Theoretical Models of Health Behavior and Workplace Self-Protective Behavior

David M. DeJoy

This paper provides a critical review of the applicability of theoretical models of health behavior to workplace self-protective behavior. Value-expectancy, environmental/contextual, and behavior change models are reviewed. On this basis, an integrative framework is proposed that conceptualizes self-protective behavior as consisting of four stages or phases: hazard appraisal, decision making, initiation, and adherence. In addition, five general constructs are identified as being of either primary or secondary importance at each stage: threat-related beliefs, response efficacy, self-efficacy, facilitating conditions, and safety climate. The proposed framework highlights the need to target interventions to each of the four stages. Particular emphasis is also assigned to environmental or situational factors in enabling and reinforcing self-protective behavior in the workplace.

INTRODUCTION

With very few exceptions, research on workplace self-protective behavior has been piecemeal and atheoretical. Studies have generally taken one of three approaches. First, a number of studies have examined various employee characteristics and their relationships to safety performance and injury experience. Characteristics studied have included: hazard and safety-related attitudes and beliefs (e.g., Cox & Cox, 1991; Dedobbeleer & German, 1987; Leather, 1988; Walters & Haines, 1988); personality dimensions and risk-taking tendencies (e.g., Jones & Wuebker, 1985; Landeweerd, Urlings, DeJong, Nijhuis, & Bouter, 1990); subjective risk assessments (e.g., Edwards & Hahn, 1980; Goldberg, Dar-el, & Rubin, 1991; Howarth, 1987; Zimolong, 1985); and job demands and other stressors (e.g., Cooper & Sutherland, 1987; Levenson, Hirschfeld, & Hirschfeld, 1980; Murphy, 1984; Smith, Colligan, Frockt, & Tasto, 1982).

A second group of studies has attempted to modify the safety-related behaviors of workers through the use of contingent reinforcement or operant-based approaches. Reinforcers have included information feedback, goal setting, social recognition, and praise, as well as more conventional rewards and incentives. Reinforcement protocols have been used to improve the use of protective eyewear (Smith, Anger, & Uslan, 1978) and hearing protectors (Zohar, Cohen, & Azar, 1980), and to increase compliance with safety regulations (Rhoton, 1980). Other studies within this group have been somewhat broader in scope and have tried to influence multiple safety-related behaviors.
and overall safety performance (e.g., Komaki, Barwick, & Scott, 1978; Sulzer-Azaroff & DeSantamaria, 1980). Supervisory behavior has also been examined using this general approach (Komaki, Zlotnick, & Jensen, 1986; Mattila, Hyttinen, & Rantanen, 1994).

The third group of studies has focused on the organizational and environmental correlates of good safety performance. Most of these studies have sought to identify the programmatic features of effective safety programs (e.g., Cohen, Smith, & Cohen, 1975; Cohen & Cleveland, 1983; Fiedler, Bell, Chemers, & Patrick, 1984; Planek & Fearn, 1993; Simonds & Shafai-Sahrai, 1977; Smith, Cohen, Cohen, & Cleveland, 1978) or the major dimensions of positive or supportive organizational safety climates (e.g., Brown & Holmes, 1986; Dedobbeleer & Beland, 1991; Mattila, Rantanen, & Hyttinen, 1994; Niskanen, 1994; Zohar, 1980).

This research has been useful but it has not provided a comprehensive understanding of worker self-protection. More is now known about the importance of certain individual and organizational characteristics, but there has been very little comparability from one study to another, and few generalizable conclusions can be drawn. For example, it is difficult to make predictions about which factors are likely to be important in a given work situation or how these factors might interact with each other. Almost nothing is known about the interplay of individual and organizational factors in influencing the safety-related actions of workers on the job.

A number of conceptual models of workplace safety and health have been proposed to help organize research findings and guide the development of occupational safety and health programs (e.g., Cohen, Smith, & Anger, 1979; DeJoy, 1990; DeJoy & Southern, 1993; Smith & Beringer, 1987). These models are useful in a heuristic sense because they underscore the need to consider the characteristics of the worker, the tasks and jobs being performed, the total work environment, and the organizational structure. But for the most part, they fall far short of being comprehensive or testable models. In view of these limitations, it may be worthwhile to look to related areas for more sophisticated and applicable models. The general area of health behavior offers a number of theoretical models that have been tested and refined over the years.

