

A Basic Information System For Health Planning

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A SPECIAL information system is fundamental to modern health planning systems such as the one described in a preceding issue of this journal (1). Objective, quantitative measures of health problems are needed so that meaningful comparisons can be made between effort and achievement and so that cost-benefit analyses can be performed. Such measures would permit identification of areas for needed health services research and help establish correlations, which cannot now be seen, between certain health activities and their impact on health problems.

The following basic assumptions were made as a starting point in constructing the information system.

1. It is possible to develop a quantitative index for all health problems on a common base.
2. It is possible to quantify all health activities.
3. A basic information system can be established which will provide the basis for cost-benefit analysis, and such analysis will be an aid to professional judgment in the decision making process.
4. A well-designed basic information system

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will also provide valuable assistance to comprehensive health planning systems and will accelerate improvement of the health status of the nation.

Criteria for Basic Information System

Based on the requirements and assumptions mentioned, we have delineated criteria for the design of an information system. Such a system must provide for quantitative comparisons of health problems on a common base. It must quantify health activities related to health and environmental problems. It has to use existing data systems to the best advantage without being bound by them. The information system must relate current and projected resources to specific health and environmental problems, providing a framework for cost-benefit analysis and the selection of alternatives. It must be adaptable to performance budgeting and accounting, flexible enough for use at all management levels, and capable of satisfying existing administrative and budgeting requirements.

Assessing the Problem

Since all health programs are in some way related to reducing or containing health problems and promoting positive health, the first major step in health planning should be to define and measure those problems on some uniform and comparable basis.

Further, good management requires that some

method be devised whereby the health problems of people can be grouped on a logical basis. Because large health agencies are moving toward comprehensive health care, all diseases and conditions affecting the population need to be considered. The International Classification of Diseases, Adapted (ICDA) provides a logical grouping of health problems.

Definition of health problems by the ICDA system offers many advantages. Its disadvantages would probably also be present in other systems. Among the more important advantages are that the system is comprehensive; all diseases and conditions are included. Diseases of similar etiology are grouped together. Thus, diseases which are vulnerable to the same or similar methods of attack are considered as part of the same problem. The current magnitude of problems and changes in that magnitude are for the most part measurable by available statistics because health records are kept according to the ICDA classification or can easily be made consistent with it. The system facilitates performance budgeting and accounting since expenditures for any disease are more readily assignable to a health problem. Cost-benefit analysis can be undertaken not only within health problems but also among health problems to assist in determining relative changes in program emphasis that will be desirable.

The relative importance of, or priorities among, health problems must be established to help in deciding on the most effective approach to a goal. Objective determination of these priorities demands that a common unit of measurement be applied to all problems. For example, in assessing the relative magnitude of two diseases, mortality cannot be used as the measure in one case and morbidity in another.

Mortality and morbidity, however, can be reduced or transformed to a common denominator such as "useful life lost," loss in "productive time," or some similar unit of measurement. It is essential that these measurements reflect the relationship between the problem and the objective. For example, if the health objective is the elimination of disease, the problem cannot be measured by the number of health services provided. The number of cases of disease would serve as a more appropriate measurement.

For problems that may adversely affect the

health of the population, a somewhat different approach is required.

Obviously, if no problem currently exists, there is nothing to measure. In this instance, the potential magnitude of a problem that might develop must be estimated on the basis of the most valid and pertinent data available. These estimates must also meet the specified criteria—that is, provide a common unit of measurement for all problems and also lend themselves to measuring progress toward the objectives.

For example, on the basis of the current mortality and morbidity from smallpox in the United States, no preventive programs for smallpox could be justified. If, however, the risk of introduction of the disease and the potential morbidity and mortality were computed for an unimmunized population and if this potential problem were compared with other existing health problems, a smallpox preventive program could be justified on a cost-benefit basis. (The use of systems analysis and other techniques in health planning in no way removes the need for mature professional judgment; these tools only arrange the problem in a way that facilitates the best application of this judgment.)

