Alcoholism and Aging

The Blue Ribbon Study Commission on Alcoholism and Aging, sponsored by the National Council on Alcoholism, was convened in the fall of 1979 with the Honorable Wilbur D. Mills as chairperson. The Commission was composed of a broad range of representatives from government, academia, voluntary organizations and the health and social service sectors. The stated goals of the Commission were:
1. to gather and evaluate present knowledge concerning alcoholism and aging;
2. to identify and analyze the information needed for thorough understanding of the problem through defining specific issues; 3. to identify and evaluate the options open as to what can be done to resolve these issues successfully; and
4. to disseminate the information gathered to the American public and to groups and individuals directly involved in the policy and implementation process. (News release of the National Council on Alcoholism, February 22, 1980.)

The outcomes of the Commission are three. 1. The Commission sponsored a two day tract, The Aging and Alcohol Abuse, at the 1980 National Alcoholism Forum of the National Council on Alcoholism. 2. It organized and sponsored a Mini-Conference on Aging and Alcoholism, held at Wingspread, Racine, WI, in conjunction with the 1981 White House Conference on Aging. 3. It prepared a report, with recommendations, to be included in the proceedings of the 1981 White House Conference on Aging. Six categories of recommendations were included: research and development, education and training, increasing the utilization of services, ensuring and improving the effectiveness of treatment, increasing the availability and access of services and protection of patients' rights.

Research center on aging and alcohol established

In December 1982, the National Institute on Alcohol Abuse and Alcoholism funded the Alcohol Research Center at the University on Gainesville, one of nine national research centers. This center is specifically designated to conduct research into the causes and the consequences of alcohol use and abuse by the elderly. As a interdisciplinary center, the research agenda includes a multi-faceted approach to the subject. An extensive educational program for a broad spectrum of health professionals is a major component of the activities.

Research conference

In November, 1983, a national research conference was convened on The Nature and Extent of Alcohol Problems Among the Elderly. The conference was sponsored by the National Institute on Alcohol Abuse and Alcoholism in collaboration with the National Institute of Mental Health and the National Institute on Aging. The conference produced a monograph by the same title, edited by George Maddox, Ph.D., Lee N. Robins, Ph.D., and Nathan Rosenberg, Ph.D.. In the preface it is stated that "the workshop at Washington University was intended as a beginning point in a systematic NIAAA effort to stimulate research interest and activity in the alcohol-aging area." (p. v.) The keynote address of the conference by Robert Straus (pp.7-28) focused on factors of change as related to both aging and alcohol, the need to develop a biomedical perspective in relation to the topic, and stated that both alcohol studies and gerontology were entering a biobehavioral era of scientific thought and activity. The conference was organized to present key issues and current evidence of mental health and social correlates of alcohol use, presented from research of the Alcohol Research Center of the University of Gainesville, FL, longitudinal data of alcohol problems among the aged from studies in St. Louis and from the Normative Aging Project of the Veterans Administration, and research data from the Epidemiological Catchment Area Studies. Future research needs were addressed by most participant in the course of their papers, emphasizing the need for more current and more extensive research that is specific to the older population.

A demonstration project related to treatment

The Health Care Financing Administration Alcoholism Project was a three year demonstration project targeted to evaluate the cost effectiveness of reimbursement under Medicare of treatment in non-hospital settings. Of the six states involved in the project, most also included the provision of reimbursement under the state funded medical assistance program or Medicaid. Because of the source of the reimbursement funds, in most agencies, there was the added benefit of stimulating the entry of the elderly into treatment. In addition to collecting data related to the reimbursement effect, agencies who participated increased and expanded their experiences with the elderly, and developed and adapted treatment modalities to meet the need of this population. A report on this additional benefit of the project was prepared by the Rutgers University Center of Alcohol Studies, New Brunswick, New Jersey. The evaluation of the data related to the reimbursement study has not yet been completed.

A LOOK TOWARD THE FUTURE

The identification of "what needs to be done" frequently has the quality of confused time sequence. Research of the problem area should precede the development of policy which would in turn give impetus to program development. But it is impossible to begin again. The reality is that movement on all fronts is needed and must proceed as best possible.

The relationship of research in the field of aging and alcohol to the development of public policy has been addressed by Stall (1987). Stall proposes a particular value of long-term perspective research as an integrative and interpretive tool for reassessing the data from both retrospective and cross sectional studies. Such research would make it possible to test and evaluate the hypotheses that have been advanced to explain the data, and would provide direction for the development of public policy. Ruben (1986) points out that elements of incongruence are present between public policy and what we do know about the nature and the scope of the problem. Future development of policy would benefit from consideration of these observations.

In relation to health and aging, there are many avenues of research that have been opened but not fully addressed. Enumeration of specific areas is repetitive and more adequately done by those whose expertise is within the specific areas of study. However, in reviewing studies, it becomes very evident that much of what we understand is based on studies that are not age and/or alcohol specific. Whereas, there is justification for applying the results of such research to the aged or to alcohol problems, additional studies that are focused on the problem area would provide a firmer foundation for the development of policy and the implementation of programs of prevention and treatment.

Programs, and ultimately people, who are coping with the problems of aging and alcohol abuse, are impacted by policies in the fields of aging, alcohol treatment, health, social services, housing, transportation, and innumerable other areas of governmental responsibility. How these policies intermesh is a prime concern for the issue of aging and alcohol. The perspective from the field frequently is that policies interact in ways that are more prohibitive than facilitating. In considering what policies should be enacted, this concern should be addressed. For example, these questions might be discussed:

> What weight should be given to current epidemiological projections in the consideration of policies related to the development of programs of prevention and treatment?
>
> What effect do current health care policies, such as the DRG's, have upon the provision of the level and the extent of medical care needed by the older person who may have multiple and extensive needs related to alcohol abuse?
>
> What policies would facilitate the development of primary prevention programs in the arenas that are most utilized by those at high risk? What incentives might be offered to encourage the private sector to be involved in the provision of prevention programs related to late-onset alcoholism?
>
> In what areas should policies be developed to address the high cost of providing institutional care for those severely disabled by alcohol? Are

other options possible tnat would allow for a more optimal quality of life?

What policy provisions are possible that would encourage and support linkages between alcoholism treatment and age services to actualize the concept of continuity of care?

Based on evaluative research of treatment modalities, what policy decisions should be considered to support specialized components to provide treatment for older persons?

Are federally sponsored programs for volunteer service appropriate avenues for involving older people in the process of addressing the need for education and prevention in relation to alcohol use and health?

The range of exploration is limitless. And the time is now.

REFERENCES

Anous, M.M., and Heimbach, D.M. Causes of death and predictors in burned patients more than 60 years of age. J Trauma 26: 135-139, 1986.

Atkinson, R.M. Alcohol and Drug Abuse in Old Age. Washington, D.C.: American Psychiatric Press, Inc., 1984.

Baker, W.W. Psychopharmacology of aging: Use, misuse and abuse of psychotropic drugs. In Gottheil, E. et al., ed. The Combined Problems of Alcoholism, Drug Addiction and Aging. Pp.150-163. Springfield, IL: Charles C Thomas, 1985.

Barboriak, J.J.; Anderson, A.J.; Rimm, A.A. et al. Alcohol and coronary arteries. Clin Exp Research 3: 29-31, 1979.

Barnes, G.M. Alcohol use among older persons: Findings from a western New York state general population survey. J Am Ger Soc 27: 244-250, 1979.

Barnes, G.M.; Abel, E.L.; and Ernst, C.A.S. Alcoholism and the Elderly: A Comprehensive Bibliography. Westport, CT: Greenwood Press, 1980.

Blusewicz, M.J.; Cannon, W.G.; and Dustman, R.E. Alcoholism and aging: Similarities and differences in neuropsychological performances. In Wood, W.G., and Elias, M.F.. ed. Alcoholism and Aging: Advances in Research. Pp. 47-60. Boca Raton, FL: CRC Press, Inc.: 1982.

Bosmann, H.B. Pharmacology of alcoholism and aging. In Hartford, J.T., and Samorajski, T., ed. Alcoholism in the Elderly: Social and Biomedical Issues. Pp. 161-174. New York: Raven Press, 1984.

Cahalan, D. Problem Drinkers. San Francisco: Jossey-Bass Inc., 1970.

Cahalan, D.; Cisin, I.H. ; and Crossley, H.M. American Drinking Practices. New Brunswick, NJ: Rutgers Center of Alcohol Studies, 1969.

Carruth, B.; Williams, E.P.; Boudreaux, L. et al. Alcoholism and Problem Drinking Among Older Persons. U.S. Department of Health, Education and Welfare,

Administration on Aging, Grant No. PHS-SRS-93-P-75146/2-02. New Brunswick, NJ: Rutgers Center of Alcohol Studies, Rutgers University, 1973; and Springfield, VA: NTIS, 1973.

Christopherson, V.A.; Escher, M.C.; and Bainton, B.R. Reasons for drinking among the elderly in rural Arizona. J Stud Alcohol 45: 417-423, 1984.

Gaitz, C.M., and Baer, P.E. Characteristics of elderly patients with alcoholism. Arch Gen Psychiatry 24: 372-378, 1971.

Gambert, S.R.; Newton, M.; and Duthie, E.H. Medical issues in alcoholism in the elderly. In Hartford, J.T., and Samorajski, T., ed. Alcoholism in the Elderly: Social and Biomedical Issues. Pp. 175-191. New York: Raven Press, 1984.

Glantz, M.D.; Petersen, D.M.; and Whittington, F.J. Drugs and the Elderly Adult. Research Issues 32. Rockville, MD: National Institute on Drug Abuse, 1983.

Glynn, R.J.; Bouchard, G.R.; LoCastro, J.S.; and Hermos, J.A. Changes in alcohol consumption among men in the Normative Aging Study. In Maddox, G. et al., ed. Nature and Extent of Alcohol Problems Among the Elderly. Research Monograph No.14. Pp. 101-116. Rockville, MD: National Institute on Alcohol Abuse and Alcoholism, 1984.

Gomberg, E.S.L. Alcohol use and alcohol problems among the elderly. In Special Population Issue. Alcohol and Health Monograph No.4. Pp. 263-290. Rockville, MD: National Institute on Alcohol Abuse and Alcoholism, 1982.

Gordon, T. Discussion: Session I. In Maddox, G. et al., ed. Nature and Extent of Alcohol Problems Among the Elderly. Research Monograph No.14. Pp. 134-138. Rockville, MD: National Institute on Alcohol Abuse and Alcoholism, 1984.

Gottheil, E.; Druley, K.A.; Skoloda, T.E.; and Waxman, H.M. The Combined Problems of Alcoholism, Drug Addiction and Aging. Springfield, IL: Charles C Thomas, 1985.

Hermos, J.A.; LoCastro, J.S.; Bouchard, G.R.; and Glynn, R.J. Influence of cardiovascular disease on alcohol consumption among men in the Normative Aging Study. In Maddox, G. et al., ed. Nature and Extent of Alcohol Problems Among the Elderly. Research Monograph No.14. Pp.117-132. Rockville, MD: National Institute on Alcohol Abuse and Alcoholism, 1984.

Hingson, R., and Howland, J. Alcohol as a risk factor for injury or death resulting from accidental falls: A review of the literature. J Stud Alcohol, 48(3): 212-219, 1987.

Janik, S.W., and Dunham, R.G. A nationwide examination of the need for specific alcoholism treatment programs for the elderly. J Stud Alcohol 44: 307-317, 1983.

Kannel, W.B. Nutritional contributors to cardiovascular disease in the elderly. J Am Ger Soc 34:27-36, 1986.

Kofoed, L.L.; Tolson, R.L.; Atkinson, R.M. et al. Treatment compliance of older

alcoholics: An elder-specific approach is superior to "mainstreaming". J Stud Alcohol 48: 47-51, 1987.

Lowe, G. Alcohol and memory processes: Implications for the elderly alcoholic. Proceedings of 34th International Congress on Alcoholism and Drug Dependence. Pp. 27-28. Alberta, Canada: Alberta Alcohol and Drug Abuse Commission, 1985.

Maddox, G.; Robins, L.N.; and Rosenberg, N., editors. Nature and Extent of Alcohol Problems Among the Elderly. Research Monograph No.14. Rockville, MD: National Institute on Alcohol Abuse and Alcoholism, 1984.

McCusker, J.; Cherubin, C.F.; and Zimberg, S. Prevalence of alcoholism in a general municipal hospital population. NY State J Med 71: 751-754, 1971.

Meyers, A.R.; Goldman, E.; Hingson, R.; and Scotch, N. Evidence for cohort or generational differences in the drinking behavior of older adults. Int'l J Aging Human Dev 14: 31-44, 1981.

Mishara, B.L., and Kastenbaum, R.: Alcohol and Old Age. New York: Grune and Stratton, Inc., 1980.

Mishara, B.L.; Kastenbaum, R.; Baker, F. et al.: Alcohol benefits in old age: An experimental investigation. Soc Sci Med 9:535-547, 1975.

Nace, E.P. Epidemiology of alcoholism and prospects for treatment. Ann Rev Med 35: 293-309, 1984.

Parsons, O.A., and Leber, W.R. Premature aging, alcoholism and recovery. In Wood, W.G., and Elias, M.F., ed. Alcoholism and Aging: Advances in Research. Pp. 79-92. Boca Raton, FL: CRC Press, 1982.

Resch, J.E., and Christensen, J.M.: Older Adult Substance Abuse, Volumes I, II and III. Lansing, MI: Michigan Office of Substance Abuse Services and Michigan Office of Services to the Aging, 1983.

Robins, L.N. Introduction to the ECA Project as a source of epidemiological data on alcohol problems. In Maddox, G. et al., ed. Nature and Extent of Alcohol Problems Among the Elderly. Research Monograph No.14, Pp. 201-216. Rockville, MD: National Institute on Alcohol Abuse and Alcoholism, 1984.

Rosin, A.J., and Glatt, M.M. Alcohol excess in the elderly. Q J Stud Alcohol 32:53-59, 1971.

Ruben, D.H. The elderly alcoholic: Some current dimensions. Adv Alcohol Substance Abuse 5: 59-70, 1986.

Russell, J.F. et al. Veterans Administration supports research on alcohol and the elderly. Alcohol Health Res World 8(3): 16-23, 1984.

Russell, R.M. A discussion of ethanol-nutriant interactions in the elderly. Drug-Nutrient Interactions 4: 165-170, 1985.

Schuckit, M.A. Clinical review of alcohol, alcoholism, and the elderly patient. J

Clin Psychiatry 43(10): 396-399, 1982.

Schuckit, M.A. Phenomenology and treatment of alcoholism in the elderly. In Fann, W.E.; Karacan. I.; Pokorny, A.D. et al., ed. Phenomenology and Treatment of Alcoholism. Pp. 167-179. New York: Medical and Scientific Books, 1980.

Schuckit, M.A., and Miller, P.L. Alcoholism in elderly men: A survey of a general medical ward. Ann NY Acad Sci 273: 558-571, 1976.

Schuckit, M.A., and Pastor, P.A. Alcohol-related psychopathology in the aged. In Kaplan, O.J., ed. Psychopathology of Aging. Pp. 211-227. New York: Academic Press, 1979.

Sherouse, D.L. Professional's Handbook on Geriatric Alcoholism. Springfield, IL: Charles C Thomas, 1983.

Simon, A.; Epstein, L.J.; and Reynolds, L. Alcoholism in the geriatric mentally ill. Geriatrics 23(10): 125-131, 1968.

Stall, R.: Research issues concerning alcohol consumption among aging populations. Drug and Alcohol Depend 19: 195-213, 1987.

Warheit, G.J., and Auth, J.B. The mental health and social correlates of alcohol use among differing life cycle groups. In Maddox, G. et al., ed. Nature and Extent of Alcohol Problems Among the Elderly. Research Monograph No.14, Pp. 29-82. Rockville, MD: National Institute on Alcohol Abuse and Alcoholism, 1984.

Williams, E.P.: Older Alcoholics in Treatment. New Jersey Department of Health, Division of Alcoholism. New Jersey Health Service Contract No. 85-274-ALC. New Brunswick, NJ: Rutgers Center of Alcohol Studies, Rutgers University, 1985.

Wisconsin Department of Health and Social Services. Examination of Problems and Solutions Related to the Chronic "Revolving Door" Alcohol Abuser. Planning Guideline #1. Madison, WI: Department of Health and Social Services, 1981.

Wood, W.G., and Elias, M.F., Editors. Alcoholism and Aging: Advances in Research. Boca Raton, FL: CRC Press. Inc., 1982.

Zimberg, S. Outpatient geriatric psychiatry in an urban ghetto with non-professional workers. Am J Psychiatry 125: 1697-1702, 1969.

Zimberg, S. Psychosocial treatment of elderly alcoholics. In Zimberg, S.; Wallace, J.; and Blume, S.B., ed. Practical Approaches to Alcoholism Psychotherapy. Pp. 347-363. New York: Plenum Press, 1985.

Zimberg, S. The psychiatrist and medical home care: Geriatric psychiatry in the Harlem community. Am J Psychiatry 127: 1062-1066, 1971.

Health Promotion and Aging
"Oral Health"

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I. BACKGROUND

There is a growing interest in the oral health needs of older persons, particularly as the size of the population age 65 and older increases and as the composition of that age group changes. The largest increase in population is occurring in the oldest-old—age 85 and over[1]—a group for which little is known regarding oral health.

Historically, older adults have had fewer financial and social resources than have other age groups, but evidence suggests that the picture is changing. For example, in 1984, 91 percent of older adults received Social Security benefits; 24 percent received income from private pensions, and 68 percent received income from private assets.[2] These represent considerable improvements over the past two decades. Furthermore, it is projected that improvements in the socioeconomic status of older individuals will continue over the next several decades. This does not mean, however, that all older Americans will be financially able to secure the necessary benefits from health care. Even considering these improvements, general health and medical expenditures are sizable. While older Americans represent nearly 12 percent of the population, they account for 27 percent of all health expenditures and purchase 25 percent of all medications sold in this country.[3,4]

In the most comprehensive, published data—the National Medical Care Expenditure Study (NMCES)—it was reported that three percent of the per capita health expenditure for those 65 and older went for dental care in 1977. Modest increases were observed in mean dental expenditure per older person between 1970 and 1977—from $31 to $40 (1977 dollars)[5] Traditionally, dental care for older persons has been an out-of-pocket expense. In 1981, nineteen percent of those ages 65-74 had some dental insurance, while 10 percent of those age 75 and older had some coverage.[6] (Self-reported dental insurance is often at a higher level for this age group.) In spite of major successes in dental research, treatment and prevention over the past several decades, oral diseases of all kinds remain among the most costly health problems prevalent in the United States, adding up to a national bill of $22.7 billion for dental services in 1986.[7]

Older Americans traditionally have accounted for large proportions of less advantaged categories and are more likely to be without major support systems, judged by sociodemographic and access measures. For example, there are high proportions who 1) live alone and are widowed, 2) have few years of education, 3) are below the poverty level, 4) are not in the labor force, or 5) live in non-urban areas.[1,6,8,9,10,11]

Improvements in oral health status and dentally-related behaviors of the older age group have been observed over the past several decades. Continued improvements in oral health status, oral hygiene practices and dental service utilization are projected as upcoming cohorts continue to become better educated, more affluent and dentate,[12,13] yet, the older individual will continue to be at risk for oral diseases.[14,15,16] There is no research evidence to suggest that tooth loss or specific oral diseases are a necessary concomitant of the aging process, nor do all persons over age 65 fall into one descriptive group in terms of oral health or dentally-related behaviors.[17] Rather, it appears that there is a great deal of heterogeneity in the older population. Likewise, there is no evidence that older persons are, by definition, in poor general or oral health.[15,18,19] The combination of genetic predisposition, lifestyle and socioeconomic environment, exposure to fluorides, oral hygiene at home and dental-visit behaviors throughout an individual's lifetime, contribute to the state of oral health, or lack thereof, in later years.[19,20,21,22]

Maintaining quality of life through retention of the dentition requires the prevention and/or treatment of oral diseases beginning at younger ages and continuing throughout the lifetime. Preventive activities for

all ages include professional and self-care. Professional preventive activities include examination of the dentition, supporting structures and muscosal tissue for decay, attrition, abrasion, periodontitis, recession, oral cancers and evidence of oral symptoms of systemic diseases, as well as oral hygiene education and regimens such as prophylaxis and fluoride applications. Appropriate restorative treatment of observed conditions is accepted as preventing further destruction of oral structures.[23] The prescription for maintaining optimal oral health through self-care is the same for the older person as it is for the younger one: daily toothbrushing with a fluoride toothpaste, use of a fluoride and/or antimicrobial rinses, interdental cleaning, dental visits at least once a year and observation of a balanced diet and food intake pattern. Some oral conditions may be prevented or retarded by a change in behaviors including stopping use of tobacco, improving toothbrushing technique or abandoning inappropriate chewing behaviors.[24] Other oral conditions and appropriate treatments may be controlled through careful monitoring of systemic conditions and medications.

The overall quality of life of any individual, particularly an older one, can be enhanced through oral diseases prevention and health promotion.[16 25] The health of the oral cavity--teeth, oral soft tissues, underlying bone, neural apparatus, immune system and glandular mechanisms—is critical to chewing, tasting, swallowing and speech, as well as adaptation to dentures if they are worn. Health of the oral cavity also contributes to nutrition, facial esthetics and protection from systemic infection and injury.

Most older Americans are relatively healthy and functionally independent. They can be expected to continue to follow habitual patterns of oral hygiene behavior and use of dental services. Still, an estimated 40 percent of older Americans are projected to constitute a special-needs category based on complex health problems and functional status.[26] These include: emotional and physical stresses associated with the aging process; physical and mental disabilities resulting from chronic diseases and physical and financial barriers to access to care.[26]

II. ORAL HEALTH STATUS--OUTCOMES OF ORAL HEALTH PROMOTION

A. Data Sources

Descriptions of the oral health and related behaviors of older Americans are available from a number of national and local sources. National data are the most readily available, but many of these studies placed an upper limit on age in the sample. Furthermore, those studies which do include older individuals typically have not focused on this age group, thus the ability to analyze the data may be limited by the number of older individuals in the subsample. The weakness in all surveys conducted to date is the near absence of a comprehensive data set on older individuals--including attitudes, knowledge, behaviors, environmental/structural conditions, as well as clinically-determined oral health status.

The major surveys which include both interview and clinical examination data on older Americans are the National Health and Nutrition Examination Survey (NHANES I), Hispanic Health and Nutrition Examination Survey (HHANES), and A Study of Dental Health Related and Process Outcomes Associated with Prepaid Dental Care: 1981 (HRSA).[8 27] A National Institute of Dental Research (NIDR) study—National Survey of Oral Health in U.S. Employed Adults and Seniors: 1985-86—contains complete clinical but minimal self-reported data on a sample of 5686 older Americans who attended 208 Senior Centers.[10]

Most other national studies do not include clinical examination and are based on data collected by interview, including information on dentally-related behaviors, attitudes and knowledge. An example is the National Health Interview Survey (NHIS) conducted by the National Center for Health Statistics. Dental health questions have not been a routine part of the core questionnaire since 1981, but issues related to dental health have been included regularly in supplements. Other examples are the 1980 NCHS Personal and Preventive Practices Survey; NHANES I Epidemiologic Followup Study; the National Medical Care Expenditure Survey, 1977; the National Medical Care Utilization and Expenditure Survey (NMCUES), 1980; and Center for Health Administration Studies and National Opinion Research Center Surveys of Medical Expenditures and Use of Health Services: 1953, 1958, 1963, 1964, 1970.[8 27 28]

Descriptions provided in this manuscript are based on reported correlations between selected measures of predisposing and enabling factors, perceived need and oral health variables which, most often, have not

been analyzed in combination as part of any predictive model. Emphasis has been placed on national probability samples and verified data over convenience samples or self-reported data. In some cases, reports may appear inconsistent, as recent analyses are providing more in-depth understanding of issues than was available when earlier research was published; for example, separation of the dentate and edentulous groups in the analysis of dental expenditures, visits and oral hygiene behaviors.

B. Oral Health Status

1. Edentulousness (Absence of Teeth)

Traditionally, the primary measure of oral health status of older populations has been the extent of edentulousness. It appears now that each succeeding generation has improved compared to older cohorts and more individuals are retaining their teeth as they age.[14 29] Based on NHIS data, in 1958, 67 percent of persons over age 74 reported being edentulous. The proportion of edentulous persons in this age category has decreased over the years to 60 percent in 1971 and 45 percent in 1983. Decreases also have been seen in populations as they reach the age group 65-74, with 55 percent being edentulous in 1958, 45 percent in 1971 and 34 percent in 1983. Declines were seen among both females and males.[30] Edentulousness is more prevalent among older persons below the poverty level and among those with fewer years of education.[30]

One fourth (27%) of those ages 65 and older who attended senior centers in 1985-86 had 20 teeth or more, while 17 percent had 1-12 teeth. The average number of teeth decreased steadily with age, with the average being 18.1 at age 65 and 15.1 for the age category age 80 and over.[10]

Presence of teeth appears to be related to socioeconomic status and race. Among the Baltimore Longitudinal Study panel members, a primarily healthy, middle-socioeconomic, well-educated, volunteer, older, study group--the average older person has 70 percent of natural dentition (20 of 28 teeth)--and only 4 percent wear full dentures.[31] Data from a North Carolina study, encompassing 15 years, indicate a decrease in mean number of missing teeth in succeeding cohorts of whites, but not in blacks.[32]

The functional adequacy of dentition is further reflected in the measured treatment needs for prosthetic services: in the 65 and older age group in 1981, 8 percent needed bridge unit(s); 19 percent needed partial denture(s); 9 percent needed full denture(s).[6] Based on self-report in 1983, approximately one-fourth of edentulous older persons needed new dentures. This proportion increased to over one-third among those below the poverty level.[30]

2. Caries

Caries in older adults is exhibited mostly as recurrent caries surrounding failing restorations, cervical caries associated with plaque accumulation at the gingival margin, root caries associated with gingival recession or as a side effect of medical conditions or pharmaceutical challenges.[33] Research indicates that a small portion of individuals account for most of the restorative treatment needs for caries.[23]

In 1985-86, older adults attending Senior Centers had an average of 20 decayed or filled coronal tooth surfaces. About 92 percent of these surfaces being filled.[10] Additionally, as individuals age, there is an increase in the prevalence of root surfaces caries.[10 34 35] Well over one-half (63%) of the individuals over age 65 have root surface caries.[10] Only about one-half (54%) of these root surfaces are filled.[10]

Prevention of root caries is particularly important, since there is insufficient knowledge of optimal therapeutic approaches for root caries, making restoration difficult. While fluoride traditionally has been associated with prevention of decay in children, a recent study in Canada showed that the occurrence of root decay in adults with lifelong histories of fluoridated water consumption was approximately 60 percent less than it was in nonfluoridated areas.[24 35]

3. Periodontal Diseases

Periodontal disease is a frequent self-reported chronic condition in persons age 65 and over, along with hypertension, hearing loss, heart conditions, vision impairments and diabetes.[20] A variety of chronic

diseases of the periodontium affect older persons including gingivitis, periodontitis, gingival recession and trauma from occlusion.[36] In 1985-86, over one half (53%) of older adults attending Senior Centers had gingival bleeding at one site or more, 23 percent had supragingival calculus and 66 percent had subgingival and supragingival calculus--prevalence rates greater than younger adults. Approximately 22 percent of older individuals have loss of attachment of 4 mm or greater at one or more site.[10]

The prevalence of periodontal diseases appears to increase with age.[10 13 36] The higher prevalence and severity of periodontal diseases among older persons may not result from enhanced susceptibility, but rather, may reflect the accumulation of disease over time.[36] If periodontitis is defined as mild pocketing, there may not be greater proportions of older adults with disease. With the increasing numbers of adults in this age group, however, this remains a considerable disease issue. The number of teeth lost due to periodontal diseases is not known, but the number of teeth which need to be extracted from periodontal disease increases with age.[10 13] Whether periodontal diseases are episodic or steadily progressive is still undecided, but evidence suggests that those persons who have retained their teeth to old age have a type of periodontitis that, at any given site, usually progresses slowly.

4. Oral Cancer

The prevalence of oral cancer is greater among men than women and increases with age, with the great majority of cases occurring in people over the age of 40.[37] In 1987, 29,800 new cases of oral cancer were discovered and 9400 deaths were estimated.[38] In a series of screenings conducted between 1957 and 1972 among older white adults in Minnesota, 10 percent had at least one oral lesion unusual enough to be recorded. Leukoplakia had a prevalence of 29.1/1000 and oral cancer a prevalence of .9/1000.[39] The progressive impact of smoking, drinking and use of smokeless tobacco on the condition of teeth and development of soft tissues lesions--specifically oral cancer--is more apparent in older individuals. Use of tobacco products and alcohol, both individually and in combination, is associated with denture-related lesions.[37] Also, lower educational levels and infrequent dental visits are associated with oral lesions.[37]

5. Other oral conditions

Other oral conditions are reported more often in older than younger adults. These include oral motor function and sensori-motor problems, such as difficulties in chewing, tasting or swallowing, oral effects of systemic diseases, acute and chronic pain, among others.

No real evidence exists that a generalized deterioration in oral motor function or performance occurs with aging, but selected oral conditions--alteration of lip posture, masticatory muscle function, increasing dysfunction of the tongue and suspensory musculature--appear to be related to aging. Functional problems which might result from these conditions include labial spill of saliva, inability to prepare food for swallowing, altered speech, dysphagia, traumatic bite injury, increased mouth breathing. Very serious dysfunctions in oral motor function can lead to fatal choking, laryngeal food penetration and regurgitation.[40]

Certain diseases of the salivary glands are more common in older adults, specifically local inflammatory diseases and Sjogren's syndrome.[41] Acute suppurative sialadenitis, as well as chronic recurrent sialadenitis, is more common in elderly, seriously ill, debilitated patients. The prevalence of Sjogren's syndrome--lymphoepithelial lesions--is second only to rheumatoid arthritis among the connective tissue diseases and a typical onset is age 40-60. In addition, there is some indication that submandibular saliva and possibly minor gland secretions may be affected by aging.[41]

Evidence suggests that there is a decline in bone mass so that by age 70, the total is only about 60 percent of the peak. These changes can be observed in the oral cavity, can be exacerbated by certain disease processes and can contribute to functional problems, such as poorly fitting dentures.[15 34 41]

Some oral conditions have become stereotypic of aging--diminution of stimulated parotid fluid output, structural changes in epithelium, atrophic change in oral mucosa, and generalized decreases in taste acuity and perception--but research has led increasingly to a lack of consensus on these conditions. Evidence suggests that other factors, such as polypharmacy, inadequate nutrition, or systemic diseases,

may be the precursors of these conditions and not age, per se.[14 41 42 43] Other age-related changes in taste and oral sensation, e.g. touch, temperature, and pressure sensibility, have been observed but not well described or documented.

III. AREAS OF PARTICULAR CONCERN

A. Concomitant Medical Conditions, Pharmacological Challenges and Oral Conditions

1. Nature of Problem

There are approximately 120 physical or mental diseases which manifest symptoms in the oral cavity or affect ability to perform dentally-related behaviors. The prevalence of most of these conditions increase with age.[24] For example:

- Slower movements, less agility, impaired vision and hearing, urinary dysfunction, vascular insufficiency, among other things, may affect the ability to follow recommendations for self-care and may make it impossible for an older individual to visit a dental office;[44]
- The oral symptoms which result from hypofunctional or nonfunctional salivary glands are unpleasant and painful and affect vital functions such as speech, taste, chewing and swallowing. Xerostomia is highly associated with prescribed radiation or medications. It may increase susceptibility to infections--both oral and systemic--and have an impact on nutrition[15 16] and increase susceptibility to caries and periodontal diseases;
- Cancer in the head, neck and oral cavity increases with age;
- Aging diabetic patients are vulnerable to oral infections and impaired healing which may lead to periodontal diseases and related oral problems;[16]
- Psychoses, affective disorders and sleep disturbances may affect the patient's willingness or ability to perform appropriate oral hygiene or seeking of dental services, thus affecting oral health, speaking or swallowing;[16]
- Neurological problems, including stroke and Parkinson's disease, can adversely affect oral functions. Dementing conditions such as Alzheimer's disease increase with age. Traditional education, training or compliance methods might be ineffective in changing any inappropriate dental health beliefs or behaviors for such patients.[56]
- Chronic and acute pain can adversely affect oral functions and the provision of dental care.

Oral health status also can affect general health status. Examples include the impact of missing teeth, inadequate restorations or poorly fitting dentures on food intake which ultimately might affect nutrition. Also, untreated oral infections can result in serious systemic complications, especially in immunocompromised patients.[16]

Medications for age-related systemic conditions--e.g. congestive heart failure, diabetes, depression, sleep disturbances, chronic pain--influence the oral conditions observed, contribute to the cause of some oral conditions, and affect the kinds of treatment which can be provided.[11] More than 75 percent of a rural Iowa population age 65 and older took medications that could affect oral health or dental treatment. About one-half of the older individuals in the Iowa study took drugs which may cause xerostomia, e.g. antihypertensives, antihistamines, decongestants, diuretics, pain killers and tranquilizers. Other commonly used drugs affect blood clotting and cause oral ulcerations or sloughing of soft tissue. About one-fourth of these older adults took muscle relaxants and medications for anxiety, which can interact adversely with drugs commonly used in dental surgery for sedation and pain relief. Drugs used commonly for cardiac conditions by older persons can interact adversely with local anesthetics containing epinephrine. Broad spectrum antibiotics, medications for diabetes, systemic corticosteroids, phenytoin for convulsions, nifedipine used for cardiovascular disease, medications for angina and congestive heart

failure and antipsychotic medications each may be associated with abnormal healing, predisposition to infection, overgrowth of gingival tissue, inability to tolerate long, stressful appointments and/or abnormal oral-facial movements.[57] Also, dental visits create anxiety for many older individuals, a condition which may be heightened by some drugs.

2. Mechanisms and Interventions Established To Deal With Problem

Health education and promotion efforts have been used to increase the awareness of older adults or caretakers regarding systemic conditions and medications which relate to oral health. Examples include: Radiation, Chemotherapy, and Dental Health, Detection and Prevention of Periodontal Disease in Diabetes and NIDR Fact Sheet: Dry Mouth (Xerostomia).

Health care providers can play an active role in early diagnosis of systemic and oral conditions, assisting the patient and each other in limiting the progression of diseases. Emphasis on the interaction among the dentist, pharmacist and physician is very important.[58] [59]

Education for dentists, physicians, nurses and pharmacists, both in basic training and continuing education, should provide increased attention to medical conditions and pharmacological challenges exhibiting symptoms in the oral cavity. Increased emphasis should be given to recording, routine monitoring and clinical application of medical histories, particularly those specific to changes since the most recent visit. Review of related medical conditions involves recording medications which the individual is taking. This is particularly important for patients who are taking multiple medications.[15]

Dentists should be knowledgeable regarding alternate treatment approaches for compromised patients. For example, the removal of oral infection and employment of antibiotic therapy is especially critical for patients undergoing cardiac or joint-replacement surgery. Where discontinuing medication with negative oral side effects or substituting less harmful agents is not possible, a protective regimen for the oral environment can be instituted. This could include sugar-free chewing gum or candy, artificial saliva, controlled-release devices and specific plaque control programs to reduce bacterial burden.

The National Foundation of Dentistry for the Handicapped and the American Society for Geriatric Dentistry encourage programs which address the needs of older individuals. They encourage dentists to consider the style of furniture, positioning of the patient, office lighting, staff assistance and other aspects of practice to improve the ease and comfort of the delivery of services to the older patient. Hearing and sight limitations have been acknowledged in some dental disease prevention programs for the impaired older adult.

The American Denal Association (ADA) is developing hospital protocols for twelve medical/surgical conditions, including head and neck radiation therapy, cardiovascular disorders, cancer chemotherapy and end-stage renal diseases. These protocols, will assist physicians and hospital-based dentists in understanding oral complications of diseases, why they are important and what to do about them. The Veterans Administration (VA) has established guidelines for the oral health of medically compromised patients in long-term care facilities to assist the health care team.

The American Society of Hospital Pharmacists sponsors a project through affiliated state chapters which distributes materials to educate older consumers on appropriate drug use and compliance.[60] Similarly, the American Pharmaceutical Association, in collaboration with state pharmacy associations, has encouraged the use of Medication and Self-Medication Awareness Tests and Health Check Test to demonstrate to older consumers the importance of having information about medicines and how to use them.[60] "Share the Health", a National Pharmaceutical Council project provides education and assistance for older adults regarding medication identification and purpose through "Operation Brown Bag".[60]

3. Apparent Deficiencies

More basic research and health professional education is needed to clarify the linkages among systemic conditions, medications and oral problems seen in older individuals. More health services research is needed to develop, evaluate and demonstrate ways to improve: 1) interaction among the dentist,

physician, pharmacist and patient regarding health care; 2) clinical applications of information on medical histories in the practices of dental and medical professionals; and 3) the routine updating of medical histories in the practices of health care providers; 4) oral health care of medically compromised patients in long-term care facilities.

B. Orientation toward Oral Health and Oral Hygiene

1. Nature of Problem

The importance attached to oral health is a key factor determining actual oral health status and the behaviors which influence its attainment among older adults.[16] A range of attitudinal, behavioral and socioeconomic factors over a lifetime interact to form that orientation. In turn, these factors affect an individual's performance of oral hygiene practices, dental visit behaviors, and compliance with recommended regimens. Attitudes, knowledge and beliefs appear to have the same correlations with dentally-related behaviors among older adults as they do among younger adults.[61] As current middle-aged adults become older, it is assumed that they will keep appropriate levels of knowledge and attitudes thus creating a more informed older sector in the future.

Perceived oral health status, as measured by the self-reported presence of conditions, has been investigated in several research projects and is often a key explanatory variable for visiting a dentist.[44] In a study of older rural Minnesota residents regarding perceived overall health status and presence of common health problems, dental (or denture) problems were frequently mentioned conditions along with vision problems, arthritis, hypertension and obesity. There were no differences in self-reported dental problems when the age group 60-74 was compared to that 75 and older. Other studies have shown that dental problems receive less mention than other chronic conditions of older persons.[45] In a 1981 national survey, only 18 percent of dentate individuals age 65 and older--compared to 28 percent of younger adults--reported two or more oral problems (e.g. broken tooth, bleeding gums, sensitive to hot and cold, canker sores, toothache, sensitive to sweets), while only 10 percent reported problems with chewing and biting.[6]

In a study of older Massachusetts health care panel study members, perceived need for care was best explained by perceived oral health status, dentate status and previous dental utilization. Age, per se, was not significantly related to perceived need and socioeconomic indicators were not predictive.[46]

Perceived oral health status is not always a reflection of actual clinical conditions.[45 47 48] For example, in a recent study of older patients scheduled for periodontal treatment, only 18 percent were aware before arriving at the dental school that they had periodontal disease.[47] In another study, it was estimated that 70 percent of older adults need treatment, 25-40 percent of older adults perceive that need, and 20-35 percent of older adults seek treatment.[49]

Lack of perceived need has been a primary reason for not seeking dental care.[8 24 53 55 62 63 64] Additionally, a low relative priority usually is assigned to dental care in comparison to other health and functional activities.[24] Survey research indicates that the combination of perceived need and attitudes toward oral health and dentistry has considerable predictive power in explaining the use of dental services by older adults.[44 61 65 66 67 68] For example, in a sample of older individuals in senior centers in the Seattle area, those who attributed greater importance to oral health, believed they needed dental care, had more teeth, and had more positive dentally-related beliefs, were more likely to seek dental care.[64]

Older Americans seem to be resigned to accepting their oral health status, yet express positive attitudes regarding oral health. Fifty seven percent of adults ages 65 to 74 believe nothing can be done to change oral health, while 70 percent of those age 75 and older believe this. Only 32 percent of older adults strongly agree that some people have good teeth and other have bad teeth no matter what they do, while 9 percent strongly agree that people lose their teeth anyway. The majority of dentate older individuals never expect to lose all of their teeth. It appears that if individuals reaches age 65 and if they have not lost their teeth already, they do not expect to. Interestingly, 80 percent of dentate older adults are satisfied with the way their teeth look.[6] As expected, most older individuals believe that the cost of dental care is often too high; but, most indicate that cost of care is not a barrier for them.[6 8 55]

Information regarding appropriate dentally-related behaviors may never have been learned or may change over time. Today's older people are more likely not to have been exposed to a preventive orientation early in life and/or may remember outdated information. Their early exposure to dentistry may have predated the acceptance of self-efficacy measures for oral health status. Older adults today have received a large amount of conflicting health information over a lifetime. Misinformation and confusion often discourages older persons from changing behaviors or seeking preventive services.[20]

The cognitive skills of older individuals as reflected by attention and recall may be somewhat diminished compared to younger individuals. This may require special attention to methods of communication, including message structuring, repetition and reinforcement, shorter session length, information limitations, active participation and multiple modes of presentation.[15] Research projects are demonstrating that established attitudes and beliefs can be altered or used to the advantage of oral health. For example, the generalized belief that people can take responsibility for their own health has been shown to be associated with reduction in plaque levels. Conversely, older persons who look to others for control and believe that dental prophylaxis is important are more likely to avail themselves of diagnostic, preventive and therapeutic dental care.[67]

Orientation toward oral health is evident also in attitudes, knowledge and behaviors known to affect oral health status. Approximately three-fourths of older adults believe smoking increases risk of cancers in the throat—a lower proportion than in younger adults. Slightly over a third of older adults believe heavy drinking increases risks of mouth and throat cancers, a higher percentage than adults of other ages.[69]

Health professionals may hold inappropriate beliefs which compound the problems faced by the older individual. For example, beliefs that older persons cannot learn, will forget quickly what is taught, that it is too late for them anyway may interfere with effective practitioner-patient interaction.[17,70] Since physicians have more contact with older adults than dentists, their attitudes toward oral health issues are important to monitor and change as appropriate.

Social and psychological risks are not easily quantified, yet need serious consideration in understanding the promotion of oral health. Significant improvements in oral health may be achieved only when the gap between clinically-determined need and perceived need—as reflected in numerous attitudinal variables—is narrowed.[49]

2. Mechanisms and Interventions Established to Deal With Problem

Not only should dental practitioners understand normal and pathological aging, they also should have excellent interpersonal skills. Dental practice provides an opportunity to educate and change the attitudes of the patient through examination and communication. For example, when the dentist or dental hygienist cleans teeth, self-care can be discussed. Additionally, when dentists and other health care providers screen for oral cancer, they can educate patients on the relation of tobacco, alcohol and oral cancer.[24] Precancerous lesions and conditions predisposing to cancer that can be detected and treated early result in less mutilation and increased survival rates.

Cognitive behavioral methods that emphasize a strategy of changing an individual's inaccurate beliefs are believed to be effective in oral health promotion. Educational and oral health promotion sessions can be conducted in private practice, but probably can reach more people, at lower cost, if provided in other settings, especially where older persons gather. It has been demonstrated that some preventive dental and educational sessions, in which motivation to achieve oral health is significantly enhanced with regular feedback, can be conducted by paraprofessionals.[25]

Oral health promotion to improve attitudes and change behaviors can relate to and build on the current lifestyle of the older individual. For example, research demonstrates that older people watch more television and read local newspapers regularly. In addition, their use of other media can be targeted and used efficiently to reach them.[20] Non-dental organizations that already have access to older adults can facilitate changes in oral health attitudes and behaviors. The American Association of Retired Persons (AARP) and the American Red Cross work together to keep members informed regarding health

promotion topics through resource manuals, slide/tape programs and articles in publications. Additionally, these organizations have established demonstration projects to encourage health promotion activities.[60]

Educational materials to improve orientation toward oral conditions and appropriate self-care and professionally-provided services are available from several sources. Some of these are specific to older adults—emphasizing problems which are more prevalent in later years or prepared with the older person in mind, e.g. the use of large print. Others addressing general adult problems also are useful to older persons. The Federal goverment, state public health departments, professional associations, and universities are active in producing oral health education audiovisual and print materials to be used with individuals or in community or institutional settings. Examples include "Keeping Your Smile in Later Years" (ADA brochure), radio spots on special care for older persons and "Prescription for Periodontal Health" (NIDR film).

In May, 1987, as part of the Congressionally proclaimed "Older American Month", the ADA established a National Senior Smile Week. The theme was "A Healthy Smile Can Last a Lifetime" and the purpose of the campaign was to heighten awareness on the part of the general public of the importance of dental care and the availability of dental services for the older adult. The kit, provided to state and local dental societies, included a planning guide, program ideas, a slide and script for television, a cassette for radio and sample advertising copy, as well as posters and other visual aids. The effort was designed to encourage media, special community activities and dental practice programs. Communities were encouraged to work with pharmacists, hospitals, health fairs and nutritional counseling services. The program also encouraged the involvement of more dentists in the provision of appropriate care for older adults. This program will continue on an annual basis.

The American Dental Hygienists Association (ADHA) has developed a national campaign--"A Beautiful Smile is Ageless"--to increase older adults' access to oral health information and services. The national organization developed a 'program kit' for use in promoting oral health care that has been adopted by 349 local chapters of the organization.[60]

3. Apparent Deficiencies

The 1980s have shown an increase in efforts to improve attitudes and knowledge of oral health for older adults, yet the efforts have not been widespread, sustained or evaluated. Many have been demonstration projects at the local level. More directed efforts are needed to encourage: 1) positive attitudes regarding the oral health of older persons on the part of both the health practitioners and the public; 2) educational materials for older dentate individuals; 3) education on lifestyle including the oral implications of tobacco use, alcohol consumption and polypharmacy.

C. Oral Hygiene Behaviors

1. Nature of Problem

Appropriate toothbrushing with fluoride toothpaste, interdental cleaning and rinsing with fluorides or antimicrobial products are useful methods to keep the oral cavity clean to prevent caries and periodontal diseases. In addition to preventing further oral disease, appropriate oral hygiene behaviors can result in improved physiological and psychological wellbeing. Plaque retention is a major problem in older adults, exacerbated by existing restorations, rough root surface topology, and inability to brush correctly.

Diminished manual dexterity, in addition to more severe functional limitations associated with serious conditions frequently seen in older persons—such as stroke, arthritis, Parkinson's disease—decrease abilities to use a toothbrush and interdental devices.[24] Also, the motivation to prevent diseases and learn new techniques may be less than for a younger adult, and for some people, self-care may not be physically possible.[33]

Most (70%) dentate older Americans believe that brushing is the most important preventive measure for dental problems. This is reflected in their dentally-related behaviors.[6] The great majority (88%) of

dentate older adults report brushing at least once a day--front and back of teeth and over one fourth (27%) of older dentate individuals report flossing at least four times a week. Frequent snacking is reported by less than one third (30%) of adults, age 65 and older.[6] While less than for younger adults, over two-thirds of dentate older adults report using a fluoride dentifrice.[6 30]

2. Mechanisms and Interventions Established to Deal With Problem

Availability of appropriate oral hygiene aids, instruction on how to use them and continuation of lifetime oral hygiene activities address this issue. These may be accomplished through maintenance of activities from younger ages or established through special training sessions.

Physical limitations of certain older adults may require oral hygiene measures such as fluoride and antimicrobial rinses. Also, toothbrushes and other oral hygiene aids are being developed with better grips and other specifications to improve ability to clean the entire oral cavity.

The VA has developed an oral hygiene in-service manual which has been used since 1985. It is provided to nursing unit administrators and is designed for periodic updating. Additionally, hands-on in-service training is offered.

Researchers at the University of Washington have demonstrated, using several different groups of older individuals, that oral hygiene can be improved and maintained through behavior management based on contingency reinforcement.[21] Research suggests that older persons benefit most from a combined program of regular oral examinations by a dentist and interactive educational sessions for home care.[25] An interactive educational approach with a self-management focus can improve oral health by increasing the individual's personal responsibility for health, perception of general health and self-esteem. A focus on 1) prevention of further disease, 2) control of iatrogenic disease, 3) prescribed regimens for medical conditions, 4) maximization of oral functions, such as mastication and speech, has been successful in these educational sessions.[25] Trained paraprofessionals and peers have been used to instruct older individuals using such behavioral techniques. A combination of traditional educational booklets, videotapes, modeling, one-on-one interaction with the instructor, self-monitoring, reporting and refining of home-care behaviors and repetitive interventions have resulted in better plaque scores over time as well as improvements in dental behaviors, perceived overall health, morale and beliefs about the importance of oral health.[25]

Demonstration projects with older persons are in place in several major communities, for example, an 'Elders Take Charge' program in Denver. Such programs need to be identified and oral health education and training should be incorporated into these general health efforts.

Commercial manufacturing can encourage oral hygiene behaviors through advertising of products.

3. Apparent Deficiencies

The importance of oral hygiene for all ages needs to be emphasized more by dental and medical personnel and the media. Other forums which have ready access to older people, e.g., retirement homes, consumer advocacy groups, Visiting Nurses Association, could be encouraged to promote oral hygiene.

For those people for whom self-care is not possible, caretakers who provide necessary oral health regimens are essential. The lack of acceptance by caretakers of this responsibility is a glaring deficiency.

D. Professionally-Provided Dental Care

1. Nature of Problem

Use of dental services has increased over the past two decades among older adults.[50 51] The percent of the population age 65 and older visiting a dentist during the past year increased from 21 percent in 1964 to 39 percent in 1983.[50 51] The 1983 data show that older people have an average of 1.5 visits to the

dentist during the past year, in contrast to 2.0 visits for those age 45-64. Less than one percent have never been to the dentist[51] and 38 percent have received no dental services in the past five years.[50] Only 31 percent of older adults, 75 years of age and older, have been to the dentist during the past year. Older white individuals are about twice as likely to have gone to a dentist during the past year than black individuals (40% vs. 19%)[50] As is the case among younger adults, having a dental visit during the past year is directly related to income.[50]

It appears that the dental visit pattern of the dentate older person is very similar to the younger adult, while it is the edentulous older adult who is less likely to visit the dentist.[6 30 47 52] Over one-half of dentate older Americans reported visiting the dentist during the past 12 months in 1983, compared to approximately 10 percent of edentulous older adults.[30] Similar data are reported from the 1986 NIDR National Survey of Oral Health in the U.S. Employed Adults and Seniors.[10] At the other extreme, in 1986 two-thirds of edentulous older adults reported that it had been three years or longer since they went to a dentist, while only 19-20 percent of the younger adults or dentate older adults had this visit pattern.[52]

Reasons for visiting a dentist are similar for younger adults and dentate older adults, with 'prevention and checkup' being the primary reason followed by 'something being wrong'.[6 10 53] Edentulous older adults cite 'something wrong' or 'prosthodontic care' as the reason for their most recent dental visit.[10 53 54] Some evidence suggests that level of education influences the reason for visit more than does the number of visits per se. As with younger adults, older adults are more likely to give no need (dentate) or no teeth (edentulous) as reasons for not visiting a dentist.[6 53]

Most older individuals report having reasonable access to a dentist, yet, access to care is not easy for some older adults, particularly frail and medically compromised individuals. Access problems may include actual availability of dentists, perceived barriers to medical care, immobility, isolation, problems with meeting expenses, functional impairments or the need for assistance in daily living.[71]

The evidence of the extent to which finances and isolation are problems is inconsistent. For example, the best predictors of the use of dental services in a study of older individuals in Massachusetts were presence of teeth and perceived need for care. Once these people reached age 75, dentate status and perceived need outweighed education and liquid assets in differentiating a dental user from nonuser.[46] Income and other socioeconomic variables appear to be associated with the priority and relative value attached to oral health. These priorities and preferences (relative values) develop from many sociocultural influences which occur over a lifetime and are not overcome by provision of money, per se.

Expenditures for dental services as well as utilization of dental services and oral hygiene behaviors among older persons traditionally are reported to be less than for younger adults. Absence of visits and lower levels of oral hygiene behaviors have been shown to be related to social and economic factors--such as lower level of education, rural residence, and inability to pay—which are characteristics common among older adults. Some research has demonstrated that Medicaid, reduced-fee and free care have not increased use of dental services in any significant way, yet little was done in analysis to differentiate dentate and edentulous older persons.[49 61 66 67 72 73]

Recent analyses suggest that dental visits and expenditures among dentate older adults are similar to those of younger adults.[6 10] Historically, the large percent of older adults who were edentulous appears to be associated with the lower expenditure and visit level. With an increasing number of dentate older adults, the issue of finances may need special consideration. With the need for complex restorations and the lack of insurance, the influence of cost of care among the older person may be considerable.

Having a regular source of care is highly correlated with the use of preventive health services. In fact, having a regular source of care may predict the use of preventive dental services far better than do perceived need, enabling or predisposing characteristics of older individuals.[6 74] While preventive services are generally less expensive than are restorative services, the absence of insurance or prepayment for most older individuals or the failure of many reimbursement systems to acknowledge preventive services may create a barrier for their regular use.[74]

2. Mechanisms and Interventions Established to Deal With Problem

Improvements in financial capabilities, such as availability of dental insurance and reduced-fee programs, address this problem for older adults. The ADA is working actively to encourage the coverage of dental care in Medicare and is encouraging corporations and insurance companies to extend dental benefits to retired and older Americans.

National and local efforts established to improve access for older adults who have financial, disability, or geographical barriers to dental care address this issue. For example, during the late 1970's, the ADA and its constituent and component societies began a directed effort to improve the use of appropriate dental services by addressing the issues of convenience and available resources in Prevention and Control of Dental Disease Through Improved Access to Comprehensive Care.[75] Through this program, over 119 state and local dental societies provide a toll-free number for referrals to local dentists. Seventy percent of the programs offer a full range of dental services, nine percent denture services only. Over 70 percent of the programs are directed toward older adults and over 80 percent are reduced fee programs. Transportation or portable equipment are available through 10 percent of the access programs.[75] In 1988, the ADA plans to encourage the component and constituent societies to re-emphasize the access programs. Additionally, the ADA contributes funds to help sustain the activities of the National Foundation of Dentistry for the Handicapped and endorses the dental degree program--Disabled Dental Services--promoted by the Association of Geriatric Dentistry.

Through the ADHAs nationwide geriatric outreach project--"A Beautiful Smile is Ageless"--hygienists work on a voluntary basis in oral health care programs. The programs provide dental screening and on-site visits to long-term care facilities, senior group settings and individual homes.

Improving access to residents of nursing homes has been an objective of other projects. As part of their teaching programs, some dental schools work with nursing homes. Many provide slide/tape materials to assist nurses in looking for oral health problems in patients, health education materials for patients and preventive treatment prescriptions along with a recall program for residents.

Some dentists throughout the United States have begun to provide care to homebound and institutionalized older Americans. Using vans furnished with portable dental equipment, dentists can screen a large number of older individuals and provide appropriate care to those who need it. These dentists, working with nursing home administrations, cooperating with caretakers and attending to records, are making the provision of services in institutions a reality.[15]

3. Apparent Deficiencies

Except for the VA, most of the programs mentioned above have been developed on a local and voluntary basis, resulting in inconsistent availability of care for many older adults. More directed efforts are needed to assure adequate oral health care for indigent, institutionalized and homebound older adults. Few programs exist in combination with non-dental organizations, e.g. Visiting Nursing Association. Continued efforts are needed to encourage payment assistance, e.g. dental insurance or Medicare for retired adults, as well as reduced-fee programs or improved medicaid for dental services for those unable to pay.

Much of the dental care system, as it exists today, is passive—individuals must seek out care. Some efforts have been made to accommodate the service delivery system to the needs of the older adults, but more consistent attention needs to be given to reaching out and meeting needs where they exist—community, senior centers, nursing homes or individual residences.

E. Oral Health of the Edentulous

1. Nature of the Problem

Edentulousness, while decreasing in the overall older population, is highly associated with level of education. Beyond this, its prevalence among older people reflects a predominant form of dental practice and patient expectation that existed when these people were younger. To continue the decrease in-

edentulouness, individuals must perceive the value of retaining their teeth. Also, dentists, as well as other health care professionals, must encourage and reinforce the value of retention of teeth.

Appropriate oral health care changes after an individual receives dentures.[6 24] Self-care usually involves cleaning dentures to prevent bad breath and oral infections as well as to preserve healthy tissues for denture support. Regular visits to the dentist are important for instruction on appropriate home care, detection of soft tissue lesions, refitting of dentures to accommodate changing bone structure and repairing ill-fitting or broken dentures.[24] Although approximately 3 million denture wearers experience denture retention problems because of alveolar ridge deterioration, dental visits after receipt of dentures are low, on average. Most denture wearers believe that they need never again go to the dentist.[6 13]

2. Mechanisms and Interventions Established to Deal with Problem

Professionally-developed educational tools as well as mass media have been used to encourage denture wearers to maintain adequate oral hygiene and to visit the dentist regularly. The ADA Access Program encourages denture wearers to visit the dentist regularly at reduced fees.

3. Apparent Deficiencies

Even with a decreasing proportion of edentulousness in the older population, the number of denture wearers will remain substantial and increased efforts to improve the oral health of these individuals are needed. Efforts to educate denture wearers must counter a strongly held traditional belief that routine dental care is not needed.

F. Professional Training for Research, Teaching and Patient Care

1. Nature of Problem

Evidence suggests that dental, medical, pharmacy, and gerontology professionals have access to information in their own specific areas of concern, but they know little about each other's areas.[20] Attention to oral health symptoms of systemic diseases and basic principles of oral disease prevention are underemphasized in schools of medicine, nursing and pharmacy. Oral health care as is relates to overall medical conditions is not consistently integrated into the learning experience in schools of dentistry, dental hygiene and dental assisting.

Diagnosis and management of oral diseases in older adults have received minimal emphasis in training dental professionals. The older adult may require special management because of potentially complicating medical conditions; the high prevalence of gingival recession, microbial plaque, gingival inflammation; reduced periodontal support and fewer teeth. Educational needs for dentists are many but greater emphases are needed on general internal medicine, morbidity patterns, pharmacology, psychological and social conditions and developmental disabilities as they relate to the oral health of older adults. The aim should be placed on prevention of further disease and maintainance of current oral health status. Training should emphasize provision of treatment using this acquired knowledge. Traditionally, the training of dental professionals has been in dental schools, separate from the remainder of provision of health care. Not only has this created a care system separate from health care, it has emphasized care for the well, ambulatory elderly—those who can voluntarily come to the dental school.[58] Not only have dental students not been taught about dental implications of medically, mentally or socially compromised individuals, they received no clinical decision-making experience with at-risk patients. This has created a cohort of practitioners who are ill-informed regarding geriatric dentistry.

Up until 1979 only 12 percent of the nation's dental schools indicated that they offered courses in geriatric dentistry in their curricula. In 1984, 60 percent of the dental schools had a course in geriatric dentistry. Nearly all dental and dental hygiene schools have begun to develop curricula, clinic and research opportunities in geriatric dentistry. Of the more than 20 topics taught, most schools devote less than one hour to each. Only 'modification of dental techniques', 'oral manifestations of systemic diseases', and 'prosthetic management' receive more than 4 hours.[76] Less than one percent of continuing education courses are directly related to geriatric dentistry.[26]

There is a critical need for trained professionals in research and clinical care. In 1986, there were 20 to 25 dentists with special training in oral health care for the older adult.[26] Beyond the insufficient number of dental professionals trained for the clinical care and informational needs of the older population, it has been suggested that some dentists have inappropriate attitudes regarding older individuals and many general practitioners may be unwilling to treat older patients.[16 24 48]

2. Mechanisms and Interventions Established to Deal With Problem

Geriatric dentistry curricular guidelines were developed by the American Association of Dental School (AADS) in 1982 and are being reviewed and revised in 1987. These guidelines set forth educational goals and behavioral objectives and outline a core content that includes essential elements and elective experiential learning objectives. A special committee is developing guidelines for postdoctoral geriatric fellowships. The ADHA, with the support of Health Services and Resources Administration (HRSA), developed a Geriatrics Curriculum for Dental Hygiene Education in which cognitive and behavioral objectives were defined, and four learning modules developed. The AADS Section on Dental Hygiene Education is developing geriatric curricula guidelines.

Dental schools are expanding advanced geriatric training opportunities with post-graduate programs for training consultants and coordinators in geriatric dentistry, two-year M.S. program in geriatric dentistry, among others. Currently, there are 270 general practice residency programs, with about 1,000 first-year positions. While older patients are not a primary objective of most of these programs, management of patients with complicating conditions is emphasized.

The VA offers a Geriatric Fellowship, providing dentists with opportunities to work with many older patients and other health care providers. Five fellows per year since 1982 have been trained, most of these staying with the VA. The VA has stimulated an elective geriatric dentistry rotation in VA medical centers (VAMC) for junior and senior dental students, as well as general practice residents in several locations. Such rotations expose the undergraduate dental student to the full continuum of care in an interdisplinary setting available through the VA health care system.

HRSA funds regional Geriatric Education Centers which encourage multidisciplinary training of health professionals in geriatrics. Located in universities, these centers serve as resources and provide short term faculty training, curriculum development, in-service and continuing education programs, and assistance to practicing professionals. Twenty-four of the 31 centers have a dental component.

Title VI of P.L. 99-660 adds new authority to train physicians and dentists who plan to teach geriatric medicine or geriatric dentistry. The options include one-year retraining programs in geriatrics to professionals who are faculty members and one-two year fellowship programs to provide training in clinical research and teaching skills for professionals who have completed graduate education programs. An AADS committee developed program considerations in responding to this new authority.

The Administration on Aging (AoA) has recently funded ten oral health promotion grants which address the issues of the older adult through continuing education for health professionals, extension of oral hygiene services through health professionals, improved strategies and interventions for the homebound, dissemination of educational and promotional materials, improved networking and cooperation among existing community and health agencies. The AADS, the recipient of one of these grants, is using the funds to encourage implementation of newly revised geriatric curricula guidelines.

Study clubs and continuing education opportunities are developing across the nation. For example, the ADA has offered clinical symposia in preparing dentists to treat the aging population. Also, dental students in universities have developed geriatric study clubs, networks and newsletters.[77] The VA and local dental societies have formed study clubs to encourage interaction.

3. Apparent Deficiencies

It is estimated that 40 percent of older adults fall into the special needs-patient group and that about 50 percent of these will seek dental care. Based on an assumption that a dentist with specialized training in geriatric dentistry can serve approximately 1000 older patients, there will be a need for 7,500 trained dental practitioners by the year 2000, and 10,000 by 2020. Even with this projection, this special group of dentists will account for only about 5 percent of all practicing dentists.[26]

There is a near absence of models to effect interdisciplinary education or to encourage the interaction among health care professionals. There is a need for routinely available training opportunities for health professionals with ambulatory as well as frail older adults for general medical and oral conditions.. Continuing education courses in geriatric dentistry need to be encouraged, specifically for those dentists who serve large number of older patients.

G. Biomedical and Health Systems Research Basis for Planning and Implementing Health Promotion

1. Nature of Problem

An adequate research base is critical for planning oral health promotion for older persons. There are still considerable gaps in knowledge regarding the severity, rate of progression, and likelihood of occurrence of oral diseases and disorders, as well as the nature of oral flora and host defense mechanisms in aging. More research is needed on how generalized or specific changes in oral diseases affect and are affected by overall health status, the oral implications of medication side effects and drug-induced oral diseases; improving pain control; improving infection control; the impact of professional health promotion (dental school or continuing education) on improving the oral health of older adults; evaluation of patient management techniques required to plan multiprofessional care.

2. Mechanisms and Interventions Established to Deal With the Problem

The National Institutes of Health (NIH), specifically NIDR and the National Institute on Aging (NIA), as part of broader research missions, have several ongoing programs which could improve knowledge regarding the oral health of the older population. Of special note are NIAs ten 5-year geriatric dentistry academic awards and Teaching Nursing Home Award.

The VA conducts research specific to the veteran population as well as general health problems which are prevalent among veterans. In addition to general clinical research opportunities, the VA considers ways of improving effectiveness and efficiency of its health delivery, which has implications for institutional as well as outpatient care. The VA has several opportunities which specifically encourage research on oral health of older adults: Dentist Geriatric Fellow Programs (a 2-year geriatric fellowship); Dental Education Centers; Career Development Programs; the Geriatric Research, Education and Clinical Centers; Interdisciplinary Team Training in Geriatrics; and the Office of Academic Affairs.

