J. Lee Westmaas, Virginia Gil-Rivas, and Roxane Cohen Silver

Designing and Implementing Interventions to Promote Health and Prevent Illness

Warnings in the media are plentiful about the dangers of potential threats to our health such as flu pandemics, mad cow disease, and excessive use of pesticides and antibiotics. Although efforts to prevent such scenarios from becoming reality are well placed, many other health conditions in which individuals can play a role in their prevention are already taking the lives of millions of people. For example, the Centers for Disease Control and Prevention (CDC) estimate that more than 440,000 smokers in the United States die prematurely every year from smoking-related diseases (CDC, 2002). In addition, although HIV infection has been known for more than a decade to be mostly preventable by behaviors such as using a condom, approximately 40,000 persons become infected with HIV each year (Glynn & Rhodes, 2005), and 4.3 million adults worldwide were newly infected with HIV in 2004 (UNAIDS, 2004). These sobering statistics point out the need to develop, and the challenge of developing, effective interventions to promote health and prevent illness.

Although the task of persuading thousands or millions of people to change their behaviors may seem daunting, this is not an unrealistic goal. When the surgeon general announced that cigarette smoking was a leading cause of cancer in 1964, approximately 42% of the U.S. population smoked (CDC, 2004). Through a combination of laws restricting smoking in public places, bans on various forms of advertisement, tobacco taxes, the availability of cognitive-behavioral programs for smoking cessation, and advances in pharmacotherapies, the rate of smoking in the United States in 2004 was approximately 21% (CDC, 2005), a 50% reduction in prevalence. In the early years of the AIDS epidemic, the increase in safer-sex activities among gay men that accompanied messages about the dangers of unprotected sex was also a remarkable example of the effectiveness of behavior change interventions (Revenson & Schiaffino, 2000; Shilts, 1987). However, the recent increases in HIV infection rate among men who have sex with men (Elford & Hart, 2003) and the increases in smoking rates observed among high school students in the 1990s (CDC, 1999), and among college students in the 2000s (Rigotti, Lee, & Wechsler, 2000; Wechsler, Kelley, Seibring, Juo, & Rigotti, 2001), demonstrate that effective prevention interventions need to be attuned to the dynamic, ongoing, and complex nature of human behavior. This chapter presents important conceptual and practical issues in designing and implementing behavioral and psychological interventions whose goal is to promote health and prevent illness. Our aim is not to present a comprehensive review of each of these issues (readers will be provided with references to articles that provide more in-depth discussions) but to direct attention to their importance and their implications for conducting effective or informative prevention interventions. Examples that illustrate topics under discussion will be taken from the smoking cessation and HIV-prevention literatures, not only because of the substantial morbidity and mortality associated with smoking and HIV infection but also because these topics have generated a substantial amount of research illustrating the challenges of conducting effective prevention interventions.

Primary, Secondary, and Tertiary Interventions

Interventions can be identified by the point along the health-illness continuum at which they occur. Primary prevention focuses on changing behaviors to prevent illness from occurring. For example, a primary prevention program for HIV-negative individuals would aim to prevent infection by promoting the use of condoms and other safe-sex strategies. Secondary prevention interventions are those that occur after the individual has been diagnosed with a condition. disease, or illness and seek to stop or reverse its progression. In the case of HIV, a secondary prevention intervention would focus on behavior change to prevent other strains of the virus from infecting those already infected. Current health policy emphasizes secondary prevention, although it has been argued that devoting more resources to primary intervention might benefit population health more substantially (Kaplan, 2000). Tertiary prevention interventions seek to control the devastating complications of an illness or negative health condition. An intervention to get hospitalized cancer patients to give up smoking to promote recovery from their surgery is an example of a tertiary prevention intervention.

Levels of Intervention

Interventions to promote health and prevent illness can also attempt to influence behavior at the individual, organizational, community, or societal level. Action at the societal (population) level represents the broadest level of influence; interventions focused on this level of influence seek to motivate entire communities that differ on sociodemographic and other dimensions. These interventions may use the media and social organizations to educate and encourage people to adopt healthy behaviors and discourage unhealthy ones. For example, advertisements by the government of Canada encouraging physical activity in its populace, the ParticipAction campaign in the 1970s, 1980s, and 1990s emphasized the positive health benefits of exercise and were expected to be viewed and acted upon regardless of age, gender, or socioeconomic status (Canadian Public Health Association, 2004). Population-based efforts usually involve simple messages that can be understood by a majority of a society's members. On their own, however, they can be less effective than other approaches in changing individual behavior. Population approaches can sometimes be costeffective, however. If only a tiny fraction of the population is motivated to change their behavior as a result of the message, the cost savings resulting from the prevention of illness among these individuals can be significantly greater than the cost of the intervention (Thompson, Cornonado, Snipes, & Puschel, 2003).

Population-wide interventions also include laws that mandate health-promoting behaviors, for example, seat belt use, the wearing of protective headgear for motorcyclists in some jurisdictions, or laws restricting smoking in the workplace. These interventions can lead to behavior change not only by increasing levels of perceived threat but also by influencing individuals' attitudes, beliefs, and appraisals. At the interpersonal level, these campaigns may result in changes in social attitudes and norms that may further contribute to behavioral change. Action at the policy or population level can also provide additional motivation for behavior change among individuals contemplating action as a result of other prevention efforts. For example, countyor statewide restrictions on smoking in workplaces and eating establishments, which have already encouraged thousands of smokers to attempt to quit smoking (Chapman et al., 1999), might need to be combined with steep tobacco taxes to encourage some smokers to quit.

Less broad in their reach are community and organizational activities that seek to promote healthy behavior in their members. Many community interventions have adopted a social ecological perspective, recognizing that behavior change is a result of social and environmental influences. The program

components of community-level interventions are often supported by the results of individual-level or clinic-based research. Indeed, it has been argued that the costs of community-wide programs to promote healthy behaviors are justifiable only if prior research supports program components (Sorensen, Emmons, Hunt, & Johnston, 1998). An example of a community intervention to prevent the uptake of smoking in youth was the Healthy for Life Project conducted in the United States. Recognizing the various social influences on smoking, the intervention targeted peers, schools, and parents, as well as community agencies (Piper, 2000). A justification for the use of community prevention approaches is based on the concept of population-attributable risk, which refers to how much risk produces a given amount of disease in a population (Rose, 1985). According to the epidemiologist Geoffrey Rose (1992), changing the risk levels of a population to a small degree can impact public health more strongly than substantially changing the risk of a smaller number of people.