### Theoretical Models of Health Behavior

A variety of models have been developed to explain why people do or do not engage in various health enhancing and medically beneficial activities. These models have been applied to a wide variety of preventive and lifestyle behaviors (e.g., vaccinations, safe sex practices, smoking, exercise, seat belt usage), screening or early detection activities (e.g., breast self-examination, cholesterol and blood pressure testing, genetic screening), sick role behaviors (e.g., clinic utilization, physician visits), and adherence to medical and other therapeutic regimens (e.g., hypertension, diabetes). Although there would appear to be an obvious link between these models and workplace self-protective behavior, very little attention has been given to examining how they might apply to actions that workers are asked to take to protect themselves from job-related hazards.

Three categories of models are considered in this paper. The first category includes the decision making or cost-benefit models derived from value-expectancy theory. These models have occupied a prominent position in the health behavior literature during the last 30 years (Glanz, Lewis, & Rimer, 1990; Weinstein, 1993). The second category is referred to here as environmental or contextual models. These models attempt to go beyond person-focused variables and take a more ecological or interactionist approach to analyzing the determinants of health behavior. The final category of models focuses on the behavior change process itself. Models in this category typically portray behavior change as a series of qualitatively distinct stages.

#### Value-Expectancy Models

Value-expectancy models are based on the premise that people estimate the seriousness of risks, evaluate the costs and benefits of various actions, and then choose a course of action that will maximize the expected outcome (Cleary, 1987). Value-expectancy models have taken a variety of forms, and three prominent examples are discussed here: the Health Belief Model (Becker, 1974); the Theory of Reasoned Action (Ajzen & Fishbein, 1980); and Protection Motivation Theory (Rogers, 1983). The three models are each different to some extent, but they all emphasize the individual's threat-related
beliefs or perceptions. Weinstein (1993) argues that value-expectancy models have four characteristics in common: (a) that motivation for self-protective behavior arises from the anticipation of negative consequences and the desire to minimize these outcomes, (b) that the impact of an anticipated negative outcome on motivation depends on beliefs about the likelihood that this outcome will occur, (c) that motivation to act arises from the expectation that the action will reduce the likelihood or severity of harm, and (d) that the expected benefits of a particular action must be weighed against the expected costs of taking the action.

Health Belief Model (HBM). Of the models presented in this section, the HBM has produced the largest body of health-related research. It is also the only one that was specifically developed to explain health behavior. The HBM model has four basic components: (a) perceived susceptibility to the health problem or condition in question, (b) the perceived seriousness of the problem or condition, (c) the perceived benefits associated with taking a particular action, and (d) the perceived barriers associated with taking the action.

Published reviews of the HBM literature (Becker, 1974; Harrison, Mullen, & Green, 1992; Janz & Becker, 1984) show considerable support for the model and offer some general conclusions about the relative importance of its major components. Perceived barriers have been shown to be the most powerful single predictor across all studies and behaviors. Perceived susceptibility and perceived benefits are also important, with susceptibility being more important for preventive than sick role behaviors. As might be expected, benefits are more important than susceptibility for sick role behaviors. In terms of the total literature, perceived severity appears to be the weakest of the four dimensions.

One of the major criticisms of the HBM is that it does not specify relationships among the major variables. Indeed, it has sometimes been referred to as being more a list of variables than a theoretical model (Wallston & Wallston, 1984; Weinstein, 1993). Most applications of the HBM combine the variables in a linear or additive fashion to test the model: susceptibility + severity + (benefits − barriers). However, some of the earlier writing on the model (e.g., Maiman & Becker, 1974) would appear to suggest a multiplicative model: susceptibility × severity × (benefits − barriers).

Theory of reasoned action (TRA). The TRA posits that behavioral intention is the immediate determinant of behavior and that all factors that influence a particular behavior are mediated through intention. Intention is determined by two components: (a) attitude toward the behavior, which consists of beliefs about the consequences of performing the behavior and the evaluation of those consequences; and (b) subjective norms, which consist of normative beliefs about what salient others think and the individual’s motivation to comply with those wishes. According to the model, intention can be predicted by the linear combination of attitude and normative beliefs multiplied by motivation to comply with the beliefs. The model is expressed as a multiple regression equation, with the weights assigned to the major components determined by multiple regression procedures.