Several important Federal intramural research efforts are concentrated in ongoing longitudinal studies: The VA at the Boston Outpatient Clinic and the NIA at the Gerontology Research Center in Baltimore. Both the Boston VA Normative Aging Study and the NIA Baltimore Longitudinal Study provide an opportunity to study normal oral physiology as it ages. These studies of volunteer groups who have frequent and comprehensive dental care, a high concern for dentition and a positive lifestyle enable the researchers to observe normal aging in the oral cavity relatively free of complications that disease or complex treatment may introduce.[31] Research on periodontal diseases and aging is being conducted by the University of New York at Buffalo and the University of Texas at San Antonio under contract with NIDR.

The NIA, NIDR and VA collaborated in the development of A Research Agenda On Oral Health in the Elderly to encourage more biomedical and behavioral research in relation to oral health in aging. This Agenda, which was published in 1986, identified research needs and established the basis for an implementation plan which is leading to program announcements, symposia, workshops, or other ways of informing

the research community of opportunities. The Research Agenda encourages grant requests from individuals as well as proposals for collaborative and interagency studies.[16]

As part of an ongoing Implementation Plan, A Catalog of Resources summarizing existing resources and funding mechanisms available at the three agencies has been developed. Also, the three agencies (NIDR, NIA, VA) issued a Request for Application (RFA) in October, 1987 inviting applications for the support of research centers on oral health in aging. Applicants are to propose multidisciplinary studies on oral health with older Americans and must represent a consortium that includes a VA and one or more non-VA institution. In addition to conducting research, successful applicants are asked to apply for a research training grant during the first year of their grant award. The development of research centers, which can emphasize the aging process should provide critical knowledge on which to base any proposed oral health promotion activities for older Americans.

3. Apparent Deficiencies

The basis for all oral health promotion programs or training opportunities to improve the oral health of older adults requires fundamental knowledge of the nature of the principal diseases and their progression, as well as how to prevent them or diminish their impact. Equally important, clinical and social and behavioral sciences research must go forward to supply essential information on epidemiology, risk factors and other sociodemographic data as well as assure that the results of research are transferred readily to appropriate application.

IV. Summary and Conclusions

A relatively high level of oral health can be achieved for most older adults through the promotion of appropriate self-care and regular dental visits. An emphasis on prevention from early childhood through middle to old age--fluoridation of community water supplies, the use of fluoride applications and mouth rinses, dental sealants, appropriate oral hygiene behaviors and routine dental visits--will promote oral health of older adults. A better understanding of the natural history of caries, periodontal diseases and other oral diseases, particularly as they relate to general systemic conditions, also should be a major focus for oral health promotion for older adults. While current epidemiological data provide some guidelines, considerably more basic, clinical and epidemiological research is needed to enhance opportunities for improving oral health for all of the nation's older adults.

Older individuals can have the same oral diseases as do younger individuals, yet the range of risk factors--behavioral, socioeconomic, biological, physical and mental—is broader, resulting in different prevalence rates and expressions.[78] Some portion of older adults will experience complicated oral conditions requiring intensive and sophisticated care. As with other special care populations, many of these individuals will have multiple medical problems with associated drug therapy, both of which may seriously affect oral health and related treatment.

While improvements in oral health of older persons are impressive, major needs still exist which can be met through health promotion efforts: 1) developing information targeted to older people--especially homebound, minorities and those in remote areas; 2) developing and implementing techniques and strategies for teaching older people ways to prevent disease and promote oral health; 3) improving training and continuing education of medical, pharmacy, nursing, health planning and dental professionals; 4) increasing the availability of assessment, prevention, and promotion services, including the use of nondental settings, e.g. alter the service delivery organization to accomodate older persons special access situations; 5) continuing efforts to reduce the financial burden of oral health care for older persons.

Oral health promotion includes efforts at the individual, health professional, community and environmental levels. Programs need to be directed toward the public--at the individual and community levels--as well as the health care professionals to improve knowledge, attitudes and behaviors. While oral disease prevention is critical, cognitive, attitudinal and behavioral dentally-related outcomes can and should be taken into consideration as values that can improve overall health and the quality of life of the older individual.

V. REFERENCES

1. Census of the United States population, 1980. Washington, D.C.: Bureau of the Census.

2. Income of the population 55 and over, 1984. Office of Research, Statistics and International Policy, Social Security Administration, December, 1985.

3. Kiyak HA. Utilization of dental services by the elderly. Gerondontology 1984; 3(1):17-25.

4. Gibson RM, Fisher CR. Age differences in health care spending: fiscal year 1977. Social Security Bulletin 1979; 42:3-16.

5. Kasper JA, Rossiter LF, Wilson R. A summary of expenditures and sources of payment for personal health services from the National Medical Care Expenditure Survey. NCHSR Data Preview 24; US Department of Health and Human Services, 1987.

6. National study of dental health outcomes related to prepayment: 1981. Rockville, Maryland: Health Resources and Services Administration, 1987. (unpublished data)

7. National income and product account. Bureau of Economic Analysis, Department of Commerce, 1986.

8. Gift HC. Utilization of professional dental services. In: Cohen LK, Bryant PS, eds. Social Sciences and Dentistry, II. London: Quintessence Publishing Company, 1984, pp. 202-266.

9. Kovar, MG. Aging in the eighties, in Advance Data From Vital and Health Statistics, Number 115, National Center for Health Statistics, May 1, 1986.

10. Oral Health of United States Adults: National Findings. National Institute of Dental Research, United States Department of Health and Human Services, NIH Publication No. 87-2868. 1987.

11. Besdine RW. Current issues in health care for the elderly. The Report of the National Invitational Conference on Issues and Strategies in Geriatric Education: 1985. March 1985.

12. Douglass CW, Gammon MD. Implications of oral disease trends for the treatment needs of older adults. Gerodontics 1985; 1(2):51-58.

13. Beck JD. The epidemiology of dental diseases in the elderly. Gerondontology 1984; 3(1):5-15.

14. Baum BJ. Current research on aging and oral health. Spec Care Dent 1981; 1(3): 105-109.

15. Giangrego E. Dentistry and the older adult. J Amer Dent Assoc 1987; 114:298-307.

16. A Research Agenda on Oral Health in the Elderly. Bethesda, Maryland: The National Institute on Aging, The National Institute of Dental Research and The Veterans Administration, 1986.

17. Gift HC. The seventh age of man: oral health and the elderly. J Am Coll Dent 1979; 46(4):204-215.

18. Halpert BP, Zimmerman MK. The health status of the 'old-old': a reconsideration. Soc Sci Med 1986; 22(9):893-899.

19. Blau ZS. Socioeconomic variations in dental status and behavior of today's elderly. Spec Care Dent 1982; 2(6):244-247.

20. Ross LN, Beall GT. Health Promotion and Aging: Opportunities for National Organizations. Washington, DC: The National Council on the Aging, Inc., 1984.

21. Price SC, Kiyak H. A behavioral approach to improving oral health among the elderly. Spec Care Dent 1981; 1(6):267-274.

22. A Research Agenda for Health Promotion and Disease Prevention for Children and the Elderly. Health Services Research 1985; 19(6):part II.

23. Morhart RE, Davis ME, Weiss DG, et al. Dental health status of an aging VA population: implications for a preventive dental health care program. Health Services Research 1986; 6 (part II):933-947.

24. Martin RF. Preventive dental care for older people. Rockville: Health Resources and Services Administration 1985.

25. Kiyak HA. Oral health promotion for the elderly, in Matarazzo JD, Weiss SM, Hard JA, et al. (eds): Behavioral Health: A Handbook of Health Enhancement and Disease Prevention. New York: J Wiley, 1984. pp. 967-975.

26. Personnel for health needs of the elderly through the year 2000. Draft Report to Congress for the Secretary, U.S. Department of Health and Human Services, March 1987.

27. Health Statistics and Older Persons: United States, 1986. Analytical and Epidemiological Studies, Series 3, No. 25, National Center for Health Statistics, 1987. (DHHS Pub# (PHS) 87-1409)

28. Gift HC. Current utilization patterns of oral hygiene practices. In: Loe H, Kleinman D (eds): Dental Plaque Control Measures and Oral Hygiene Practices. Oxford, England: IRL Press Limited, 1986, pp. 39-71.

29. Weintraub JA, Burt BA. Oral health status in the US: tooth loss and edentulism. J Dent Educ 1985; 49(6):368-376.

30. Ismail AI, Burt BA, Hendershot GE, Jack S, Corbin SB. Findings from the dental care supplement of the National Health Interview Survey, 1983. J Amer Dent Assoc 1987; 114:617-621.

31. Baum BJ. Characteristics of participants in the oral physiology component of the Baltimore Longitudinal Study of Aging. Comm Dent Oral Epid 1981; 9:128-134.

32. Hughes JT, Rozier RG, Ramsey DL. Natural History of Dental Diseases in North Carolina 1976-1977. Durham, North Carolina: Carolina Academic Press, pp. 250-254.

33. Banting DW. Dental caries in the elderly. Gerondontology 1984; 3(1):55-61.

34. Baum BJ. Research on aging and oral health: an assessment of current status and future needs. Spec Care Dent 1981; 1(4):156-165.

35. Stamm JW, Banting DW. Comparison of root caries prevalence in adults with life-long residence in fluoridated and nonfluoridated communities. J Dent Res 1980; 59:405.

36. Page RC. Periodontal diseases in the elderly: a critical evaluation of current information. Gerodontology 1984; 3(1):63-70.

37. Hand JS, Whitehill JM. Oral mucosal lesions in an elderly population. J Amer Dent Assoc 1986; 112: 73-76.

38. American Cancer Society, 1987.

39. Bouquot JE. Common oral lesions found during a mass screening examination. J Amer Dent Assoc 1986; 112:50-57.

40. Baum BJ, Bodner L. Aging and oral motor function: evidence for altered performance among older persons. J Dent Res 1983; 62(1):2-6.

41. Mandel ID. Oral defenses and disease: salivary gland function. Gerondontology 1984; 3(1):47-54.

42. Baum BJ. Evaluation of stimulated parotid saliva flow rate in different age groups. J Dent Res 1981; 60(7):1292-1293.

43. Hill MW. The influence of aging on skin and oral mucosa. Gerondontology 1984; 3(1):35-45.

44. Branch L, Jette A, Evashwick C, Polansky M, Rowe G, Dierhr P. Toward understanding elders' health service utilization. J Comm Health 1981; 7(2): 80-92.

45. Marinelli RD, Sreebny LM, Kamen S. Perception of dental needs by the well elderly. Spec Care Dent 1982; 2(4):161-164.

46. Wilson AA, Branch LG. Factors affecting dental utilization of elders aged 75 years or older. J Dent Educ 1986; 50(1):673-677.

47. Lie T, Mellingen JT. Periodontal awareness, health, and treatment need in dental school patients. Acta Odontol Scand 1987; 45:179-186.

48. Kandelman D, Lepage Y. Demographic, social and cultural factors influencing the elderly to seek dental treatment. Int Dent J 1982; 32(4):360-370.

49. Branch LG, Antczak AA, Stason WB. Toward understanding the use of dental services by the elderly. Spec Care Dent 1986; 6(1):38-41.

50. Jack SS. Use of dental services: United States, 1983, in Advance Data from Vital and Health Statistics, Number 122, National Center for Health Statistics, August 8, 1986.

51. Health United States: 1986. US Department of Health and Human Services, DHHS Pub. No (OHS) 87-1232, 1987.

52. Brown LJ, Brunelle JA, Miller AJ, et al. Oral health of US adults 1985; tooth mortality, sociodemographic and other dental health characteristics. Paper presented at the International Association of Dental Research, 1987.

53. National Health Interview Survey. National Center for Health Statistics, unpublished data, 1986.

54. Bureau of Economic and Behavioral Sciences. Utilization of Dental Services by the Elderly Population. Chicago: American Dental Association, 1979.

55. Gift HC. The elderly population: oral health status and demand and utilization of dental services. J Am Soc Ger Dent 1978; 13(2):9-21.

56. Whittle JG, Sarll DW, Grant AA, Worthington HV. The dental health of the elderly mentally ill: a preliminary report. Br Dent J 1987; 162:381-383.

57. Levy SM, Baker KA, Semla TP, Kohout FJ. Medications with dental significance: usage in an elderly population. Paper presented at the International Association for Dental Research, March 1987.

58. Ettinger RL. Evolving curricular developments in the health professions. The Report of the National Invitational Conference on Issues and Strategies in Geriatric Education: 1985. March 1985.

59. Tryon AF. A model for intergrating geriatrics into the dental school curriculum. Spec Care Dent 1981; 1(3): 114-121.

60. Ross LN. Compendium of Health Promotion-Related Initiatives for Older Adults. Washington, DC: The National Council on the Aging, Inc., 1984.

61. Diehnelt D, Kiyak HA. Predictors of oral health behaviors among elderly Japanese-Americans. Unpublished manuscript, 1984.

62. Evashwick C, Conrad D, Lee F. Factors related to utilization of dental services by the elderly. Am J Public Hlth 1982; 72:1129-1135.

63. Knazan Y. Dental health promotion for senior citizens. Paper presented at meetings of the International Association of Gerontology, July 1985.

64. Kiyak HA, Crinean J, Stockinger S. Older persons' use of dental services compared to other health services. Paper presented at meetings of the GSA, November 1985.

65. Kiyak HA. Explaining patterns of dental service utilization among the elderly. J Dent Educ 1986; 50(11):679-687.

66. Kiyak HA, Miller RR. Age differences in oral health behavior and beliefs. J Public Hlth Dent 1982; 42:404-416.

67. Gilmore S, Kiyak HA. Predictors of dental behaviors among the elderly. Spec Care Dent 1985; 5:169-173.

68. Beck J, Cons N, Field H, Walker J. The Iowa Survey of Oral Health: 1980. Iowa City, Iowa: University of Iowa College of Dentistry and Iowa Dental Association, 1982.

69. Provisional data from the health promotion and disease prevention supplement to the national health interview survey: United States, January-March, 1985, in Advance Data From Vital and Health Statistics, Number 113, National Center for Health Statistics, November 15, 1985.

70. Hagebak JE, Hagebak BR. Serving the mental health needs of the elderly. Community Mental Health J 1980; 16:263-275.

71. Antczak AA, Branch LG. Perceived barriers to the use of dental services by the elderly. Gerodontics 1985; 1:194-198.

72. Doherty N, Segal J. Dental care as an extended Medicare benefit: The Triage Experiment. Technical Report, University of Connecticut, 1978.

73. Portnoy R, Yellowitz J. Senior citizens need teeth too. Paper presented at meetings of the Gerontological Society, November 1977.

74. Wolinsky FD, Coe RM, Miller DK, et al. Health services utilization among the noninstitutionalized elderly. J Health Social Behavior 1983; 24(4):325-337.

75. Results of the 1985 Access Program Survey. Chicago: American Dental Association, 1986.

76. Beck JD, Ettinger RL. The development of geriatric curricula in U.S. dental schools, 1979-1984. J Dent Educ 1987; 51(9): 523-527.

77. Geriatric Dentistry Network Newsletter 1987, 1(1).

78. Mecklenburg RE, Martin RF. Oral health objectives for the elderly in the year 2000. Gerodontics 1986; 2:161-163.

HEALTH PROMOTION AND AGING
"PHYSICAL EXERCISE"

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INTRODUCTION

Disuse invites dysfunction, while use favors function. At the most fundamental level, use connotes viability and activity promotes productivity. Confinement to enforced inactivity and immobility for a prolonged period of time results in numerous undesirable physiologic changes, including a decline in cardiovascular fitness, increase in body fat, decrease in lean body mass, loss of bone density, increase in plasma lipids, decline in glucose tolerance and deterioration in cognitive-motor function, memory and mental acuity. This profile of inactivity is similar to physiologic changes thought to occur with aging.

Aging is associated with a decline in time spent physically active - a behavior "forced" upon many individuals due to their changing lifestyle of increased work stresses, more family obligations and greater fatigue. It follows therefore, that the reverse, a heightened degree of physical activity and fitness, may confer protection or prevent declines in functional capacity. With aging, regular physical activity may make it easier to participate in activities of daily living, thereby prolonging an active, functional independent lifestyle. Thus, for some older individuals the sequellae of physical inactivity may mimic disease. Enforced physical activity may reverse this process; such an outcome would reenforce the causal relationship between reduced physical activity habits and the declines in functional reserve capacity commonly observed with advancing age.

RESEARCH IN GERONTOLOGY

Biological Aging and Declines in Functional Reserve Capacity

The empirical approach to defining the effects of aging in humans has been to focus on time-related declines in organ function. These declines are commonly attributed to a biological aging process; yet, closer inspection of the available information indicates that there is a wide variance in the functional status of individuals and that this diuversity in function increases with advancing age. Unlike diseases which affect certain individuals, the aging process is universal and results in gradual decline in the functional reserve capacity (defined as the difference between basal and maximal function) of the cardiovascular, endocrine, musculoskeletal, and other systems and changes in body composition and may be considered a normal part of the human life experience. While it can be argued that qualitative and quantitative differences in the organ function of older individuals reflect heterogeneity in individual rates of aging *per se*, an alternative hypothesis is that diversity in physiologic function is due to the influence of extrinsic factors and diseases that covary with biological age to affect functional reserve capacity in older humans. To what extent the rate of decline and ability to maintain function into older age is dependent on factors extrinsic to the aging processes is not known. Some of these extrinsic factors may be classified as the purported lifestyle habits of physical activity, dietary control of body weight and saturated fat consumption, and abstinence from cigarettes and alcohol.

The risk for declines in functional capacity of various organs with aging may be exaggerated and the prospects for reversal, delay or prevention of functional loss with aging vastly underestimated. An examination of the effects of treating disease and its consequences, maintaining regular physical activity habits, and controlling body weight by dietary discretion on the functional reserve capacity of the aging human being is necessary in order to understand the health-related consequences of biological aging itself. The impact of diseases and purported age-associated declines in physical activity increases in body weight, indiscretions in diet, stresses of psychosocial or socioeconomic nature and personal habits of alcohol consumption and cigarette smoking, which occur with advancing age on the overall functional performance of the human being is probably underestimated.

Disease and Declines in Functional Reserve Capacity with Aging

Susceptibility to disease increases with advancing age and available evidence suggests that vulnerability to a number of chronic diseases (and subsequent disease-related declines in function) can be attenuated by changing lifestyle habits. For example, reducing body weight lowers risk for non-insulin dependent or type II diabetes; a low fat, low cholesterol diet reduces risk for coronary artery disease; smoking cessation reduces risk for lung cancer and heart attacks; a low salt diet reduces blood pressure and risk for stroke; and avoidance of excess sun lowers the incidence of skin cancer. There is a consistent relationship between physical activity status and the incidence of coronary artery disease that is comparable in magnitude to that related to serum cholesterol, smoking >1 pack/day of cigarettes and systolic hypertension (1). Physical exercise also is associated with a lower risk factor profile (lower lipids, better blood pressure and glucose tolerance, elevated high density lipoprotein cholesterol) for coronary artery disease (2). The interaction among diseases, lifestyle variables, and putative aging makes it difficult to assess the effects of each of these processes on the overall functional capacity of the aging human being unless the influence of all the factors on functional capacity are delineated or controlled while the physiologic effects of one single process are measured. This is not always feasible because change in one usually alters the others, thereby limiting the ability to distinguish the physiological effects of each process independently.

One approach to studying the effects of extrinsic variables on age-related declines in organ function might be to first differentiate the effects of disease from those of biological aging. To identify the effects of one disease is not difficult when clinical signs and symptoms of other diseases are not present; however, the effects of asymptomatic disease can be easily overlooked and may cause substantial functional impairments. Furthermore, the effects of several diseases on functional capacity can be synergistic.

Arteriosclerosis is the main disease process which correlates directly with biological age, and has the greatest impact on cardiovascular function and longterm survival in the elderly (3). Asymptomatic coronary disease was probably responsible for the decline in the peak exercise ejection fraction below resting levels in 72% of apparently healthy volunteers over 60 yrs of age (4). The coexistence of wall motion abnormalities in 50% of individuals older than 70 years of age with an abnormal ejection fraction response to exercise suggests that regional ischemia was indeed present. In contrast, during maximal cycle exercise there was neither a decline in the ejection fraction below resting levels nor were there regional wall motion abnormalities in normotensive older

subjects intensively screened for coronary artery disease by exercise thallium scintigraphy (5). This suggests that biological aging per se does not reduce cardiac function in older individuals who are properly screen for cardiovascular disease. Hypertensive disease also has a substantial effect on cardiac performance by increasing arterial stiffness and pressure, pulse wave velocity and left ventricular wall thickness, decreasing the early diastolic filling rate and prolonging ventricular relaxation (6). There is a 25% increase in left ventricular wall thickness and a 50% reduction in early diastolic filling rate at rest between the third and ninth decades in clinically normotensive individuals (7,8); thus, hypertension might accelerate age-related changes in cardiac function. This would increase afterload in the aging heart, alter the pulsatile component of external cardiac work, reduce arterial distensibility and raise systolic arterial blood pressure, pulse wave velocity and peripheral vascular resistance. Physical conditioning modestly lowers both systolic and diastolic blood pressure, and reduces peripheral vascular resistance in hypertensive middle-aged patients (9), and increases stroke volume, cardiac output and left ventricular wall thickness without changing peripheral vascular resistance in normotensive younger subjects (10). Whether exercise training would increase arterial distensibility and reduce pulse wave velocity and systolic arterial pressure in older subjects is not known; but lower pulse wave velocity and systolic arterial pressure are common in cultures where levels of physical activity are high and the sodium content of diets are low (11).

Rigorous screening for silent ischemia and hypertension at rest and by maximal treadmill exercise testing with electrocardiography and thallium scanning (12) can provide individuals free from coronary artery and other asymptomatic cardiovascular disease in which to study the physiological effects of exercise training, independent of disease, on cardiovascular and endocrine-metabolic functions in aging man. Using these techniques the prevalence of coronary artery disease in subjects over the age of 70 years was estimated to approach the post-mortem finding of greater than 70% narrowing of at least one major coronary artery in 40-60% of unselected hearts (13). Similarly, screening the older individuals for diabetes with the glucose tolerance test by the criteria of the National Diabetes Data Group (14,15) and for hyperlipidemia using criteria from the Lipid Research Clinics Prevalence Study (16,17) allows detection and exclusion of older people with generally accepted abnormalities in glucose and lipoprotein lipid metabolism who may be at high risk for asymptomatic disease or organ dysfunction. While disease causes demonstrable and clearly significant impairments in functional capacity, increased physical activity by raising aerobic capacity, lean body mass and energy level and reducing body fat can have a substantial impact on the functional status of the aging human being.

Physical Activity and Maintenance of Functional Reserve Capacity

An emphasis on maintenance or improvement in functional capacity with advancing age has not been a major focus of gerontologic research. A substantial amount of information regarding the effects of aging on physiologic function is derived from cross-sectional studies which report declines in performance among different age groups. In the analysis of measurements of the various functional status within group data, there is substantial heterogeneity in the physiologic function of individuals within the various age groups. While mean data may show a decline in the functional reserve capacity among the elderly, there are older individuals with either minimal or no loss, and sometimes equal or even better functional capacity than that of the average younger person. This information has come to the forefront in evaluating the physiologic effects of factors extrinsic to

primary biologic aging, such as regular, intense physical activity, on functional reserve capacity. In master athletes, individuals over the age of 50 years who are very physically active, highly conditioned and compete regularly in athletic events, there is minimal loss in cardiovascular function with advancing age, and glucose tolerance, insulin sensitivity, and lipoprotein lipids are comparable to those of younger athletes (18-21). Master athletes, and other older individuals without specific pathologic linked losses in function commonly associated with disease, who have maintained functional reserve capacity comparable to younger counterparts might constitute that category of non-diseased elderly who have aged successfully (22). This suggests there are more important determinants of health than biological (as opposed to functional) age in disease-free older people. The role of these extrinsic factors or lifestyle behaviors, especially physical activity habits, as significant modulators of physiologic function in the elderly requires further evaluation.

A profound effect of physical exercise training on cardiovascular, endocrine-metabolic and musculoskeletal function in younger individuals is now well recognized, and it is likely that many changes in functional reserve capacity that have been previously attributed to an "aging process" are in part due to the sedentary lifestyle and dietary indiscretion that accompanies advancing age. It is not known how much of an improvement in physiological function can be expected in response to varying levels of physical exercise in sedentary elderly subjects, nor is it known to what extent and under what conditions medically unsupervised physical activity can be recommended for healthy or disease-afflicted elderly. Further investigation is needed to understand the mechanisms by which aging affects physiologic responses to acute and long-term physical activity and to define the roles that physical conditioning can play in the promotion and maintenance of health and the prevention of diseases attributed to biological aging.

The perspective gained in this area of gerontologic investigation will be limited if only cross-sectional data are examined, especially when all that is reported are mean data. Only through longitudinal investigations of medically defined, carefully selected cohorts can the impact of physical activity on the functional reserve capacity of aging humans be distinguished from other extrinsic factors, disease and biological aging itself. Several longitudinal studies examining the potential of exercise training to slow age-related declines in cardiovascular, musculoskeletal, bone-mineral, and glucose and lipoprotein lipid metabolism are currently supported by the National Institute on Aging. There are also studies in progress to investigate the mechanisms by which physical exercise may improve the functional reserve capacity and the medical condition of elderly people afflicted with diseases such as coronary artery disease, hypertension, type II diabetes mellitus and osteoporosis. If the results of these studies are to provide insight into the efficacy of aerobic exercise as a therapeutic modality to improve the well-being of the rapidly expanding population of older people, the common experimental problems distinguishing confounding effects of aging, cohort, secular and time effects on the experimental measures must be considered and may require an age-time matrix type of study design (23).

DEFINITION OF THE ISSUES

The specific contributions of physical inactivity and deconditioning to the commonly observed declines in the functional reserve capacity of major organ systems with aging have not been thoroughly delineated. The maintenance of physical activity and conditioning status measured as maximal aerobic capacity

(the ability of the cardiovascular system to deliver blood and oxygen to working muscles and of exercising muscles to utilize the oxygen and energy substrate to perform work in response to a maximal exercise stimulus) (24) into older age may have substantial health and socioeconomic benefits for the elderly. The fact that high levels of maximal aerobic capacity (VO_2max) observed in selected master athletes are associated with improved metabolic function and the maintenance of a high level of functional reserve capacity compared to their sedentary peers suggests that this is the case. Although maximal aerobic capacity is probably the best measure of physical work capacity and fitness in younger individuals, it may not be the only measure of organ performance or necessarily the best measure of functional reserve capacity in the elderly. Energy expenditure, measured as oxygen consumed, or other physiologic responses (hemodynamic, muscular, hormonal, cognitive-motor or otherwise) to submaximal isotonic work on a bicycle or treadmill, to an isometric (weight) stimulus, or to environmental and mental stressors are also important, useful measures of human performance.

The goal of remaining physically active with advancing age is to delay the declines in functional capacity with aging. Not only does regular aerobic exercise maintain muscle strength, coordination, speed, endurance and agility, but it reduces body fat and other risk factors for coronary artery disease, heightens mental acuity, maintains self esteem and enhances quality of lifestyle. The rehabilitative capacity of regularly performed aerobic exercise also is demonstrated in human disease. Physical activity has improved physiological function and overall performance in some patients with ischemic coronary artery disease, hypertension, endstage renal disease, diabetes mellitus, weakness due to muscle wasting and depression. The salutary effects of physical conditioning on behavior include enhanced motivation, increased confidence in the ability to perform daily tasks and activities, successful return to a regular work schedule, and a heightened level of energy for activity; all presumed due to increased aerobic capacity. Such improvements could maintain the functional capacity of older people afflicted with disease, in spite of concomitant physical limitations. This suggests that regular physical activity may be a suitable mode of rehabilitation for older individuals with limited function due to disease and for maintaining the functional reserve capacity of the healthy elderly.

If physical conditioning status is maintained by regular exercise, can age-associated declines in functional capacity be avoided? Can vigorous exercise successfully restore the declines in organ function and vulnerability to diseases and stresses associated with aging? If so, how much exercise is needed? How often and at what intensity? Is there a threshold for activity or set point for VO_2max at which beneficial adaptations will occur or deteriorations ensue? Can the observations in master athletes with high levels of maximal aerobic capacity or in disease-afflicted individuals who regain functional capacity through regular physical activity be solely ascribed to exercise? Many questions need be answered regarding the potential for physical exercise to promote successful, healthy aging and to restore the functional capacity of those afflicted with disease. Substantial research is needed to understand the relationship of regular physical exercise and the maintenance of heightened aerobic capacity to the functional status of the aging human being.

Major Areas Which Require Investigation

Evaluation of the potential role for regularly performed physical exercise in the prevention and/or reduction in the extent of age-related diseases and disorders in humans, and the determination of the exercise

prescription (type, frequency, intensity and duration) and magnitude of the increase in aerobic capacity required to produce these effects.

Assessment as to whether or not there is a threshold for the increase in maximal aerobic exercise capacity required to achieve a specific functional reserve capacity. Are there different benefits for different degrees of exercise intensity?

Investigation of the mechanisms by which regularly performed exercise increases cardiovascular, endocrine-metabolic, cerebral, and other organ function, maximal aerobic capacity, and the ability to work and function independently, and reduces risk factors for disease in the elderly.

Measurement of the biological adaptations to increased exercise/physical activity in man <u>in vivo</u> at functional levels ranging from the whole body to the specific organ systems, tissues and to the cellular and molecular level, and the determination of the influences of advancing age on these processes.

Evaluation of whether or not maximal aerobic capacity (VO_2max) is the best measure of physical conditioning status, cardiovascular function and overall functional reserve capacity in the elderly.

Determination whether functional declines with short- and long-term deconditioning are more rapid and of greater magnitude in older active individuals than in comparably conditioned younger individuals, and an assessment as to whether or not deconditioned older individuals are capable of rehabilitation to previous levels of performance after deconditioning.

Assessment whether the recommendation for increased physical activity in older individuals is medically safe for healthy as well as disease-afflicted elderly. If affirmative, then studies are needed to develop guidelines for baseline medical evaluations and appropriate prescriptions (type, frequency, duration and intensity of activity) for exercise training older people that maximize the benefits of exercise while preventing injury.

THE ELDERLY BE PHYSICALLY CONDITIONED?

; of the longitudinal studies documenting improvements in functional reserve ıcity with aerobic conditioning are in younger and middle-aged individuals; ;s-sectional comparisons in epidemiologic studies provide most of the ɔrmation on the potential of physical exercise training to increase aerobic ıcity and improve functional reserve capacity in the elderly (2, 25-27). In few longitudinal studies examining the effects of exercise training on ɜntary people over the age of 60 years, the training stimulus was of short ıtion and low intensity, and sample sizes were small. As a result, a ;tantial change in maximal aerobic capacity was documented in some (28-30), not in other studies (31-33). These inconsistencies have limited the ability ·each a conclusion about the trainability of older individuals (34). However, physiological results of longitudinal studies in which high intensity ·cise was used to condition older individuals (30,35), the benefits achieved middle-aged and older patients with coronary artery disease (36), type II ɔetes (37,38) and chronic renal disease (39) with participation in vigorous

aerobic exercise programs, and the observations in master athletes (18-21) support the view that exercise has the potential to improve functional capacity and prevent disease in the elderly.

Several studies have attempted to determine the training intensity required to raise VO_2max substantially in older individuals. In an early study (28), 60% of people aged 60-79 yrs increased their aerobic capacity an average of 7% after participation in a 6 week walking and jogging program at an intensity of 40-50% of heart rate reserve. In another study, there were comparable increases in the peak VO_2max of 60-70 year olds after 9 weeks of exercise at an intensity of either 57 or 70% of VO_2max (29). The most comprehensive study to date involved, a 6 month program of walking at 40% of heart rate reserve which increased VO_2max by 12% in 11 healthy subjects ages 65$\pm$3 years (30,35); however, in spite of the rise in VO_2max during the lower intensity exercise, glucose and lipoprotein lipid metabolism did not improve. Subsequently, higher intensity exercise at 80-85% heart rate reserve for 6 months raised VO_2max an additional 18% and substantially improved hemodynamic, metabolic and pulmonary responses (30,35,40,41). It is not clear whether it was the duration or the intensity of the training stimulus which limited the improvement in the functional reserve capacity of these older subjects. Although the older individuals increased their VO_2max an additional 18% in response to the vigorous aerobic exercise program, the lower intensity training stimulus was sufficient to improve cardiac performance, but not the metabolic function of these individuals. While VO_2max increased in older subjects at these lower intensities, higher intensity training programs and a more significant rise in maximal aerobic capacity over a longer time period might be required for older subjects to achieve the metabolic improvements observed in younger and middle-aged subjects after endurance training (42-45). The high VO_2max and associated cardiovascular and metabolic benefits achieved by master athletes who have trained intensely for a long period of time lends credence to this hypothesis (18-21,46,47).

In some older subjects, the cardiovascular and metabolic adaptations to exercise programs may be significantly less than in younger individuals. This may reflect the presence of asymptomatic disease or irreversible changes in cardiac, respiratory and/or skeletal muscle structure and function in older subjects which limits the ability of the exercise stimulus to produce physiologic adaptations in the function of various organs comparable to those observed in healthy younger subjects (48,49). The suggestion that enhanced muscular adaptations, rather than increased cardiac output may be responsible for the greater oxygen extraction at maximal exercise in master athletes suggests that peripheral, not central adaptations are primarily responsible for their elevated VO_2max (49). These changes in skeletal muscle structure and function may take longer to occur in older individuals. Whether or not endurance exercise can induce these peripheral adaptations in sedentary older individuals and raise their VO_2max to levels comparable to those found in younger individuals may require longterm longitudinal studies.

The ability of master athletes to maintain high levels of VO_2max and have glucose tolerance, insulin sensitivity, and plasma lipoprotein lipid levels comparable to those found in younger active individuals (18-21) suggests that maintenance of a high level of physical activity into older age can slow the decline in the functional reserve capacity of the cardiovascular and endocrine-metabolic systems previously attributed to biological aging (48). Preliminary results in several highly conditioned master athletes who began intensive physical exercise training in their 6th decade of life and in one who deconditioned for 10 weeks (VO_2max

declined from 53 to 39 ml/kg·min) suggest that these cardiovascular and metabolic adaptations are probably not inherited (50).

In studies examining the effect of regular chronic wheel exercise on cardiac function in sedentary adult rats there was a mild augmentation in cardiac oxidative enzyme capacity and an attenuation of the age-related decline in myocardial calcium activated actomyosin ATPase activity. This indicates that exercise conditioning can partially reverse the decline in cardiac muscle oxidative capacity observed in aging sedentary rats (51), suggesting that the relative efficacy of chronic exercise to modulate myocardial performance is possible into older age, and apparent age-related declines in myocardial function, at least in rodents, can be reversed by physical conditioning.

It is possible that the vigorous high intensity training program required to test the hypothesis that physical exercise will improve functional reserve capacity in the elderly may not be possible in all older individuals. The ability to condition some older individuals may be limited by obesity or coexistent disease or other medical conditions. Obesity, defined as a body mass index >30 Kg/m^2 (52) is associated with hypertension, diabetes, hyperlipidemia and arteriosclerosis (53), and an increased mortality from coronary heart disease (54). Thus, overweight individuals are at increased risk for complications during exercise training and require careful screening for overt and asymptomatic disease prior to onset of exercise training. Furthermore, oxygen consumption and cardiac work are increased in overweight individuals during exercise (55), increasing risk for cardiovascular complications. Weight reduction prior to participation in a physical exercise program may reduce risk for complications during training and enhance the ability of overweight individuals to raise their maximal aerobic capacity. Simultaneous programs of weight reduction by hypocaloric feeding and behavior modification combined with physical exercise may be even more beneficial, since increased energy expenditure during exercise will enhance the caloric deficit produced by hypocaloric feeding (55,56). Preliminary results in healthy overweight, middle-aged and older men screened for occult coronary disease by maximal treadmill stress testing suggests that such a combined intervention promotes a greater reduction in adipose tissue mass than achieved either by hypocaloric feeding or exercise alone (57). Such an approach seems attractive if confounding extrinsic factors such as disease do not limit the exercise capacity of these sedentary, overweight individuals or place them at risk for injury. Thus, prior screening for disease, especially symptomatic and asymptomatic coronary artery disease by careful medical exam and exercise stress testing with electrocardiography and thallium scans would provide a healthy population of older individuals at low risk for exercise-induced complications in which to test whether prolonged, intensive physical exercise in elderly individuals will cause cardiovascular, metabolic and other physiologic adaptations comparable to those seen in younger individuals.

ARE AGE-RELATED DECLINES IN CARDIOVASCULAR FUNCTION MODIFIABLE BY PHYSICAL EXERCISE

The most effective test to evaluate the maximal functional capacity of the cardiovascular system is to measure maximal oxygen uptake during strenuous exercise. This test determines the capacity of the cardiovascular system to deliver oxygen to working muscles and for exercising muscles to utilize the oxygen to perform the work (24). Most of the studies examining the effects of aging on VO_2max are cross-sectional comparisons of the changes in physiologic responses to maximal exercise stress with age in active, but non-athletic men. They report a rather uniform average 10% per decade or 0.45 ml/kg·min per year

mean decline in VO_2max from age 25-80 years (25,58). However, in highly trained master athletes there was a decline in VO_2max of only 5% per decade (18). The rate of decline in VO_2max with advancing age in longitudinal studies is heterogeneous, and dependent on the physical activity status of the population studied. In subjects aged 40-72 years divided into active and inactive categories, the VO_2max of active men who jogged an average of 3 miles/week declined by much less rapidly than that of sedentary men (59). In men aged 40-60 yrs old who ran an average of 25 km/week, there was no decline in VO_2max over a 10 year period of follow-up (60). In a recent longitudinal study there was a decline in VO_2max of less than 2% per decade in highly conditioned master athletes aged 50-82 yrs who remained competitive and a significant 12% decline per decade in the VO_2max of those who ceased competition but remained highly active during the 10 year period (19). In that study, maximal heart rate and fat free mass decreased and percent body fat increased comparable amounts in both groups, suggesting that the competitive group either increased arteriovenous oxygen difference (i.e., muscular adaptations occurred) or raised stroke volume (i.e., cardiac adaptations occurred since maximal heart rate decreased) during the 10 year period of intensive training. Thus, while maximal heart rate declines with advancing age, it appears that highly conditioned elderly subjects without evidence cardiovascular disease can maintain their aerobic capacity by increasing muscle oxidative capacity (arteriovenous oxygen difference) and by increasing stroke volume and diastolic filling (Frank Starling mechanism) to compensate for the progressive decline in maximal heart rate with advancing age (46-49). In addition to the physiologic adaptations observed with regular high intensity endurance exercise in healthy conditioned older athletes, long term, high intensity aerobic training produces both cardiac and peripheral adaptations in middle-aged patients with ischemic heart disease (36,61,62). In these patients the peripheral adaptations also may be of greater significance then central (cardiac) ones, since left ventricular wall thickness, contractility and function during systole did not change (46).

Thus, while maximal aerobic capacity declines with advancing age, this decline can be attenuated by central and peripheral circulatory adaptations. In highly conditioned master athletes there is a decline in VO_2max with advancing age that can be attributed to a decline in maximal cardiac output caused by the well-documented age-related decline in maximal heart rate (46-48). However, this can be attenuated by continued high intensity aerobic training (19). Thus, because of variability in lifestyle habits there may be diversity in VO_2max and cardiac hemodynamics in elderly individuals such that some older individuals have a VO_2max comparable to that of younger individuals.

In addition to differences in the disease status, physical activity habits and body composition of older subjects, studies in disease-free older subjects indicate that there are at least three significant age-associated alterations in cardiac structure and function. These are a mild increase in left ventricular wall thickness (8,48), slowed and delayed ventricular relaxation (6,8), and diminished contractile performance during physical exercise (46,48). The first two age-related changes probably reflect a compensatory response to the increased workload imposed by vascular changes (increased peripheral vascular resistance), which increase pulse wave velocity and afterload. This increases the pulsatile component of external cardiac work and raises systolic arterial pressure (11). These changes are magnified in individuals with hypertension (6) and are an independent risk factor for cardiovascular mortality (63). The clinical relevance of the left ventricular hypertrophy observed with advancing age is not clear, but under conditions of acute volume overload or exercise stress may raise

ventricular and pulmonary pressures and increase shortness of breath. Physical conditioning profoundly affects the circulatory system in younger individuals by increasing stroke volume, decreasing peripheral vascular resistance, and increasing left ventricular mass (10,48); in older subjects it might also increase arterial distensibility, reduce pulse wave velocity and lower systolic blood pressure. The effects of physical conditioning on these processes are not known in older people.

The third age-related change in cardiovascular function, a decline in maximal aerobic capacity, defined by the Fick equation as the product of cardiac output and arteriovenous oxygen difference during maximal exercise stress is dependent on the population studied, and age-related changes in the peripheral and central circulation (46-48). In disease-free individuals cardiac output, measured at peak oxygen consumption using the gated blood pool scan technique during cycle exercise to exhaustion, was maintained with advancing age (5,12). However, neither arteriovenous oxygen difference nor cardiac output or their determinants have been measured at VO_2max; and in preliminary studies evaluating the mechanisms regulating aerobic capacity in master athletes and sedentary older subjects, peripheral and not central adaptations seem responsible for the higher levels of VO_2max in highly conditioned master athletes (49). Other possible reasons for differences in VO_2max among older individuals may be the inappropriate normalization of oxygen consumption during maximal exercise stress to total body mass rather than to lean body mass since muscle mass decreases with advancing age (64,65) and the additive effects of the age-associated decline in blood flow to muscle during maximal exercise in elderly subjects (66). While there is a progressive decline in pulmonary function with advancing age that may be caused by effects of biological aging or environmental exposures and lifestyle (67,68), they do not seem to limit exercise capacity in individuals without evidence of pulmonary disease because maximal ventilatory capacity is rarely achieved at VO_2max. Hence, the pulmonary system is usually not rate-limiting in exercise performance, although oxygen exchange in the lung may hinder performance during prolonged exercise.

Thus, the health status and lifestyle habits of the individuals studied seem to have the most profound affect on cardiovascular performance during maximal exercise stress testing. Coronary artery disease, whether overt or asymptomatic has the most significant impact on cardiac function and screening out individuals with cardiovascular disease especially in older populations, dramatically alters cardiac performance (5,12,48). In healthy older individuals, screened for coronary artery disease, differences in cardiac function may be primarily due to physical conditioning status. In the only study addressing this issue, both cardiac output and end diastolic volume were higher at the same level of exercise intensity after a 12 week aerobic training program, but end systolic volume did not change (69). The extent to which the peripheral (muscle mass, blood flow and oxygen extraction) and central (ventricular function, cardiac output, and oxygen exchange) factors determining maximal aerobic capacity (Fick Equation) differ among healthy elderly subjects with varied physical activity habits, and the effects of physical conditioning on these parameters is not known.

ARE GLUCOSE AND LIPID METABOLISM MODIFIABLE BY PHYSICAL EXERCISE IN THE ELDERLY?

Some of the alterations in glucose and lipoprotein metabolism which occur with advancing age predispose older people to diabetes mellitus and hyperlipidemia (15,16), major risk factors for coronary artery disease, the leading cause of death in older Americans (3). If physical inactivity and a reduced aerobic

capacity are major determinants of the decline in metabolic function and increase in adiposity which predispose older individuals to develop atherosclerosis, then interventions which improve physical conditioning status and VO_2max should improve metabolism, reduce risk factors for atherosclerosis and decrease cardiovascular complications during stress. A better understanding of the effects of change in lifestyle habits on glucose and lipid metabolism with advancing age might have important health implications for reducing the prevalence of coronary artery disease and prolonging the survival of older individuals.

A beneficial effect of physical conditioning on glucose and lipoprotein metabolism and body composition is recognized in younger and middle-aged individuals (2,26,27,42-45) and several studies indicate that similar changes occur in older subjects (28-30). The longitudinal studies in older individuals are few in number and most are descriptive, not mechanistic. Furthermore, changes in body fat and diet during training, the duration and intensity of the exercise, and the timing of the last exercise session relative to the performance of the research tests affect glucose and lipoprotein metabolism and may limit the ability to distinguish effects of physical conditioning per se from those of other extrinsic factors affecting metabolism.

Declines in metabolic function with advancing age are highly variable, and in a substantial percentage of older subjects measures of lipoprotein lipids, glucose metabolism and body composition are comparable to those in younger subjects. The reduction in overall muscle mass and blood flow to muscle in elderly individuals contributes to the decline in metabolic function by decreasing muscle structure and function and reducing the peripheral utilization of substrates. Thus, while glucose utilization and lipoprotein turnover traditionally have been normalized to body weight or the pool size of a substrate, it may be appropriate to normalize these parameters for lean body mass and organ function in older individuals.

Glucose Metabolism with Advancing Age

The 5 mg/dl deterioration in glucose tolerance per decade observed with advancing age is primarily caused by peripheral tissue resistance to the action of insulin (14,15). Studies using the glucose clamp technique indicate that at submaximal insulin concentrations both glucose disposal and the suppressibility of hepatic glucose production by insulin on the average are reduced in older subjects despite normal insulin receptor binding (70-72). This raises plasma insulin levels and reduces glucose tolerance, both of which increase risk for accelerated atherosclerosis (73). Tissue responsiveness to insulin, defined as the glucose disposal rate at maximal insulin concentration, is normal in some and reduced in other elderly subjects depending on their degree of hyperinsulinemia and glucose intolerance. This suggests that in some older people there may be a post-insulin receptor defect in insulin action, yet this has not been examined directly at the cellular level. Other mechanisms, such as reduced insulin secretion (74) and increased levels of norepinephrine resulting in impaired insulin secretion and action (75), also may worsen glucose metabolism in older individuals.

Cross-sectional data in master athletes (20) and sedentary younger and older individuals (38,42,43) suggest that the maintenance of high levels of physical activity into older age protects against the age-related deterioration in glucose tolerance and insulin sensitivity. In only one study examining the effects of

aging on glucose metabolism was VO_2max and percent body fat of the subjects measured directly (21); and there are no longitudinal studies of the effects of change in physical conditioning status and body fat on the mechanisms regulating glucose metabolism in older individuals. Thus, the relationship of physical conditioning status to glucose metabolism in older individuals, independent from hereditary factors and other extrinsic variables, is not known.

Lipoprotein Lipid Metabolism with Advancing Age

The finding of elevated levels of high density lipoprotein cholesterol (HDL-C) and lower triglyceride and low density lipoprotein cholesterol (LDL-C) levels in master athletes that are comparable to those in athletic younger individuals suggests that physical conditioning may improve lipoprotein lipid metabolism and reduce risk for coronary artery disease in older individuals. There is little known about the regulation of lipoprotein metabolism in elderly subjects, but the impact of extrinsic factors, genetics and disease on metabolic function is substantial (76). For example, obesity and diets high in cholesterol and saturated fat lower HDL-C, raise LDL-C and increase plasma triglyceride levels (77,78). Alcohol intake (79), medications (80) and chronic diseases also have substantial effects on lipoprotein lipids, most of them undesirable. Chronic diseases, such as diabetes, renal and liver disease, common in elderly populations lower HDL-C and raise plasma LDL-C and triglyceride levels. These abnormalities in lipoproteins are associated with increased risk for atherosclerosis and coronary artery disease (16,76). If the presence of these conditions is undetected, lipoprotein lipid profiles will be altered independent of biological aging.

Thus, the accurate study of the effects of physical activity on lipoprotein metabolism in older individuals requires rigorous screening to select healthy people of comparable body weight and diet without evidence of disease or genetic factors which affect lipoprotein metabolism. Such a design would distinguish the metabolic effects of exercise capacity from those erroneously attributed to biological aging per se. Studies of this type have not been performed in the elderly and might provide insight into the role of physical exercise programs in reducing risk for coronary artery disease in seniors.

CAN AGE-RELATED LOSS OF BONE DENSITY BE PREVENTED BY PHYSICAL EXERCISE?

There is a progressive decline in bone density in both males and females with advancing age. These losses may be so severe in elderly females to result in fractures causing progressive disability, limited activity and substantial declines in functional capacity (81). Although biological aging is considered a major factor in the loss of skeletal bone, the effects of estrogen and vitamin D deficiency, physical inactivity, cigarette smoking and excessive alcohol also contribute to the development of osteoporosis in the elderly (81-84). In postmenopausal females the rate of loss in skeletal mass and bone density is greatly accelerated due to estrogen deficiency; however, this decline can be accelerated by the present of the aforementioned additional extrinsic risk factors which enhance osteopenia.

Physical inactivity is one potentially modifiable factor contributing to the loss of skeletal integrity and bone density. A number of cross-sectional studies suggest that bone loss can be attenuated by physical exercise (84-86); thereby slowing the emergence of osteoporosis and reducing the heightened risk of bone fracture in the elderly. If estrogen is replaced in the postmenopausal female,

bone resorption will decrease; simultaneous weight bearing exercise may further augment bone accretion and increase bone mass (87). Estrogen administration (in the postmenopausal female), cessation of cigarette smoking, reduction in alcohol intake, dietary supplementation with vitamin D (and perhaps calcium) and other extrinsic factors may be additive with the effects of exercise to reduce the progression of osteopenia in the elderly. Although supplemental calcium administration alone or with estrogen does not increase bone density (88), its effects when administered during exercise are not known.

The increase in muscle mass and strength, and enhancement of agility associated with physical exercise may substantially reduce the vulnerability of older individuals, especially postmenopausal women, to risks of bone fracture. While the 1984 Consensus Conference on Osteoporosis (89) recommended modest weight bearing exercise for the possible prevention of bone loss, closer inspection of the literature indicates that more information is needed (90). If it is decided which older individuals might benefit from physical activity, it will be necessary to determine the type, intensity and duration of the exercise program best suited to increase bone density; assess whether there are additional requirements for supplemental hormones, vitamins and minerals to maximize the effects of exercise; and develop measures of bone density and aerobic capacity to accurately evaluate the effects of exercise on bone-mineral metabolism. Many factors can affect the progression/remission of osteoporosis; hence the selection of subjects, size of the sample studied and method of randomization to treatment will be critical.

ARE ADAPTATIONS TO ENVIRONMENTAL STRESS IMPROVED BY PHYSICAL EXERCISE?

The ability to adapt to changes or stresses in the environment declines with advancing age. Older individuals are on the average less tolerant to extremes of temperature (91,92), more prone to orthostatic hypotension after rapid positional change (93) and more often remain tachycardic, hypertensive and fatigued after physical exertion than younger people (94). Tolerance to temperature and recovery from exhaustive exercise are improved in younger and middle-aged individuals after physical conditioning (95-97), but the results of exercise training on these responses are not known in the elderly. Paradoxically, exercise training worsens orthostatic tolerance in younger subjects (98,99), but the effects in older sedentary individuals with impaired baseline orthostatic tolerance are not known. Blood volume, blood flow and thermoregulation (sweating and shivering) affect responses to these environmental conditions; these parameters have neither been measured in healthy older individuals nor related to maximal aerobic capacity, body composition or diet. One would suspect that more physically active older individuals would be more tolerant to these stresses, but this requires investigation.

SUMMARY AND FUTURE PROSPECTS

There is evidence that regularly performed exercise may improve the quality of life and protect against the development of disease in elderly subjects. Several studies have shown that the functional reserve capacity of the cardiovascular, endocrine-metabolic and musculoskeletal systems can be maintained and/or improved by regular exercise in healthy, elderly subjects. Controlled longitudinal studies have shown that regularly performed exercise is associated with fewer risk factors for arteriosclerosis and coronary artery disease in middle-aged men and women and a few studies have documented similar effects in older subjects. Results in master athletes and in patients with disease support the hypothesis

that physical activity will improve the functional capacity of older people. More information is needed to determine the extent to which physical conditioning will benefit the elderly and type and quantity of regular exercise which should be prescribed for older populations. This can be achieved both by large scale longitudinal studies as well as by small short and long term evaluations in healthy and disease afflicted older subjects of the mechanisms by which exercise training improves functional capacity, reduces risk factors for arteriosclerosis and improves the quality of life. If it can be documented that exercise training slows or prevents the age-related deterioration in functional capacity and makes it easier for the elderly to complete activities of daily living with more energy and less fatigue, then regular exercise could be incorporated into programs of public health and preventive medicine as a means by which the productivity, independence, and active lifestyle of the aging population can be prolonged.

In studying the effects of exercise on the functional reserve capacity of the elderly it will be important to determine the age, gender and clinical characteristics of the older subjects most likely to benefit. Guidelines for medical screening and baseline evaluations of functional reserve capacity will be needed to determine the exercise prescription most likely to achieve the desired physiologic result without risking injury to the older participant. This will require determination of the type, intensity, duration and frequency of exercise for each functional decline and risk factor which develops with advancing age. Standardized methods will be required to monitor physiologic responses to exercise, determine the rate of progression to higher levels of exercise and document the physiologic effects of the exercise program. Safeguards will be needed to maintain diet, drugs and other lifestyle habits constant to permit accurate assessment of the physiological effects of physical exercise.

Progress in this area of investigation will require support for centers of excellence to perform large scale exercise studies to document the physiological effects of physical exercise, and its role in the prevention of disease, reduction in the utilization of health resources and improvement in the mental health and the quality of life of elderly populations (100). Longitudinal studies of this type would ultimately have sufficient data to determine the impact of exercise training on morbidity and mortality in the elderly and establish the relationship of physical activity to survival in healthy and disease-affected older individuals.

REFERENCES

1. Morbidity Mortality World Reports, Progress in Chronic Disease Prevention: Protective Effect of Physical Activity on Coronary Heart Disease 1987; 36:426-429.
2. Leon, AS. Physical Activity Levels and Coronary Heart Disease. Analysis of Epidemiologic and supporting studies. Med Clinics North America 1985; 69:3-20.
3. Levy RI. Declining mortality in coronary artery disease. Arteriosclerosis 1981; 1:312-325.
4. Port S, Cobb FR, Coleman RE, et al. Effect of age on the response of the left ventricular ejection fraction to exercise. New Eng J Med 1980; 303:1133-1137.
5. Rodeheffer RJ, Gerstenblith C, Becker LC, et al. Exercise cardiac output is maintained with advancing age in healthy human subjects: Cardiac dilation in increased stroke volume compensate for a diminished heart

rate. Circul. 1984; 69:203-213.
6. Lakatta EG. Do hypertension and aging have a similar effect on the myocardium? Circul. 1987; 75:69-77.
7. Fleg JL. Alterations in Cardiovascular Structure and Function with Advancing Age. Am J Cardiol 1986; 57:33-44.
8. Gerstenblith G, Frederiksen J, Yin FCP, et al. Echocardiographic assessment of a normal adult aging population. Circ 1977; 56:273-278.
9. Seals DR, Hagberg JM. The effect of exercise training on human hypertension: a review. Med and Sci in Sports and Exercise 1984; 16:207-215.
10. Blomqvist CG. Cardiovascular Adaptations to Physical Training. Ann Rev Physiol 1983; 45:169-189.
11. Avolio AP, Fa-Quan D, We-Qiang L, et al. Effects of aging on arterial distensibility in populations with high and low prevalence of hypertension: Comparison between urban and rural communities in China. Circul. 1985; 71:202-210.
12. Lakatta EG. Health, disease and cardiovascular aging. In: Health in an Older Society: Institute of Medicine and National Research Council, Committee on an Aging Society, The National Academy Press, Washington, DC, 1985. pp. 73-104.
13. Elveback L, Lie JT. Combined high incidence of coronary artery disease at autopsy in Olmstead County, Minnesota, 1950-1979. Circul. 1984; 70:345-349.
14. Davidson MB. The effect of aging on carbohydrate metabolism: A review of the English literature and a practical approach to the diagnosis of diabetes in the elderly. Metabolism 1979; 28:688-705.
15. Goldberg AP, Andres R, Bierman EL: Diabetes mellitus in the elderly. In: Principles of Geriatric Medicine, (eds. R Andres, EL Bierman, WR Hazzard), New York: McGraw Hill Inc., N.Y., 1985. pp. 750-763.
16. Hazzard WR. Disorders of lipoprotein metabolism in aging. In: Principles of Geriatric Medicine, (eds. R Andres, EL Bierman, WR Hazzard), New York: McGraw Hill, Inc., 1985. pp. 764-775.
17. LaRosa JC, Chambless LE, Criqui MH, et al. Patterns of dyslipoproteinemia in selected North American populations. Circul. 1986; 73:1-12.
18. Heath GW, Hagberg JM, Ehsani AA, et al. A physiological comparison of young and older endurance athletes. J Appl Physiol 1981; 51:634-640.
19. Pollock ML, Foster C, Knap D, et al. Effect of age and training on aerobic capacity and body composition of master athletes. J Appl Physiol 1987; 62:725-731.
20. Seals DR, Allen WK, Hurley BF, et al. Elevated high-density lipoprotein cholesterol levels in older endurance athletes. Am J Cardiol 1984; 54:390-393.
21. Seals DR, Hagberg JM, Allen WK, et al. Glucose tolerance in young and older athletes and sedentary men. J Appl Physiol 1984; 56:1521-1525.
22. Rowe JW, Kahn RL. Human aging: Usual and successful. Science 1987; 237:143-149.
23. Elahi VK, Elahi D, Andres R, et al. A Longitudinal Study of Nutritional Intake in Men. J Gerontology 1983; 38:162-180.
24. Astrand PO, Rodahl K. Textbook of work physiology. McGraw Hill, St. Louis, 1977.
25. Buskirk ER, Hodgson JL. Age and aerobic power: the rate of change in men and women. Fed Proc 1987; 46:1824-1829.
26. Kannel WM, Sorlie P. Some health benefits of physical activity: The Framingham Study. Arch Intern Med 1979; 139:857-861.

27. Paffenberger RS, Hyde RT, Jung DL et al. Epidemiology of Exercise and Coronary Heart Disease. Clinics In Sports Medicine 1984; 3:297-318.
28. DeVries, HA. Physiological effects of an exercise training regimen upon men aged 52-88. J Gerontol 1970; 25:325-336.
29. Badenhop DT, Cleary PA, Schaal P, et al. Physiological adjustments to higher-or lower-intensity exercise in elders. Med Sci Sports Exercise 1983; 15:496-502.
30. Seals DR, Hagberg JM, Hurley BF, et al. Effects of endurance training on glucose tolerance and plasma lipid levels in older men and women. Jour Amer Med Assoc 1984; 252:645-649.
31. Benested, AM. Trainability of old men. Acta Med Scand 1965; 178:321-327.
32. Saltin B, Hartley LH, Kilbom A, et al. Physical training in sedentary middle-aged and older men. II. Oxygen uptake, heart rate, and blood lactate concentration at submaximal and maximal exercise. Scand J Clin Lab Invest 1969; 24:323-334.
33. Suominen H, Heikkinen E, Liesen H, et al. Effects of 8 week's endurance training on skeletal muscle metabolism in 56-70 year old sedentary men. Eur J Appl Physiol 1977; 37:173-180.
34. Holloszy JO. Exercise, health, and aging: a need for more information. Med Sci Sports Exer 1983; 15:1-5.
35. Seals DR, Hagberg JM, Hurley BJ, et al. Endurance training in older men and women. I. Cardiovascular response to exercise. J Appl Physiol 1984; 57:1024-1029.
36. Ehsani AA, Heath GW, Hagberg JM, et al. Effects of twelve months of intense exercise training on ischemic ST-segment depression in patients with coronary artery disease. Circul. 1981; 64:116-1124.
37. Goldberg AP, Phair RD, Krauss R, et al. Dyslipoproteinemia in type II diabetes: Metabolic effects of exercise training. J Amer Coll Nutr 1985; 4(3):308-309.
38. Koivisto VA, Yki-Jarvinen, DeFronzo, RA. Physical Training and Insulin Sensitivity. Diabetes/Metabolism Reviews 1986; 1:445-482.
39. Goldberg AP, Geltman EM, Hagberg JM, et al. The therapeutic benefits of exercise training for hemodialysis patients. Kidney Intl 1983; 24:S303-309.
40. Seals DR, Hurley BF, Schultz J, et al. Endurance training in older men and women II. Blood lactate response to submaximal exercise. J Appl Physiol: 1984; 57:1030-1033.
41. Yerg JE, Seals DR, Hagberg JM, et al. The effect of endurance exercise training on ventilatory function in older individuals. J Appl Physiol 1985; 58:791-794.
42. Rosenthal M, Haskell WL, Solomon R, et al. Demonstration of a relationship between level of physical training and insulin-stimulated glucose utilization in normal humans. Diabetes 1983; 32:408-412.
43. Hollenbeck CB, Haskell W, Rosenthal M, et al. Effect of Habitual Physical Activity on Regulation of Insulin Stimulated Glucose Disposal in Older Males. J Amer Ger Soc 1985; 33:273-277.
44. Wood PD, Haskell WL. The effect of exercise on plasma high density lipoproteins. Lipids 1979; 14:417-427.
45. Wood PD, Haskell WL, Blair SN, et al. Increased exercise level and plasma lipprotein concentrations: A one year, randomized controlled study in sedentary, middle-aged men. Metabolism 1983; 32:31-39.
46. Ehsani, AA. Cardiovascular adaptations to exercise training in the elderly. Fed Proc 1987; 46:1840-1843.
47. Hagberg, JM. Effect of training on the decline of VO_2max with aging. Fed Proc 1987; 46:1830-1833.

