Behavioral Science Activities at the Centers for Disease Control and Prevention

A Selected Overview of Exemplary Programs

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Behavioral research and surveillance activities are conducted across the Centers for Disease Control and Prevention (CDC). This article highlights activities in 4 program areas: violence against women, tuberculosis elimination, HIV prevention, and occupational health. The unique constraints and opportunities of each organization and program focus have shaped the way research has developed in each of these areas. Behavioral scientists also face many common challenges at CDC. Despite the difficulties of integrating behavioral research into an institution that historically has focused on biomedical and epidemiological research, behavioral scientists have made important contributions to public health. Many opportunities remain for psychologists to translate theory and operationalize constructs for use in solving important public health problems.

Behavioral and social science research is conducted throughout the Centers for Disease Control and Prevention (CDC) and is critical to the accomplishment of CDC's mission to promote the nation's health. It is sometimes difficult for scientists outside of CDC, however, to understand precisely how research programs are initiated and carried out by behavioral and social scientists in the organization. No single model adequately illustrates how this is done. Some activities are mandated by Congress; others are initiated through proposals from CDC to Congress; and centers within CDC allocate internal funds according to emerging public health issues and according to their mission, priorities, and programmatic needs.

What is common to all behavioral research carried out by CDC scientists is collaboration with external colleagues. These colleagues include research and program staff in universities and hospitals; local, state, and federal governmental organizations; and national and community-based nongovernmental organizations. A variety of mechanisms exist for working with external prevention partners (see Rugg, Levinson, DiClemente, & Fishbein, 1997, this issue). Although some of the research is conducted through grants or contracts, much more is conducted through the cooperative agreement mechanism, which allows CDC scientists to collaborate with their external partners on the design and conduct of the research. It is through these collaborative relationships that CDC is able to respond quickly to emerging health threats and to opportunities to prevent disease, disability, and injury.

The following sections describe only a few of the current behavioral research and surveillance activities of CDC. They were selected, in part, to highlight the diversity of activities: surveillance, risk factor identification and determinants research, and intervention testing. Examples of these different types of activities can be found in a wide range of areas across CDC. We have chosen to describe studies from three specific program areas—violence against women, tuberculosis (TB) elimination and control, and HIV prevention—in which, until the 1980s, no behavioral or social science research had been conducted at CDC. Also described is a comprehensive program of behavioral research at the National Institute for Occupational Safety and Health (NIOSH), where behavioral research has a somewhat longer history.

Typically, public health research begins with the development of a surveillance system and builds toward the development and evaluation of interventions. The Behavioral Risk Factor Surveillance System (CDC, 1995b), a monthly, population-based, random-digit-dialed telephone survey of such behaviors as smoking, alcohol use, physical activity, and seat belt use, and the Youth Risk Behavior Surveillance System (Kolbe, Kann, & Collins, 1993) are some well-known examples of surveillance systems. In the newest area of research described in this article, violence against women, a surveillance system is now being developed as the first step in the development

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of a comprehensive research program. In the next area described, TB elimination, in which research has progressed from surveillance to the investigation of behavioral determinants, research on the determinants of adherence to treatment is highlighted. In HIV prevention, in which surveillance, behavioral determinants, and intervention research are all underway, the focus of the discussion is on an intervention research program. The description of the work at NIOSH includes both etiologic and intervention research and focuses on psychosocial and organizational factors that contribute to occupational health. Taken together, these activities exemplify some of the important, programmatically relevant research that is conducted through close collaboration with CDC's prevention partners and illustrate the unique challenges of conducting behavioral research in public health.

Surveillance of Violence Against Women

Although CDC is best known for its focus on infectious diseases, it also focuses on behaviors that result in injury, disability, or death. CDC has focused on preventing violence since the early 1980s, when efforts addressed the prevention of homicide, assault, suicide, and suicide attempts. The Division of Violence Prevention (DVP) in CDC's National Center for Injury Prevention and Control now employs a number of behavioral scientists and has four priority areas for violence prevention: youth violence, family and intimate partner violence, suicide, and firearm injuries. Early in 1994, CDC was funded to strengthen efforts to prevent family and intimate partner violence and to work toward the development of a national prevention program. The Family and Intimate Violence Prevention Team (FIVPT) was created within DVP: It is an interdisciplinary team that includes a criminologist, a psychologist, an evaluation researcher, an anthropologist, a communications expert, and several other public health personnel. The team is targeting its initial efforts at identifying effective measures for reducing the threat to adolescent and adult women of physical abuse or sexual assault by partners, acquaintances, and strangers.

To accomplish its mission, the FIVPT is using a public health approach to achieve four broad goals (Saltzman & Johnson, 1996). The first of these goals is discussed in more detail in the following pages. The goals include:

- Defining, describing, and tracking the problem: in other words, *surveillance.* CDC is developing monitoring systems that show how often violence against women occurs, which women face the greatest risk, and whether the problem is improving or worsening over time at national levels, local levels, or both.
- Increasing knowledge of the causes and consequences of violence against women. CDC is supporting prevention-oriented research that will lead to greater knowledge of modifiable factors associated with violence against women and the development of new prevention strategies.
- Demonstrating and evaluating ways to prevent violence against women. CDC is undertaking activities to determine the effectiveness of specific interventions for preventing violence against women and how to combine specific interventions into effective programs.
- Translating and disseminating findings from FIVPT activities. CDC is working to change social norms by making the public more knowledgeable about family and intimate partner violence and steps to prevent it. CDC will also support training and education of health care providers to identify victims of family and intimate partner violence and refer them for prevention services.