If health planners are to set priorities for the application of resources, they must determine which problems to attack in order to make the greatest measurable progress toward their overall goals. They must also consider the relative magnitude of the various problems, the relative influence of these problems on the community's productive potential, and the relative costs of their amelioration.

In determining relative magnitude, the planners will have to recognize that directly comparable quantitative measures will not be possible in all instances. Factors such as impact on morale or sentimental appeal are not yet susceptible to measurement (although it is hoped that continued research in health-related social science will facilitate this measurement). Such factors will, however, sometimes outweigh measurable ones. The final decision will usually be based on a combination of measurable and immeasurable considerations. In any event, the measurable factors, even though not all-inclusive, will make the comparison of the various

health programs more meaningful, provide a continuing index, and permit more valid planning decisions.

Health Problem Index

The following health problem index, developed by the staff of the Division of Indian Health of the Public Health Service, exemplifies how several measurable factors may be combined to achieve a quantitative basis for comparing problems.

$$Q = MDP + \frac{A}{N}(274) + \frac{B}{N}(91) + N(274)$$

where:

M = Health problem ratio $\frac{(\text{Target group rate})}{(\text{Reference rate})}$

D = Crude target group mortality rate per 100,000

P = Years of life lost due to death

A = Number of inpatient days

B = Number of outpatient visits

C = Days of restricted activity

N = Target group population

274 = Conversion constant $\frac{100,000}{365}$

91 = Conversion constant $\frac{100,000}{365} \times \frac{1}{3}$

While this index is not the millennium, it represents a practical approach to health problem quantification. The index or magnitude of a health problem is obtained through a formula using the following variables: the crude death rate for the target population, a ratio based on a comparison of the target health problem rate

with the U.S. rate or other selected reference rate for the same problem, the lost productive potential as measured by days of hospitalization, the number of visits to outpatient facilities, the days lost because of restricted activity with or without medical treatment, the years of productive life lost because of premature death, and other factors.

Tables 1 and 2 illustrate use of the health problem index on a national basis. (The data in these calculations are from a national health survey carried out in 1963-64 under the auspices of the National Center for Health Statistics, Public Health Service.) This same technique can be used, with slight modifications, to obtain indexes for specific disease problems within a health problem.

By replacing the health problem ratio M with a specific disease ratio and using specific disease data in the terms D , A , B , and C , a priority listing of diseases within a specific health problem can be formulated for use in establishing the major causes of a health problem. The Division of Indian Health has used the health problem index, or Q index, since 1965. Despite certain deficiencies, it has proved a useful tool in the allocation of resources and has aided management in making decisions. An obvious deficiency is that all data needed to determine the days of restricted activity are not collected regularly at the community level. Such deficiencies, however, do not preclude the

Table 1. Mortality rates, number of hospital days, days of restricted activity, and physician visits, by selected diseases in the United States, 1963-64

Major class of disease from International Classification of Diseases	Mortality rate per 100,000	Hospital days (in thousands)	Physician visits (in thousands)	Days of restricted activity (in thousands)
All causes.....	939.7	207,977	844,000	1,607,304
1. Infective and parasitic diseases.....	9.7	4,174	73,428	201,263
2. Neoplasms.....	151.3	19,827	20,692	19,080
6. Diseases of the nervous system.....	111.3	13,100	76,804	34,545
7. Diseases of the circulatory system.....	365.8	34,613	119,358	24,392
8. Diseases of the respiratory system.....	49.1	17,338	231,256	764,128
9. Diseases of the digestive system.....	37.1	31,432	44,732	73,840
10. Diseases of the genitourinary system.....	16.4	17,634	23,632	43,668
11. Complications of pregnancy, and so forth.....	.7	17,886	24,476	52,229
12. Diseases of skin and cellular tissue.....	1.2	2,128	40,512	25,118
13. Diseases of bone and organs of movement.....	1.1	10,791	25,320	28,394
17. Accidents, poisoning, and so forth.....	70.2	22,558	60,768	300,820
All other.....	125.8	16,496	103,022	39,827

use of the index. They only suggest that means should be devised to overcome such deficiencies. For example, a regular, periodic, limited household survey could be initiated to supply the necessary data on restricted activity.