48. Gerstenblith G, Renlund DG, Lakatta EG. Cardiovascular response to exercise in younger and older men. Fed Proc 1987; 46:1834-1839.
49. Fleg J, Gerstenblith G, Lakatta E, et al. Personal Communication.
50. Busby J, Drinkwater D, Goldberg A, et al. Personal Communciation.
51. Lakatta EG, Spurgeon HA. Effect of Exercise on cardiac muscle performance in aged rats. Fed Proc 1987; 46:1844-1849.
52. Bray, GA. Definition, measurement, and classification of the syndromes of obesity. Int J Obesity 1978; 2:99-112.
53. Van Itallie, TB. Health implications of overweight and obesity in the United States. Ann Intern Med 1985; 103:983-988.
54. Hubert HB, Feinleib M, McNamara PM, et al. Obesity as an independent risk factor for cardiovascular disease: a 26-year follow-up of participants in the Framingham Heart Study. Circul. 1983; 67:968-977.
55. Bray, GA. The Energetics of Obesity. Med Sci Sports 1983; 15:32-40.
56. Gwinup, G. Effect of Exercise Alone on the Weight of Obese Women. Arch Int Med 1975; 135:676-680.
57. Drinkwater D, Bleecker E, Meyers D, et al. Personal Communication.
58. Hodgson JL, Buskirk ER. Physical fitness and age, with emphasis on cardiovascular function in the elderly. J Am Geriatr Soc 1877; 25:385-392.
59. Dehn MM, Bruce RA. Longitudinal variations in maximal oxygen intake with age and activity. J Appl Physiol 1972; 33:805-807.
60. Kasch FW, Wallace JP. Physiological variables during 10 years of endurance exercise. Med Sci Sports 1976; 8:5-8.
61. Ehsani AA, Heath GW, Martin WH III, et al. Effects of intense training on plasma catecholamines in coronary patients. J Appl Physiol 1984; 57:154-159.
62. Ehsani AA, Martin WH III, Heath GW, et al. Cardiac effects of prolonged and intense exercise training in patients with coronary artery disease. Am J Cardiol 1982; 50:246-253.
63. Kannel, WB. Prevalence and natural history of electrocardiographic left ventricular hypertrophy. Amer Jour Med 1983; 25:4-11.
64. Borkan GA, Hults DE, Gerzof AF, et al. Age changes in body composition revealed by computed tomography. J Gerontol 1983; 38:673-677.
65. Tzankoff SP, Norris HA. Effect of muscle mass decrease on age-related BMR changes. J Appl Physiol 1977; 43:1001-1006.
66. Allwood MJ. Blood flow in the foot and calf of the elderly; a comparison with that in young adults. Clin Sci 1958; 17:331-338.
67. Permutt S, Martini HB. Stasis pressure-volume characteristics of lungs in normal males. J Appl Physiol 1960; 15:819-825.
68. Shepherd RJ. Physical Activity and Aging. London: Crown Helm Ltd, 1978.
69. Schocken DD, Blumenthal JA, Port S, et al. Physical conditioning and left ventricular performance in the elderly: Assessment by radionuclide angiocardiography. Am J Cardiol 1983;52:359-364.
70. DeFronzo, RA. Glucose Intolerance and Aging: Evidence for tissue insensitivity to insulin. Diabetes 1979; 28:1095-1101.
71. Rowe JW, Minaker KL, Palotta JA, et al. Characterization of the insulin resistance of aging. J Clin Invest 1983; 71:1581-1587.
72. Fink RI, Kolterman OG, Griffin J. et al. Mechanisms of insulin resistance in aging. J Clin Invest 1983; 71:1523-1534.
73. Stout, RW. Insulin and Atheroma - An Update. Lancet 1987; 1:1077-1079.
74. Chen M, Bergman RN, Pacini G, et al. Pathogenesis of age-related glucose intolerance in man: insulin resistance and decreased B-cell function. J Clin Endocrinol Metab 1985; 60:13-20.
75. Rowe JW, Troen BR. Sympathetic nervous system and aging in man. Endocr

Rev 1980; 1:167-179.
76. Brunzell, JD. Pathophysiologic approach to hyperlipidemia In: Yearbook of Endocrinology 1984, (eds. Schwartz TB, Ryan WG), Yearbook Medical Publishers, Inc., Chicago 1984. pp. 11-30.
77. Zimmerman J, Kaufman N, Fainaru M, et al. Effect of Weight loss in Moderate Obesity on Plasma Lipoprotein and Apolipoprotein levels and on High Density Lipoprotein Composition. Arteriosclerosis 1984; 4:115-123.
78. Goldberg AP, Schonfeld G. Effects of diet on lipoprotein metabolism. Ann Rev Nutrition 1985; 5:195-212.
79. Taskinen MR, Nikkila EA, Valimaki M, et al. Alcohol Induced changes in serum lipoproteins and in their metabolism. Amer Heart J 1987; 113:458-463.
80. Wallace RB, Hunninghake DB, Chambless LE, et al. A screening survey of dyslipoproteinemias associated with prescription drug use. The Lipid Reserch Clinics Program Prevalence Study. Circul. 1986; 73:70-79.
81. Riggs BL, Melton LJ. Involutional Osteoporosis. New Eng J Med 1986; 314:1676-1696.
82. Williams AR, Weiss NS, Ure CL, et al. Effect of weight, smoking and estrogen use on the risk of hip and forearm fractures in post menopausal women. Obstet Gynecol 1982; 60:695-699.
83. Bilke DD, Genant HK, Cann C, et al. Bone Disease and Alcohol Abuse. Ann Int Med 1985; 103:42-48.
84. Krolner B, Toft B, Nielsen SP, et al. Physical exercise as prophylaxis against involutional vertebral bone loss: A controlled trial. Clin Sci 1983; 64:541-546.
85. Smith EL, Reddan W, Smith PE. Physical activity and calcium: modalities for bone mineral increase in aged women. Med Sci Sports Exerc 1981; 13:60-64.
86. Aloia JF, Cohn SH, Babu T, et al. Skeletal mass and body composition in marathon runners. Metabolism 1978; 27:1793-1796.
87. Aloia JF. Estrogen and exercise in prevention and treatment of osteoporosis. Geriatrics 1982; 37:81-85.
88. Ettinger B, Genant HK, Cann CE. Postmenopausal bone loss is prevented by treatment with low dose estrogen with calcium. Ann Int Med 1987; 106:40-45.
89. Osteoporosis, Consensus Conference. JAMA 1984; 252:799-802.
90. Block JE, Smith R, Black D, et al. Does exercise prevent osteoporosis? JAMA 1987; 257:3115-3117.
91. Collins KJ, Dore C, Exton-Smith AN, et al. Accidental hypothemia and impaired temperature homeostasis in the elderly. Brit Med J 1977; 1:353-356.
92. Drinkwater BL, Horvath SM. Heat tolerance and aging. Med Sci Sports 1979; 11:49-55.
93. MacLennan WJ, MRP Hass, Timothy JI. Postural hypotension in old age: is it a disorder of the nervous system or of blood vessels? Age and Ageing 1980; 9:25-32.
94. Montoye HJ, Willis PW, Cunningham DJ. Heart rate response to submaximal exercise: Relation to age and sex. J Gerontol 1968; 23:127-133.
95. Roberts MF, Wenger CB, Stolwijk JAJ, et al. Skin blood flow and sweating changes following exercise training and heat acclimation. J Appl Physiol: 1977; 43:133-137.
96. Brooks GA, Fahey TD. Exercise in the heat and the cold. In: Exercise Physiology: Human Bioenergetic and its applications. Macmillan Publishing Company, New York, 1985. pp. 443-469.
97. Hartley LH, Saltin B. Reduction of stroke volume and increase in heart

rate after a previous heavier submaximal work load. Scand J Clin Lab Invest 1968; 22:217-223.
98. Stegemann, Busert JA, Brock D. Influence of fitness on the blood pressure control system in man. Aerosp Med 1974; 45:45-48.
99. Greenleaf JE, Bosco JS, Jr., Matter M. Orthostatic tolerance in dehydrated, heat-acclimated men following exercise in the heat. Aerosp Med 1974; 45:491-497.
100. Rowe J, Beck JC, et al. Report of the Institute of Medicine: Academic Geriatrics for the Year 2000. J Amer Ger Soc 1987; 35:773-791.

Health Promotion and Aging
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THE FREQUENCY AND IMPACT OF FALLING IN THE ELDERLY

Falls (ICD-9 codes E880-E888) are the leading cause of death from injury in persons over the age of 65. Approximately two-thirds of reported injury-related deaths of persons 85 years of age and older are due to falls (1). Of the 8200 fatal falls that occurred in the United States in 1985 for persons aged 65 years or older, 59% were those that occurred in the home. This large number of fatal falls listed on death certificates, however, may understate by one-half the number of deaths in which falls are contributing causes (2).

Approximately 250,000 hip fractures per year among persons ages 45 and over result from falls, with an annual medical cost exceeding $7 billion (3). There may also be six times as many fractures of other bones as there are hip fractures in persons over the age of 65 (4), most of which are attributable to falls (5).

The majority of falls in the elderly result in minor physical injury (6), with only a small percentage of falls causing severe injury, such as a fracture. Estimates of the proportion of falls causing a fracture range from four to six percent in ambulatory populations, with one percent or less resulting in hip fractures (6,7). Slightly higher rates of hip fractures per fall have been reported among institutionalized populations (8,9,10).

Most falls, however, go unreported and are not medically attended. Respondents to the 1984 U.S. Health Interview Survey (HIS) Supplement on Aging were asked about their history of falling in the previous 12 months. Among women, 19% of those ages 55-69, 23% of those ages 70-79 and 34% of those age 80 or more said they had fallen in the past year. For men, the percentages were 15, 17 and 28, respectively. Overall, about half of those reporting a fall said they fell more than once. The proportion of multiple falls was highest for those age 80 and over for both sexes (11). The incidence of falls is considerably higher in long-term care facilities than among elderly living in the community (7,8, 9,12,13).

Psychological trauma resulting from falls may be severe and can result in loss of confidence in the ability to perform daily routine, restriction of activity, decreased mobility and increased dependence. Deconditioning, muscle atrophy and joint stiffness or contractures that result from immobility may lead to more falls and further mobility restrictions.

CRITICAL CONCERNS REGARDING HOST, BEHAVIORAL AND ENVIRONMENTAL FACTORS

1. PROBLEMS WITH DATA ON THE OCCURRENCE OF FALLS, RISK FACTORS AND INTERVENTIONS

Reporting Fall-related injuries are not consistently reported in public health

surveillance systems or medical care data bases. Although records of falls are required in most long-term care facilities, there is no standardized reporting system. In addition, efforts are needed to insure standard application of coding systems for falls. Inaccurate self-report of falls by the elderly may also affect research and prevention efforts. One recent study found that 13% of persons with a confirmed fall during a 12-month period failed to recall having a fall when questioned at the end of the 12 months (14). Other problems include absence of a definition of falls that is easily understood by study participants and the "response burden" sometimes placed on participants who report falls.

Risk factors and interventions Until recently, there have been few prospective studies of risk factors for falls or injury from falls. Many presumed risk factors for falls exist among those who do not fall as well as those who do. There are few existing studies that have included statistical analyses of fallers compared to a control group, or that have evaluated the strength of suspected risk factors using odds ratios, relative risks, or attributable risk measures. No studies have used adjustment or multivariate analysis to control for multiple risk factors. Case-control studies of falls are relatively numerous. However, the risk of falling, the risk of injury and factors leading the person to seek medical care, such as perceived severity of the injury or preexisting medical conditions, all contribute to differences between cases and controls, making interpretation difficult.

Finally, there are very few controlled trials of the effectiveness of interventions to prevent falls, and none of the yield and effectiveness of medical workups of previous fallers. Therefore, existing preventive and treatment efforts are empiric in nature, relying mostly on common sense and descriptive studies of the characteristics of falls and fallers. Host and environmental risk factors and behavioral interventions remain an uncertain and an ad hoc undertaking.

2. PROBLEMS ARISING FROM THE COMPLEX NATURE OF FALLS

Falls in the elderly are the common result of a very large number of pathophysiological processes, primary aging processes, behavioral and environmental factors (15). Some falls are an acute symptom of a chronic or episodic cerebrovascular, cardiovascular or neurologic disorder (16-19). Syncopal falls are prototypical of this kind of fall. However, a variety of acute illnesses may manifest nonspecifically in falls in persons with multiple risk factors (12,20). Falls can also be a nonspecific result of disease-related and age-related declines in gait, balance, sensory perception, strength, coordination, reflexes and other aspects of neuromuscular function (12,21). When the healthy, active older person falls, it often involves an unexpected hazard in the environment, one which could also cause a much younger person to take a spill (slippery surfaces or unseen obstacles). However, the older person may be influenced by more subtle environmental factors, such as lighting and visual and spatial design.

The multifaceted, multifactorial nature of falls has prompted attempts to develop a typology of falls (22-25). These typologies focus on the circumstances of falls and provide information about the probable etiologic factors that guide intervention efforts (24). In addition, greater specificity about outcomes would enhance understanding of risk relationships by allowing researchers to link specific risk factors or biologic measurements to specific types of fall. Some examples of these typologies follow:

- unexplained falls versus falls with a self-evident etiology (i.e. syncope, seizure, stroke)
- falls due to host (intrinsic) factors versus falls due to environmental (extrinsic) factors
- pattern or recurrent falls versus occasional or isolated falls

falls occurring in the sick or older elderly (age 75 and over) versus those occurring in the healthy or younger elderly (ages 60-74).

Unfortunately, work on classifying falls is still developmental and may be of limited value in understanding and preventing falls for the following reasons:

a. It is sometimes difficult or impossible to obtain valid information about the circumstances of a fall.

b. Syncopal falls may have an etiology similar to many "unexplained falls" which do not progress to full loss of consciousness but do involve the effects of decreased cerebral perfusion on muscle tone and balance (26,27).

c. Most falls probably have a mixed etiology, involving both host and environment as contributing factors.

d. Trips and slips involving a definite hazard may also implicate 1) age-related changes in gait (28), and 2) decline in the speed and organization of dynamic postural responses to external displacement (29), blurring the distinction between environmental and balance falls.

e. What constitutes an environmental hazard depends on the individual's functional capacity. With functional decline, features of the environment which were once negotiated without difficulty can become major barriers.

f. The same individual can fall for different reasons on different occasions. This makes it difficult to classify individuals as one type of faller or another.

g. Persons at risk for falls because of abnormalities of gait or balance may so restrict their activities that they fall infrequently over the near-term. Such "adaptations" to diminished capacities may be dysfunctional over the long-term, accelerating loss of function and leading to multiple falls.

Prevention of falls must address a large number of risk factors. At present, we know very little about the interaction between risk factors which will be necessary in the development of effective prevention efforts.

3. PROBLEMS ARISING FROM THE UNCERTAIN SIGNIFICANCE OF ANY FALL

Because the etiology of falling is complex, the significance of any individual fall is difficult to determine, both for health care professionals and for the person who falls. This may lead to inappropriate actions at several extremes, including: extensive medical work-ups which have little yield; dismissal of the fall as of no consequence; inappropriate reductions in mobility and activities, including use of physical and chemical restraints (30); or extreme fear of falling again.

In some persons, a fall or series of falls signals serious acute illness, precipitous functional decline and, possibly, imminent death (7,31,32). For these reasons, any fall must be taken seriously by clinicians. However, most falls in the elderly do not carry this meaning. Falling is an ubiquitous experience throughout life, usually resulting in no or only very minor injury.

Though the circumstances of falls appear, on average, to change with age (12,33), the most frequent fall in the elderly is a consequence of persons with diminished functional capacity attempting to meet the intrinsic and external demands of mobility within specific environments. For the relatively fit and functionally able, mobility entails constant exposure to and successful negotiation of a wide range of physical environments. Risk of fall is spread over many diverse situations and environments. As function declines, success in mobility focuses increasingly on basic movements, such as transfer, short walks and quiet standing within a familiar environment. These basic movements then become the focus of exposure to fall risk.

The behavioral response to falling and postural instability affects the trans-

lation of physical decline into reduced mobility (34). A fall or a near fall provides information about activities and circumstances which place a particular person with a given set of capacities at risk as well as information about a mismatch between the external and intrinsic demands of mobility and individual competence (35). This information may motivate a reduction in mobility, in turn resulting in reduced exposure to the risk of falling by decreasing the range of environmental exposures and by decreasing the time at risk while walking, transferring and standing. Indeed, persons who do not adjust their activities to declining capacities may be at especially high risk (12,36).

Clearly, however, adjustments in activity and mobility in response to falls are neither universally appropriate nor sufficient to eliminate the risk of falling. 1) Fear and excessive restrictions in activity may reduce exposure to the risk of falling in the short term, but only increase the long-term risk by undermining self-confidence and physical conditioning. 2) For the elderly whose functional capacity is severely compromised, maintenance of even a minimum of independent mobility may entail substantial risk. 3) Some risk of falling is probably unavoidable if mobility and independence are to be maintained in the presence of functional decline.

The goals of prevention should be realistic and based on our best understanding of the problem. It is realistic to aim for modest reductions in the frequency of falls and perhaps to prevent a recurrence of falling in some individuals. It is not realistic, given our current understanding, to eliminate falls as a feature of aging. Even if every fall does have a set of causes, there will remain a random element in many falls beyond our ability to model, predict or anticipate.

Equally important, prevention efforts must strike a balance between protection from risk and the maintenance of mobility, function, personal autonomy and an acceptable quality of life. To optimize the latter, it may be necessary to accept a certain level of risk. Prevention should focus on modifying risk factors that reduce that level of risk as much as possible while impinging on independence and autonomy as little as possible.

Prevention efforts would benefit from an increased understanding of behavioral and psychological responses to the onset of instability and falls. The nature of this response may have important implications for the individual's short-term and long-term risk. Fear and excessive activity restrictions may only increase risk in the long run. On the other hand, failure to make some behavioral accommodation to aging and disease may also increase risk in the near term. Adaptations to diminished function, while perhaps inevitable, should be appropriate to the threat and emphasize and strengthen residual capacities. In addition, research is needed on what constitutes "risk-taking behavior" in the context of specific functional disabilities.

Finally, preventing the adverse consequences of falls, including injury, fear and the "long lie," may be as important a goal as preventing falls. Severe injury may precipitate maladaptive behavioral responses as well as lead directly to physical deconditioning and further falls.

REVIEW OF HOST AND BEHAVIORAL FACTORS

The following risk factors are limited to controlled studies in which comparisons were made between "fallers" and "nonfallers." Specific study designs vary considerably. Nearly all of the associations between risk factors and falls reported here are univariate and do not control for confounding.

1. GENERAL RISK FACTORS

Age and Sex. These variables may contribute to identifying persons at risk, but tell us little about actual causes of falls or where to intervene to reduce risk.

There is substantial variation in risk within age groups. Biologic and functional variability within age groups may be more important determinants of fall risk than age-dependent variations.

History of Previous Falls and Dizziness. It is not known how the risk of injury is related to the frequency of falling. The ratio of injuries prevented per fall prevented may vary considerably between frequent and infrequent fallers. For example, those who fall frequently may do so in a way that has a low risk of injury or learn to protect themselves from injury. Research is needed on how the mechanics of falling affect the risk of injury (5). Certain interventions may be less effective after a person has fallen. For example, extreme fear of falling may reduce acceptance of exercise programs to improve neuromuscular function.

Health Status, Mobility Limitation and Functional Disability. General health variables appear valuable in identifying elderly at increased risk of falling because their association may reflect a common origin in underlying diseases and conditions. However, mobility limitations and functional disability may also have a direct bearing on prevention to the extent that they indicate a mismatch between the external and intrinsic demands of mobility and personal competence increasing the risk associated with routine activities (35). Residual capacities may be enhanced by environmental modifications that reduce the demands placed on the individual. However, it is not known whether environmental and behavioral interventions that improve function also reduce fall risk. Moreover, the relationship between mobility and fall risk is complex and not well understood.

Mental Status, Psychological Status, and Psychosocial Factors. Cognitive, psychosocial and psychological risk factors for falls in the elderly are not well understood, but are being evaluated in ongoing prospective studies. Neurological disorders affecting cognitive function are often clinically associated with neuromuscular deficits and falls in the elderly, but it is not known if the association is causal (18,37-39). The causal relationships are potentially complex (40). Confusion, impaired judgement, distraction, agitation, depression and lack of awareness may increase exposure to hazardous situations. Associated gait and balance deficits and psychomotor depression may increase the chance that a fall will result. Depression, in turn, may result from falls, injury or physical illness. Antidepressant and sedative medication may increase the risk of falls (41,42). The behavioral aspects of depression that affect fall risk are not well understood. There are no studies of the effect of cognitive or psychological factors on the coping strategies and adaptations of elderly in response to falls and instability.

Physical Activity. Longitudinal studies of physical activity and falls are needed since reduced activity levels may result from previous falls, fear of falling or gait and balance problems. Moreover, increased physical activity could increase exposure to environmental hazards.

Environmental Hazards. Environmental hazards include such factors as stairway design and disrepair, inadequate lighting, slippery floors, unsecured mats and rugs, and lack of non-slip surfaces in bathtubs, among others. These factors have been implicated in about one-third to one-half of all falls or falls injuries in the home (43-45). Most studies that deal with home environmental hazards are difficult to interpret, however, because of differences in case selection criteria, information collected, and presentation of data. Definitions, especially those of environmental hazards, were not provided, making valid comparisons difficult.

Only two investigators who studied the environment used a referrent group of nonfallers for comparison: one of case-control and one of cohort design (31,45). However, these investigators described the environment only for cases and not

for the referrant group, and the environment was not assessed visually. Instead, persons were interviewed to determine what the respondents felt were the causes of their falls. Few studies actually defined the environment or an environmental hazard, and none provided a uniform approach to assessing the environment. Despite indications that several potential risk factors might be interrelated, only one study explored the possibility of such interactions in a limited way (45). More analytic studies need to focus on where falls occur in the home and on the prevalence of various home hazards. The risk attributable to each of these home hazards, especially in relation to a person's time at risk to these exposures, is critical to the design of prevention strategies. Moreover, the definitions of a room, dwelling unit, and home hazard need to be clearly stated, reproducible and valid. The use of analytic techniques that determine risk factors for diseases, such as the determination of the interaction of host factors and the environment, will be key to the etiology of falls and fall injuries. Intervention strategies would then be based on sound epidemiologic principles and would take into account acute and chronic health problems as well as contributing environmental factors.

2. COMMON INTERMEDIATE PATHWAYS: NEUROMUSCULAR FUNCTION

Gait and Balance. Clinical and laboratory assessment of gait and balance is increasingly sophisticated and shows significant promise as a method of assessing fall risk. Important research issues remain, however, including 1) identification of the modifiable causes of gait and balance abnormalities, 2) the relationship of clinical assessments of balance and gait to laboratory measurement of the biological mechanisms of balance and gait, 3) the utility of computerized gait analysis for fall risk assessment and research, 4) the utility of gait and balance measures as intermediate outcome measures for risk factor modification studies, and 5) the relationship of falling to the determinants of total motor reaction time (46).

In addition, the relationship between balance and gait is not well understood. For example, slowed walking speed may be caused by balance problems, fear of falling, or both, or it may be due to pathology not directly related to balance (47). The effect of musculoskeletal conditions on gait and balance performance is not well understood. The ability to influence corrective and protective response through training and learning should be investigated (46). Finally, an understanding of how specific gait and balance problems transform environmental features into "fall hazards" would help focus environmental intervention efforts.

FACTORS AFFECTING NEUROMUSCULAR FUNCTION AND OTHER SPECIFIC RISK FACTORS

Muscle Strength. The effect of improvements in muscle strength on gait or balance, or on the risk of falling, is not known. Upper and lower limb strength may be important in protective responses during a fall which prevent injury, but this has not been studied (5).

Afferent and Efferent Systems. Published studies linking either clinical or laboratory measurement of the sensory and motor nerve systems to data on falls are lacking, though some studies are in progress. There is indirect evidence, however, that simultaneous abnormality in somatosensory, visual and vestibular systems critically impairs dynamic balance (29,48). Clinical assessment of proprioception, vibration sense and reaction time need to be validated against laboratory measures.

Vision. Visual function is degraded by conditions affecting the crystalline lens and other intervening structures, reducing and scattering the light reaching the retina (49). Early detection and treatment of common conditions such as glaucoma and cataract should improve visual function (50) and might reduce falls. Improved correction of acuity is feasible (updated prescriptions, improved compliance) and could also reduce falls. Environmental and behavioral adaptations

to reduced visual performance may improve visual function and also reduce falls, but this has not been studied systematically.

Decreased cerebral perfusion. True syncopal falls in the elderly may be uncommon (24,42), and dizziness may accompany these falls more often than cause them (37). However, there are no data on the incidence of these falls. Falls due to postural hypotension may also be relatively uncommon since many elderly adapt readily to the symptoms of homeostatic dysfunction (51,52). Decreased cerebral perfusion may cause falls by compromising muscle tone and postural control without other symptoms being present (26), but this is not well studied.

Medications and alcohol. The use of individual drugs should not be blamed for falls without appropriate evidence. The most difficult problem is distinguishing the effect on falling of specific drugs (e.g., antihypertensives or hypnotic-anxiolytics) from the effect of underlying diseases (e.g., hypertension or dementia) or from the effect of drug-disease and drug-drug interactions (27,41). The effect of polypharmacy on falling is a potentially important problem (53) that has not received sufficient study. Detailed studies of falls and drug and dose-specific physiologic effects in the elderly are needed to focus intervention efforts. Better methods are needed for collecting data on alcohol use in the elderly and linking it to data on falls. The effect of medication review programs for the elderly on the risk of falling is not known.

Specific diseases. Intensive clinical work-ups of elderly who fall will uncover large numbers of diseases and pathologic conditions thought to contribute to falling (54,55). But many of these conditions will also be frequent in elderly who do not fall. It is not known if the diagnostic search for treatable medical causes of falls has sufficient yield to justify the effort and cost. The presence of multiple pathology and abnormality may be as important a determinant of the risk of falling as individual conditions (20). The effect of specific conditions, such as arthritis and peripheral neuropathy, on falling and intermediate risk factors is relatively unexplored and warrants increased attention.

REVIEW OF PROGRAMS TO PREVENT FALLS BY MODIFYING HOST AND BEHAVIORAL FACTORS

Although fall prevention efforts in the community and health care settings are not uncommon, few of these programs have been systematically evaluated in terms of outcomes or cost. As a result, these efforts have yielded remarkably little useful information. Some of the reasons for this situation are as follows:

1. Many programs are part of comprehensive community-oriented health promotion efforts that treat falls and injury as only one of a sometimes daunting array of objectives. The result is that inadequate resources are devoted to evaluating the program's effect on the incidence of falls or fall-injury.

2. The outcomes of fall prevention programs can be difficult and costly to measure, a problem faced by both clinical and community-based interventions.

- Anticipated effect sizes are small (e.g., 10-15% reductions in the number of falls), necessitating relatively large sample sizes.
- Frequent and intensive contact with individuals is required to assess falls per se in community settings.
- Injurious falls treated in emergency rooms are only a small portion of all falls, increasing sample size requirements, and may be insensitive as indicators of the effect of community programs.
- Falls treated in doctors' offices are more numerous, but may be subject to reporting inaccuracies and are expensive to monitor in an entire community.
- Measurements of intermediate outcomes which could reduce sample size requirements, such as gait and balance performance, are in a developmental stage and require individual contact by trained personnel.

4. The appropriate outcome measure is not always clear (e.g., number of falls, number of injurious falls, fallers, fallers with injury, severity of injurious falls). Individuals with very large numbers of falls may skew the results of analyses of number of falls, even for relatively large sample sizes.

5. Fall prevention programs usually combine several intervention components addressing multiple risk factors. While this is appropriate given the multifactorial causes of falls, most studies have neither an appropriate design nor the statistical power to determine the effectiveness or cost of the separate intervention components.

6. There is an over-reliance on one group, pretest-posttest designs, the results of which are often incorrectly analyzed. The selection criteria for subjects in these studies are often inadequately specified.

7. Many intervention programs in health care settings are undertaken without a rigorous approach to methods resulting in a number of limiting deficiencies.

Review of Prevention Programs

The programs reviewed here were evaluated with a controlled study design and were published with sufficient detail in methods to evaluate the validity of the study findings.

1. Interventions in community populations. There are only a handful of published intervention studies in community populations meeting the above criteria.

a) A multiple risk factor intervention program using the Portland, Oregon, Kaiser Permanente Medicare population focuses on the ambulatory elderly (56). Two thousand five hundred households of the elderly were randomized to intervention and control groups. Both groups were provided with the results of an initial home safety audit, were given a home safety publication, and underwent an assessment of risk factors for falls, including performance measures of strength and balance. Both groups are being followed for 24 months to ascertain falls and fall-related medical care utilization.

The intervention received by the experimental group included: 1) encouragement and assistance in completing safety repairs and modifications identified in the home audit; 2) a series of four falls-prevention workshops covering a) exercises to improve strength, balance, flexibility, posture, and conditioning, b) drug safety and calcium intake, c) falls risk awareness and risk control, d) development of social support skills and an environment for group reinforcement; 3) guidelines for preventive health care, and screening and follow-up care for vision and hearing problems.

This is the most rigorous and best designed fall prevention intervention study to date. Preliminary results indicate that both the intervention group and the control group are experiencing reductions in the rate of self-reported falls per 100 person-years during year 2 compared with year 1 of the study (56). However, with follow-up nearing completion, no consistent differences have emerged in the incidence of fall-related injuries between the control and intervention groups. This study will be one of the few to provide data on the costs of the intervention. However, since the entire intervention group received all of the program components, only limited information will be available on the relative effectiveness of the various tactics.

b) One hundred elderly persons seen in community medical practices in Birmingham, England, and who had fallen in the previous 4 weeks were randomly assigned to two treatment groups (57). One group underwent an intensive, "long" (up to 12 visits) course of home-based exercise physical therapy and the other group received a "short" course (no more than three visits). Participants were followed for four months for falls and changes in balance and mobility. After

four months, there were no differences in outcome between the two groups, but both groups showed improvement in mobility and balance measures. The fact that only half of the study population fell during follow-up was cited as an indicator of effectiveness. However, the historical controls used for comparison provide an insufficient basis for this conclusion.

2. Interventions in Institutions. A large number of institutions have undertaken fall prevention programs, but few have been systematically evaluated.

a) Fife et al.(58) evaluated an individualized nursing intervention to prevent falls in a community hospital in Cleveland, Ohio. The program was implemented in two hospital units, with two units comparable in census and in age of patients used as controls. Patients deemed at high risk of falling were identified (based on an informal risk analysis) at admission to the experimental units (83% of all unit admissions) and an individualized prevention program developed for each patient. At the end of the 12-week study period, there were no differences between the number of falls reported in the experimental and control units. The authors reported contamination of control groups. A reduction in falls on the experimental units compared to historical controls was cited as evidence of effectiveness. However, the appropriateness of the control period and method of comparison were not demonstrated.

b) Rainville (59) reports the result of a similar hospital-based study. Patients on an experimental unit of the hospital were assessed for fall risk upon admission and a "standard care plan" implemented for these patients. The intervention consisted of patient and family education in the hospital on fall hazards, increased staff awareness of the high-risk patient, and a special care protocol focusing on transfer to and from bed. Evaluated with a pretest-posttest design, this study also failed to demonstrate a clinically or statistically significant decrease in falls following implementation of the program.

c) A study reported by Gray-Vickery (60) demonstrates an increased short-term awareness of potential fall hazards in the home among elderly hospital patients receiving safety education classes. However, the study is limited by small numbers and a one group, pretest-posttest design.

3. Clinical Interventions. In spite of numerous articles on the clinical evaluation of the faller, very few studies have systematically assessed the yield of treatable medical disorders in fallers or the effectiveness of treatment in preventing falls.

A "falls clinic" was established at a geriatric care center on Long Island, New York, which emphasized an interdisciplinary approach to diagnosis, treatment and counseling of patients who had previously fallen (54). Intensive medical management was accompanied by a home visit from occupational and physical therapists and by falls-prevention education for patients and their families. A total of 120 potential fall-related diagnoses were identified in 36 elderly fallers by cardiologists, neurologists, physiatrists and geriatricians. A substantial decline in the number of patients who fell during 12 months of post-intervention follow-up compared to before the intervention (22% vs 100%) was cited as evidence of effectiveness. However, patient selection criteria that may have affected the likelihood of falling again are not specified and no information is provided on the cost of the intervention. It is not possible to determine the contribution of the medical workup and treatment to the observed reduction in falls.

Are common sense and the existing state of knowledge of risk factors sufficient, in the absence of adequate experimental evidence to warrant the endorsement and propagation of specific prevention tactics? In the case of low-cost, low-risk interventions such as risk awareness and exercise programs, the answer is probably yes, especially when there are other benefits besides fall prevention. For

higher cost strategies such as home modifications and falls clinics the answer is probably no. In addition to falls, intervention studies should monitor mobility, functional status, dependence and psychosocial outcomes to determine if there are benefits of intervention in addition to reduction in falls and if a reduction in falls comes at the expense of autonomy, level of activity, and quality of life.

MOTOR VEHICLE AND PEDESTRIAN INJURY TO THE ELDERLY

OVERVIEW OF THE TOPIC

Motor vehicle and pedestrian injuries (ICD-9 codes E805.2, E822.7, E810-E819) to older persons (age 65 and above) occur primarily as a result of the transfer of mechanical energy to people in amounts or rates that exceed their injury thresholds (61). Motor vehicle injury is by far the leading cause of fatal injury for all ages, and for the elderly it is the leading cause to age 75 when it is exceeded only by falls.

More than any other injury type, motor vehicle injuries are systematically investigated, and a variety of information is routinely provided on circumstances surrounding the event. Centralized, computerized databases exist at both state and national levels on these injuries, although there is variation in the quality from state to state. Because of the amount of information available on the circumstances surrounding motor vehicle injury, it has been possible to develop interventions aimed at alleviating specific causes of injury.

Although major shortcomings continue to exist, these state crash files can be used alone or in conjunction with other databases to address a wide variety of problems. They can be linked to driver history files. They can provide additional information on highway design characteristics associated with certain kinds of injury-producing crashes and on specific vehicle design characteristics associated with injury to elderly occupants. In some states they can be linked to ambulance run data to evaluate the time required to provide medical attention and how the time delay is related to subsequent outcome. In a few states all these databases can be linked to hospital data, including trauma registries and hospital discharge data. The potential for such data linkage provides the opportunity for addressing such questions as whether certain vehicle design characteristics are associated with a greater probability of post-crash fire resulting in burn injuries to occupants. Likewise, data from trauma registries, if linked to crash files and then to highway files, can be used to determine whether there are certain highway design characteristics, including the presence or absence of pedestrian controls, that are associated with injury to elderly pedestrians. These data can be used in conjunction with other databases such as census data and economic indices to address such questions as how fluctuations in the economy relate to motor vehicle injury and whether some groups are at different risks.

One special problem with using available databases concerns the older person's greater vulnerability to injury and later death from a given crash. The elderly motor vehicle crash victim may die long after the injury producing event as a result of infection or another problem resulting from the crash. If the proximate cause of death is pneumonia, the death may not be readily identified as motor-vehicle-related and thus be lost to the analysis. Investigators in this area need to be sensitive to this problem in attributing causes of death and time frames for defining motor vehicle deaths.

Background National Rates by Age, Race, and Sex

For the population age 65 and older, mortality rates per 100,000 for the years 1978-1982 were much higher for males (34.2) than for females (14.9). Black and other males have 1.6 times the rate of white males until age 75, at which age the rates become similar. Black and other females have between 0.7 and 0.8 times the rate of white females at all ages 65 and over. However, the rates for all groups are gradually decreasing.

When death rates are divided into ages 65-74 and those age 75 and over, rates are much higher for the older age category. These figures do not take into consideration amount of exposure to risk, but there is evidence that exposure decreases with age, so that the increased rates associated with older age would be even greater if exposure were considered.

According to the National Safety Council (62), in 1985 there were 45,600 motor vehicle deaths and 1,700,000 disabling injuries. Approximately 6400 of the fatalities were age 65 and older. Based on the number of licensed drivers, those age 65-74 had lower rates of both fatal crash involvement and total crash involvement than was true for the driving population as a whole. In contrast, drivers age 75 and older had 59 fatal crashes per 100,000 drivers, compared to 38 for drivers of all ages. For total crashes (fatal and nonfatal), this age group had 26 per 100 licensed drivers, compared to 21 for drivers of all ages. While these rates were higher than those for the general driving population, they were lower than those for drivers below age 25.

Crash involvement rates based on mileage driven, rather than number of licensed drivers show drivers over age 65 to be overrepresented in crashes (63-68). Some studies report that on a per mile basis the older driver is second only to the young driver in crash risk, while other analyses rank the elderly driver as having the highest crash risk per mile driven.

Although pedestrian fatalities account for more than 18 percent of all motor vehicle fatalities (62), they account for 23 percent of motor vehicle deaths occurring to persons ages 65-74 and 35 percent of those occurring to persons age 75 and older. Although this overrepresentation may be attributable to greater exposure, a comprehensive study by Tobey et al. (69) reported that persons age 60 and over represented only 7.7 percent of pedestrians observed but accounted for 12.8 percent of the pedestrian injuries (both fatal and nonfatal). Thus it appears that the elderly are overrepresented in pedestrian casualties whether the analysis is based on population or exposure.

Effect of Aging Population on Importance of Motor Vehicle Injury as a Public Health Issue

The elderly are the most rapidly growing segment of our population and it may be anticipated that without efforts to facilitate mobility for the elderly, the magnitude of the motor vehicle and pedestrian injury problem will increase.

One factor that may ameliorate the injury problem is related to driver cohort effect. Many elderly drivers today, particularly women drivers, have limited driving histories, but because of a spouse's death or failing health have increased their driving time or even obtained a license for the first time. As a result, their driving inexperience is reflected in their performance. In contrast, larger proportions of the younger population are obtaining licenses than was previously true. When these young drivers become elderly, they will have a lifetime of driving experience behind them, which in turn should result in more proficient performance and a reduction of the number of collisions and injuries occurring to the elderly.

ENVIRONMENTAL ASPECTS OF THE INJURY PROBLEM

The highway transportation system was designed without taking into account the capabilities and limitations of the elderly (70). Relatively little attention has been given to the special characteristics of the elderly driver. Vehicle design does not consider what features might facilitate or impair the functioning of older operators and highway design has been developed primarily on the basis of performance measures obtained from young males. Sivak, Olson, and Pastalan (71) found that older drivers who had similar results as younger drivers on standard tests of visual acuity still had to get much closer to highway signs at night in order to read them. Consequently they had less distance remaining

in which to react to the information provided. Older people as a group need more light in order to see as well as younger drivers and they have more difficulty with glare recovery.

In both violations and crashes, older drivers are overrepresented in problems associated with intersections. They are especially likely to have problems with yielding right of way, observing stop signs and traffic signals, and maneuvering left turns (66,72,73).

One critical need is to modify vehicle and highway design to facilitate the driving task for the elderly. The National Academy of Sciences (NAS) is currently conducting a major study on improving mobility and safety for older persons and is commissioning a number of papers addressing specific aspects of the problem. Some issues being investigated are improvements in intersection design (for both drivers and pedestrians), vehicle modification to increase crash protection for the elderly, and sign legibility and conspicuousness. However, no attention is given to modifying vehicles so as to facilitate the driving task for the elderly, nor is the highway design in general given serious attention.

An environmental modification that has been given considerable attention in Europe but relatively little in this country is that of exterior vehicle design that would reduce pedestrian injury in the event of a collision. Most pedestrian crashes occur at relatively low speeds (20 mph), and modification in vehicle design, such as softer structured bumpers, can change the probability of victim survival and impairment (74).

Review of Programs or Efforts Attempting to Deal with the Problem

Modifications to the transportation system that simplify the task of driving or walking should aid the elderly. Three specific modifications are far-side bus stops, increased delineation of highways, and redesigned residential areas to reduce the amount and speed of traffic.

The location of bus stops is associated with the probability of injury occurring to passengers disembarking from the bus. Traffic coming from behind a bus cannot see passengers disembarking and crossing an intersection until they are very close. If the bus crosses the intersection before stopping, passengers disembark and cross the intersection behind the bus where they have a better view of traffic. Thus relatively simple changes can reduce the probability of injury.

Increasing the delineation on highways (centerline and edge and lane lines, as well as guide signs and delineator posts) increases the probability that they will be seen. Uniformity of delineation is also important to reduce confusion.

The Woonerf, a design for a living environment implemented in Europe, the Netherlands and Japan that includes joint and safe utilization of space by people for recreational purposes and vehicles reduces the danger of vehicle crashes (75). Residential areas are designed to severely limit through traffic and to reduce drastically the speeds of local traffic.

BEHAVIORAL ASPECTS OF THE INJURY PROBLEM

There is evidence that the elderly as a group restrict their driving as they recognize their increasing limitations (63,76,77). However, elderly drivers are not necessarily aware of some of their problems. Planek et al. (78) examined older drivers' errors that resulted in crashes with how older drivers perceived their driving problems. Failure to yield right of way was the major cause of the crashes, but the older drivers ranked it ninth out of ten maneuvers posing problems. Even with self restriction, on a per mile basis, risk of crash among the elderly is among the highest of any driving group.

A critical concern is that so little has actually been attempted to help older drivers and pedestrians. As a group they appear as responsible and motivated to do well, but it is likely that those most in need of behavioral modification would be least likely to seek and respond to intervention programs.

Review of Programs or Efforts Attempting to Deal with the Problem

Licensing Programs: Very few states have special procedures for driver licensure after a certain age, and none have been carefully evaluated.

A study by Zaidel and Hocherman (79), examining Israel's requirement for vision and medical evaluations for renewal applicants age 65 and older, found that 25 percent of the applicants had to wear corrective lenses. Because many of the applicants had already obtained glasses, only seven percent actually started wearing them as a result of the required vision test. The authors therefore concluded that the requirement was not cost effective. However, vision screening in the licensing station can be conducted at minimal cost, and those applicants already using corrective lenses would not be required to seek professional evaluation. Furthermore, the seven percent of applicants detected who were in need of lenses would translate into many thousands of drivers in this country.

The Florida Senate Committee on Transportation reported that the 70 year and over age group experiences a license examination failure rate that is nearly double that of all drivers similarly tested and that their mileage crash rate is higher than that for all other age groups over 25. Once involved in a crash, their chances of being seriously injured or killed are the highest of any age group.

Related to increased evaluation of older drivers for license renewal is the need for a system to ease older drivers out of the driving population gradually. To be effective, these programs must pay attention to the capabilities of older drivers and the demands placed on them by specified driving circumstances.

In addition to improved evaluation and appropriate restriction of older drivers, there is a need for increased attention to meeting the transportation needs of the elderly through public transportation or other systems such as volunteers or carpooling. The transportation needs of the elderly will increase, and they will be met either by individuals struggling with them one by one or with the help of a more organized, coordinated approach where resources and solutions are shared.

Driver Education: The National Retired Teachers Association/American Association of Retired Persons (AARP) has developed a program for special needs of the elderly called "55 Alive/Mature Driving" (80). The American Automobile Association (AAA) has also developed a program called "Safe Driving for Mature Operators." The AARP program is much more widely used, but neither program reaches more than a tiny fraction of the older driver population. Furthermore, it is highly likely that those taking the course are in least need of improvement.

Pedestrians: Interventions focused on the elderly pedestrian appear to make a difference. These include far-side bus stops, separation of motor vehicle and pedestrian traffic, cessation of all traffic in any direction during the pedestrian signal, enforcement of existing laws and ordinances concerning pedestrians, improved vehicle design, improved lighting of streets used by pedestrians, increased conspicuity of pedestrians, and improved emergency medical services.

HOST FACTORS

In considering the increased impairment accompanying age, J. Waller (81) differentiates between changes that are associated with what he refers to as normative aging and issues involving pathological aspects of aging. While many of these conditions can be identified through careful evaluation, some of them are less readily detected so that increased risk of injury may occur despite efforts to identify potential problems before they arise.

In addition to the older person's higher risk of collision involvement as a driver or pedestrian, it is clear that the elderly are more vulnerable to injury from any given crash. Data from the Fatal Accident Reporting System (FARS) show that a much lower proportion of older drivers survived with no injury and,

conversely, a higher proportion suffered fatal injury (72). Data from FARS as reported by Partyka (73) also show that this increased probability of death steadily increased with increasing age. Partyka concludes that the increased probability of fatality for the older driver is more related to decreased resistance rather than to crash configuration per se. This finding and conclusion are consistent with an earlier report by Baker and Spitz (82).

One more consideration is the use of drugs including alcohol since the elderly are more likely to be on medication, and all too often they have been given no medical counsel as to the potential effects on their functioning (77). An older person of a given weight is likely to reach a higher blood alcohol concentration (BAC) from a specified quantity of alcohol than a younger person of the same weight (83,84). Older persons may recognize this change, for it appears that they modify their alcohol intake (84,85). While frequency of drinking changes little with age, the quantity of alcohol consumed tends to decrease.

The major concern in dealing with host factors is that chronological age is not a good measure of the aging process itself. While there are clear relationships between chronological age and the overall average performance of the elderly, the predictions for individuals are not that reliable. As a result, interventions must be carefully designed to accomplish what is needed while avoiding any discrimination or appearance of discrimination against the elderly.

INTENTIONAL INJURIES: SUICIDE AND HOMICIDE

SUICIDE: Reports in the scientific literature have consistently concluded that suicide (ICD-9 codes E950-E959) increases with advancing years (86-89). The elderly (age 65 and older) constitute about 12% of the U.S. population but comprise 18.7% of all suicides. Moreover, this phenomenon is not limited to the United States, but is a characteristic of all industrialized nations.

The United States ranks at about the median for elderly male suicides and at the lowest for suicides among the female elderly (90). Actually, the suicide rate among the elderly has been decreasing over the past twenty years. However, older persons still are at the greatest risk of suicide despite this relative improvement (91).

The suicide attempts of older persons tend to be more serious and dangerous from a psychological and a medical point of view (92). The first attempt is likely to be successful, and gestures or attempts as cries for help are relatively rare. The elderly tend to use methods that are deadly and certain such as firearms (employed by 64% of the elderly, 57% of the younger cases) and to avoid those methods such as drug overdoses or gas which allow greater opportunity for intervention and rescue (14% of elderly suicides vs. 21% for youthful suicides).

However, suicide rates do not increase with increasing age for all elderly. Rates increase only for white males while they actually decline for black males and for females of both races. Accordingly, prevention measures might be focused on reduction of suicides among white males, the high-risk population, although prevention efforts might benefit all groups.

Age-related Factors

Physical health Sainsbury's study (88) of coroner's cases (N = 409) indicate that physical illness was a factor in 35% of the cases over sixty years of age as contrasted to the youthful cases (ages 15-29) in which illness figured in only 10%. Dorpat, Anderson and Ripley (93) found that in their sample of 80 cases of completed suicide, physical illness was the most frequent precipitating factor by those who were over sixty years of age. The reality of increased physical illness in the elderly leads one to consider the question of voluntary euthanasia and "the right to die" via so-called "rational suicide." The dilemma over whether a person in a free society enjoys the right to take his own life is fraught with emotional conflict almost as pointed as that of the counterpart "right to life" controversy (94,95). As a result of our increasing medical,

pharmacological and technological sophistication, life can be extended quantitatively at the same time it may deteriorate qualitatively.

Despite the reality of physical decline in later life and the heightened risk of suicide therein, certain preventive steps are suggested. First, a study by Motto and Greene (96) found that 42% of a cohort of 175 suicides had some type of medical contact within the six months preceding their suicide. Studies by Robins and Vail have confirmed this finding (97). Educational efforts aimed toward this population by physicians and the medical community could be extremely effective in diagnosis, referral and even treatment of the susceptible elderly patient. Secondly, changes in the budget priorities of this nation that direct greater funding for human and social services could relieve the anxiety that medical expenses can quickly wipe out a lifetime of savings.

Mental Health The incidence of clinical depressive illness preceding serious suicide attempts is quite high among older persons (92,98,99). Research also indicates that the frequency of completed suicides is linked to depressive disorders more than any other form of mental disorder (97). Typical depressive conditions in the person contemplating suicide are rarely of full-blown psychotic dimensions, but rather an individual with no previous history of serious emotional problems whose defense mechanisms of a lifetime are now insufficient to withstand the combination of biological, psychological and social stresses of old age. Butler and Lewis (100) enumerate some of the major diagnostic considerations for suicide in old age in addition to physical illness and being a white male as discussed earlier. These risk factors include depression, withdrawal from social and personal relationships (101), bereavement, especially within the first year of a loss (102), isolation due to widowhood, illness or disengagement (103), expectation of death from some cause, not necessarily suicide (93), induced helplessness often stemming from removal from home and placement in an institutional setting (104) alcoholism (105), and hopelessness (99), which is one of the most serious diagnostic signs. The feeling of exhaustion and failure, the fear of being a burden to others, financially and otherwise, the loss of interest in pleasurable activities are all symptoms of high suicide potential and their overt expression must be taken very seriously.

Treatments for depression include anti-depressive medications, milieu therapy such as the establishment of caring social support networks, and psychotherapy of a supportive nature.

Social forces play a critical role in suicide prevention. In our society, a premium is placed upon appearance, occupational status, and power and financial standing, attributes which almost always decline with age. And yet, as previously noted, there is a significant exception to the finding that suicide increases with age, even in our society. An increase is found only among white males. Conversely, the rates for blacks, Native Americans, and Mexican-American males and for both white and black females actually decline in later years. Are there positive factors that inhibit suicide in certain communities? Several explanatory hypotheses have been proposed (106):

Role of the elderly differs noticeably in the white community and communities of other races. Families in cultures that tend to be extended rather than nuclear provide more interaction and purposeful activity for the elderly, such as child care, housekeeping, and food preparation. Although dictated by necessity, the net result is to establish and strengthen social bonds which Durkheim (86) considered the greatest bulwark against the commission of suicide. Many white elderly, because of economic affluence, live apart and alone without the social nexus and sense of participation found in more traditionally oriented societies.

Status of the elderly is also greater in the communities of races other than whites where wisdom and experience are honored, and the elderly actually enjoy an increase in status as they grow older (107-109). However, the trend is toward changing these traditional values when societies industrialize and modernize.

Relative deprivation is a concept that helps explain the great plurality of white male suicides at the upper ages. White males, as a group, have enjoyed the greatest advantages and the greatest prestige during their active years. Thus, they have the farthest to fall when confronted with the vicissitudes of aging. Presumably the white male who begins to feel his power and influence eroding experiences a greater sense of loss than women or minorities who have long been accustomed to a lowered status due to racism, sexism and economic hardship. Therefore, women and minorities do not have to suffer these losses in old age.

What are the policy and theoretical implications of these findings? First individuals must learn to be realistic in their goals and aspirations since inability to achieve these high-reaching aspirations may lead to depression and other emotional problems as earlier discussed. Second is an appreciation of respect for age underscored by greater acceptance of the aging process and the inclusion of the elderly in the family structure. But foremost is understanding the importance of human relationships and response. The most distressingly difficult part of aging is not the material adversity nor the physical pains and illnesses, but rather the feeling of being useless, unwanted, superfluous. Communities that deal successfully with these issues, through necessity as much as design, provide a role, status and purpose for their elderly population.

HOMICIDE: In 1983, the latest year for which fully reliable and complete vital statistics are available, 20,141 people died by homicide (ICD-9 codes E960-E969) in the United States. Of these, some 1,244 cases or 6.2% were elderly (65 years and older). Since the elderly constitute about twelve percent of the general population it is clear that they are underrepresented by half in the population of homicide victims.

Homicide is very much a condition of the impetuous, youthful years of life. The rate characteristically declines after the first year of life and then begins accelerating through the teen years, reaching a peak at ages 25 to 35 and declining steadily from that point with very minor fluctuations. Males run a risk about 3 to 4 times that of females with the exception of infanticides during the first year of life when the victim is more likely to be female. Blacks have a homicide risk five times greater than that for whites and the risk for young black males can only be described as astronomical. These relative race and sex differences are perpetuated throughout the lifespan; however, the absolute numbers are considerably reduced by the time one reaches later life. In addition to these quantitative differences there are qualitative distinctions between homicide in the elderly as contrasted to the general homicide picture. For instance, the distribution of homicide by method indicates that the elderly are much more likely to be killed by beating or strangling than are their younger counterparts. The predominant motive is robbery and, therefore, they are much less likely to know their assailant (110). Preventive programs or even research studies on the topic of elderly homicides are extremely scant (110). If homicides are considered within the context of elder abuse, there is slightly more to review including a thorough overview by Pedrick-Cornell and Gelles (111) and a systematic study recently published by Powell and Berg (112). However, neither of these sources deal with the problem of homicide per se but rather with the topic of physical abuse of a nonlethal nature. The neglect of this topic in the literature may reflect its underrepresentation in the elderly population. (The incidence of homicide is less than one-fourth of the suicide incidence for this age group.) Accordingly the following recommendations are proposed:

A. It is a truism that the odds of being a victim of a violent crime are tied to neighborhood income. Poor people bear a disproportionate share of the crime burden. For the most part this means the minority elderly who are trapped by poverty and discrimination in areas described as subcultures of violence. This entails a subculture in which members are recruited into a vicious cycle of street crimes followed by prison terms where antisocial behavior patterns are reinforced, encouraging more violence (113). This vicious cycle will only be remedied when we address the conditions that underlie and perpetuate it (114).

B. Since the elderly are perceived by the criminally motivated as representing vulnerable prey, any moves toward strengthening their position through increased social networks (strength in numbers), assertiveness training and political demands for increased police protection will be helpful in changing the perception of vulnerability. However, this cannot be completely overcome since the elderly are realistically more vulnerable due to their relative frailty. There are strong implications here for community education programs directed toward the elderly. Most elderly homicides occur in the victim's home. To decrease the possibility of having to open their doors to strangers, the installation of an inexpensive optical viewer in the front door would be a sufficient preventative step which could be underwritten by community agencies. Other strategies might involve the establishment of mutual aid networks through telephone linkages and the provision of an "eyes on the street" crime prevention program which would have the added benefit of fostering closer interpersonal relationships and emotional support. Such approaches have the advantage of reducing robberies which are the primary ways in which the elderly are murdered and also of reducing through neighborhood contact, the isolation and loneliness which frequently accompany aging.

REFERENCES

1. Baker S, O'Neill B, Karpf RS. The Injury Fact Book. Cambridge, MA: Lexington Books, 1984.
2. Hongladarom GC, Miller WF, Jones JM, et al. Analysis of the Causes and Prevention of Injuries Attributed to Falls. Office of Environmental Health Programs, Department of Social and Health Services. Olympia, Washington, 1977.
3. Kelsey JL, Hoffman S. Risk Factors for Hip Fracture. NEJM 1987; 316(7):404-406.
4. Grazier KL, Holbrook TL, Kelsey JL, et al. The Frequency of Occurrence, Impact, and Cost of Musculoskeletal Conditions in the United States. Chicago: American Academy of Orthopedic Surgeons, 1984.
5. Melton LJ, Riggs BL. Risk Factors for Injury after a Fall. Clinics in Geriatric Med
6. Nevitt MC, Cummings SR, Kidd S, et al. Risk Factors for Recurrent Falls in the Ambulatory Elderly. Unpublished paper, 1987.
7. Gryfe C, Amies A, Ashley M. A Longitudinal Study of Falls in an Elderly Population: I. Incidence and Morbidity. Age and Ageing 1977; 6:201-210.
8. Baker SP, Harvey AH. Fall Injuries in the Elderly. Clinics in Geriatric Medicine. Philadelphia: W.B. Saunders, 1985; 1(3):501-512.
7. Berry G, Fisher R, Lang S. Detrimental Incidents, Including Falls in an Elderly Institutional Population. J Am Ger Soc 1981;29(7):322-324.
10. Morris E, Isaacs B. The Prevention of Falls in a Geriatric Hospital. Age and Ageing 1980;9:181-185.
11. National Center for Health Statistics. Unpublished data from the 1984 Health Interview Survey: Supplement on Aging.
12. Nickens H. Intrinsic Factors in Falling among the Elderly. Arch Int Med 1985;145:1089-1093.
13. Venglarik JM, Adams M. Which Client Is a High Risk? J Gerontol Nursing 1983; 11(5):28-30.
14. Cummings SR, Nevitt MC, Kidd S. Forgetting Falls. Unpublished paper, 1987.
15. Radebaugh TS, Hadley E, Suzman R (eds.). Falls in the Elderly: Biologic and Behavioral Aspects. Clinics in Geriatric Medicine. Philadelphia: W.B. Saunders, Vol. 1, August 1985.
16. Lipsitz L. The Drop Attack: A Common Geriatric Symptom. J Am Ger Soc 1983;31(10):617-620.
17. Lipsitz L. Syncope in the Elderly. Ann Int Med 1983;99:92-105.
18. Sabin T. Biologic Aspects of Falls and Mobility LImitations in the Elderly. J Am Ger Soc 1982;30(1):51-58.
19. Kapoor WN. Evaluation of Syncope in the Elderly. J Am Ger Soc 1987;35:826-828.
20. Tinetti ME, Williams FT, Mayewski R. A Fall Risk Index for Elderly Patients Based on Number of Chronic Disabilities. Am J Med 1986;80:429-434.
21. Wolfson LI, Whipple R, Amerman P. Gait and Balance in the Elderly: Two Functional Capacities that Link Sensory and Motor Ability to Falls. Clinics in Geriatric Medicine. Philadelphia: W.B. Saunders 1985;1(3):649-660.

22.Isaacs B. Clinical and Laboratory Studies of Falls in Old People: Prospects for Prevention. Clinics in Geriatric Medicine. Philadelphia: W.B. Saunders 1985;1(3):513-524.

23.Brocklehurst JC, Exton-Smith AN, Lempert-Barber SM, et al. Fracture of the Femur in Old Age: A Two-centre Study of Associated Clinical Factors and the Cause of the Fall. Age and Ageing 1978;7:2-15.

24.Wild D, Nayak U, Isaacs B. Description, Classification and Prevention of Falls in Old People at Home. Rheum Rehab 1981;20:153-159.

25.Campbell A, Reinken J, Allan B, et al. Falls in Old Age: A Study of Frequency and Related Clinical Factors. Age and Ageing 1981;10:264-270.

26.Lipsitz L, Nyquist RP, Wei J, et al. Postprandial Reduction in Blood Pressure in the Elderly. N Engl J Med 1983;209(2):81-83.

27.Lipsitz LA. Abnormalities in Blood Pressure Homeostasis that Contribute to Falls in the Elderly. In Falls in the Elderly: Biologic and Behaivoral Aspects. Clinics in Geriatric Medicine. Philadelphia: W.B. Saunders 1985;1(3): 637-648.

28.Imms F, Edholm O. Studies of Gait and Mobility in the Elderly. Age and Ageing 1981;10:147-156.

29.Woollacott MH, Shumway-Cook A, Nashner L. Postural Reflexes and Aging. In Mortimer JA, Pirozzolo FJ and Maletta GJ (eds): The Aging Motor System. New York: Praeger Publishers, 1982.

30.Robbins LJ. Restraining the Elderly Patient. Clin Ger Med 1986;2(3):591-599.

31.Wild D, Nayak U, Isaacs B. How Dangerous Are Falls in Old People at Home? Brit Med J 1981;282:266-268.

32.Tideiksaar R, Kay AD. What Causes Falls? A Logical Diagnostic Procedure. Geriatrics 1986;41(12):32-50.

33.Prudham D, Evans J. Factors Associated with Falls in the Elderly: A Community Study. Age and Ageing 1981;10:141-146.

34.Tinetti ME. Performance-Oriented Assessment of Mobility Problems in the Elderly. J Am Ger Soc 1986;34(2):119-126.

35.Hogue C. Mobility. In Schneider C, et al.(eds). The Teaching Nursing Home: A New Approach to Geriatric Research, Education, and Clinical Care. New York: Raven Press, 1984.

36.Brody EM, Kleban MH, Moss MS, et al. Predictors of Falls Among Institutionalized Women with Alzheimer's Disease. J Am Ger Soc 1984;32(12):877-882.

37.Isaacs B. Are Falls a Manifestation of Brain Failure? Age and Ageing 1978;7 (Supplement):97-111.

38.Visser H. Gait and Balance in Senile Dementia of Alzheimer's Type. Age and Ageing 1983;12:296-301.

39.Buchner DM, Larson EB. Falls and Fractures in Patiennts with Alzheimer's Type Dementia. JAMA 1987;257(11):1492-1495.

40.Mossey JM. Social and Psychologic Factors Related to Falls among the Elderly. Clinics in Geriatric Medicine. Philadelphia: W.B. Saunders 1985;1(3):541-554.

41.Ray WA, Griffin MR, Scchaffner W, et al. Psychotropic Drug Use and the Risk of Hip Fracture. N Eng J Med 1987;316(7):363-369.

42.Granek E, Baker SP, Abbey H, et al. Medications and Diagnoses in Relation to Falls in a Long-Term Care Facility. J Am Ger Soc 1987;35:503-511.

43.Sheldon JH. On the Natural History of Falls in Old Age. Brit Med J 1960; 5214-1690.

44.Lucht U. A Prospective Study of Accidental Falls and Resulting Injuries in the Home among Elderly People. Acta Sociomed Scand 1971;2:105-120.

45.Waller J. Falls among the Elderly--Human and Environmental Factors. Acc Anal Prev 1978;10:21-33.

46.Stelmach CD, Worringham CJ. Sensorimotor Deficits Related to Postural Stability: Implications for Falling in the Elderly. Clinics in Geriatric Medicine. Philadelphia: W.B. Saunders, 1985;1(3):679-694.

47.Mathias S, Nayak USL, Issaacs B. Balance in Elderly Patients: The "Get-up and Go" Test. Arch Phys Med Rehab 1986;67:387-389.

48.Nasher LM, Black FO, Wall C. Adaptation to Altered Support and Visual Conditions During Stance: Patients with Vestibullar Deficits. J Neuroscience 1982;2:536-544.

49.Sekuler R, Kline D, Dismukes K (eds). Aging and Human Visual Function. New York: Alan R. Liss, Inc., 1982.

50.Applegate WB, Miller ST, Elam JT. Impact of Cataract Surgery with Lens Implementation on Vision and Physical Function in Elderly Patients. JAMA 1987; 257(8):1064-1066.

51.Overstall P. Prevention of Falls in the Elderly. J Am Ger Soc 1980;28(11):481-483.

52.Rubenstein L, Robbins A. Falls in the Elderly: A Clinical Perspective. Geriatrics 1984;39(4):67-78.

53.Wells BG, Middleton B, Lawrence G, et al. Factors Associated with the Elderly Falling in Intermediate Care Facilities. Drug Intelligence and Clin Pharm 1985.

54.Foley CJ, Wolf-Klein GP. Prevention of Falls in the Geriatric Patient with Osteoporosis. Clin Rheumat Pract 1986;136-143.

55.Kapoor W, Snustad D, Peterson J, et al. Syncope in the Elderly. Am J Med 1986;80:419-428.

56.Hornbrook MC, Wingfield DJ. Falls Hazards in the Homes of the Elderly. Presentation at Annual Meeting of Gerontological Society of America. Chicago: November 22, 1986.

57.Obonyo T, Drummond M, Isaacs B. Domiciliary Physiotherapy for Old People Who Have Fallen. Int Rehab Med 1984;5:157-160.

58.Fife DD, Solomon P, Stanton M. A Risk/Falls Program: Code Orange for Success. Nursing Manage 1984;15(11):50-53.

59.Rainville NG. Effect of an Implemented Fall Prevention Program on the Frequency of Patient Falls. Qual Rev Bull 1984;10(9):287-291.

60.Gray-Vickrey M. Education to Prevent Falls. Geriat Nursing 1984;5(3):179-183.

61.Baker SP, O'Neill B, Karpf, RS. The Injury Fact Book. Lexington, Mass.: D.C. Heath and Company, 1984.

62.National Safety Council. Accident Facts. Chicago: National Safety Council, 1986.

63.Planek, TW. The Aging Driver in Today's Traffic: A Critical Review. In Waller PF (ed). North Carolina Symposium on Highway Safety: The Elderly in a Mobile Society. Fall 1972;7:3-38.

64.Wiener EL. Elderly Pedestrians and Drivers: The Problem That Refuses To Go Away. In Waller PF (ed). North Carolina Symposium on Highway Safety: The Elderly in a Mobile Society 1972;7:53-95.

65.Waller PF, Reinfurt DW. The Who and When of Accident Risk: Can Driver License Programs Provide Countermeasures? Chapel Hill: UNC Highway Safety Research Center, 1973.

66.Waller PF, House EG, Stewart JR. An Analysis of Accidents By Age. Chapel Hill: UNC Highway Safety Research Center, 1977.

67.Joksch HC, Thoren S. Car Size and Occupant Fatality Risk, Adjusted for Differences in Drivers and Driving Conditions. Hartford, CT: The Center for the Environment and Man, Inc., January 1984.

68.Maleck TL, Hummer JE. Driver Age and Highway Safety. In: Transportation Research Record 1059. Washington: Government Printing Office, 1986.

69.Tobey HN, Shunamen EM, Knoblauch RL. Pedestrian Trip Making Characteristics and Exposure Measures. Washington: U.S. Department of Transportation, 1983.

70.Waller PF. Preventing Injury to the Elderly. In: Phillips HT, Gaylord SA (eds) Aging and Public Health.

71.Sivak M, Olson PL, Pastalan LA. Effect of Driver's Age on Nighttime Legibility of Highway Signs. Human Factors 1981;23(1):59-64.

72.Brainin PA. Safety and Mobility Issues in Licensing and Education of Older Drivers. Washington: National Highway Traffic Safety Administration, 1980.

73.Partyka S. Comparison of Age of Drivers in Two Car Fatal Crashes. Washington: National Highway Traffic Safety Administration, 1983.

74.Ashton SJ, Peddler JB, Mackay GM. Pedestrian Head Injuries. In: Huelke DF (ed). Proceedings American Association for Automotive Medicine, 22nd Conference and the International Association for Accident and Traffic Medicine VII Conference.

75.Ichikawa K, Tanaka K, Kamiya H. Living Environment and Design of Woonerf. International Association of Traffic and Safety Sciences Research 1984;8:40-51.

76.Ysander L, Herner B. Elderly Male Automobile Drivers in Gothenburg and Their Traffic Behavior in the Year 1971. Proceedings of First International Conference on Driver Behavior.

77.Yee D. A Survey of the Traffic Safety Needs and Problems of Drivers Ages 55 and Over. In: Malfetti JL (ed). Drivers 55+ Needs and Problems of Older Drivers: Survey Results and Recommendations. Ed. by J. L. Malfetti, 96-128. Virginia: AAA Foundation for Traffic Safety, 1985.

78.Planek TW, Condon ME, Fowler RC. An Investigation of the Problems and Opinions of Aged Drivers. Chicago: National Safety Council, December 1968.

79.Zaidel DM, Hocherman, I. License Renewal for Older Drivers: The Effects of Medical and Vision Tests. Jnl Safety Research 1986;17:111-116.

80.Seaton M. 55 Alive/Mature Driving. Proceedings of Twenty Third Conference of the American Association for Automotive Medicine, 1979.

81.Waller JA. Injury Control. A Guide to the Causes and Prevention of Trauma. Lexington, Mass.: D.C. Heath and Company,1985.

82.Baker SP, Spitz WU. Age Effects and Autopsy Evidence of Disease in Fatally Injured Drivers. JAMA 1970;214:1079-1088.

