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Operationalizing Theoretical Constructs in Bloodborne Pathogens Training Curriculum

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This article describes how the protection motivation theory (PMT) was used to inform the production of video curriculum for a bloodborne pathogens training program for hospital nurses. Although hospital nurses are well acquainted with the work practices designed to prevent bloodborne pathogen exposures (universal precautions), there is evidence that they do not always follow them. First, the original PMT is adapted to reflect what is currently known about the role of affect in health behavior prediction. Second, the authors show how the four PMT message constructs—probability of occurrence, magnitude of noxiousness, response efficacy, and self-efficacy—guided the planning, shooting, and editing of the videotapes. Incidental to this process was the operationalization of these message constructs in such a way that affective reactions would result. The results show that this video curriculum successfully aroused negative affect in the target audience. Only by carefully planning and documenting how message constructs are operationalized in health education materials can one be sure of achieving theory-based (and thus the most replicable) message design.

Lewin's dictum that there is nothing so practical as a good theory[1] has, for decades, been a kind of rallying cry for theorists who sometimes must bear the criticism that their work is not very useful for solving real problems. However, many practitioners who use theory to guide their work might rightly reply to Lewin that "there is nothing less practical than a bad theory." Health behavior theories should provide guidance to health educators on specific problems such as curriculum design and/or health behavior assessment. One key to usefulness of a theory lies in its constructs. Constructs are the parts of a theory,

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the A and B in the "If A, then B" statement. If these constructs are not sensible and not readily applicable to a practitioner's needs, then the practitioner will not rely on that theory for guidance.

Practitioners have the difficult job of operationalizing constructs. For the purposes of this article, *operationalization* will be defined as *putting a theoretical construct to work in an applied setting*. Typically, operationalization occurs when one develops questions for a survey, a test, or an interview. For example, factual questions asked of subjects on a posttest may operationalize a measure of a knowledge construct. That measure may be compared to an operationalization of a health behavior construct, for example, to test the theory that knowledge of a health problem is connected with preventive action. The process of construct operationalization is thus frequently used to evaluate health education efforts. But its use in developing those efforts has been less widespread.

In this article we discuss how to use health behavior theory in instructional design. Specifically, we describe how theoretical health message constructs were operationalized in occupational health training materials designed to prevent bloodborne pathogens exposures among health care workers (HCWs). Those constructs originated in one of the few health behavior theories that provides even limited guidance about the design of interventions, Rogers' protection motivation theory (PMT).[2] In this article, we first provide a brief introduction to the occupational health behavior problem: universal precautions compliance among HCWs. Then we discuss PMT and explain how we adapted PMT to current evidence regarding the role of affective mediating variables in determining health behaviors. Next, we describe the process of producing video curriculum that operationalizes the message constructs of the modified PMT. From planning the videotapes, to shooting the footage in a hospital setting, to editing the tapes into coherent expressions of the constructs, we detail the influence of theory on the work of instructional design. Our purpose is to show how a systematic use of theory is important throughout the health education process, not just in the use of measures to evaluate it.

USE OF UNIVERSAL PRECAUTIONS BY HEALTH CARE WORKERS

The threat of infection with bloodborne pathogens became a serious concern to HCWs with the advent of the acquired immunodeficiency syndrome (AIDS) epidemic. The occupational risk of exposure and subsequent transmission of bloodborne pathogens such as hepatitis B virus and human immunodeficiency virus type 1 (HIV-1), the virus that causes AIDS, has been documented among HCWs.[3] Nurses and lab workers have reported the highest number of HIV-1 infections from occupational, primarily percutaneous, exposures.[4] To help prevent these exposures, the Centers for Disease Control and Prevention (CDC) recommended as early as 1987 that HCWs treat all patients as if they were infected with a bloodborne pathogen. Thus the recommendations are termed *universal precautions* (UP). Most of the recommendations were later mandated by the Occupational Safety and Health Administration's (OSHA) Bloodborne Pathogen Standard.[5] In spite of these developments, UP compliance rates remain suboptimal.[6] Both observational and self-reported studies have shown low UP compliance rates, especially with respect to barrier protection, with rates for certain practices dipping below 50%.[7,8,9] Blood and body fluid exposures continue to occur at unacceptably high rates.[10] Thus there is a continuing need for workplace interventions that will increase UP compliance and reduce exposure risks.