Among the advantages of the health problem index is that it provides a common base for comparison among and within health problems and for translating morbidity and mortality into a common unit of measurement. The index reflects the susceptibility of the health problem, or diseases, to modern health improvement practices. It permits comparison of diseases which primarily produce morbidity with those which produce both mortality and morbidity and affords a means of measuring program accomplishment in relation to an objective.

Measuring Environmental Problems

There are several environmental conditions which are affected by traditional health activities. Significant among these conditions are various kinds of pollution. In addition to contributing to health problems, some environmental conditions also cause extensive damage to property, vegetation, livestock, and so forth. Rodents and other disease vectors, such as mosquitoes, cause economic loss. The extent or magnitude of the nonhealth portion of these environmental problems can usually be expressed in terms of monetary loss, for they result in damage to material things or interfere with human activities. Control for health reasons of such environmental problems can thus decrease economic losses. Therefore, in cost-benefit analysis, any economic benefits accruing from such control should be credited to the traditional health activity responsible for the gain.

The problem of aesthetic degradation is not measurable at this time by any acceptable index. It is one of the problems which are in the realm of measurement by value judgment. The extent of such a problem is usually reflected in public attitudes expressed through legislative representatives. An example of such a problem is the current controversy over roadside junkyards.

To the system used in the International Classification of Diseases, Adapted, for numbering,

describing, and coding 17 major classes of health problems, we have added a class 18 on general health and six classes of major environmental problems, numbers 19-24. Thus, the 18 classes of major health problems are listed as follows:

<i>Class number and general description</i>	<i>ICDA codes (inclusive)</i>
1. Infective and parasitic diseases.....	002-138
2. Neoplasms	140-239
3. Allergic, endocrine system, metabolic, and nutritional diseases.....	240-289
4. Diseases of blood and blood-forming organs	290-299
5. Mental, psychoneurotic, and personality disorders	300-329
6. Diseases of the nervous system and sense organs	330-398
7. Diseases of the circulatory system.....	400-468
8. Diseases of the respiratory system.....	470-527
9. Diseases of the digestive system.....	530-587
10. Diseases of the genitourinary system.....	590-637
11. Deliveries and complications of pregnancy, childbirth, and puerperium.....	640-689
12. Diseases of the skin and cellular tissue....	690-716
13. Diseases of the bones and organs of move- ment	720-749
14. Congenital malformations.....	750-759
15. Certain diseases of early infancy.....	760-776
16. Symptoms, senility, and ill-defined condi- tions	780-795
17. Injuries and adverse effects of chemical and other external causes.....	800-999
18. General health.....	-----

The six classes of major environmental problems related to the 18 health problems, with the codes we assigned them, are as follows:

<i>Class number and general description</i>	<i>Subproblem codes (inclusive)</i>
19. Air pollution.....	A01-A08
20. Water pollution.....	A20-A27
21. Solid wastes.....	A40-A41
22. Rodents	A50-A53
23. Vectors	A60-A67
24. Pesticides	A82-A86

Classification of Health Activities

Because the next stage in systematic planning requires relating health activities to health and environmental problems, these activities must be classified and defined in some logical systematic way.

Health services areas. For the basic information system, all health services are grouped into four categories or health services areas. These

Table 2. The health problem index of the United States for selected classes of diseases, 1963-64

Major class of disease from the International Classification of Diseases	M	D	P	N (274)	N (91.3)	N (274)	Q value
All causes.....	1	939.7	16.6	306.71	414.74	2,404.62	18,725
1. Infective and parasitic diseases.....	1	9.7	23.9	6.15	36.08	301.10	575
2. Neoplasms.....	1	151.3	15.2	29.12	10.12	28.02	2,367
6. Diseases of the nervous system.....	1	111.3	11.1	19.32	37.74	51.68	1,344
7. Diseases of the circulatory system.....	1	365.8	11.7	50.83	58.40	35.82	4,425
8. Diseases of the respiratory system.....	1	49.1	18.6	25.57	113.64	1,143.19	2,196
9. Diseases of the digestive system.....	1	37.1	17.9	46.35	21.98	110.47	843
10. Diseases of the genitourinary system.....	1	16.4	14.6	26.01	11.61	65.33	342
11. Complications of pregnancy, and so forth.....	1	.7	43.4	26.38	12.03	78.14	147
12. Diseases of skin and cellular tissue.....	1	1.2	17.9	3.14	19.91	37.58	82
13. Diseases of bone and organs of movement.....	1	1.1	12.8	15.91	12.44	42.48	85
17. Accidents, poisonings, and so forth.....	1	70.2	32.3	33.27	29.86	450.05	2,781
All other.....	1	125.8	----	24.33	50.62	59.58	-----