Some interventions are limited to specific institutions such as work sites or schools. Considering that many individuals spend a substantial amount of time at places of employment or education, the proliferation of work site and school programs addressing a wide range of health issues such as smoking, weight loss, and physical activity is not surprising.

Individual-level interventions are characterized by higher levels of personal interaction between the targets of the interventions and their providers and are more likely to be based on psychosocial or biomedical explanations for behavior. An example is a program to reduce smoking prevalence by having physicians provide advice and support for smoking cessation (Goldstein et al., 1997). Evaluations of such interventions led to the recommendation in 1996 by the United States Agency for Health Care Policy and Research (AHCPR) that physicians practice the "Four Rs" during their patients' checkups: emphasize the risks of smoking, the rewards of quitting, the relevance of the risks of smoking to the smoker (and the rewards of quitting), and repetition of these messages (Fiore, Jorenby, & Baker, 1997). These recommendations for physician interventions were found to be cost-effective compared with other prevention interventions (Cromwell, Bartosch, Fiore, Hasselblad, & Baker, 1997). Family members or friends can also become involved in individual-level approaches. For example, social pressure by a spouse or family members to change an individual's behavior (i.e., social control) has been associated with the degree to which spouses reduce their levels of smoking (Westmaas, Wild, & Ferrence, 2002).

Advocates of ecological models of health promotion interventions recommend an integration of these various levels of influence in any effort to change health behaviors (Stokols, Pelletier, & Fielding, 1995). Nonetheless, the decision as to whether an intervention should be at the individual, community, or population level, and whether it should be primary, secondary, or tertiary, will be influenced by a number of factors. These include the amount of financial resources available, political considerations, findings from prior prevention/intervention research. the likelihood of community cooperation, and the believed causes of the behavior or illness in question. Of these, an important first step is to understand the various influences on the illness- or health-promoting behavior and to use a theoretical model to guide the design of the intervention.

Psychosocial and Other Pathways to Disease

Research in the last three decades has provided convincing evidence of the contribution of psychosocial, biological, and behavioral factors in illness and health, and several theories to explain these associations have been elaborated (Schneiderman, 2004). Understanding how psychosocial, behavioral, and biological factors independently and/or interactively contribute to health is an important step in deciding when and how to intervene. Having a theoretical model as a template from which to understand the influence of these variables on health and behavior change is important in designing a successful and cost-effective intervention.

Models of Health Behavior Change

To date, prevention intervention efforts have been largely guided by individual-level theories in which social and cognitive variables play a central role (Kohler, Grimley, & Reynolds, 1999; Rutter & Quine, 2002). Chief among these are the health belief model (HBM; Rosentock, Strecher, & Becker, 1994); the theories of reasoned action (Ajzen & Fishbein, 1977, 1980) and planned behavior (Ajzen, 1991, 1998); social cognitive (learning) theory (Bandura, 1986, 1997); and the transtheoretical model of change (Prochaska & DiClemente, 1983). These models and theories overlap to a considerable extent, but each emphasizes key concepts that significantly influence health behavior change (Elder, Ayala, & Harris, 1999).

The HBM proposes that behavior change will occur if individuals perceive a threat to their wellbeing and believe that the benefits of engaging in behavior change outweigh the barriers or costs associated with that behavior. Cues to action (e.g., education, symptoms) are viewed as prompting behavior change, particularly when levels of perceived threat are high (Rosentock, Strecher, & Becker, 1994). The HBM has been used to predict a variety of health behaviors such as breast self-examination (Champion, 1994), safe-sex practices (Zimmerman & Olson, 1994), and exercise (Corwyn & Benda, 1999), among others. Although the HBM has been widely used, the relationship between key elements of the model and behavior change are rather small (Sheeran & Abraham, 1996), suggesting the need to consider the influence of factors in addition to those central to the model. More recently, principles of social-cognitive theory have been incorporated in interventions guided by the HBM in an effort to increase the likelihood of health behavior change.

Social-cognitive (learning) theory (Bandura, 1997, 1998) posits that self-efficacy beliefs, goals, outcome expectations, and perceived barriers or aids involved in enacting a behavior jointly influence human motivation, action, and health (Bandura, 1998). Self-efficacy refers to one's perceived ability to take the action necessary to achieve the desired effects or outcomes. Self-efficacy beliefs are the result of direct and vicarious experience and verbal persuasion. Bandura (1998) suggests that personal self-efficacy beliefs play an influential role in health in two ways: (a) by influencing biological pathways (i.e., sympathetic nervous system activation, immune functioning) involved in the relationship between stress and illness, and (b) by its impact on individuals' decisions to make behavioral changes, their motivation to maintain these changes and their ability to resume those efforts when they face a setback. Outcome expectations regarding the physical effects of a health behavior (e.g., discomfort), the social reactions it evokes, and self-evaluative reactions to one's behavior are also important influences on health behavior. Barriers to the initiation and maintenance of behavioral change may exist within the individual (such as whether he or she has the resources and skills needed), may be situational, or may be the result of larger social and structural factors. An extensive body of research has documented the influence of self-efficacy beliefs on individuals' efforts to implement and maintain dietary changes (McCann et al., 1995); physical activity and exercise adherence (McAuley, Jerome, Marquez, Elavsky, & Blissmer, 2003); smoking cessation (Shiffman et al., 2000); condom use (Baele, Dusseldorp, & Maes, 2001); alcohol use (Maisto, Connors, & Zywiak, 2000); and drug use (Reilly et al., 1995). Prevention intervention programs based on social-cognitive theory include several components, including an informational component to increase perceptions of the risks and benefits associated with a particular behavior, teaching social and cognitive skills that can be used to initiate behavior change, building self-efficacy to promote behavior maintenance, and building social support to sustain change (Kohler, Grimley, & Reynolds, 1999).