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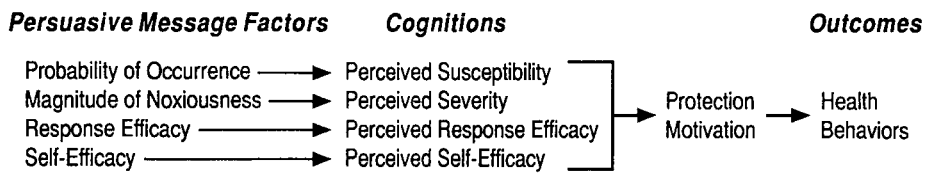

Figure 1. The protection motivation theory.
SOURCE: Adapted from Rogers,[2] Maddux and Rogers,[26] and Witte.[27]

Under OSHA rules, annual training on bloodborne pathogens is required for anyone who may reasonably be expected to come into contact with blood or other bodily fluids.[5] This training presents a challenging opportunity to health educators. The specific UP behaviors (e.g., putting on gloves, disposing of needles and other sharps properly) are widely known and not difficult to perform under ideal circumstances. The problem is performing the tasks while simultaneously providing care to patients. Many HCWs perceive patient care responsibility as superseding self-protection responsibility. If it is to be effective, bloodborne pathogens training must motivate HCWs to actually perform UP *in a demanding environment.* Simple skill training is not enough.

Theory for Occupational Safety Instructional Media Development

Protection Motivation Theory

Protection motivation theory is particularly well suited to guide the development of health education interventions because it attempts to explain responses to environmental messages with an information processing framework.[2,11] That is, compared to other models (e.g., theory of reasoned action,[12] the Health Belief Model[13]), PMT proposes specific message characteristics (see leftmost portion of Figure 1) that predict certain psychological states of the individual (middle of Figure 1), which ultimately lead to health behaviors (right side of Figure 1). The four persuasive message constructs in Figure 1 lead directly to four cognitive mediating processes. First, information in the message (i.e., training curriculum) about the probability of occurrence of a health threat leads to perceived susceptibility (one's perception of the likelihood of sustaining an injury or illness from conditions as they currently stand). Second, information about the magnitude of noxiousness of the health threat leads to perceived severity of that threat. These two constructs involve information and perceptions about how much discomfort or, in general, how serious the consequences are of experiencing the health threat. For example, in the case of the HIV-1 virus, strong ceiling effects have been shown among college students for perceptions of the severity of infection, probably because there is no known cure for AIDS.[14,15,16] Third, response efficacy information leads to perceived response efficacy and fourth, self-efficacy information leads to self-efficacy perceptions. Response efficacy may be defined as the capability of the recommended behavior to be effective against the health threat.[17] Self-efficacy may be defined as one's expectations of coping successfully with the health threat.[18] Finally, PMT proposes that the cognitive mediating processes together lead to protection motivation, which is usually operationalized as intentions to perform the recommended behavior,[11] as well as actually performing the recommended health behavior.

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The PMT has been used extensively to investigate persuasive health message effects.[19] Rogers and his colleagues used it to investigate messages on smoking, sexually transmitted diseases, and driving;[20,21] exercise;[22] a (fictional) new virus;[11] and alcohol consumption.[23] These studies and others[14,24,25,26] provide evidence of the value of PMT constructs in predicting the outcomes of health messages. Although Rogers[11] subsequently proposed changes in the PMT, Witte[27] has pointed out the advantages and clarity of this original version.

The Role of Affect

The PMT typifies the emphasis of most health behavior theories on cognitive constructs and the neglect of affective constructs, a deficiency discussed by Dillard.[28] Affect has been defined as the product of a person's assessment (either consciously or unconsciously) of match between personal objectives and experienced stimuli. A close match between experiences and objectives leads to positive affect. Lack of match leads to negative affect.[29] Affect therefore has a valence component and a strength component. Emotions may be thought of as stronger, more specific forms of affect. Activation is an affective state. It may include various emotions (e.g., excited, happy, interested), or it may include no emotions (e.g., lethargy).

Inclusion of affect in the health behavior equation is important for three reasons. First, there is substantial evidence that cognitive mediating variables (e.g., threat and efficacy perceptions) are affected by a person's affective reactions.[24,30-33] Second, there is evidence that affective reactions to messages may have an effect on an individual's motivations.[34,35,36] For example, in a test of the role of aroused fear on behavioral intentions, Witte found that fear (an emotion generated by a message about AIDS) had a direct effect on adaptive behavioral intentions, independent of cognitive perceptions about personal susceptibility or AIDS severity.[14] Finally, it may be that prior studies of health communications have found little influence of emotional content because they have measured a too-limited spectrum of the affect construct. The vast majority of studies have limited themselves to measures of anxiety or fear of the subject health threat.[19,27] Such methods may not capture the full role of affective reactions because they neglect related emotions like guilt, empathy, or anger. Recent investigations of prosocial, affect-arousing messages (including AIDS prevention) have used broader arousal measures than have commonly been used in health communication research. Briefly stated, these studies used general measures of (a) the valence and (b) the strength of affective responses to messages. They found support for models that reflect a more prominent role for affective reactions as predictors of both cognitions and behavioral intentions. In particular, negative affect (e.g., tension, scared) was a useful predictor of health-related cognitions and intentions.[37,38,39]

Our modified PMT model is depicted in Figure 2. In it, we propose that the four persuasive message constructs have an impact on negative affect. The affective mediating variables (negative and positive affect) will combine with cognitive mediating variables (perceived threat and efficacy) to affect protection motivation, or behavioral intentions. The model also predicts that the affect variables will have an impact on protection motivation directly. The influence of individual differences between subjects (e.g., age, work experience) on both affects and cognitions is also predicted by our model.