Issues in Surveillance of Violence Against Women

Public health surveillance—the ongoing and systematic collection, analysis, and interpretation of health data—is the foundation on which CDC has traditionally built its prevention activities. The quality of surveillance data has important implications for the accuracy of the predictions that underlie public health decisions. Without this information, program staff cannot determine whether they are reaching the people who need their services or whether their prevention strategies are working. As in other areas of public health, surveillance data related to violence against women are critical for decision makers who need to determine public health priorities and disseminate health data to the public.

Successful completion of the FIVPT's intervention, evaluation, and dissemination goals requires well-developed surveillance strategies that allow for defining, describing, and tracking the problem of violence against women. Unfortunately, surveillance systems designed to monitor national incidence of and trends in violence against women are not in place. We are also uncertain about the usefulness of existing data sources, originally designed for other purposes, in monitoring violence against women. Although there is general consensus that violence against women has a high prevalence (e.g., Browne, 1993; Goodman, Koss, Fitzgerald, Russo, & Keita, 1993), we are unable to determine how often violence against women occurs; which women face the greatest risk; how many people, including children and family members, are affected; whether the problem is improving or worsening over time; and how it varies across jurisdictions.

Several challenges face us in developing surveillance strategies that will allow us to accomplish our goals. The absence of agreed-upon terminology and case definitions is one of the most critical areas of concern. Researchers and practitioners often use different terms, including *spouse abuse, domestic violence, family violence, intimate violence, sexual assault,* and *rape,* to describe violence against women. Often they use different terms to refer to the same thing; at other times, they use the same term but are referring to different subparts of the larger phenomenon of violence against women.

For infectious diseases, the focus for surveillance is frequently on the number of victims affected; for violence against women, incidence and prevalence figures can reflect many things, and there is no agreement about the measurements to be made. We can measure the number of abused women or rape victims, batterers or rapists who commit abuse, and abusive partnerships. We can measure the number of people involved or the number of violent events (i.e., the number of abused women, the number of times they have been assaulted or injured, or the number of violent incidents). Because some women are raped or assaulted multiple times, often during a given incident, the number of incidents will differ from the number of assaults. Each measurement strategy will produce a different estimate of the size of the problem.

Outcome measures are similarly complex because they can relate to victims, perpetrators, or both, and because an abuser may stop his violence against one partner yet begin abusing someone else. His original victim also could be suffering more physical violence, but at the hands of a different partner. Thus, even if we know that members of a couple have terminated their abusive relationship, we might still get different answers about whether there is ongoing abuse, depending on which of the following questions is asked: whether an abused woman is currently in an abusive relationship, whether an identified abuser is currently perpetrating abuse, or whether the partners in an abusive relationship are currently in an abusive relationship with each other.

Despite evidence that violence against women is prevalent and results in serious injury, health departments are not in agreement that violence prevention should be a priority. In some places, violence may be seen as an important topic but not necessarily a public health problem, and there may be no attempt to gather information on its prevalence. It is not surprising, therefore, that figures on the extent of the problem vary widely. Strengthening surveillance for violence against women requires the involvement of a diverse group of individuals, including victim advocates and others not traditionally trained in the public health arena. Such a group must also include behavioral scientists who can address the complex issues related to conceptualizing the problem and defining and measuring behaviors and outcomes and who can help educate health department staff about the importance of supporting surveillance activities. To begin addressing these issues and to monitor violence against women, particularly intimate partner violence and rape, the FIVPT is engaged in a number of innovative projects, briefly described below.

Standard definitions and minimum data set. Early in 1996, the FIVPT convened a working group of experts to develop standard definitions for key variables and to recommend a minimum data set for surveillance. The working group included researchers, advocates, policymakers, and other public health representatives. Three states—Massachusetts, Michigan, and Rhode Island—have received funds to develop an inventory of their existing data sources on violence against women and to conduct pilot surveillance using the definitions and minimum data set developed by the working group. Each state will use its available or newly developed data sources. For example, Massachusetts will focus on injury data from hospital emergency departments by using an existing statewide surveillance system for weapon-related injuries, and Michigan will make use of a state prosecutor's database on intimate partner violence. Information obtained from the pilot tests will be used to refine the definitions and minimum data set for wider use. Ultimately, this work should lead to comparable data nationwide.

Rape prevention and education activities. The Violence Against Women Act (1994) of the 1994 Crime Bill included an increase of $28.5 million for fiscal year 1996 for rape prevention and education activities. This funding will be administered through the CDC Preventive Health and Health Services block grants. Because some of the same definitional problems exist for sexual assault as for other forms of violence against women, the FIVPT will provide technical support to state and local sexual assault prevention programs for their surveillance activities. For example, it will encourage states to use a consistent definition of rape to collect information from different data sources so that there can be uniform data collection. The FIVPT also will offer advice on conducting surveillance for rape using multiple data sources to avoid duplication of cases.

National telephone survey on violence against women. Through an interagency agreement, CDC and the National Institute of Justice are supporting a random-digit-dialed national telephone survey to determine levels of violence against women and the extent of related injuries. Data collection began late in 1995 and was completed in the spring of 1996. The survey, conducted by the Center for Policy Research in Denver, Colorado, was modeled on the Canadian Violence Against Women Survey (Statistics Canada, 1993) conducted in 1993. A representative sample of 8,000 women were asked about violence by intimate partners, acquaintances, and strangers. Eight thousand men were also interviewed about intimate partner violence. The large sample size will allow us to measure injuries and their tangible costs. The survey also includes questions about the use of mental health services and other medical services and should allow estimation of the associated costs of service use. The interviews with men will enable us to compare the severity of women's and men's injuries from intimate partner violence. Results of the survey will be compared with existing information from the recently revised National Crime Victimization Survey (U.S. Department of Justice, 1992) to assess whether it is sufficient to adequately measure the problem or whether a separate, periodic national survey focused on violence against women is needed.