The theories of reasoned action (Ajzen & Fishbein, 1977, 1980) and planned behavior (Ajzen, 1988, 1991) propose that for behavior change to occur, individuals must experience a strong intention to change. Behavioral intentions, in turn, are predicted by (a) expectancies that a behavior will produce a particular outcome, (b) attitudes toward the behavior, (c) beliefs about what others think is appropriate behavior (subjective norms) and motivation to comply with others' opinions, (d) perceptions of control over one's behavior, and (e) other behavioral, normative, and control beliefs (Albarracin, , Johnson, Fishbein, & Muellerleile, 2001). The application of these theories to prevention intervention efforts and prediction of behavior requires defining the targeted individuals' key beliefs, values, and attitudes and their levels of perceived control (Ajzen & Fishbein, 1980). These theories have been widely used to predict health behaviors and to develop prevention interventions. The empirical evidence, however, suggests a weak to moderate association between key elements of the theory and condom use (Albarracin et al., 2001), contraceptive use (Adler, Kegeles, Irwin, & Wibbelsman, 1990), physical activity (Blue, 1995), alcohol use (Johnston & White, 2003), and smoking (Higgins & Conner, 2003), among others.

The transtheoretical model of change (TMC; Prochaska & DiClemente, 1983) proposes that behavior change is a process. Key elements include stages of change, the process of change, decisional balance (pros and cons of change), and situational self-efficacy. The stages of change are precontemplation (not ready to change within the next 6 months), contemplation (thinking about change within the next 6 months), preparation (ready to change in the next 30 days), action, and maintenance (more than 6 months of sustained action). The TMC posits that tailoring interventions to individuals' readiness to change based on their current stage will be more likely to produce behavioral changes. This theory has been used to predict a wide range of health behaviors, including alcohol and drug use (Prochaska, DiClemente, & Norcross, 1992), physical activity (Marshall & Biddle, 2001), and sexual risk behaviors (Grimley, Prochaska, & Prochaska, 1993), but there have been null effects reported by some interventions using this approach (Adams & White, 2005). Other theoretical models guiding health promotion research include cognitive/information processing (Joos & Hickam, 1990) and social support theories (Gonzalez, Goeppinger, & Lorig, 1990).

Key Elements of Successful Interventions

Based on research demonstrating the value of key concepts from the preceding models in predicting behavior change, Elder et al. (1999) summarized the important ingredients for successful health promotion and prevention programs. Specifically, for a person to change, she or he must "(1) have a strong positive intention or predisposition to perform a behavior; (2) face a minimum of information processing and physical, logistical, and social environmental barriers to performing the behavior; (3) perceive her/himself as having the requisite skills for the behavior; (4) believe that material, social, or other reinforcement will follow the behavior; (5) believe that there is normative pressure to perform and none sanctioning the behavior; (6) believe that the behavior is consistent with the person's self-image; (7) have a positive affect regarding the behavior; and (8) encounter cues or enablers to engage in the behavior at the appropriate time and place" (p. 276).

Some interventions have targeted one or more of these requirements for behavior change (e.g., self-

efficacy in performing the behavior, outcome expectancies) and have also examined how they influence physical health or physiological outcomes. Sobel (1995) argues that psychosocial variables such as sense of control and optimism, in addition to self-efficacy, not only directly impact health behaviors but also have direct effects on physiological processes that in turn influence health. Interventions that attempt to increase levels of these "shared determinants of health," he believes, are important in changing any health-relevant behavior but have not been given the attention they deserve. For example, although feelings of self-efficacy have been found to be an important predictor of behavior change, few interventions have been developed in which creating feelings of self-efficacy regarding the targeted behaviors is an important goal. The studies of Lorig and colleagues at the Stanford Arthritis Center were offered by Sobel as an example in which the finding that improvement in symptoms (reduced pain) was predicted most strongly by an enhanced sense of control over symptoms led to a change in intervention focus (Lorig & Fries, 1990; Lorig et al., 1989). The result was a restructuring of the intervention to focus on enhancing feelings of self-efficacy based on achievable goals (e.g., walking up two steps rather than a whole flight of stairs), and which produced significant reductions in pain and subsequent physician visits.

The research and interventions of Kemeny with HIV-positive patients have also targeted health behavior change variables such as outcome expectancies (see Kemeny, 2003). Their research program found that in men diagnosed with AIDS, negative expectancies about their future health were the strongest predictor of accelerated time to death, controlling for a variety of confounding factors such as baseline health status or immune functioning. Other important psychosocial predictors were negative appraisals of characteristics or the self and rejection sensitivity. Rejection sensitivity about one's homosexuality was significantly related to the rate of CD4 decline and to faster progression to AIDS and mortality (Cole, Kemeny, & Taylor, 1997). Interventions to alter cognitive appraisals of the disease process among these men, in addition to cognitive-behavioral stress management, have been found to produce significant changes in physiological parameters relevant to HIV, such as CD4 T cells and viral load (Schneiderman, Antoni, & Ironson, 2003).

Social Influences and Health Behavior Change

One psychosocial variable that may be a valuable component of interventions to change health behaviors is providing support for achieving the desired goal. Many interventions have included social support in an effort to delay illness or prolong life (e.g., Zabalegui, Sanchez, Sanchez, & Juando, 2005). For example, interventions to help smokers quit have included strategies to elicit social support from others or have assigned smokers to buddies who provide support during situations with a high risk for relapse (May & West, 2000; Park, Schultz, Tudiver, Campbell, & Becker, 2004).

In many cases, however, the promise of social support has not lived up to expectations. For example, some studies have found null or adverse effects of critical incident stress debriefing (CISD), a form of immediate social support provided to survivors of acute trauma, on the incidence of posttraumatic stress disorder (McNally, Bryant, & Ehlers, 2003). In addition, a recent Cochrane metaanalysis of psychosocial interventions for women with metastatic breast cancer found no evidence of long-term effects, although methodological features of the trials reviewed, as well as insufficient power to detect effects, may have precluded finding effects. Personality factors may also moderate the extent to which social support is beneficial, but few studies have examined the role of personality factors or other individual differences as they interact with support provision. Possible candidates are hostility (Lepore, 1995) and defensiveness (Strickland & Crowne, 1963; Westmaas & Jamner, in press); experimental studies have found these dispositional qualities to moderate the extent to which social support is beneficial in reducing subjective and physiological reactions to stressors.