categories are designated by the terms, "normal development," "repair," "containment," and "basic research."

The category "normal development" covers not only efforts to protect a person's health or to prevent his illness, but also actions taken to insure that he develops normally from birth to old age. Thus, the category includes prenatal care and efforts made to improve the abilities and opportunities of the older person so that he can live productively, as well as such diverse activities as air pollution control, multiphasic screening for disease and disability, accident prevention, promotion of physical fitness, the fostering of positive mental health, and the encouragement of social and cultural development.

The repair category covers the efforts expended to cure illness and see that the person returns to a normal state and function. It thus includes curative medical and dental care in hospitals, nursing homes, and outpatient clinics, as well as in the patient's home.

Containment is the term used for care directed at a chronic disease, mental illness, or condition of old age which cannot be completely cured. The purpose of the care is to contain the illness or disability at the minimal level possible. Containment includes long-term maintenance care in institutions and at a patient's home, as well as physical-mental rehabilitative treatment on an inpatient or outpatient basis.

Basic research in health consists of studies and investigations into physiology—into bodily functions and responses and their inter-relations,

for example. Such studies are not aimed at any particular disease or condition. Examples of such investigations are studies of cell structure and of blood chemistry.

General activity areas. Each of the four broad health services areas is subdivided into five general activity areas—direct operations, research, facilities, training, and demonstration and testing. Direct operations means all activities concerned with the direct provision of health services under each of the four health service areas mentioned. The term "research," as distinguished from basic research, is used in this system to mean efforts expended in exploring and developing new and better methods, facilities, and equipment for carrying out activities under the four health service areas. Facilities includes activities directed toward the provision of physical facilities and equipment for the conduct of direct operations, research, and training under the four health services areas. Training covers activities designed to develop manpower which will have the specialized skills and knowledge necessary for carrying on the direct operations and the necessary research in each of the four health services areas. Demonstration and testing are activities designed to demonstrate or test model systems and techniques for the improvement of health services.

The general activity areas are further subdivided into narrower program categories, under which specific activities are listed as program elements. The complete list of program categories and program elements under the

health service area categorized as “normal development” and the general activity area termed “direct operations” is shown in the box.

Output measures of effort expended under each program element in the classification system result in certain quantifiable end products. These products, termed output, are customarily used to measure what has been done in a program. Output will consist of such items as number of persons treated, number of samples collected and analyzed, and number of pollution sources eliminated.

Relating Activities to Problems

The health problem index for quantifying health problems and the classification of health activities and output are essentials of a basic health information system. These tools provide the means of relating what has been done, what is being done, and what is planned to the fundamental problems of death, illness, and disability and the related environmental problems. This relationship can be illustrated graphically by a sort of accounting ledger or “matrix,” showing all health activities in relation to all

Classification of Health Activities

Health services areas and general activity areas, giving a complete listing of program categories and program elements under “direct operations” in the health services area called “normal development” and with the assigned classification code numbers.