The prominent role accorded affective reactions is not meant to diminish our estimation of the importance of the previously discussed message constructs (again, see leftmost part of Figure 2). Because the primary purpose of this article is to describe the process of

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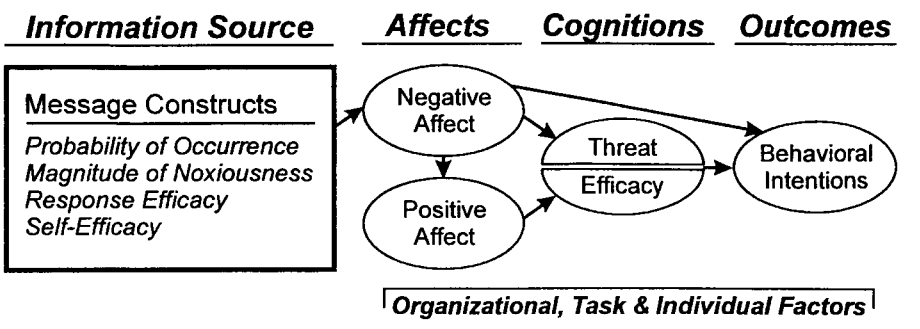

Figure 2. Model for UP training curriculum.

operationalizing these message constructs, we will forgo a discussion of the hypotheses based on our model. Instead, we now turn to a description of how theoretical constructs were used to guide the making of videotapes for in-hospital training.

MAKING VIDEOTAPES TO OPERATIONALIZE CONSTRUCTS

Video Production/Study Site

The training videotapes were produced in the same hospital in which we eventually collected data about their effectiveness among staff members. Consequently, some staff members who worked on and even appeared in the videotapes were part of the subject pool for the study of the training's effectiveness approximately one year later (a biasing factor we measured). The hospital is a 450-bed, acute care, community-based private hospital located in a suburb of Washington, D.C. The hospital has been engaged in an extensive effort to revitalize its safety program for about 2 years prior to the video production effort. This project was one of a number of safety programs that the hospital conceived and executed.

From incident reports, the hospital knew that needlestick injuries were occurring primarily among the nursing staff and the support services workers (i.e., laundry, central services, housekeeping, and dietary workers). Interviews with clinical staff revealed that many of them were not aware of the risks to nonclinical personnel. Therefore, it was decided that an in-house videotape would be developed that would emphasize the sharps injury risks of nonclinical personnel. The audience for the training was to be staff nurses, since (a) the targeted behavior (proper sharps disposal) was frequently performed by nurses and (b) because they represented a large (714 of approximately 2,000 employees) and accessible population for training.

Operationalizing Constructs Stage 1: Shooting the Video

Shooting the videotape was the first phase of preparing the finished tape, which would contain operationalizations of the theoretical constructs of interest. Planning the tape involved the merger of research and practical interests. Practically, it was important to

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involve the hospital employees in the videotape shooting. First, employee involvement was consistent with the organizational push to involve workers in occupational health efforts. Second, the safety committee, which originally conceived the idea for a videotape, wanted to use the tape to open a communication channel directly from the "downstream" support services workers, upward to the clinical staff. They wanted to make sure that support services workers' concerns and working conditions were a prominent part of the videotape.

There were two prominent research concerns. The first concern was operationalizing the probability of occurrence and the magnitude of noxiousness constructs in the video in ways that would result in aroused negative affect. Here the practical concern of using the workers at risk in the video served the research interest too. Qualitative presentations of risk information, such as stories of individual exposures or near-miss exposures, have been shown to be more effective than quantitative (e.g., statistical) presentations of the same risk on measures of affect, how long the information is remembered, and motivation to take action.[40-43] Nevertheless, a survey by the authors of available training videotapes on bloodborne pathogen protection for workers revealed that most tapes used a quantitative approach to describe the risk of infection, with no qualitative or case study information to supplement it. A shift in emphasis toward using qualitative data in this production would provide a contrasting instructional method for evaluation. Also, using actual workers (rather than actors) was expected to add to the perceived credibility of the video production, since task-related behaviors (with which they were familiar) were the focus. Speaker (or actor) credibility has been shown to be an important predictor of persuasion in communications research.[44]

The second research concern was to use the replicability of the video medium to its best advantage. Videotape, although not as lifelike as a trainer's presentation, provides a consistent presentation of information. This helps to reduce some confounding message factors. In live training presentations, each trainer has personal teaching preferences and special talents that they use situationally to maximize results. In addition, interactions with trainees vary from session to session. When comparing sessions, it often becomes difficult to determine what caused differences on outcome measures. This is not to say that video eliminates message confounders (e.g., size of screen, picture quality, sound playback level), only that there may be fewer of them. By using video, and by using it for more of the training session rather than less, we could be more sure that the training would be delivered relatively consistently.