The TRA has been applied with considerable success to a number of health behaviors, including exercise, weight loss, child safety seats, smoking, condom usage, and alcohol and drug use (see Cleary, 1987; Kirscht, 1983; Sutton, 1987 for reviews). Besides its focus on behavioral intention, the most obvious difference between the TRA and HBM is that the TRA includes subjective norms as a major determinant of health-related behavior. The TRA also goes further in specifying how its constructs should be measured and how they combine to form behavioral intention. On the negative side, much of the research on the TRA has been confined to predicting behavior intention rather than actual behavior (Baranowski, 1992–1993).

More recent versions of both the HBM (Rosenstock, Strehler, & Becker, 1988) and the TRA (Ajzen, 1985) have added self-efficacy (Bandura, 1986) as an important component. The principal argument for including self-efficacy is that people must feel confident that they are capable of performing the behaviors required to produce the desired outcomes. Self-efficacy appears to be especially important for lifestyle modifications and other behaviors involving long-term change and maintenance (Strecher, DeVellis, Becker, & Rosenstock, 1986).

Protection motivation theory (PMT). This model features two cognitive processes, threat appraisal
and coping appraisal, which combine to form protection motivation. Protection motivation (typically measured as behavioral intention) is conceptualized as an intervening variable that activates coping behavior. Threat appraisal evaluates the intrinsic (e.g., pleasure) and extrinsic (e.g., social approval) rewards that increase the probability of making a maladaptive response against perceptions of vulnerability and outcome severity that decrease the probability. Threat appraisal is the algebraic sum of these variables. Coping appraisal consists of judgments about the efficacy of a preventive response (response efficacy) plus the assessment of one's ability to successfully perform the necessary responses or behaviors (self-efficacy) minus the costs associated with the response.

Protection motivation is assumed to be greatest when: (a) the perceived threat is severe, (b) the individual feels vulnerable, (c) the adaptive response is believed to be effective, (d) the person is confident of his or her abilities to complete the adaptive response, (e) the rewards of the maladaptive behavior are small, and (f) the costs of the adaptive behavior are low. Although this is an additive model within each of the two appraisal processes, interactive effects can occur between threat and coping appraisal processes (e.g., self-efficacy \times severity). Presumably, this allows the model to predict outcomes that are contrary to totally rational decision making (Prentice-Dunn & Rogers, 1986). Although less extensively researched than the two previous models, the major components of PMT have been supported (Prentice-Dunn & Rogers; Rogers, 1983). Much of this work has involved fear-arousing communications and attitude change.

Applicability to Workplace Self-Protective Behavior

Aside from some consideration of HBM constructs with respect to personal protective equipment (e.g., Cleveland, 1984; DeJoy, 1986; Terrell, 1984), very little effort has been made to apply the value-expectancy models to worker safety and health. However, viewed as a group, these models do highlight several constructs that should be relevant to workplace self-protective behavior. These constructs include: (a) threat-related beliefs, (b) self-efficacy, (c) response efficacy, (d) barriers, and (e) normative expectations (see Table 1).

**Threat-related beliefs.** Beliefs about susceptibility (probability) and severity are featured in each of the models. The interrelationship of susceptibility and severity tends to be treated differently in the various models, but a multiplicative relationship would appear to be most in line with the value-expectancy tradition. For example, a high level of perceived susceptibility may not necessarily lead to self-protective behavior if the severity of the threat is minimal. On the other hand, for a highly lethal outcome, perceived susceptibility may be the major dimension.

**Self-efficacy.** In one form or another, self-efficacy has been incorporated into each of the value-expectancy models. Because most instances of worker self-protection involve the performance of a set of prescribed actions on a long-term basis, self-efficacy should be an important factor. Workers need to feel confident about their ability to perform required behaviors on a regular and long-term basis.

**Response efficacy.** Beliefs about the consequences or effectiveness of preventive action also play a role in each of the models. They are treated as benefits in the HBM, as part of attitudes in the TRA, and as response efficacy in PMT. In most workplace applications, response efficacy involves perceptions about the effectiveness of prescribed work practices or protective equipment in preventing hazardous exposures.