Violence during pregnancy. Staff from the FIVPT, in collaboration with the Division of Reproductive Health in CDC's National Center for Chronic Disease Prevention and Health Promotion, developed questions about violence against women that have been in-

cluded in the core survey for the Pregnancy Risk Assessment Monitoring System (PRAMS; Adams et al., 1991). PRAMS is an ongoing, population-based surveillance system designed to supplement data from vital records and to generate state-specific data for planning and assessing perinatal health programs. PRAMS collects information through self-administered questionnaires from a random sample of women who have recently given birth. The average annual sampling sizes range from 1,500 to 2,500 women per state (about 100–200 per month). Currently, PRAMS is in place in 13 states and the District of Columbia.

The new violence-related items include information about whether a woman experienced violence before pregnancy, during pregnancy, or at both times; the woman's relationship to the perpetrator(s) of the violence; and whether the frequency of abuse changed during the pregnancy. It will be possible to examine contextual factors that may be related to the pregnancy–violence relationship by analyzing other PRAMS items, such as whether the woman was involved in a physical fight during her pregnancy, whether her partner said he did not want her to be pregnant, and whether the woman argued with her husband or partner more than usual during pregnancy.

Georgia Women's Health Survey. In another collaborative effort between the FIVPT and the Division of Reproductive Health, information about violence against women was included in a representative, population-based telephone survey on women's health conducted by the Georgia Department of Human Resources (Serbanescu & Rochat, in press). Telephone interviews were conducted with 3,130 women ages 15–44. The violence module for the survey included items similar to those recently added to the PRAMS questionnaire. Women provided information about their history of abuse by a partner or ex-partner, abuse by the partner during the past 12 months, and abuse just before and during pregnancy.

Because Georgia is one of the states that participates in PRAMS, the FIVPT plans to compare some of the findings from the two surveys. That analysis will allow us to examine how varied survey contexts and different wording of questions may affect prevalence measurements. CDC's past and continuing involvement in developing violence-related questionnaire modules such as those included in the Georgia Women's Health Survey and PRAMS will contribute substantially to our ability to measure and monitor the prevalence of violence against women.

Behavioral Determinants Research on Tuberculosis Elimination and Control

The World Health Organization (WHO) predicts that in this decade, there will be 90 million new TB cases and 30 million deaths from TB worldwide. TB affects more people in the world than any other single infectious disease (Raviglione, Snider, & Kochi, 1995). Yet it is preventable and curable.

In 1994, the rate of TB in the United States was 9.4 cases per 100,000 people (more than 24,000 reported cases), a 10% increase from 1985, when TB incidence was the lowest since national reporting began in 1953 (CDC, 1995c). Epidemiologists attribute this increase to (a) the interaction between TB and HIV–AIDS, (b) the immigration of persons from countries with a high prevalence of TB, (c) transmission among persons residing in crowded congregate settings such as prisons and homeless shelters, and (d) weaknesses in the nation's public health services for TB (Cantwell, Snider, Cauthen, & Onorato, 1994; CDC, 1995c). Additional causes include poor adherence to treatment among some infected patients (Sumartojo, 1993) and inappropriate treatment practices among some physicians (Mahmoudi & Iseman, 1993; Sumartojo, Hale, & Geiter, 1993).

Behavioral issues are evident at every level within the complex system of TB control:

- Psychosocial factors such as social support, perceived locus of control, behavioral intentions, and culturally influenced health beliefs affect care seeking and adherence among patients.
- Health care providers influence treatment outcomes through their methods of communicating with patients and their perceptions of patients' skills and motivations.
- Cultural, subcultural, and socioeconomic groups help determine members' beliefs and behaviors concerning TB treatment and their acceptance of public health services for TB.
- The structure and functioning of health care organizations influence patient services and treatment outcomes.
- The media and the decisions of policymakers influence the kinds of services available to patients. It follows that a broad scope of behavioral research on TB is needed.

At CDC, a program of behavioral and social research on TB has been emerging in the Division of Tuberculosis Elimination, National Center for HIV, STD, and TB Prevention. Behavioral scientists with additional training in epidemiology have worked with public health specialists, physicians from a number of specialty areas, nurses, health educators, and epidemiologists. The nature of this work has been applied and interdisciplinary. Studies have addressed a range of topics, including adherence to treatment, the cultural knowledge and beliefs of foreign-born patients, and physicians' treatment practices for TB.

Patient Adherence to Treatment

A primary goal of TB control is to ensure that patients complete the medication cycle, a regimen that lasts at least six months. Adherence is essential to cure disease, to prevent the development of drug-resistant disease, and to prevent infection and disease in others. Currently CDC and the American Thoracic Society recommend that all TB patients receive supervised or directly observed ther-

apy (DOT), whereby a health care provider or other designated person watches the patient ingest pills (American Thoracic Society, 1994). Although evidence is ample that supervised therapy is effective (Klein, DiFerdinando, & Naizby, 1994; Sumartojo, 1993), it is only one of a variety of patient-focused services that work together to improve adherence (Block, Sumartojo, & Castro, 1994). Behavioral research must help to define the best mix of patient services and provider practices to ensure the success of DOT programs.