In the smoking cessation literature, some intervention studies that have sought to increase the amount of social support for smokers likewise have proved to be ineffective (May & West, 2000). However, data suggest that attention to potential moderators such as gender and the use of theoretical models to guide research may be valuable in understanding how social support can be used effectively in interventions. For example, Westmaas and Billings (2005) hypothesized that social support might facilitate smoking cessation by reducing subjective responses to stressors such as negative affect and cravings, responses that in prior research predict the likelihood of lapsing (Kassel, Stroud, & Paronis, 2003). However, they hypothesized that the gender of the support provider and recipient would moderate the effects of support in reducing negative affect and cravings. Prior research on gender and social support suggested to them that among men, emotional support during quitting should originate from a romantic partner, whereas among women, effective sources of support could include same-sex friends or strangers. They found that, indeed, women smokers' negative affect and withdrawal symptoms were minimized during a stress task if a female stranger provided support, whereas men smokers' negative affect and withdrawal symptoms increased if the support provider was a female confederate. These results indicated that smoking cessation interventions may need to take into account theory and findings on gender in constructing interventions that include supportive components.

In other areas of health psychology research, gender, age, and sociocultural factors may be important factors in whether the provision of social support is an effective component of interventions. Attention to how social support is defined (structural, emotional, social pressure, etc.) and other methodological factors such as the use of standardized measures and process evaluation, are also important in evaluating the effects of social support components. These methodological factors are discussed in subsequent sections in more detail.

A Social Ecological Approach to Health Behavior Change

Social ecological models of behavior change address the multiple sources of influence on health-relevant behaviors. In a model described by Sorensen and colleagues (1998), these sources of influence are explained in terms of lenses through which various disciplines view the behavior or illness:

At the micro level, the biomedical lens focuses on biophysiological theories of disease causation. . . . The psychosocial lens maintains a primary focus on the individual, investigating questions about individual and social behaviors such as personality structures, a sense of control, and self-efficacy. . . . The epidemiological lens examines disease patterns within populations and aims to understand differential risk factors, including biological predispositions as well as behavioral and environmental exposures. By contrast, the society-and-health lens brings to the foreground cultural, social, economic, and political processes and aims to understand the ways in which these social structures influence differential risks. The social ecological model cuts across these disciplinary lenses and offers a theoretical framework that integrates multiple perspectives and theories. This framework recognizes that behavior is affected by multiple levels of influence, including intrapersonal factors, interpersonal processes, institutional factors, community factors, and public policy. (p. 390)

Social ecological models to promote healthful behaviors can also address the influence of physical environments. According to Stokols (1992), in a social ecological approach, "the healthfulness of a situation and the well-being of its participants are assumed to be influenced by multiple facets of both the physical environment (e.g., geography, architecture, and technology) and the social environment (e.g., culture, economics, and politics)" (p. 7). Of five health-related functions of the sociophysical environment noted by Stokols, one is environment as "an enabler of health behavior exemplified by the installation of safety devices in buildings and vehicles, geographic proximity to health care facilities, and exposure to interpersonal modeling or cultural practices that foster health-promotive behavior" (pp. 13-14).

Multiple Influences on Health Behavior Change: The Case of Smoking

A good example of the multiple levels of influence that comprise a social ecological approach to behavior change is the case of smoking. Smoking is implicated in many illnesses, and the ability to quit appears to be a function of societal, psychosocial, and biological variables. Cigarette smoking is believed to account for approximately 90% of all lung cancer cases (Siemiatycki, Krewski, Franco, & Kaiserman, 1995), but most smokers will not develop lung cancer. Genetic polymorphisms in glutathione s-transferase enzyme activity may influence the degree to which carcinogens in cigarette smoke are metabolized, and by implication the likelihood of lung cancer development (Harrison, Cantlay, Rae, Lamb, & Smith, 1997; Nyberg, Hou, Hemminki, Lambert, & Pershagen, 1998; Jourenkova-Mironova et al., 1998). These and other advancements, such as the development of a vaccine to prevent nicotine from reaching the brain (Shine, 2000), offer the possibility of future biologically based interventions to prevent the development of lung cancer among smokers (secondary prevention).

Psychosocial factors are also associated with smoking initiation, such as parental or sibling smoking, and perceived norms about the acceptability of smoking. School-based primary interventions have addressed these psychosocial factors. Recent metaanalyses of school-based interventions found that the most effective approaches were those that included a focus on social reinforcement for not smoking, whereas the least effective were those that sought only to increase awareness of the dangers of starting to smoke (Levinthal, 2005).

In addition to psychosocial factors as contributors to smoking behavior, societal-level factors are implicated, such as the price of cigarettes and the portrayal of smoking among actors in movies (Anderson & Hughes, 2000). Community approaches to the prevention of smoking have recognized that in addition to psychosocial factors, these societal-level factors are also important.

Sociodemographic and cultural variables, such as age, gender, ethnicity, and/or socioeconomic status, may moderate the impact of biological, psychosocial, and societal influences on smoking. These variables have taken on increased importance in the design of interventions to reduce or prevent smoking because of recent evidence that smoking initiation is also now occurring at a later age through cigarette promotion activities in bars that cater to college students (Rigotti, Moran, & Wechsler, 2005). This has occurred as laws curbing advertising directed at youth have been enacted (e.g., the Joe Camel campaign). Such recent developments suggest that to appropriately evaluate populationlevel interventions such as those limiting the advertising or price and availability of cigarettes, age, or educational level will need to be considered as possible moderators of the effectiveness of these activities. Gender or ethnic differences in smoking initiation, in reasons for smoking, and in smoking prevalence or ability to quit have also been demonstrated (Mermelstein, 1999; Perkins, 2001; Perkins, Donny, & Caggiula, 1999), suggesting their potential role as moderators of intervention effectiveness.