**Barriers.** Barriers are considered explicitly in the HBM and the PMT, and indirectly in the TRA. Indeed, the HBM literature (Janz & Becker, 1984) suggests that barriers or costs are the single best predictor of health behavior. Relevant to the workplace, research on the use of personal protective equipment shows that job-related barriers are often a major factor in non-compliance (Acton, 1977; Cleveland, 1984; Terrell, 1984).

**Normative expectations.** The TRA is the model that considers the effects of the social environment most directly. Social influences are also considered, somewhat tangentially, in the intrinsic-extrinsic rewards portion of PMT. Research on safety program effectiveness (e.g., Cohen & Cleveland, 1983; Fiedler et al., 1984; Planek & Fearn, 1993; Simonds & Shafai-Sahraei, 1977) and safety climate (e.g., Dedobbeler & Beland,
TABLE 1
VALUE-EXPECTANCY CONSTRUCTS APPLIED TO WORKPLACE SELF-PROTECTIVE BEHAVIOR

<table>
<thead>
<tr>
<th>Construct</th>
<th>Definition</th>
<th>Workplace Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threat-related beliefs</td>
<td>Beliefs about hazard susceptibility and severity</td>
<td>Construction worker's beliefs about his/her likelihood of falling off scaffolding</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>Beliefs about one's ability to follow indicated safety measures successfully</td>
<td>Emergency medical technician's beliefs about being able to dispose of used needles safely</td>
</tr>
<tr>
<td>Response efficacy</td>
<td>Perceived effectiveness of available safety measures</td>
<td>Underground coal miner's confidence in automated carbon monoxide detection system</td>
</tr>
<tr>
<td>Barriers</td>
<td>Factors that interfere with the use of available safety measures</td>
<td>Physical discomfort associated with wearing hearing protectors in textile plant</td>
</tr>
<tr>
<td>Normative expectations</td>
<td>Social/organizational factors that influence worker self-protection</td>
<td>Supervisor's indifference to safe lifting practices in warehousing operation</td>
</tr>
</tbody>
</table>

1991; Mattila et al., 1994; Niskanen, 1994; Zohar, 1980) highlight the important role of social-organizational factors in supporting good safety performance. The safety literature also contains a number of studies indicating that performance and other types of feedback from supervisors and coworkers can be an important factor in shaping work-related safety behavior (see review by McAfee & Winn, 1989).

Contextual or Environmental Models

The models discussed thus far have been primarily concerned with how the individual's attitudes, beliefs, and expectations influence his or her reaction to various health threats. Only limited attention is given to social or environmental factors, or to the context in which the individual operates. The need for a person × situation or interactionist approach to workplace safety and health has been discussed in general terms by several authors (e.g., DeJoy & Southern, 1993; DeJoy, Wilson, & Huddy, 1995; Sheehy & Chapman, 1987; Smith & Beringer, 1987). The interactionist perspective holds that individual and situational (environmental) factors combine multiplicatively in influencing worker behavior.

PRECEDE model. The PRECEDE model developed by Green and colleagues (Green & Kreuter, 1991; Green, Kreuter, Deeds, & Partridge, 1980) would appear to qualify as a contextual model. "PRECEDE" is an acronym for "predisposing, reinforcing, and enabling causes in educational diagnosis and evaluation," and this model was developed as a framework to be used in planning health education programs. This basic framework has been adapted to workplace self-protective behavior (Dedobbeleer & German, 1987; DeJoy, 1986; Peters, 1991).

In the PRECEDE model, three sets of diagnostic or behavioral factors drive the development of prevention strategies. Predisposing factors are the characteristics of the individual (beliefs, attitudes, values, etc.) that facilitate or hinder self-protective behavior. Predisposing factors are conceptualized as providing the motivation for behavior. The threat-related beliefs and efficacy expectancies that are prominent features of the value-expectancy models would be included here. Enabling factors refer to objective aspects of the environment or system that block or promote self-protective action. Green and colleagues (Green et al., 1980) define enabling factors as "factors antecedent to behavior that allow motivation or aspiration to be realized" (p. 68). The skill and knowledge necessary to follow prescribed actions would be included here, as would the availability and accessibility of protective equipment and other resources. Most barriers or costs would be classified as enabling factors. Reinforcing factors involve any reward or punishment that follows or is anticipated as a consequence of the behavior. Performance feedback and the social approval/disapproval received from coworkers, supervisors, and managers would qualify as reinforcing factors in workplace settings.