A related issue is whether it is possible to predict early in treatment which patients are likely to take medications as recommended and which should receive DOT. In collaboration with the Massachusetts Department of Public Health, we studied the usefulness of psychosocial measures for predicting patient adherence (Sumartojo, 1992). We found that patients with active disease who reported more positive expectations concerning their health and their treatment outcomes were more likely to adhere to the regimen than were those with lower expectations. Adherence was also more prevalent among patients receiving preventive therapy who reported believing that (a) they were infected with TB, (b) they expected to take their medication without problems, and (c) they believed their adherence was important to others. Although preliminary, this study showed that psychosocial measures may be developed to help TB programs identify which patients are at risk for poor adherence and, perhaps more important, learn how to help these patients complete treatment. This study suggests that psychologists trained in theories of behavior change can make important contributions to prediction or improvement of patient adherence.

Culturally Based Knowledge and Beliefs

In 1994, approximately 32% of persons diagnosed with TB in the United States were immigrants (CDC, 1995c). TB control personnel require information on the health-related beliefs and knowledge of foreign-born patients to communicate with them effectively as well as to identify barriers to health care seeking and adherence. We have conducted several ethnographic studies to identify beliefs that may interfere with TB treatment or prevention. In one study Vietnamese, Korean, Mexican, Haitian, and African American patients with TB reported fearing the stigma associated with TB, possible side effects from TB drugs, and the disruption or loss of work caused by illness or clinic appointments. Members of all groups also expressed suspicion that their diagnosis might be incorrect, that the prescribed medication might be too strong or lead to iatrogenic conditions, and that they would not receive good treatment from public health facilities (LTG Associates, Inc., 1992). In a study of recent Vietnamese refugees conducted in upper New York state, 51 interviewees expressed fear of the stigma associated with TB. Many attributed the disease to incorrect causes (e.g., hard manual labor, 51%; smoking, 49%), and many did not acknowledge the need for modern medicines (43%) or the importance of following a physician's advice on treatment (47%; Carey et al., 1995). Qualitative data such as these are essential for interpreting treatment completion rates and for informing the design of various intervention strategies to improve adherence.

Physicians' Treatment Practices

A third area of research has addressed the regimens used by physicians to treat TB. In 1992, we conducted a national survey of 1,772 physicians to assess how they would treat a patient with TB (Sumartojo et al., 1993). Even though the physicians practiced in specialties and geographic regions where they were likely to encounter TB, only 59% described a regimen that conformed to national TB treatment recommendations. Among physicians specializing in lung disease, 71% described a recommended regimen. These data suggest the need for interventions to improve providers' knowledge or use of published treatment recommendations. In addition, they serve as baseline data for subsequent studies to assess changes in physician practices after the increased attention paid to TB in the United States since 1992.

Research Opportunities

Behavioral scientists have a unique perspective on public health topics that gives them the potential to be innovative and effective, particularly if they are willing to combine behavioral and epidemiologic research techniques. An example includes the application of sampling and analytical techniques used in social network analysis to conduct contact investigations of infectious TB cases. These techniques would be useful in current studies that are attempting to correlate the genetic characteristics of TB strains with the social contacts of TB patients (Small et al., 1994). Behavioral researchers might also adopt the techniques used for community randomized trials to study the effects of communitywide interventions in improving TB knowledge, health care seeking, or adherence to medication regimens.

In August 1994, CDC collaborated with the National Institutes of Health and the Health Resources and Services Administration to conduct an agenda-setting workshop for research on TB and behavior (CDC, 1995a). Participants identified five broad areas for study: (a) how best to inform the public about TB and to overcome the stigma associated with TB, (b) how to identify and reach persons at highest risk for TB, (c) how to increase patient adherence, (d) how to improve provider practices, and (e) how to identify and implement the best mix of TB control services. These and other questions about influencing health-related behavior pose an immense challenge for TB control efforts, nationally and internationally. Greater involvement by behavioral researchers can help meet this challenge. Because of the very high incidence of TB in developing countries, behavioral interventions to improve care seeking, adherence, provider practices, and quality of services can help vast numbers of people. The behavioral scientists at CDC have provided information and consultation to international organizations, including WHO and the World Bank, and to TB

programs and researchers in India, Botswana, Uganda, Thailand, and other developed and developing countries.

Intervention Research on the Prevention of HIV Infection and Transmission

Until the emergence of the HIV–AIDS epidemic in the 1980s, there were few behavioral scientists at CDC studying sexual behavior and drug use. With neither a vaccine nor an effective treatment in sight, however, reducing HIV-related risk behavior soon became central to control of the epidemic, and the number of behavioral and social scientists at CDC grew. CDC now sponsors behavioral research on HIV–AIDS in a wide variety of areas.