<i>Code number</i>	<i>Activity</i>	<i>Code number</i>	<i>Activity</i>	<i>Code number</i>	<i>Activity</i>
100000	Normal development	110300	Consumable products	110805	Farm environment
110000	Direct operations	110301	Milk	110806	Recreational environment
110100	Public education in health	110302	Shellfish	110807	Hazardous substances
110101	Mass communications	110303	Other foods	111000	Health service organization and development
110102	Group communications	110304	Food service	111001	Home health services
110103	Individual communications	110305	Water (public)	111002	Extended care, nursing, and convalescent home services
110104	Public information services	110306	Biologicals	111003	Health economics
110105	Technical information services	110307	Drugs	111004	Multiphasic screening
110106	Physical fitness development	110308	Cosmetics	111005	Standards and methods
110107	Student aid	110309	Tobacco	111006	Health service planning
110108	Institutional aid	110310	Water (private)	111007	Family planning
110200	Physical environment	110400	Positive personal and family health	111008	Student aid
110201	Air pollution control	110401	Physical examination	111009	Institutional aid
110202	Water pollution control	110402	Physical fitness development	111010	Referral services
110203	Disease vector control	110403	Immunization	120000	Research
110204	Noise control	110404	Multiphasic screening	130000	Facilities
110205	Housing	110405	Mass screening	140000	Training
110206	Solid wastes	110406	Clinics	150000	Demonstration and testing
110207	Ionizing radiation	110407	Home consultation		(Each of the last three items above contains the same program categories and program elements as the other general activity area—code 110000, Direct operations.)
110208	Public places	110408	Oral health	200000	Repair
111209	Pesticide control	110409	Nutritional services	300000	Containment
110210	Sewage disposal (public)	110410	Vital records	400000	Basic research
110211	Sewage disposal (private)	110411	Specialized testing		(Each of the three health services areas—last three items of list—contains the same general activity areas as code 100000, Normal development. However, the subclasses of activities, that is, the program categories and program elements, are unique to these health services areas.)
110212	Rodent control	110412	Normal deliveries		
		110413	Family planning		
		110500	Epidemiology		
		110501	Surveillance		
		110502	Epidemic investigations		
		110503	Epidemic control		
		110600	Quarantine		
		110601	International		
		110602	Interstate		
		110700	Disaster		
		110800	Accident prevention and occupational health		
		110801	Vehicular		
		110802	Home environment		
		110803	Institutional environment		
		110804	Work environment		

many operational programs into a computer system should lead to greater accuracy in selecting the programs which will have the greatest impact on health and environmental problems at the least possible cost.

Value of Basic Information System

As stated, the basic information system described is designed to assist the program manager in decision making. It does not make his decisions for him, but rather furnishes him with a set of objective orderly data which will make him aware of the implications of his decisions. The system also forces the program manager to make a comprehensive review of health and environmental problems and of possible actions when he formulates plans for the future.

Sets of activities directed toward reduction of given health and environmental problems will form the basis for program packages designed to overcome those problems. The individual activity or program element as described in the classification system becomes the program of the organizational unit.

The basic information system can be evaluated in terms of the original criteria as follows:

1. The system provides a quantitative comparison between and within health problems through a numerical index.
2. Health activities may be related to health and disease problems and related environmental problems by use of a matrix.
3. Existing data systems can be used but will require modification or expansion, especially in respect to sampling procedures.
4. Current and projected resource requirements can be related to health and environmental problems by applying the matrix concept.

5. Cost-benefit studies are facilitated by use of the matrix and by provision in the basic information system for relating particular activities to particular health and environmental problems, thereby permitting choices among various activities.

6. Performance budgeting and accounting are facilitated, since costs of a set of activities (a program package) can be identified. This identification permits the program manager to gauge his program for a projected outcome (health or environmental objective) by varying the resource input.

7. The entire basic information system meets the criterion of flexibility since both the program structure and the health and environmental problems can be expanded or consolidated to meet demands at the various levels of management.

Summary

The current philosophy of comprehensive health planning has stimulated a demand for a basic information system which will provide the objective measurement required to assist in decision making. The suggested system includes (a) a numerical health index to aid in defining and measuring health and environmental problems, (b) a classification system for health activities, and (c) a coded list of output measures of effort. The relationship of health activities to health and environmental problems is displayed in a matrix.

REFERENCE

- (1) Michael, J. J., Spatafore, G., and Williams, E. R.: An approach to health planning. Public Health Rep 82: 1063-1070, December 1967.