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SELF-REGULATION, HEALTH, AND BEHAVIOR: A PERCEPTUAL-COGNITIVE APPROACH

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Self-regulation systems are designed to adapt to threats via coping procedures that make efficient use of resources based upon valid representations of the environment. We discuss two components of the common-sense model of health threats: illness representations (e.g., content and organization) and coping procedures (e.g., classes of procedure and their attributes – outcome expectancies, time-lines, dose-efficacy beliefs, etc.). Characteristics of each of these domains, and the connection between the two, are critical to understanding human adaptation to problems of physical health. Rather than posing a barrier to factors outside the person that control behavior, an emphasis on subjective construal involves a view of the person as an active problem-solver embedded in a bi-directional system of sensitivity and responsiveness *vis à vis* the social, physical, and institutional environments in which health threats occur and through which intervention efforts may be directed.

KEY WORDS: Self-regulation, illness representations, coping, self-representations, health threats, motivation.

Although “self-regulation” has become something of a buzz word in both personality and health research, it has not been spared attack. The core criticism is that by focusing on phenomenology, that is, common-sense and subjective experience, self-regulation models ignore and disconnect the actor from external reality (Ogden, 1995). This charge has taken two forms. That from the “politically incorrect” right asserts that the introduction of common sense leaves “... Psychology stumbling down the road to hell” having committed the sin of abandoning its proper focus on external causes (Kimble, 1995). The other, from the “politically correct” left, argues that focusing on what is in the person’s head leads us to accept external reality as *de facto* fixed and to define therapy and adjustment as the transformation of the person’s outlook rather than the transformation of the external world (Sampson, 1981).

Our title, and that of previous papers (Leventhal, 1982; 1984a,b), was chosen to emphasize the falseness of these criticisms. As with other models of cognition (Anderson, 1983; 1993) and emotion (Scherer, 1984), the self-regulation model that we are proposing takes account of individual’s views of their environments as well as of their selves. As such, many of its constructs are people’s common-sense *representations* of reality (potential

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pathogens) and of themselves (adaptive resources). These representations are accorded significant explanatory power as they are the primary determinants of coping procedures (cognitive and behavioral actions to manage health threats). Representations are activated and elaborated on the basis of relevant cues (e.g., symptoms, health-related news items) and, when this creates a problem for the individual (i.e., a health threat), problem-solving proceeds by formulating goals which, in turn, generate action plans.

Despite the emphasis on representations, these models do not dissociate the individual from reality. Quite the opposite, because representations are tied to reality in at least three ways: (1) The dimensions of the physical world, including the somatic experience of the body, define the basic parameters of experience (Gibson, 1950); (2) Common-sensical though they may be, representations generate goals or targets for adaptive action, and they are validated or invalidated by feedback from internal and external realities that are affected by goal-directed acts; (3) The accumulated experience of others, in the form of cultural and social information, plays a major role in the construction of representations and in the acquisition, selection, and performance of coping procedures (e.g., Bandura, 1969; 1977). In sum, although self-regulation systems are designed to optimize self-generated goals, their operation is guided by the individual's need for efficient adaptation to the environment, which may require changing behavioral strategies or tactics, redefining or altering goals, or modifying the environment.

This brief overview of our "perceptual-cognitive model of self-regulation" is divided into two sections. In the first, which concerns the person, we discuss the nature of representations, that is, people's definitions of disease threats, as well as the coping procedures used for threat control. The procedures are conceptualized as "if-then rules" (Anderson, 1993; if it is an everyday cold, do X1; if it is pneumonia, do X2). Next we discuss the linkages between self, representations, and coping procedures, that is, how a disease comes to be a threat that is self-relevant and generates behavioral efforts at adaptation. The role of affect is acknowledged, although detailed discussion of this topic is left for another occasion. We then address the effects of the social environment on people's representations and coping procedures. Our task here is to outline the contextual factors influencing representations and behavioral choices in specific settings. In short, we move from themes (e.g., such as self-regulation, or declarative and implicit knowledge as the basis for representing threats), to coping procedures or "rules" for managing threats, to more specific theoretical statements about the self-regulation process, and from theory to models defining how self-regulation will evolve in response to a specific disease threat in a specific social and medical context.