83.Vestal RE, McGuire EA, Tobi JD, et al. Aging and Ethanol Metabolism. Clin Pharmacol Therapeutics 1977;21:343-354.

84.Vogel-Sprott M, Barrett P. Age, Drinking Habits, and the Effects of Alcohol. J Studies Alcohol 1984;45(6):517-521.

85.Stall R. Change and Stability in Quantity and Frequency of Alcohol Use Among Aging Males: A 19-Year Follow-up Study. Brit J Addiction 1986;81:537-544.

86.Durkheim E. Suicide. Glencoe, IL: Free Press, 1951. (Original French edition of Le Suicide published in 1897.)

87.Dublin LI. Suicide: A Sociological and Statistical Study. New York: Ronald Press, 1962.

88.Sainsbury P. Social and Epidemiological Aspects of Suicide with Special Reference to the Aged. In: Williams RH, Tibbits C, Donahue W (eds). Processes of Aging: Social and Psychological Perspectives (Vol. II). New York: Atherton, 1963.

89.Weiss JMA. Suicide in the Aged. In: Resnik HLP (ed). Suicidal Behaviors. Boston: Little Brown, 1968.

90.Statistical Abstract of the United States: 1987 (107th ed.). Washington: US Bureau of the Census, 1986, p. 823.

91.Seiden RH, Freitas RP. Shifting Patterns of Deadly Violence. Suicide and Life-threatening Behavior 1980;10(4): 195-209.

92.O'Neal P, Robins E, Schmidt E. A Psychiatric Study of Attempted Suicide in Persons over Sixty Years of Age. Arch Neurol Psych 1956;75:275-284.

93.Dorpat TL, Anderson WF, Ripley HS. The Relationship of Physical Illness to Suicide. In: Resnik HLP (ed). Suicidal Behaviors. Boston: Little Brown, 1968, pp. 209-219.

94.Battin MP. On the Relationship Between Suicide-prevention and Suicide-advocacy Groups. Suicide and Life-threatening Behavior 1982;12(4):254-260.

95.Seiden RH. Self-deliverance or Self-destruction? Euthanasia Review 1986;1(1):48-56.

96.Motto JA, Greene C. Suicide and the Medical Community. Arch Neurol Psych 1958;80:776-781.

97.Robins E, Murphy GE, Wilkinson RH Jr, Gassner S, Kayes J. Some Clinical Considerations in the Prevention of Suicide Based on a Study of 134 Successful Suicides. Am J Public Health 1959;49:888-899.

98.Batchelor IRC, Napier M. Attempted Suicide in Old Age. Brit Med J 1953;2:1186-1190.

99.Farbedrow NL, Shneidman ES. Suicide and Age. In: Schneidman ES, Farberow NL, Litman RE. The Psychology of Suicide. New York: Science House, 1970, pp. 165-174.

100. Butler RN, Lewis MI. Aging and Mental Health. St. Louis: C.V. Mosby, 1977.

101. Cummings E, Henry WE. Growing Old: The Process of Disengagement. New York: Basic Books, 1961.

102. Holmes TH, Rahe RH. The Social Readjustment Rating Scale. J Psychosomatic Research 1967;11:213-218.

103.Galle OR, Gove WR. Overcrowding, Isolation and Human Behavior. In: Taueber KE, Bumpass LL, Sweet JA (eds). Social Demography. New York: Academic Press, 1978, pp. 95-132.

104.Braceland F. Psychological Aspects of Aging. In: Vedder CB, Lefkowitz AS (eds). Problem of the Aged. Springfield, Il.: Charles C Thomas . Publisher, 1965, pp. 203-214.

105.Seiden RH. Suicide: Behavioral Aspects. In: The Encyclopedia of Crime and Justice. New York: Free Press, 1983, pp. 1521-1526.

106.Seiden RH. Mellowing with Age: Factors Influencing the Nonwhite Suicide Rate. Int J Aging Human Develop 1981;13(4): 265-284.

107.Messer M. Race Differences in Selected Attitudinal Dimensions of the Elderly. Gerontologist 1968;8(4):245-449.

108.Robins L, West P, Murphy G. The High Rate of Suicide in Older White Men. Soc Psych 1977;12:1-20.

109.Wylie FM. Attitudes Toward Aging and the Aged Among Black Americans: Some Historical Perspectives. Aging and Human Development 1971;2:66-70.

110.Allen N. Homicides in the Elderly. Unpublished research report, U.C.L.A. Neuropsychiatric Institute, 1985.

111.Pedrick-Cornell C, Gelles RJ. Elder Abuse: The State of Current Knowledge. Family Relations 1982;31:457-465.

112.Powell S, Berg RC. When the Elderly Are Abused: Characteristics and Intervention. Ed Gerontol 1987;13:71-83.

113.Wolfgang ME, Ferracuti F. Subculture of Violence--A Psychological Theory. In: Wolfgang ME (ed). Studies in Homicide. New York: Harper and Row, 1967, pp. 271-280.

114.Kastenbaum R, Aisenberg R. The Psychology of Death. New York: Springer, 1972.

Health Promotion and Aging
"MEDICATIONS AND GERIATRICS"

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I. Introduction and General Overview

Health promotion and disease prevention in the elderly is both appealing and worthy of our attention. While old age is not preventable, much of the disease and disability which is common in late life is preventable.[1] The rational use of medications, at both the policy and clinical level, has an important place in achieving this end, providing an important component in a health promotion strategy for healthy aging. Rowe and Kahn have cautioned against a "gerontology of the usual."[2] The focus on typical aging as "normal" ignores the enormous heterogeneity in this population. This may mislead scientists and policy makers to view what is "usual" as a reasonable health objective for older Americans.

II. Basic Demographics and Population Data

In 1987, about 12% of the U.S. population is 65-years or older. By 1990, the 65 and older group will reach 12.7% of the population; by 2000 the percentage rises to 13.1; and by 2020, to 17.3%. By the year 2020, the 65 and over population will have increased by 102%, compared to the 31% growth for the entire U.S. population for the same 40 year period.[3]

Changes will also be taking place within the elderly population itself. Not only will there be more citizens over 65 years of age, both in absolute number and percentage, but individuals within this age group will be living longer and, on the average, may tend to be more frail, and possibly in greater need of medical care. The older age groups, especially those over 75, will increase most dramatically. The current number of persons over 85 (2.7 million) will double by the end of the century. Conservative estimates to the year 2050 indicate that at least 50% of Americans will survive to their 85th birthday, with the 85 years and older population constituting at least 15 million people.[4]

III. Health Characteristics

Three general health characteristics of older U.S. residents are relevant to medications and geriatrics. First, the pattern of health service utilization influences the opportunities for receiving a prescription; second, the epidemiology of disease (especially chronic disease) influences the duration of treatment; and third, drug activity in the aging body influences therapeutic safety and efficacy.

A. Utilization of Health Services. Prescription drugs are prescribed for the elderly primarily as outpatients making physician office visits, as inpatients in long-term care facilities, and as hospitalized patients, as well as upon discharge from health care institutions. Persons 65 and older account for 20.5% of physician office visits in 1985.[5] And while most elderly are not in nursing homes, they did occupy 88% of the available nursing home beds in 1985.[6] And in 1986 persons 65 and older accounted for more than 40% of the hospitalizations in this country, staying an average 8.5 days compared to 6.8 days for 45-64 years of age.[7] "In the near future, the majority of all users of health and health related services with the exception of obstetrics and pediatrics will be persons over 65."[3]

B. The Epidemiology of Disease. As briefly discussed above, the elderly in America are more likely to use health services than are younger age groups.[8] This is explained in part by the fact that in spite of fewer acute illnesses, their recovery time is often longer; the fact that they are nearly twice as likely to suffer from a chronic illness; and the possibility that they may overuse services relative to true need.[9,10] In view of this reality the health care system's response requires strategies that are often quite different than those for younger persons because of the following:

the prevalence of chronic disease. Eighty percent of persons 65 years and older have one or more chronic diseases. Certain of these diseases are largely age dependent, such as coronary artery disease and dementia of the Alzheimer's type; other diseases, such as most cancers, are considered age related.[11]

multiple pathology. The existence of several simultaneously active conditions is much more prevalent in the aged than in those younger.

nonspecific presentation of disease. Several diseases which occur at all ages have a different natural history in the elderly. Almost any of the classic signs or symptoms of disease are present in the elderly in uncharacteristic ways. Instead of usually anticipated presentations, diseases often give rise to nonspecific problems which may be incorrectly identified as due to aging rather than due to disease. These nonspecific problems include falling, dizziness, acute confusion, new incontinence, weight loss, failure to thrive, etc.

silent presentation of disease. Especially likely to be obscured in the elderly are pulmonary embolism, pneumonia, cancer, acute surgical abdomen, thyrotoxicosis, depression, drug intoxication, myxedema, myocardial infarction, alcoholism.[12,13]

C. Pharmacokinetics and Pharmacodynamics of Drugs. Drug disposition in the body of an elderly patient may be quite different than in a similar patient forty years younger. Although these changes may not necessarily occur, when present they are largely the result of age related changes in body composition, renal and hepatic function, and concurrent disease states. In addition, an older patient may not respond to a given drug concentration in the same manner as a younger individual.[14,15] Age related physiologic changes in older patients dictate that while the standard guidelines for applying pharmacokinetic principles often apply, they must be approached with caution because some of the usual assumptions may not be valid. In particular, the clinician must more carefully consider possible changes in body composition and vital organ function.

ABSORPTION / A number of aging-related physiologic changes occur in the gastrointestinal tract (GI) which increase the possibility of altered drug absorption. With advancing age intestinal blood flow may decrease; muscle tone and motor activity in the GI tract may decline; and mucosal cells may have atrophied, reducing both gastric secretory and absorptive function. The elderly demonstrate prolonged and widely variable gastric emptying times when compared to younger groups.[16] In addition, the pH of GI fluid is increased in the elderly, a change that may effect the absorption of calcium.[17] In spite of these demonstrated and theoretical GI changes, altered absorption does not appear to be a clinically important factor in dosage calculations for older patients.[18]

DISTRIBUTION / Body composition undergoes noteworthy changes over a lifetime of 70+ years. Body fat increases, muscle mass decreases, and total body water decreases. By age 70 greater than 30 percent of body weight in a given individual may be fat. On the other hand, muscle mass contributes a smaller proportion of body weight, declining by an estimated 25 to 30 percent by age 70. Total body water decreases in the elderly from 13 to 18 percent.[19,20] These changes can have a clinically significant impact on the distribution of both water soluble and lipid soluble drugs. As a rule, with substantially increased age, water soluble drugs will have decreased distribution, while lipid soluble medication will have increased distribution.

The plasma protein binding of drugs in the elderly may be altered.[21] The two major plasma proteins are albumin and alpha-1-acid glycoprotein. Older patients often have a lower than normal serum albumin level, usually the result of decreased albumin production. Also, an

increased level of alpha-1-acid glycoprotein has been associated with advanced age.[21] The potential significance of these changes are either an increased free fraction of drugs bound to albumin (e.g. warfarin, phenytoin) or decreased free fraction of drugs bound to alpha-1-acid glycoprotein (e.g. lidocaine, propranolol). These alterations in binding may lead to the erroneous clinical judgments based on misinterpretation of serum blood levels.

METABOLISM / Phase I oxidative metabolism can be impaired in the elderly patient due to decreased microsomal enzyme activity. Also, the metabolism of drugs with high hepatic extraction ratios can be impaired due to a decrease in hepatic blood flow.[22] This is particularly important when prescribing certain drugs such as diazepam, quinidine, theophylline, propranolol, and imipramine. Easily estimating the extent of impaired metabolic function is not currently possible; consequently, dosage adjustments necessitated by metabolic impairment are, at best, estimates based on investigational and clinical experience.

Hepatic Phase II metabolism via conjugation is not meaningfully altered with advancing age. Consequently age related changes in clearance of drugs metabolized by glucuronidation clearance have not been reported. For example, oxazepam, lorazepam, and temazepam doses need not be reduced in older patients on the basis of hepatic function alone.

ELIMINATION / Glomerular filtration rate (GFR) declines steadily with increasing age. Because of the typical decline of muscle mass with advancing age, production of creatinine also declines. This produces serum creatinine levels usually considered normal for younger persons, but unreliable as an indicator of renal function in the older person. Thus, a calculated creatinine clearance is recommended when considering the proper dose of such drugs as digoxin, cimetidine, many antibiotics, and active metabolites such as N-acetylprocainamide and normeperidine.[23,24]

PHARMACODYNAMICS / The term pharmacodynamics usually refers to the magnitude of pharmacological effect that results from the interaction of drugs with receptors at the site of action. There is little information about the pharmacodynamics of drugs in the elderly, but an increased "sensitivity" to a number of drugs has been reported.[20,25] Perhaps the most widely reported is the enhanced pharmacological effect of narcotic analgesics in the elderly.[26,27] In a study by Kaiko it was found that elderly cancer patients, who received intramuscular morphine post-operatively, had significantly greater total pain relief and duration of pain relief than their younger counterparts. No information regarding adverse effects was reported.[28] This study confirmed similar findings reported in an earlier study by Bellville, et al.[29] Demonstrating decreased pharmacodynamic sensitivity, Vestal et al. have reported a reduction in response to both beta adrenergic agonist and antagonist drugs in the elderly.[30] From these and similar reports there is some evidence that age-related pharmacodynamic changes can occur. For the most part whether these alterations are due to diminished homeostatic mechanisms, chronic disease, or changes at the receptor or post-receptor remains to be determined.[20,25]

IV. Areas of Particular Interest

Medications are usually beneficial, sometimes of no value, and on rare occasion detrimental in their contribution to the health of the elderly. Numerous areas are of particular interest with regard to drugs for older patients. The few areas discussed in this background paper are the extent and pattern of drug use among older patients; the health promoting benefits the elderly derive from medications; their susceptibility to untoward effects of drugs; the potential for new technologies to benefit the elderly; successful interventions and programs; and selected deficiencies in current programs and services.

A. The Extent of Drug Use. The elderly take prescription and non-prescription drugs to a greater extent than younger persons. This appears to be so because their greater use of health services makes them more likely to receive prescriptions or make self-medication decisions.

PRESCRIPTION DRUG USE / As previously mentioned, the elderly make up 12% of the U.S. population. It is estimated however that this group accounts for approximately 30% of all drugs prescribed in the U.S.[5,31] In 1982 all consumers spent $14.5 billion for prescriptions dispensed by community pharmacies.[32] The elderly's precise proportion of that cost is not known, but if it was 30% that would be $4.35 billion. An FDA study found that those over 75 years of age

received the most prescriptions in 1982, averaging almost 17 annually. The "young-old," those 65 to 74, received only 13.6 that year. These numbers are much larger than the averages of those in the 55 to 64 age group (9.3 prescriptions) and the 45 to 54 age group (6.9 prescriptions).[33]

The 1985 National Ambulatory Medical Care Survey of office based physicians found that elderly women accounted for 12.5 percent of all visits and 17.7 percent of visits in which drugs were prescribed; elderly men accounted for 8.0 percent of visits and nearly 11 percent of visits involving drug prescription.[32] Overall at least one drug was prescribed or provided in over 68 percent of office visits by those 65 years of age and older.

OTC DRUG USE / Self medication as part of self-care seems to be one of the most important and frequent health maintenance actions taken by the elderly. A recent study of rural elderly found 65% of those surveyed to have used over the counter (OTC) medications in the previous two weeks, with women taking more than men.[34] This was consistent with findings from an earlier study of an elderly population in which 64% had taken OTC medications; again, women used more than men.[35] Respondents in this study reported consuming in a one day period an average of 1.74 prescription drugs and 1.13 over-the-counter drugs.[34]

B. Patterns of Drug Use. Drug use patterns in the elderly vary according to the populations in which data is collected. The best defined data comes from ambulatory elderly populations. Two ongoing programs, the Dunedin Program in Florida and the N.I.A.'s Established Populations for Epidemiologic Studies of the Elderly (EPESE), provide the most extensive and detailed information about both prescribed and OTC medications in a controlled study population or cohort. The Dunedin Program which has screened approximately 3,000 elderly each year since 1978 for undetected medical disorders, has also collected patient-recorded information about prescribed and OTC medication. Over a five-year period 93% of patients in that population took some medication, with a mean of 3.7 medications at the time of interview. The study also found women to be consuming more than men, and drug use increasing with advancing age.[36] The most common therapeutic indications for all drugs were antihypertensives, non-narcotic analgesics, antirheumatics, various vitamins and cathartics. Striking changes over the five year period include an increase in mean drug use (from 3.2 medications) and a considerable increase in nutritional supplement use.[35]

The EPESE project, a community-based surveillance program funded by the National Institute of Aging, is being conducted at four research sites; New Haven (Yale University), East Boston (Harvard University), rural Iowa (University of Iowa), and the Piedmont area of North Carolina (Duke University). Extensive information regarding both prescription and OTC medication use is being collected as part of these in-home surveys of between 3,000 to 4,500 community elderly. The first published report of medication use in an EPESE population was from Iowa where 88% of patients took some medication, with the mean being 2.87 drugs. In this population medication use increased with age and was greater in women.[34] The most common therapeutic indications for drugs were cardiovascular, analgesics, vitamins and nutritional supplements, gastrointestinal products and CNS agents. Analgesics, vitamins, and GI agents (e.g., laxatives) were the most frequently taken over-the-counter therapeutic categories in Iowa among rural elderly.[34] In fact, products classified as "analgesics and antipyretics" constituted over 39% of the reported OTC drug use; and three most frequently mentioned categories accounted for more than 94.1% of this use. While the Dunedin and Iowa populations and methods are not comparable, the most distinguishing difference is the apparently greater use of drugs seen in the Florida population.

Additional information about commonly prescribed medications for ambulatory elderly comes from a variety of sources. The most recent information (1986) is from two electronic data bases: IMS America Ltd. (Ambler, PA), and Pharmaceutical Data Services [PDS] (Scottsdale, AZ).[37,38] The top five therapeutic classes prescribed for the elderly according to the IMS data were digitalis preparations, diuretics, beta-blockers, nitrates, and antiarthritics. The PDS data, reflecting prescription drugs dispensed, showed the top five drugs for the elderly to be hydrochlorothiazide and triamterene, digoxin, potassium chloride, nitroglycerin, and furosemide.

Drug use patterns from institutional settings are less well defined. A 1976 survey of long-term care facilities found that most patients received between 4 and 7 medications with the mean being 6.1 drugs.[39] The most common therapeutic indications were cathartics, analgesics,

tranquilizers, sedative/hypnotics, and vitamins. According to PDS, the top five drug products dispensed to elderly nursing home residents in 1986 were digoxin, furosemide, potassium chloride, dipyridamole, and nitroglycerin.[38] This pattern reasonably reflected the frequency of use these products had among non-institutionalized elderly that year. In alarming contrast, the sixth and seventh ranking drugs among elderly nursing home residents were haloperidol and thioridazine HCl; among non-institutionalized elderly these same agents ranked 99th and 90th respectively.[38] This report also revealed that during the first quarter of 1986, 59.2% of the elderly in the nursing homes received 4 or more prescriptions, compared to 35% of the non-institutionalized elderly.

Drug usage in hospitalized elderly is available from a variety of sources. A drug use surveillance project on a geriatric specialty unit found 500 of 521 patients to be given medications. Patients observed during the study period were given an average of 6.1 medications. In order, the most frequently used drugs were diuretics, antibiotics, bronchodilators, and analgesics.[40] Another study of 56 hospitalized elderly patients reported the mean drug use to be 4.1 medications prescribed for chronic use with the most common therapeutic indications being cathartics, analgesics, vitamins, diuretics, and cardiac drugs.[41]

C. Health Promotion Benefits of Drug Therapy. Health promotion strategies, particularly in older populations, must clearly rely on both social-behavioral and medical strategies. Many maladies of old age can be traced to health risk behaviors of young adulthood, and as a result prevention is often viewed as having little value as a health strategy after 65 years of age. Kannel and Gordon have suggested "that because of the relatively high incidence of mortality in the elderly the absolute impact of preventive measures short-term may actually be greater in the elderly than the younger despite a lesser relative impact."[42]

Since that suggestion, made in 1977, the preventive value of treating diastolic-systolic hypertension in the elderly has been demonstrated. The V.A. cooperative study demonstrated a 54 percent reduction in fatal and nonfatal cardiovascular events in the 60 years and over age group.[43] The Hypertension Detection and Follow-up Program found that older patients receiving drug therapy according to structured guidelines (otherwise termed "stepped-care") had lower incidence of stroke and lower mortality than age matched controls referred to their usual "regular care" for management.[44] And, results from the European Working Party on High Blood Pressure in the Elderly Trial have shown dramatic reductions in morbidity and mortality among drug treatment subjects over a seven year period.[45] Of course the importance of attentive monitoring during treatment cannot be over emphasized; anti-hypertensive medications are among the most widely implicated contributors to adverse drug reactions in the elderly [reviewed later in this paper].

The efficacy of influenza vaccine was evaluated in nursing homes of Genesee County, Michigan, during the winter of 1982-83. Investigators found the use of influenza vaccine to reduce both incidence and severity of influenza virus infections among the elderly.[46] A positive cost-effectiveness analysis of influenza vaccination programs for the elderly was reported comparing medical costs and health effects between vaccinated and unvaccinated elderly from 1971-1972 through 1977-1978.[47] Despite belief in the preventive value of the vaccine, medical compliance with recommendations for its use has been poor; institutional policy appears to be the best means for accomplishing wide spread immunization.[48]

Disability and immobility are associated with fractures in older persons; and fractures are associated with low bone mass.[49] The N.I.H. estimates that about 1.3 million fractures a year can be attributed to osteoporosis in people aged 45 years and older.[50] As one of the most prevalent afflictions of advancing age, osteoporosis-related vertebral fractures burden one-third of women by age 65. By age 81 hip fractures, usually associated with osteoporosis, will have stricken one-third of the women.[51] An effective means of preventing the loss of bone mass in postmenopausal women is regular use of estrogen therapy, particularly when combined with calcium supplements.[52,53,54] The FDA recently acknowledged this preventive indication to be an effective use of estrogens when taken for 21 or every 28 days and combined with calcium supplements and exercise.

A variety of useful but less well documented preventive and protective actions of drugs have been reported. For example, a case-control study of 300 cataract patients and 609 controls found a protective effect from long-term use of aspirin-like analgesics.[55] Such findings clearly require methodologic scrutiny and additional investigation. But they also ought to encourage the continuing search for agents with potential for preventive/protective impact on common disabling conditions of advanced years.

D. Health Risks and Problems Associated With Medications. The major areas of concern with regard to health risks and problems associated with geriatric drug therapy can be organized as bio-medical, behavioral, economic, and health policy/health services. Conversely, these areas also represent important targets for drug oriented health promotion interventions. In general, issues reviewed independently in this background paper (e.g. adverse drug reactions, compliance, costs, access, and attitudes) are very much interdependent, and an integrated approach to solutions is recommended.

DRUG RELATED BIO-MEDICAL ISSUES / Aging is associated with a variety of physical changes and health problems. Adverse drug reactions also present in a wide variety of symptoms throughout the body. A major challenge for the clinician is to distinguish between symptoms of aging and those associated with drug therapy. Mental disturbances, fatigue, depression, and syncope are examples of complaints that are associated with commonly encountered conditions as well as frequently prescribed medications.[56]

1. THE EPIDEMIOLOGY OF ADRs. Just as drug use patterns vary with populations, incidence and prevalence data for adverse drug reactions (ADRs) is quite dependent on data collection methods and settings in which studies have been conducted. Multicenter collaborative drug surveillance programs, voluntary reporting to FDA, cohort surveillance, the control phase of intervention demonstrations, institutional or population specific prevalence surveys, and computerized record linkage of secondary data sets have provided the most enlightening perspective on ADRs in the elderly thus far.

The Boston Collaborative Drug Surveillance Program (BCDSP) formalized and standardized clinical data collection on medication use and effects in a consortium of hospitals. Routine screening procedures have been used by BCDSP to correlate patient factors and drug response. From this effort dozens of adverse effects associated with drug therapy have been identified; advanced age has been an important variable in several instances (e.g. heparin in older women[57] and high dose flurazepam in older patients[58]).

The FDA has been collecting reports of suspected and known adverse drug reactions (ADR's) since 1968. The data has limitations because of the spontaneous and voluntary nature of the reporting system. Nevertheless, the value of summary information from this data set to alert researchers and clinicians to drugs worthy of more careful attention should not be overlooked. Recently FDA data from the 15 year period 1968-82 was tabulated to identify medications which may cause the older patient untoward effects.[59] From this analysis the five generic drug classes with the highest reported adverse drug reactions were identified. These were, in order, antiparkinsonian drugs, antibiotics, antiarthritics, antiarrhythmics and diuretics. The most recent data from FDA spontaneous reporting indicates an overall rate of 8.5 ADR reports per 100,000 population; the rate among those 65 and older is nearly double that.[60]

Drug induced admissions to hospital were examined along with other iatrogenic causes of hospitalization at a 769-bed urban teaching hospital.[61] In that institution 4.2% of admissions during two summer months were attributed to medication; half of which were considered by the investigators to be potentially avoidable. Medications accounted for 77% of all iatrogenic admissions. The average age among all iatrogenic admissions was 55 years. Another report of 293 admissions to a family medicine inpatient service found 15.4% to be drug-related with almost one-half occurring in patients 60 years of age or older.[62]

The occurrence of ADRs during hospital stays provides another perspective. During March and April of 1981 records for all admissions to Denver's VA Medical Center were reviewed.[63] In this study the occurrence of hospital associated iatrogenic complications for veterans aged 65 and older was compared with younger patients. The younger group had no complications caused by

drug reactions while 17.7 percent of the older group experienced an ADR. This rate is consistent with those reported in other studies.[64,65] The differences between hospitals are perhaps due to the use of different criteria for determining a drug reaction.

Growing awareness of aging has stimulated an increasing number of investigators to use large computerized data sets to focus on drugs for their possible etiologic part in common problems of old age. Two examples for illustrative purposes are included. (1) An association between psychotropic drug use and hip fractures has been identified using computerized Medicaid files; dementia as a confounding variable did not appear to influence the results.[66] (2) A slightly increased risk of hospitalization because of gastrointestinal bleeding has been noted among elderly users of nonsteroidal anti-inflammatory drugs compared to nonusers at the Group Health Cooperative of Puget Sound.[67]

2. FACTORS CONTRIBUTING TO ADRs. It's estimated that at least 60 percent of adverse drug reactions are an extension of normal pharmacologic action.[68,69] Because most adverse effects are pharmacologic and usually well-known minor reactions, many should be preventable with more careful prescribing, monitoring, and patient education.

Elderly patients are at a higher risk of developing drug reactions than the general population. Several factors are known to predispose older persons to this excess risk. The first, and perhaps strongest factor is multiple drug use. Perhaps the first approach to preventing adverse drug reactions is to limit the number of drugs. This would not only reduce the chances of side effects occurring, but also reduce the possibility of drug interactions.[56]

Polypharmacy ... The incidence of polypharmacy or multiple medication use in the elderly is substantial.[34,36] One of the major associated problems is adverse drug reactions.[70] Williamson and Chopin found an increasing prevalence of ADRs as the number of prescribed drugs increased, occurring in 10.8% of those taking one drug and 27.0% of those taking six.[71] Another study of ambulatory elderly with dementia also found an increased incidence at ADR's with an increased number of medications.[72]

A number of factors contribute to the problem of polypharmacy.[73] Patients who use multiple physicians and pharmacies run the risk of receiving drugs that are therapeutic duplicates and drugs that interact since the health care professionals they see may not be completely informed about other prescriptions. In addition, there is a greater risk of medication errors and/or noncompliance due to polypharmacy.[74]

Pharmacokinetic and Pharmacodynamic Changes ... As previously mentioned, there are a number of possibly age-related physiological changes that may effect the pharmacokinetics of drugs in the elderly. There is a possibility of adverse drug reactions occurring when total body clearance of drugs is reduced either due to decreased hepatic metabolism or renal excretion. This risk is increased because the higher resulting plasma concentration should correlate with higher concentrations at the receptor site with an accompanying chance of enhanced pharmacological effects. In addition, regardless of pharmacokinetic changes, the elderly may experience enhanced pharmacodynamic response to drugs.

Often, however, it is difficult to determine which mechanisms, if not both, simultaneously contribute to adverse drug reactions. For example, a study from the Boston Collaborative Group has shown that at high doses of flurazepam (= or > 30mg) 39% of patients 70 years of age or older, experienced adverse drug reactions.[58] This compared to an incidence of 2% in the same group taking 15mg/day of flurazepam. A later study of flurazepam kinetics found a prolongation of its half-life in elderly men.[75] However, there are several studies of similar benzodiazepines in which the elderly had greater central nervous system sensitivity than younger subjects despite having the same drug plasma concentrations.[76,77]

Drug Interactions ... Traditionally, the term drug interaction (DI) has been defined as the effect -- either favorable or unfavorable -- that the administration of one drug has on another drug. Only a few studies examining DI's in the elderly have been reported. In a study of 573 hospitalized elderly, 2.16% of prescriptions written during their hospitalization produced potential drug interactions.[78] The investigators classified 78.2% of those interactions as avoidable or probably avoidable. Drug interactions in a 1975 nursing home survey of 562 patients were found in 5.8% of medication orders.[79] Another study of 132 nursing homes and 11,173 patients found

that 2.7% of patients had clinically significant drug interactions occurring.[80] The occurrence of drug interactions among 1,094 ambulatory elderly was found to be much greater than that in the institutional populations (15%).[81]

It is not clear what proportion of potential drug-drug interactions are actually of clinical significance. For example, in one study 80% of the patients only required close patient monitoring as opposed to dosage reduction or drug discontinuance.[80] Still, the elderly are at an apparently increased risk for drug interactions as a consequence of the prevalence of polypharmacy. Also, in individual elderly patients who have altered homeostatic mechanisms and limited functional reserves, drug interactions may cause significant morbidity.

There are two major types of drug-drug interactions: pharmacokinetic and pharmacodynamic. Pharmacokinetic drug interactions occur when one drug alters the absorption, distribution, metabolism, or elimination of another drug. Interactions with the greatest potential for adverse drug reactions are those involving a decrease in the total body clearance of drugs with a narrow therapeutic index. For example, cimetidine has been shown to decrease the clearance of antipyrine, a marker of oxidative liver metabolism.[82] Pharmacodynamic drug interactions occur when one drug either enhances or diminishes the pharmacological effect of the other drug. This usually involves an interaction at the site of action or the receptor level. Of particular importance in the elderly is the cumulative effect of drugs with different desired pharmacological effects but similar side effects. For example, alcohol is reported to significantly contribute to sedation experienced by patients taking drugs with central nervous system depression side effects such as antihypertensives of psychotropics.[83]

Drug interactions in an even broader context include their adverse interactions with disease processes, foods, or laboratory tests. Drug-disease interactions, although less common than drug-drug interactions, have a greater potential to produce clinically meaningful adverse effects.[78,81] Information about drug-food (drug-nutrient) interactions is increasing.[84] It is well known that some foods can alter the pharmacokinetics of drugs, but drugs can alter appetite and/or cause vitamin deficiencies as well.[84] An area of current research interest is the effect of nutritional deficiencies on hepatic function and drug metabolism.[85] Drug-lab interactions (drug induced alterations of laboratory values) require careful evaluation and interpretation. They may indicate drug-induced illness or statistically significant, but clinically insignificant changes in laboratory test values. With growing interest in self-care and the in-vitro home diagnostic market, it will be imperative that patients and health care professionals understand that drugs may interfere with test results.[86]

3. BIO-EQUIVALENCE AND GENERICS. Generic prescription products provide a potential cost savings for the elderly. However, this potential has not been fully realized. The older consumer has shown reluctance to request generics in spite of potential savings. Reasons include perceived safety, efficacy, and financial risks; preference for the known product; and uncertainty about quality.[87,88,89]

There is a considerable debate about the use of generic drugs.[90] Since the passage of the 1984 Drug Price Competition and Patient Term Restoration Act, there has been an increasing number of generic products approved by the FDA.[91] One potential benefit of generics is that they are usually less expensive than brand name drugs. This should translate to cost savings for elderly patients. A recent study, however, questioned the cost savings of generic drugs and found wide variations in the prices of generic and brand name drugs.[92] Some have used this data to conclude that "it is not unusual for a generic drug to cost more than a brand name drug."[93] It is important to point out that in this study the consumer usually paid less for generics. Also, the study was conducted during 1984 before the new law took full effect.

Concerns have also been raised about the efficacy of generic drugs in the elderly.[94,95] This may stem from the fact that prior to approval for marketing, the studies required to prove bioequivalence are single-dose bioavailability studies of only 20-30 young health male volunteers. In addition, statistical variations as great as a 30% difference in generic vs. brand name drugs are acceptable.[90] Although the question of how this information specifically relates to the elderly patient is not fully answered, it is important to note that since 1984 there has not been a documented report to the FDA of a serious problem with a generic product.[96]

BEHAVIORAL ISSUES / The elderly appear to be particularly vulnerable to their own attitudes toward taking medications and the attitudes of others providing care. Straus has reviewed the complexity of behavioral issues as a risk factor in geriatric drug use.[97] Issues of compliance and attitudes provide a useful background to the larger topic.

1. COMPLIANCE. Assuming that a certain prescribed or OTC medication is beneficial, medication compliance or adherence is imperative to achieve therapeutic success. Numerous studies have shown, however, that whenever self administration or discretionary action is involved, patients frequently fail to take their medication as prescribed.[98,99,100,101] Patient noncompliance to prescribed therapies can have serious consequences. First and foremost, noncompliance can neutralize any therapeutic benefits of medical care rendered. Second, medication errors and/or medication noncompliance can lead to adverse drug reactions. Third, it has been associated with higher rates of hospitalization, longer length of stay in the hospital, and increased ambulatory visits, resulting in additional and unnecessary diagnostic and treatment procedures that generate avoidable costs.[102,103,104]

There is considerable controversy whether the elderly are less compliant with medications than younger patients. Two studies among noninstitutionalized elderly conducted 24 years apart reported an approximately similar medication error rate (59% and 50%).[74,98] Also, when the elderly were compared to a younger population, compliance rates were again similar.[105,106] Indeed, noncompliance seems to be associated with an increasing number of drugs rather than an increasing number of years.[107] An added dimension compounding the problem at the clinical level is the fact that physicians tend to overestimate their patients' compliance with prescribed regimens.[108]

Patient factors implicated as contributors to noncompliance include behavioral, social, and personal considerations. There is difficulty attributing health related behaviors, such as compliance, to the aging process. Not only are there methodological constraints (prevalence data vs. life course incidence data), but health behavior is also related to the social circumstances and historical context of an individual's life.[109] Nonetheless, an individual's perception and response to illness clearly influence his/her drug-taking behavior.[110] Eraker et al. have proposed a model for patient behavior which combines components Becker's earlier Health Belief Model and patient preferences.[111] This thoughtful approach to the issues of compliance contends that the matter is one of shared responsibility between physician and patient. One premise of this model is that the physician's responsibility is inversely related to the degree of patient participation; thus, the less responsible the patient, the more so must be the physician.

Social isolation has been found to play a significant roll in noncompliance.[112] A large proportion of older Americans live alone, increasing their likelihood of having compliance problems. In addition, one-third of the approximately 20 million Americans classified as illiterate are 60 years of age and older[113] compounding the potential risk of misunderstandings or lack of knowledge about therapy.[114] Other patient factors include personal impairments such as difficulties with vision or memory or learning disabilities,[115,116] and physical limitations imposed by arthritis or other handicaps.[117] There is also evidence that some nonadherence in the elderly may be intentional[118] and perhaps represent intelligent noncompliance.[119] In addition, it appears that economic issues play a role in noncompliance among older persons. A 1986 AARP telephone survey of a population (sample size not available) 45 years and older found 13% of those deciding against having prescription filled doing so because of cost.[91]

2. ATTITUDES. Provider attitudes may place the elderly, especially the poor elderly, at an increased for substandard medical care.[120] In spite of more prescriptions per office visit for older patients,[5] office practice encounter time with older patients is apparently less than with younger patients.[121] Perhaps this results from a perpetuation of the agism myths which Surgeon General Koop sees as self-fulfilling prophecies.[122] Wetle has suggested that this may partially be attributed to misapplication of population-based data.[123] Applying average life expectancy data in making individual management decisions deprives the patient of credit for surviving to the moment of care; the more appropriate issue is the life expectancy beyond this encounter for the individual patient.

ECONOMIC ISSUES / More than 30% of the national health care budget is spent on care for older Americans.[3] Nevertheless, this does not come close to covering the full expense of health needs of the elderly. Beyond this, out-of-pocket payments and third-party payors account for additional health expenses.

1. PERSONAL EXPENSES. A high rate of use and the large out-of-pocket expenditure for drugs place economic concerns on a par with safety and efficacy as important medication issues to be faced by the elderly. There are more elderly, and more of them are using more expensive drugs. Prescription prices in the U.S. rose 56% from January 1981 to June 1985; this far out-paced the Consumer Price Index which grew 23% over the same period. National telephone surveys by AARP in 1985 and 1986 found 62% of the elderly to be taking prescription drugs on a regular basis, with just less than half (45%) receiving some assistance from insurance or other health coverage. Among those without assistance the number of older patients paying more than $40 each month increased from 24% to 34%.[91] The extent of poverty (12.4% in 1986) among older Americans has remained at or near current levels for several years.[124]

Currently, Medicare coverage for outpatient medications moving through legal hurdles and final implementation. Overall, the potential cost of drugs under Medicare depends on the number of participants, the number of units per participant, and the unit cost of medications prescribed. Each factor is rising. In 1967 less than 78% of Medicare beneficiaries were taking medications; by 1980 the proportion had grown to more than 80%. Over that same period the average number of prescriptions per beneficiary grew from 10.4 to 12.1 annually. Because prescription size (doses dispensed) has increased over that same period the growth curves cannot be compared, but the average prescription cost more than doubled going from $4.00 in 1967 to $8.05 in 1980; in 1984 the cost for Medicare beneficiaries was over $10.00 per prescription.[125]

Although there are some state pharmaceutical assistance programs,[126] Medicare does not pay for outpatient drugs at this time. They will, however, reimburse for drugs administered as part of an office visit, with the notable omission of influenza vaccination. Perhaps Medicare use of health maintenance organizations in the future may change this policy.[127] For elderly patients that fall below a certain income level, Medicaid coverage of medications is available. In 1986 an estimated 6.6 percent of the elderly were covered by Medicaid insurance.[128] A recent study analyzing different Medicaid cost-saving programs found that the elderly had less access to "essential" medications [as determined by an expert panel (e.g., insulin, thiazides, furosemide, digoxin)].[129] The use of generic drugs may be an approach for patients and third parties to reduce medication costs.

New factors in understanding the cost of prescriptions are encountered each year. An estimated 5% of physicians are now dispensing drugs they prescribe, with nearly one-third of office-based MD's expected to do so "within a few years."[130] It's probably too early to appreciate the full impact of physician dispensing on drug costs for the elderly, but analysis by the Pennsylvania Department of Aging in the fourth quarter of 1986 found that elderly patients paid nearly $2.00 more per prescription when doctors dispensed the medication. The report did not indicate whether wholesale cost or quantity dispensed had been controlled in the analysis.[131]

2. PAYMENT AND REIMBURSEMENT. A major activity now under legislative consideration and enactment is the reimbursement of outpatient drugs for Medicare beneficiaries. Regardless of the exact outcome of this activity by the current Congress, this area will be of major interest for health economists and government officials for years to come. Although the primary concern of Medicare beneficiaries is the substantial out-of-pocket costs associated with prescription drugs, the primary concern of government officials is the cost of such a provision.[126] Given the finite dollars that Congress envisions for this benefit and the demographics of this benefit as a dramatic growth area, further refinement and adjustment will almost certainly occur with the introduction of the benefit.

At the request of the Health Subcommittee of the Senate Finance Committee, the Office of Technology Assessment (OTA) has submitted an examination cost containment strategies and possible approaches appropriate to drug coverage under Medicare.[126] Some (but not all) of the specialized cost-containment mechanisms offered for further exploration by OTA include various forms of price setting, provider and patient incentive programs, beneficiary cost-sharing

programs, Federal grants to state pharmaceutical assistance programs, and developing a federal restrictive formulary.

Options for defining drug coverage under Medicare are limited. Comprehensive coverage, acknowledged by OTA to be the most expensive, might include all prescription drugs or all drugs prescribed for documented chronic diseases. Over-the-counter medications could be a component of this program. A limited coverage approach, on the other hand, could finance only selected therapeutic categories or targeted sub-populations (e.g., poor elderly or nursing home residents). Some options for specifying drug groups for coverage included determination of "life-sustaining" drugs by medical consensus, identifying drugs likely to prevent hospitalization with its associated costs, and approval only for drugs (or drug products) for which the manufacturer can demonstrate specific evidence of efficacy and safety when used by elderly patients. A third option available under Medicare is "phased-in" implementation drug coverage. This approach could allow for administrative consideration of changes in clinical practice standards, and benefit from accumulated program experience.[126]

HEALTH POLICY AND HEALTH SERVICE ISSUES / The delivery of health services and the implementation of health policy are indicators of society's expectations for health promotion. The drug component of a larger strategy is reflected in these selected examples.

1. MEDICAID. Although only 6.6% of the elderly were covered by Medicaid insurance in 1986, these were by definition among the least able to afford out-of-pocket health expenses.[128] Efforts to reduce costs and focus benefits under Medicaid have been a dominating health policy issue at the state level for several years. An analysis of the effects of a $1.00 copayment compared to a monthly limitation of 3 prescriptions found Medicaid's monthly savings under the two systems to be comparable.[129] However, the proportion of "essential" medications [see pg. E-10] obtained by recipients was greater under the copayment arrangement.

One approach has been the adoption of a generic formulary for Medicaid recipients by Alabama. Under that State's provisions, reimbursement for brand name drugs will not be made when generic equivalents are available. In another tack coverage of most anti-anxiety drugs was discontinued by Kansas; while coverage of psychotherapeutic drugs has been added by Arizona.[132]

Recently three states (Florida, Iowa, and North Carolina) adopted Medicaid service programs that are preventive in nature, but none of the three were directed at drugs or targeted the elderly. In 1985 Michigan adopted a therapeutic drug utilization program to identify Medicaid recipients at risk for drug induced illness.[132] In view of the higher rate of ADRs among the elderly, successes in this program ought to have greatest benefit for older recipients of Medicaid.

In view of the the increased general use of medications[38,39,133] (and psychotropic drugs in particular[38]), preadmission screening of applicants for nursing homes may shield some from overmedication while perhaps leading to more appropriate therapy for those admitted. Minnesota recently adopted a nursing home applicant screening program, and Massachusetts was considering the same in mid-1985.[132]

2. MEDICARE. An average 17% annual increase in Medicare expenditures between 1967 and 1983 prompted the shift to a prospective payment system based on diagnostic related groups (DRG's). This change in the reimbursement system was accompanied by increased rates of hospitalization for elderly Medicaid nursing home residents in Wisconsin.[134] Higher drug usage is usually associated with hospitalization; whether this occurred in this population is not known.

In spite of changes since 1983 Medicare costs continue to rise; and rising health care costs have financial impact on the elderly. In dealing with the issue the 100th Congress seems to favor an approach which will limit out-of-pocket health expenses to $2000 annually.[135] Proposals to expand Part B to include outpatient prescription coverage received wider support in 1987 than in previous years. Under consideration is a requirement that participating pharmacies would consent to offer medication counseling to all eligible program participants.

Prescription drug assistance under Medicare could include policy features designed to improve overall drug therapy. The OTA background paper on options for drug coverage by the Medicare Program included several policy features that might accomplish this end.[126] Among the options

outlined were concepts of periodic professional review of drug regimens, limiting the number of prescriptions that can be funded, requiring a single dispensing pharmacy site, rewarding safety and toxicity studies targeted at elderly patients, and providing incentives for user-friendly packaging and labeling as well as patient education services.

3. HEALTH MAINTENANCE ORGANIZATIONS. Medicare recipients have been able to join an HMO since April 1985. During the two years following enactment of the legislation allowing this choice, slightly more than 900,000 (5.5%) of the eligible Medicare recipients had done so.[127] However, serious questions have been raised about the long term feasibility of a prepaid capitation system of providing health services for the elderly.[136,137] In some instances the actuarial basis for capitation payments does not reflect the population served; also, if treatments are influenced by financial self-interests the patient may suffer. In addition, a few early providers have allegedly devised enrollment campaigns which made access to enrollment sites difficult for frail or handicaped elderly. It is clearly in the interest of HMOs to promote health and prevent disease among their members; whether medications become an important facet of their strategy remains to be seen. There is some evidence that annual prescriptions per person is approximately unchanged in older subscribers but declines among younger subscribers following enrollment in prepaid health plans.[138]

4. PHARMACY SERVICES. Interest in mail-order prescription services has increased in recent years. Although its advantages and disadvantages have been debated in hearings and editorials, rigorous evaluation of the risks and benefits is lacking. Costs, counseling, error rates, convenience and access are the usual issues addressed. Proponents cite advantages that include savings due to an economy of scale, better ability to monitor therapy because of less "switching" between pharmacies, and convenience for less mobile patients.[139] Detractors claim higher error rates, less personal counseling,[140] and even higher costs. In 1985 an Arizona based study reported that a 4% savings in unit costs was offset by a 9% higher utilization by mail-order users.[141] It reported that changes in therapy for older users brought about more frequent ordering and increased wastage.

Labeling and packaging of prescriptions for older patients ought to take into account the possibility of visual impairments and confusion about products of similar size and color.[142] Many pharmacists use special services and "senior discounts" to attract the older patients. If such programs succeed in establishing client loyalty, the opportunity for regular counseling and ADR monitoring should benefit the older patient.

"Brown Bag" projects are programs in which elderly are encouraged to bring medications to a convenient location for review and counseling. Their focus is the ambulatory older population, and their purpose is to detect potential medication problems and correct those that need attention. One program has reported approximately 88% of participants need reinforcement, clarification, education, or health provider follow-up.[143]

5. FRAUD. The elderly seem to be less suspicious of medications that do not produce their promoted or expected results.[144] Among 172 older respondents (age 60 or older) to a 1984 survey, one-half reported purchasing a health product that did not work and just over one-half of those (53%) suspected it to be quack medicine. While appropriate cautions regarding interpretation were stated, the authors pointed out that the elderly are particularly vulnerable to fraud and the consequences of quackery because they are more likely to suffer from conditions for which many quack medications are promoted.

6. ADVERTISING. The claims that OTC as well as prescription drugs portray, either directly or indirectly, to the elderly are an area of continuing concern. Surveillance of the prescription drug claims relating to the elderly that are made directly to consumers or through health practitioners, will continue to share an area of high interest and surveillance by FDA.

E. Developing Technologies. New technologies in information management, drug products, and health service delivery bode well for improvements in drug therapy for the elderly. As computerized expert diagnostic systems become more user-friendly, the power of knowledge previously available only through years of experience should make extensive information available to all that care for elderly patients.[145] Public awareness of the special needs of older

citizens has served to stimulate the application of new technologies in areas which benefit the elderly.

In the future, advances in technology are expected to result in the development of new dosage forms and new drug entities that will be more convenient for older patients as well as more specific and efficacious in their pharmacologic effects.[146,147] A number of novel drug delivery systems are currently being developed.[146] For example, transdermal delivery systems can extend a drug's duration of effect, and therefore should assist in improving compliance. Biotechnology advances are also expected to result in the development of numerous new therapeutic entities.[147,148] A number of pharmaceutical firms are currently working to develop new drugs that might reverse congnitive losses in Alzheimer patients.[149]

Geriatric assessment units have been referred to as examples of "new technologies" in health services, and have grown in number and scope since 1979.[150] A 1985 survey of 104 units found that nearly half had begun operation during the previous two years, and two-thirds of the others increased their capacity during that time. Most (approx. 60%) are outpatient units, and 27% of those reported "improvement in drug regimens" to be either their 1st or 2nd most important effect.

F. Successful Interventions and Programs. Drug related problems in the elderly do not usually occur in isolation. The several successful interventions reviewed here gave emphasis to a particular outcome (e.g., compliance, polypharmacy, adverse drug reactions, cost savings), but in most instances the intervention required multidisciplinary effort and cooperation, and effected more than one area of need.

COMPLIANCE / The success of drug-related health promotion patient interventions depends on relevance, individualization, feedback, reinforcement, and facilitation.[151] Ten strategies for reducing drug errors in the elderly were reviewed by Green et al. in 1986.[152] These investigators found facilitation to be the most common technique, with no more than half incorporating relevancy or individualizing intervention, and even fewer using feedback or reinforcement. They concluded that interventions combining interpersonal communication methods, visual materials and memory-aids had been shown to be effective means of reducing drug errors as well as related clinical symptoms in the elderly. Several of these studies compared the effectiveness of different strategies on medication compliance and errors. MacDonald, et al., found no significant difference between medication counseling and counseling with a medication calendar. Both strategies significantly improved compliance in comparison to controls.[153] Color-coded weekly medication packaging significantly reduced medication errors when compared to color-coded conventionally dispensed medications, medication counseling, and no intervention.[154] Another study compared verbal medication counseling alone and in combination with either written information, a medication calendar, or a seven day medication package.[155] Attitudes, knowledge, and compliance in an elderly ambulatory population were assessed. Drug knowledge was most favorable effected by verbal instruction alone or combined with a medication calendar. In contrast, patient reported compliance was improved only by the combined intervention of verbal medication counseling and use of a seven day medication package. In general, patients felt the interventions were useful with the notable exception of the medication calendar.[155]

EDUCATION FOR PRESCRIBING / There is some evidence that physician peer education can have positive impact on prescribing in general. Studies by Ray and Schaffner have shown that the prescribing of antibiotics and diazepam improves after receiving education visits from a physician.[156,157,158] Also, pharmacist provided drug information can favorably impact on the prescribing of specific drugs or therapeutic classes of drugs.[159,160,161] Avorn found improvement in the prescribing of cerebral and peripheral vasodilators, oral cephalosporins and propoxyphene after education visits by a clinical pharmacist. The program, involving 400 physicians, resulted in a 14% reduction in utilization.[159] Hanlon, et al., found the prescribing of the above mentioned medications and the number of medications prescribed per patient to be lower than national prescribing data in a family medicine residency program with an active clinical pharmacy program.[160] Finally, a controlled study showed that global prescribing practices were favorably impacted by continuing education provided by clinical pharmacists and pharmacologists.[161]

ADR REDUCTION and SAVINGS / Interventions by clinical pharmacists as consultants in long-term care facilities (LTCF's) have been documented as being effective. One study of feedback from the LTCF clinical pharmacist consultant reduced the incidence of medication errors, the number of inappropriate or unnecessary drugs, and the incidence of adverse drug reactions, thereby reducing medication and hospitalization costs.[133] In a long-term study evaluating the initiation, termination, and reinstitution of a consultant clinical pharmacist, it was found that there was lower drug-use, admission, discharge, and death rates during the time the consultant was with the facility.[162] A recent paper examining the cost-benefit ratio of pharmacist-conducted drug-regimen review in LTCF's estimated a net savings of $220 million nationwide.[163]

Another study monitored adverse reactions in 2,771 randomly chosen hospitalized patients during 1969-1976. Medications as well as indications for starting and stopping therapy were tabulated, and records for the 1969-72 period were compared with those for the 1973-76 period. An active surveillance and ADR reporting program during the second period resulted in a 61% reduction in the number of patients affected by reactions to drug therapy; with the greatest reductions in the two age bands over 70 years of age (69% and 89%).[164]

A novel study evaluating the pharmacist as a prescriber of drugs to previously diagnosed LTCF patients, found them to be more effective than physicians in terms of number of drugs prescribed, lower number of deaths, and increased number of patients discharged to lower levels of care.[165] The significance of this study may not be the role of the pharmacist as an independent mid-level practitioner but extrapolating this information to include the pharmacist as an integral part of a multidisciplinary team.

MULTIDISCIPLINARY COOPERATION / Nursing initiative at one teaching nursing home has targeted reduction in cathartic drug use as a priority.[166] In nursing homes conflicting schedules limit opportunities for personal contact and direct dialogue among professionals. Although drug regimen reviews conducted by nursing personnel in Iowa intermediate care facilities have identified a variety of problems, widely variable physician responsiveness to reports and recommendations has been reported.[167] In Georgia Longe et al. found that written recommendations of consultant pharmacists in skilled nursing facilities were usually effective, with 72% of drug-dosage recommendations and 80% of laboratory test recommendations being accepted.[168] In North Carolina an interdisciplinary team review approach to drug therapy recommendations resulted in a reduction in the number of medications at one long-term care facility.[169]

V. Priorities and Recommended Programs to Address Areas of Concern

THE AGING PROCESS and DRUG DEVELOPMENT / Basic research into the aging process and the diseases of aging is needed. Distinction between aging processes and disease processes is not possible in many instances.[170] Investigation into the physiology of aging will contribute to needed understanding of pharmacodynamic changes and guide drug development specifically beneficial to older patients. Health promotion and disease prevention initiatives should benefit from this basic research and, perhaps lead to the development of products that will enhance the quality of life in later years.

DRUG TESTING / In the past, there have been few carefully carried out geriatric clinical drug trials that investigated the pharmacokinetics and pharmacodynamics of drugs in older patient samples.[171] However, in recent years there has been a steady increase in information about these areas of interest.[172] FDA labeling guidelines were revised in 1979. These guidelines directed that prescription drug labeling feature special age group indications or precautions.[173] It is now common for FDA new drug applications to include analyses relating age with drug responses.[174] Evidently Phase III clinical trials are now less likely to have excluded subjects on the basis of advanced age. At FDA, Dr. Temple expects to have a formal drug testing proposal in place in 1987.[174] Although there are some disagreements about the specifics of the proposal,[175] a number of professional groups are encouraged by the FDA's requiring the inclusion of formal testing of new drugs in the elderly and improved labeling of such information. Once a drug testing regulation is approved, the clear need will be for more studies of currently marketed drugs (Phase IV) in older patients.

Clinical drug trials in which subjects are stratified on age and factors known to alter drug disposition are controlled. These studies are needed in order to identify agents for which pharmacokinetic changes are truly age-dependent. This approach to testing would provide elderly patients with maximum benefit at minimum risk and allow companies developing new drugs to inform prescribers of true factors effecting dose.

POST-MARKETING DRUG SURVEILLANCE / The field of pharmacoepidemiology, or the study of drug use and drug effects using specific epidemiological methods has emerged in recent years.[176] Interest in post-marketing surveillance (PMS) of drugs and their effects is evident in several sectors, including the government, the pharmaceutical industry, and third party payors.[177] Investigations carried out once a new product has been marketed (Phase IV studies) can include careful assessment of spontaneous reports, additional clinical trials, cohort monitoring, and case control studies.[178] Two primary objectives of PMS are an assessment of efficacy and toxicity under conditions of actual clinical use, and an evaluation of the relative impact on approved indications.[179]

There are a number of data-bases which investigators utilize to study drug use, some of which were previously mentioned in this paper. Recently, there has been great interest regarding the effects of non-steroidal antiinflammatory drug since they are so widely used in the elderly; several studies utilizing the Medicaid Drug Event (Compass) Data Project,[180] The Boston Collaborative Drug Surveillance Program,[181] The American Rheumatism Association Medical Information System (Aramis),[182] and the FDA data-base have been published.[183]

In view of the evidence that older patients are at higher risk of adverse drug reactions and may exhibit atypical response to therapy, PMS in populations 65 years of age and older seems particularly advisable. Presently there are limitations due to the inherent nature of the data-bases themselves,[184] and the lack of a comprehensive national system.[185] There are, however, encouraging signs that the field of pharmacoepidemiology will continue to emerge and play an important role in knowledge of drugs and the elderly.[186,187]

LACK OF TRAINED PROFESSIONALS / Specialized knowledge of clinically important pharmacokinetic and pharmacodynamic changes that often accompany the aging process are needed for prescribing for the elderly.[188,189] It has been persuasively argued that many problems associated with prescribing can be avoided,[69,78] and yet about half the physicians delivering care in geriatric assessment units have no special training in care of the elderly.[150] Specialty training programs in gerontology and geriatrics offer one approach to imparting the specialized knowledge needed to avoid such problems. Unfortunately projections of population growth, particularly in the numbers of frail "old-old", strongly support the contention that requirements for geriatric specialists over the next decade will not be met.[190,191,192,193] At present there are 66 geriatric medicine programs and 27 geropsychiatry programs in the U.S.[192] A new fellowship program to train 4-6 physicians in geriatric clinical pharmacology will begin in 1988.[194] At a broader and more basic level, medical schools are providing only minimal training of geriatrics.[191]

Federal law mandates that a pharmacist review the drug regimens of all LTCF patients. This regulation has resulted in decreased exposure to unnecessary drugs and an associated decline in the cost of drugs in nursing homes. In addition adverse drug reactions and subsequent hospitalizations have also declined.[163] Although this role is established, there are only three accredited pharmacy residencies in geriatrics, and ten funded geriatric pharmacy fellowships in the U.S.[195,196] A 1985 survey of U.S. Schools of Pharmacy found that 40 schools planned to incorporate an AACP developed text on geriatrics in their coursework.[197] At least 10 schools indicated plans to offer geriatrics courses not previously available. The Geriatric Education Centers (GEC) Program has also stimulated expanded training in geriatric drug therapy.[198]

Whether responsibility for drug therapy management of elderly patients should be a shared or independent exercised, there is agreement that neither medicine[199] nor pharmacy[196,198,200] will provide an adequate number of specialized practitioners in the near future. Interdisciplinary training programs designed to enhance cooperative relationships between physicians, pharmacists and nurse-specialists should shorten the period during which the elderly can anticipate the shortage of geriatric drug specialists.

REIMBURSEMENT FOR SERVICES / Among issues usually associated with Medicare reimbursement, medication for the elderly is not typically considered. However, the opportunity (or risk) to receive medications begins with access to the prescriber and so reimbursement policy that effects access will probably effect drug utilization patterns as well. The American College of Physicians has recently published a position paper on alternative payment approaches for Medicare in which it suggests that inequities in the present reimbursement system "induce physicians to provide technologic and procedural services as opposed to cognitive and interpersonal services such as history taking, preventive health care, or patient education and counseling."[201]

FINANCING / An immediate assessment of the probable financial consequences of ambulatory drug coverage under Medicare is needed. The potential impact of such coverage on prescribing, pharmacy services, and self-care practices has not been studied.[126]

VI. Summary

Drug therapy represents an important approach to promoting health in the elderly. Rational and judicious use of medications can enhance the quality of life for older patients with chronic diseases. Wide variations in body compositon and organ system function exist among older persons. Consequently the clinical management of individual elderly patients demands caution and an appreciation of the possible variations in drug response. Respect for these nuances in drug response are essential to rational prescribing for the elderly.

It appears that drug usage in the elderly is considerable in terms of medications taken and associated expenses. There are also patterns of medication use which, while easily understood, suggest the need for greater prescribing forethought in subsets of the 65 and older population. For instance, increased prescribing for and general use of medication among older women; an increase in the number of medications with advancing age continues into the ninth decade of life; and more medications ordered in settings where higher levels of care is provided.

Changes in pharmacokinetics and pharmacodynamics can contribute to adverse drug reactions in the elderly. Polypharmacy (a major reason for drug interactions) and non-compliance (particularly excessive dosing) can also contribute to the incidence of ADRs. It is often difficult to predict the specific cause making advisable the use of lower initial doses with careful dose escalation titrated to therapeutic response.

As new drugs designed specifically for geriatric needs are developed, as additional training programs are funded, as new technology raises health costs in general, and as the number of elderly over 75 increases, the questions of "Who pays?" and "How much?" take on even more challenging dimensions. The issues to be faced in providing affordable, safe, and effective medications for older people in the U.S. are plentiful today, but will surely be even more numerous beyond the year 2000. 1988 is not too soon to begin to address them.

VII. REFERENCES:

1. Hazzard WR. Preventive Gerontology: Strategies for Healthy Aging. Postgrad Med 1983;74:279-287.
2. Rowe JW and Kahn RL. Human Aging: Usual and Successful. Science 1987;237:143-149.
3. U.S. Department of Commerce, Bureau of Census, Projections of the Population of the United States: 1982-2050 (Advance Report). Current Population Reports, Series P-25, No. 922, October 1982. Projections are middle series.
4. Siegal JS and Taeuber CM. Demographic Perspectives of the Long-lived Society. Daedalus 1986;115:72-117.
5. N.C.H.S., Koch H and Knapp DE. Highlights of Drug Utilization in Office Practice, National Ambulatory Medical Care Survey, 1985. Advance Data From Vital and Health Statistics, No.134. DHHS Pub.No.(PHS)87-1250. Public Health Service, Hyattsville, MD., May 19, 1987.
6. N.C.H.S., Hing E. Use of Nursing Homes by the Elderly. Preliminary Data from the 1985 National Nursing Home Survey. Advance Data From Vital and Health Statistics. No.135. DHHS Pub.No.(PHS) 87-1250. Public Health Service, Hyattsville, MD., May 14, 1987.
7. N.C.H.S. 1986 Summary: National Hospital Discharge Survey. Advance Data From Vital and Health Statistics. No.145. DHHS Pub.No.(PHS) 87-1250. Public Health Service, Hyattsville, MD., Sept.30, 1987.
8. Irelan LM, Motley DK, Schwab K, et al. Almost 65: Baseline from the Retirement History Study. DHEW Social Security Admin., Office of Research & Statistics. Research Report No.49, HEW Publ.No. (SSA)76-11806, 1976, pp.7-34.
9. Gruenberg EM. Patterns of Disease Among the Aged. NIA Science Writer Seminar Series, DHEW, NIH Publ.No. (PHS) 79-1407, revised July, 1979.
10. Davidson SM and Marmor TR. The Cost of Living Longer. Lexington, MA: D.C. Heath and Co., 1980, pp.1-9.
11. Brody JA and Schneider EL. Diseases and Disorders of Aging: An Hypothesis. J Chronic Dis 1986;11:871-876
12. Williams ME. Clinical Implications of Aging Physiology. Am J Med 1984;76:1049-1054.