However, using video for most of the training session had drawbacks. First, it meant that there would be little or no opportunity to provide practice time. Evidence has shown that one of the best ways to teach a procedural behavior (e.g., UP) with training is to provide opportunities to practice the behavior and receive feedback.[45] Second, it meant that the video should have a "stand alone" quality to it (i.e., it should have a planned flow, a beginning, a middle, and an end). More than just operationalizing constructs, the video would have to arouse and sustain interest over a period of time as first one construct and then another were operationalized.

In view of these constraints, a documentary style was chosen for the video production as best fitting these overall practical and research requirements of using qualitative risk information to operationalize the constructs of interest. The videotapes would be contrived to have a flow in order to sustain interest. That is, the tapes would have an identifiable opening (e.g., with music and a title), middle (e.g., presentation of information about the threat and about UP), and end (e.g., with music reprise and review points). A major limitation of the production would be the absence of planned practice time in the

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Table 1. Examples of Interview Content by Job Category

Job Category	Interview Content Area	Relevant Message Construct
Support services workers	Sharps injury experiences and feelings about those injuries	Probability of occurrence, noxiousness of event, empathy- and fear-arousing information
	Factors that they believed contributed to the injury (e.g., careless medical personnel)	Guilt-arousing information
Hospital managers	Workload at the hospital	Self-efficacy (i.e., the organizational barriers to compliance will be controlled)
	Responsibilities of hospital management to protect workers from injuries	
Safety specialist	National HCW needlestick epidemiology	Probability of occurrence
	Needlestick problem in the broader context of hospital safety issues	Probability of occurrence, noxiousness of event
	Sharps injuries that resulted in infections	Probability of occurrence, noxiousness of event, empathy- and fear-arousing information
	Technology and methods to prevent needlesticks	Response efficacy depictions
	Factors that influence UP compliance	Self-efficacy depictions
Nurses	Sharps injury (or near-miss) experiences	Probability of occurrence, noxiousness of event, empathy- and fear-arousing information
	Workload, hazards (other than sharps) at work	Self-efficacy (barriers to compliance)
	Effectiveness of sharps disposal units, other UP	Response efficacy depictions
	Importance of UP compliance	Self-efficacy depictions
	Organizational factors that contribute to sharps injuries	Self-efficacy depictions (barriers to compliance)

training session. In addition, a quasi-experimental design was chosen for the evaluation study. That is, we decided to compare the effectiveness of an available, commercially produced tape to our own production. The commercial tape, selected by an expert training panel for its accuracy and quality, used a preset narration, no worker interviews, and only quantitative risk information. We also decided that if we gathered enough information in our videotaped interviews with workers, we would make more than one videotape, and use one to emphasize qualitative risk information (again, for comparison purposes).

A script was prepared to serve as a general guide for videography. It indicated which job category of worker would cover each of the theoretical constructs. Whenever possible, staff who had experienced needlesticks at work were scripted to be interviewed about the circumstances of their sharps injury (susceptibility information) or how they felt about the injury after it happened (magnitude of noxiousness information). To increase message credibility, it was planned that the workers' own words, unscripted and unrehearsed, would be used to operationalize constructs. Table 1 gives an overview of the planned interview content for the tape. In addition, the script called for video to be shot of various

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work scenes (to demonstrate workloads, a barrier to compliance) and UP practices (to model compliance behaviors). Graphics were scripted to mark different segments of the tape and to summarize recommended practices. Interviews with managers were planned to provide evidence of organizational commitment to reduce injuries.

Seventeen staff employees—approximately half clinical workers and half support service workers—consented to be videotaped. They were selected on the basis of their (a) job assignment, (b) needlestick history, and (c) time constraints of both the production team and the interviewee. In addition, nine management-level employees were taped. The managers were recruited on the basis of their positions as representatives of either support services or nursing activities, or on the basis of their expertise in infection control and safety. Both managers and support services workers were selected and preinterviewed prior to the videotaping of the final interview. Approximately 25 additional employees were taped as they performed their jobs. Video performance releases were signed by everyone who consented to be taped.