Current research ranges from risk-factor surveillance (Potter & Anderson, 1993) and behavioral determinants research (Bartholow et al., 1994; Doll et al., 1991) to cost–benefit studies (Holtgrave, Valdiserri, Gerber, & Hinman, 1993). The subject matter is varied and includes research on school-based HIV prevention education (Collins et al., 1996), HIV antibody counseling and testing (Higgins et al., 1991; Valdiserri, Holtgrave, & Brackbill, 1993), health communications (Steckler et al., 1995), reproductive decision making and condom use among African American and Latina–Latino women and couples (Harrison, 1994; Harrison et al., 1995; Moore, Harrison, Kay, Deren, & Doll, 1995), and social and cultural factors affecting HIV risk reduction among bisexual men (Doll & Beeker, 1996). Several studies are also in progress in international settings, for example, a survey of HIV risk behavior among Peace Corps volunteers (Moore, Beeker, Harrison, Eng, & Doll, 1995) and an HIV prevention community-needs assessment in a South African township (Shongwe, Fernandez, Beeker, Valentine, & Schmid, 1994). In response to recent developments in HIV treatment and prevention technologies, research is also underway on factors affecting adherence to perinatal zidovudine treatment regimens among HIV-infected women (J. Moore, personal communication, December 12, 1995), determinants of female condom use among persons who attend clinics for treatment of sexually transmitted diseases (R. J. Cabral, personal communication, March 16, 1995), and working with communities to conduct HIV vaccine efficacy trials (Hennessy et al., 1996; MacQueen et al., 1994).

Intervention Testing

Although formative research and descriptive research logically precede intervention testing, a sense of urgency has always accompanied public health efforts to control the HIV–AIDS epidemic. Thus, behavioral scientists were compelled to field intervention studies before the scientific groundwork was fully in place. One of CDC's earliest behavioral intervention research efforts was the five-city AIDS Community Demonstration Project, first funded in 1985 (CDC, 1992) and again in 1989 for a second, community-level, intervention phase (CDC, 1996; O'Reilly & Higgins, 1991; Pulley, McAlister, Kay, & O'Reilly, 1996). To design this groundbreaking demonstration project, researchers drew on social and psychological theory and intervention research in other areas (especially community-level intervention research on cardiovascular disease risk reduction) and conducted a year of formative research activities prior to the development of the community-level interventions. Evidence of the project's success has recently been reported (Fishbein, Johnson, & The AIDS Community Demonstration Projects, 1996; Rietmeijer et al., 1996). Intervention research continues to be an important component of the HIV behavioral research agenda, which now includes community-level and street-based intervention as well as facility, clinic, and school-based intervention research (Cabral et al., 1993; CDC, 1993a, 1993b, 1996; Collins et al., 1996; S. Schulz, personal communication, December 6, 1995).

The primary purpose of HIV-related behavioral intervention research is to provide the scientific basis for national HIV prevention programs and policies. To meet both scientific and programmatic needs, the intervention models designed, implemented, and evaluated must (a) be acceptable to the populations for whom they are intended, (b) be feasible to implement in relevant settings, and (c) have the potential to be sustained once research dollars are withdrawn. To help achieve these objectives, CDC collaborates with federal, state, and local research and prevention partners in both the design and conduct of the research.

Several important features characterize much of the intervention research conducted: a solid foundation of theory and formative research, the use of both quantitative and qualitative methods to assist in the design of intervention and evaluation, and the development and implementation of multisite projects with common intervention and evaluation protocols. One current project that illustrates this approach—the Comprehensive AIDS and Reproductive Health Education Study (Project CARES)—is described in more detail.

Project CARES

Project CARES is part of a larger research effort known as the Prevention of HIV in Women and Infants Demonstration Project, a collaborative initiative between the Division of Reproductive Health, the Division of HIV/AIDS Prevention, and investigators in six U.S. cities (Cabral et al., 1993). The goal of this initiative is to design, implement, and evaluate behavioral interventions to prevent the spread of HIV among women and infants, specifically by increasing the use of condoms and other means of contraception among women at risk for HIV infection and unintended pregnancy. Because women may be at risk for both disease and unintended pregnancy, a key goal was to develop interventions that integrated recommendations for both pregnancy and disease prevention and that were sensitive to the unique situations and priorities of women at risk.

Project CARES has two main objectives: to reduce barriers to access to the use of reproductive health services and to assist women in making changes in behavior.

The first objective is met by placing services in sites where women come for other needs (e.g., homeless shelters, drug treatment centers, a pediatric AIDS clinic); the second is met through an enhanced counseling intervention delivered by specially trained peer advocates.

The outcome evaluation uses a longitudinal design involving a comparison of two conditions: standard family planning (Title X [Family Planning Services and Population Research Act of 1970]) services and standard services plus enhanced counseling services. Self-report data are collected at baseline and at three follow-up assessments (at 6, 12, and 18 months). Between March 1993 and September 1995, 1,568 women were recruited to participate in the project: 1,248 women at risk for HIV and unintended pregnancy in Philadelphia (e.g., homeless women; women using drugs; and women trading sex for drugs, money, and other things) and 320 women living with HIV infection in Baltimore. Final 18-month follow-up assessments will be completed in April 1997. Extensive process and cost data are also being collected to enhance evaluation of specific program components. These data will aid in adapting the program for use with other populations or in different settings.

The transtheoretical model (TM) of behavior change, also known as the stages-of-change model, was used to guide the development of intervention components and the measurement of condom and other contraceptive use. The TM describes behavior change as a gradual process in which people move through a sequence of five stages (Prochaska & DiClemente, 1983, 1984; Prochaska, DiClemente, & Norcross, 1992). This model was selected for three main reasons. First, although interventions to change risk behaviors typically assume that individuals are ready to change, data from community samples of individuals at high risk for HIV suggest that most have no intention to change their behavior (Schnell, Galavotti, Fishbein, & Chan, 1996). The stages-of-change framework allows us to characterize these individuals and to design interventions specifically for them. Second, by modeling behavior change as an incremental process, measures assessing progress toward change can be developed; this measurement strategy enables evaluators to detect program effects that other measurement strategies would miss. Third, the TM integrates key concepts, such as self-efficacy (Bandura, 1977, 1986) and decisional balance (Janis & Mann, 1977), from leading theories of human behavior. Specifying the relationship between these variables and progress toward behavior change facilitates the development and evaluation of specific intervention components (Skinner, Strecher, & Hospers, 1994).