Although a social-ecological perspective in designing health promotion interventions has been promulgated and extensively implemented (see reviews by Merzel & D'Afflitti, 2003; Sorensen et al., 1998), a single unifying framework that integrates multiple levels of influence on a particular behavior, and that acknowledges possible interactions among them, has been absent (Merzel, & D'Afflitti, 2003). Goodman and colleagues have also argued that without the specificity of an integrative social-ecological model with which to test hypotheses, it is difficult to properly evaluate the effects of community-level prevention interventions (Goodman, Liburd, & Green-Phillips, 2001).

Designing Interventions

An initial step in designing prevention interventions is deciding who should be the target of the intervention. This decision should be partly related to whether the focus of the intervention is primary, secondary, or tertiary prevention. Many illness-promoting behaviors begin during youth or adolescence, and so primary interventions will often need to target individuals in these age groups. Good examples are school-based interventions to prevent initiation of smoking, to prevent obesity, or to prevent pregnancies and sexually transmitted diseases. However, primary interventions can also target older individuals, such as older HIV-negative men who have sex with men, or college students who are in danger of starting to smoke or binge drink. Age and gender differences are important considerations because they are related to maturational or sociocultural factors that are likely to play a role in the factors influencing health behaviors and whether the behavior is adopted. The use of explicit sexual language in print messages urging gay men to use condoms to prevent HIV infection, for example, while believed to have been effective for this population, could be offensive if applied to young women who are also in danger of becoming infected.

If the target population for an intervention consists of specialized groups such as ethnic and racial minorities, immigrant populations, children, the elderly, or the physically ill, other challenges exist. For example, cultural beliefs may play a significant role in the adoption of the behavior, and culture-appropriate materials may be needed to deliver the intervention. In an intervention to reduce the likelihood of HIV infection among migrant farmworkers in California who have sex with other men, but who would not self-identify as gay, Conner and colleagues distributed a novella (ongoing sagas presented in comic book format) to promote condom use (Mishra, Sanudo, & Conner, 2004). In this particular socioethnic group, such an approach was seen as a legitimate source of information compared with other possible options.

In addition to cultural factors, specialized groups may also differ on other sociodemographic characteristics, such as literacy or socioeconomic status, which will dictate the methods used to deliver the intervention. If English is not the native language of the intended recipients, the intervention will of course need to be presented in their language. If reading ability is limited, print media are not appropriate.

The sociodemographic and cultural characteristics of a targeted population can also influence whether an intervention should be undertaken at the individual, community, or societal level. If the targeted population is difficult to recruit for faceto-face interactions, then community- or societylevel interventions, rather than individual-level prevention approaches, may be more appropriate. If individuals from some communities may have to endure a long commute to attend a cognitivebehavioral smoking cessation clinic provided by a hospital, or may not have the financial resources to make the trip, public service messages on radio stations or campaigns delivered through church groups may have a better chance at reaching them. For example, Brandon and colleagues recruited recently quit smokers for a relapse-prevention intervention through newspaper, radio, and media advertisements that provided them with a toll-free number to call to register for the program (Brandon et al., 2004). The intervention consisted of brochures that were mailed directly to participants. This technique was effective in decreasing relapse rates.

Sometimes an intervention seeks to target those who are most at risk. If reducing risk in the most at-risk individuals is the overarching goal, it might be assumed that increasing the intensity of the intervention will be needed to change behavior. However, even moderately intense prevention efforts could increase the attrition rate in such a population. Equally important, the intervention will be less likely to show positive effects among those most at risk. For example, the aim of the Community Intervention Trial for Smoking Cessation (COMMIT) was to increase cessation rates among heavy smokers (i.e., those smoking more than 25 cigarettes a day). However, postintervention analyses indicated that COMMIT succeeded in increasing quit rates among light and moderate smokers (i.e., those smoking less than 25 cigarettes a day) but not among heavy smokers (Fisher, 1995).

Another important consideration in selecting participants is how generalizable the results of the intervention are intended to be, which in turn will influence whether the intervention is likely to be adopted by others. The RE-AIM framework, developed by Glasgow and colleagues, is a system of evaluating health promotion interventions that includes an assessment of the representativeness of participants, and the settings in which the intervention was conducted (Glasgow, Bull, Gillette, Klesges, & Dzewaltowski, 2002). Among the components of RE-AIM (Reach, Effectiveness, Adoption, Implementation, Maintenance), Reach refers to "the percentage of potential participants who will take part in an intervention, and to how representative they are of the population from which they are drawn" (p. 63). Glasgow and colleagues evaluated health promotion interventions conducted between 1996 and 2000 that attempted to change dietary, smoking, and physical activity behaviors, and that included a comparison or control group. They found that among 36 studies, although a majority reported on the percentage of eligible patients who participated, few studies reported whether participants, compared with those who declined, differed on sociodemographic or medical variables. Knowing who declined, why they did so, and whether they differed from participants on sociodemographic variables such as sex, age, and socioeconomic status can help in the design and revision of recruitment strategies so that generalizability of an intervention is enhanced.

Selecting the Appropriate Design

To be able to conclude that an intervention is effective, plausible alternative explanations must be ruled out. Randomization of individuals, schools, work sites, or communities to intervention and con-

trol groups represents the best strategy for ruling out alternative explanations, but participant responses to and reactions against the randomization process must be attended to and minimized, if possible (Wortman, Hendricks, & Hillis, 1976). In addition, other designs, including longitudinal research, can be used to support causal inferences. However, longitudinal designs are based on the assumption that certain parameters do not change over time, and there is still the possibility of spuriousness that needs to be accounted for in order to make causal inferences (Kenny, 1979). One threat to the ability to make causal inferences is the problem of selection bias. Selection bias occurs if the units making up the intervention and control groups differ before the intervention is even implemented (Larzelere, Kuhn, & Johnson, 2004). These biases can lead to both overestimating and underestimating the effects of interventions. In some interventions, selection biases operate so that the sickest or riskiest groups are targeted for behavior change. Regression to the mean by these individuals, defined as the tendency over time to approach mean levels of a behavior (Cook & Campbell, 1979), can give the appearance that the intervention produced positive effects. Without randomization to intervention and control groups of the most atrisk individuals, regression to the mean as a plausible alternative interpretation of results cannot be eliminated.