13. Rowe JW. Health Care of the Elderly. N Engl J Med 1985;312:827-835.
14. Greenblatt DJ, Sellers DM and Shader RI. Drug Disposition in Old Age. N Engl J Med 1982;306(18):1081-1088.
15. Rock RC. Monitoring therapeutic drug levels in older patients. Geriatrics 1985;40(6):75-86.
16. Evans MA, et.al. Gastric Emptying Rate in the Elderly: Implications for Drug Therapy. J Am Geriatr Soc 1981;29:201-205.
17. Recker RR. Calcium Absorption and Achlorhydria. N Engl J Med 1985;313:70-73.
18. Johnson SL, et al. Gastrointestinal Absorption as a Function of Age: Xylose Absorption in Health Adults. Clin Pharmacol Ther 1985;38:331-335.
19. Mayersohn M. Special Pharmacokinetic Considerations in the Elderly. In: Applied Pharmacokinetics, Evans WE et al. eds. Spokane, WA: Applied Therapeutics 1986;pp.229-293.
20. Pucino F, Beck CL, Seifert RL, et al. Pharmacogeriatrics. Pharmacotherapy 1985;5:314-326.
21. Wallace SM and Verbeeck RK. Plasma Protein Binding of Drugs in the Elderly. Clin Pharmacokin 1987;12:41-72.
22. James OFW. Drugs and the Ageing Liver. J Hepatology 1985;1:431-435.
23. Cockcroft DW and Gault MH. Prediction of Creatinine Clearance from Serum Creatinine. Nephron 1976;16:31-42.
24. Bennett WM, et al. Drug Prescribing in Renal Failure: Dosing Guidelines for Adults. Amer J Kid Dis 1983;3:155-193.
25. O'Malley K, Kelly JG, Swift CG. Responsiveness to Drugs. In: Clinical Pharmacology in the Elderly. CG Swift (ed) New York: Marcel Dekker, 1987 p. 83-101.
26. Hanlon JT, O'Brien JG. Pharmacological Management of the Elderly Patient with Terminal Cancer Pain. [in press] J Geriatr Drug Ther
27. Kaiko RF, Wallenstein SL, Rogers AG, et al. Narcotics in the Elderly. Med Clin North Am 1982;66:1079-1089.
28. Kaiko RF. Age and Morphine Analgesia in Cancer Patients with Postoperative Pain. Clin Pharmacol Ther 1980;28:832-826.
29. Bellville JW, Forrest WH, Miller E, et al. Influence of Age on Pain Relief from Analgesics. JAMA 1971;217:1835-1841.
30. Vestal RE, Wood AJJ, Shand DG. Reduced Beta-Adrenoceptor Sensitivity in the Elderly. Clin Pharmacol Ther 1979;26:181-186.
31. Baum C, Kennedy DL, Forbes MB, et al. Drug Use in the United States in 1981. JAMA 1984;251:1293-1297.
32. Baum C, Kennedy DL, Forbes MB, et al. Drug Use and Expenditures in 1982. JAMA 1985;253:382-386.
33. Baum C, Kennedy DL, and Forbes MB. "Drug Utilization in the Geriatric Age Group." in Geriatric Drug Use -- Clinical and Social Perspectives, Pergamon Press, New York, 1985, pp.63-69.
34. Helling DK, Lemke LH, Semla TP, et al. Medication Use Characteristics in the Elderly: The Iowa 65+ Rural Health Study. J Am Geriatr Soc 1987;35:4-12.
35. May FE, Stewart RB, Hale WE, et al. Prescribed and Nonprescribed Drug Use in an Ambulatory Elderly Population. South Med J 1982;75:522-528.
36. Hale WE, May FE, Marks RG, et al. Drug Use in an Ambulatory Elderly Population: A Five-Year Update. Drug Intell Clin Pharm 1987;21:530-535.
37. Anon.(IMS America, Ltd.) NDTI Drug Data for 65 Plus Patients - 1986 [in press] J Geriatr Drug Therapy.
38. Benson JW. Drug Utilization Patterns in Geriatric Drugs in the U.S. - 1986. [in press] J Geriatr Drug Therapy.
39. Dept.HEW. Physicians Drug Prescribing Patterns in Nursing Homes. Washington, D.C., 1976.
40. Leach S and Roy SS. Adverse Drug Reactions: An Investigation on an Acute Geriatric Ward. Age Aging 1986;15:241-246.
41. Reynolds MD. Institutional Prescribing for the Elderly: Patterns of Prescribing in a Municipal Hospital and a Municipal Nursing Home. J Am Geriatr Soc 1984;32:640-645.
42. Kannel WB and Gordon T. Cardiovascular Risk Factors in the Aged: The Framingham Study. In: Haynes SG and Feinleib M, eds. Proceedings of the Second Conference on the Epidemiology of Aging. Washington, D.C.: DHHS Public Health Service, 1980. NIH Pub.No.80-969. p.82.
43. V.A. Cooperative Study Group. Effects of Treatment on Morbidity in Hypertension. Circulation 1972;XLV:991-1004.
44. Hypertension Detection and Follow-up Program Cooperative Group. Five-Year Findings of the Hypertension Detection and Follow-up Program. JAMA 1979;242:2572-2561.
45. Amery A, Brixko P, Clement D, et al. Mortality and Morbidity Results from the European Working Party on High Blood Pressure in the Elderly Trial. Lancet 1985;1:1349-13..
46. Patriarca PA, et al. Efficacy of Influenza Vaccine in Nursing Homes. JAMA 1985;253:1136-1139.
47. Riddiough MA, et al. Influenza Vaccination: Cost-effectiveness and Public Policy. JAMA 1983;249:3189-3195.
48. Setia U, Serventi I and Lorenz P. Factors Affecting the Use of Influenza Vaccine in the Institutionalized Elderly. J Am Geriatr Soc 1985;33:856-858.
49. Hui SL, et al. A Prospective Study of Change in Bone Mass with Age in Postmenopausal Women. J Chron Dis 1982;35:715-725.
50. N.I.H. Consensus Development Panel (NIADDK). Osteoporosis. JAMA 1984;252(6):799-802.
51. Riggs BL and Melton LJ. Involutional Osteoporosis. N Engl J Med 1986;314:1676-1684
52. Ettinger B, Genant HK and Cann CE. Postmenopausal Bone Loss is Prevented by Treatment with Low-dosage Estrogen with Calcium. Ann Intern Med 1987;106:40-45.
53. Young RL and Goldzieher JW. Current Status of Postmenopausal Oestrogen Therapy. Drugs 1987;33:95-106.
54. Stevenson JC, Townsend PT, Young O, et al. Calcitonin and the Calcium-regulating Hormones in Postmenopausal Women: Effect of Oestrogens. Lancet 1981;1(8222):693-695.
55. Van Heyningen R and Harding JJ. Do Aspirin-Like Analgesics Protect Against Cataract? Lancet 1986;1:1111-1113.
56. Pulliam CC and Stewart RB. Adverse Drug Reactions in the Elderly. In: Pharmacy for the Geriatric Patient. Carrboro, NC: Health Sciences Consortium, 1985. pp.11/6-11/7.
57. Jick H, et al. Efficacy and Toxicity of Heparin in Relation to Age and Sex. N Engl J Med 1968;279:284-289.
58. Greenblatt DJ, Allen MD and Schader RI. Toxicity of High Dose Flurazepam In the Elderly. Clin Pharmacol Ther 1977;21:355-61.
59. Moore SR and Jones JK. "Adverse Drug Reaction Surveillance in the Geriatric Population: A Preliminary View." in Geriatric Drug Use -- Clinical and Social Perspectives, Pergamon Press, New York, 1985,pp.70-77.
60. Tanner A, et al. Geriatric ADR Reports - FDA 1986. [in press] J Geriatr Drug Therapy.
61. Lakshmanan MC, et al. Hospital Admissions Caused by Iatrogenic Disease. Arch Intern Med 1986;146:1931-1934.
62. Ives TJ, et al. Drug-Related Admissions to a Family Medicine Inpatient Service. Arch Intern Med 1987;14:1117-1120.
63. Jahnigen D, et al. Iatrogenic Disease in Hospitalized Elderly Veterans. J Am Geriatr Soc 1982:30(6):387-390.

64. Becker PM, McVey LJ, Saltz CC, et al. Hospital-acquired Complications In a Randomized Controlled Clinical Trial of a Geriatric Consultation Team. JAMA 1987;257:2313-2317.
65. Levy M, Kewitz H, Altwein W, et al. Hospital Admissions Due to Adverse Drug Reactions: A Comparative Study from Jerusalem and Berlin. Eur J Clin Pharmacol 1980;17:25-31.
66. Ray WA, et al. Psychotropic Drug Use and the Risk of Hip Fracture. N Engl J Med 1987;316:363-369.
67. Beard K, Walker AM, Perera DR, et al. Nonsteroidal Anti-inflammatory Drugs and Hospitalization for Gastroesophageal Bleeding in the Elderly. Arch Intern Med 1987;147:1621-1623.
68. Burnum JF. Preventability of Adverse Drug Reactions. Ann Intern Med 1976;85:80-81.
69. Melmon KL. Preventable Drug Reactions: Causes and Cures. N Engl J Med 1971;284:1361-1368.
70. Klein LE, German PS, Levine DM. Adverse Drug Reactions Among the Elderly: A Reassessment. J Am Geriatr Soc 1981;29:525-530.
71. Williamson J and Chopin JM. Adverse Drug Reactions to Prescribed Drugs in the Elderly: A Multicentre Investigation. Age and Aging 1980;9:73-80.
72. Larson EB, Kukull WA, Buchner D, et al. Adverse Drug Reactions Associated with Global Cognitive Impairment in Elderly Patients. Ann Intern Med 1987;107:169-173.
73. Kroenke K. Polypharmacy: Causes, Consequences, and Cure. Am J Med 1985;79:149-152.
74. Darnell JC, et al. Medication Use by Ambulatory Elderly: An In-Home Survey. J Am Geriatr Soc 1986;34:1-4.
75. Greenblatt DJ, Divoll M, Harmatz JS et al. Kinetics and Clinical Effects of Flurazepam in Young and Elderly Non-insomniacs. Clin Pharmacol Ther 1981;30:475-486.
76. Castleden CM, George CF, Marcer D et al. Increased Sensitivity to Nitrazepam in Old Age. Br Med J 1977;1:10-12.
77. Swift CG, Ewen JM, Clarke P, et al. Responsiveness to Oral Diazepam in the Elderly: Relationship to Total and Free Plasma Concentrations. Br J Clin Pharmacol 1985;20:111-118.
78. Gosney M and Tallis R. Prescription of Contraindicated and Interacting Drugs in Elderly Patients Admitted to Hospital. Lancet 1984;2:564-568.
79. Cooper JW, Welling I, Fish KH, et al. Frequency of Drug-Drug Interactions. JAPhA 1975;15:24-31.
80. Armstrong WA, Priever CW, Hays RL. Analysis of Drug-Drug Interactions in a Geriatric Population. Amer J Hosp Pharm 1980;37:385-387.
81. Adams KRH, et al. Inappropriate Prescribing in the Elderly. J Roy Coll Phys (London) 1987;21:39-41.
82. Feely J, Pereira L, Guy E, et al. Factors Affecting the Response to Inhibition of Drug Metabolism by Cimetidine-dose Response and Sensitivity of Elderly and Induced Subjects. Br J Clin Pharmacol 1984;17:77-81.
83. Yamanaka-Yuen NA. Ethanol and Drug Interactions. Drug Interact Newsletter 1985;5:45-48.
84. Lamy PP. The Elderly and Drug Interactions. J Am Geriatr Soc 1986;34:586-92.
85. Hathcock JN. Nutrient-Drug Interactions. Clin Geriatr Med 1987;3:297-307.
86. Gossel TA. Fecal Occult Blood Testing Kits. US Pharm 1984;(Feb):10-16.
87. Bearden WO, Mason JB and Smith EM. Perceived Risk and Elderly Perceptions of Generic Drug Prescribing. Gerontologist 1979;19:191-195.
88. Mertz B and Stephens N. Marketing to Older American Consumers. Intl J Aging and Hum Devel 1986;23:47-58.
89. AARP. Prescription drugs: A Survey of Consumer Use, Attitudes and Behavior. Washington, DC. 1984. p.49.
90. Strom BL. Generic Drug Substitution Revisited. N Engl J Med 1987;316:1456-1462.
91. Brown J. Prescription Drug Costs for Older Americans. Issue Brief. Washington, D.C.: AARP Public Policy Institute, March, 1987. pp.1-6.
92. Bloom BS, et al. Cost and Price of Comparable Branded and Generic Pharmaceuticals. JAMA 1986;256:2523-2530.
93. Lasagna L. The Economics of Generic Prescribing: Winners and Losers. JAMA 1986;256:2566.
94. Morgan JP, Schwartz LL, Sherman FT. A Survey of Generic Drug Legislation and Geriatric Pharmacotherapy: Opinions of Those Who Generate the Literature. J Am Geriatr Soc 1983;31:535-539.
95. Lamy PP. What Should We Know About Generics. Geriatric Medicine Today. 1986;5:25-27.
96. Faich GA, Morrison J, Dutra EV, et al. Reassurrance About Generic Drugs. N Engl J Med 1987;316:1473-1475.
97. Straus R. "Risk Factors in Geriatric Drug Use: Behavioral Issues." in: Moore SR, Teal TW eds., Geriatric Drug Use -- Clinical and Social Perspectives. Pergamon Press, New York, 1985,pp.160-167.
98. Schwartz D, Wang M, Zeitz L, et al. Medication Errors Made by the Elderly, Chronically Ill Patients. Am J Public Health 1962;52:2018-2029.
99. Stewart RB and Cluff LE. A Review of Medication Errors and Compliance in Ambulant Patients. Clin Pharmacol Ther 1972;13:463-468.
100. Smith DL. Patient Compliance with Medication Regimens. Drug Intell Clin Pharm 196;10:386-393.
101. Atkinson L, Gibson II and Andrews J. The Difficulties of Old People Taking Drugs. Age and Aging 1977;6:144-150.
102. Blackwell B. The Drug Defaulter. Clin Pharmaco Ther 1972;13:811-823.
103. Hood JC and Murphy JE. Patient Noncompliance Can Lead to Hospital Readmissions. Hospitals 1978;52:79-84.
104. Haynes RB. Strategies for Improving Compliance. In: Compliance with Therapeutic Regimens. Sackett DL and Haynes RB, eds. Baltimore: Johns Hopkins, 1976, pp.69-82.
105. German PS, Klein LE, McPhee SJ, et al. Knowledge Of and Compliance With Drug Regimens in the Elderly. J Am Geriatr Soc 1982;30:568-571.
106. Haug MR and Ory MG. Issues in Elderly Patient-Provider Interactions. Rsch on Aging 1987;9:3-44
107. German PS and Klein LE. Drug Side Effects and Doctor/Patient Relationship Among Elderly Patients. J Social and Admin Pharm 1984;2:67-73.
108. Roth HP and Caron HS. Accuracy of Doctors' Estimates and Patients' Statements on Adherence to a Drug Regimen. Clin Pharmacol Ther 1978;23:361-370.
109. Ory MG. Social and Behavioral Aspects of Drug Taking Regimens Among Older Persons. [in press] J Geriatr Drug Therapy.
110. Becker MH and Maiman LA. Sociobehavioral Determinants of Compliance with Health and Medical Care Recommendations. Medical Care 1975;13:10-21.
111. Eraker SA, Kirscht JP and Becker MH. Understanding and Improving Patient Compliance. Ann Intern Med 1984;100:258-268.
112. Blackwell B. Drug Therapy: Patient Compliance. N Engl J Med 1973;289:249-252.
113. Irelan LM, Motley DK, Schwab K, et al. Almost 65: Baseline from the Retirement History Study. DHEW Social Security Admin., Office of Research & Statistics. Research Report No.49, HEW Publ.No. (SSA)76-11806, 1976, pp.7-34.

114. Fletcher SW, Fletcher RH, Thomas DC, et al. Patients' Understanding of Prescribed Drugs. J Community Health 1979;4:183-189.
115. Dirckx JH. Labels for prescribed drugs (letter). JAMA 1979;242:413-414.
116. Richardson JL. Perspectives on Compliance with Drug Regimens Among the Elderly. J Compliance Health Care 1986;1:33-43.
117. Bootman JL. Maximising Compliance in the Elderly. In: Pharmacy Practice for the Geriatric Patient. Carrboro, NC: Health Sciences Consortium, 1985. pp.14/8-14/12.
118. Cooper JK, Love DW, Raffoul PR. International Prescription Nonadherence (Noncompliance) by the Elderly. J Am Geriatr Soc 1982;30:329-333.
119. Weintraub M. A Different View of Patient Compliance in the Elderly. In: Vestal RE ed. Drug Treatment in the Elderly. ADIS; Sydney, 1984.
120. Heller TA, et al. Quality of Ambulatory Care of the Elderly: An Analysis of Five Conditions. J Am Geriatr Soc 1984;32:782-788.
121. Keeler EB, et al. Effect of Patient Age on Duration of Medical Encounters with Physicians. Med Care 1982;20:1101-1108
122. Koop CE. Exploring the Myths and Realities of Aging and Health. Aging 1984;(Apr-May):5-9.
123. Wetle T. Age as a Risk Factor for Inadequate Treatment. JAMA 1987;258:516
124. U.S. Department of Commerce, Money Income and Poverty Status of Families and Persons in the U.S.: 1986. (Advance Report). Current Population Reports, Series P-60, No.157
125. Anon. Some Facts About Drug-cost Burden on the Elderly from HCFA. PMA Newsletter 1985;(Jan.21):3-4.
126. OTA Project Staff (Solan G, et al.) Prescription Drugs and Elderly Americans: Ambulatory Use and Approaches to Coverage for Medicare. Health Program, Office of Technology Assessment, U.S. Congress. October, 1987.
127. Iglehart JK. Second Thoughts About HMO's for Medicare Patients. N Engl J Med 1987;316:1487-1492.
128. N.C.H.S., Ries P. Health Care Coverage by Age, Sex, Race, and Family Income: United States, 1986. Advance Data From Vital and Health Statistics, No.139. DHHS Pub.No.(PHS)87-1250. Public Health Service, Hyattsville, MD., Sept.18,1987.
129. Soumerai SB, et al. Payment Restrictions for Prescription Drugs Under Medicaid. N Engl J Med 1987;317:550-556.
130. Relman AS. Doctors and The Dispensing of Drugs. N Engl J Med 1987;317:311-312.
131. Anon. Physician Dispensing Update. NARD Journal 1987;(Aug.):46.
132. Intergovernmental Health Policy Project. Major Changes in State Medicaid and Indigent Care Programs. The George Washington University. July, 1985.
133. Cheung A, Kayne R. An Application of Clinical Pharmacy Services in Extended Care Facilities. Calif Pharm 1975;23:22-8.
134. Sager MA, Leventhal EA and Easterling DV. The Impact of Medicare's Prospective Payment System on Wisconsin Nursing Homes. JAMA 1987;257:1762-1766.
135. Hogan GH and Abernathy GB. Effect of Catastrophic Health-Care Legislation on Hospital Pharmacy Services. Am J Hosp Pharm 1987;44:2232,2234.
136. Peck RL. Medicare-supported HMOs: Should Physjcians Give Up on the Frail Elderly? Geriatrics 1987;42:95-96,98.
137. Gillick MR. The Impact of Health Maintenance Organizations on Geriatric Care. Ann Intern Med 1987;106:139-143.
138. Rabin DL, Bush PJ and Fuller NA. Drug Prescription Rates Before and After Enrollment of a Medicaid Population in an HMO. Publ Health Rep 1978;93:16-23
139. Konnor DD. Competitive Economics Promote Cost Consciousness. Presented at the Symposium on "The Changing Economics of Healthcare: Impact on Pharmacy in the 90's and Beyond." Orlando, FL, November 16, 1986.
140. Dickinson J. What Do Mail-Order Rxs Really Mean for Pharmacy. US Pharm 1987;(Oct):32,34,100.
141. Anon. Mail Order Rx Costs Are 5% Higher Than Conventional Drug Plans. The Green Sheet. F-D-C Reports, Inc., Chevy Chase, Md., September 29, 1986.
142. Waldinger CW. Drug Dispensing for the Elderly [letter]. N Engl J Med 1987;316:695.
143. Taubman AH, Truncellito M and Mattea EJ. The Brown Bag Rx Project: How It Helps Community RPhs to Provide Counseling Services. Pharm Times 1986;(Feb):73-76.
144. Morris LA and Klimberg R. A survey of the elderly's view and experiences regarding quack medicines. [in press] J Geriatr Drug Therapy.
145. Torasso P. Knowledge Based Expert Systems for Medical Diagnosis. Stat Med 1985;4:317-325.
146. Block LH and Shukla AJ. Drug Delivery in the 1990's. US Pharm 1986;11:51-58.
147. Peck JC. Future Directions in Geriatric Drug Activities. [in press] J Geriatr Drug Ther.
148. Saks DF. Todays Trends to Spur Drug Industry Growth. US Pharm 1986;11:12-22.
149. Katzman R. Alzheimers disease. N Engl J Med 1986;314:364-373.
150. Epstein AM, Hall JA, Besdine R, et al. The Emergence of Geriatric Assessment Units: The "New Technology of Geriatrics" Ann Intern Med 1987;106:299-303.
151. Mullen PD and Green LW. Measuring Patient Drug Information Transfer: An Assessment of the Literature. Washington, D.C., Pharmaceutical Manufacturers Association, 1984.
152. Green LW, Mullen PD and Stainbrook GL. Programs to Reduce Drug Errors in the Elderly: Direct and Indirect Evidence From Patient Education. J Geriatr Drug Therapy 1986;1:3-18.
153. MacDonald ET, MacDonald JB, Pheonix M. Improving Compliance After Hospital Discharge. Br Med J 1977;2:618-621.
154. Martin PC and Mead K. Reducing Medication Errors in a Geriatric Population. J Am Geriatr Soc 1982;30:258-260.
155. Ascione FJ, Shrimp LA. The Effectiveness of Four Education Strategies in the Elderly. Drug Intell Clin Pharm 1984;18:126-131.
156. Schaffner W, Ray WA, Federspiel CF, et al. Improving Antibiotic Prescribing in Office Practice: A Controlled Trial of Three Educational Methods. JAMA 1983;250:1728-32.
157. Ray WA, Schaffner W, Federspiel CF. Persistence of Improvement in Antibiotic Prescribing in Office Practice. JAMA 1985;253:1774-776.
158. Ray WA, Blazer DG, Schaffner W, et al. Reducing Long-Term Diazepam Prescribing in Office Practice: A Controlled Trial of Educational Visits. JAMA 1986;256:2536-539.
159. Avorn J and Soumerai SB. Improving Drug-Therapy Decisions Through Educational Outreach: A Randomized Controlled Trial of Academically Based "Detailing." N Engl J Med 1983;308:1457-1463.

160. Hanlon JT, Andolsek KM, Clapp-Channing NE, et al. Drug Prescribing in a Family Medicine Residency Program with a Pharmacotherapeutics Curriculum. J Med Educ 1986;61:64-67.
161. Manning PR, Lee PV, Clintworth WA, et al. Changing Prescribing Practices Through Individual Continuing Education. JAMA 1986;256:230-232.
162. Cooper JW. Effect of Initiation, Termination, and Reinitiation of Consultant Clinical Pharmacist Services in a Geriatric Long-Term Care Facility. Med Care 1985;23:84-88.
163. Kidder SW. Cost-Benefit of Pharmacist-Conducted Drug-Regimen Reviews. Consult Pharm 1987;2:394-398.
164. Levy M, et al. Drug Utilization and Adverse Drug Reactions in Medical Patients. Israel J Med Sci 1977;13:1065-1072.
165. Thompson JF, McGhan WF, Ruffalo RL. Clinical Pharmacists Prescribing Drug Therapy in a Geriatric Setting. J Am Geriatr Soc 1984;32:154-59.
166. Patterson J. Maximizing RN Potential in a Long-Term-Care Setting. Geriatr Nursing 1987;(May/June):142-144.
167. Thomas B and Price M. Drug Reviews. J Ger Nursing 1987;13:17-21.
168. Longe RL, Martell PH, Gelbart AO, et al. Drug Therapy Communications To Family Physicians in a Nursing Home. Can Fam Physician 1986;32:2595-2598.
169. Andolsek KM, Hanlon JT, Lyons R, et al. Drug Therapy Team Review in a Long Term Care Facility. Drug Intell Clin Pharm 1987;21:660.
170. Williams TF. "Setting the Agenda for Geriatric Drug Research." in: Moore SR, Teal TW eds., Geriatric Drug Use -- Clinical and Social Perspectives. Pergamon Press, New York, 1985,pp.55-60.
171. World Health Organization. Health Care in the Elderly: Report on the Technical Group on Use of Medicaments by the Elderly. Drugs 1981;22:279-94.
172. Swift CG, Triggs EJ. Clinical Pharmacokinetics in the Elderly. In: Swift CG ed, Clinical Pharmacology in the Elderly. New York: Marcel Dekker, P.31-82.
173. Millstein LG. "Issues in Geriatric Labeling Revisions." in Geriatric Drug Use -- Clinical and Social Perspectives, Pergamon Press, New York, 1985, pp.17-21.
174. Temple R. Clinical Investigation of Drugs for use by the Elderly. [in press] J Geriatr Drug Therapy
175. Abrams WB. "Development of Drugs for use by the Elderly." in: Moore SR, Teal TW eds., Geriatric Drug Use -- Clinical and Social Perspectives. Pergamon Press, New York, 1985,pp.200-205.
176. Porta MS, Hartzema AG. Contribution of Epidemiology to the Study of Drugs. Drug Intell Clin Pharm 1987;21:741-7.
177. Stewart RB. Pharmacoepidemiology. Drug Intell Clin Pharm 1987;21:121-24.
178. Jones JK. Post-marketing Surveillance, Annual Reports, Long-term Follow-up. Drug Info J 1982;(Jan-June):87-92.
179. Wardell WM, et al. Postmarketing Surveillance of New Drugs: Review of Objectives and Methodology. J Clin Pharmacol 1979;(Feb-Mar):85-94.
180. Carson JL, Strom BL, Super KA, et al. The Association of Non-Steroidal Antiinflammatory Drugs and Upper Gastrointestinal Tract Bleeding. Arch Intern Med 1987;147:85-88.
181. Fox DA, Jick H. Non-Steroidal Antiinflammatory Drugs and Renal Disease. JAMA 1984;251:1299-1300.
182. Grigor RR, Spitz PW, Furst DE. Salicylate Toxicity in Elderly Patients with Rheumatoid Arthritis. J Rheumatol 1987;14:60-66.
183. Rossi AL, et al. Ulcerogenecity of Piroxicam: An Analysis of Spontaneously Reported Data. Br Med J 1987;294:147-50.
184. Jick H. Use of Automated Data-Bases to Study Drug Effects After Marketing. Pharmacotherapy 1985;5:278-279.
185. Wegner F. Post-Marketing Surveillance (PMS) and Geriatric Drug Use. in: Moore SR, Teal TW eds., Geriatric Drug Use -- Clinical and Social Perspectives. Pergamon Press, New York, 1985,pp.95-97.
186. Hartzema AG, Porta MS, Jilson HH. Introduction to Pharmacoepidemiology. Drug Intell Clin Pharm 1987;21:739-40.
187. Program Announcement for the 3rd International Conference on Pharmacoepidemiology. Pharmacoepidemiology Newsletter 1987;3:2-4.
188. Ferry ME, Lamy PP, Becker LA. Physician's Knowledge of Prescribing for the Elderly; A Study of Primary Care Physicians in Pennsylvania. J Am Geriatr Soc 1985;33:616-625.
189. Vestal RE. Clinical Pharmacology. In: Andres R, Berman EC, Hazard WR, eds. Principles of Geriatric Medicine. New York: McGraw-Hill 1985:424-443.
190. Anon. Geriatrics and the USA. [editorial] Lancet 1986;1:133-134.
191. Schneider EL, Williams FF. Geriatrics and Gerontology: Imperatives in Education and Training. Ann Intern Med 1986;104:432-35.
192. Committee on Leadership for Academic Geriatric Medicine. Report of the Institute of Medicine: Academic Geriatrics for the Year 2000. J Am Geriatr Soc 1987;35:773-91.
193. Lamy PP. New Dimensions and Opportunities. Drug Intell Clin Pharm. 1985;19:399-402.
194. Program Announcement for Merck Fellowship in Geriatric Clinical Pharmacology.
195. Anon. Roster of Residents Completing ASHP Accredited Programs in Calendar Year 1987. Am J Hosp Pharm. 1987;44:1137-42.
196. Kaul AF, et al. Post Graduate Pharmacy Fellowships (1986-1987). Drug Intell Clin Phar 1987;21:205-210.
197. Palumbo FB. Effectiveness Measures of an Established Drug Curriculum. [in press] J Geriatr Drug Therapy.
198. Gleich CS. Innovations in Geriatric Drug Training: The Experience in the Geriatric Education Centers. [in press] J Geriatr Drug Therapy.
199. Rowe J, Beck JC, Beeson PB, et al. Report of the Institute of Medicine: Academic Geriatrics for the Year 2000. J Am Geriatr Soc 1987;35:773-791.
200. Campbell WH, Chalmers R, Cohen E, et al. Pharmacy and the Elderly. Bureau of Health Manpower, DHEW Pub.No.(HRA)80-36 Washington, D.C., 1980.
201. Health and Public Policy Committee, American College of Physicians. Medicare Payment for Physician Services. Ann Internal Med 1987;106:151-163.

HEALTH PROMOTION AND AGING
"MENTAL HEALTH"

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Introduction: The emphasis in this paper is on the direction that health promotion efforts might take to enhance the mental health of the elderly by building on the established effectiveness of primary, secondary and tertiary health care interventions. This approach accepts that health promotion strategies should invoke the capacity of elderly persons to take responsibility for their health style and care decisions and should thus make available the requisite information and a social and service environment which allows a proper role in such decisions; and that individuals at high risk for mental health problems should be targeted for special efforts in health promotion as well as screening, risk appraisal and early intervention programs.

Partly because of space limitations, this paper does not do justice to the complexity and activity of developments in this field. A supplement will be available to address two substantial limitations in the coverage of this review:

1. The set of conditions which are discussed here are not intended to be exhaustive: The specific mental health conditions chosen to illustrate the discussion are in the realm of dementia, delirium, schizophrenia, depression, and anxiety. Taken together, these conditions constitute the great majority of severe mental health problems among the elderly (alcoholism is omitted because it is covered in another background paper). Notably missing are problems which lie in the range between severe conditions and normal states: Low morale, grief reactions, loneliness, diminished self-esteem, age related slowing of intellectual processes, loss of creativity and productivity, reduced social engagement and activities, lack of friendly relationships, changes in sexual performance with aging, and the like. These are not less important or less accessible to preventive interventions than the more severe conditions which are discussed, although arguably, their consequences appear to be less devastating and the urgency of the need for interventions less pressing.

2. The types of interventions which are described are not restricted to classical health promotion techniques: Biomedical treatments are covered on the grounds that these are main reference points in the content of health education, in decisions on mental health care that the elderly are called upon to make, in restructuring of social emvironments to foster autonomy and self-care, in the purposes of screening and in selecting modes of early intervention. However, some widely used interventions do not receive the space they deserve in this review: Such as stress

management including relaxation exercises, autogenic training, biofeedback, assertiveness training and self-hypnosis; bereavement counselling, easing relocation stress, resocialisation, memory training, cognitive-behavioral methods of redressing self-defeating ways of responding to perceived experiences, and skills training in coping with problems; and methods of empowering the elderly through involvement in service to others, advocacy groups, resident's councils and the like. The central reasons for the omission of discussion on these and many other interventions are lack of space and (in some instances) their uncertain relevance to the severe mental conditions that serve as the focus of the paper.

Severe mental health problems: Interventions aimed at promoting the mental health of the elderly should be built on an understanding of certain characteristics of severe mental health problems among the elderly:

I. The effects of age on mental health and its treatment; as an indication of what knowledge can be transferred from experience with youger persons and what is unique to old age. II. The frequencies of specific conditions and the sites at which they may be found; to show the size and distribution of the public health problem. III. The consequences of specific conditions in terms of the distress, disability and danger to the patient, and disturbance to others; as a gauge of the urgency of the need for health promotion and preventive intervention. IV. The etiology of mental health conditions; as a guide to the potential for health promotion and preventive intervention. V. The ways in which problems are amenable to prevention; with respect to the onset, relapse or consequences of disease. VI. The barriers to seizing the opportunities that may arise for intervention; and the strategies and needed resources for enhancing the chances of successful intervention.

I. The effects of age on mental health and its treatment.

There are three broad groups of elderly patients with mental health problems: 1. Those who developed their problem during adult life and have since grown old. 2. Those who have a problem which more commonly presents in adult life but in this instance is of late onset. 3. Those whose problem typically presents in old age.

The fact that the person is chronologically elderly reveals very little about the circumstances surrounding a mental health problem because the elderly are a differentiated group. Only in some elderly do mental health problems acquire a distinctive 'geriatric character'; that is show the effects of age:

1. On the clinical presentation: The picture of mental illness in old age is largely similar to that in younger patients; the specific conditions should therefor be readily recognizable by professionals familiar with adult psychiatry. Exceptions to this rule are of significance to health promotion in that potentially

treatable conditions may be overlooked: for example, depression in the elderly is often overshadowed by complaints of somatic symptoms, or masked by ambiguous descriptions of distress such as complaints of emptiness, anxiety or unease. Subjective reports or objective signs of memory impairment dominate the clinical picture in about 10% of severe depressions; phobic anxiety is often disguised as disability.

2. On outcomes: There is a tendency to underestimate the potentially good spontaneous and treated outcomes that can be obtained with most mental conditions occurring in old age; even relative to the outcomes in younger patients. For example, schizophrenic-like states which begin in old age (paranoias or paraphrenias) even if untreated are less likely to show progressive emotional deterioration, inability to express thoughts coherently, or loss of iniative than is typical for younger schizophrenics (Kay 1963) The symptoms of adult onset schizophrenia become less troublesome to the patient and others if the patient survives to old age. However, some aspects of mental illness become more severe with age; suicidal efforts are more determined, delusional depression is frequently a serious problem (Meyers and Greenberg 1986).

Paranoia tends to respond well to pharmacological treatment if the compliance of the patient is maintained (Post 1984b); the proportions of elderly with depressions who return to normal and symptom free function after treatment are not substantially less than in younger patients (Georgotas et al 1985; Godber et al 1987). While it is true that the prognosis for the primary dementias is generally gaurded at the present, a small but importamt proportion of suspected cases turn out to be treatable and reversible conditions.

The successfulness of intervention in the elderly may sometimes be obscured and overlooked because of the complexity of adequate treatment and the care required in its administration. Compared with younger cases, depressions in the elderly maybe somewhat more difficult to treat because of physical complications which frequently accompany it and the age associated adjustments required in medication regimes.

3. On pharmacological treatment: Pharmacological interventions for elderly patients are given in a context of geater complexity than for younger patients. The elderly patient frequently has multiple conditions and correspondingly is often found to be on four, five or more medications; probably from more than one prescriber and several other sources such as over-the-counter and stocks of hoarded medications. There age related alterations in metabolism, protein binding, distribution, and sensitivity to and excretion of psychotropic medications which demand greater care and special experience with administration of medications. The elderly are particularly vulnerable to anticholinergic side effects of psychotropics and to medication induced delirium. With certain medications (e.g. tertiary tricyclic antidepressants) it takes longer than in younger patients to achieve a steady state of the blood levels of the parent medication and its active metabolites, and smaller daily doses are needed to obtain therapeutic blood levels. It is not surprising that there is a higher risk of

drug interactions and side-effects in the elderly: toxic or interactive side effects are relatively common.

Accordingly, dosage and administration of psychotropic medications must be adjusted to allow for age related changes. Usual practice is to start low and increase dosage slowly but the clinician must avoid falling over backwards through giving overly cautious treatment. Although there are a few studies suggesting that moderate dosages may be effective, a high rate of therapeutic success will depend upon a willingness to pursue treatment with intensity and duration where necessary; the cooperation of the patient (and in many cases the family or other caregiver) is crucial to the success of such treatment.

4. On service patterns: The elderly may be reluctant to bring their incipient mental health problems to sites offering expert treatment (for example, community mental health centers). To address rather than overwhelm these resistances, the services need to reconsider their own organization, attitudes, procedures and location as well as channels for better informing the elderly about the resources and benefits which are being offered.

Since many elderly patients with mental health problems have multiple conditions which cut across disciplinary boundaries, their use of services differs from that in younger patients. Mental health problems are likely to present in medical and social service settings: psychiatrists may have to expand their skills to include primary medical care and conversely, primary care physicians may have to acquire psychiatric skills; bridges between social and medical settings are vital.

The elderly patient will on average require the spending of considerable time for screening, comprehensive or multidisciplinary evaluation of their problems, the eliciting of appropriate community resources, and the arranging of referrals as necessary. Coordination of services (case management) becomes important in order that the patient does not become lost or receive redundant and possibly deleteriously interacting treatments.

5. On the base rates of specific psychiatric disorders. Preventive services to the elderly must be matched to the age specific probabilities of specific mental health problems. The dementias and deliria become much more common with advancing age while schizophrenic syndromes decrease. The rates of depression remain considerable in clinical populations but despite stereotypes about the adversities of old age there is not an excessively high rate of major depression and nor other types of depression (Robins et al. 1984) among the general elderly population; it is clear that it is not normal for the elderly to be depressed and the goals of health promotion should take this into account.

6. On the person's support system. Most elderly are women, traditionally the heaviest users of mental health services at all ages. Very old women are likely to be widowed; they can be difficult to reach with health promotion information or to draw into treatment and maintain in the community, especially if there is no family to act as a line of communication or to replace the

care and attention formerly given by the spouse. However, about two thirds of the elderly live with someone else in the household and around 80% have a family member or friend who is willing to help look after them. Thus there is usually an opportunity for health promotion efforts to draw upon the assistance of the informal support network. Nevertheless, there is a call for extraordinary determination on the part of health promotion and prevention services to reach the needy segment of the elderly who are truely isolated.

Comment: Age induced alterations in mental health and its treatment are sometimes for the better, not always for the worse; either way they require new understanding of the biological, psychological and social processes of aging in order to adequately plan for health promotion and preventive interventions.

Some older patients are like younger patients and some are different; it is these latter who require special geriatric approaches. The principles of geriatric interventions to improve mental health are modifications of those governing adult mental heath strategies. Mental health professionals who are interested in reaching the elderly must master an additional knowledge base and set of skills, and expand the organization of their referral network for health promotion, screening, consultation, community services and relocation; and will need a deep interest in, and empathy with, the problems of the aged.

There is no justification for setting the goals of treatment at a lower level for the elderly than for younger patients; either because of a presumed lesser ability to respond to treatment or the even more dubious grounds that they have a briefer life expectancy or less need to be optimally functional.

II. <u>The frequencies of specific conditions and the sites at which they may be found.</u>

DEMENTIAS AND DELIRIA: The dementias are a set of typically chronic syndromes in which the most striking features involve deterioration of memory, orientation, general intellectual and specific cognitive capacities and social functioning; occurring in clear consciousness and arising usually after intellectual maturity has been reached.

Among dementias in the general elderly population about 60% or more are Alzheimer's disease type, 10% or less are a relatively pure multi-infarct (or other cerebro-vascular) type and 15% a mixture of the last two; the remaining 15% are secondary to neurological diseases such as Huntington's Chorea or Parkinsonism, or a so-called reversible secondary dementia arising from such causes as intracranial lesions, normal pressure hydrocephalus, a systemic condition or depression.

Persons with primary or secondary dementia who reside in the community constitute about 5% of the elderly (i.e. 65 years and over) population; persons with these dementias who reside in long

stay institutions are a further 2 1/2% of the elderly population (although they constitute up to 50% of the long stay residents) (Gurland and Cross 1982). Therefore, most dementias live outside institutions.

Rates of dementia rise steeply with age and reach 20% over age 80. Incidence varies from less than 1% annually at age 70 to around 4% at age 85. The lifetime risk of dementia is around 1 in 3 for males who survive to 85 years. Women are probably not more prone to develop dementia but many more of them survive to extreme old age where the risk is highest.

The dementias must be distinguished from the deliria (acute confusional states), which share some of the main symptoms of dementia but are relatively acute in onset and course, and show a clouded or hyperaroused alteration of consciousness. Deliria typically result from systemic disorders arising outside the cranium.

Deliria are frequent in medical settings, especially where the prevailing physical illnesses are acute and severe; some level of cognitive impairment (not necessarily meeting criteria for delirium) has been reported in as much as 25% or more of elderly patients in such settings (McCartney and Palmateer 1985).

SCHIZOPHRENIA: Symptoms of schizophrenia occur in old age in two main contexts: 1. As a result of the aging of schizophrenics whose condition began prior to old age. 2. As part of a late onset primary psychiatric disorder known as late-life paraphrenia in European psychiatry and as paranoia in DSM-III.

Up to half the long stay patients in large psychiatric centers are elderly (Goodman and Siegel, 1986) and about half of these are schizophrenics of earlier onset who have grown old; many of these aged schizophrenics are placed in nursing homes, especially if chronic medical problems have supervened.

Paranoia is chronic but not progressive, has a predominance of paranoid delusions and often hallucinations and leads to suprisingly little impairment of affect, volition or intellect. Among psychiatric first admissions with symptoms of schizophrenia, 10% or more begin after middle age (Rabins 1984, Volavka and Cancro 1986). Paranoia is found in about 10% of psychiatric first admissions after the age of 60; in upwards of 3% of elderly nursing home residents and less than 2% of the community residing elderly population. Paranoia is predominantly a disorder of women, partly because this gender is the majority group in the elderly population but also because of a much higher risk for this disorder in elderly women than in elderly men; in contrast to the gender risk for adult schizophrenia.

DEPRESSION: The cluster of depressions of all types, major depression, dysthymia, cyclothymic disorder and atypical depression but including also dysphorias considered to be of clinical interest, is in the region of 13% of the general elderly population; with major depressions accounting for 1-2%. In inpatient settings the depressions of all types usually constitute

about half the admissions, with major depressions the predominant type. Depressions of clinical interest are also frequent in outpatient psychiatry and in primary medical care; in the latter site the major depressions are a minority of cases (Sireling et al. 1985) while masked and atypical depressions are common.

ANXIETY: It is perfectly reasonable to expect that the elderly would suffer high rates of anxiety given the frequency with which their life situations appear precarious. Nevertheless, the prevalence of anxiety disorders in the general population is around 10% of elderly women with the majority of these being phobias, especially agoraphobias (Turnbull and Turnbull 1985); prevalence in males is around half that in females. Anxiety disorders in the elderly are seen more frequently in primary care practice than in psychiatric settings; reflecting the observation that sedatives and hypnotics are widely dispensed by primary care physicians.

III. <u>The consequences of specific conditions in terms of the distress, disability and danger to the patient, and disturbance to others.</u>

DEMENTIA AND DELIRIUM: The primary dementias are invariably disabling as the disorder involves first the higher order tasks such as work, handling finances, finding the way in public places, shopping or doing household chores; at a later stage, the simple self care tasks such as bathing, dressing, use of toilet, mobility, continence and feeding. Dependence on others for assistance and supervision increases over time. Parietal dysfunction (difficulties in naming or understanding the use of common objects) obtrudes as the disease advances and, in the closing stages, seizures, spasticity, profound weight loss, intercurrent infections and coma. Life expectancy is considerably shortened by dementia unless assiduous nursing and medical care keep the complications (e.g. undernutrition, aspiration of food, infections and other overlooked medical illness, contractures, bedsores, overmedication, and falls) under control.

Disturbing behaviors are very frequent: Aggression, nocturnal restlessness, wandering, and incontinence are particularly disruptive and add to the heavy demands on the caregiver's time and energy. The family may be devastated also by a profound erosion of the patient's personality, a dropping of standards of decency and a patient's apparent indifference to the caregiving. Family members are more often depressed than is the patient (Gurland and Birkett 1983).

The consequences of deliria depend on whether the condition is recognized and the underlying cause promptly identified and appropriately treated. If so, the delterious consequences are usually limited and transient; if not, the mortality rate is high, and avoidable morbidity may arise as a result of the patient's confusion (e.g. falls and fractures).

SCHIZOPHRENIA: The majority of adult onset schizophrenics achieve old age. About one third of the survivors to old age have

recovered virtually completely but the remainder are left with impaired functioning; including around a third of the whole cohort who have chronic or relapsing symptoms (Ciompi 1985). With age and the passage of time the person tends to become quieter and easier to supervise or live with. Nevertheless, although patients may have few troublesome symptoms, poor social functioning or supports may make living in the community or discharge from hospital difficult; the promotion of health among this dependent population can be facilitated by access to enriched alternative environments in the community such as group homes.

The onset of paranoia is usually fairly slow. The person is preoccupied by experiences of harassment, assault, and intrusion of privacy; and eventually responds to the psychotic phenomena with vigor, making persistent complaints to authorities, striking back at neighbors because of imagined grievances, trying desperately to escape through flight or suicidal actions, or entering a state of withdrawn siege. Emaciation, shouting at hallucinations, pacing and moving furniture around an apartment, furtive nocturnal sorties and eccentric appearance may arouse the concern of others; leading to hospitalization or eviction which swells the ranks of the homeless.

DEPRESSION: The distress of a depressive disorder is worse by an order of magnitude than that of normal depression. Other mood changes that accompany depression, such as irritability, apathy and loss of interest in social roles may damage the interpersonal and supportive relationships which are vital to the patient's tenure in the community. The consequential costs are not only to be measured in human terms; there are also expenditures due to increased and inappropriate use of physicians services.

A prolonged episode of depression can lead to undernourishment, dehydration, inactivity and self neglect; with serious undermining of the patient's physical health. Mortality rates are increased by depression in excess of that explainable by suicide and declines in health behaviors; one possible mechanism being an alteration of immune mechanisms.

There are exceptionally high rates of suicide among elderly white males. This is a generational (cohort) phenomenon and not due to aging, (Gurland and Cross 1982); future groups of elderly white males will probably have lower rates as do current cohorts of females, and non whites. Nevertheless, the elderly tend to be deadly serious in their suicidal actions (their first attempt is likely to be their last). Behaviors which are potentially harmful to the self (eg. non compliance with medical regimes, failing to report warning symptoms of illness, neglect of diet, fighting, or falling) may sometimes be analagous to suicide attempts. These behaviors are seen quite often among the elderly in nursing homes and call for a search for an underlying depression.

ANXIETY: Anxiety disorder has both an emotional component (e.g. fear, tension, dread, irritability and worried apprehension), a behavioral component (e.g. distractibility, complaints and reassurance seeking), and, especially in the elderly a somatic component. The somatic symptoms of anxiety are both subjective (e.g.

feelings of respiratory restriction, palpitations, feeling shaky, dizziness and headache or chest pains) and objective (e.g. sighing and rapid breathing, trembling, diarrhea, vomiting, coughing, rapid pulse, and sweating). These symptoms are not only distressing but also can be disabling and exhausting. Self medication or inappropriate presribing for relief of symptoms can lead to drug dependence and other serious side effects. Unnecessary and even harmful hospitalization may be precipitated by the presentaion of the anxiety symptoms in the guise of an acute medical (e.g. cardiac) crisis.

IV. The etiology of mental health conditions.

DEMENTIA AND DELIRIUM: In Alzheimer's Disease the frequency of microscopically visible senile plaques around nerve terminals and neurofibrillary tangles inside neurones in the cerebral cortex (parietal, temporal and occipital regions especially) and hippocampal region of the limbic system, is increased beyond age norms (Blessed et al. 1968, Katzman et al 1983); dendritic processes and spines waste away. There is still uncertainty as to whether these neuropathological changes are the cause or result of brain dysfunction, and whether they are reversible up to a point.

The locus coeruleus and Nucleus Basalis of Meynert are particularly affected by Alzheimer changes, and through their projections, large areas of the cerebral cortex. There is degeneration of cholinergic neurotransmitter pathways essential to memory processes; choline acetyl transferase is decreased and the production of the neurotransmitter acetylcholine is presumably reduced. The muscarinic receptors situated after the neural juncture (post-synaptic) are not affected. There are other relevant structural and neurotransmitter changes but this basic model provides a rationale for the efforts to develop treatments which would enhance acetylcholine neural transmission in dementia through use of precursors (e.g. choline), extenders (e.g. physostigmine) and agonists (i.e. substitutes such as arecoline) (Lauter 1985).

The fundamental cause of Alzheimer's Disease is not known, and there is probably more than one. In surveys of precursors, head trauma occurs more often than expected by chance. The presence of amyloid and immunoglobulins in plaques in the brain has led to the suggestion of a brain tissue autoimmune disease; changes in brain antibody levels and the HLA histocompatibility system have given some support to this avenue of research. Possibly a breakdown in the blood brain barrier allows access to damaging substances such as aluminum along the lines of dialysis dementia; however the latter differs in important respects including the neuropathology. A transmissible slow virus has been sought but found consistently only in kuru and Creutzfeldt-Jacob disease. A familial pattern consistent with an autosomal dominant mode of inheritance has been reported particularly in the severe and younger cases and those with focal signs; penetrance increases with age but may be complete by the age of 90. There are also clues that there may be a link with Down's syndrome (Heston and

Mastri 1977) leukemia and an older age of the mother (and perhaps the father) at time of the patient's birth; abnormal microfilaments may be implicated in this triad of disorders. Recent studies have linked one form of familial patterning with trisomy and a subsection abnormality on chromosome 21; thus adding to the genetic and neuropathological overlap with Down's syndrome (Delabar 1987).

Multi infarct dementia is characterized by arteriosclerosis of the blood vessels supplying the brain and numerous, usually small cerebral infarcts. Cognitive impairment rather than stroke is the predominant presentation. Presumably, the well known predispositions to arteriosclerosis may play a role in multi infarct dementia as well.

The causes of the reversible secondary dementias and of deliria are to some extent overlapping: intracranial lesions such as hematomata (trauma induced pockets of blood pressing on the brain) or tumors, systemic conditions such as pernicious anemia, or metabolic and endocrine disturbance. Deliria may additionally arise from toxic states, septic agents, drug side effects, anoxia, or an intracranial infection. Reversible dementias can further be due to normal pressure hydrocephalus (enlargement of the cerebral ventricles probably due to inadequate reabsorption of cerebrospinal fluid), or even depression. Dementias may also be secondary to alcoholism, Parkinson's disease, Huntington's chorea, Creutzfeldt-Jacob disease (caused by a transmissible agent that can be carried in transplanted tissue) and repeated head trauma. Neurosyphilis is currently still a possibility and the AIDS virus may one day increase its attack on the older age groups.

SCHIZOPHRENIA: Among families of elderly patients with paranoia, the risk of a schizophrenia is raised but not as high as in families of earlier onset schizophrenics (Funding 1961, Kay 1963). The risk among relatives is raised for both adult and late onset types but with some loading towards the latter (Bridge and Wyatt 1980b). It has also been suggested that the mode of transmission is recessive. Women are particularly vulnerable to paranoia. The life long personality is usually abnormal: Unsociable, cold hearted and prone to take offense; isolated, single or divorced, or with few sibs and few children (Kay et al. 1976).

In spite of an abnormal personality, patients with paranoia maintain competence in the running of their own lives until the onset of the illness in old age. Socially evident deafness precedes the psychosis in a higher proportion of cases than for depressive disorder; a severe degree of hearing loss (as indicated by audiometric tests and social function) occurs more frequently than in depressives or the general elderly population (Cooper et al. 1976). The deafness usually dates back several decades and is of the type (conductive or mixed) caused by chronic middle ear disease and not by aging.

DEPRESSION: There appears to be a spectrum of association between old age depression and neuropathology; with the majority of depressive disorders in old age being just as functional as in

younger persons. The neurotransmitter (biogenic amine) hypothesis is as valid for the elderly as for younger depressions; moreover, there are age related changes increasing monoamine oxidase activity (leading to increased break down of the biogenic amines) and decreasing the activity of tyrosine hydroxylase (with reduced production of biogenic amines) which reinforce the rationale for biological treatment of some of the depressions in old age.

Life events are variably related to the precipitation of depression among the elderly. Most depressive episodes in old age are noted to be preceded by a negative life event, generally bereavement or physical illness and disability; depression and physical illness occur together in the elderly at a far higher rate than is expected by chance. The absence of a confidante predisposes to depression in the face of a severe adverse life event. These facts seem in accordance with the widely held view that in old age depression is often a consequence of isolation and losses of close persons, health, material resources and status, as are likely to occur at this phase of life.

A wide variety of medications may be depressogenic in elderly patients: especially the benzodiazepines, barbiturates, antihypertensives, digitalis, L-dopa, or anticonvulsants (Ouslander 1982).

ANXIETY: Cases of anxiety disorder in the elderly (with persistence of symptoms for at least a month) may fall into any of the following broad classes: Panic states with or without agoraphobia, other specific phobic states, generalized anxiety disorder, or adjustment disorder with anxious mood. These diagnostic classes and their etiologies are usually identical to those found in younger groups of patients.

V. The ways in which problems are amenable to prevention.

1. Prevention of onset.

DEMENTIA AND DELIRIA: Community resources which can be applied to supporting the family have been mentioned as a means of preventing the onset of reactive mental illness and demoralization among these caregivers. Patients with dementia are at risk for superimposed delirium, the symptoms of which may be incorrectly dismissed as an advance in the dementia process; cases of dementia should be kept in mind for active preventive efforts.

Many of the potential causes of deliria can be avoided or treated prior to their provoking the state of delirium. Mostly this involves providing good primary medical care and the early treatment of such conditions as pernicious anemia, thyroid abnormalities (e.g. hypothyroidism, apathetic hyperthyroidism), occult infections, malnutrition and dehydration. Attention must be given to controlling medications, especially those with anticholinergic properties, and coordinating prescriptions from all sources including multiple service providers, self medication and over-the-counter drugs.

SCHIZOPHRENIA: The role of deafness in precipitating paranoia can be understood as a paradigm for the effect of poor social communication and lack of opportunity for reality testing in vulnerable individuals. Other causes of poor communication such as the development of increased isolation in old age may explain the late precipitation of paranoia. The long latent interval between deafness, isolation and the onset of paranoia suggests that there are opportunities for preventive intervention aimed at improving hearing impairments and social interaction.

DEPRESSION: Key life events are markers of vulnerability to depression in the elderly person: bereavement, the onset of physical disability or illness, and relocation to a venue that is perceived as undesirable. These are opportunities for counseling, and shoring up social networks; especially involving or substituting for a confidante, preparation for relocation (e.g. to a nursing home) so as to inform and involve the entrant as a participant in making choices, and help with adjustment after bereavement. Among other external depressogenic agents, medications rank high and should be kept to a minimum routinely.

ANXIETY: The exercise of abilites which lead to experience of mastery may help to allay general anxiety; continuation of social activities may prevent the onset of restrictive agoraphobias.

2. Prevention of consequences.

2.1 THROUGH EARLY RECOGNITION: Given the highly effective treatments now available for a wide range of mental health problems of the elderly, it is important that remediable conditions be recognized and treated early. Many consequences of mental illness can thus be averted: The deterioration of the patient's health if deliria are not noticed and investigated so that the underlying condition can be reversed; the dislocation of the paranoid patient from the community and the breakdown of the patient's trust in the treatment team; the loss of independence, risk of suicide, emaciation and deleterious effects on concomitant physical disorders in the patient with depression; the social isolation and drug dependency that can emerge when anxiety is uncontrolled; and especially the unnecessary distress that may be inflicted on the patient. In primary dementia as well, early recognition and intervention can prevent a rift between the patient and supporting family and the damage resulting from indiscretions, and can permit the patient and family to become educated about the contingencies for which they must plan.

The difficulties that must be overcome to achieve the early recognition that paves the way to early intervention involve the unfamiliarity of many practitioners with geriatric presentations of mental disorder, the mixed and atypical symptom patterns among the elderly that may make differential diagnosis complex, lack of adequate testing and investigatory techniques, insufficient time given over to taking a history from the patient and family members, and reluctance of patients to report their symptoms early or to consult specialists where advisable.

DEMENTIA AND DELIRIUM: Efforts at early recognition in dementia

should first be directed at the identification of reversible conditions, which are found in up to 20% of investigated cases (Cummings 1983, NIA Task Force 1980).

The first priority in assessing patients for possible dementia is a history and a specific inquiry for symptoms of depression or delirium. Next steps are a physical examination and review of medications as causes of deliria, and a search for neurological signs or a condition associated with secondary dementia.

The clinical recognition or exclusion of dementia is assisted by brief clinically feasible tests (e.g. the Mental Status Questionnaire or Mini Mental Status Examination) together with other clinical information. An extensive range of widely accessible technical investigations of blood, urine, chest and heart are essential to detect hidden causes of deliria; and so is some form of brain imaging (usually computerized axial tomography) to help rule out an intracranial mass or normal pressure hydrocephalus, or to show up brain infarcts. Neuropsychological batteries can help to confirm a diagnosis of dementia; regional blood flow studies or electroencephalograms can assist the identification of the subtype of dementia.

SCHIZOPHRENIA: The onset of paranoia almost invariably arises out of a previously abnormal asociable personality, after a long prodrome. There may be signs of an impending episode: The patient appears at first to be merely embattled and aggrieved; the victim of an unfriendly environment. An increase of complaints and restlessness may be noticeable. As frankly paranoid symptoms emerge the condition must be distinguished from organic and depressive syndromes. A failure to begin treatment early may leave time for the patient's delusory suspicions to include medications and the health care team and lead to the patient's withdrawal and impregnable resistance to receiving help.

DEPRESSION: For the most part, the criteria for diagnosis of the depression subtypes may be applied to the elderly as is customary for younger patients. However, in a minority of cases there are special difficulties in diagnosing depression in the elderly because of masking, complication by physical illness, or presence of cognitive impairment or striking paranoid or anxiety symptoms.

The masking of depression can be minimized by routinely probing for depressed mood and associated symptoms. Furthermore, patients who have previously had a depression and are relapsing can sometimes convey that their previous symptoms are returning without being able to pinpoint a depressed mood. This underlines the value of continuing aftercare of recovered patients in view of the high rate and often subtle symptoms of relapse among elderly depressives.

Distinguishing between the somatic (vegetative) symptoms of depression and the physical symptoms of medical illness or the aging process is quite a common problem (Gurland and Toner 1982): The somatic symptoms of depression include those usual for adult major depressions but more often extend to discomforts, aches and pains which may be vague or referred to a specific site such as

the chest, abdomen, urinary tract or oral area. In medical illness, symptoms such as loss of energy and interest, sleep disturbance, loss of appetite and weight may resemble the symptoms of depression; and may precede the discovery of the underlying physical illness (particularly with secondary carcinomas in the brain, apathetic hyperthyroidism, carcinoma of the head of the pancreas, uremia, pernicious anemia, heavy metal poisoning, or collagen disease). Where the differential diagnosis of depression and physical illness arises it requires a proper investigation of evidence for both conditions and a detailed examination of the symptoms and their chronological sequencing. Blood level assays may identify whether there is a medication which might be precipitating the depression.

The conjunction of symptoms suggesting depression and cognitive impairment calls for distinguishing depressive dementia (pseudodementia) from depression in dementia. Depressive dementia is discovered in about 4% of patients referred for investigation of presumptive dementia (Rabins 1985). These patients tend to recover their normal cognitive functioning when the depression is relieved (Bulbena and Berrios 1986); although recent work suggests that after an interval of wellness (which may be lengthy) a greater than chance proportion of these cases may emerge as clearcut dementia. Recognition of the reversible depressive dementia is assisted by neuropsychological testing (Caine 1981) and certain clinical features (described by Wells, 1979, and Rabins, 1985).

ANXIETY: Aging produces an increased chance of anxiety being accompanied by a physical disorder; if the latter is present it may produce symptoms that overlap with the anxiety symptoms making differential diagnosis more difficult. In cases of late onset of anxiety disorder a determined search for a possible underlying physical condition should be instituted (Lader 1982). Even where the anxiety disorder occurs alone the physician may be unduly influenced by the age of the patient to interpret the symptoms as indicating a physical (e.g. cardiovascular) disorder with a consequently misdirected emphasis in investigation and treatment.

Several physical disorders are particularly likely to be misdiagnosed as anxiety because they produce trembling, tachycardia and hyperexcitability (eg. hypoglycemia, hyper-thyroidism); or dread, bewilderment, weakness, dizziness, resp-iratory distress and sweating (eg. silent myocardial infarct, pulmonary embolism, small stroke or cerebral ischemic attack). Other physical conditions mimicking the symptoms of anxiety include excess intake of caffeine, sympathomimetic medications in non-prescription drugs for colds or allergies, and the withdrawal symptoms of sedatives, hypnotics or alcohol. Probing for a depression underlying anxiety symptoms is also a high priority since the depression if present would then be the main target of intervention.

Phobic anxiety cases may not be recognized when fear or avoidance of a situation is rationalized as a disability due to frailty or chronic physical disorder. Opportunities for rehabilitation may thereby be missed.

2.2 THROUGH EFFECTIVE TREATMENT: Most mental health problems of the elderly offer the prospect of complete return to normality or at least substantial improvement, if treated appropriately and in a timely fashion. This is in contrast to such physical disorders as stroke, heart disease or cancer where permanent damage is usually incurred at or preceding the time of onset of symptoms. Conditions such as major depression, dysthymia, paranoia, and general anxiety are for practical purposes as functional (without permanent structural damage) in the elderly as in the young; these conditions do not in general herald the onset of dementia or other declines associated with aging.

However, the functional mental health disorders of the elderly often have a long duration if neglected, and may become irretrievably chronic if treated too late. Thus, the successful treatment of these disorders will truncate the episode, lower prevalence rates and prevent years of individual suffering and disability; as well as remove the risks to which the patient is exposed while ill (e.g of suicide).

Treatment of these 'functional' conditions in the elderly is remarkably effective if applied with skill and determination; treatment of some organic disorders such as delirium is equally effective. In the case of primary dementia, effective treatments are currently directed at secondary symptoms; treatments for the the basic intellectual changes are still evolving.

DEMENTIA: The treatment of a primary dementia should follow the ruling out of reversible conditions that resemble it.

The specific treatment of Alzheimer's disease is not yet out of the experimental stage. Current understanding of the pathophysiology of this condition has led to the abandonment of treatments aimed at combating anoxia and has turned attention away from drugs (such as hydergine) with uncertain and marginal effects towards those which fit the rational cholinergic model. There are several variations on this latter theme: (a) Choline, a constituent of normal diet, in the concentrated form of oral lecithin; to promote production of acetylcholine. (b) Anticholinesterase (e.g. physostigmine) parenterally (and more recently, orally) with the intention of allowing accumulation of acetylcholine at nerve endings by preventing its breakdown. Physostigmine is short acting, but newer drugs of this class are being tried (e.g. tetrahydroaminoacridine). (c) Arecoline or the longer acting oxotremorine, in an attempt to bypass the impaired neuron and stimulate post synaptic receptor sites since these remain intact. (d) Piracetam to increase the activity of neural cells and perhaps increase the firing rate.

Interventions derived from the cholinergic hypothesis of the dementia deficits have led to measurably improved cognitive functioning in some studies but not yet of a degree and duration that has clinical significance. The search will continue for an effective drug with a lasting action and tolerable side effects, which can act at specific cholinergic sites that mediate memory processes and can capitalize on the structures that retain some

functional potential, at least in the earlier stages of Alzheimer's disease.

There are also treatments specific to other subtypes of dementia. Removal of plaques in the external carotid arteries and control of hypertension may be beneficial in preventing progression of the multi infarct type. Ventricular shunts or other means of aiding the flow of cerebrospinal fluid may relieve some cases of normal pressure hydrocephalus.

Treatment of behavioral problems is not specific to the subtype of dementia. A superimposed complication of dementia such as delirium or depression must first be ruled out. The patient's restlessness at night may exhaust the caregivers; simple remedies are best (eg. daily activities, a soft night light) and a short acting benzodiazepine at night only if necessary until a non pharmacological routine is established. Anxiety, irritability, suspiciousness and repetitive overactivity should also be managed without resort to chemical restraints if possible, but psychotropics may be temporarily needed.

The management of the dementias should concentrate on adjusting the demands on the patient to be engaging but not overwhelming, easing the introduction to new caregivers or locations, and clarifying the information the patient needs to relate to the environment, other people and time through use of signs and other cues. Depending on the level of disability entailed and the capability of the family to provide the appropriate personal assistance, a lengthy list of special services can be invoked in the community or in congregate sites. Social services and local chapters of self help societies devoted to this condition offer advice on obtaining services. For example, respite care (e.g. sitting services, day care, or temporary admission to a hospital or a nursing home) is available in many communities to relieve overly taxed family caregivers and reduce the risk of permanent placement of the person in an institution. Support groups for families add emotional and practical help.

Modified psychotherapy, remotivation therapy, reality orientation can be valuable aspects of care; even though the measurable benefits for cognitive functioning are slight, if any, the impact on self esteem and social activity can be gratifying.

The underlying condition in cases of secondary dementia or delirium is either known, strongly suspected or can be discovered by careful clinical investigation. For those causes shared by secondary dementias and deliria, or peculiar to deliria, the prognosis is good for the intellectual changes if treated in a timely fashion. For some other secondary dementias there are also helpful interventions.

SCHIZOPHRENIA: In elderly patients with paranoia it is essential that compliance with treatment be obtained although this is not easy. Without treatment very few patients will recover whereas with treatment the great majority of patients should improve. A favorable response is usually quickly evident, and more than half the treated patients will return completely to their premorbid

state, usually an abnormal personality (Post 1984).

DEPRESSION: The importance of treating depression in the elderly is supported by the good initial response (which is comparable to that obtained in younger patients), the relief of distress and functional impairment, the improvement in accompanying physical illness, and the reduction in the risk of suicide that can be obtained.

With adequate treatment of major depression, the prognosis for short term improvement is good where duration is short but becomes very gloomy if the duration is over 2 years; until otherwise proved it is safest to infer that early referral and intervention will reduce the proportion of refractory cases. If a medication is at fault then withdrawing it should be followed by improvement in the depressive symptoms within a few weeks.

Suicide is usually preceded by a clinical depression or other psychiatric disorder. In the great majority of elderly suicides there has been a recent contact with a psychiatrist or primary care physician suggesting that better liaison between these professionals might create an opportunity for preventive intervention. The risk of suicide is increased by bereavement, isolation and concommitant physical illness.