Formative research began with assessment of the applicability of the stages-of-change model to the measurement of condom and other contraceptive use among women at high risk for HIV infection and transmission. The results obtained were largely consistent with research on other health behaviors (Prochaska et al., 1994) supporting the validity of the measures and the generalizability of the model for this behavioral domain (Galavotti et al., 1995). In addition, more than 200 semistructured, in-depth interviews were conducted with service providers and with women at high risk for, or infected with, HIV. These qualitative data were used to ensure that the intervention would be both appropriate for and acceptable to the target populations and feasible in the selected service settings.

The enhanced intervention that was subsequently developed consists of theory-based individualized counseling tailored to a woman's readiness to change her behavior (i.e., her stage of change) and is delivered by specially trained peer paraprofessionals, known as "advocates" (Cabral et al., 1996). A common intervention and evaluation protocol is used in the two Project CARES cities. Use of a common intervention strategy allows for some assessment of the generalizability of the model for different populations and settings. All women participating in the project are also offered standard (Title X) reproductive health services.

Women assigned to the enhanced intervention meet with an advocate for up to six months, typically for five or six 25- to 45-minute face-to-face sessions (Milstein et al., 1995). After one or more initial sessions during which advocates develop rapport and trust and assess a client's readiness to change specific risk behaviors, advocates begin counseling by focusing on stages of change. A manual, *Project CARES: Advocates' Guide to Stages of Change Counseling* (Project CARES Intervention Work Group, 1994), guides advocates in their interactions with clients. Through a series of questions and guiding principles, the manual helps advocates select influencing factors, such as self-efficacy, that are appropriate for a client in a given stage of change. It also contains a menu of clinical exercises and activities from which advocates can choose once they determine the areas on which to focus. Process-evaluation results indicate that advocates in both cities are assessing stage of change appropriately and consistently and are using appropriate influencing factors and counseling activities in their encounters with clients (Cabral et al., 1996).

Analysis of baseline data from the demonstration program is underway. Preliminary results suggest that several psychosocial variables targeted by the intervention (e.g., self-efficacy, perceived advantages, perceived partner support, and perceived norms) have a strong and significant positive association with higher stage of change for condom use with main and other partners and for contraceptive use with any partner (Galavotti, Cabral, Gargiullo, et al., 1996; Stark et al., 1996). Analysis of the early (six-month) longitudinal data from Project CARES has begun and when completed will allow us to evaluate how successful the intervention was in assisting women in changing risk behavior.

The aims of this theory-based, multisite, coordinated demonstration program are to help build a body of knowledge about (a) how to support risk reduction behavior among women at high risk for both HIV–STD and unintended pregnancy; (b) how to design and deliver intervention programs that are acceptable to diverse

groups of women at risk, are feasible to implement, and are potentially sustainable; and (c) how to best measure the behavioral outcomes that are critical to the evaluation of these prevention programs. Ultimately, the results from this research should promote the development of more cohesive HIV prevention policy recommendations for women throughout the country.

Psychological Research in Occupational Safety and Health

NIOSH is the site of what may be the longest standing formal research program in behavioral science within CDC. The Occupational Safety and Health Act, which created NIOSH in 1970, specifically mandated the study of psychological facets of occupational injury and disease (§§ 20a1, a4, and a7). In response to this mandate, NIOSH undertook a broad program of psychological research (Cohen & Margolis, 1973). Today, that program is focused most heavily in the areas of neurobehavioral toxicology, occupational stress, and ergonomics and cuts across all divisions in NIOSH.

Unlike psychological research at NIOSH, psychological research conducted elsewhere in CDC often investigates behaviors and individual-level psychological factors that place individuals at increased risk for exposure to disease agents. This research is intended to lead to the development and testing of strategies for promoting behavior change to reduce risk. The emphasis is consistent with the research tradition in health psychology, which has focused on the influence of factors such as coping style, attitudes or beliefs, and personality characteristics on disease processes. In contrast to this emphasis on individual-level factors, psychological research at NIOSH focuses more on environmental conditions (i.e., the content and organization of work) as risk factors for disease and targets for intervention.

Snapshot of Psychological Research at NIOSH

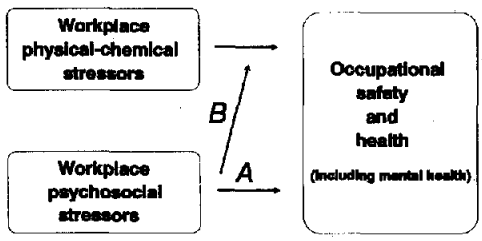
Pioneering research conducted by NIOSH on the effects of industrial agents (e.g., lead, mercury, carbon monoxide, carbon disulfide, and other solvents) on the nervous system provided impetus to the field of neurobehavioral toxicology (Xintaras, Johnson, & de Groot, 1974). In-house laboratory research featured some of the first human studies of neurobehavioral effects of acute exposures to organic solvents (Dick, 1992) and some of the first animal studies on behavioral teratologic effects of solvents (Nelson, 1986). More recently, NIOSH has produced some of the first evidence of persistent neurobehavioral effects of exposure to organophosphate pesticides (Steenland et al., 1994). Of particular significance, NIOSH psychologists played an integral role in the development of the WHO Neurobehavioral Core Test Battery, one of the most widely used, noncomputerized, neurobehavioral test batteries. NIOSH has also fostered the development of computer-based neurobehavioral tests and has collaborated with other agencies to incorporate such tests in the most recent National Health and Nutrition Examination Survey (National Center for Health Statistics, 1994). Completed in 1994, this survey collected detailed neurobehavioral data from more than 5,000 healthy adults.