The interviews were focused but fairly unstructured to allow workers to reveal their experiences, attitudes, and feelings in ways that would seem most genuine to other workers on a television screen. A taped interview is not a natural conversation-inducing setting. Extra lights, taping equipment, and video production personnel can inhibit candid exchanges with workers. On the other hand, many questions were intended to elicit information about the specifics of the workers' jobs—something most people can talk about relatively easily. Often interviews went in different directions depending on which content areas the worker seemed more inclined to add something from his or her own experiences. For example, some workers who experienced needlesticks had more comments about the effects on their family. Others seemed to have more thoughts about their anxieties about follow-up medical protocols.

Operationalization Stage 2: Editing the Video

A total of 6 hours of raw videotape footage were collected over 4 days of shooting. Given that the finished tape was planned to be 20 minutes in length, 6 hours of original footage represented a "shooting ratio" of approximately 18 to 1, a fairly common ratio for documentary video production. Finding the 5% to 10% of footage that would make an effective training presentation was time consuming. It is not unusual for a single coherent thought that takes a few seconds in the final video production to be expressed in fragments over several minutes in the original interview. The selection and juxtaposition of images and sounds to operationalize the theoretical constructs and make a coherent overall training tape is mostly accomplished in the editing process, especially when using a documentary video production style that relies on unrehearsed interviews.

In the first stage of editing, all of the footage was cataloged. That is, each distinct camera view or complete verbal thought was timed and described in terms of both its visual and aural content. Because a large percentage of the footage consisted of employee interviews, cataloging involved recording who was speaking, what was said, and how long they took to say it. A brief example from the interview conducted with the hospital plumber follows, with time of each utterance shown in brackets:

Plumber: [description of job duties]. [39:20]
Plumber: I have access to all areas of the hospital . . . [39:50]
Plumber: I average 2-3 toilets per day [unstopping them]. [40:10]

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Plumber: I have to clear sinks, sometimes large sinks. [40:20]
Plumber: . . . because people tend to throw things in them that they shouldn't . . . [40:30]
Interviewer: Have you ever been injured while clearing drains? [40:45]
Plumber: Yes, I have been. [40:50]
Interviewer: Tell me what happened. [40:55]
Plumber: The first time I got stuck with a needle was while I was clearing a drain in the parking lot . . . [41:00]

Catalog notations averaged one for every 10 seconds of raw footage, yielding a catalog with over 2,000 entries.

To make the tape, each video segment was categorized as to what theoretical construct it might help operationalize (e.g., probability of occurrence, self-efficacy), or by its content (e.g., hospital new needle purchase rates) if no construct was obviously indicated. Notations of the emotional tone (e.g., ironic, maudlin, angry, anxious) were also made for many of the segments. Then, lists of segments were regrouped by their construct category. For example, all the segments that dealt with HCWs' susceptibility to occupational bloodborne pathogen infections were grouped together.

This does not mean that specific video segments were classified as representing an entire theoretical construct. It is more accurate to say that a segment was deemed an indicator of one or more dimensions of a construct.[46] An example of the way the video segments were classified may be found in Table 2. It summarizes the video segments that were used to operationalize the message constructs of probability of occurrence and magnitude of noxiousness in the video about downstream workers. The segments are listed (with their running time in seconds) in the column on the right-hand side of the table. Each segment is further associated with a particular group of HCWs: a subgroup of support services workers, the overall group of support service workers, nurses, or HCW overall (middle columns of Table 2). Each of these groups is a dimension of the two basic constructs. These dimensions facilitated the mixing of segments in the final program in such a way that an impression of overall risk was created.

During editing, it became clear that there were enough different segments that operationalized dimensions of both probability of occurrence and magnitude of noxiousness to make two different videotapes: one emphasizing the needlestick risks of support services workers and a second emphasizing the risks to nurses themselves. Both tapes were completed in order to compare the effects of these two different operationalizations of the message constructs on the outcome variables. For the support services workers tape (eventually titled *Not Only Our Patients, Not Only Ourselves*), the editor tried to use segments that would elicit audience sympathy for the support services workers. We thought this would lead to negative emotions like guilt and shame among nurses about their neglect of proper sharps disposal practices. In the second tape (eventually titled *I'm at Risk*), the editor mixed segments containing exposure experiences of nurses with segments from the safety specialist interview. The latter segments involved details from cases in which nurses (and a physician) in other health care facilities actually contracted HIV-1 from occupational exposures. The anticipated effect was that negative emotions such as fear and anxiety would result. Although both tapes were hypothesized to raise negative affect, they would obviously do it in different ways. Note that Table 2 has an illustrative purpose and it reflects only the segments that were chosen to operationalize constructs in the finished tape, *Not Only Our Patients, Not Only Ourselves.*

The segments chosen to operationalize the efficacy constructs for both tapes were very similar, although not identical. Segments from the infection control specialist and the

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Table 2. Operationalization of the Noxiousness of Event and Probability of Occurrence Message Constructs