Well-designed randomized clinical trials represent one of the most powerful means of assessing health behavior theories and the effectiveness of interventions. However, as Helgeson and Lepore (1997) note, designing a randomized clinical intervention will often require balancing "the needs of the individual patient with the requirements of the research protocol" and "the practical or logistical issues in conducting an intervention with the theoretical and experimental issues." Helgeson and Lepore further note that this balancing act will sometimes require unforeseen modifications to the research protocol in order to ensure patient recruitment and retention and/or the cooperation of clinic staff. As an example they mention the occasional cancer patient who is dismayed by his or her assignment to the control group and asks to be put in the intervention group. The authors resolved this issue in their own research by favoring patients' wellbeing (e.g., providing them with referrals to other support groups in the community; see Hohmann & Shear, 2002, for another discussion of these problems).

When there is nonrandomization of units to intervention and control groups, assessing possible preexisting differences between intervention and control groups on variables that may influence the targeted behavior becomes paramount. These principles have not always been followed in community interventions to prevent the uptake of smoking in young people, however. According to a recent Cochrane database review, among the 17 community intervention studies designed to prevent youth smoking that included control groups and assessed baseline characteristics (their criteria for inclusion in the review), in 8 studies the allocation of communities or schools to the intervention or control groups was nonrandom, and some studies did not account for baseline differences in smoking in their follow-up analyses (Sowden, Arblaster, & Stead, 2005).

In the absence of randomization to intervention and control groups, matching individuals or communities from intervention and comparison groups on variables associated with the targeted behavior is appropriate. In a review of 32 community interventions to reduce smoking in adults that included a control group, however, only 5 studies demonstrated that the intervention and control communities were comparable on demographic variables at baseline (Secker-Walker, Gnich, Platt, & Lancaster, 2005).

In randomized controlled interventions conducted at the community level, the need to maintain scientific rigor through standardization and control can sometimes conflict with community goals and priorities. A certain amount of flexibility in accommodating the needs of participating community organizations is important for ensuring intervention integrity and can ultimately influence the effectiveness of the intervention. Involving communities in the design and implementation process will help both researchers and communities understand each other's perspectives and can ensure that the goals and priorities of both parties are met.

The expense of randomized controlled trials at the community level, in which the unit of allocation to experimental and comparison groups is the community or organization, can be a motivating factor in considering alternative designs, especially if required levels of statistical power are to be achieved. Sorensen and colleagues (1998) have stated that in designing interventions at the community level, "an expanded range of research methodologies is required to address the diverse needs for scientific rigor, appropriateness to research questions, and feasibility in terms of cost and setting" (p. 401). They describe other designs that could supplement the randomized control trial in answering questions about the effectiveness of community interventions, including observational studies, qualitative research methods, and action research methods. For example, qualitative research methods would be appropriate for understanding community needs, priorities, and resources before an intervention is designed.

With the increased popularity of the Internet, a number of Web-based interventions have also been developed. Web-based interventions offer the advantages of accessibility, low cost, data completeness, standardization, personalization or tailoring of information, and potentially greater accuracy of reporting symptoms or illegal or stigmatizing behaviors. Subjects can also participate in program elements in the privacy of their own homes and at their own convenience, and the degree of program participation can be easily assessed. Currently, there is a paucity of well-controlled research on the efficacy of Web-based interventions to promote health behaviors, but there are promising signs. For example, current Web-based interventions addressing smoking cessation, substance use, depression, and post-traumatic stress disorders have demonstrated positive treatment effects compared with control groups (Barr Taylor & Luce, 2003; Bock et al., 2004; Copeland & Martin, 2004).

Power Analyses

For any research endeavor, conducting power analyses is an important means of determining the number of units to be assigned to experimental and control groups in order to answer questions about the intervention's effectiveness. If a proposed study is not adequately powered, the absence of reliable (significant) differences between groups could be attributed to lack of power. Power analyses can also determine whether there are sufficient data points to adequately evaluate if intervention effects on outcome variables are moderated by other variables (e.g., motivation to quit smoking or gender). Such analyses represent the testing of "group X moderating variable" interactions and provide valuable information, especially if no main effects are obtained.

In individual-level interventions, the unit of allocation is the participant, with power analyses indicating the number of participants that should be recruited in each group in order to detect significant main or interaction effects at predetermined levels of power (usually 80%). In community interventions, the unit of allocation is the work site, school, hospital, city, or town. Power analysis to determine adequate sample sizes in community interventions need to account for statistical dependencies of responses within each unit or cluster (Donner & Klar, 1996; Koepsell et al., 1992). When only one community receives the intervention, with another community serving as the control group, conducting power analysis is difficult if results are to be analyzed at the cluster level. Indeed, it has been argued that the modest or nonsignificant effects of several community interventions to promote health and prevent illness may have been due to insufficient power to detect positive effects, even small ones (Secker-Walker et al., 2005).

Enlisting Cooperation for Interventions

In clinic-based interventions, the goal is often to evaluate the efficacy of a specific treatment on a specific outcome. An example is determining whether a cognitive-behavioral intervention for smoking cessation is effective in getting hospitalized patients to quit. Clinic-based interventions usually involve nurses, doctors, or other health care professionals (e.g., therapists, psychologists, and psychiatrists). Helgeson and Lepore (1997) provide several guidelines and comments that are useful in enlisting the cooperation of medical personnel. For example, they note that to gain access to a medical population, the first step is to identify a physician who values research and can be convinced that the results of the intervention will translate to benefits for the patient and the medical community. Including physicians in designing the intervention itself may be challenging, given the time constraints that many have, but nurses, whose training emphasizes the psychosocial needs of the patient, can often provide valuable information about patients and the operation of the institution (Holman, 1997). This information can be especially valuable in the design phase of the intervention. Because of the multitude of demands faced by clinic staff, minimizing the amount of work required of them (e.g., in developing a list of eligible patients for the study) will be important in maintaining their interest and cooperation. Maintaining contact with staff, particularly nurses, who are often vital to the successful implementation of the project, rewarding them for their cooperation, and providing updates and evidence of the intervention's value will also help to achieve this goal (Helgeson & Lepore, 1997, Grady & Wallston, 1988).