From its inception, NIOSH has had a vigorous program of research in occupational stress, which is concerned with the effects of workplace psychosocial factors on health. Recent products of this program include a 1990 national strategy for prevention of work-related psychological disorders (Sauter, Murphy, & Hurrell, 1990) and a series of international conferences on work and well-being, held in partnership with the American Psychological Association (APA). The program also sponsors a new APA postdoctoral training program in occupational health psychology and has spawned a new APA publication, *Journal of Occupational Health Psychology,* which began publication in the spring of 1996.

NIOSH research under this program is depicted conceptually in Figure 1, which shows multiple pathways between psychosocial factors and health. Pathway *A* in this figure denotes a direct influence of psychosocial factors on health. NIOSH has a rich history of research in this area, dating from early study of occupation-specific stressors (e.g., police work) and occupational differentials in stress-related disorders (Caplan, Cobb, French, Van Harrison, & Pinneau, 1975; Colligan, Smith, & Hurrell, 1977; Kroes & Hurrell, 1975) to a more recent interest in the health effects of specific job characteristics, such as worker autonomy or control (Murphy, 1991; Sauter, Hurrell, & Cooper, 1989). As an extension of this work, NIOSH is collaborating with large private companies in field studies examining the role of conceptually broader characteristics, such as organizational climate and culture, on stress and health. A unique feature of these studies is the search for attributes of *healthy companies*—organizational characteristics that not only foster physical and psychological well-being among workers but lead to high levels of organizational effectiveness (Murphy & Lim, 1995).

Figure 1 also shows indirect effects of psychosocial factors on health outcomes more traditionally associated with workplace physical and chemical stressors (Pathway

Figure 1
Conceptual Depiction of Stress Research at the National Institute for Occupational Safety and Health



Note. A and B are pathways.

B), and it is here that the NIOSH stress program converges with NIOSH studies of ergonomics and other health effects. These indirect effects of psychosocial factors have received relatively little attention in the occupational stress literature but are increasingly apparent in NIOSH research. For example, associations between workplace psychosocial factors and accidental injury at work are suggested in a comprehensive literature review by NIOSH (Johnston, 1995) and in NIOSH studies of farm accidents (Scharf, Kidd, & Veazie, 1995). Additionally, an influence of psychosocial factors and health complaints is suggested in NIOSH studies of indoor air quality problems in the workplace (NIOSH, 1991). Some of NIOSH's studies in this area converge with previously mentioned research in other units of CDC. For example, complementing studies of individual (behavioral) risk factors for HIV exposure, DeJoy, Murphy, and Gershon (1995) found that psychosocial factors such as organizational safety climate are highly predictive of needle-stick injury in hospital environments. Of particular and longstanding interest at NIOSH is accumulating evidence that implicates workplace psychosocial factors in the etiology of work-related musculoskeletal disorders (Bongers, de Winter, Kompier, & Hildebrandt, 1993; Moon & Sauter, 1996). Nowhere is this effect more evident than in studies of musculoskeletal disorders among video display terminal (VDT) users.

Workplace Psychosocial Factors and Work-Related Musculoskeletal Disorders

NIOSH first suspected a link between the psychosocial environment and musculoskeletal disorders among VDT users in a 1979 study at a West Coast newspaper and insurance company. A much higher prevalence of various musculoskeletal symptoms was seen among clerical VDT users (e.g., 56% for neck–shoulder pain) than among work peers who did not use VDTs (19% for neck–shoulder pain). Increased psychosocial demands (greater work pressure and reduced autonomy and supervisory support) were also seen among the VDT users, suggesting a possible etiologic role of these factors (Smith, Cohen, Stammerjohn, & Happ, 1981).

A NIOSH-supported follow-up study at the University of Wisconsin resulted in findings nearly identical to effects seen in the West Coast study (Sauter, Gottlieb, Jones, Dodson, & Rohrer, 1983). In this cross-sectional study, VDT users again reported increased work pressure and reduced support and personal control in their jobs compared with workers who did not use VDTs. Adding these factors (job control and social support) as predictor variables to regression models linking ergonomic and physical environmental factors to musculoskeletal outcomes substantially increased the explanatory power of these models.

Subsequent study by others has added to the evidence linking workplace psychosocial factors and upper extremity musculoskeletal disorders in VDT work (Green & Briggs, 1990; Linton & Kamwendo, 1989; Ryan & Bampton, 1988; Spillane & Deves, 1988). However, like earlier NIOSH studies, many of these investigations suffered from methodological limitations that cloud much of the research on psychosocial factors and health. Among these limitations is the predominance of self-report questionnaire methods for assessing both the psychosocial environment and musculoskeletal problems. This approach may result in common method variance and, thus, may overestimate causal relationships (Watson & Pennebaker, 1989). Furthermore, the cross-sectional nature of all these studies renders inferences regarding causation unreliable.