Antidepressants are indicated for treatment of major depressions and other severe depressions. Differences in effectiveness between the commonly used antidepressants are not yet sufficiently marked or invariant in the elderly to dictate a rote choice of medication; however, the side effects characteristic of a particular medication require special consideration in the elderly (Neshkes and Jarvik 1986). The benefits of pharmacological treatment for depression must be weighed against side effects; of most concern are excessive sedation, cardiac arrythmias and conduction defects, orthostatic hypotension (with the risk of falling and fracturing) or anticholinergic syndromes of the peripheral (e.g. urinary retention or narrow angle glaucoma) or central (e.g. confusional) types. Lithium carbonate is used in the elderly for the relief of the manic phase of bipolar depression, for the maintenance control of relapses in unipolar depression and as an adjuvant to antidepressants in refractory depressions.

Electroshock therapy is a safe and effective treatment for depression in the elderly. This treatment is advisable for cases otherwise refractory to treatment, rapidly progressive, severe, suicidal or losing a high proportion of body weight. The side effects of confusion or memory impairment are not lasting and are negligible with unilateral administration to the non dominant hemisphere and when the total number of treatments is not more than twelve (which should be sufficient for those who are likely to respond at all).

Psychotherapy, either individual or group, is widely used by psychogeriatricians for depressed patients, either as adjuvant to physical treatments or where the latter are not appropriate. Groups are well accepted by the depressed elderly.

ANXIETY: Reassurance and explanations to the patient, supportive psychotherapy, strengthening the involvement of the social network and reducing environmental threats are the first choices for relief of generalized anxiety in the elderly. Adequate exercise, curtailment of excessive sleeping especially during the day, regular bedtime rituals, simple relaxation routines and formal behavioral strategies for reducing tension should all be considered prior to and as adjuvants to pharmacological interventions. Psychotherapy and cognitive therapy are also helpful. Benzodiazepines are relatively free of dangerous side effects and are useful when used in low dosage for short periods; over longer periods their use can be troublesome in the elderly who are prone to drug accumulation and unwanted sedative or central inhibitory effects with intellectual changes.

The treatment of phobic anxiety is basically the same as in younger persons (e.g. behavior therapy) but may have to be blended with the techniques of rehabilitation medicine. Similarly, for panic disorder (with or without associated agoraphobia) the approach to treatment is like that used in young adults; tricyclic antidepressants and monoamine oxidase inhibitors are effective.

3. Prevention of relapses.

Elderly patients who have suffered and recovered from a mental health problem remain at high risk of relapse. Unless preventive steps are taken or maintenance treatment is introduced, disorders like major depression and general anxiety are likely to show a pattern of repeated episodes; paranoia is prone to lapse back into a chronic psychotic state; delirium may recur in a life threatening manner. Yet preventive steps or maintenance treatment can dramatically change the frequency of relapse; can make the difference between a sick and dependent patient and a person who is free of distress and able to function normally or adequately.

DEMENTIA AND DELIRIUM: Preventing the relapse of behavioral problems in dementia is crucial to alleviating the patient's distress, relieving the burden on family caregivers and reducing the likelihood of the patient needing admission to a long term care facility. Techniques for keeping the patient engaged in activities while keeping challenges within tolerable limits have been described.

SCHIZOPHRENIA: The potential for relapse of paranoia is so high that maintenance treatment is the rule. Even where maintenance is attempted, about a quarter of the patients will remain in, or return to a psychotic state. This is in contrast to the aged adult schizophrenic whose symptoms have generally become so muted that they often require little in the way of medication control.

When the symptoms have abated the neuroleptic should be maintained but reduced gradually; efforts at further cautious reduction should be made every few months and drug free "holidays" attempted twice a year. At the first sign of relapse the previous level of dosage should be reinstituted. The goal is the lowest dose necessary to assist reasonable adjustment of the patient and

minimize the elderly patient's high risk of tardive dyskinesia. More general long term measures include testing the benefit of hearing aids and relieving social isolation through day care.

DEPRESSION: High rates of relapse are the rule among elderly depressives. Over 70% will recover with initial treatment but about 75% of these will relapse over the long haul unless maintained on pharmacological treatment (Post 1984). Among treated elderly depressives about equal thirds stay well, remain depressed or recover and relapse. In any event, the psychiatrist should see the patient regularly after recovery unless there is good communication through the family or primary care practitioner.

Cognitive therapy has been systematically evaluated in the older age group with favorable results (Borson and Raskind 1986). Its success seems to prove that the elderly, contrary to the stereotype, are capable of changing their habitual modes of thinking and reacting. By learning cognitive schemata less loaded with negative evaluations of their performance and experiences, they are able to respond with greater satisfaction and mastery to daily events.

ANXIETY: Some of the measures recommended for curtailing an episode of general or phobic anxiety, should also reduce the chances of a recurrence; including supportive psychotherapy, strengthening social supports and reducing environmental threats. Similarly, the routines described for improving sleep habits and reducing tension mitigate against relapses.

VI. <u>The barriers to seizing the opportunities that may arise for intervention; and the strategies and needed resources for enhancing the chances of successful intervention.</u>

Conventional and innovative techniques of health promotion can convey to the elderly and their support network the essential facts of mental health preventive interventions which have been reviewed here: The potential for relief of suffering and impaired functioning; the importance of seeking treatment early; the information that allows participation in treatment decisions, self monitoring of the need for initiating and cooperating in treatment, and judgments on the quality of treatment being received; the effects of life event stress and the value of interpersonal relations in coping at those times; the health implications of communicating intimately with significant others; the normal mental health standards that are achievable in old age and the snares in attributing remediable mental health problems to a deterioration brought on by aging; methods of maintaining good mental health through good physical health, rehabilitation of disability, and discretion with medications; simple measures to regulate sleep and control anxiety; and much else. In addition to arming the elderly with such facts, health promotion programs can put the elderly in a position to press for specific organizational changes consistent with the interventions they select.

Some of the difficulties facing health promotion (and disease prevention) interventions are: 1. There are too few professional and non-professional service providers who have special training in the mental health problems of the elderly and the means of preventing them. 2. There is a discrepancy between the sites to which the elderly in need of intervention tend to gravitate and the sites at which special skills and treatment are available. 3. There are attitudes on the part of the elderly which mitigate against their explicitly seeking help for mental health problems, on the part of the public which lead to underestimation of the effectiveness of current treatments, and on the part of service providers which tend to deny the elderly the time and attention that they need. 4. Medicare and other reimbursement mechanisms do not cover enough ambulatory psychiatric visits (including those to residents of nursing homes) to permit adequate prevention of the onset or relapse of mental health problems; nor to deliver the services at the sites which would gain optimum contact with the population at risk; much less for health promotion for high risk groups who are not yet ill. 5. The knowledge base is still patchy on the identification of high risk indicators for mental illness among the elderly: some predictors are strong (e.g of relapses) and some weak (e.g. of first onset of depression in old age). Similarly, there is variability in the specification of effective interventions: some are proven effective (e.g. antidepressive medications) and some are very promising but as yet uncertain in management or effect (e.g. strengthening social supports to buffer stress). Research can redress these gaps in knowledge.

ACKNOWLEDGMENTS: With permission, this review is based upon two papers recently prepared by the same authors; the bibliography for the citations in the text of this review is contained in the two source papers and has not been repeated here because of space limitations:

Gurland BJ, Mayeux R, Meyers BS: The effectiveness of intervention for the mental health of the elderly, in Grimley-Evans J, Kane R and Macfadyen D. (eds) Improving the Health of Older People a World View. Oxford University Press, London, 1988.

Gurland BJ, Meyers BS: Geriatric psychiatry, Talbott JA, Hales RE, Yudofsky S (eds): Textbook of Psychiatry. American Psychiatric Press, 1988.

HEALTH PROMOTION AND AGING
NUTRITION

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"The trick is to live to be 100. Very few people die after that."

George Burns

Aging is inevitable. Health promotion, including good nutrition, can slow the rate of degeneration and foster the independence and well-being of older individuals. For years, health promotion activities targeted only younger adults. Health professionals and adults over 65 simply accepted the high rate of chronic disease and the concomitant physical and mental impairments. Health-promoting dietary recommendations were generally viewed as useless. However, a preponderance of evidence now suggests many potential benefits of good nutrition for older persons:

1) Life expectancy after age 65 has increased in part because of an abundant food supply, which has eliminated most nutritional deficiencies (1).
2) Reducing body weight and excess intakes of sodium, sugars, fats, and cholesterol can lower the risk of developing hypertension, diabetes, and heart disease for many individuals and improve the management of these diseases for older as well as younger individuals (2).
3) Nutritious diets that protect physical and mental health help older people to work longer and lead independent lives (1).
4) Maintaining a reasonable weight, exercising regularly, and selecting a proper diet may retard the aging process and delay certain debilitating conditions common in old age (i.e., osterporosis, hypertension, dementia, and diabetes) (3).
5) Preventing malnutrition can reduce the need for recurrent hospitalizations and prevent the occurrence of complicating conditions, thereby, lowering medical costs (3).
6) Selecting the best, most economical foods to meet nutritional needs and using appropriate nutrition programs can maximize limited financial resources and permit independent living for the older population.
7) Correcting poor diets for healthy older persons eliminates the need for and avoids the hazards of high doses of expensive dietary supplements (4).

To design appropriate nutrition strategies for those over 65, decision-makers need to 1) consider the heterogeneous characteristics of the elderly population, 2) differentiate age-related changes from effects of degenerative diseases, and 3) recognize the limitations of the current research base. This paper discusses these factors as well as other related areas -- problems in determining nutritional status and nutrient requirements of older persons, emerging research issues, and the effectiveness of current nutrition interventions. Several links between nutrition and other health promotion areas are identified. The issues identified in this paper, though not exhaustive, provide a starting point for developing the strategies that will address nutrition concerns in the rapidly growing, aging population in the U.S.

CHARACTERISTICS OF OLDER PERSONS

Older persons, generally defined as individuals over the age of 65, represent a very diverse group. The sex and racial composition of specific cohorts change as the subgroup ages beyond 80 years. The physical and mental capabilities of elders within and among older subgroups also vary widely; thus the potential benefits of nutrition therapies are not uniform. Attempting to foster independence and well-being in this heterogeneous population will require that policy makers and health care professionals examine the distinct characteristics of two to three age strata over 65 before developing broad interventions or formulating policies.

The variations in physiological, physical, and mental functions are greater among older persons than among any younger cohort. This heterogeneity reflects, in part, the diversity in lifestyles, economic and social conditions, food supply, culture, education, and exposure to other environmental factors experienced during their growing and maturing years. Genetics, of course, also plays a major role in the rate of functional loss in various organs and one's susceptibility to chronic diseases (such as cancer, coronary heart disease, diabetes, and osteoporosis). A later section describes more fully the differences in age-related functional changes and occurrence of chronic diseases.

Psychosocial and economic determinants

Many psychosocial factors affect the food habits and nutritional status of the old. Depression, loss of self-esteem, loss of spouse, inability to live independently, and loss of a sense of purpose and motivation adversely affect nutritional status by decreasing appetite and interest in eating and food preparation (5). Place of residence and economic status can determine access to food sources and health care services.

In 1985, the majority of those over 65 were white, non-institutionalized women, either living in a family setting (67%) or living alone (30%). Few (5%) lived in nursing homes, and most of these were over 85. After age 80 to 85, males and blacks are more likely to survive. Although many older persons maintain households, many need help with personal care and food purchasing and preparation. Older persons tend to reside more frequently in central cities, small towns, and rural areas where access to social and health services, nutrition programs, and food stores may be limited. Because older residents in urban and rural areas are often less educated and poorer than suburban residents, their risk of nutritional problems increases (6). The dietary patterns of these rural residents include large amounts of salty snacks, heavy sweets-sugar desserts, and high fat meat (7).

Older persons are more likely than younger adults to be poor or live on fixed incomes. Federal programs (Medicare, Medicaid, Social Security) have slowed the onset of poverty for some, but more than two out of every five of those over 65 are poor or economically vulnerable (8). Those over 85, nonwhites, women, and persons living alone experience the highest rates of poverty (8, 9, 10). As inflation increases, those living on fixed or low incomes find that a larger portion of their income is spent for food. The recent low inflation rate has partly eased this burden. Participation in the food stamp program, the nutrition program for seniors, and the commodity supplemental food program has also improved older persons access to food; but these safety-net programs provide protection for only a small proportion of poor older persons (8).

The cultural and social influences on food habits are also important to consider in planning nutrition strategies (10, 11, 12, 13). Davis and Randall (14) described trends in family structures and gender roles, in social integration, in employment opportunities, in education and in economic stability that affected the food habits and food choices of three subgroups of the population who would be over 65 by the year 2000. For example, individuals born between 1910-1930 experienced food shortages: often lived close to their food supply: and were less educated. They may require different food offerings and educational tools than persons born between 1940-1950. Nutritional problems of the older cohort who ate more complex carbohydrates and less fat may differ from the younger cohort who were exposed to more processed foods with more fats and simple sugars. A lower fertility rate among those born in 1910-30 could limit family support as they age compared to those born ten to twenty years later.

Nutritional status

The nutritional status of the older persons often reflects lifetime nutrient intakes and food behaviors, as well as age-related conditions and socioeconomic determinants. Experience with chronic degenerative diseases and conditions, drug regimens, drug and diet interactions, and functional status also influences health. To interpret the nutrition data from surveys, caution should be taken not to confuse cross-sectional data showing secular trends in dietary patterns with longitudinal data showing within person changes over time (15, 16, 17).

The most recent survey data from NHANES II showed older adults selecting most frequently the following foods from each specific group: whole and low fat milk and cheese (milk group), grapefruits and melon (fruit group), potatoes and tomatoes (vegetables), bread, biscuits, and muffins (breads and cereals group), and ground beef (meat group) (18). The 1977-78 National Food Consumption Survey data showed that one-third of older adults used whole grain breads and that older persons were the highest users of eggs, skim milk, vegetables, fruits, soups and lowest users of soft drinks (19).

National survey data (20) also show that estimated food energy intakes decline with age; the lowest mean intakes are for those 75 years and over (about 1850 kcal for males and 1400 kcal for females). Adults generally gain weight until age 50; then, relative weights decline. The variance for energy intakes of those over 65 years of age is great, due to the small numbers in this subset. Assessments of caloric intake adequacy require data on body size and physical activity.

For some older persons, having been obese and consuming inappropriate levels of sodium and perhaps, calcium, protein, and fat earlier in life may have raised their chances of developing hypertension, cardiovascular disease (CVD), diabetes, and cancer. Dietary cholesterol intakes for many over 65 (means are 461 mg for males, 316 mg for females) remain above recommended levels for lowering the risk of CVD.

Intakes of most nutrients except vitamin C and vitamin A also appear to decrease with age. Foods consumed by most older adults provided adequate levels of protein, preformed niacin, vitamin C, folate, and phosphorus. Intakes of calcium iron, vitamin A, thiamin, riboflavin, and potassium for most adults either approached or failed to meet the RDAs. In general, biochemical or clinical markers of deficiency were rarely found (<5% on average) in the older persons (21). Of concern are older women who have high rates of bone fractures and related lower intakes of calcium and vitamin D-rich milk products (22, 23).

Usage of dietary supplements, drugs, and alcohol

An appropriate assessment of nutritional status cannot overlook the population's use of dietary supplements, drugs, and alcohol. In turn, additional data on the nutritional status and requirements may stimulate promotion of more dietary supplement use by older persons. [The elderly as targets of health fraud are discussed later.]

Usage of supplements by older persons has increased from an estimated 1 percent in 1975 (24) to estimates of 40 percent nationwide in 1980 (25). Analysis of national survey results suggests that those who use supplements may not be the individuals most in need of them (4, 22, 26, 27). Approximately half of those who use supplemental vitamins take multivitamins, in particular vitamin C and E (22, 28, 29). Dietary supplementation does not appear to routinely improve nutritional status for older persons. It may even lead to nutrient imbalances, toxicities and/or interactions with drugs, especially if megadoses (10 times the RDAs) are taken (4, 22, 30).

Although older Americans constitute about 10 percent of the population, they use about 25 percent of all prescription drugs. This is not surprising since many chronic diseases are managed with prescription drugs. Over half of older people take at least one medication daily and many take six or more a day for multiple diseases. The drug-drug and drug-nutrient interactions may affect body composition, nutrient balance, or appetite, as discussed later (31).

Excessive alcohol intakes may also advance nutrient deficiencies (i.e., thiamin, niacin and other water soluble nutrients), may damage organs and tissues important to nutrient utillzation, and may depress appetite and the desire and ability to eat. The result can be poor nutritional status. Older persons have a lower tolerance for alcohol which becomes more concentrated as body water declines with age. Approximately 30% percent of those 65 and over consume alcohol on a regular basis (at least one time/week). About 15% of this cohort are considered light drinkers, 11% moderate drinkers, and 6% heavy (32). If the older persons' drinking habits are reflective of the adult population, then the 5 percent of the population which drinks most heavily, accounts for about 50 percent of the total alcohol consumption. Since alcohol is a risk factor for diabetes, hypertension, cancer, and liver disease, moderation of intake is advisable at any age.

EFFECTS OF AGING AND CHRONIC DEGENERATIVE DISEASES

Normal aging changes body composition, physical performance, organ system function and condition in all individuals if they live long enough; however, changes occur at different rates in different people. Even within the same individual, degeneration of various tissues and organs occurs at different rates (33). There are some 60- or 70-year-olds with organ function tests equivalent to someone 30 or 40 years younger. Conversely, there are some younger individuals with physiological capacities in the range of an average elder (34).

Age-related changes

Physiological changes in many organ systems naturally accompany the aging process. Examples of various age-related conditions that can affect the nutritional status of older persons include sensory impairments, altered endocrine, gastrointestinal, and cardiovascular functions, and changes in the renal and musculo-skeletal systems (35).

During the aging process, changes in dentation and in the oral cavity (recession of gums and decreased salivary flow) can occur. These conditions are exacerbated by some medications. Dental caries, periodontal disease, and trauma have led to the loss of natural teeth in approximately 29% of those over 65 and 50% of individuals over 80. Being toothless or having ill-fitting dentures can reduce chewing ability and raise the risk of choking. Well-fitting dentures are essential for chewing high fiber, nutritionally-rich foods, such as raw fruits and vegetables, whole grain products, and nuts. The use of fluoridated water, fluoride treatments, regular dental care, and improved diet may decrease dental problems for the next generation of older persons. Less is known about prevention of periodontal disease, especially the potential role of nutrients (e.g., sucrose, fluoride, and calcium). [These issues will be considered in background papers prepared for other working groups.]

Decreased organ or tissue function can be accelerated by anorexia or nutrient imbalances or deficiencies related to chronic illness, use of therapeutic regimens, or lack of proper medical care. Many age-related conditions affect the older person's ability to ingest, absorb and utilize

essential nutrients, as well as obtain and prepare food. Additional age-related changes are discussed under emerging research issues.

Chronic disease-related changes

The prevalence of hypertension, diabetes, CVD, cancer, osteoporosis, and arthritis increases with age. Four out of five older persons have at least one chronic condition and many have multiple problems. Obesity, affecting approximately 28% of older persons, is also related to many chronic diseases. Many of these conditions require special diets, drugs, or other therapeutic regimens that could further compromise nutritional status.

Mortality and morbidity rates for diseases differ by gender and race. This may reflect genetic differences, lifestyle habits, or differences in access to health care. Therefore, when planning nutrition strategies, special diet-related problems should be considered by race and sex. Briefly, 1982-84 data (36, 37) show that reported rates of CVD, stroke, and cancer are higher for males than females, with the highest incidence among black males. Hypertension and arthritis rates are highest among females, especially blacks. The prevalence of diabetes is comparable for white males and females, but about 50% higher for black females than for white females (36, 38). This may be due to the high prevalence of obesity among older black females (37).

Osteoporosis, generally affects more women than men, measured by the higher proportion (four to one) of bone fractures in women than men, and more whites than blacks (36) and Mexican Americans (39) . Higher bone density initially explains part of these differences; but the potential for obesity may explain the racial difference and should also be explored. Associated immobility handicaps an older person's ability to purchase and prepare food and thus limits food selections and independent living. Similarly, resorption of the residual alveolar ridge (bony ridge in which teeth are positioned) reduces the retention of dentures (40, 41) and may limit food selections.

MAJOR POLICY ISSUES

The previous descriptions of the socioeconomic factors, nutritional status, usage of drugs, alcohol and dietary supplements, and specific health problems, serve as background to the major policy issues. This section highlights the following areas to explore in developing nutrition policies for the aging:

1) Nutrition surveillance and monitoring
2) Emerging research issues
3) Nutrition services for older persons
4) Technology advances
5) Food assistance and nutrition programs
6) Nutrition education and information

This listing does not order the importance of these issues, but rather the logical progression from information gathering to dissemination. For the public, the value of research is best realized when people learn the consensus on the findings through the mass media or nutrition education programs.

Nutrition surveillance

Several national and state surveys have been conducted on, or include, the older population. These surveys are designed to determine the amounts and types of foods consumed, the nutrient content of intakes, the existence of clinical signs of nutritional problems, and the hematological or biochemical evidence of sub- clinical nutritional deficiencies. A limited number of cross-sectional population studies supplement these national data; however, there is almost as much variability between individuals within an age group as between group averages of age decade groups (42). The NIA Baltimore Longitudinal Study of Aging provides the only data to assess individual variations in intake, biochemical, anthropometric, and functional parameters.

Many surveys lack documentation of dietary supplement usage. There has also been minimal nutrition surveillance and monitoring among institutionalized elders (those in ambulatory care centers and long-term care facilities), homebound, or homeless older persons. Likewise, little is known about older persons in defined ethnic groups such as Asian Americans, native Americans, and, until recently, Hispanics. Nutritional data on subgroups of older persons, such as those over 80 years of age, in whom malnutrition may be more common, are also missing. It is often difficult to compare nutritional surveys which include or focus on older persons because of differences in dietary methodology and standards (43).

To date, the nutrition surveys of older persons in the U.S. have been very limited in scope, have frequently excluded the oldest old age groups, and have used varying standards of comparison in presenting the frequencies of nutrient deficiencies (33). In the NHANES I and NHANES II, adults ages 65-74 years comprised approximately 6-8% of the sample. The USDA Nationwide Food Consumption Surveys (NFCS) also collects data on the food intakes of individuals ages 65-74, representing

approximately 10% of the 1977-78 NFCS. No information on individuals older than 75 was gathered from either survey.

- Comparisons of independently-living and institutionalized older persons

The nutritional status of long-term institutionalized and independently living older persons needs to be compared. Older persons in institutions are usually subject to fixed meals which may not accommodate their individual food preferences, though they often adhere to specified dietary regimens. Often, individuals in these settings lose interest in foods and eat sparingly. A national survey of geriatric patients in institutions in the U.S. and of homebound individuals would be instructive. Major areas to research include (44):

1. Food-energy and nutrient needs of sedentary and bedridden patients;
2. The means to best carry out nutritional screening and assessment of geriatric patients in these facilities;
3. The interpretation of clinical, anthropometric, hematological, and biochemical indices of nutritional status in chronically sick older patients, with or without age-related conditions (i.e., skin disease, renal dysfunction, anemia, and muscle wasting);
4. The responsiveness of patients showing one or more indices of malnutrition to nutrient supplementation; and
5. Acceptable values for nutritional status indicators in nursing home patients.

- Methods of nutritional assessment

Dietary intakes documented later in life may not correlate with anthropometric, biochemical measurements, or clinical evaluations taken at the same time. Often these measurements more closely describe a myriad of historical experiences and long-term food intakes. Longitudinal studies provide information that begins to explain possible relationships of intakes to other measurements. To standardize the results of geriatric nutritional studies, a core set of assessment tools needs to be identified and then used routinely (as a minimum) for all studies or surveys.

Nutrient and energy intakes are determined using 24-hour recalls, food records, food frequencies and dietary histories. Interpretation of the histories requires standards. Appropriate standards for various age-subgroups of older persons do not exist. Comparisons are made to nutritional data from NHANES I and II and the 1977-78 NFCS despite limitations identified earlier. Reliability of information in these dietary histories has also been questioned. Memory, vision, and hearing may decline with age, making it more difficult to recall accurately foods previously eaten. Likewise, arthritis may impede record keeping.

Anthropometric measurements (e.g., height, weight, and skinfolds) are affected by aging. For example, height decreases over time due to changes in the integrity of the skeletal system. Measurements are often hard to obtain because of poor posture, or the inability of the older persons to stand erect unassisted. For these individuals, recumbent length, total arm length, knee height and arm span have been proposed as alternative methods to estimate stature (45, 46). More research on the reliability of these measurements is needed before they can be recommended as routine clinical practice.

Actual weight is less difficult to measure than height. For ambulatory people, a calibrated balance beam scale is used. For the non-ambulatory, wheel chair or bed balance beam scales are available. Before weighing, the patient's hydration state should be noted, as severe edema or dehydration can distort actual weight and anthropometric measurements (47). Skinfold measurements are also affected by the age-related decrease in lean body mass that results in a larger proportion of body weight as fat. Fat stores are also redistributed truncally. Changes in skin compressibility and elasticity hinder interpretation of skinfold measurements (33).

Biochemical parameters may be affected by an age-related decline in renal function, by shifts in fluid balance, by drug-drug or drug-nutrient interactions, by the long-term effects of chronic or coexisting disease, and by malnutrition. For example, low serum albumin levels often indicate poor nutritional status; however, kidney and liver disease, cancer, congestive heart failure, and other diseases (common among older persons) cause marked reductions in serum albumin (37). Ruling out these conditions must be done before low serum albumin concentration is associated with malnutrition alone. For accurate results, biochemical analysis should use several blood and void samples (48, 49, 50).

The most effective clinical methods of nutritional assessment are based on physical examinations and observation, and reflect long-term nutritional status. Clinical evaluations must be highly scrutinized because of the potential for human error, especially when large numbers are evaluated. For example, several age-related changes in clinical appearance--dry skin, sensory loss, and sparse hair -- may appear to be representative of one or more nutrient deficiencies (47). Other limitations in assessment methodology are discussed later.

Emerging research issues

Nutrition and aging research focuses on two general areas: issues related to interaction of diet and aging functions (i.e., physiological, psychological, sociological) and dietary relationships with pathological conditions common to old age. More specifically, much of the current research is directed toward the following topics:

1) The effects of aging on nutrient digestion, absorption and utilization and the relationship between these effects and nutrient requirements.
2) The role of dietary restriction in modifying age-related physiological changes or the role of diet in treating conditions associated with changes in immune and endocrine functions and changes in body composition.
3) The influence or effects of neurological, environmental, and dietary factors on senile dementia or sensory deficits in older persons.
4) The influence of physiological, behavioral, and environmental factors (e.g., sensory function, dental status, culture, cognition, and economics) on the quality and quantity of food eaten by older individuals, and on the relationship between various patterns of dietary intake and nutritional and health status.
5) The nutritional changes including changes in food intake which accompany chronic diseases common in the older person.
6) The role of nutrition and nutritional status during adult years in the etiology and pathogenesis of diseases and problems of older persons.
7) The effect of therapeutic regimens (i.e., drugs, surgery) on nutritional status and the effects of nutritional status on the efficacy of therapeutic agents.
8) The association between nutritional status and morbidity and mortality -- examining patterns of dietary intake and mortality.
9) Valid methodologies for use in assessing nutritional status in older persons and in establishing age-appropriate norms.

Although recent estimates suggest that 20% of the population in the year 2010 will be over 60, and that one half of those will be at least 75 years of age, much of the research base on nutrition, aging, and health is quite immature. An increase in the understanding of these dynamic interrelationships can improve the quality of life of the aged, provide more effective health care, and lessen the impact of aging on the health of older persons.

A balance of animal experiments, epidemiologic research, and clinical trials is needed to study the nutritional status and requirements of geriatrics. To assess nutritional status ideally requires 1) determining daily consumption of energy and nutrients, 2) measuring tissue levels of nutrients, 3) clinical examinations including anthropometric measurements, and 4) evaluating physical and mental function. Current assessments of older persons are handicapped by a lack of appropriate age-related biomarkers and valid standards for intake and biochemical and anthropometric values to which survey results can be compared. The related limitation in methodology and gaps in research knowledge were discussed under the nutrition surveillance section.

Many of the gaps in our knowledge about nutrition and aging are being investigated by NIA-supported researchers and by researchers at the NIA, the USDA Human Nutrition Research Center on Aging, and other government and private research centers around the country.

- Effects of aging on dietary intakes and eating patterns

The need for research on socioeconomic influences on eating behaviors of older persons and the biopsychosocial antecedents of age-related changes in eating habits will be discussed in this section. There is a need to clearly differentiate generational patterns in selection and eating of foods from changes in eating habits which are age-specific. Since previous educational, social, economic, and cultural experiences vary widely among various cohorts of individuals over age 65 years, these influences on food use and preparation patterns need to be separated from late life modifications in eating habits that result from age-related physical changes, chronic diseases, and lifestyle changes (51). Little is known about the diets and nutritional status of individuals 75 years of age and older, who are part of the most rapidly growing and frailest segment of the U.S. population.

Future research also needs to address the differences in dietary patterns associated with various stages in the late life cycle and with the variety of settings within which older persons live (i.e., alone, with family, or institutionalized). In addition, the effects of interventions, social or nutritional, at these various stages and in these settings need to be evaluated (51).

Among the socioeconomic factors, the type and level of income are particularly important. Poverty, for example, can restrict the amount and frequency of food purchases and also influence housing, cooking facilities, and overall health (3). Eating patterns and food choices are also determined by family structure, social situations, emotional status, cultural and religious beliefs, and living arrangements. Therefore, retirement, children leaving home, divorce or death of spouse, a

move to an institution, a new community, or a residence with limited cooking facilities, or entering or re-entering the labor force later in life can introduce changes in the food purchases, food preparation methods, and eating environment. These changes, along with social isolation and psychological problems, may cause anorexia or disinterest in food. Boredom can lead to over eating or snacking. Lewin's (52) social network analyses and Gifft's (53) examination of nutrition, behavior, and change provide approaches to determine what social interactions change with age and how these changes effect nutritional status. Research that has identified food- and nutrition-related attitudes and knowledge of older persons will be discussed in the last section.

Age-related sensory impairments and prescriptions for special diets further affect food choices. Loss of vision may restrict ability to prepare food or obtain food. Loss of hearing may constrain socializing at mealtime or may make it dif- ficult to get information on menu items or food products. Loss of smell and taste acuity may directly affect appetite and decrease the desire to eat (54, 55). Professionally prescribed diets such as low sodium, low fat, and low sugar may further depress appetite and increase anorexia. Future research should investigate the effect of special diets on food intakes and new ways to formulate appetizing foods lower in specific nutrients, yet acceptable to the target population. Answers to these questions will certainly require cooperation among gerontologists, physiologists, and food scientists.

- Aging, and energy and nutrient requirements

The nutritional requirements of those over 65 are difficult to determine and are largely unknown. Undetected disease and use of dietary supplements or medication complicate the task of defining population samples that are representative of various strata of older persons. In addition, there are few controlled metabolic studies in humans related to micronutrient metabolism in aging (21). An examination of long-term diets of very old people who have remained healthy until an advanced age may shed light on nutrient needs of older persons.

At present, most nutrient requirements are generally age invariant. However, RDAs for all persons over 51 are extrapolated from data collected mainly on males ages 20 to 30 years of age (48, 56). Current research on the vitamin nutriture of older persons may provide data to modify the current recommendations, especially as the relationships between specific nutrients and chronic diseases unfold or if newer RDAs optimize health and tissue function.

Energy needs decline with age because of decrease in metabolism related to a decrease in physical activity and loss of lean body mass. Since energy needs decline while nutrient needs remain stable or perhaps increase, recommending nutrient levels in terms of weight of the nutrient per 1000 kcal or per unit of lean body mass may be particularly useful for those over age 65 years. Conversely, energy intake restriction and exercise affect aging. This topic will be addressed later.

Protein synthesis appears to decline with age (44, 57), as does the synthesis of muscle tissues, organ tissue, and other protein moieties (e.g., collagen, immune system components, and enzymes) (33). Declining protein intakes do not appear to affect deleteriously older populations who have no evidence of wasting diseases (57). Nitrogen and dietary protein requirements may, however, be increased in response to physiological stress common in older persons (i.e., infections, fractures, surgery and burns) (56). Preventing protein deficiency with attendant hypoalbuminemia is most important in older persons when protein-bound drugs are taken (44). Patients with renal or hepatic disease may require protein restrict- ions. However, the quantity and type of protein best able to meet the needs of older people has not been ascertained, even for healthy populations.

Present evidence indicates that vitamin A and riboflavin absorption or tissue levels do not decline with age, despite intakes that are lower than the present RDA (17). Research on the role of carotenoids in cancer etiology may indicate advantages of increased intakes. Age does not appear to affect folate absorption and/or metabolism, except in individuals with atrophic gastritis (58). Individuals with hypo- and acholorhydria may compensate for the malabsorption through increased bacterial folate synthesis.

Some research suggests that the RDAs for vitamin D, B6, and B12 might be too low, at least for certain groups of older persons (21). Reduced vitamin D synthesis in the skin, lack of sun exposure, low intakes, and impaired 1-a hydroxylation depress vitamin D production in older persons (59). For now, increased sun exposure combined with low-dose supplementation (i.e., 10 ug/day) (21) or twice-per- year regimen of 2.5 mg vitamin D2 (60) are recommended for housebound older persons to maintain adequate serum vitamin D. Both human and animal research suggest age-related reductions in vitamin B6 absorption and metabolism (e.g. impaired pyridoxal phosphate formation or increased urinary excretion), but more conclusive data are needed to suggest changes in the RDA (21). Serum vitamin B12 levels appear to decline with increasing age, perhaps because of pernicious anemia and/or atrophic gastritis-related malabsorption (21). Negative health consequences of these changes have not been documented (61).

There is no consistent evidence for linking vitamin E, thiamin, or vitamin C requirements with age. The effect of increasing dietary vitamin E levels on tissue lipid peroxidation and platelet

vitamin E levels (and function) needs further exploration (21). Age-related changes in thiamin absorption vary depending on the assessment method used; however, it is well known that alcohol interferes with thiamin absorption and phosphorylation. Age-related declines in vitamin C levels in the blood, plasma, and leukocytes are reported in most studies; however, changes in tissue levels are less consistent (21). Smoking (62), medication (63), and environmental stress (64) combined with low intakes, can compromise vitamin C status, but the health consequences of these observations are not well-established (34).

Until improved methods for biochemical evaluations of vitamin K and niacin nutriture are available, it is difficult to determine changes in nutrient requirements for these vitamins. Incomplete food tables handicap studies on zinc, copper, chromium, and selenium status of the older persons. Fluid intake, especially water, declines in older persons along with a age-related loss of body water. Adequate water intake (e.g., 30 ml/kg of body weight) or approximately 1 ml of water for each calorie ingested) (64) is reasonable and important to normal renal and bowel function (5, 65).

Several questions are important to consider in setting nutritional requirements for the aging (44):

1. Can we formulate dietary recommendations that mitigate against development of aging changes in body composition?
2. Since diseases such as osteoporosis, atherosclerosis, and cancer are in part age-related and appear to have long latency periods, can we offer guidelines for the diets of younger people which will protect them from the development of these diseases?
3. What criteria should we use to determine the nutrient needs of elders?
4. What are the specially formulated preventive health goals for the elderly? Should they change with successive age strata over 65 years?

- Effects of energy intake and expenditures on the aging process

Although some older persons seek the "fountain of youth" in dietary supplements, the answer to deceleration of the aging process may be found in caloric deprivation or increased energy expenditure. Energy intake restriction (ER) without essential nutrient deficiency has been the only intervention in animals that extends maximum lifespan in all species tested and across wide phylogenetic differences. Long-term national studies of persons on low calorie diets are often confounded by low levels of nutrients and/or poor personal health habits.

Walford et al. (66) described four phases that trace the history of ER in the study of aging. Initial work showed that ER slows the biological aging process and favorably affects the incidence and age of onset of malignancies, arthritis, renal disease, and osteoporosis in animals. Secondly, animal studies demonstrated that ER animals had slowed age-related changes (not necessarily disease related) in the immune system, liver enzymes, age pigments, behavioral and psychomotor patterns. The third phase is a search for mechanisms that suggest causality that might include altered gene expression, thymic hormone levels, protection against free radical injury, and DNA repair. Descriptions of the effect of ER on circulating levels of insulin, somatostatin, thyroxine, and other hormones are needed. Exploring energy restriction in humans is the next phase.

Increasing energy expenditure through exercise also appears to influence mortality and morbidity through a number of complex physiological mechanisms. The effects of inactivity mimic the effects of aging (67); almost 50% of the functional decline attributed to aging may in fact be related to inactivity (68). Combined with a calorie-appropriate diet, exercise maintains a reasonable body weight, lean body mass and good physical performance. This combination also helps to prevent or reduce fat cell hypertrophy, production of high density lipoproteins (HDLs), hypertension, osteoporosis and insulin resistance. [A separate background paper explores exercise in more detail.]

With the increasing interest in the effects of peroxidation processes on aging, intervention with various antioxidants, including vitamins A, C, and E and selenium has been tried in both animal and human trials but the results have been mixed or inconclusive. More research is needed in this area.

- Drug and nutrient/food interactions

The high use of drugs among the aging may further compromise their health. The average older person receives more than 13 prescriptions a year and may take as many as 6 drugs at a time. Cardiac drugs (e.g., diuretics) are most widely used by the aging population, followed by drugs to treat arthritis, psychic disorders, and respiratory and gastrointestinal conditions. Many of these diseases are diet- related, and the use of drugs may complement, supplement, or supplant diet therapy.

Long-term use of a variety of drugs (often at high doses) raises the risk of drug-nutrient interactions. Individuals with nutritionally inadequate intakes and impaired nutritional status are at the highest risk. Use of high-potency nutrient supplements may also affect drug efficacy.

Physicians need to explain carefully the potential side-effects when certain drugs and foods/supplements are taken together. For some older persons, altering the drug therapy may be more appropriate than recommending dietary changes or food restrictions. Periodic assessments can identify borderline nutritional status that require appropriate dietary recommendations, nutrient supplementation, or change in drug regimen.

Roe (44, 69) has detailed several areas of drug-nutrient interactions. These include 1) diet effects on drug disposition, 2) drug disposition in malnourished subjects, 3) drug induced malnutrition, and 4) drug-food and drug-nutrient incompatibilities. Key interactions relevant to the aging population are discussed below and more detail on drug use is provided in a separate background paper. More research is needed to explain these interactions and to determine their clinical significance in the aging population.

Foods components and nutrients can affect drug absorption and metabolism. Heavy metals, high fat intakes and, to a lesser extent, high protein foods delay gastric emptying and, thus, delay the passage of drugs into the small intestines. High protein diets may also accelerate hepatic drug metabolism. A fasting state may hasten drug absorption from an empty stomach.

Malnutrition also alters drug absorption, protein binding, drug metabolism and drug clearance. Protein-bound drugs such as warfarin and diazepam may be more toxic in patients with hypoalbuminemia. On the other hand, some drugs decrease absorption of nutrients or cause mineral depletion. Such drugs include laxatives, antacids, anti-inflammatories (e.g., aspirin), diuretics, antibiotics, analgesics (e.g., indomethacin), and hypocholesterolemics (e.g., cholestyramine). Appetite can be enhanced by tricyclic antidepressants, reserpine, antihistamines, and anabolic steroids, whereas amphetamines and related drugs depress the appetite. But the aging process can reverse these effects. Phenothiazine, a psychotropic agent, that usually increases food intake may decrease appetite in older persons whose rate of drug metabolism is slowed. Specific foods or alcoholic beverages can precipitate adverse reactions to drugs. Some reactions such as the tyramine reactions with monoamine oxidase inhibitors may be life-threatening, while others such as the reactions caused by disulfiram and hypoglycemic agents to alcohol are extremely unpleasant.

Guidelines for drug development are needed that include studies in the elderly and consideration of various drug and food/nutrient interactions. Initially, research must determine how much drug efficacy and safety might improve with proposed guidelines (70). The quality of such research depends in part on the reliability of nutritional status assessments conducted and nutritional standards applied. Education-information transfer about drug-nutrient interactions for the public and the caregivers also needs consideration (70).

- Diet and chronic degenerative conditions

The prevalence of chronic conditions, such as osteoporosis, gastrointestinal disorders, diabetes, cardiovascular disease, and central nervous system disorders, increases with age. Questions about the role of nutrition in delaying the onset or mitigating the consequences of these conditions are the focus of NIA-sponsored research and conferences. The following examples are illustrations of aging and nutrition research topics:

Osteoporosis: Osteoporosis is defined as an absolute decrease in the amount of bone, leading to fractures after minimal trauma. Although age-related bone loss is common, certain older persons are at higher risk of developing fractures than others. Riggs (71, 72) suggests that osteoporosis may be two distinct bonethinning syndromes: 1) a "postmenopausal" form (Type I), associated with estrogen deficiency and 2) a "senile" form (Type II), highly correlated with aging. Type I, occurring predominantly in females 15-20 years after menopause, thins trabecular bones (e.g., vertebral bodies, ultradistal radius (forearm), and mandibles) that lead to fractures and tooth loss. Type II, occurring mainly in persons of both sexes over 75 years, thins both the cortical bone and trabecular bones proportionately, leads to fractures of hip, femur, tibia, and pelvis.

Definitive etiologies for either the early deficit in trabecular bones in Type I or gradual thinning in Type II need to be determined. Pharmacokinetic studies using calcitonin and diphosphonates have begun to explain the cellular mechanisms of bone resorption. Other studies (73, 74) have suggested risk factors including insufficient bone density at maturity, low levels of endogenous estrogen and other hormones, prolonged immobility and weightlessness, long term use of corticosteroids, family history, impaired intestinal or renal function, and diet. Prevention of osteoporosis has become a public health concern and has brought the promotion of foods high in calcium (e.g., milk products), calcium fortified foods (e.g., cereals, breads, and soft drinks), high potency calcium supplements, and other nutrient supplements. NIH Consensus Conference (75) recommended calcium intakes at a level of 1000 to 1500 mg, estrogen therapy, and exercise for women.

Questions remain about 1) what levels of calcium intakes are most protective against age-related bone loss and do these levels vary with age or sex of individual, 2) do calcium requirements vary with the level and type of physical activity, 3) how does calcium intake/supplementation interact

with estrogen status, 4) do calcium, fluoride, and vitamin D metabolites protect bones independently or in conjunction with estrogen therapy, weight-bearing exercise, or other approaches, and 5) how do vitamin D, protein, phosphorus, and even alcohol affect calcium requirements. Lastly, designing precise methods for measurement of bone mass is critical for determining relationships between diet and bone loss for the population or assessing the risk of bone fractures in individuals so as to use prophylactic therapy most effectively (76).

Osteoarthritis (OA) also causes great pain, immobility, and loss of independence for many aging individuals. Although nutrient deficiencies or excesses have not been implicated in this disease, obesity has been found to be associated with OA of the knee and hip but not of the sacroiliac joint (77).

Glycation in diabetes and cardiovascular disease: Glycation or non-enzymatic glycosylation may well be involved in the etiology of a number of age-related diseases. Glycosylation describes the process whereby glucose, fructose, or galactose react with proteins or nucleic acids to form a Schiff base. The Schiff base undergoes further changes to form advanced glycosylation end (AGE) products. The excessive accumulation of AGE products in the tissues, especially in the arterial walls, accelerates progressive stiffening or rigidity of these tissues. This rigidity may be caused by the cross-linking of proteins (e.g., collagen) and increases with age.

Elevated glucose concentrations characteristic of diabetes promote advanced glycosylation, thus accelerating stiffness of the tissues. Such rigidity may lead to reduced elasticity in the cardiovascular system. As a result, cardiac function declines, renal blood flow decreases, and vital lung capacity and oxygen uptake also decline. Further studies on advanced glycation may elucidate the mechanisms involved in the formation of senile cataracts, aging peripheral nervous system, and etiology of atherosclerotic plaques.

Hypochlorhydria: New research initiatives are studying the effects of aging on gastric secretions and the subsequent impact on nutritional status of the older persons. Hypochlorhydria incidence increases with age and may affect up to one-third of those people over 60 years of age. Women are more often affected than men, but the current extent of the problem and those at highest risk for disease are not known. Future epidemiologic studies of hypochlorhydria must be based on a common standardized case definition in order to assess the impact of aging on the disease. The causes of hypochlorhydria and the commonly associated atrophic gastritis are also largely unknown, yet these disorders have far reaching implications for health maintenance in the older population.

The major clinical implications of hypochlorhydria are altered absorption of nutrients and drugs in the upper gastrointestinal tract, bacterial over growth resulting in infections and changes in the immune response, and the predisposition to other diseases and disorders. Defective absorption of calcium, iron, folate, and vitamin B12 and the related deficiency diseases are of particular concern in hypochlorhydric patients. Reduced production of hydrochloric acid may affect the development of gastric cancer.

B-vitamins and central nervous system function: Current knowledge of the extent of interactions of nutrition and neurology is limited. The effect of B vitamins and other nutritional factors on brain function, including dementia and motor control, is better established. Deficiencies of various nutrients, particularly vitamin B12, thiamin, niacin, and folate impair cognition. Rigorously controlled, double-blind, prospective trials may elucidate the cognitive effects of malnutrition, especially subclinical, or multiple deficiencies of B-vitamins. To date, much information in this field is based on animal studies that may have limited applicability to human conditions, or on clinical pathology complicated by advanced age, alcoholism, and disease.

In addition, analytical methods specific and sensitive enough to measure the levels and metabolism of B vitamins are only beginning to be developed. However, still more basic methodological research is needed before further refinement in study design can be attempted. For example, based on new evidence using updated technology, it appears that folic acid as a naturally occurring excitatory agent found in the brain may have a mechanistic relationship to neuropathological conditions such as epilepsy-related brain damage, lithium neurotoxicity, tardive dyskinesia, and neuronal degeneration associated with aging.

The study of nutrients' effect on brain function has not received widespread attention because it was commonly believed that the brain was well protected from fluctuating plasma levels of dietary nutrients by the blood-brain barrier (BBB). Now, it appears that food constituents affect the synthesis of brain neurotransmitter and thereby modify brain function (e.g., alertness or depression) and behaviors (e.g., sleep). Fernstrom (78) and Wurtman (79) have shown that the levels of serotonin, an appetite-controlling neurotransmitter, can be increased by a high-carbohydrate, protein-poor meal that elevates brain tryptophan, accellerating serotonin synthesis. They report similar regulation of brain acetylcholine by ingestion of choline-containing compounds and of brain dopamine by tyrosine-containing compounds. Besides macronutrients, levels of trace minerals in the brain affect formation of synapses, nerve impulses, and other brain activity in neurotransmitter systems (80). Since the blood-brain barrier serves as

the interface between brain metabolism and diet, understanding the BBB nutrient transport processes provide insights into the mechanisms by which diet may influence brain functions (81). Research in this area is still too young to attribute altered behavior solely to nutrient-induced changes in neurotransmitter levels. Improved study designs are needed that use standardized methods for measuring behavioral responses and that adequately evaluate the dietary components and nutritional status of subjects and controls (82).

Although clinical research has not associated the severe senile dementia in Alzheimer's disease with aluminum toxicity (83) or other nutritional imbalances, future research in this area may be promising. Appropriate biochemical testing of individuals suffering mental loss or other central nervous system dysfunction may be required for differential diagnosis of these problems.

Also of research interest is the effect of aging on the interaction of B vitamins with other nutrients in the brain and nervous system. For example, alcohol consumption which can cause Wernicke's encephalopathy compromises thiamin pyrophosphate-dependent enzymes and interferes with thiamin absorption and phos- phorylation. The drug, Dilantin, can increase folate requirements and Sinemet, used to treat Parkinsonism, can cause niacin deficiency.

Nutritional services in the health care of the older persons

About 85% of older persons have one or more chronic, potentially debilitating diseases and could benefit from nutrition services. Up to half of older individuals have clinically identifiable nutrition problems requiring professional intervention (3). If the goal of health promotion is to assure the older persons' health, independence, and quality of life, incorporation of nutritional services into the continuum of health care -- institution, ambulatory, and home-based care -- for older persons is paramount. Since older persons are more susceptible to foodborne poisoning than younger people, proper sanitation practices are needed in food preparation and service in all these health care settings.

o Nutritional Assessments

Nutritional services, whether therapeutic, rehabilitative, or maintenance services, include clinical, educational and foodservice components. As part of clinical services, nutritional assessments should become routine parts of physical examinations for all older residents of health care facilities, nursing homes, or community health centers (84). In turn, the findings of these assessments should guide medical orders including drug regimens, scheduling surgery, dietary guidance, and other nutritional therapy. (The limitations of assessments were discussed earlier.)

Complete diet histories provide information on eating habits that can identify nutrient inadequacies early. Since the food habits of the older persons reflect long-term patterns, special attention to the food preferences, cultural and religious beliefs, economic status, drug and supplement use, and lifestyles can enhance compliance with specific dietary regimens, while ensuring they obtain enough food and enough of the food they like.

For hospitalized or institutionalized patients, regular documentation of food intake may alert health professionals to potential nutrition problems (5). Anorexia, induced by drug or radiation therapies or resulting from surgery or chronic conditions, can quickly lead to nutrient deficiencies, especially in frail older persons. Nutritional therapies, either enteral or parenteral, formulated feedings, have minimized attendant medical complications (e.g., infection), improved therapeutic responses, and sped recovery in some patients. However, the prospective payment system of financing health care (discussed below) may be a disincentive to use of nutritional support in hospitals.

For the hospitalized or frail older persons who cannot eat, providing adequate nutrition support through tube or intravenous catheter can contribute to regaining health and independence. Enteral and parenteral feedings can sustain life for patients who are physically unable to swallow, digest, or absorb food and fluids taken by mouth and for patients who refuse to eat.

The efficacy of these therapies is not universal across all diseases. Little is known about the efficacy in older persons, partly because of the lack of information on the nutritional requirements and standards for the older persons. Nutritionists and other health care professionals will more frequently participate in debates about withholding and withdrawing nutritional support and hydradration from terminally ill, comatose, and severely debilitated people. In addition, health care providers will be faced with questions about when and if to use these treatments with severely demented persons who cannot decide on the course of their therapy and may need to be physically restrained (85).

• Education and training for working with older persons

With the emergence of diverse health problems among the fast-growing numbers of older persons, the number of education and training programs on aging and geriatric nutrition have grown. NIA sets

as two high priorities: 1) training of clinicians and biomedical researchers to specialize in nutrition and aging issues and 2) development of centers of excellence in nutrition and aging research.

Professional societies (86), research centers (87) and programs for medical, nursing, and nutrition students (88, 89) have offered courses or seminars to address ethical concerns in nutrition for long-term care patients and to encourage positive attitudes toward the older persons. Although it may be necessary to train some health professionals to be geriatric specialists, the benefits of "main-streaming" older persons into generic health care services outweigh the hazards of stigmatizing and stereotyping their health problems (89). Appropriate funding for ambulatory and health care services for older persons may also change the perception of students that these jobs are often low paying.

- Impact of health care financing on nutritional care of older persons

As the population ages and individuals live longer, health care expenditure will increase. The major reason for this increase is that health care utilization is greatest among the older persons, especially the oldest old -- the segment of our population that is growing the fastest. To date (1984) major sources of financing the health care of older persons in the United States are: 1) medicare (49%), 2) out-of-Pocket (25%), 3) medicaid (13%), 4) insurance (7%), and 5) other government sources (6%). The federal government pays for about 68% of all health care expenditures (90).

Government expenditures are dispersed as follows: 39% to hospital costs, 20% to personal health and physician services expenditures, and 21% to nursing home and other expenditures. In 1983, due to escalating health care expenditures, Congress and the Administration proposed reform -- the prospective payment system (PPS) for Medicare reimbursement of hospitals.

Under the PPS, Medicare pays for each hospital admission, a rate predetermined on the basis of the patient's principal diagnosis and certain other factors. Each admission is assigned to one of 468 diagnosis related groups (DRGs) for payment. PPS is intended to discourage extended inpatient stays and encourage the substi- tution of less expensive care outside of the hospital (91). As a result of the PPS there has been a decline in the average length of stay for Medicare patients, and therefore an increased demand for postdischarge services. The prospective payment system provides a financial incentive for hospitals to cut costs below the reimbursable level and adjust inputs, such as tests, personnel time, and special procedures (92). Studies are determining the impact of PPS on the quality of care (92) and on access to in-hospital nutritional support services (93).

The impact of PPS on the nutritional status of post discharge patients also needs examining. Patients are discharged early in what appears to be poorer states of health and needing extensive care (94). Health providers are finding it harder to retain patients requiring long term nutritional support for a long enough time to monitor their status and train them before discharge. Since October 1983 greater numbers of these patients (40% increase in discharges) are being transferred to skilled-nursing homes or requiring home health care (95). Often these facilities do not have the proper equipment, supplies or trained personnel to deliver safe and appropriate tube or intravenous catheter feeding (5). Hospice programs and some home health care programs include nutritional services; however, the majority of alternative community-based services do not include nutritional services (3). The costs of nutrition services provided by hospice programs are absorbed under the organization's administrative overhead (3) because medicare and most third party payment services do not reimburse nutrition services directly.

Cost containment pressures are projected to shift more demand from the hospital to the community, especially to home care services traditionally provided through the nonprofit sector. The number of Medicare certified home health agencies increased from 2,212 in 1972 to 5,755 in 1985. The growth has primarily taken place in facility-based and for-profit home health agencies, while the number of more traditional nonprofit providers -- visiting nurse associations and government agencies -- has declined slightly (96). Questions arise as to how the communitycare nonprofit sector will cope with the increasing demands for delivering of highly technical in-home health care that drains resources from delivery of more traditional, community-decided, multi-services (e.g., transportation, food preparation assistance, primary health care) (97).

Technological advances and feeding the older persons

Changes in the physiology and organ systems of older persons challenge the food industry as it attempts to serve the growing market of elders. Creativity will be needed to formulate products that are flavorful, visually attractive, and have high nutrient densities. Products will need to supply high nutrient levels for their caloric value. Fortified products need to assure high bioavailability of the added nutrients. For several years, food manufacturers have been gradually lowering the salt, fat, and sugar content of food, while retaining good flavor in most products. Manufacturers have also addressed current nutrition research concerns by increasing the fiber, calcium, and vitamin D content of cereals and other foods. Special diet products that are low

protein, cholesterol-free, lactose-free, or very low in sodium are also available (35, 98). An earlier section also discussed the use of parenteral and enteral feedings.

Supermarkets and food stores are recognizing their responsibilities toward their aging clients. Some grocery stores are establishing specific shopping hours for senior citizens complete with bus service, bargain sales, and refreshments. Other ways to reduce barriers to food shopping include: 1) sales on small packages and at off peak-hour times, 2) educational materials written in larger print that suggest tips for meal planning, budgeting and food preparation for single-person households; 3) take-home product listings to use with telephone orders, 4) shelf-labels with large print, 5) uncluttered aisles, and 6) convenient benches and rest rooms (81).

Nutrition and food assistance programs

Over the past 20 years, both the public and private sector have initiated and reformed food assistance programs to respond to evidence that nutritional deficiencies were prevalent in older persons, especially those with low-income or who are socially isolated. A variety of services are now available to elders with a continuum of functional capacity (99). The Continuum of Community Nutrition Services model developed by Balsam (100) describes this variety.

Federal nutrition programs include the food stamp program, the commodity supplemental food program, the congregate feeding program, and the home-delivered meal program. Private charities have teamed with the public programs to expand food service to elders. Soup kitchens offer breakfasts and suppers and food pantries provide emergency food boxes. Luncheon clubs (101) have permitted seniors receiving home delivered meals to congregate in neighbors' homes. Restaurants have cut prices for older persons and accepted their food stamps. Food industries have designed packaging and processing techniques to provide shelf-stable meals for evening and weekend use. Volunteers offer escort services to supermarkets or deliver groceries to many home-bound persons (102).

Revisions to the USDA Food Stamp Program extended benefits to low income elders by eliminating the purchase requirement and increased their benefits by allowing for medical and shelter deductions (103). Nonetheless, many older persons still receive only minimal benefits ($10/month) and their participation rates are low (<50% of eligible) (90). For low-income, often frail, elders, who were uninterested in receiving food stamps and had difficulty in shopping, Congress authorized delivery of low-cost commodity packages under the Commodity Supplemental Food Program.

The DHHS National Nutrition Program for Older Americans, as specified in Title III of the Older Americans Act, includes food service for both the ambulatory old (congregate feeding) and the home-bound old (home-delivered meals) (3). Evaluations (103, 104, 105, 106) of the congregate feeding program and the home-delivered meals (107) generally show that participants have higher intakes of essential nutrients than nonparticipants.

During recent hearing on program reauthorization, the American Dietetic Association (ADA) (108) raised concern that future program budgets must account not only for the annual inflation but also for the annual rate of increase in the older population. The flexibility in funding for Title III concerns many because it permits shifting funds from meal programs to supportive services. Currently, the congregate feeding program reaches only 10% of the eligible population. The need for home-delivered meals has increased significantly (35% to more than 50% increase in persons receiving meals) in the first year after the implementation of the new prospective payment system of health care financing (3). As dietary restrictions become more complex, especially for those in their late 70s or 80s, demand for special meals and nutrition information will increase, requiring additional program resources and qualified professionals.

To formulate policies for food assistance programs requires attention to:

a. Planning and conducting systematic evaluations of food programs to assure they meet the changing needs (nutritional, social, educational, and economical) of the heterogeneous older population;
b. Developing new approaches to reach underserved groups of elders, such as the homeless and socially impaired elderly, minority and ethnic elders, and to extend food service beyond weekday lunches;
c. Setting and revising (as needed) nutritional guidelines for meals served in senior citizen feeding programs;
d. Establishing a clearinghouse for exchanging information on innovative programs that meet identified community needs;
e. Assuring that educated and trained nutrition professionals assist with planning and monitoring these programs at all levels of government.

Nutrition education and information

The tools that promote good nutritional health for older persons are most probably the nutrition information gained from mass media or education programs. Because of the myriad of nutrition messages received, sorting out consistent truths from half-truths or conflicting information frustrates people at all ages. Educators need effective ways to minimize the confusion and also to translate current, relevant research into dietary advice applicable to elders. The great heterogeneity among older persons and the reality that life-long habits are resistant to change make designing nutrition messages a challenge for educators.

Key to appropriate, effective nutrition education for this group is understanding the complexities of aging, applying knowledge of the change process, and assessing cognitive, affective, and nutritional status changes (109). Effective nutrition education also requires knowing the perceptions older persons have toward eating and foods. Many older persons, relate food to social interactions and entertainment and also recognize food as a source of nutrients that is important to health (110). More research on factors that facilitate learning and making dietary changes can improve nutrition education efforts (111).

Applying communication theory (112) and marketing principles (113) to nutrition education enhances the chances that the consumer will act on the research-based dietary guidance. Such an approach allows the audience to identify what they want to know, how they want to receive information, where they want to learn, and how often they want follow-up. For example, older persons have sought a uniform set of dietary guidelines, appropriate for most chronic diseases. They have also posed questions about health fraud, use of vitamin and other dietary supplements, and drug and food interactions (114).

Though not tailored specifically for older persons, the DHHS/USDA Dietary Guidelines for Americans provide essential information for motivating dietary changes that promote health. Modifying the text slightly to be more relevant for older persons, printing copies with large lettering, and distributing them through Title III programs could permit wider use. The Healthy Older People program conducted by the Office of Disease Prevention and Health Promotion promotes good nutrition, proper exercise, and other health messages through the media and consumer education materials (115). Combatting health fraud is a priority of the FDA, the Federal Trade Commission (FTC), and Congress. The two agencies have launched an educational/media campaign against health fraud, and recently sought stronger court actions against false advertisements for dietary supplements (115). Since nutrition education has been found to be negatively correlated with misconceptions about "vitamin/mineral supplements" (116), informing older persons about the benefits and hazards of dietary supplements could result in more prudent use of these substances. Food labels also provide good sources of nutrition information; but without close monitoring of the health claims on labels, older persons could be deceived or adopt false expectations of the food.

Title III of the Older Americans Act is the only federal nutrition program for older people that reimburses nutrition education. Based on the recent National Association of Area Agencies on Aging and the Administration on Aging's survey results (117), nutrition education, though often a high priority for some program administrators, is not routinely incorporated into all programs. Three reasons most frequently cited for lack of nutrition education are inadequate funds, the absence of qualified nutrition educators, and the lack of specific program standards and guidelines for nutrition education (118).

Other nutrition policy considerations might include (119):

1. What central nutritional message do seniors want - changing the amount of food eaten, eating more nutritious foods, understanding drug and food interactions, or learning about and using community nutrition programs?
2. How can the messages delivered by the federal government be better coordinated, and how can the government messages be coordinated with those of the private sector?
3. What format, language, and style for educational materials are most useful and appealing to older persons?
4. What medium (e.g., groups, mass media) is most effective to use in reaching older persons as a group and the various subgroups over age 65?
5. What should be done to assure that qualified nutritionists assist with planning, coordinating, evaluating, and monitoring nutrition education programs at the federal, state, and local level?

REFERENCES

1. U.S. Congress, Office of Technology Assessment. Technology and Aging in America. Health Promotion/Disease Prevention and Nutrition in the Elderly. Washington, D.C.: Government Printing Office, 1985. pp. 119-134

2. Costell, DO. Diagnosis of Non-Cardiac Chest Pain in Older Patients. Geriatrics 1985; 40(10): 61-86

3. Posner, BM., Fanelli, MT., et al. Position of the American Dietetic Association: Nutrition, Aging, and the Continuum of Health Care. J Am Diet Assoc 1987; 87(3): 344-347

4. Guthrie, HA. Supplementation: A Nutritionist's View. J Nutr Ed 1986; 18(3): 130-132

5. Chernoff, R. and Lipschitz, DA. Aging and Nutrition. Comprehensive Therapy 1985; 11(8): 29-34

6. Norton, L. and Wozny, MC. Residential Location and Nutritional Adequacy Among Elderly Adults. J Gerontol 1984; 39: 592- 95

7. Akin, JS et al. Cluster Analysis of Food Consumption Patterns of Older Americans. J Am Diet Assoc 1986; 86: 616-24

8. Villers Foundation. On the Other Side of Easy Street. Washington, D.C.: Villers Foundation, 1987

9. Lewis, M. Older Women and Health: An Overview. Women & Health 1985; 10:1-6

10. Bailey, FE. and Walker, ML. Socio-Economic Factors and Their Effects on the Nutrition and Dietary Habits of the Black Aged. J Gerontol Nursing 1982; 8(4): 203-7

11. Newman, JM. Cultural, Religious and Regional Food Practices of the Elderly. J Nutr Elderly 1985; 5(1): 15-19

12. Netland, PA. and Brownstein, H. Acculturation and the Diet of Asian- American Elderly. J Nutr Eld 1984; 3(3): 37-56

13. Newman, JM. and Ludman, EK. Chinese Elderly: Food Habits and Beliefs. J Nutr Eld 1984; 4(2): 3-13

14. Davis, MA. and Randall, E. 1981 Social Change and Food Habits of the Elderly. National Institute of Aging's Social and Psychological Developments in Aging. Paper for the White House Conference on Aging 1981.