The PRECEDE model was developed as a program-planning framework rather than as a causal model of health behavior (Green et al., 1980). The three diagnostic categories were...
intended primarily as reference points for analyzing the determinants of behavior that would be most responsive to health education efforts. As such, little attention was given to delimiting the categories or to specifying combinational rules. The PRECEDE model has been used extensively to plan and evaluate health education and related programs in a variety of settings, including the workplace (Green & Kreuter, 1991). However, there have been relatively few formal tests of this model.

Applicability to Workplace Self-Protective Behavior

The PRECEDE model increases the saliency of environmental or contextual variables in two important ways: (a) by directing attention to the skills and resources that are prerequisite to the achievement of behavioral goals, and (b) by viewing the environment as an important source of support and reinforcement for behavior change and maintenance. The recently revised version of the PRECEDE model, the PRECEDE/PROCEED model (Green & Kreuter, 1991) is even more distinctly environmental. The revised version proposes that an environmental diagnosis should occur along with the behavioral diagnosis, and that special attention should be given to the interaction of behavioral and environmental factors. This encourages the selection of both behavioral and environmental targets for change within the intervention program.

However, it is the interactive nature of the three diagnostic factors that is probably of greatest potential importance to understanding worker behavior. In particular, efforts to influence the beliefs and attitudes of workers and, thus, motivate them to follow safe practices may fail if the environment is nonsupportive. This calls attention to the importance of job-related barriers, the ready availability of safety equipment and devices, and the importance of skill-based training in facilitating self-protective behavior. A second point is that even well-motivated and well-trained workers may not respond appropriately if doing so is not acknowledged or reinforced by peers, supervisors, and management. Performance feedback and the safety-related attitudes and actions of management would appear to be especially important in this regard.

Behavior Change Models

The final category of models includes those that focus on the process of behavior change. The Transtheoretical Model (Prochaska & DiClemente, 1982) and the Precaution-Adoption Process (Weinstein, 1988) are perhaps the best exemplars of this general category. Both of these models portray the change process as a series of stages. A fundamental tenet of the stage change perspective is that people at different points in the change process require different types of information and assistance to move to the next stage. The variables or factors important at one stage may be quite unimportant at another stage. For example, beliefs about susceptibility or severity may be important early in the change process, such as during initial awareness and decision making, but become less important once actual behavior change is underway.

Transtheoretical Model. Prochaska and colleagues (Prochaska, DiClemente, & Norcross, 1992) describe the process of behavior change as consisting of five principal stages: (a) precontemplation, (b) contemplation, (c) preparation, (d) action, and (e) maintenance. Precontemplation is the stage in which the person is not seriously thinking about changing his or her behavior. Contemplation begins when the person starts to think seriously about changing in the near future (i.e., about 6 months). Preparation denotes that the person intends to make a change in the very near future, and that he or she has a plan for action and has already made small or preliminary behavior changes (thus, preparation has both intentional and behavioral dimensions). Action is the period following initial behavior change (usually about 6 months). Maintenance extends from this point until termination.

A growing body of evidence exists for the basic stages of change construct, mostly involving addictive behaviors and psychotherapy (Prochaska & DiClemente, 1992). Work with this model has also sought to uncover the processes of change, or the activities that individuals engage in when they attempt to modify problem behaviors. Of considerable importance is the observation that the processes of change appear to be quite similar across a variety of different behaviors (Prochaska et al., 1992). That is, for many behaviors, information-seeking and consciousness-raising activities are relevant for people entering contemplation, and stimulus control.
and social support are important processes for those in the action and maintenance stages. The ultimate goal is to integrate the stages and processes of change, and to identify the most effective strategies for moving people from one stage to the next (DiClemente et al., 1991).