Construct Dimension	How Operationalized in Video	Duration
Message construct: Noxiousness of event		
Overall	HIV risks	(:08)
	A needlestick may be a death sentence	(:04)
Support services workers		
Dietary workers	Anxiety of workers about possible exposures	(:07)
Laundry workers	Personally felt/family-felt anxiety	(:12)
Maintenance	Personally felt/family-felt anxiety	(:16)
Housekeeping	Personally felt/family-felt anxiety	(:13)
Message construct: Probability of occurrence		
Overall	Needlestick epidemiology (national)	(:23)
	Needlestick epidemiology (local)	(:28)
Nurses	Workload	(:57)
	Stress	(:14)
	Distraction	(:10)
	Urgency of care	(1:05)
Support services workers		
Overall	Needlestick epidemiology	(:15)
	Individual needlestick experiences	(:26)
Dietary	Workload	(:17)
	Needlestick risks	(:24)
Clean room	Workload	(:40)
	Needlestick risks	(:27)
Laundry	Workload	(:06)
	Needlestick risks	(:25)
	Needlestick experiences	(:50)
Maintenance	Workload	(:07)
	Risks	(:21)
	Needlestick experiences	(:41)
Housekeeping	Needlestick risks	(:23)
	Needlestick experience	(:22)

safety specialist interviews about the effectiveness of sharps containers were used in both tapes. The infection control specialist talked about the recent replacement of sharps containers throughout the facility with "larger boxes that have a wide mouth and a straight drop," three convenience- and safety-enhancing features. She also discussed the hospital-wide adoption of a needleless intravenous therapy system as playing a role in the reduction in needlestick incidence rates. The safety specialist talked about the fact that "sharps containers are great but they have to be used and they have to be emptied on time." Segments were selected for both tapes from interviews with nurses, in which they discussed how the increased number of sharps containers in the hospital not only made their jobs easier, but safer. Segments in which nurses described how the needleless intravenous system contributed to safety were also selected.

Operationalizing self-efficacy in media productions frequently involves modeling the target behavior(s).[47] A number of visual shots of UP compliance activity were selected to operationalize this construct. Views of used syringes being deposited in the sharps

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Table 3. Operationalization of the Response- and Self-Efficacy Message Constructs

Construct Dimension	How Operationalized in Video	Duration
Message construct: Response efficacy		
Positive aspects	"Needleless IV system was installed to reduce use of needles"	(:16)
	"New (and improved) needle disposal containers were installed"	(:19)
	"Since introduction of the IV system and the new sharps containers, injuries have been reduced"	(:24)
Negative aspects (barriers to compliance)	"Disposal containers have to be accessible and emptied on time"	(:10)
	"In some situations you can not use the needleless system"	(:06)
Message construct: Self-efficacy		
Positive aspects	"There are lots of resource people available [on compliance issues]"	(:13)
	"It's up to the organization to provide support and training for UP"	(:12)
	"Staffing levels can be a problem, although not here"	(:11)
	Scenes of proper sharps disposal	(:08)
	Scenes of proper biohazard trash disposal	(:13)
Negative aspects (barriers to compliance)	"Increased stress from shouldering more responsibilities"	(:22)
	"Workload"	(:22)
	"There are situations when you just can't take all the precautions"	(:31)
	"In a code situation [many UP are temporarily ignored]"	(:19)
	"Job pressures (e.g., starting an IV on a baby)"	(:31)
	"We have to provide a lot of care and education in a short time"	(:13)
	"Distractions in the operating room"	(:05)
	"Habits of workers are hard to break"	(:28)
	Scene of improper sharps disposal in patient care setting	(:25)

disposal containers were used. Views of glove and gown use and biohazard waste disposal were also used. Audio from selected interviews was used as voice-over for these shots (e.g., a segment from the safety specialist in which she states that UP compliance must be a high priority).

However, as stated, these behaviors are common behaviors for which self-efficacy perceptions were assessed to be already high under ideal circumstances. That is, nurses felt that UP compliance was easy as long as they had time. In the interviews it became clear that barriers to UP compliance was a dimension of self-efficacy perceptions. Consequently, that material was also used to operationalize the self-efficacy message construct in both tapes.

There is a substantial body of research that supports this operationalization. That research has shown the value of "inoculating" audiences against persuasive attempts to discourage the desired behavior.[48] These inoculations are presentations of reasons why a recommended behavior may be difficult to accomplish or be otherwise inadvisable. Acknowledging the commonly cited difficulties of health behavior compliance can reduce reliance on these difficulties as excuses for noncompliance and may increase self-efficacy for compliance. The operationalization of the efficacy constructs for both tapes is summarized in Table 3.