15. Schneider, EL., Vining, EM., Hadley, EC., et al. Recommended Dietary Allowances and the Health of the Elderly. N Engl J Med 1986; 314(3): 157-60

16. Elahi, VK., Elahi, D., Andres R., et al. A Longitudinal Study of Nutritional Intake in Men. J Gerontol 1983; 162-180

17. Garcia PL., Battese GE., and Brewer, WD. Longitudinal Study of Age and Cohort Influences on Dietary Patterns. J Gerontol 1975; 30: 349-56

18. Dresser, CM, Dietary Status of Community-Based Older Persons. Paper presented at the American Dietetic Association 67th Annual Meeting, Washington, D.C., Oct. 15-18, 1984

19. Cronin, FJ., Krebs-Smith, SM., Wyse, BW., et al. Characterizing Food Usage By Demographic Variables. J Am Diet Assoc 1982; 81: 661-73

20. USDA. Nutrient Intakes: Individuals in 48 States, Year 1877-78. Nationwide Food Consumption Survey 1977-78 Report No. I-2. Human Nutrition Information Service, USDA, 1984

21. Suter, PM. and Russell, RM. Vitamin Requirements of the Elderly. Am J Clin Nutr 1987; 45: 501-12

22. Garry, PJ., Goodwin, JS., Hunt, WC., et al. Nutritional Status in a Healthy Elderly Population: Dietary and Supplemental Intakes. Am J Clin Nutr 1982. 36: 319-31

23. Omdahl, Jl., Garry PJ., Hunsaker, LA., et al. Nutritional Status in a Healthy Elderly Population: Vitamin D. Am J Clin Nutr 1982; 36: 1225-33

24. DHHS/FDA. Consumer Nutrition Knowledge Study: A Nationwide Study of Foodshopper's Knowledge, Beliefs, Attitudes, and Reported Behavior Regarding Food and Nutrition Report II 1975. Washington, D.C.: Government Printing Office, 1976

25. McDonald, JT. Vitamin and Mineral Supplement Use in the U.S.. Clin Nutr 1986; 5(1): 27-33

26. Stewart, ML., McDonald, JT., Levy, AS., et al. Vitamin/Mineral Supplement Use: A Telephone Survey of Adults in the United States. J Am Diet Assoc 1985; 85(12): 1585-90

27. Shank, FR. and Wilkening, VL. Consideration For Food Fortification Policy. Cereal Foods Wld 1986; 31(10): 728-740

28. Cordaro, JB., and Dickinson, A. The Nutritional Supplement Industry-- Realities and Opportunities. J Nutr Ed 1986; 18(3): 128-129

29. Scheider, CL., and Nordlund, DJ., Prevalence of Vitamins and Mineral Supplement Use in the Elderly. J Fam Prac 1983; 17: 243-47

30. Garry, PJ., Goodwin, JS., Hunt, WC., et al. Nutritional Status in a Healthy Elderly Population: Vitamin C. Am J Clin Nutr 1982; 36: 332-39

31. Lecos, CW. Diet and the Elderly, Watch Out for Food-Drug Mismatches. FDA Cons 1984/85; 18(10): 7-9

32. DHHS/NCHS. Health Promotion Data for the 1990 Objectives, Vital and Health Statistics, Washington, D.C.: Government Printing Office, Sept 1986; Number 126

33. Chernoff, R. Aging and Nutrition. Nut Today 1987; March/April: 4-11

34. U.S. Congress, Office of Technology Assessment. McGandy, R. Nutrition and Aging. Final Report for the Office of Technology Assessment, 1985

35. Bidlack, WR., Smith, CH., Clemens, RA., et al. Nutrition and the Elderly. Institute of Food Technologists'. Expert Panel on Food Safety and Nutrition

36. DHHS/NCHS. Health Statistics on Older Americans. Vital and Health Statistics Washington, D.C.: Government Printing Office, 1986 series 3(25)

37. DHHS/NCHS. Health United States 1985. Washington, D.C.: Government Printing Office, 1985

38. DHHS/NCHS. Prevalence of Known Diabetes Among Black Americans, Vital and Health Statistics, Washington, D.C.: Government Printing Office, 1987; Number 130

39. Bauer, RL., Diehl, AK., Barton, SA., et al. Risk of Postmenopausal Hip Fracture in Mexican American Women. AJPH 1986; 76(8): 1020-21

40. Atwood, DA. Bone Loss of Edentulous Alveolar Ridges. J Periodontol 1979; 51: 11-21

41. Tallgren, A. The Continuing Reduction of the Residual Alveolar Ridges in Complete Denture Wearers: A mixed-longitudinal Study Covering 25 Years. J Prosthet Dent 1972; 27: 120-32

42. Norris, AH. and Shock NW. Aging and Variability. Annals NY Acad Sci 1966; 134: 591-601

43. O'Hanlon, P. and Kohrs, MB. Dietary Studies of Older Americans. Am J Clin Nutr 1978; 31: 1257-69

44. Roe DA. Geriatric Nutrition. Englewood Cliffs, New Jersey: Prentice-Hall Inc., 1983. pp. 1-199

45. Chumlea, WC., Roche, AF., and Steinbaugh, ML. Estimating Stature From Knee Height for Persons 60 to 90 Years of Age. J Am Geriatr Soc 1985; 33: 116-120

46. Lipschitz, DA., Mitchell, CO. Nutritional Assessment of the Elderly-- Special Considerations. Wright and S Heymsfield (Eds.), Nutritional Assessment Boston: Blackwell Scientific, pp. 131-39

47. Fanelli, MT. The ABC's of Nutritional Assessment in Older Adults. J Nutr Eld 1987; 6(3): 33-41

48. Clemens, RA., and Brown, RC. Biochemical Methods for Assessing the Vitamin and Mineral Nutritional Status of the Elderly. Food Tech 1986; 40(2): 71-81

49. O'Neal, RM., Johnson, OC., and Schaefer, AE. Guidelines for Classification and Interpretation of Group Blood and Urine Data Collected as Part of the National Nutrition Survey. Pediatr Res 1970; 4 103-6

50. Sauberlich, HE., Dowdy RP., and Skala, JH. Laboratory Tests for the Assessment of Nutritional Status. Cleveland, OH: CRC Press Inc., 1974.

51. Howell, S. and Loeb, MB. Nutrition and Aging. Geriatr 1969;9(3): 1-122

52. National Academy of Sciences, National Research Council. Lewin, K. Forces Behind Food Habits and Methods of Change. The Problem of Changing Food Habits. Bulletin Number 108, Washington, D.C.: National Academy Press, 1943

53. Gifft, HH., Washbon, MV., Harrison, GG. Nutrition, Behavior, and Change. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1872. pp. xiii-xv

54. Schiffman, SS. Mechanisms of Disease, Taste and Smell in Disease. N Engl J Med 1983; 308(21): 1275-79

55. Schiffman, SS. and Pasternak, M. Decreased Discrimmination of Food Odors in the Elderly. J Gerontol 1979; 34(1): 73-79

56. Bidlack, WR., Kirsch, A., and Meskin, MS. Nutritional Requirements of the Elderly. Food Tech 1986; 40(2): 61-9

57. Munro, HN., McGandy, RB., Hartz, SC. et al. Protein Nutriture of a Group of Free-living Elderly. Am J Clin Nutr 1987; 46(4): 586-92

58. Russell, RM., Krasinski, SD., Samloff, IM. et al. Folic Acid Malabsorption in Atrophic Gastritis: Compensation by Bacterial Folate Synthesis. Gastroenterology 1986; 91: 1476-82

59. MacLaughlin, J. and Holick, MF. Aging Decreases the Capacity of Skin to Produce Vitamin D3. J Clin Invest 1985; 76: 1536-8

60. Davis, M., Mawer, EB., Hann, JT. et al. Vitamin D Prophylaxis in the Elderly: A Simple Effective Method Suitable for Large Populations. Age and Ageing 1985; 14: 349-54

61. Bowman, BB., Rosenberg, IH. Assessment of the Nutritional Status of the Elderly. Am J Clin Nutr 1982; 35: 1142-1151

62. Pelletier, O. Vitamin C and Cigarette Smokers. Ann NY Acad Sci 1975; 258: 156-68

63. Sahud, MA. and Cohen, RJ. Effect of Aspirin Ingestion on Ascorbic Acid Levels in Rheumatoid Arthritis. Lancet 1971; 1(2): 937-8

64. National Academy of Sciences, Food and Nutrition Board. Recommended Dietary Allowances. Washington, D.C.: National Academy Press, 1980

65. Krause, MV. and Mahan, LK. Food, Nutrition and Diet Therapy 7th Edition. Philadelphia, Pennsylvania: W.B. Saunders Co., 1984. pp. 182, 327, 441, 605,

66. Wolford, RL., Harris, SB., and Weindruch, R. Dietary Restriction and Aging: Historical Phases, Mechanisms, Current Directions. J Nutr, in press Oct., 1987.

67. Drinkwater, BL. The Role of Nutrition and Exercise in Health. Seattle, Washington: Continuing Dental Education, University of Washington, 1985. pp. 88-92

68. Nieman, DC. The Sports Medicine Fitness Course. Palo Alto, California:Bull Publishing Co., 1986. pp. 330-40

69. Roe, DA. Nutrition and Drug Interactions, Present Knowledge in Nutrition. Washington, D.C.: The Nutrition Foundation, 1984, pp.797-818

70. Hartz, SC., (ed). Drug-Nutrient Interactions, proceedings of the International Conference on Nutrients, Medicines and Aging. New York: Alan R. Liss, Inc. 1985; 4(1/2)

71. Riggs, BL. and Merton III, LJ. Involution Osteoporosis. N Engl J Med 1986; 314(26): 1676-84

72. Riggs, BL., Wahner, W., Seeman, K., et al. Changes in Bone Mineral Density of the Proximal Femur and Spine With Aging. J Clin Invest 1982; 70: 716-723

73. Kelsey, JL. and Hoffman, S. Risk Factors for Hip Fracture. N Engl J Med 1987; 316(7): 404-6

74. Johnston, CC., Norton, J., Khairi, MRA., et al. Heterogeneity of Fracture Syndromes in Postmenopausal Women. J Clin Endocrinol Metab 1985; 61(3):551-6

75. DHHS/NIH. Consensus Development Conference Statement, Osteoporosis. Washington, D.C.: U.S. Government Printing Office, 1984

76. Buchanan, JR., Myers, C., Greer, RB., et al. Assessment of the Risk of Vertebral Fracture in Menopausal Women. J Bone Joint Surg 1987; 69-A(2): 212-17

77. Hartz, AJ., Fischer, ME., Bril, G., et al. The Association of Obesity With Joint Pain and Osteoarthritis in the HANES Data. J Chronic Dis, 1986; 39(4): 311-19

78. Fernstrom, JD. Acute and Chronic Effects of Protein and Carbohydrate Ingestion on Brain Tryptophan Levels and Serotonin Synthesis. Nut Reviews (Suppl) 1986; 44:25-36

79. Wurtman, RJ. Ways That Foods Can Affect The Brain. Nutr Reviews (Suppl) 1986; 44: 2-5

80. Sandstead, HH. Nutrition and Brain Function: Trace Elements. Nutr Reviews (Suppl) 1986;44: 37-41

81. Pardridge, WM. Blood-Brain Barrier Transport of Nutrients. Nutr Reviews (Suppl) 1986; 44: 15-23

82. Anderson, GH., and Hrboticky, N. Approaches to Assessing the Dietary Component of the Diet-Behavior Connection. Nutr Reviews (Suppl) 1986; 44: 42-51

83. Wheater, RH. Aluminum and Alzheimer's Disease. JAMA 1985; 253(15): 2288

84. Schaeffer, AE. Nutrition Policies for the Elderly. Am J Clin Nutr 1982; 36: 819-822

85. U.S. Congress, Office of Technology Assessment. Life-Sustaining Technologies and the Elderly. Washington, D.C.: U.S. Government Printing Office, 1987

86. Lipschitz, DA., and Chernoff, R. Nutritional Care a Growing Issue for Providers. Am Health Care Assoc J Dec 1985: 47-48

87. Institute for Health and Aging. Health Promotion for the Elderly: Clinical Practice and Community Resource Series. University of California, San Francisco, 1986

88. Shoaf, LR. and Kotanchek, NS. Training in Geriatrics for Future Dietitians. J Am Diet Assoc 1987; 87(3): 330-33

89. Wilson, SL., Whittington, FJ. Preparing Nutrition Students to Work With the Elderly. J Nutr Ed 1985; 17(2): 44-6

90. U.S. Senate, Special Committee on Aging. Developments in Aging: 1986 Volume 3. Washington, D.C.: U.S. Government Printing Office, 1987

91. U.S. Congress, Office of Technology Assessment. Medicare's Prospective Payment System--Strategies for Evaluating Cost, Quality and Medical Technology. Washington, D.C.: U.S. Government Printing Office, 1985

92. Prospective Payment Assessment Commisssion. Report and Recommendations to the Secretary, U.S. Department of Health and Human Services, April 1, 1987. Washington, D.C.: Prospective Payment Assessment Commission, 1987

93. Adamow, CL. and Clipper, AJ. Is prospective payment inhibiting the use of nutrition support services? Discussion and research implications. J Am Diet Assoc 1985; 85(12):1616-9

94. Statements of Eleanor Chelimsky, GAO, Judith Wagner, Office of Technology Assessment, and Donald A. Young, Prospective Payment Assessment Commission, on "Quality of Care Issues in the Medicare Program" before the U.S. Senate, Committee on Finance, June 3, 1986.

95. U.S. Senate, Special Committee on Aging. Developments in Aging: 1986 Volume 1. Washington, D.C.: U.S. Government Printing Office, 1987

96. U.S. General Accounting Office. Medicare: Need to Strengthen Home Health Care Payment Controls and Address Unmet Needs. Washington, D.C.: Government Printing Office, 1986

97. Estes, CL. The Aging Enterprise: In Whose Interests?. Int J Health Serv 1986; 16: 243-251

98. Leveille, GA. and Cloutier, PF. Role of the Food Industry in Meeting the Nutritional Needs of the Elderly. Food Technology 1986; 2: 82-88

99. Posner, B. and Karachenfels, M. Optimal Nutrition Services for Older Americans, Boston: Mass Dept of Public Health, 1985

100. Balsam, A. and Osteraas, G. Instituting A Continuum of Community Nutrition Services: Massachusetts Elderly Nutrition Programs. J Nutr Eld. accepted for publication in Spring, 1987

101. Balsam, AL. and Duffy, M. Elderly Luncheon Clubs: Bridging the Gap Between Congregate and Home Delivered Meals. J Nutr Eld 1983; 2(4): 31-35

102. Steele, MF. and Bryan, JD. Dietary Intake of Homebound Elderly Recipients and Non-Recipients of Home Delivered Meals. J Nutr Eld 1985/6; 5(2): 23-34

103. Welmer, JP. The Nutritional Status of the Elderly. J Nutr Eld 1983; 2(4): 17-25

104. Kirschner Associates, Inc. and Opinion Research Corporation. An Evaluation of the Nutrition Services for the Elderly, prepared for the Administration on Aging, DHHS, Washington, D.C.: Government Printing Office, 3 Vols., 1983

105. Harrill, I., Bowski, M., and Kyler, A. The Nutritional Status of Congregate Meals Recipients. Aging 1980; 311, 312 : 36-41

106. Balsam, A., Osteraas, G., Bass, S., et al. An Evaluation of the Congregate Nutrition Program for the Elderly. Boston: Univ Mass Ger Program, 1985

107. Yessian, M. and Monier, C. Follow Up on the Home Delivered Meals Program Service Delivery Assessment. DHHS, Office of the Inspector General, 1982

108. American Dietetic Association. ADA Testimony on the 1987 Reauthorization of the Older Americans Act of 1965. J Am Diet Assoc 1987; 87(7): 943-4

109. Shannon, B. and Smiciklas-Wright, H. Nutrition Education in Relation to the Needs of the Elderly. J Nut Ed 1979; 11: 85-89

110. Axelson, L. and Penfield, MP. Food and Nutrition-Related Attitudes of Elderly Persons Living Alone. J Nut Ed 1983;15(1): 23-27

111. Sims, LS. Nutrition Education Research: Reaching Toward the Leading Edge. J Am Diet Assoc (Suppl) 1987; 87(9): 10-18

112. Gillespie, AH. Communication Theory as a Basis for Nutrition Education. J Am Diet Assoc (Suppl) 1987; 87(9): 44-52

113. Fleming, PL. Applications of the Marketing Perspective in Nutrition Education. J Am Diet Assoc (Suppl) 1987; 87(9): 64-8

114. Maloney, SK., Fallon, B., and Wittenberg, CK. Study of Seniors Identifies Attitudes, Barriers to Promoting Their Health. Promot Health 1984; Sept- Oct: 6-8

115. U.S. Senate, Special Committee on Aging. Developments in Aging: 1986 Volume 2-Appendixes. Washington, D.C.: U.S. Government Printing Office, 1987

116. Grotkowski, ML. and Sims, LS. Nutritional Knowledge, Attitudes and Dietary Practices of the Elderly. J Am Diet Assoc 1983; 47: 263-68

117. Aging Health Policy Center. Nutrition Policy and the Elderly, Policy Paper No. 2. San Francisco: University of California, 1983

118. Hickman, D. Nutrition Education, Past, Present and Future. Aging 1980; 311, 312: 17-20

119. Posner, BM. Nutrition Education for Older Americans: National Policy Recommendations. J Am Diet Assoc 1982; 80: 455-8

HEALTH PROMOTION AND AGING
"PREVENTIVE HEALTH SERVICES"

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The problems of old age pose an unprecedented challenge to health professionals. The potential of preventive health care to contribute to the wellbeing of the elderly, to result in economic savings due to caring for a less disabled population, and to provide a more humane, less technological approach to medical care, has aroused considerable interest. Health maintenance of the elderly, nevertheless remains a complex, controversial and emotional topic.[1] Fundamental to the successful application of preventive strategies for the elderly is an understanding of the scope of prevention as it applies to the elderly.[2]

Patterns of disease and functional limitations are related to the demography of the elderly population.[3] Life expectancy statistics by age, race and sex demonstrate that after reaching age 65 Americans have considerable mean life expectancy. For example, 75 year old white women can be expected to live a mean of 12 more years; 75 year old black men can be expected to live a mean of 9 more years.[4] This remarkable expectation for additional life emphasizes the opportunities for disease prevention among the old.

The most common causes of death among individuals over the age of 65 are heart disease and cancer with heart disease accounting for nearly half of all deaths. Cancer deaths are mainly due to colon, breast, uterus, prostate cancer, and leukemias. Other common causes of death include injuries, pneumonia, diabetes, and pulmonary disease.[4]

In 1977, adults 65 years of age and over had 14.5 bed-disability days, and in 1984 15.1 days.[5] Chronic medical conditions are significant contributors to functional impairment. Common chronic impairments include arthritis, hypertension, hearing loss, heart disease, vision loss, and diabetes.[6] Recent reviews emphasize the importance of identifying factors that increase or decrease the probability of an "impairment" becoming a "handicap".[7-9] Some common handicaps in the elderly include immobility, inability to dress, inability to bathe, and inability to use the toilet. An accumulation of handicaps leading to dependence is a strong predictor of the need for long term care services.

TASKS OF PREVENTIVE HEALTH SERVICES

Effective health maintenance of the elderly requires that a number of tasks be performed by many sectors of society. Although this paper focusses primarily on the job of the health care provider; the elderly themselves, their families, and private and public health systems all contribute to health maintenance. Adoption of a healthy lifestyle by individuals in middle age could contribute greatly to health in later years. Successful aging requires life-long self-development and adaptation to loss. Individuals who plan and respond to expected and unexpected financial and social stress may be able to avoid the problems of isolation and depression.

Families, friends, and other social supporters have the challenge of providing informal and formal support while respecting the older person's autonomy. Over-protection by support interventions that occur prior to real need may inadvertently encourage dependency and accelerate functional loss.

Government and other purchasers of health services have the responsibility to find effective preventive health strategies and encourage their application. For example, Medicare limits payment for preventive health maneuvers, and routine vision, hearing, and dental examinations. Somer's has recently emphasized that selective funding of preventive interventions for the elderly by Medicare may represent an effective "cost control" strategy for the federal government. Somer's has also described the potential of governmental incentives for responsible consumer health behavior.[10]

Combatting agism is a task that the elderly, their families, health care providers, and the government share. There remains a widespread belief that people in their 60's or 70's are too old or disabled for effective preventive health care.

In their progress toward a rational and effective preventive approach for geriatric care, clinicians must clarify the complexities of applying anticipatory strategies to this age group. In addition strategies addressing the prevention of specific diseases, health maintenance plans for the elderly should include: a re-evaluation of the traditional preventive health delivery systems, personalized health maintenance measures, reduction of iatrogenic problems, addressing the needs of family caregivers, strategies to enhance functional status, and strategies to strengthen social supports.

The purpose of this paper is to discuss the guidelines by which preventive health services should be applied to this older age group; to review clinical trials in which health maintenance packages have been applied to the elderly population; and to provide a guide to potential preventive health maneuvers.

PRINCIPLES OF APPLYING HEALTH MAINTENANCE STRATEGIES TO THE ELDERLY

Scientific Validation of Maneuvers

Ensuring a sound scientific basis for a preventive health intervention has been addressed in recent years by McKeown[11], Cochrane and Holland[12], Spitzer[13], Sackett[14,15] Frame and Carlson[16,17] and the Canadian Task Force on the Periodic Health Examination[18,19].

This work has been essential in protecting the healthy population from iatrogenic insult, preventing unnecessary costs both to the individual and to society, and to maintain the "scientific integrity" of the professionals concerned. It has led to careful study of the impact of disease, the efficacy of detection maneuvers and the quality of evidence supporting the effectiveness of intervention strategies.

The focus of this work has been on early diagnosis through secondary prevention or screening.[15] Recommendations have also been made in the area of primary prevention, such as immunizations. Screening includes large public health programs; for example, checking blood pressure at the senior center. The combination of several tests as a screening package is referred to as multiphasic screening. The periodic health examination is when screening occurs as a preventive health visit in the physicians office. When preventive health services occur as part of ongoing acute or chronic health care this is referred to as case

finding.[20] For example, a 75 year old man presenting with acute bronchitis also has his blood pressure checked and is given guiac cards to take home to check for occult blood in the stool.

These strategies focus on the detection of asymptomatic disease. Yet, the relevance of this work to the elderly is somewhat limited, for it has focussed on primary and secondary prevention strategies for biomedical disorders in young populations. This is useful insofar as old age is not a separate period of life but part of a continuum, and for full effectiveness preventive measures need to start in childhood and continue throughout adult life. Nevertheless it does not provide the practicing clinician with a course of action when confronted with frail, elderly patients.

Personalize Preventive Health Services

The elderly are a heterogenous population and their health care must be personalized. In doing this, the following principles should be considered:

Recognize that Death May be a Legitimate End Point: A patient's right to benefit from the developments of medical science is incontestible but at some point in the life cycle, however, a patient has the right to die peacefully and with dignity. This is particularly true for those suffering from irremediable disease. Preventive health care of the elderly, therefore, has as its principal goal not simply the prolongation of life but improvement of the quality of that life.

Minimize Unnecessary Disruption to Life Style: A number of preventive health measures have the potential for disrupting a patient's life. Prescribing a low-sodium or weight-reduction diet, or urging the patient to stop smoking are examples. While these measures have a place in the management of selected groups of patients, the clinician must appreciate that in old age, when the chance of prolonging life is limited, the quality of that life is more relevant. Many patients see restriction of diet or the cessation of smoking as seriously affecting what enjoyment they have left in life. These emotional issues regarding life satisfaction must always be balanced against the theoretical advantages to health. If independently living elderly so wish, they need not comply with the prescribed preventive health measures. Institutionalized elderly are less fortunate and can be prisoners to the zealous application of preventive strategies.

Respect Patients' Autonomy: As elderly patients age they become more frail and may be at risk living alone. A patient's family may become sufficiently anxious about the risk that they try to institutionalize the old person. Despite the express wish of the patient to remain in his own home. The clinician at these times must respect the patient's right to self-determination. The exception to this is the case of the mentally incompetent patient (although the presence of dementia does not necessarily imply incompetence).

Time the Intervention Precisely: There is a critical intervention time, or "window", when the various types of preventive support should be provided. A patient's functional status may deteriorate slowly for several years until a crisis develops, then the patient's health deteriorates rapidly. If support is provided too late, institutionalization is often the outcome. If it is provided too early, it fosters dependency, wastes resources, is costly, and is considered by many patients to be an intrusion on their privacy.

Minimize Iatrogenic Insult

There is decline in physiological functioning in almost every organ system in the elderly which results in impaired homeostasis. Reduction of iatrogenic insult is therefore an important goal of health maintenance. Drug induced disease is perhaps the most commonly seen problem, but even the hospitalization process is not without risk for this age group. More and more literature[21,22] reveals significant iatrogenesis from the procedures used including nosocomial infections, falls within the institution and psychologic insult associated with relocation.[23]

Reduction of iatrogenic insult should not only be a goal of health maintenance but should be a principle by which health maintenance strategies are applied. For instance the Hemoccult Slide Test has been recommended for the detection of colorectal carcinoma in those over age 50 years yet is far from ideal as a routine test for use with the frail elderly. In this population the majority of positive tests may not be due to carcinoma but to asymptomatic diverticular disease or duodenal ulceration.[24] This is important because the Hemoccult is not an innocuous test. A positive result mandates an extensive work up from sigmoidoscopy to double contrast enema and colonoscopy. Morbidity in the elderly resulting from these procedures, from the required bowel preparation and from any accompanying hospitalization is significant. These factors must be weighed in the balance when considering the routine use of the Hemoccult Test for the frail but asymptomatic elderly population.

STRATEGIES FOR APPLYING HEALTH MAINTENANCE MEASURES

Screening and Case Finding in the General Population

The conventional approach to applying preventive care strategies is annual or regular screening programs. In the elderly this has been extended to identifying symptomatic but unreported illness by case finding. A number of reports over the last thirty years have suggested the benefit of screening elderly populations. Rubenstein, et al. have recently reviewed published reports of screening programs for the elderly living in the community.[25] Among elderly populations screening has consistently identified significant numbers of active clinical problems. However, the clinical significance of these findings depends on the characteristics of the population being screened, and only a few studies have attempted to measure the effectiveness of screening or case finding among the elderly[26] and only one used a randomized design.[27] This clinical trial involved 295 British patients living in the community. The screening intervention was a traditional medical history (obtained by a nurse and a questionnaire) and a physical exam. The study group increased its use of health and social services but had a decrease in use of in-hospital days as compared to controls. There was no identified impact from screening on physical or social disability. The reliability and validity of the scales used to measure outcomes in this study were not defined.

Screening of the community living elderly may slightly improve mortality rates, but the results remain inconclusive.[28,29] Screening has even less impact on functional status with only marginal non-statistical improvements being observed though in some of the studies the reliability and validity of the scales used to measure the outcomes have not been well defined. Most investigators believe their patients benefit from a screening program and report a perceived increase in patient morale and esteem but these subjective impressions have not been borne out when more sophisticated measurements have been used.[29] At best screening programs for the elderly have been demonstrated to have a marginal and transient effect at best on the quality of life.

Screening of the institutionalized elderly has been reviewed in a number of recent studies. In one study it was found that approximately half of the annual screening examinations produced either a new finding or clarification of an old problem.[30] These new findings were then assessed independently for their degree of importance by the patient's primary care physician. It was estimated that 3.4 per cent were of major importance, 26.8 per cent were of intermediate importance, and 69.8 per cent were of minor importance. These results provided only modest support for endorsing annual medical examinations for nursing home residents. In another survey of an academically affiliated Veterans' Administration Nursing home it was likewise concluded that ongoing health care as part of an academic geriatric program might obviate the need for annual screening or physical examinations.[31]

Levinstein, et al. reviewed the yield of routinely performed panels of laboratory tests in a large, non-profit community skilled nursing unit.[32] They concluded that in their population a CBC, serum electrolytes, urea nitrogen, creatinine, serum glucose, thyroid function tests, and a urinalysis would be beneficial to a substantial number of patients if performed as part of routine care or as annual screening test. The identification and erradiction of asymptomatic bacteriuria was a common result of this screening program, and the authors do state that the value of treating asymptomatic bacteriuria in this population has not been proved. It has been pointed out that none of the recommended tests have also been recommended by the Cannadian Task Force for this age group.[33]

In summary, current evidence for the efficacy of screening and case finding in general populations of community living or institutionalized elderly remains weak.

Screening and Case Finding in Selected Patient Groups

Rather than screen the whole of the elderly population, an alternative is to focus on selected patient groups. The elderly may self-select. For instance, a postal questionnaire has been used to allow those fit enough and with no significant problems to exclude themselves from further study. By using this self-report technique, about a fifth of a screening workload can be avoided.[34]

The results of several pre-admission screening programs suggest that referral for nursing home-type care is a further opportunity for the instigation of health maintenance measures as part of a multidimensional assessment. Apart from bringing to light undetected disease the subsequent rehabilitation and provision of home supports can do much to avert or delay institutionalization and allow resettlement (of the patient) at a less intense level of care.

Another method is to select only those elderly patients perceived to be "at risk". The concept of "risk" has at least two problems. First, the term has been used variously to imply risk of death, risk of increased morbidity, or risk of being institutionalized, all stigmatizing and stressful to the patient. Second, attempts to validate "at risk" groups previously defined in the world literature failed to find any of the definitions particularly effective for case finding.[35]

Periodic Health Examinations

A final strategy for the application of health maintenance measures is opportunistic case finding, that is seeking out unreported illness during normal doctor-patient interactions. This has been shown to be particularly effective where the health care delivery system has a strong primary care base with

primary care providers serving a defined population and acting as "gatekeepers" to a variety of resources. In this way over 90 per cent of an identified elderly patient population may make contact with the primary care base over a one year period.[36] The concept offers both a challenge and opportunity to primary care providers particularly those operating within health maintenance organizations.

Opportunistic case finding also removes the artificial dichotomy between preventive and traditional medical care. Health maintenance measures would no longer be a separate activity performed on a relatively fit population. Health maintenance and traditional medical care thus become integrated and the medical process serves as a major channel for the delivery of preventive health services. Sommer's has suggested that all new Medicare enrollees be required or encouraged to register with a primary physician. Identification of efficacious preventive services and fostering them through Medicare reimbursement is required to implement this strategy.[10]

POTENTIAL PREVENTIVE HEALTH MEASURES

Effective preventive health care of the elderly requires an appreciation of problems outside the narrow focus of primary and secondary prevention. Health in old age consists of three interwoven components: the absence of disease (including iatrogenic disease), an optimal functional status, and an adequate support system. Preventive health services for the elderly should intend to achieve the following goals:

1. Prevent or palliate physical, psychiatric, and iatrogenic disorders.
2. Prolong the period of effective activity and independent living.
3. Ensure a support system adequate to preserve the patient's autonomy, independence, and quality of life at all levels of care.
4. Avoid institutionalization as far as is practical in both humanitarian and economic terms.
5. Ensure that when illness is terminal there is as little distress as possible to patient and caregivers.
6. Minimize the burden on family and other caregivers in order to improve their morale and prolong the period of time they are willing to be caregivers.

Kane and colleagues have developed a framework for developing and evaluating preventive interventions for the elderly.[37] They emphasize that the traditional terminology of prevention is not easily applied to a patient group with chronic diseases. Four groups of potentially preventable clinical problems are outlined: 1) problems that can be addressed in traditional prevention terms (diseases that fit into the usual primary, secondary, tertiary prevention concepts), 2)behaviors likely to produce beneficial or adverse effects on health status (risk factor modification), 3)problems requiring attention from caregivers (case finding and anticipatory care of common geriatric functional problems), and 4) iatrogenic problems. Table 1 lists items relevant to the elderly in each of these four categories. Selected items are discussed below.

TRADITIONAL PREVENTION

Clinical Problem: Bacteriuria
Proposed Preventive Measure: Periodic urine examinations

Therapy has been shown to be effective in erradicating asymptomatic bacteriuria in elderly women[38]. However the effect of this treatment on morbidity and

mortality is unclear. Several studies have suggested a mortality risk associated with bacteriuria among institutionalized elderly.[39-41] However, others have found bacteriuria to be transient and to frequently resolve without treatment.[42]

Clinical Problem: Breast Cancer
Proposed Preventive Measure: Periodic Mamogram

The age-specific incidence of breast cancer, that is the number of cases per year per hundred thousand females in each age group, shows a progressive rise with age. A recent carefully conducted trial from Sweden showed that prognosis was best when the age at diagnosis was between 45 and 49 years, but thereafter survival worsened with increasing age.[43] The difference in relative survival between those older than 75 and those 45 to 49 years increased from 8.6 percent at two years, to 12.2, 20.3 and 27.5 percent after five, ten and fifteen years of follow up respectively. No data are available on the screening of the very old for breast cancer, but case-control studies from Europe indicate a value for mammographic screening in reducing mortality in patients up to 74 years of age.[44,45]

Clinical Problem: Cervical Cancer
Proposed Preventive Strategy: Periodic Pap Smear

The value of regular screening for cervical cancer by use of the Pap smear may decrease in old age. It is suggested that when clinicians are confronted by elderly women with a history of previous normal Pap smears they should repeat this procedure an additional time. If the test is negative, no further screening seems to be required for the age-specific incidence of conversion from negative to positive smears decreases from 0.3 per thousand in women 55 to 59 years old to 0 for those over 80.[46] However, 15% of women aged 65 to 74 years and 38% of women 75 years and older report never having had a Pap smear.[47] These women may require periodic screening.

It is also known that urban, black and hispanic populations have a high incidence of cervical carcinoma as do those with multiple sexual partners, prior venereal disease and those in the lower income group. It may be that screening of these high risk groups should be more aggressive. In a recent survey of an elderly New York population the prevalence rate of abnormal smears was found to be 13.5 per thousand.[48]

Clinical Problem: Colorectal cancer
Proposed Preventive Measure: Six-slide occult blood test: sigmoidoscopy

Colorectal cancer is common in the elderly; peaking in incidence at about age 80.[49] Five year survival rates appear to be similar for older as compared to younger victims. Sigmoidoscopy is recommended by the American Cancer Society (ACS) every three years after the age of 50.[50] The cost and the poor patient acceptance of this test has been discussed.[17] Its acceptance and complication rate in older subjects has not been sufficiently studied.

The ACS and the Canadian Task Force have recommended annual stool occult blood testing. Two large controlled trials have reported promising preliminary results.[51,52] A positive test requires follow-up sigmoidoscopy and barium enema or colonoscopy. The test only detects fecal blood, and in the elderly many false positives will result in lower bowel examinations. The morbidity in the elderly from these procedures, from required bowel preparation and from any accompanying hospitalization may be significant.

Clinical Problem: Endometrial Cancer
Proposed Preventive Measure: Patient education to report postmenopausal bleeding

The incidence of endometrial cancer increases with age.[53] Risk factors include obesity, estrogens, and infertility. This cancer appears to develop over years from endometrial adenomatous hyperplasia. Abnormal endometrial bleeding is found in 80% of women with this cancer;[54] and many of these cases are detected in early stages.[55] Endometrial tissue sampling has been recommended for high risk women.

Clinical Problem: Lung Cancer
Proposed Preventive Measure: Periodic chest x-ray

In the general population the ACS and the Canadian Task Force do not recommend routine screening chest x-rays. Reducing tobacco use is the best method of preventing lung cancer.

Clinical Problem: Ovarian Cancer
Proposed Preventive Measure: Annual pelvic exam

Ovarian cancer is aggressive; early metastatic disease is common. The incidence of this cancer increases with age.[53] Early detection of this cancer can lead to five year survival rates approaching 80%.[56] Unfortunately, there is no evidence that annual pelvic examinations will detect early cancers or improve survival rates.[57]

Clinical Problem: Prostate Cancer
Proposed Preventive Measure: Digital rectal exam

Prostate cancer is common among elderly men; and is the third leading cause of cancer death among men.[53] The natural history of this cancer in elderly men is poorly understood. Autopsy results show Stage A (occult) disease to be very common; and how many of these Stage A cancers progress to clinically significant disease is unclear. Studies supporting routine rectal examinations have not included many elderly subjects,[58] and a recent review of a screening program with over 2000 subjects concluded that rectal examination is an insensitive screening test for early prostate cancer.

Clinical Problem: Hypertension
Proposed Preventive Measure: Periodic Blood Pressure Check

In recent years there have been several clinical trials of the treatment of systolic-diastolic hypertension that have included patients over age 60.[59,60] The European Working Party on High Blood Pressure in the Elderly reported a significant decrease in cardiac mortality in the treatment group, a non-significant decrease in cerebrovascular mortality, and a no difference in overall mortality.[59,61] Other studies have demonstrated a reduction in the incidence of stroke disease.

Hard evidence is still confined to those under 80 years of age for there has been insufficient numbers of the very old enrolled in the existing trials from which to draw statistical conclusions. There is therefore still doubt about the risk-benefit equation of treatment in the very old away from the carefully monitored conditions of a controlled trial. It is the very old population that is most at risk from excessive or rapid hypotensive therapy as well as from the side effects of the medication. Compliance with therapy in the general elderly population may

not be as good as in the relatively fit, motivated elderly populations attending blood pressure clinics. This may be particularly true in the case of the very old population in whom 1 in 5 will have some degree of cognitive impairment. Effective prevention of the complications of hypertension still requires considerable research into strategies with the old old.

The case for treating isolated systolic hypertension is not as yet proved and awaits the result of two ongoing controlled trials.

Clinical Problem: Influenza
Proposed Preventive Measure: Influenza Vaccine; Amantadine

There is good evidence of the efficacy of influenza vaccine in the community living elderly and moderately good evidence for its efficacy in the institutionalized elderly population.[62-64] Influenza vaccination reduces mortality, morbidity and hospitalization rates. However vaccination rates remain low though a number of strategies such as postal and telephone reminders have improved compliance with this procedure.

Amantadine hydrochloride is an antiviral agent that is specific for influenza A. Amantadine has been 70-90% effective in preventing influenza A illness in an institutional outbreak.[65] Amantadine is recommended by the C.D.C. for high risk individuals allergic to vaccine, as an adjunct to late immunization of high-risk individuals, and during nursing home epidemics.

Clinical Problem: Pneumonia
Proposed Preventive Measure: Pneumococcal Vaccine

Studies suggest the efficacy of pneumococcal vaccination in the elderly.[66] The appropriateness of widespread vaccination programs must, however, be seen in the context of the populations for which they are recommended. It is essential to consider the effect of other concomitant disease on mortality rates from pneumococcal pneumonia. When no other conditions co-exist the mortality from pneumococcal pneumonia is low (9/100,000 cases), but this increases a hundred fold for those with two or more high risk associated conditions. Therefore, two target populations may exist. One fit group, mostly living in the community, who respond well to antibiotic therapy and who have a good prognosis irrespective of vaccination status. The second group, many of whom will be institutionalized, are seriously debilitated from concomitant disease, have a poor prognosis, and prevention might be better than attempted cure. It should also be noted that it is in precisely this frail population that there are still doubts about the efficacy of the vaccine.[67]

Clinical Problem: Tetanus
Proposed Preventive Measure: Tetanus Toxiod Immunization

Most cases of tetanus in the United States occur in individuals over the age of 60.[68] Inadequate immunization status among the elderly has been documented and is felt to be the cause for the relatively high attack and fatality rates among the elderly.[69] However, the overall incidence rate for tetanus is very low; 0.2/100,000 for individuals over the age of 60. The cost-effectiveness of large tetanus immunization programs for the elderly should be evaluated.

Clinical Problem: Hypothyroidism
Proposed Preventive Measure: Periodic T4, TSH measurement

Hypothyroidism is present in about 1 in 500 of the community-living adult population,[70] but the incidence increases with age so that it is a condition commonly encountered by those physicians dealing with the elderly.[71,72] Bahemuka and Hodkinson found it in 2.3 per cent of consecutive admissions to a geriatric department.[73] Because of its frequency, its impact on physical and psychiatric morbidity, the simplicity and low cost of the test for its detection, and the efficacy of its treatment, periodic evaluation of thyroid function in an aged population may be a useful health maintenance strategy.

Clinical Problem: Tuberculosis
Proposed Preventive Measure: Periodic PPD skin testing or chest x-rays

Persons 60 years and older account for 25 - 50% of all cases of tuberculosis.[74-76] Reactivation tuberculosis is a major mechanism for active disease. With advancing age, the frequency of false negative PPD skin tests in the presence of active disease increases. Chest x-rays are not currently recommended for the purpose of screening to detect tuberculosis.[77] Because of the risk of liver toxicity INH chemoprophylaxis for elderly PPD convertors or for exposed contacts with negative chest x-rays is controversial.[69] Prevention of tuberculosis outbreaks in nursing homes requires careful evaluation of PPD reactivity status at the time of admission and aggressive infection control measures if an active case is identified.

RISK FACTORS OR BEHAVIORS

Clinical Problem: Hypercholesterolemia
Proposed Preventive Measures: Routine screening for blood lipids

Recent studies supporting the screening for and the treatment of elevated cholesterol levels have been encouraging.[78,79] Lowering cholesterol levels through diet or medications is increasingly accepted as effective in preventing heart disease. The relevance of this work to individuals over age 70 is unclear. The Framingham study documents that the relationship between cardiovascular disease and cholesterol levels decreases with age.[80]

Clinical Problem: Smoking Habits
Proposed Preventive Measure: Advice and assistance to quit smoking

Although smoking rates tend to fall in old age, 17.9 per cent of men and 16.8 per cent of women of this age group in the United States still smoke.[81] Although the principle of minimizing disruption to the patient's lifestyle must be seriously considered, data suggest that in addition to its correlation with coronary heart disease, peripheral vascular disease, lung cancer, and chronic obstructive lung disease, smoking in the elderly is also associated with decreased bone mineral density, loss of body weight, decreased muscle strength, and accelerated lung aging. The demented elderly who smoke also pose a fire hazard.

The benefits of stopping smoking in younger patients has been well described. Recently Jajich has shown that stopping smoking late in life is associated with a rapid and sustained reduction in mortality from coronary disease.[82] Many programs are available to assist individuals to stop smoking. Although there may be isolated successes, their success in the elderly is generally poor.

CASE FINDING

Clinical Problem: Alcoholism
Proposed Preventive Measure: Historical screening

Although the data is difficult to obtain it is generally felt that alcoholism is a common and serious clinical problem among the elderly.[83] It is felt that as many as 1/3 of older people with alcoholism developed the disease in their later years as a result of physical or psychosocial stress. These patients may go unnoticed by health providers. Health workers should be aware of high-risk profiles; eg. possible" dementia", recent falling or fractures, depression.

Clinical Problem: Constipation
Proposed Preventive Measure: Historical Screen

Constipation, a problem more often perceived than real in the community-living elderly, nevertheless can result in psychological distress, impaction with overflow soiling, hemorrhoids, and diverticular disease. It may be managed by the maintenance of physical activity and an adequate fluid intake and by additional dietary fiber in the form of bread or supplements. Fiber may also protect against symptomatic diverticular disease of the colon.

Clinical Problem: General deconditioning with age
Proposed Preventive Strategy: Exercise programs

There is considerable potential for the maintenance of physical function in old age by physical exercise programs. Physical training programs have been shown to reduce the decline in maximum oxygen consumption that accompanies aging,[84] to increase muscle strength,[85] to improve joint mobility,[86] and to improve the sense of balance.[87] Imaginative yet acceptable exercise programs need to be developed and integrated into the social life of the elderly. Guidelines and precautions for the prescription of these programs have been described.[88] An unanswered question is whether the elderly population, particularly those that are frail, will have the motivation to carry out such exercise, frequently and at a sufficient level of intensity to achieve a conditioning response.

Clinical Problem: Dementia
Proposed Preventive Measure: Periodic screening by standard mental status test

The recognition of dementia in the elderly is important primarily to improve the behavioral and functional problems associated with the disease and to provide support to the caregivers. The identification of dementia at an early stage may assume increasing importance as research into new treatment modalities expands.

Clinical Problem: Depression
Proposed Preventive Measure: Periodic screening by questionnaire

Depression and dysphoria are common in the elderly and are amenable to antidepressant therapy, environmental manipulation, and other measures. As with dementia, the greatest hindrance to its management is lack of recognition. Increased awareness of depression as a treatable entity could be improved by identifying high risk sub-groups or by the inclusion of a short screening instrument into the routine clinical evaluation.

Clinical Problem: Breakdown of Family Support
Proposed Preventive Measure: Evaluate Family Stress

Families in most western societies provide over 80 per cent of all home health care for the elderly. In undertaking this caring role they often experience

significant burden which may result in adverse outcomes including psychological distress, physical illness, family disruption, increased institutionalization, increased consumption of community resources and, if no help is provided to them, abuse of the elderly. It is therefore in the best interest of everyone to avoid this breakdown of family support. A number of strategies could be established to minimize this burden (though evaluative research on these strategies is still in its early stages). Evidence is accumulating from a number of trials and demonstration projects that providing informal support services such as homemaker programs are of benefit not only in reducing stress but in preventing institutionalization.

Another type of support is respite care for selected groups of caregivers under stress. For families of the cognitively impaired , a resource is an in-home sitting service. Day care respite may also be of value particularly for the physically frail. Traditional in-patient respite care has been widely used for many years in the United Kingdom; however, there are still only descriptive studies evaluating efficacy. This efficacy is still being estimated in terms of ultimate prevention of long term care rather than improving the morale of the families concerned.

Clinical Problems: Falls
Proposed Preventive Measure: Anticipatory removal of environmental hazards, medication monitoring, etc.

Falls in the elderly are associated with significant morbidity, mortality and an increased rate of institutionalization.[89] Isaacs work from the United Kingdom shows that it is possible to identify those at high risk of falling based on an assessment of walking speed, extent of body sway and the extent to which the person mobilizes. A high correlation has been shown between a simple clinical score and more sophisticated biomedical measuring techniques in making these assessments.[90]

Although theoretical frameworks have been devised for the prevention of falls and check lists exist for the elimination of home hazards, the elderly themselves may be reluctant to make the necessary life style changes to reduce their chances of falling.

Clinical Problem: Foot problems
Proposed Preventive Measure: Routine podiatric care

Foot problems (nail abnormalities, calluses, bunions, ulcerations, etc.) are common among the elderly. It is clear that older people with peripheral vascular disease and/or diabetes require attentive foot care. In addition, many elderly are functionally unable to care for their own feet (vision, dexterity, reach, cognition). Preventive foot care may be beneficial to many elderly.

Clinical Problem: Hearing Loss
Proposed Preventive Measure: Hearing Screening

Hearing deficits in the elderly are common. The vast majority of patients are suffering from presbycusis, wax in the external auditory canal, or both. The first part of any screen for hearing deficit should consist of the clinician's exam and the assessment of pure tone hearing. Screening otoscopes can reliably identify patients for further evaluation. Improvements and modifications in design and construction of hearing aids have enabled a greater proportion of the hearing impaired elderly to benefit from amplification.

Clinical Problem: Poverty and Inadequate Housing

Proposed Preventive Measure: Income and housing programs

Many elderly are poor. Health maintenance strategies must allow for this by providing adequate income, not just because of the correlation between poverty, poor health, and limitation of activities, but to enable the elderly to cope with major problems within the health reimbursement structure. The latter include increasing out-of-pocket expenses for medical care, the lack of funding for hearing aids, glasses, walking aids, dental care, and so forth, and the need to spend-down almost to poverty level before receiving any supplementation for long-term nursing home care. Standard housing has an indirect effect on the health of many elderly and results in isolation, accidents in the home, and hypothermia.

Clinical Problem: Immobility
Proposed Preventive Measure: Rehabilitation

Although exercise programs may be considered a primary preventive strategy, rehabilitation and functionally oriented care are the main tertiary preventive strategies aimed at minimizing disability. Rehabilitation tends to be considered a specialist topic conducted by therapists and physiatrists often in specialized units remote from the mainstream of medical practice. It is also strongly biased toward the admission of younger age groups and has a work-oriented goal. The term functionally oriented care is therefore used in the context of the elderly, and it is the duty of nurses and physicians to conduct it as well as therapists. In many cases it is as effective as more specialized rehabilitative programs.[91,92]

Clinical Problem: Incontinence
Proposed Preventive Measure: Historical Screening

For the elderly without dementia, a high cure rate should be expected for incontinence,[93,94] yet there is considerable shame and reluctance about reporting this problem. A priority for the prevention of incontinence must therefore be to educate this older population and their caregivers that incontinence can be treatable. A simple clinical algorithm is available for the assessment of the elderly incontinent woman. This has been shown to correlate well with sophisticated urodynamic studies, and the approach may do much to remove the need for invasive procedures and hence reduce iatrogenic insult.[95]

The prevention of incontinence may depend on a wide range of other strategies such as improving the patient's mobility, improving access to and stability at the toilet, and, in the case of institutionalized patients, ensuring an adequate nurse-to-patient ratio to permit an effective toilet-training program.

In established incontinence in demented patients, cure is less likely, but considerable benefit may result from the correct use of behavioral strategies, specialized garments, appliances, and indwelling catheters. Implementing these measures may benefit by a community-based case-finding and surveillance program by nursing staff.

Clinical Problem: Insomnia
Proposed Preventive Measure: Historical Screen

As many as 30% of elderly persons complain of serious difficulty in falling asleep or remaining asleep. Sleep disturbance is particularly common in the nursing home, with most residents receiving prescriptions for sedative-hypnotics. Insomnia is commonly associated with concomitant medical problems, and careful evaluation is required. Nonpharmacologic treatment of insomnia can benefit many elderly.

Clinical Problem: Loss
Proposed Preventive Measure: Anticipatory Counseling

Death of a spouse or loved one carries a significant risk of morbidity and mortality for the bereaved. Several studies now show the benefit of bereavement counseling for the elderly,[96,97] and this may be considered a useful health maintenance measure. Similar support may be required for the caregivers of the demented elderly during the latter part of their illness.

Retirement has been estimated as the tenth most stressful event occurring over the life cycle. However, studies suggest that less than one third of persons have difficulties adjusting to it. The case for the benefit of preretirement counseling is unproved although satisfied retirees start thinking and planning for retirement at an earlier age.[98]

Clinical Problem: Nocturia
Proposed Preventive Measure: Historical Screen

Nocturia, may be precipitated by diuretics or the return of edema fluid from the limbs at night but many elderly have an uninhibited neuropathic bladder as the underlying pathophysiologic cause. This may be helped by the use of an anticholinergic agent such as flavoxate hydrochloride at night.

Clinical Problem: Relocation Stress
Proposed Preventive Measure: Anticipatory Counseling

There is now a sizable literature on the mortality and morbidity associated with relocation stress. Factors that seem to reduce these negative effects are the opportunity for choice, personal preparation for the move, and a perception of control in the decision-making process. Simple measures have been outlined to effect these goals.[99] When an elderly person relocates to another person's house, social stresses can possibly be prevented by giving advice on such matters as privacy, daily routine, financial responsibilities, and the sharing of household tasks.

Clinical Problem: Poor Vision
Proposed Preventive Measure: Vision Screening

About a fifth of those over 65 years of age have poor vision. This may severely restrict daily activities, result in social isolation, produce depression, and aggravate paranoid and delusional states. A simple test of vision carried out by relatively untrained personnel emphasizing near rather than distance vision (for example by the use of print charts) would uncover many problems that could then be referred to physicians for ophthalmoscopic examination. There is insufficient evidence at present to support routine screening for open angle glaucoma by tonometry.[17]

Apart from specific treatment such as cataract extraction or laser photocoagulation for senile macular degeneration or diabetic retinopathy, simple methods such as the provision of glasses or low vision aids can be of value. Much of the visual difficulty experienced by the elderly at home can also be relieved by improved illumination. One study found that the provision of a 60 watt bulb in a small lamp improved visual acuity in 82 per cent of the elderly subjects attending a low vision clinic.[100]

IATROGENIC

Clinical Problem: Iatrogenic Insult
Proposed Preventive Measure: Multiple Strategies

The prevention of iatrogenic insult is a priority in the health care of the elderly. Iatrogenic insult occurs throughout the complete range of medical management. Considerable benefit would arise by altering clinical behavior to prescribe drugs not only more skillfully but to prescribe them less, by the adoption of a stronger case-management principle throughout the numerous consults in the acute-care hospital, by adopting the principle of minimal interference in the medical work-up, and by the introduction of multidisciplinary geriatric assessment.

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TABLE I: POTENTIALLY PREVENTABLE GERIATRIC CLINICAL PROBLEMS

TRADITIONAL PREVENTION	RISK FACTORS OR BEHAVIORS	CASE FINDING	IATROGENIC
BACTERIURIA	DIET	ADL	DIAGNOSTIC
CANCER	(CHOLESTEROL)	ALCOHOLISM	TESTS
BLADDER	EXERCISE	CONSTIPATION	DRUGS
BREAST	OBESITY	DECONDITIONING	INTERACTIONS
CERVICAL	SEAT BELTS	DECUBITI	SIDE EFFECTS
COLO-RECTAL	SMOKING	DEMENTIA	INSTITUTIONS
ENDOMETRIAL	STRESS/LOSS	DENTITION	HOSPITALS
LUNG		DEPRESSION	NOSOCOMIAL
ORAL		FAMILY SUPPORT	INFECTION
OVARIAN		FALLS	NURSING HOMES
PROSTATE		FOOT CARE	
SKIN		HEARING	
DIABETES		HOUSING/INCOME	
FRACTURES/		IMMOBILITY	
OSTEOPOROSIS		INCONTINENCE	
GLAUCOMA		INSOMNIA	
HEART DISEASE		LOSS	
HYPERTENSION		NOCTURIA	
HYPO/		RELOCATION STRESS	
HYPERTHERMIA		SLEEP PROBLEMS	
INFLUENZA		VISION	
MACULAR			
DENGERATION			
PNEUMONIA			
STROKE			
TETANUS			
THYROID DISEASE			
TUBERCULOSIS			

BIBLIOGRAPHY

1. Kennie DC. Health maintenance of the elderly. Clinics in Geriatric Medicine 1986; 2:53-83
2. Warshaw GA. Prevention and the elderly. J Fam Prac 1986; 22:119-121
3. Winogrond IR, Duthie EH, Cadmus RR. Older Adults. In: The Preventive Approach to Patient Care. Ed. Sheridan DP, Winogrond IR. New York: Elsevier Science, 1987. pp. 97-143
4. US Dept of Health and Human Services: Advance report, final mortality statistics, 1983. Monthly Vital Statistics Report 1985; 34:6
5. US Dept of Health and Human Services: Health United States 1986. 1986; p. 12
6. US Dept of Health and Human Services: Current Estimates from the National Health Interview Survey: United States 1981. Washington, DC, National Center for Health Statistics 1982, vol 10, p. 141
7. DeFriese GH, Hersh AS, McManas MA. A proposed research agenda for health promotion and disease prevention for children and the elderly. Health Services Research. 1985; 19:1033-1041
8. Green LW. Some challenges to health services research on children and the elderly. Health Services Research. 1985; 19:693-815
9. Lee PR. Health promotion and disease prevention for children and the elderly. Health Services Research. 1985; 19:783-792
10. Somers AR. Why not try preventing illness as a way of controlling medicare costs? NEJM 1984; 311:853-856
11. McKeown T. Validation of Screening Procedures. In: Screening in Medical Care. Nuffield Provincial Hospitals Trust. London: Oxford University Press, 1968. pp. 1-13
12. Cochrane AL, Holland WW. Validation of screening procedures. Br Med Bull 1971; 27:3-8
13. Spitzer WO, Brown BP. Unanswered questions about the periodic health examination. Annals of Internal Medicine 1975; 83:257-263
14. Sackett DL. Screening for early detection of disease: to what purpose? Bull NY Acad Med 1975; 39-52
15. Sackett DL, Haynes RB, Tugwell P. Clinical Epidemiology. Boston: Little, Brown and Company. 1985
16. Frame PS, Carlson SJ. A critical review of periodic health screening using specific screening criteria: parts 1-4. J Fam Pract 1975; 2:29-36, 123-129, 189-194, 283-289
17. Frame PS. A critical review of adult health maintenance. J Fam Prac 1986; 22:341-346, 417-426, 511-520; 23:29-42
18. Canadian Task Force on the Periodic Health Examination. The periodic health examination. CMA Journal 122:1-46, 1979
19. Canadian Task Force on the Periodic Health Examination: The periodic health examination: 1984 update. Can Med Assoc J 1984; 130:1278-1285
20. Freer C, Almind G, Warshaw G, et al. Screening and case finding. In: Prevention of Disease in the Elderly. Ed: Muir Gray JA. Edinburgh: Churchill Livingstone, 1985. pp. 51-63
21. Steel K. Iatrogenic disease on a medical service. J Am Geriatr Soc 1984; 32:445
22. Jahnigen D, et al. Iatrogenic disease in hospitalized elderly veterans. J Am Geriatr Soc 1982; 30:387-390
23. Gillick MR, et al. Adverse consequences of hospitalization in the elderly. Soc Sci Med 1982; 16:1033-1038
24. Mangla JC, et al. Diagnosis of occult gastrointestinal lesions by stool guaiac testing in a geriatric hospital. J Am Geriatr Soc 1981; 29:473
25. Rubenstein LZ, Josephson KR, Nichol-Seamons M, et al. Comprehensive health screening of well elderly adults: An analysis of community program. J. of Gerontology 1986; 41:342-352
26. Lowther CP, MacLeod RDM, Williamson J. Evaluation of early diagnostic services for the elderly. British Medical Journal. 1970; 275-277
27. Tulloch AJ, Moore V. A randomized controlled trial of geriatric screening and surveillance in general practice. J. Royal College of General Practitioners. 1979; 29:733-742

28. Hendriksen C, et al. Consequences of assessment and intervention among elderly people: a 3 year randomized control trial. Brit Med J 1984; 289:1522
29. Vetter NJ, et al. Effect of health visitor working with elderly patients in general practice: a randomized control trial. Brit Med J 1984; 288:369
30. Irvine PW, et al. The value of annual medical examinations in the nursing home. J Am Geriatr Soc 1984; 32:540
31. Gambert SR, Duthie EH, Wiltzius F Sr. The value of the yearly medical evaluation in a nursing home. J. Chronic Dis 1982; 35:65-68
32. Levinstein MR, Ouslander JG, Rubenstein LZ, et al. Yield of routine annual laboratory tests in a skilled nursing home population. JAMA 1987; 258:1909-1915
33. Komaroff AL. Screening tests for nursing home patients. JAMA 1987; 258:1941
34. Barber JH, Wallis JB. The effects of a system of geriatric screening and assessment on general practice workload. Health Bull. 1982; 40(3):125
35. Taylor R, et al. The Elderly at Risk: A Critical Review of Problems and Progress in Screening and Case Finding. Research Perspectives on Ageing 6. Age Concern Research United Kingdom, 1983
36. Williams EI. Characteristics of patients aged over 75 not seen during one year in general practice. Brit Med J 1984; 288:119
37. Kane RL, Kane RA, Arnold SB. Prevention and the elderly: risk factors. Health Services Research. 1985, 19:945-1006
38. Boscia JA, Kobasa WD, Knight RA, et al. Therapy vs no therapy for bacteriuria in elderly ambulatory nonhospitalized women. JAMA 1987; 257:1067-1071
39. Boscia JA, Kobasa WD, Knight RA, et al. Epidemiology of bacteriuria in an elderly ambulatory population. Am J Med 1986; 80:208-214
40. Nordenstam GR, Brandberg CA, Oden AS. Bacteriuria and mortality in an elderly population. N Engl J Med 1986; 314:1152-1156
41. Dontas AS, Kasviki-Charvarti P, Chem L, et al. Bacteriuria and survival in old age. N Engl J Med 1981; 304:939-943
42. Boscia JA, Kobasa WD, Knight RA, et al. Epidemiology of bacteriuria in an elderly ambulatory population. Am J Med 1986; 80:208-214
43. Tabar L, Fagerberg CJG, Gad A, et al. Reduction in mortality from breast cancer after mass screening with mammography. Lancet 1985; 1:829-832
44. Collette HJA, Rombach JJ, Day NE, et al. Evaluation of screening for breast cancer in a non-randomized study by means of a case-control study. Lancet 1984; 1:1224-1226
45. Verbeek ALM, Holland R, Sturmous F, et al. Reduction of breast cancer mortality through mass screening with modern mammography. Lancet 1984; 1:1222-1224
46. Cervical cancer screening: The Pap smear. Summary of an NIH Consensus Statement. Br. Med. J., 1980; 281:1264
47. Celentano DD, Shapiro S. Weisman CS: Cancer preventive screening behavior among elderly women. Prev Med 1982; 11:454-463
48. Mandelblatt J, et al. Gynecological care of elderly women. Another look at papanicolau smear testing. JAMA 1986; 256:367-371
49. Patterson WB. Oncology perspective in colorectal cancer in the geriatric patient. In Yancik R, Carbone PP, Patterson WB, et al (Eds) Perspectives on Prevention and Treatment of Cancer in the Elderly. New York, Raven Press, 1983; pp 105-112
50. American Cancer Society: ACS report on the cancer-related health checkup. CA 1980; 30:194-240
51. Winawer SJ, Andrews M, Flehinger B, et al. Progress report on controlled trial of fecal occult blood testing for the detection of colorectal neoplasia. Cancer 1980; 45:2959-2964
52. Gilbertsen VA, McHugh R, Schuman L, et al. The earlier detection of colorecctal cancers, a preliminary report of the results of the occult blood study. Cancer 1980; 45:2899-2901

53. Young JL Jr, Percy CL, Asire AJ (eds): SEER Program: Incidence and mortality, 1973-77. National Cancer Institute Monograph 57, Washington DC, Government Printing Office, 1981, p. 75
54. Boon MI, Calvert JC, Gates HS. Uterine cancer screening by the family physician. Am Fam Physician 1984; 30:157-166
55. Jenson CB, Shahon DB, Wangensteen OH. Evaluation of annual examinations in the dectection of cancer. JAMA 1960; 174:1783-1788
56. Silberberg BS. Cancer statistics 1984. CA 1984; 34:7-23
57. Smith LH, Oi RH. Detection of malignant ovarian neoplasms: A review of the literature. Obstet Gynecol Surv 1984; 39:313-360
58. Gilbertsen VA. Cancer of the prostate gland: Results of early diagnosis and therapy undertaken for cure of the disease. JAMA 1971; 215:81-84
59. Hypertension Detection and Follow-up Program Cooperative Group: Five-Year Findings of the Hypertension Detection and Follow-up Programs. JAMA 1979; 242:2462
60. Amery A, Brixco P, Clement D, et al. Mortality and morbidity results from the European Working Party on High Blood Pressure in the Elderly Trial. Lancet 1985; 1:1349
61. Report of the Management Committee. The australian therapeutic trial in mild hypertension. Lancet 1980; 1:1261-67
62. Howells CHL, Jenkins-Vesselinova CK, Evans AD, et al. Influenza vaccination and mortality from bronchopneumonia in the elderly. Lancet 1975; 1:381-383
63. Barker WH, Mullooly JP. Influenza vaccination of elderly persons. Reduction in pneumonia and influenza hospitalizations and deaths. JAMA 1980; 244:2547-2549
64. Patriarca PA, Weber PA, Parker RA, et al. Efficacy of influenza vaccine in nursing homes: Reduction in illness and complications during an influenza A (H_3N_2) epidemic. JAMA 1985; 253:1136-1139
65. Atkinson WL, Arden NH, Patriarca PA, et al. Amantadine prophylaxis during an institutional outbreak of type A (H_1N_1) influenza. Arch Intern Med 1986; 146:1751-1756
66. Health and Public Policy Committee, American College of Physicians: Pneumococcal vaccine. Ann Intern Med 1986; 104:118-120
67. Simberkoff MS, et al. Efficacy of pneumococcal vaccine in high risk patients. New Engl. J. Med. 1986; 315:1318-1327
68. Division of Immunogenetics, Centers for Disease Control: Tetanus--United States, 1982-1984. MMWR 1985; 34:602-611
69. Yoshikawa TT, Norman DC. Aging and Clinical Practice: Infectious Diseases. New York: Igaku-Shoin, 1987. pp. 206-212
70. Evereel DC, Hall R. Hypothyroidism. Br Med J 1972; 1:290
71. Sawin CT, Deepak C, Azizi F, et al. The aging thyroid; increased prevalence of elevated serum thyrotropin levels in the elderly. JAMA 1979; 242:247-250
72. Tunbridge WMG, Evered DC, Hall R, et al. The spectrum of thyroid disease in a community: The Whickham survey. Clin Endocrinol 1977; 7:481-493
73. Behemuka M, Hodkinson HM. Screening for hypothyroidism in elderly patients. Brit. Med. J. 1975; 2:601
74. Page MI, Lunn JS: Experience with tuberculosis in a public teaching hospital. Am J Med 1984; 77:667-670
75. DeBuitleir M, Fitzgerald MN. The changing profile of tuberculosis in a general teaching hospital: A five-year review of 121 cases. Irish Med J 1982; 75:390-399
76. Dutt AK, Jones L, Stead WW: Short-course chemotherapy for tuberculosis with largely twice-weekly isoniazid-rifampin. Chest 1979; 75:441-447
77. Lordi GM, Reichman LB: Tuberculosis. When not to order roentgenograms. JAMA 1985; 253:1780-1781
78. Shekelle RB, Shryock AM, Paul O, et al. Diet, serum cholesterol, and death from coronary heart disease; the Western Electric study. N Engl J Med 1981; 304:65-70

79. Lipid Research Clinics Program. The lipid research clinics coronary primary prevention trial results: I. Reduction in incidence of coronary heart disease. JAMA 1984, 251:351-364.
80. Kannel WB, Gordon T. Cardiovascular Risk Factors in the Aged: The Framingham Study In: S G Havnes and M Feinbeb (eds.). Second Conference in the Epidemiology of Aging. DHEW Publication No. (NIH 80-969. Bethesda, MD: National Institutes of Health. 1980
81. Jajich CL, et al. Smoking and coronary heart disease mortality in the elderly. JAMA 1984; 252:2831
82. US Department of Health and Human Services. National Center for Health Statistics: Health United States 1983. DHHS Publication No. (PHS) 84-1232. Hyattsville, Maryland, 1984
83. Blazer DG, Penny Vacker MR. Epidemiology of alcoholism in the elderly. IN: Hartford JT. Sahorajski T (eds): Alcoholism in the Elderly. New York: Raven Press, 1984. pp.25-33
84. DeVries H. Physiological effects of an exercise training regimen upon men aged 52 to 88. J Gerontol 1970; 25:325
85. Aniansson A: Muscle function in old age with special reference to muscle morphology effect of training and capacity in activities of daily living, Departments of Rehabilitation Medicine and Geriatric and Long-Term Medicine, University of Goteborg, Sweden, 1980.
86. Frekany GA, Leslie DK. Effects of an exercise program on selected flexibility measurements of senior citizens. Gerontology 1975; 21:182,
87. Vanfraechem J, Vanfraechem R. Studies of the effect of a short training period on aged subjects. J Sports Med Phys Fitness, 1975 21:182
88. Council on Scientific Affairs: Exercise programs for the elderly. JAMA 1984; 252:544
89. Perry BC. Falls amoung the elderly. A review of the methods and conclusions of epidemiologic studies. J Am Geri Soc 1982; 10:167-171
90. Isaacs B. Clinical and laboratory studies of falls in old people. Prospects for Prevention. Clinics in Geriatric Medicine. 1985; 1:513-524
91. Feldman DJ, et al. A comparison of functionally oriented medical care and formal rehabilitation in the management of patients with hemiplegia due to cerebral vascular disease. J Chronic Dis 1962; 15:207
92. Stern PH, et al. Factors influencing stroke rehabiliation. Stroke, 1971; 2:213
93. Resnick NM. Management of urinary incontinence in the elderly. NEJM 1985; 313:800-805
94. Williams ME, Pannill FC. Urinary incontinence in the elderly. Ann Int Med 1982; 97:895-907
95. Hilton T, Stanton SL. Algorithmic method for assessing urinary incontinence in elderly women. Brit Med J 1981; 292:940
96. Gerber I, Weiner A, Battin D, et al. Brief therapy to the aged bereaved. In: Schoenberg G. and Gerber I. (eds). Breavement: Its Psychological Aspects. New York, Columbia University Press, 1975
97. Parkes CM. Bereavement counselling--does it work? Br Med J, 1980; 181:3
98. Howard JH, Marshall J Rechnitzer PA, et al. Adapting to retirement. J Am Geriatr Soc 1982; 30:488
99. Brubeck E, Walton R. When an elderly patient needs extended care. Geriatrics. 1979 (February), p. 93
100. Cullinan TR, Gould ES. Silver JH, et al. Visual disability and home lighting. Lancet 1979; 1:642

HEALTH PROMOTION AND AGING
SMOKING AMONG OLDER ADULTS:
THE PROBLEMS, CONSEQUENCES AND POSSIBLE SOLUTIONS

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I. INTRODUCTION

In smokers at any age, smoking is a modifiable behavior with serious health consequences. Unfortunately, the body of knowledge directly applicable to helping older smokers quit is limited because older smokers, as an identified group, have been a lower priority for research than younger populations. This state of affairs must change. Although the prevalence of smoking is somewhat lower in the older population than in younger groups, older adults are at least equally interested in personal health promotion; the consequences of continued smoking are especially serious for them; and the benefits of their quitting are substantial. For example, as this paper will show, smoking cessation can improve vital capacity and reduce disability and can reduce costs incurred by all third party reimbursers of health care costs, including the federal government. Clearly, older Americans who smoke should be encouraged to quit smoking. The sections that follow address the health consequences of smoking and benefits of cessation, the economic impact of smoking, potential smoking cessation strategies and recommended directions for research policy and practice.