For interventions at the community level, the skills and priorities of the individuals, agencies, and institutions participating in the intervention are more varied. Altman (1995a) summarized four recommendations for improving community-level interventions, at least two of which refer to the importance of community cooperation. The four recommendations include "(i) integrate interventions into the community infrastructure, (ii) use comprehensive, multi-level intervention approaches, (iii) facilitate community participation and promote community capacity-building, and (iv) conduct thorough needs assessment/social reconnaissance in order to tailor interventions to the community context." Spending the time to understand the priorities of community organizations, whose assistance is required for the intervention to be implemented, and incorporating their needs into the intervention goals will help to sustain their cooperation during the research phase. At the same time, demonstrating how the intervention goals can benefit the community and obtaining consensus for their importance will help ensure that the needs of all parties are adequately met. However, some flexibility is still required on the part of the academically oriented research team so that the intervention is tailored to the community context.

Process Evaluation

Designing, planning, and executing an intervention, especially one that requires the cooperation of researchers, community agencies, workplaces, and media, involves a tremendous amount of effort. To be able to determine whether these considerable efforts are effective in producing the intended changes and are cost-effective, a rigorous evaluation of intervention delivery is required. Without extensive process evaluation, interpreting a lack of differences between intervention and control groups is particularly problematic. For example, if teachers implementing a smoking resistance program among middle schoolers deviate significantly from activities geared to changing norms about smoking and resisting offers to smoke, then nonsignificant effects of the intervention could be attributed to the intervention group having received a weaker dose of the treatment. Ongoing evaluation of program activities and delivery can also be used to appropriately modify program components once the intervention is under way.

A model example of rigorous process evaluation occurred in the COMMIT trial, a five-year community intervention trial to decrease smoking prevalence among heavy smokers (Fisher, 1995). Monitoring of program delivery was extensive, with logs completed by staff and volunteers and computerized record keeping of intervention activities. Process evaluation in other community interventions has included surveys completed by the targeted population and deliverers of the intervention, either by phone or through the mail, focus groups and semistructured interviews, and tracking and documenting program activities. In some trials, these functions were performed by computerized systems (Secker-Walker et al., 2005).

Process evaluation in community interventions can also include a determination of its reach and penetration. Reach refers to how aware members of the target population are of program activities such as radio or television advertisements, newspaper articles, health fairs, workplace programs, treatment clinics, self-help kits, and so on. Penetration refers to the extent to which the targeted population participated in these activities. Polling of representative samples of individuals from the targeted population can determine reach and penetration, which can be presented as the number or proportion of individuals who partook of intervention activities. This information should be an important part of the dissemination of trial results because low rates of awareness and/or penetration could account for nonsignificant differences between intervention and comparison groups on key outcomes. Penetration (intervention dose) can also be used to determine dose-response relationships, a measure of the effect of the intervention.

A case can be made that assessing the reach and penetration in comparison groups or communities for activities that are similar to intervention components should also be performed. There may be diffusion or "spillover" of the treatment from the experimental group or community into the comparison group or community. At the community level, this is likely to occur if the media extensively cover intervention activities. Comparison communities may also independently conduct their own health fairs, enact legislation, or provide media messages that produce effects similar to those of the intervention. For example, in the Alliance of Black Churches Project to reduce smoking through counseling by church members, the difference between the intervention group and the comparison group in whether they received information about smoking from a church member was 29% versus 20%, respectively (Schorling et al., 1997). In the COM-MIT trial, differences in indices of penetration for the intervention and control communities were also relatively small.

Secular trends in awareness of and engagement in behaviors that promote health and prevent illness may also lead to behavioral changes in the control group that are comparable to those in the intervention group. For example, the decreased social acceptability of smoking, facilitated first by the surgeon general's report and subsequently by tobacco taxes, public health campaigns, and the Master Tobacco Settlement Agreement, may be contributing to a decline in smoking rates in many geographic areas. The secular trend of reducing smoking levels has been cited for the observation of a greater decrease in smoking prevalence in the control compared with the intervention community in the Pawtucket Heart Health program (Carleton, Lasater, Assaf, Feldman, & McKinlay, 1995). Secular trends in smoking reduction may have also precluded finding stronger effects in the COMMIT trial (Bauman, Suchindran, & Murray, 1999). A greater intensity of intervention dosage may be needed to overcome secular trends observed in comparison communities. In addition, to better assess intervention effectiveness, investigators should determine the extent to which secular trends in behavior change are occurring prior to the implementation of the intervention (Secker-Walker et al., 2005).

Outcome Evaluation

For any health promotion or disease prevention intervention, what the outcome variables should be, by what means they should be assessed (questionnaires, interviews, etc.), and how often and when they should be measured need to be determined. In community-level interventions, outcome variables should be relevant or salient to the individuals from the communities or populations being studied (Hohmann & Shear, 2002). Hohmann and Shear (2002) suggest that while symptoms and diagnostic categories may be important for comparative purposes, for participants the important or expected outcomes may be different (e.g., an increase in level of daily functioning). The use of standardized measures with demonstrated reliability and validity, or measures that have been used in prior research, should be encouraged because they allow for easier comparison with results of prior research.

Who the intervention is targeting, as discussed previously, may play a role in determining which methods should be used to assess outcome variables. Self-report measures are often the most convenient and may be the best option if highly personal information, such as sexual practices or illegal activity, is sought. Structured interviews conducted over the telephone or computer-assisted interviews also provide some degree of anonymity and are probably less subject to the problem of missing data than are questionnaires. Both questionnaire and interview formats allow some degree of control of the testing context and data quality by researchers, but the degree of control needed will depend on the question being asked. For example, in a study investigating why women stay in abusive relationships, Herbert and colleagues used a strategy that ensured that women who completed the sensitive questionnaires could do so without the knowledge of their abusive spouses (Herbert, Silver, & Ellard, 1991).