Precaution-adoption process. The precaution-adoption process (Weinstein, 1988) also has five stages: (a) has heard of hazard, (b) believes in susceptibility for others, (c) acknowledges personal susceptibility, (d) decides to take precaution, and (e) takes precaution. A central feature of this model is that personal susceptibility is treated as a series of three stages rather than as a single dimension or continuum. This conceptualization derives from the idea that people are likely to have little interest in taking precautions unless they feel personally vulnerable. A further complication is that people tend to be optimistically biased in judging their personal levels of risk. That is, for many different hazards, people consider their own risk to be considerably less than that of most other people (Weinstein, 1980, 1982, 1987). The decision making stage in this model involves many of the same hazard-related beliefs and cost–benefit considerations that are featured in the value-expectancy literature. However, since the stages are cumulative, decision making does not begin until the requirements of stage three have been met. Barriers are particularly important in translating a decision into action (stage 5). Weinstein and colleagues have tested this model in several studies of home radon testing (Weinstein & Sandman, 1992).

Applicability to Workplace Self-Protective Behavior

Inherent in both stage models is the view that different kinds of information and interventions will have different saliencies depending on where the individual is in the change process. For example, minimizing the costs or barriers associated with following a particular self-protective action will have very little impact on people who are not yet aware of the threat or who do not think that they are personally susceptible to it. Value-expectancy models, in contrast, assume that the probability of action is essentially an algebraic function of the individual’s beliefs and that this same predictive equation applies across the entire behavior change process. The stage change perspective argues that different equations are needed for each stage.

Providing workers with information about particular job-related hazards is likely to be most useful for increasing awareness and a sense of personal susceptibility. But beyond this point, such information is likely to be of limited effectiveness in changing and maintaining relevant work practices. Once awareness and personal susceptibility are established, attention might better be focused on related skill development and self-efficacy enhancement, and with actions that reduce barriers and create more favorable cost–benefit ratios for safe behavior.

Long-term adherence ultimately requires constructing task and work environments that support safe behavior, even under the most adverse workload conditions. Borrowing from relapse prevention research (e.g., Marlatt & Gordon, 1985), conscious efforts are needed to assess the situations and circumstances under which adherence is likely to fail. Alternative strategies or coping responses should be available to workers for use in such situations. The identification and analysis of special requirements and high risk situations should be an important feature of a comprehensive safety program.

The importance of environmental supports during the action and maintenance stages blends nicely with the preceding discussion of enabling and reinforcing factors within the PRECEDE framework. In the final analysis, high levels of both individual and collective control may be critical to successful long-term adherence. Presumably, efforts to enhance self-efficacy have the direct effect of increasing the individual’s sense of personal control. However, groups of people may also possess a sense of control. Peterson and Stunkard (1989) describe collective control as: “a norm — or shared belief — about the way that the group works, what it is that the group can and cannot accomplish by what actions” (p. 822). As described by these authors, collective control bears considerable resemblance to Zohar’s (1980) concept of safety climate. For Zohar, safety climate is: “a summary of molar perceptions that employees share about their work environments” (p. 96). It is generally thought that safety climate serves as a frame of reference for guiding relevant behavior in the workplace and that employees develop reasonably coherent expectations regarding behavior-outcome contingencies in their environment (cf.
Schneider, 1975). It follows that collective control or safety climate should be an important consideration in fostering long-term and broad-based adherence to safe work practices.

**An Integrative Framework for Workplace Self-Protective Behavior**

Each of the categories of models reviewed thus far has something to contribute to understanding workplace self-protective behavior. The value-expectancy models provide a fairly circumscribed set of person-focused variables that are likely to be important to any type of self-protective behavior. The PRECEDE model, as an environmental or contextual model, directs attention to the interaction of person and situational factors, and to how the work environment, broadly defined, can enable and reinforce self-protective actions. The stage models emphasize that precautionary behavior is inherently dynamic and comprised of qualitatively different phases or stages.

Figure 1 portrays self-protective behavior as consisting of four stages: hazard appraisal, decision making, initiation, and adherence. These stages may be viewed as representing different levels of motivational readiness to engage in self-protective behavior. However, the factors that influence this readiness are not limited to person-focused variables. Table 2 features five general constructs that are likely to be important to self-protective actions in the workplace. The constructs build on those portrayed earlier (see Table 1), with two modifications. The term facilitating conditions expands the concept of barriers relative to its usage in the value-expectancy models and emphasizes the importance of environmental supports in self-protective behavior.