This paper is based upon a review of the literature conducted using MEDLINE searches, current government reports and focus groups of older adults conducted during the summer of 1987 for the Office of Disease Prevention and Health Promotion (ODPHP) (Doremus Porter Novelli, 1987) and for Fox Chase Cancer Center (FCCC), Philadelphia, PA, (Rimer, research in progress).

Older Adults as a Target Group for Health Promotion

The demographic profile of American society is undergoing a dramatic shift, marked by aging of the population. Currently, 12% of the population is over 65 years; by 2010, about 14% of the population will be 65 years of age and older. Adults now aged 50-74 constitute 20% of the population and over 22% of United States smokers.

The increase in the older population is expected to occur in two stages. Through the year 2000, the proportion of the population aged 55 and over should remain relatively stable, at about 22%. By 2010, the proportion of older Americans is projected to rise sharply; more than a quarter of the total United States population is expected to be at least 55 years old, and one in seven Americans will be at least 65 years old. By 2050, one in three persons is expected to be 55 years or older, and one in five will be 65-plus (Special Committee on Aging, 1987b).

The focus of this paper will be on adults 55 years of age and older, in order to include the pre-retirement population which can be reached with the smoking cessation message at an important transition point in their lives. Moreover, the data suggest that stopping smoking in the younger-old group will have the most dramatic impact on morbidity and mortality. Some of the data are

summarized for the 65 years and older group only because of limitations in the way data are reported.

The word "older" is preferred to "old" or "elderly," since chronological age is a poor predictor of health status or lifestyle, and older people are no more homogeneous than are children or the middle-aged (Rowe and Bradley, 1983). "Old" people are seen as infirm and dependent. But the reality is that the majority of older Americans continue to lead relatively healthy, active lives well into their 80's, and Americans of all ages are healthier than they were 10 to 20 years ago (Special Committee on Aging, 1987a). Indeed, smoking may spell the difference between being "old" and simply being "older" at a later age. Consequently, it is appropriate to recognize older people as a target for health promotion and disease prevention activities (Mallamad et al., 1984; Rowe, 1985). Increasingly, it is being recommended that older people adopt healthier diets, start or continue a program of regular aerobic exercise and stop smoking (e.g., Sorenson et al., 1983; Heckler, 1985; Kane et al., 1985).

Health promotion activities can educate older people about the association between lifestyle health habits and the leading causes of death and disability and can assist people in changing behaviors that may lead to illness (Heckler, 1985).

Older adults are very much concerned with their health and health promotion (Hershey et al., 1982; Mallamad et al., 1984; ODPHP, 1984; Prohaska et al., 1985). The evidence shows that older people can benefit from a variety of health promotion programs (Leviton and Santa Maria, 1979; USDHHS, 1980; Lorig et al., 1981; Anderson, 1982; FallCreek and Stam, 1982; Kirchman et al., 1982; Lidoff and Beaver, 1982; Bolten and Ball, 1983; Moore et al., 1983; Sorenson et al., 1983; USDHHS, 1983; Barbaro and Noyes, 1984; Nelson et al., 1984; Heckler, 1985; Rimer et al., 1986a, 1986b; ODPHP, 1987). Studies indicate that when educated about health habits, older people have higher levels of compliance and behavior change than those in other age groups (Morisky et al., 1982; Green, 1985).

II. HEALTH EFFECTS OF SMOKING AND BENEFITS OF CESSATION

A. Health Consequences of Smoking

As people live longer and are less likely to die from infectious or acute illnesses, chronic health conditions such as heart disease, cancer or lung disease are accounting for both more morbidity and more mortality among older people. Smoking is considered a major risk factor in eight of the top 16 causes of death for people aged 65 and over (Special Committee on Aging, 1987b). Smoking is the single greatest cause of premature death and preventable disease and disability in the United States (USDHHS, 1986b). Smoking-related cancer deaths account for 41% of cancer deaths in males 65 years and older and 15% of cancer deaths in women 65 years and older (OTA, US Congress, 1985). The latter are expected to rise with increases in women's smoking.

Smoking exerts a significant impact on morbidity and mortality from cardiovascular, cerebrovascular and respiratory diseases. Although the risk ratio for overall mortality and morbidity from cardiovascular disease decreases with advancing age, the absolute number of deaths directly caused by cigarettes increases (Kane et al., 1985). Among adults aged 55 to 64 years, there are 996 deaths from coronary heart disease (CHD) per 100,000 men for smokers compared to

542 for nonsmokers; for adults 65 to 74 years, the rates are 1400 for nonsmokers compared to 2025 for smokers (USDHHS, 1984a).

Howard et al. (1987) found that the impact of cigarette smoking on survival after a transient ischemic attack in a cohort approximately 64 years of age was of a magnitude equal to that of a previous stroke or ischemic heart disease.

Smoking continues to affect lung function into old age (Sparrow, 1984); 55% of the respiratory-system disease deaths among men 65 years and older are attributable to smoking and 38% of women's deaths are due to smoking. Deaths from chronic obstructive lung disease (COLD) rise linearly to about 425 per 100,000 adults among smokers 75 to 84 years compared to about 50 per 100,000 for nonsmokers (USDHHS, 1984b).

Prevalence rates of cough, phlegm and chronic bronchitis among smokers are reported to have increased with advancing age in the United States population samples studied by the National Center for Health Statistics and in several cross-sectional studies (USDHHS, 1984b). Smoking appears to be a significant predisposing factor in the development of pneumococcal infections (Burman et al., 1985). Burr et al. (1985) found that the symptoms of cough and phlegm and a substantial reduction in lung function were associated with smoking. Sparrow et al. (1987), using longitudinal data from the Normative Aging Study, found evidence of an association between smoking and nonspecific airway responsiveness.

Exposure to passive smoking also is a problem for older adults, especially those with compromised health status. In urban areas, air pollutants may combine synergistically with tobacco smoke to aggravate pre-existing chronic heart and lung diseases (Mitchell et al., 1979). Passive smoking exacerbates both the onset of angina and the symptoms of bronchial asthma (Fielding, 1985a).

Smoking also complicates existing illnesses, which are likely to be more prominent in older people than in younger ones. Smoking may decrease the ability of gastric ulcers to heal, and the rate of recurrence of duodenal ulcers is higher in smokers (Achkar, 1985). Smoking also reduces smell and taste ability in older adults (Moore, 1986; Somerville et al., 1986). Smoking appears to have a negative effect on bone mineralization and density, a particular concern for older women who may be susceptible to osteoporosis (Mellstrom et al., 1982). Smoking exerts a separate and distinct effect on osteoporosis and the subsequent risk of fracture (Melton and Riggs, 1986).

Smoking can affect mean levels for drugs, such as Propanolol (Vestal et al., 1979) and interferes with a range of other drug therapies, including antidepressants, Lidocaine, Pentazocine HCI, Phenothiazines, Phenylbutazone and Inderal. Cigarette smoking dramatically decreases serum levels of Theophylline, Aminophylline and Oxtriphylline. Heavy smokers may need doses that are 50% to 100% greater than those of nonsmokers. Cigarette smoking also shortens the half life of Heparin and decreases the effectiveness of Propoxyphene (Darvon). Heavy smokers may need about one-half more Insulin than nonsmokers (Todd, 1987). The smoker who is on estrogen therapy runs an increased risk of cardiovascular complications (Todd, 1987). The result of these effects is that drug dosages for the average older person may be subtherapeutic or ineffective (Greenblatt et al., 1982). Smoking also may affect clinical test results, causing increases in values such as red cell mass, LDL cholesterol, hemoglobin and hematocrit (Mellstrom et al., 1982; USDHHS, 1986a). Mellstrom et al. (1982) also found an

elevated level of potassium in serum and plasma among smokers independently of medication.

Thus, continued smoking represents a significant health threat to older Americans. It affects every aspect of health, from increased risk of morbidity and mortality, to effects on the way life-saving drugs are metabolized.

B. Health Benefits of Cessation

There is now substantial evidence that older adults who have never smoked or are ex-smokers are healthier than those who continue to smoke. Abramson (1985) concluded, on the basis of a review of large prospective trials, that longevity can probably be increased by giving up smoking in the 60's and, especially for heavy smokers, in the early 70's. The United States Department of Health and Human Services (ODPHP, 1986) wrote that "until recently, the danger of long-term smoking was generally thought to be irreversible and permanent. We now have documented evidence that smoking cessation in older persons can produce positive health effects."

When the Honolulu Heart Program examined the biological, social and lifestyle characteristics among middle-aged men of Japanese ancestry that are associated with the maintenance of health during late adult years, researchers found that individuals who stayed healthy, smoked fewer cigarettes and consumed less alcohol. Following systolic blood pressure, smoking was the most consistent discriminator between remaining healthy and all separate categories of disease (Benfante et al., 1985).

Cessation of smoking exerts a protective action which increases with the number of years since stopping (Graham and Levin, 1971; Hazzard, 1983; Lubin et al., 1984; Vineis et al., 1984; Pathak et al., 1986). When a person of any age stops smoking, the benefits to the heart and circulatory system begin right away. The risk of heart attack and stroke drops and circulation to the hands and feet improves. The Framingham data suggest that the benefits of cessation on coronary heart disease are almost immediate while the benefits on respiratory function occur over a longer period of time (Gordon et al., 1974). Schuman (1981) found some decrease in mortality after quitting for one to four years in a study of men 50 to 69 years. In a very significant study, Jajich et al. (1984) showed that while elderly smokers had a 52% higher risk for coronary heart disease than nonsmokers, quitting smoking in later life was associated with a rapid and sustained reduction in mortality from coronary heart disease.

Significant improvements in circulation and pulmonary perfusion (Mason et al., 1983; Rogers et al., 1985) occur rapidly when older people stop smoking. The majority of improvement occurs in the first year following cessation. Cessation from smoking should produce gains in cerebral circulation and prevent further progression of cerebrovascular diseases (Rogers et al., 1985). Mason et al. (1983) concluded that much of the abnormality in pulmonary epithelial permeability induced by smoking is rapidly reversible. The cessation of cigarette smoking also has a substantial salutary impact on the incidence and progression of chronic obstructive lung disease (COLD). Cigarette smokers who quit prior to developing abnormal lung function are unlikely to go on to develop ventilatory limitations (USDHHS, 1984b). Of course, the benefits will accrue sooner for lighter and moderate smokers compared to heavier smokers (Oster et al., 1984) and will be most significant for the younger-old.

III. ECONOMIC IMPACT OF SMOKING ON OLDER ADULTS

Older adults represented only 11% of the population in 1980, but they accounted for 31% of personal health care expenditures (Rice and Estes, 1984). In 1984, per capita health care expenditures for persons 65 years and older were $880 per person (Parsons, 1987). The costs associated with smoking exacerbate the rising health care costs experienced by older adults. Health economists have examined the costs of smoking from several vantage points: prevalence-based calculations of the national economic costs of smoking; adaptation of national estimates to calculate statewide costs; estimates of the costs to business and prospective, incidence-based estimates of the expected costs to individuals who smoke (Shultz, 1985; Schelling, 1986). The prevalence approach examines the current costs to society while the incidence approach examines primarily the future costs of smoking.

There are three kinds of costs with which we should be concerned: (1) direct costs of medical care and additional costs of disease; (2) indirect costs, including the value of lost productivity, output or foregone manpower resources and (3) intangible costs (such as the costs inflicted on others) (Rice et al., 1986). These intangible costs do not include the pain and suffering on patients and their families (Loeb et al., 1984) which are much more difficult to estimate. Direct costs rise relative to indirect costs at older ages as older people begin to retire and have fewer significant productive years ahead of them.

Current and former smokers use more medical care, experience more work-loss days and have higher mortality rates than persons who have never smoked (Rice et al., 1986). For older adults, many of these costs are borne by Medicare; some of the costs also are transferred to Social Security. Rice et al. (1986) argued that the most important costs of smoking are smoking-related diseases and the attendant morbidity, mortality, medical care costs, indirect losses and intangible losses from pain, suffering and other quality-of-life changes.

Using 1985 data, the Office of Technology Assessment (OTA, US Congress, 1985) estimated that the total health care costs of smoking-related disease amount to between $11 billion and $35 billion or from three percent to nine percent of total United States health care spending. Future costs for smoking-related diseases in women will be higher because of the fact that the rate of lung cancer in women has been rising exceptionally rapidly (Loeb et al., 1984). Naturally, the costs are not incurred evenly among smokers but are affected by such factors as the intensity of one's smoking and the number of years one has smoked (Oster, et al., 1984).

Even for older adults, the costs associated with smoking are profound. Smokers aged 65 and older experience more restricted activity days, hospital days and physician visits than those who have never smoked (Rice et al., 1986). Rice et al. (1986) estimated that almost $5.67 billion in direct costs were attributable to smoking for adults 65 years of age and older. Medicare costs alone have been estimated to be $3.4 billion annually (OTA, US Congress, 1985). These costs indeed may only represent part of the problem. For example, Melton and Riggs (1986) noted that smoking has an independent effect on osteoporosis. Osteoporosis costs the United States more than $6 billion annually. Osteoporosis has been estimated to be a factor in 70% of fractures among white women over 40 years of age and in 15% of white men of similar age. Hip fracture incidence is about one percent per year in women enrolled in Medicare, with a cumulative incidence by 40 years of 32% for women and 17% for men (Heidrich and

Thompson, 1987). Also, cost estimates rarely reflect losses due to fire, which may be higher for older adults. In one study, 14% of fires were ascribed to cigarette smoking (Brodzka et al., 1985). As already noted, the cost estimates also do not reflect intangible costs, which are undoubtedly substantial.

Oster et al.'s (1984) analysis showed that even for the oldest age groups (70 years and older), the cumulative economic benefits of quitting are noteworthy; from $600 to approximately $2500 for men and from $400 to approximately $3000 for women. Quitters in this age can avoid between 32% and 52% of the expected losses; younger quitters will avoid a higher proportion of losses. For adults aged 55-59 years, as much as $9093 is saved each time one heavy smoker quits (USDHHS, 1986c).

Of course, it is possible that reductions in smoking will produce lowered costs for treating smoking-related diseases but higher costs in future years for treating the additional people who survive (OTA, US Congress, 1985). Older adults whose deaths are averted by virtue of smoking cessation may then survive to collect Social Security. They also may make additional claims to Medicare and other health insurance systems. As individuals age, their health care costs are borne not only by themselves but also by the government and by employers. However, even in the unlikely case that dollars ultimately were not saved from reductions in smoking, this still may be a cost-effective if not necessarily a cost-saving activity (Warner, 1984; OTA, US Congress, 1985). The conclusions of Oster et al. (1984) cannot be ignored: at any age, it literally pays to stop smoking, since the benefits of quitting are sizable.

IV. OLDER ADULTS AS A TARGET FOR HEALTH PROMOTION AND SMOKING CESSATION

A. Some Preliminary Considerations: Smoking Rates of Older Adults

Although a significant proportion of older Americans already have quit smoking, current smoking rates for adults 50-74 years old are still relatively high, particularly for those 50-65 years (32% for males 50-64 years and 27% for women of the same age) (Remington et al., 1985). Rates in 1985 were 22% for men 65-74 and 16% for those 75-84. The corresponding rates for women were 18% for women 65-74 years and 8% for women 75-84 years (Havlik, 1987). There are important differences in cessation rates for population subgroups. For example, a population survey in Florida found that 33% of white men 65 years and older were ex-smokers compared to 26% of nonwhite men (Dzegede et al., 1981). Smoking rates are higher for Hispanics--40% of male Mexican-Americans aged 55-74 smoke; 20% of female Mexican-Americans smoke (Havlik, 1987). Smokers 45-64 years of age are least likely to try to quit smoking and least likely to be successful if they tried (Cummings, 1984). The estimates of current smoking rates must be viewed with caution since many studies report smoking rates only for adults 45 to 64 years and those 65 years and older.

Even though the prevalence rates for this age group are lower than younger age groups, current smokers aged 50-74 are especially at risk from continued smoking because (1) they have smoked longer, and (2) they have been and continue to be heavier smokers (Shopland and Brown, 1985). A higher proportion of smokers in this age cohort smoke more than 25 cigarettes a day and smoke high and very high nicotine brands (Remington et al., 1985; Moss, 1979). The highest proportion of smokers are men who were born between 1910 and 1930 and thus now are aged 50 and older (Cummings, 1984). Little evidence exists that the percent of smokers in the older (65+) age subgroup has decreased over time (Havlik, 1987). Since one

in four persons will be aged 55 and older by 2010, the implications of these smoking rates are profound.

B. Need for Targeted Smoking Cessation Programs

While there are many available smoking cessation programs, none that is described in the published literature has been directed specifically at older adults (Bosse and Rose, 1984). Smoking cessation for older adults was not explicitly included in a number of prominent health promotion programs for older adults (FallCreek and Mettler, 1980; Kemper et al., 1981; FallCreek and Stam, 1982; Nelson et al., 1986). One program guide (FallCreek and Mettler, 1980) includes brief background information about the benefits and risks of smoking and resources for smoking cessation programs that can be used by program planners.

Simplistic generalizations from studies of young and middle-aged adults to the old are fraught with difficulty (Rowe, 1985). Thus, simply using existing smoking cessation strategies without appropriate age-tailoring may fall short of the desired impact. To reflect this, smoking cessation messages and programs should be tailored to the special needs of older smokers and reflect the physiologic, psychosocial and pathologic impacts of aging (Rowe, 1985).

Quit rates might be improved with programs that address age-related quitting barriers and emphasize age-related quitting incentives. Little is known about how older people make the decision to quit, how they quit and what withdrawal symptoms they experience. Some withdrawal reactions (e.g., sleeplessness, constipation and impaired concentration) might be especially disconcerting for older smokers, and little is known about this, either.

Obstacles that are likely to be faced by older smokers include: greater pessimism about their ability to quit--a consequence of their greater number of quit attempts (e.g., Remington et al., 1985); their longer smoking history and tendency to be heavier, more addicted smokers (Remington et al., 1985, Moss, 1979; Shopland and Brown, 1985); possible shielding from strengthening nonsmoking norms and influences in the workplace (USDHHS, 1986b); and doubt/pessimism about the benefits of quitting and pessimism about cancer prevention in general (USDHHS, 1987). Older adults also may be more fatalistic about taking health risks, because they do not perceive personal harm from these risks. For example, focus group participants in Philadelphia mentioned that they had been smoking many years, and they were in good health. Thus, they felt they had no incentive to quit (Rimer, research in progress). In addition, smokers 65 years of age and older are less knowledgeable about the health effects of smoking; they are somewhat less likely than younger smokers to recognize that smoking is related to cancers of the larynx, esophagus and lung and chronic bronchitis (Shopland and Brown, 1987). Older smokers also are less likely than younger smokers to be told by their physicians to quit, unless they present with smoking-related illness or symptoms (Ockene et al., 1985).

Nevertheless, older adults may be more receptive to cessation messages than younger audiences due to their increased susceptibility to the health consequences of continued smoking. Special quitting incentives for older adults should include: greater concern with health protection (USDHHS, 1987); desire to remain independent; greater immediacy of smoking health risks; exposure to friends and relatives with smoking-related illnesses; greater physician contact (Dzegede et al., 1981; Doremus Porter Novelli, 1987), the benefits of cumulative learning over repeated quit attempts (e.g., Schacter, 1982) and higher

prevalence of smoking-related illnesses and chronic conditions, which have been shown to be among the most powerful quitting motivators (Pederson and Lefcoe, 1976).

Serious illness adds weight to the physician's message and is related to a greater likelihood of successful quitting (USDHHS, 1984a; Ockene et al., 1987). Studies conducted among pulmonary and cardiac patients show that the presence of disease appears to be an important precursor of compliance. The more severe the disease, the more likely patients are to follow their physician's advice (Schwartz, 1987). Most notably, survivors of a myocardial infarction have cessation rates averaging 50% (USDHHS, 1984a). Because older smokers are more likely to quit in the presence of respiratory and/or cardiac disease (Schwartz, 1987), clear demonstration of personal harm might increase perceived susceptibility to smoking-related diseases and, thus, the likelihood of quitting. For example, demonstration of lung effects using a carbon monoxide ecolyzer might raise perceived susceptibility and make older people more receptive to the quitting message.

V. SMOKING CESSATION STRATEGIES THAT APPEAR PROMISING FOR OLDER ADULTS

A. Introduction

Older smokers may need special help in quitting smoking because they tend to be long-term, heavier smokers. The variety of smoking cessation methods have been reviewed comprehensively, most recently by Schwartz (1987). These include self-help, medication such as Nicorette®, hypnosis, educational approaches, clinics and groups, physician counseling and mass media and community trials. Some of these methods are likely to be more appropriate for older adults than others.

There is now substantial evidence that several factors improve success in quitting, e.g., use of multiple cessation methods, presence of illness or risk factors which enhance motivation to quit and good maintenance procedures for long-term support (Schwartz, 1987). The most promising approaches are based on social learning, that is, they treat smoking as a learned behavior in which the would-be quitter must learn to manage the antecedents and consequences of smoking (Lichtenstein and Brown, 1980). The most successful strategies are likely to be those that are woven into a smoker's regular environment--the medical care setting,, workplace, school and media (Ockene et al., 1987).

Kottke et al. (1987) conducted a meta-analysis to examine 108 intervention comparisons in 39 controlled smoking cessation trials. They concluded that the program with the best results six months after the initiation of intervention would be one in which both physicians and non-physicians used multiple intervention modalities to deliver individualized face-to-face interventions on multiple occasions (Kottke et al., 1987). The authors argued that ways should be found to increase the frequency, variety and ubiquity of smoking cessation messages (Kottke et al., 1987).

What is not known are what kinds of programs will be most effective for older adults. Not only are older adults not studied systematically; the data often are not presented in such a way as to permit age-related generalizations to be made.

In the next section, some of the promising strategies that can be adapted for older adults are reviewed briefly, and have been grouped according to broad

categories: (1) self-help, which may be introduced to the prospective quitter in a variety of ways; (2) clinical interventions; (3) physician-mediated interventions; (4) mass media, which have been used for a range of purposes, from simply raising awareness to teaching specific quitting techniques; and (5) community and worksite-based strategies, which take advantage of social relationships.

B. Potential of Self-Help Cessation Methods Among Older Adults

Self-help treatment approaches have potential cost-effectiveness and wide appeal to Americans. Most smokers attempting to quit do so without outside help: 95% of America's 32 million ex-smokers have quit on their own (Horn, 1978), and most current smokers express a preference for self-help quitting instructions, books and aids over formal face-to-face clinic and counseling approaches (Schwartz and Dubitzky, 1967). The vast majority of smokers are unwilling to enroll in organized cessation programs (Cohen et al., 1987). The 1982 Surgeon General's Report (USDHHS, 1982) concluded that the preferences of smokers and the unaided efforts of most who have quit point clearly to the desirability of effective self-help programs in smoking cessation. Abstinence rates for self-help programs range from 5% to 40% and may be enhanced with brief health professional interventions (Janz et al., 1987). Older focus group participants in Philadelphia expressed a clear preference for self-help over group methods (Rimer, research in progress).

However, most self-help methods are not oriented to older smokers, and it is not known whether the techniques that are appropriate for younger smokers will be effective for older smokers. Research is needed to identify the most acceptable self-help strategies and messages for older people. For example, it is likely that the reasons for quitting may vary with the age of the smoker. Smoking cessation manuals typically show young and middle-aged adults and provide examples that are more relevant to these groups as well.

Self-help packages should include several features to promote adherence, including age-tailored quitting advice and reinforcement. Besides examining standard smoking history, psychosocial and health-related predictors and other variables, a range of subject and intervention characteristics that may influence adherence to the recommended self-quitting strategies should be examined. Self-help strategies must include age-tailored advice. The new American Lung Association (ALA) self-help smoking cessation guide, Freedom From Smoking® For You and Your Family (Strecher and Rimer, 1987), contains age-related exercise recommendations. But other tailoring could be done, as well. For example, many older people may lack the social support networks accessible to younger adults, e.g., at work, but may have others. The temptations they face may be different, and certainly the appropriate alternatives to smoking must be age-appropriate.

The impact of self-help methods for older adults could be enhanced through mailed and telephone reinforcements delivered to older adults in their homes to cue and reinforce behavioral change and its maintenance. Research shows the promise of such interventions as potentially cost-effective means of boosting quit rates by providing longer-term reinforcement (e.g., Janis, 1983; Orleans et al., 1986).

Boosting the number and success of self-guided quit attempts through widescale cost-effective programs to aid self-quitters is a priority for national smoking

control (Greenwald et al., 1987)--a critical strategy in the effort to achieve the nation's cancer control objectives for the Year 2000.

C. Clinical Interventions

The most effective programs are broad-spectrum, involving multicomponent treatments that incorporate behavioral, cognitive and aversive approaches (Ockene et al., 1987). The programs are based upon strategies of teaching new coping skills or enhancing old ones and preventing relapse. According to Ockene et al. (1987), the best outcomes and greatest potential are evidenced by multicomponent packages that include psychological, behavioral, social and physiological approaches.

D. Reaching Older Adults Through Physician Offices

The Surgeon General (USDHHS, 1982) concluded that brief and simple advice by a physician to quit smoking is a relatively inexpensive way to help people quit. Most adult smokers claim they never have been told to stop smoking by their physicians (Cummings et al., 1987; Cohen et al., 1987). Although United States physicians view smoking as an extremely serious health risk and feel responsible for helping their patients quit, only two-thirds advise most of their patients to quit, and fewer than one-fourth offer any kind of structured assistance in helping them quit (Orleans, 1985).

Currently, 30% of the practice of internists and medical subspecialists is devoted to older people, and this may increase to 50% within the next 20 years (Stults, 1984). More than 16% of the total physician visits during 1983 were made by persons aged 65 and over. The average American 50-74 years makes 4.5 ambulatory visits per year and those 65 years and older make 6.3 visits per year (Rice and Estes, 1984). Thus, there are millions of potential encounters in which the smoking issue can be raised and dealt with and in which reinforcement can be provided. Even a modest level of impact, such as the six percent cessation rate obtained by counseling alone (Russell et al., 1983), could translate to significant reductions in smoking-related morbidity and mortality among older adults.

Although adults 60 years of age and older report that they are more likely to follow a doctor's orders than younger people (USDHHS, 1986d), physicians spend less time with older patients (Kane et al., 1980) and are less likely to give a strong cessation message to older adults (Ockene et al., 1985).

Physicians' offices are among the most important potential sites for smoking cessation activities directed at older adults (Hazzard, 1983; Fletcher, 1984). Schwartz (1987) reviewed 28 physician intervention trials. Among trials reporting one year follow-up, the median rate for counseling alone was six percent; this increased to 22.5% when the intervention went beyond counseling and climbed to 32% and 43% for pulmonary and cardiac patients. In one of the most promising studies, Russell et al. (1983) found quit rates of 10%, 14% and 20% for control, advice to quit and advice plus nicotine gum, respectively. Li et al. (1984) also showed that brief physician counseling can be effective--8% quit rates compared to 4% for simple warnings. Thus, there is clear evidence that, especially when the proper support is added to physician counseling, physician-mediated interventions can be quite powerful.

Primary care interventions should include five steps: (1) identifying smokers, (2) giving brief, personalized quit-smoking advice, (3) introducing the

treatment, (4) setting a quit date and follow-up dates and (5) assisting patients to recycle through the same treatment or to try a more intensive or specialized treatment in the event of a relapse of setback (e.g., NCI, 1987; Orleans, 1986, in press; Orleans et al., 1987). These are consistent with the recommendations of the US Preventive Services Task Force. A number of good summary articles and manuals now are available to help physicians advise smokers (e.g., Danaher et al., 1980; Windsor et al., 1980; Working Group on Physician Behaviors To Reduce Smoking Among Hypertensive Patients, 1983; Sachs, 1984; Orleans, 1985; Hughes and Kottke, 1986; USDHHS, 1986a). However, only one of these guides includes age-related guidelines for quitting smoking (USDHHS, 1986a).

Self-help materials and Nicorette® gum are two strategies that can be combined effectively with brief physician intervention. Self-help quitting strategies are well suited to diffusion through the health services sector. Quit rates from self-help manuals are likely to be higher when they are provided after personal medical advice to quit (e.g., Janz et al., 1987). Providing nicotine gum at no cost may markedly improve the rates at which physicians counsel patients about smoking (Cohen et al., 1987), although it is likely that Nicorette® will be contraindicated for many older adults. Helping physicians to develop reminder systems also will increase the proportion of patients whom they counsel (Cohen et al., 1987).

The physician-mediated intervention is one of the most promising smoking-cessation strategies for older adults. Physicians are credible sources of health information, and the cessation message can be integrated logically within the continuing health care of older adults.

B. Reaching Older Smokers in Community and Worksite Settings

Community-based interventions are based, in part, upon the hypothesized importance of social factors in quitting and continued abstinence and the potential for changing smoking norms (Ockene et al., 1987). An additional benefit of the community setting for older adults is that they can be reached where they live. A number of community intervention studies have been conducted or are in process, for example, North Karelia, Stanford Three-Community, Pawtucket Heart Health and the Minnesota Heart Health Program (Farquhar et al., 1977; Puska et al., 1983; Blackburn et al., 1984; Lasater and Carleton, 1985). These programs have demonstrated reductions in smoking; they have been most effective when intensive, multi-strategy and occurred over a long period of time (Ockene et al., 1987).

A number of community organizations can be utilized to promote smoking cessation programs for older adults. Twenty million Americans belong to the American Association of Retired Persons (AARP), and many of them can be reached through local chapters which can be used to offer the smoking cessation message, provide self-help materials and track older adults into more intensive interventions, if needed. Also, in view of the large proportion (75%) of older people who are members of a church or synagogue and claim to attend church regularly (49%) (Gallup Poll, 1981), religious groups offer another logical delivery site for health promotion activities for older adults. Such programs can produce positive changes in health-related knowledge, beliefs and behaviors (Rimer et al., 1986a). Voluntary health agencies, senior centers and public health clinics also can be important intermediaries in delivering such programs. Reaching older people with health information as they attend their usual activities in the community may be a cost-effective alternative to more extended

group programs, which may produce positive changes but can reach only a relative few and at greater cost.

Worksites offer another means to provide environmental and social support to older smokers. Kiefhaber and Goldbeck (1986) noted that older workers, their spouses and retired employees are three groups that can be reached through worksite wellness programming. Pre-retirement groups may offer the opportunity to reach workers at an important transition point in their lives, when they may be receptive to health information and willing to change their behavior. It is estimated that more than 75% of the Fortune 500 firms should have pre-retirement programs in place by 1989 (Siegel, 1986). Smoking and other health promotion topics can be integrated within these programs.

F. Mass Media Approaches

The mass media may offer important channels for communicating the message, "you are never too old to quit." A large majority of older people read newspapers regularly, and they are heavy viewers of television. The mass media could be used to raise older adults' awareness regarding the relationship between smoking and disease and to encourage them to ask their physicians about smoking. Although there have been some relatively successful mass media smoking cessation programs (Schwartz, 1987), person-to-person communication appears to be a necessary part of efforts to reduce smoking and maintain cessation (USDHHS, 1984b). Green and McAlister (1984) concluded that the mass media are not likely to have much effect at the point of public health program diffusion unless their social objectives are reinforced by families, peer groups and other formal and informal community systems.

In addition, smoking cessation messages must compete with a host of other concerns for Public Service Announcement placement. Messages about older people then would compete with messages aimed at other high-risk audiences. Furthermore, smoking cessation messages in the print media are far outweighed by pro-use advertisements sponsored by the tobacco companies. Careful planning at the national and local level can help to overcome some of these barriers.

The media, then, remain a necessary but not sufficient component of smoking cessation programs aimed at older adults. They might be used most effectively in raising older adults' awareness about the consequences of continued smoking and the benefits of cessation and providing linkage to self-help materials (Dubren, 1977; Best, 1980; Puska et al., 1981).

VI. RECOMMENDED SMOKING CESSATION APPROACHES

Several approaches can be used in designing specific smoking cessation messages to reach older adults. These include:

- **Provide more vivid information.** Techniques like case studies and photovignettes can be used to heighten vividness and to increase the salience of the cessation message for older adults (Nisbett and Ross, 1980).

- **Promote "peace of mind" as a major benefit.** This message can be used to encourage smokers to seek help and to provide a sustained rationale for quitting.

- **Highlight the relationship between smoking and medical and potential medical problems.** These are critical motivating factors for stopping smoking, especially for older adults. The message should include clear, direct evidence that older adults can be harmed by continued smoking and gain significant benefits by cessation.

- **Use reliance on physicians as a basis for action.** Older adults could be encouraged to "ask your doctor how to quit smoking" or "talk to your doctor about your smoking." Physician messages should be unequivocal. A "clean bill of health" for an older smoker is perceived as an endorsement for continued smoking (Rimer, research in progress). Credible physicians, the Surgeon General, for example, could be important mediators in conveying the importance of cessation to older adults through the mass media and practicing physicians.

- **Provide specific information.** Behavioral research, (e.g., Leventhal et al., 1965; Zimmerman et al., 1986) suggests that adults are more likely to perform a recommended health behavior when specific information is provided. There is every reason to believe that this applies to older as well as younger adults. Information about why to quit, how to quit and where to get help should be translated into specific action instructions.

The information should be relevant to and individualized to older adults, and, where possible, include feedback and reinforcement (Green, 1984; Hoyt and Janis, 1975; Orleans et al., 1986).

VII. POLICY IMPLICATIONS AND FUTURE DIRECTIONS

The scientific evidence suggests that older adults experience significant harm from continued smoking and can reap substantial benefits from quitting. The strongest empirical support is for a focus on adults 55-75 years old where the health benefits of cessation are clearest.

In order to improve the quantity of quality of smoking cessation efforts directed at older adults, changes must occur on many levels. These include data collection, financing and the development and evaluation of interventions. In this final section, questions and issues related to these areas will be raised.

Reliable data on the smoking behavior and related health practices of older adults are scant. Problems with many of the current national and local studies of smoking behavior are that: the population is subdivided into large, unwieldy categories, and adults 65 years and older are treated as a homogeneous unit. At the very least, national studies should report the smoking practices of older adults in quintiles. This will provide the only reasonable basis for assessing current and tracking future smoking behavior among older adults. Classifying older adults as 65 years and older is simply not helpful in this regard. Other means of rectifying deficiencies in data collection and reporting should be considered, as well.

A cursory review of the mean age for many of the well-known smoking cessation studies suggests that older adults are not being recruited. Researchers could be encouraged to recruit older people into smoking cessation studies and to provide detailed information on age-related quit rates, as well as process data about quitting experiences.

We also must examine ways in which incentives can be built into our financing systems to encourage improved health promotion practices for older adults. Somers (1984) has suggested several options related to Medicare. Public and private insurance mechanisms for improving prevention services should be considered.

As an alternative or an addition to financing incentives for prevention, should cigarette excise taxes be raised, with part of the revenue devoted to provide for the medical care costs associated with smoking (Loeb et al., 1984)? This would also shift the burden of smoking-related diseases onto smokers themselves. This strategy raises a number of social and ethical questions concerning who is responsible and who pays. On the one hand, payment would be shifted to those responsible for the costs. On the other hand, shifting costs might be distasteful to some, because smoking has become more and more a habit of less affluent Americans (USDHHS, 1986b) who might be regarded as having fewer choices about their risk-taking behavior. Thus, they might be seen as bearing a disproportionate burden. Nevertheless, as Bayer and Moreno (1986) argued, the tendency to place greater and greater obligations on society for the provision of health care through third-party mechanisms means that the burden has become increasingly communal. This should challenge us to develop solutions that are ethically acceptable.

As this review has shown, older adults have not been a focus for smoking cessation efforts. How can smoking cessation interventions be integrated within the usual delivery of health care services to older adults. How can practitioners and researchers be encouraged to reach out to meet the special needs of older adults? Would it not be helpful to educate physicians and their staffs about how to counsel older adults to change health behaviors, such as smoking? They could be helped to implement simple reminder systems, such as that developed by Cohen et al. (1987). At the very least, physicians should act as positive role models for nonsmoking behavior, and their offices should be smoke-free zones (USDHHS, 1984b).

Multidisciplinary teams of smoking cessation experts and educational gerontologists might examine some of the most promising self-help smoking cessation manuals and recommend how to tailor them to meet the quitting needs of older adults. The efficacy of these tailored guides, with and without other supports, such as mailed and telephone reinforcements and physician counseling, could be tested. Self-help programs could be mediated by voluntary health organizations and by other organizations interested in meeting the health needs of older adults.

No one approach to cessation is sufficient. A recent National Cancer Institute (NCI) report concluded that there is ample evidence to suggest that the cumulative effect from a number of interventions on an individual's smoking behavior is greater than the effect from any one intervention (NCI, 1987). This is an important conclusion, because it means that multiple messages do not have a deadening or desensitizing effect, as has sometimes been thought. Thus, there must be attempts to reach older adults with the quitting message through the mass media, self-help, the organizations to which they belong, the physicians from whom they seek care, by introducing inducements for prevention into government financing systems, and, finally, by changing social norms regarding smoking and older adults.

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VIII. CITATIONS AND REFERENCES

1. Achkar, E. Peptic Ulcer Disease: Current Management in the Elderly. Geriatrics 1985; 40: 77-79, 82-83.
2. Abramson, JH. Prevention of Cardiovascular Disease in the Elderly. Public Health Rev 1985; 13: 165-233.
3. Anderson, WF. Is Health Education for the Middle-Aged and Elderly a Waste of Time? In T Wells (ed), Aging and Health Promotion. Rockville, MD: Aspen Systems Corporation, 1982.
4. Barbaro, EL, Noyes, LE. A Wellness Program for a Life Care Community. Gerontologist 1984; 24: 568-571.
5. Bayer, R, Moreno, JD. Health Promotion: Ethical and Social Dilemmas of Government Policy. Health Aff 1986; 5: 72-85.
6. Benfante, R, Reed, D, Brody, J. Biological and Social Predictors of Health in an Aging Cohort. J Chronic Dis 1985; 38(5): 385-395.
7. Best, JA. Mass Media, Self-Management, and Smoking Modification. In PO Davidson and SM Davidson (eds) Behavioral Medicine: Changing Health Lifestyles. New York, NY: Brunner/Mazel, Inc., 1980. pp. 371-390.
8. Blackburn, H, Luepker, R, Kline, F et al. The Minnesota Heart Health Program. In S Weiss, J Matarazzo, N Miller et al. (eds) Behavioral Health: A Handbook for Health Enhancement and Disease Prevention. New York, NY: John Wiley and Sons, Inc., 1984.
9. Bolten, CR, Ball, J. Understanding Health in Old Age: A Role for the Health Educator. Health Education 1983; 14: 36-38.
10. Bosse, R, Rose, CL (eds). Smoking and Aging. Lexington, MA: DC Heath and Company, 1984.
11. Brodzka, W, Thornhill, HL, Howard, S. Burns: Causes and risk factors. Arch Phys Med Rehabil 1985; 66: 746-752.
12. Burman, LA, Norrby, R, Trollfors, B. Invasive Pneumococcal Infections. Rev Infect Dis 1985; 7: 133-142.
13. Burr, ML, Phillips, KM, Hurst, DN. Lung Function in the Elderly. Thorax 1985; 40: 54-59.
14. Cohen, SJ, Christen, AG, Katz, BP et al. Counseling Medical and Dental Patients about Cigarette Smoking. Am J Public Health 1987; 77: 313-316.
15. Cummings, KM. Changes in the Smoking Habits of Adults in the United States and Recent Trends in Lung Cancer Mortality. Cancer Detect Prev 1984; 7: 125-134.
16. Cummings, KM, Giovino, G, Sciandra, R et al. Physician Advice to Quit Smoking: Who Gets It and Who Doesn't. American Journal of Preventive Medicine 1987; 3: 69-75.
17. Danaher, BG, Ellis, BH, Farquhar, JW. How To Help Smokers Who Want To Quit. Patient Care 1980 August 15; 86-121.
18. Doremus Porter Novelli. Focus Groups on Preventive Health Care For Older Persons. Prepared for Office of Disease Prevention and Health Promotion and American Cancer Society, August 1987.
19. Dubren, R. Evaluation of a Televised Stop-Smoking Clinic. Public Health Rep 1977; 92: 81-84.
20. Dzegede, SA, Hackworth, JR, Pike, SW. Factors that Differentiate Smokers from Exsmokers in a Florida Metropolitan Area. Public Health Rep 1981; 96(4): 326-334.
21. FallCreek, S, Mettler, M. A Healthy Old Age: A Sourcebook for Health Promotion with Older Adults. Seattle, WA: University of Washington, 1980.
22. FallCreek, S, Stam, SB. The Wallingford Wellness Project. Seattle, WA: University of Washington (Monograph No.2), 1982.
23. Farquhar J, Maccoby N, Wood P, et al. Community education for cardiovascular health. Lancet 1977; 1: 1192-1195.
24. Fielding, JE. Smoking: Health Effects and Control (First of Two Parts). N Engl J Med 1985a; 313(8): 491-498.

25. Fletcher, DJ. Promotion Health in Elderly Patients. Geriatric Consultant 1984; 2(4): 26-29.
26. Gallup Poll. Gallup Opinion Index. 1981.
27. Gordon, NP, Cleary, PD. Smoking Cessation in a National Probability Sample Cohort 1979-1980. The Institute for the Study of Smoking Behavior and Policy, John F. Kennedy School of Government, Harvard University. October 1986, Unpublished Manuscript.
28. Gordon, T, Kannel, W, McGee, D. Death and Coronary Attacks in Men Giving Up Cigarette Smoking. Lancet 1974; 2: 1345-1348.
29. Graham, S, Levin, ML. Smoking Withdrawal in the Reduction of Risk of Lung Cancer. Cancer 1971; 27(4): 865-871.
30. Green, LW. Modifying and Developing Health Behavior. In L Breslow (ed), Annual Review of Public Health (Volume 5). Palo Alto, CA: Annual Reviews, Inc., 1984.
31. Green, LW. Some Challenges to Health Services Research on Children and the Elderly. Health Serv Res 1985, Part II; 19(6): 793-815.
32. Green, LW, McAlister, AL. Macro-Intervention to Support Health Behavior: Some Theoretical Perspectives and Practical Reflections. Health Educ Q 1984; 11:322-339.
33. Greenblatt et al. Drug Disposition in Old Age. N Engl J Med 1982; 306: 1081-1088.
34. Greenwald, P, Cullen, JW, McKenna, JW. Cancer Prevention and Control From Research Through Applications. JNCI 1987; 79: 389-400.
35. Havlik, RJ. Determinants of Health--Cardiovascular Risk Factors. In Vital and Health Statistics (Series 3, No. 25). Washington, DC: USGPO, 1987. pp. 37-40.
36. Hazzard, WR. Preventive Gerontology: Strategies for Healthy Aging. Preventive Gerontology 1983; 74(2): 279-287.
37. Heckler, MM. Health Promotion for Older Americans. Public Health Rep 1985; 100(2): 225-230.
38. Heidrich, F, Thompson, RS. Osteoporosis Prevention: Strategies Applicable for General Population Groups. J Fam Pract 1987; 25: 33-39.
39. Hershey, JC, Probst, J, Portnoy, B. An Evaluation of a National Health Promotion Campaign. Report to the Office of Health Information, Health Promotion, and Physical Fitness, and Sports Medicine (Contract No. 282-80-0056-SHP), Kappa Systems, Inc., 1982.
40. Horn, D. Who is Quitting--and Why? In JL Schwartz (ed) Progress in Smoking Cessation: Proceedings, International Conference on Smoking Cessation. New York, NY: American Cancer Society, 1978. pp. 27-32.
41. Howard, G, Toole, JF, Frye-Pierson, J. Factors influencing the survival of 451 transient ischemic attack patients. Stroke 1987; 18: 552-557.
42. Hoyt, MF, Janis, IL. Increasing Adherence to a Stressful Decision via a Motivational Balance Sheet Procedure: A Field Experiment. J Pers Soc Psychol 1975; 31: 833-839.
43. Hughes, JR, Kottke, T. Doctors Helping Smokers: Real World Tactics. Minn Med 1986; 69: 293-295.
44. Jajich, CL, Ostfeld, AM, Freeman, DH. Smoking and Heart Disease Mortality in the Elderly. JAMA 1984; 252(20): 2831-2834.
45. Janis, I. The Role of Social Support in Adherence to Stressful Decisions. Am Psychol 1983; 38: 143-160.
46. Janz, NK, Becker, MH, Kirscht, JP et al. Evaluation of a Minimal-Contact Smoking Cessation Intervention in an Outpatient Setting. Am J Public Health 1987; 77(7): 805-809.
47. Kane, R, Solomon, D, Beck, J et al. The Future Need for Geriatric Manpower in the United States. N Engl J Med 1980; 302: 1327-1332.
48. Kane, RL, Kane, RA, Arnold, SB. Prevention and the Elderly: Risk Factors. Health Serv Res 1985, Part II; 19(6): 945-1006.

49. Kemper, DW, Deneen, EJ, Giuffre, JV. Growing Younger Handbook. Boise, ID: Healthwise, Inc., 1981.
50. Kiefhaber, AK, Goldbeck, WB. Worksite Wellness. In K Dychtwald, J MacLean (eds), Wellness and Health Promotion for the Elderly. Rockville, MD: Aspen Publication, 1986. pp. 147-164.
51. Kirchman, MM, Reichenbach, V, Giambalvo, B. Preventive Activities and Services for the Well Elderly. Am J Occup Ther 1982; 36: 236-242.
52. Kottke, TE, Battista, RN, DeFriese, GH et al. Attributes of Successful Smoking Cessation Interventions in Medical Practice. Prepared for the United States Preventive Services Task Force, 1987.
53. Leventhal, H, Jones, S, Singer, R. Effects of Fear and Specificity of Recommendation Upon Attitudes and Behavior. J Pers Social Psychol 1965; 2: 20-29.
54. Leviton, D, Santa Maria, L. The Adults' Health and Development Program: Descriptive and Evaluative Data. Gerontologist 1979; 19: 534-543.
55. Li, VC, Kim, YJ, Ewart, CK et al. Effects of Physician Counseling on the Smoking Behavior of Asbestos-Exposed Workers. Prev Med 1984; 13: 462-476.
56. Lichtenstein, E, Brown, RA. Smoking Cessation Methods: Review and Recommendations. In WR Miller (ed), The Addictive Behaviors. New York, NY: Pergamon Press, 1980. pp. 169-206.
57. Lidoff, L, Beaver, L. Peer Groups for Health Education. Washington, DC: National Council on Aging, 1982.
58. Loeb, LA, Ernster, VL, Warner, KE et al. Smoking and Lung Cancer: An Overview. Cancer Res 1984; 44: 5940-5958.
59. Lorig, K, Kraines, R, Holman, H. A Randomized Prospective, Controlled Study of the Effects of Health Education for People with Arthritis. Presented at the American Rheumatism Association Meeting, Boston, MA, 1981.
60. Lubin, YH, Blot, WJ, Berrino, F et al. Modifying Risk of Developing Lung Cancer by Changing Habits of Cigarette Smoking. Br Med J 1984; 288: 1953-1956.
61. Mallamad, SS, Eisner, EJ, Ostrove, N. Health Promotion and the Elderly. Washington, DC: Porter, Novelli & Associates, 1984.
62. Mason, GR, Uszler, JM, Effros, RM et al. Rapidly Reversible Alterations of Pulmonary Epithelial Permeability Induced by Smoking. Chest 1983; 83(1): 6-11.
63. Mellstrom, D, Rundgren, A, Jagenburg, R et al. Tobacco Smoking, Ageing and Health Among the Elderly: A Longitudinal Population Study of 70-Year-Old Men and an Age Cohort Comparison. Age Ageing 1982; 11: 45-58.
64. Melton, LJ, Riggs, BL. Letter to the Editor. N Engl J Med 1986; 314(3): 181.
65. Mitchell, RS, Judson, FN, Moulding, TS et al. Health Effects of Urban Air Pollution: Special Consideration of Areas at 1,500 m and Above. JAMA 1979; 242(11): 1163-1168.
66. Moore, SR. Smoking and Drug Effects in Geriatric Patients. Pharmacy International 1986; 7(1): 1-3.
67. Moore, SR, Kalu, M, Yavaprabbas, S. Receipt of Prescription Drug Information by the Elderly. Drug Intell Clin Pharm 1983; 17: 920-923.
68. Morisky, DE, Levine, DM, Green, LW et al. Health Education Program Effects on the Management of Hypertension in the Elderly. Arch Intern Med 1982; 142: 1835-1838.
69. Moss, AJ. Changes in Cigarette Smoking and Current Smoking Practices Among Adults: United States 1978. Advance Data 1979; 52: 1-15.
70. National Cancer Institute, Smoking, Tobacco, and Cancer Program. Presented to the Board of Scientific Counselors, Division of Prevention and Control, National Cancer Institute, September 22, 1987.
71. Nelson, EC, McHugo, G, Schnurr, P et al. Medical Self-Care Education for

Elders: A Controlled Trial to Evaluate Impact. Am J Public Health 1984; 74: 1357-1362.
72. Nelson, EC, Roberts, E, Simmons, J et al. Medical and Health Guide For People Over Fifty. Washington, DC: American Association of Retired Persons, 1986.
73. Nisbett, R, Ross, L. Human Inference: Strategies and Shortcomings of Social Judgment. Englewood Cliffs, NJ: Prentice-Hall, 1980.
74. Ockene, J, Williams, J, Hosmer, D et al. Factors Affecting Patients' Smoking and Physicians' Intervention Practices. Presented at the Society of Behavioral Medicine Meeting, San Francisco, CA, November 1985.
75. Ockene, JK, Hosmer, DW, Williams, JW et al. Factors Related to Patient Smoking Status. Am J Public Health 1987, 77: 356-357.
76. Office of Disease Prevention and Health Promotion. Aging and Health Promotion Marketing Research for Public Education. Arlington, VA: SRA Technologies, Inc. (PHS B84-211150), 1984.
77. Office of Disease Prevention and Health Promotion. Healthy Older People Program Memo (USDHHS, PHS) 1987; 2(1).
78. Office of Disease Prevention and Health Promotion. Smoking Cessation for Older People. Technical Review Notes. (USDHHS, PHS), 1986.
79. Office of Technology Assessment, Health Program Office, US Congress. Smoking-Related Deaths and Financial Costs, Staff Memo, September 1985.
80. Orleans, CT. Essential Elements of a Smoking Cessation Program: Facility Initiated Patient Protocols. Presented at the National Cancer Institute Conference on a State-of-the-Art Smoking Cessation Program, Bethesda, MD, December 1986.
81. Orleans, CT. Smoking Cessation Initiatives in Primary Care Settings. Journal of the Medical Society of New Jersey, in press.
82. Orleans, CT. Understanding and Promoting Smoking Cessation: Overview and Guidelines for Physician Intervention. Annu Rev Med 1985; 36: 51-61.
83. Orleans, CT, McCoubrey, C, Short, E et al. Minimal Telephone Counseling to Promote Self-Guided Smoking Cessation. Presented at the Meeting of the Association for Advancement of Behavior Therapy, Chicago, IL, 1986.
84. Orleans, CT, Strecher, V, Thompson, B et al. Quit For Life. Durham, NC: North Carolina Mutual Life Insurance Company, 1987.
85. Oster, G, Colditz, GA, Kelly, NL. The Economic Costs of Smoking and Benefits of Quitting for Individual Smokers. Prev Med 1984; 13; 377-389.
86. Parsons, PE. Cost of Health Care. In Vital and Health Statistics (Series 3, No. 25). Washington, DC: USGPO, 1987. pp. 76-79.
87. Pathak, DR, Samet, JM, Humble, CG et al. Determinants of Lung Cancer Risk in Cigarette Smokers in New Mexico. JNCI 1986; 76(4): 597-604.
88. Pederson, LL, Lefcoe, NM. A Psychological and Behavioural Comparison of Ex-Smokers and Smokers. J Chronic Dis 1976; 29: 431-434.
89. Prohaska, TR, Leventhal, EA, Leventhal, H et al. Health Practices and Illness Cognition in Young, Middle Aged, and Elderly Adults. J Gerontol 1985; 40: 569-578.
90. Puska, P, McAlister, A, Pekkola, J et al. Television in Health Promotion: Evaluation of a National Programme in Finland. Intl J Health Ed 1981; 24: 238-250.
91. Remington, PL, Forman, MR, Gentry, EM et al. Current Smoking Trends in the United States: The 1981-1983 Behavioral Risk Factor Surveys. JAMA 1985; 253(20): 2975-2978.
92. Rice, DP, Estes, CL. Health of the Elderly: Policy Issues and Challenges. Health Aff 1984; 25-49.
93. Rice, DP, Hodgson, TA, Sinsheimer, P et al. The Economic Costs of the Health Effects of Smoking, 1984. The Milbank Quarterly 1986; 64(4): 489-547.

94. Rimer, B, Keintz, MK, Fleisher, L. Process and Impact Evaluation of a Health Communications Program. Health Education Research 1986a; 1(1): 29-36.
95. Rimer, B, Keintz, MK, Glassman, B et al. Health Education for Older Persons. In W Ward, Z Salisbury, JG Zapka, SB Kar (eds), Advances in Health Education and Promotion (Volume 1, Part B). Greenwich, CT: JAI Press, Inc., 1986b. pp. 369-396.
96. Rogers, RL, Meyer, JS, Judd, BW et al. Abstention from Cigarette Smoking Improves Cerebral Perfusion Among Elderly Chronic Smokers. JAMA 1985; 253(20): 2970-2974.
97. Rowe, JW. Health Care of the Elderly. N Engl J Med 1985; 312(13): 827-835.
98. Rowe, JW, Bradley, EC. The Elderly Cancer Patient. In R Yancik (ed), Perspectives on Prevention and Treatment of Cancer in the Elderly. New York, NY: Raven Press, 1983.
99. Russell, MAH, Merriman, R, Stapleton, J et al. Effect of Nicotine Chewing Gum as an Adjunct to General Practitioners' Advice Against Smoking. Br Med J 1983; 287(6407): 1782-1785.
100. Sachs, DPL. Office Strategies to Help Your Patients Stop Smoking. J Respir Dis 1984; 5(2): 35-48.
101. Schacter, S. Recidivism and Self-Cure of Smoking and Obesity. Am Psychol 1982; 37: 436-444.
102. Schelling, TC. Economics and Cigarettes. Prev Med 1986; 15; 549-560.
103. Schuman, LM. Smoking as a Risk Factor in Longevity. In D Danon, NW Shock, M Marois (eds), Aging: A Challenge to Science and Society. Oxford, England: Oxford University Press, 1981. pp. 204-218.
104. Schwartz, JL. Review and Evaluation of Smoking Cessation Methods. Washington, DC: USDHHS (NIH 87-2940), 1987.
105. Schwartz, JL, Dubitzky, M. Expressed Willingness of Smokers to Try Ten Smoking Withdrawal Methods. Public Health Rep 1967; 82: 855-861.
106. Shopland, DR, Brown, C. Toward the 1990 Objectives for Smoking: Measuring the Progress with 1985 NHIS Data. Public Health Rep 1987; 102(1): 68-73.
107. Shopland, DR, Brown, CD. Analysis of Cigarette Smoking Behavior by Birth Cohort. Presented to the Interagency Committee on Smoking and Health, Washington, DC, 1985.
108. Shultz, JM. Perspectives on the Economic Magnitude of Cigarette Smoking. NY State J Med 1985; 85(7): 302-306.
109. Siegel, SR. Preretirement Programs in the '80's. Personnel Administrator 1986 February; 77-83.
110. Somers, AR. Why Not Try Preventing Illness as a Way of Controlling Medicare Costs? N Engl J Med 1984; 311(13): 853-856.
111. Somerville, K, Faulkner, G, Langman, M. Non-steroidal anti-inflammatory drugs and bleeding peptic ulcer. Lancet 1986; 1: 462-464.
112. Sorenson, AW, Seltser, R, Sundwall, D. Primary Cancer Prevention as an Attainable Objective for the Elderly. In R Yancik (ed), Perspectives on Prevention and Treatment of Cancer in the Elderly. New York, NY: Raven Press, 1983.
113. Sparrow, D, O'Connor, G, Colton, T et al. The Relationship of Nonspecific Bronchial Responsiveness to the Occurrence of Respiratory Symptoms and Decreased Levels of Pulmonary Function. The Normative Aging Study. Am Rev Respir Dis 1987; 135: 1255-1260.
114. Sparrow, DW. The Influence of Aging and Smoking on Pulmonary Function. In R Bosse and CL Rose (eds), Smoking and Aging. Lexington, MA: DC Heath and Company, 1984.
115. Special Committee on Aging, United States Senate. Developments in Aging: 1986, Volume 1. Washington, DC: USGPO, 1987a. pp. 173-195.

116. Special Committee on Aging, United States Senate. Developments in Aging: 1986, Volume 3. Washington, DC: USGPO, 1987b. p. 10.
117. Strecher VJ, Rimer, B. Freedom From Smoking® For You and Your Family. New York, NY: American Lung Association, 1987.
118. Stults, BM. Preventive Health Care for the Elderly. West J Med 1984; 141(6): 832-845.
119. Todd, B. Drugs and the Elderly. Cigarettes and Caffeine in Drug Interactions. Geriatr Nurs 1987; 8: 97-98.
120. United States Department of Health, Education and Welfare. Healthy Older Adults. In Healthy People. Washington, DC: USDHEW, 1979. pp. 71-81.
121. United States Department of Health, Education, and Welfare. Vital and Health Statistics: Data From the National Health Survey (Series 10, Number 34), 1967.
122. United States Department of Health and Human Services. Clinical Opportunities for Smoking Intervention: A Guide for the Busy Physician. Washington, DC: USGPO (NIH 86-2178), 1986a.
123. United States Department of Health and Human Services. The Health Consequences of Involuntary Smoking: A Report of the Surgeon General. Washington, DC: USGPO (DHHS (CDC) 87-8398), 1986b.
124. United States Department of Health and Human Services. The Health Consequences of Smoking: Cardiovascular Disease. Washington, DC: USGPO (DHHS (PHS) 84-50204), 1984a.
125. United States Department of Health and Human Services. The Health Consequences of Smoking: Chronic Obstructive Lung Disease: A Report of the Surgeon General. Washington, DC: USGPO (DHHS (PHS) 84-50205), 1984b.
126. United States Department of Health and Human Services. Health, United States: 1980. Hyattsville, MD: Public Health Service (PHS 81-1232), 1980.
127. United States Department of Health and Human Services. A Physician Talks About Smoking: A Slide Presentation. Washington, DC: USDHHS, 1986c.
128. United States Department of Health and Human Services. Prevention in Adulthood. In The Health Consequences of Smoking: A Report of the Surgeon General. Washington, DC: USGPO, 1982. pp. 257-288.
129. United States Department of Health and Human Services. Public Health Service Implementation Plans for Attaining the Objectives for the Nation. Public Health Rep 1983 Supplement to September-October; 1-164.
130. United States Department of Health and Human Services. Technical Report Cancer Prevention Awareness Survey Wave II. Hyattsville, MD: Public Health Service (NIH 87-2907), 1986d.
131. Vestal, RE, Wood, AJJ, Branch, RA et al. Effects of Age and Cigarette Smoking on Propranolol Disposition. Clin Pharmacol Ther 1979; 26(1): 8-15.
132. Vineis, P, Esteve, J, Terracini, B et al. Bladder Cancer and Smoking in Males. Int J Cancer 1984; 34: 165-170.
133. Warner, K. The Economics of Smoking and Lung Cancer. In LA Loeb, VL Ernster, KE Warner et al. Smoking and Lung Cancer: An Overview. Cancer Res 1984; 44: 5940-5958.
134. Windsor, RA, Green, LW, Roseman, JM. Health Promotion and Maintenance for Patients with Chronic Obstructive Pulmonary Disease: A Review. J Chronic Dis 1980; 33: 5-12.
135. Working Group on Health Education and High Blood Pressure Group. The Physician's Guide: Improving Adherence Among Hypertensive Patients. Washington, DC: USDHHS, 1987.
136. Working Group on Physician Behaviors. The Physician's Guide: How to Help Your Hypertensive Patients Stop Smoking. Washington, DC: USDHHS (NIH 83-1271), 1983.
137. Zimmerman, RS, Safer, MA, Leventhal, H et al. The Effects of Health Information in a Worksite Hypertension Screening Program. Health Educ Q 1986; 13(3): 261-280.

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