Beginning in 1989, psychologists teamed with epidemiologists at NIOSH on two field studies to permit a more definitive picture of musculoskeletal morbidity and contributing factors in VDT work (Hales et al., 1994; NIOSH, 1993). Study sites were a regional telecommunications firm (N = 533 directory assistance and other VDT operators) and a major metropolitan newspaper (N = 973 news editors and VDT operators in three additional departments). In both studies, questionnaires were administered to elicit information on musculoskeletal symptoms, the workplace psychosocial environment, extent of VDT work, and a range of other work and nonwork activities. Additionally, physical examinations of the neck, shoulder, elbow, and hand–wrist were administered for all study participants in the telecommunications study and for only the hand–wrist in a subsample of participants in the newspaper study. Cases of musculoskeletal disorders were defined in two ways: symptom (i.e., questionnaire) data alone and, to reduce possible bias associated with exclusively self-reported measures, a more objective criterion involving both symptom data and physical examinations.

Findings lent further support to suspected psychosocial effects. In the telecommunications study, although the overall explanatory power was fairly modest, factors denoting increased work pressure and increased uncertainty about job futures were predictive of both increased number of symptoms and more objectively defined musculoskeletal disorders among directory assistance operators. In the newspaper study, psychosocial factors were predictive of symptoms only.

To test the possibility that a negatively perceived psychosocial environment could be the result, not the cause, of musculoskeletal disorders, the telecommunications study examined ratings of the psychosocial environment in work sites with high and low prevalences of musculoskeletal disorders. However, the ratings were obtained from asymptomatic workers, thereby reducing the potential for bias by the experience of musculoskeletal problems. Results still showed a higher prevalence of musculoskeletal disorders in the more negatively rated work sites.

More recently, NIOSH has undertaken field interventions to evaluate the effectiveness of organizational interventions to reduce musculoskeletal disorders among VDT operators. In a controlled study of 100 data entry clerks at the Internal Revenue Service, reorganization of work schedules to provide more frequent rest breaks re-

sulted in reduced discomfort in the neck, back, and upper extremities without sacrifices in productivity (NIOSH, 1995).

An important challenge is to improve understanding of the mechanisms linking psychosocial factors and work-related musculoskeletal disorders. Psychosocial stressors may correspond with physically demanding tasks—for example, the repetitive nature of data entry work is both highly monotonous and biomechanically stressful—or stressful work may produce muscle tension that adds to the musculoskeletal loads created by physical task demands. Alternatively, it is possible that psychosocial factors influence workers' responses to physical stress. For example, the salience of somatic sensations resulting from physical loads might be increased in dull, unstimulating, and unrewarding work environments, leading to a greater likelihood of detecting these sensations and labeling them as symptoms of ill health (see Sauter & Swanson, 1996, for further discussion of these mechanisms). Unfortunately, the rather substantial body of social psychological literature on symptom perception and attribution theory (e.g., Cioffi, 1991; Pennebaker & Hall, 1982) has received little attention in occupational health.

In summary, the field of occupational health presents a rich landscape of research opportunity for psychologists. This opportunity should grow with the expansion of service and information work in which psychosocial stressors predominate and with increasing attention in medicine and industry to stress as a threat to health and productivity.

Conclusions

The preceding descriptions show how the history and status of behavioral research at CDC vary by organizational setting and substantive focus. Unique constraints and opportunities have shaped the way the research agendas have developed; however, behavioral researchers in public health face several common challenges. Because the scientific environment at CDC has long been dominated by biomedical and epidemiological research, familiarity with the theories and methods of behavioral and social science is not widespread. With this lack of familiarity comes skepticism about the ability of behavioral interventions to produce behavior change (Galavotti & Beeker, 1993) and mistrust of self-reported behavior data (Galavotti, Cabral, & Beeker, 1996). Surprisingly, ethnographic and qualitative research has, to some extent, flourished in this environment, perhaps because the qualitative research tradition is more like the clinical case study approach familiar to medicine. Some of the traditional quantitative research methods of psychologists have met with more resistance. Nevertheless, there is increasing interest in behavioral research at CDC, and psychologists and other behavioral and social scientists have helped (a) to expand the use of theory in the development of explanatory models and interventions to prevent disease, disability, and injury; (b) to increase the involvement of communities and individuals at risk in the design and conduct of research; (c) to heighten researchers' appreciation for process as well as outcome data; and (d) to foster the development and use of psychometrically sound measures of psychosocial and behavioral constructs.

There is much to be gained by integrating psychology and public health (Iscoe, 1982; Leviton, 1996; Winett, 1995). The field of psychology is rich with methods and models that can be used to help solve public health problems, and we have yet to make our greatest contributions. We encourage health psychology to continue to apply theoretical constructs in health intervention research and to develop and test new models of health behavior that include interpersonal, social, and environmental factors. We encourage community psychology, with its broader systems approach, to continue to turn its attention to health. And we encourage the field as a whole to train more psychologists to work in multidisciplinary settings and to apply psychological constructs and methods to solve some of the most pressing and, we believe, some of the most interesting problems of human behavior.

Despite the difficulties inherent in blending biomedical and behavioral worldviews, the opportunities for psychologists and other behavioral and social scientists at CDC are as varied as they are exciting. Few settings provide so many opportunities to work on interdisciplinary teams examining multiple aspects of a problem. Few institutions can provide the funds and the access to study relevant populations in communities, workplaces, schools, and health and social service settings. And few researchers so often see their research affect recommendations for national, and sometimes international, policies and programs.

With these opportunities come unique and important responsibilities—responsibilities to the taxpayers, to our public health partners, to the people who choose to participate in our research, and especially to those we hope may ultimately benefit from our work. We believe the behavioral sciences have made, and will continue to make, important contributions to improving the nation's health, and we hope that others in the behavioral and social sciences will join us in working toward the accomplishment of that mission.

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