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The final step in the editing process is to make a meaningful videotape using the segments selected to operationalize constructs. This does not mean just editing one selected statement after the other until they are all included. To achieve an overall coherency, pace, and rhythm requires careful attention. Table 4 summarizes all the segments, in order of appearance, in *Not Only Our Patients, Not Only Ourselves*. A brief statement of the issues covered in the program is followed by segments on the risks to nonclinical workers from misplaced needles. The response efficacy, self-efficacy, barriers to compliance, organizational support, and behavioral recommendations follow. Within this flow, the editor placed brief reprises of previously introduced constructs and previews of constructs to be more fully introduced later.

Table 5 summarizes the content differences across all three tapes used in the study. The tapes were pretested with small groups of nurses in a large urban teaching hospital in the midwestern United States before use in the main study. We now turn to a brief discussion of how these training tapes were evaluated.

Evidence of Message Construct Operationalization Success

Because study hypotheses center on differences in affective, cognitive, and behavioral outcomes expected to result from different levels of the message constructs, confirmation that the tapes used in this study are associated with different levels of affective arousal is an important prerequisite to hypothesis testing. This is known as a manipulation check. It tests whether there are any (theoretically relevant) differences between treatment conditions. In the evaluation study, 311 nurses and other staff members completed a 56-item pencil-and-paper survey immediately after seeing one of the three quasi-randomly assigned tapes. Demographic data, negative and positive affect, cognitions, and behavioral intentions were measured.

Although a full analysis of the data is not yet available, preliminary results of the manipulation check of treatment conditions are available. From data collected using the PANAS scale[49] to measure respondents' self-reports of affective response felt during the tape, it appears that there are differences across the tapes in the amount of negative affect they aroused, $F = 16.92$, $df = 2, 281$, $p = 0.0001$. Follow-up comparisons of treatment means for the negative affect measure indicated that both tapes produced for the study aroused greater negative emotions than the off-the-shelf tape. There was no difference on this measure between the two tapes produced for the study. Similarly, there appears to be a difference between all three tapes when a subscale of guilt was used, $F = 5.21$, $df = 2, 285$, $p = 0.006$. The tape concerning the support services workers' risks aroused more guilt emotion than either the tape concentrating on nurses' risks or the off-the-shelf tape. There was no difference between the latter two tapes. It appears that the study manipulation was moderately successful. In addition, there were no differences across tapes on a subscale of interest and attentiveness, $F = 2.17$, $df = 2, 288$, $p > 0.10$. It appears that negative emotions were more aroused in some tapes in spite of the indications that each tape had about the same interest value for viewers.

SUMMARY AND CONCLUSION

In this article we first presented an adaptation of a commonly used health message theory, PMT, to fit current empirical evidence about the importance of emotional arousal

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Table 4. Sequence of Message Constructs in a Finished Training Tape

Show Segment (Duration)	Scenes	Featured Workers	Duration	Construct Operationalized
Opening (1:55)	7	Safety specialist, nurses, laundry, maintenance, central processing	(1:02) (:31)	Probability of occurrence, noxiousness of event
	2	Nurses		Self-efficacy
	1	Maintenance worker	(:14)	[Empathy arousal depiction]
	1	Safety specialist	(:08)	[Recommended standard]
Where do sharps appear? (7:32)	2	Safety specialist, infection control specialist	(:42)	Probability of occurrence, noxiousness of event [to support services workers]
	3	Dietitian	(:48)	
	2	Central processing supervisor	(1:07)	
	8	Laundry supervisor, laundry worker	(1:33)	
	7	Maintenance worker	(1:24)	
	3	Safety specialist, housekeeping worker	(:58)	[Empathy arousal depiction]
Why do sharps appear in the wrong places? (4:31)	9	Assistant vice president, nurses	(1:01)	Self-efficacy [barriers to compliance—organizational and job]
	1	Nurse		
	2	Nurses	(:09)	Social norms (doctor's use of UP)
			(:21)	Self-efficacy [barriers to compliance—organizational and job]
	6	Safety specialist, nurses	(1:40)	Social norms (culture of sacrifice)
	3	Laundry supervisor, laundry worker, housekeeping worker	(:40)	[Guilt arousal depiction—carelessness is unacceptable]

Increasing proper sharps disposal (3:27)	3	Proper sharps disposal	(:08)	Self-efficacy depictions
	1	Nursing supervisor	(:12)	Self-efficacy (organizational factors)
	2	Safety specialist	(:28)	Self-efficacy (barriers to compliance individual level: habit)
	4	Nurses, infection control specialist, safety specialist, procurement specialist	(1:10)	Response efficacy
	2	Nurses	(:17)	Barriers to compliance
	3	Nurses	(:31)	Behavioral recommendation
	2	Safety specialist, nurse	(:13)	Emotional arousal (guilt)
	1	Vice president	(:32)	Self-efficacy (organizational support)
	1	Laundry worker	(:04)	Threat to SSW
Closing (:30)	1	Graphics	(:30)	Behavioral recommendations

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Table 5. Summary of Videotape Differences