For interventions conducted at the individual level, demand characteristics are more likely to be a problem. For example, smokers who undergo a cognitive-behavioral intervention to quit smoking may be motivated to misrepresent their actual levels of smoking at the end of the intervention because of the expectation by clinic staff that they should have quit or reduced their smoking. This consideration has led many smoking cessation programs to include biochemical validation of smoking status. In general, however, the more limited the contact between participants and clinic staff, the less likely smokers are to misrepresent their actual levels of smoking (Velicer, Prochaska, Rossi, & Snow, 1992). In addition, findings from randomized experiments document that when research participants respond to questions without interacting directly with an interviewer, they are more likely to reveal sensitive and/or personal information (Lau, Thomas, & Liu, 2000; Turner et al., 1998).

The reliability of participants' responses can also be assessed through the use of collateral reports from subjects' romantic partners, family, and/or friends. Convergence of evidence from these sources provides a greater degree of confidence about the reliability of responses. In addition to self-report or interview format, observational or archival measures can be useful indicators of intervention effectiveness. An example would be documentation of the number of teenage pregnancies before, during, and after an intervention promoting condom use in adolescents.

These methods of assessment differ in convenience and amount of resources required. As noted earlier, Web-based questionnaire assessments have been used with increasing success in health psychology research because of their convenience and low cost, and it is likely that they will be seriously considered for use in future health-promoting interventions. (See also Schlenger & Silver, 2006, for additional information on the pros and cons of the use of the Web for data collection.)

The assessment of outcomes, and of potential mediating or moderating variables, should be conducted before, during, and after the intervention. Assessing outcomes sometime after the intervention has ended can answer important questions about its long-term efficacy. For example, follow-up of cognitive-behavioral smoking cessation programs has found impressive quit rates soon after the intervention ended, but a substantial number of smokers relapse within the subsequent year (USDHHS, 2000). This has led to a focus on devising relapse prevention programs for smokers, some of which have been successful (e.g., Brandon et al., 2004). Many community-level prevention efforts have also led to short-lived behavioral changes. However, some of the health effects of interventions may take vears to be realized. This has stimulated efforts to encourage the sustainability or maintenance of interventions after researchers have collected and published their data.

Sustaining Interventions at the Community Level

If intervention activities are to be transferred to community organizations, their leaders should be involved in the planning and implementation of the intervention, which will need to be sensitive to the priorities and limitations of community resources (Altman, 1995b). According to Altman, questions of ownership and control of community programs should be addressed prior to implementation, and any conflicts resolved, so that there is "broad-based support from a cross-section of community constituencies" (p. 529) both during the intervention and after the research phase has ended. An exchange of skills, through education and training, between researchers and community staff and fostering a sense of empowerment in communities to obtain resources for programs also contribute to sustainability. For example, educating community leaders on effective performance evaluation should foster a sense of empowerment and produce skills that leaders can use to design and implement unique interventions that address the same health behaviors.

Disseminating Research Findings

Although expenditures on health promotive research have been substantial, knowledge of how to disseminate findings from research to primary-care clinics and community agencies that deliver health services is only now emerging as a research endeavor in its own right (Kerner, Rimer, & Emmons, 2005). Much work remains, however, for dissemination research to advance as a science. As Kerner et al. note, the best research methods for evaluating dissemination strategies have not yet been established, which limits the amount of guidance available for researchers who want to conduct dissemination research. These authors also recommend more infrastructure support from private and public sectors and greater consensus among journal reviewers and editors on how to evaluate dissemination research projects. Nonetheless, translating the empirical results of scientific investigations into practical recommendations for health care professionals, schools, work sites, and community organizations is critical. Working effectively with the media and others to take research findings to the public-to ensure that they are effectively applied to both policy and practiceshould be an important goal of health psychology researchers. With increasing attention to these issues, the efforts devoted to designing effective health-promoting interventions will hopefully translate to evidence-based practices that improve the public health.

Ethical Issues

Any research whose goal is to change behaviors, even health-promoting ones, must attend to ethical issues involving the use of human subjects. Because of concerns regarding the use of community samples in intervention research, nonprofit agencies, health care settings, schools, and work sites may serve as gatekeepers to block access to potential research subjects. Convincing these gatekeepers of the value of one's research often requires demonstrating sensitivity to the ethics of human subject experimentation (Sieber, 1998). Moreover, conducting interventions at any level of analysis must also involve the review of research plans by institutional review boards housed in academic institutions, as well as in individual research settings (e.g., individual hospitals). The provision of an inherently more appealing treatment may require eventually offering it as an option to the control group at a later date (e.g., designing a "waiting list" control group). Designing research on specialized populations, such as geriatric, pediatric, or medically ill samples, requires special attention to issues of informed consent, avoiding coercive procedures, and providing ample opportunity for refusal and termination of participation in the research effort over time. It is important that the individual researcher conduct a careful cost-benefit analysis, weighing the personal rights of individual participants against the potential benefits for society of the research. While ethical issues surrounding the design and implementation of community-based intervention research may be challenging and will undoubtedly require creativity and persistence, conducting methodologically rigorous research on human participants is required for the science of health promotion and illness prevention to advance.

Conclusion

The value of health promotion and intervention programs to improve health and reduce illness has been amply demonstrated in several domains of behavior. Indeed, it can be argued that intervention programs are victims of their own success when individuals in control groups show the same improvements in health behaviors as those in intervention groups. However, for progress to continue in our dynamic environment, where new threats to

mental and physical health emerge (e.g., bioterrorism) and old ones adopt new faces (e.g., water pipes for smoking), lessons learned from prior intervention research must be considered as well as new approaches. Attention to such principles as the use of theoretical models to guide research, consideration of individual, cultural, and sociodemographic differences and their moderating effects on treatment outcomes, the equivalence of intervention and control groups, and the appropriate use of statistical analyses and methods should provide the foundation for health promotion and intervention research. However, to improve the health of the greatest number of individuals, the expertise of others who are invested in advancing our ability to promote health and prevent illness is needed. Their involvement, as well as that of the targets of our research, will necessarily contribute to our understanding the most effective ways to initiate and sustain health behavior change.

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