Also, safety climate is used to represent the manifold of social and organizational factors that may impinge on workplace behavior. Each of the five constructs can be further described in terms of specific variables.

Because current knowledge is not sufficient to exclude any of the constructs at a particular stage, the five constructs in Table 2 are labeled as being of either primary or secondary importance for each stage. As with other stage models, the stages should be treated as cumulative; for example, the individual must believe that a particular hazard represents a serious threat before he or she will enter the decision making stage. Efficacy considerations and facilitating conditions will be of little importance for those who are unaware of the hazard or for those who have appraised the hazard as insignificant. A discussion of the four stages follows.

**Hazard appraisal.** The individual's threat-related beliefs are of primary importance during this stage. As discussed earlier, perceived susceptibility (likelihood) and severity can be expected to interact to form perceived threat. Response efficacy, or the availability of effective preventive strategies, may also be important at this stage. Defensive or self-protective motives (e.g., Miller & Ross, 1975) may cause the individual to dismiss or discount a hazard for which preventive strategies are unavailable or of limited effectiveness. Unwarranted optimism or overconfidence may also play a role in hazard appraisal (Weinstein, 1987). At this stage, workers should benefit from information about the hazard itself, including risk estimates, exposure modes, available control measures, and so forth. The importance of having workers personalize the risks should not be ignored.

**FIGURE 1**

STAGE OR SEQUENTIAL MODEL OF WORKPLACE SELF-PROTECTIVE BEHAVIOR

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STAGE OR SEQUENTIAL MODEL OF WORKPLACE SELF-PROTECTIVE BEHAVIOR

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TABLE 2
SELF-PROTECTIVE BEHAVIOR CONSTRUCTS AND THE STAGES OF SELF-PROTECTIVE BEHAVIOR

<table>
<thead>
<tr>
<th>Construct</th>
<th>Hazard Appraisal</th>
<th>Decision-making</th>
<th>Initiation</th>
<th>Adherence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threat-related beliefs</td>
<td>P</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Response efficacy</td>
<td>P</td>
<td>P</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>S</td>
<td>P</td>
<td>S</td>
<td>S</td>
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<tr>
<td>Facilitating conditions</td>
<td>S</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>Safety climate</td>
<td>S</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
</tbody>
</table>

Note: P = primary importance; S = secondary importance

**Decision making.** Efficacy considerations and the costs and benefits associated with alternative courses of action become important during the decision making stage. Efficacy considerations include those related to the effectiveness of available precautionary actions (response efficacy), as well as the individual's perceptions of his or her ability to successfully accomplish these actions (self-efficacy). Self-efficacy can be developed through education/training and skill-building exercises, as well as actual experience in performing the relevant behaviors. The modeling of these behaviors by coworkers may also enhance self-efficacy expectancies.

The cost–benefit portion focuses on weighing the benefits of the self-protective action against the costs incurred. Costs may include time constraints, actual or imagined reductions in productivity or skilled performance, physical discomfort, and any other encumbrances that reduce "quality of life" on the job. Facilitating conditions serve to counteract costs, and might include the ready availability of needed safety equipment, training in the correct usage of this equipment, and redesigned jobs and equipment that make self-protection easier and more effective. The cost–benefit analysis might also include safety climate considerations.

**Initiation.** Facilitating conditions and safety climate are the principal constructs during the initiation stage. At this stage, attention shifts to the environmental and organizational factors that support and reinforce self-protective action. These factors become very important as behavioral intention is translated into action, and as workers try out new behaviors. Although safety climate remains a rather elusive concept, it appears reasonable to conclude that the attitudes and actions of management play a prominent role in the safety climate of the organization (Brown & Holmes, 1986; Dedobbeleer & Beland, 1991; Zohar, 1980). Safety performance information and other types of feedback received from coworkers and supervisors is also likely to be an important aspect of safety climate.

**Adherence.** Environmental and organizational factors can be expected to play major roles in sustaining long-term adherence. As workers successfully follow prescribed actions, their self-efficacy should increase, and with that, their resistance to nonadherence. Many self-protective actions become relatively automatic over time, and this should also help to sustain long-term adherence. Response efficacy should also increase with time as workers become more confident of the effectiveness of the actions in question. Still, efficacy considerations remain secondary to barriers and safety climate at this stage. Long-term maintenance ultimately depends on creating task and work environments that support safe behavior, even under the most stressful or demanding conditions.