Tape Characteristic	Tape A (Commercially Produced)	Tape B (Produced for Study)	Tape C (Produced for Study)
Audience	BROAD (all HCWs)	NARROW (nurses)	NARROW (nurses)
Exposure route content	BROAD (many situations)	NARROW (needlestick emphasis)	NARROW (needlestick emphasis)
Organizational focus	BROAD (cues are nondescript)	NARROW (shot entirely in trainees' hospital)	NARROW (shot entirely in trainees' hospital)
Relevance of health threat to audience	LOW (all HCWs)	MEDIUM (same hospital but nonnurses)	HIGH (nurses in same hospital)
Use of probability of occurrence message construct	LOW (quantitative data only)	MEDIUM (quantitative and qualitative data)	HIGH (includes stories of occupational infections with HIV-1)
Use of efficacy message constructs	HIGH	HIGH	HIGH

in messages. This adaptation may add to an understanding of the role of emotions in health behavior change processes. Some authors have concluded that emotional arousal has no place in public health education settings because arousal is either counterproductive, unproductive, or unpredictable.[50,51,52] However, evidence to the contrary exists. Zajonc's influential conclusion that "preferences need no inferences" called attention to the unjustified dominance of cognitive explanations of behaviors 15 years ago.[30] More recently, Damasio persuasively argued that neurobiological evidence suggests that the portions of our brains that deal with our emotions profoundly color our thinking (and eventual actions).[53] He concludes that it is feelings rather than cognitions that allow us to make the sophisticated social behavior decisions that help define human existence. If that is true, then emotions must play a role in workplace safety behaviors as well. Our training evaluation study (still being analyzed) addresses that possibility.

The second part of this article described how the theoretical constructs of the modified PMT were operationalized in video training materials. In the main, we used structured interviews with HCWs to operationalize the four message constructs: probability of occurrence, magnitude of noxiousness, response efficacy, and self-efficacy. We edited relevant segments into two different videotapes that emphasized stories of HCWs' experiences with bloodborne pathogen exposures and the results for themselves and for their families. One of the tapes emphasized the exposures of nonclinical HCWs and the other emphasized the exposures of nurses.

Our description shows the complexity of operationalizing intervention constructs, especially for field experiments. For example, there were limitations to the amount and type of taped interviews with HCWs that the research team was able to collect. Some questions clearly made workers uncomfortable and were not pursued (e.g., lack of UP compliance among physicians). In addition, cooperation of clinical staff from some busy departments was limited due to workload. There were also limitations to our video editing. We did not equate our messages for length, nor did we equate the length of time devoted to each construct within a tape. When operationalizing the two threat constructs, one

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might be tempted to balance evenly between susceptibility and severity information. However, in the case of bloodborne pathogens there is little need for severity information, since the effects of HIV-1 infection are so catastrophic and so well known. Consequently, susceptibility information was emphasized in this project. But the needs of the next health or injury hazard, the next workplace, and the next group of workers will require new operationalizations of the same theoretical framework. Consequently, careful attention (and documentation) of the operationalization of message constructs is necessary in order to understand message effects.

As a training tool, video, especially custom-designed video, has major advantages for operationalizing constructs in useful ways. In 18 minutes, one of the videotapes described above brought six nurses, seven downstream workers, several managers, and a safety consultant "into" training sessions. Their images and their own spoken words about their risk perceptions and their emotions were present, even though they themselves were not. Each person's segment had been edited to get at the strongest (and theoretically relevant) points. Each point was linked to the points made by others. Music and graphics added emphasis. But the versatility and precision offered by electronic media does not necessarily mean that better and more precise operationalizations will result. The temptation to compare the number of seconds devoted to a construct across treatments, both within and between studies, should be resisted. Too many other factors come into play.

For example, the limitations of our effort to operationalize concepts with videotapes is evident from Table 5. Although presented as a guide to the differences between study treatment conditions, it also may be read as a guide to confounded message manipulations. If there is a difference on outcome measures between say, tape A and tape B, will it have resulted from the targeted audience, the threat relevance, the organizational specificity, or some other difference? Although we hope to sort out these confounders to the limits of the data, there are hundreds of factors that are uncontrolled across tape conditions. This problem has existed in health message research for a long time.[54] Jackson has suggested that a change in experimental design would help solve this problem in message effects research.[55] She argues that by including a replications factor in every study (i.e., by using more than one example of every message type in an experiment), researchers could separate the variance in outcome variables that is due to differences between operationalizations *of the same construct.* Although this suggestion is useful, it may not always be possible to construct and test, say, four or five instantiations of each message factor of experimental interest. Video and other training technologies hold potential for somewhat controlling the confounding factors in messages, but that goal is so complicated as to be elusive. We may progress if we can begin to more accurately map our curricula constructions onto our theoretical models.

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