Although this proposed framework certainly needs to be tested and validated, there are several lines of inquiry that support the general organization of the framework and the assignment of various self-protective behavior constructs to particular stages. First, it is generally acknowledged that awareness and knowledge are necessary but often insufficient to produce and sustain behavior change, including self-protective actions in the workplace. This supports the focus on threat-related beliefs and response efficacy in the first stage, and the
view that hazard appraisal is only one stage in
the process. Second, there is considerable
agreement that behavior change and mainte-
nance are different processes. As such, a con-
struct or factor that is important in bringing
about initial behavior change may not play the
same role in sustaining the change over time.
Third, there is broad agreement that the individ-
ual's subjective beliefs related to costs and ben-
efits play a central role in most health- and
safety-related decision making. And fourth,
organizational and environmental factors appear
to be particularly important in facilitating and
sustaining desired behaviors. Indeed, the occu-
pational safety and health literature suggests
that these factors may be critically important in
workplace settings.

CONCLUSIONS

This paper reviewed three categories of theo-
retical models that have been used to analyze
and predict health-related behavior. On this
basis, an integrative framework was proposed
that conceptualizes workplace self-protective
behavior as consisting of four sequential stages:
hazard appraisal, decision making, initiation,
and adherence. The proposed framework is inte-
grative in that its basic structure comes from the
behavior change models, while the constructs or
factors considered relevant at each stage are
derived from the value-expectancy and environ-
mental/contextual models.

The principal implication of this framework
is that different constructs or factors can be
expected to be important at different stages.
Threat-related beliefs and response efficacy are
likely to be most important during hazard
appraisal. During this stage, workers determine
both what is dangerous and whether they can
protect themselves by taking specific actions
and/or by using specific protective equipment.

Efficacy considerations (response and self-
efficacy) and cost–benefit factors assume
increased importance during the decision mak-
ing stage. Workers determine that available sa-
fty protocols are both effective and practical. The
personal weighing of costs and benefits is at the
very heart of this stage. This calculus takes into
consideration beliefs about the threat itself,
expectancies surrounding the required actions,
barriers and environmental supports, and inter-
ences about the attitudes and actions of peers,
supervisors, and management.

During the initiation and adherence stages,
facilitating conditions and safety climate are the
primary factors. Attention is focused on the
environmental and organizational factors that
support and reinforce self-protective actions.
Performance feedback may be a particularly
valuable tool for encouraging workers to accept
that the self-protective actions in question are
effective and practical. Adherence, as the final
stage, requires the creation of task and work
environments that support safe behavior under
all conditions. High levels of both individual
and collective control may be critical to long-
term adherence, and creating a positive safety
climate may be the best way to foster perceived
control at both levels.

In practical terms, there is a need to match
interventions and stages; the utility of any inter-
vention depends on where the individual worker
is in the change process. For example, interven-
tions to improve worker self-protection typically
revolve around hazard communication and
information-based training in safe work prac-
tices. Such efforts are likely to be most benefi-
cial during the hazard appraisal and decision
making stages. These particular interventions
are much less relevant to the factors hypothe-
sized to be most important during initiation and
adherence. It follows that programs to maxi-
mize self-protective behavior in the workplace
need to be multifaceted and should feature
interventions targeted to workers at each of the
four stages.

As a final point, the proposed framework also
highlights the importance of situational or envi-
ronmental factors in workplace self-protective
behavior. As Table 2 shows, the individual's per-
sonal beliefs about the hazard and the effective-
ness of precautionary action are most important
during the first stage (hazard appraisal). But,
beyond this point, environmental factors become
increasingly more important, and become critical
as intention is converted into action (initiation),
and as self-protective behavior is sustained
(adherence). Given the interactive aspect of indi-
vidual and situational factors, even well-designed
efforts to influence the hazard-related beliefs and
attitudes of workers may fail if the environment
is nonsupportive. The importance of the environ-
ment in enabling and reinforcing safe workplace
behavior cannot be overemphasized.

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REFERENCES


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