In closing, we make a limited number of comparisons between other models and the one here offered. By focusing briefly on the differences, we feel we can justify the use of our more differentiated approach to understanding behavior in this domain and remind the reader that the model is based upon three simple propositions: (1) People are active problem solvers, they see and define their worlds, select and elaborate coping procedures to manage threats, and change the way they represent problems when they obtain disconfirming feedback; (2) Problem-solving processes occur in context; and (3) The energy expended or motivation to enhance health and to prevent and cure disease is directed to what is perceived to be the most immediate and urgent threat and is limited by resources and a satisfaction rule.

THE PERSON LEVEL

What are Representations?

Illness representations have been the focus of our self-regulation model. Representations stand for individuals' common-sense definition of health threats (Leventhal, Meyer and Nerenz, 1980; Leventhal, Nerenz and Leventhal, E., 1982; Leventhal, Nerenz and Leventhal, E., 1982; Leventhal and Nerenz, 1983; Weinman, Petrie, Moss-Morris and Horne, 1996). As used in our model, they have two sets of properties: content and organization.

Representations have content. The content of representations defines the nature of health threats: their *identity*, i.e., the label of the threat (e.g., coronary; breast cancer; flu; etc.) and its symptoms (e.g., chest pain; breast lump; cough and fatigue; etc.); their *time-line*, i.e., the time for the development of the disease, its duration, and time for recovery; their putative *causes* (e.g., stress; blow to the breast (Taylor, Lichtman and Wood, 1984); exposure to the cold; etc.); *consequences*, imagined and real (e.g., sudden death; disfigurement and sexual dysfunction; loss of work time; etc.); and *control*, or the degree to which the disease can be prevented, cured, and kept from progressing. These attributes can be described normatively, i.e., culturally-shared notions concerning diseases (D'Andrade, Quinn, Nerlove and Romney, 1972; Bishop and Converse, 1986; Pennebaker, 1982), and they can be described at the individual level (Baumann and Leventhal, 1985; Pennebaker, Cox, Gonder-Frederick *et al.*, 1981). The attributes define the problem, i.e., the disease the individual is attempting to prevent, cure or control, and thereby set the direction for action and specify goals and criteria for evaluating outcomes (symptom and functional changes, etc.).

Representations are organized. Representations are organized in at least two ways. The first is based upon feature patterns, syndromes, or schemata, and the second involves the level of cognitive processing. Our studies of hypertension and cancer (Meyer, Leventhal and Guttman, 1985; Leventhal, Easterling, Coons, Luchterhand and Love, 1986) point to three patterns or schemata for this disorder. An *acute* pattern, one with which we are all familiar, implies a disease is generated by external pathogens (cause), is of limited seriousness (consequences), develops rapidly and is limited in duration (time-line), is categorized in one or more ways, e.g., as a cold, flu, stomach upset, etc. (label), is symptomatic (identity indicators of fatigue cough, fever, etc.), and the symptoms, if not their underlying causes, are typically manageable (control). Historically, Western medical institutions have been structured upon the diagnosis and treatment of acute disease and this structure has kept this model salient in the public mind (Dingle, 1973). The need for a "cognitive" shift caused by the realities of having to manage chronic disease in an aging population has been the source of enormous expense and stress in the health care system (see Knowles, 1977).

Cyclical conditions, such as seasonal allergic reactions, form the second type of syndrome, and *chronic* conditions, the third. Other investigators have identified a larger number of patterns or syndromes based upon identity or illness labels (Bishop and Converse, 1986; Cacioppo, Andersen, Turnquist and Tassinari, 1989; Pennebaker, 1982).

The bi-level nature of illness representations is most evident with respect to their identity. Specifically, illness are identified by both an abstract label (e.g., flu, hypertension, cancer) and concrete-sensory symptoms (indicators such as coughs and fever, headaches,

palpable tumors, etc.). Labeling is an everyday event. As Schachter and Singer (1962) demonstrated decades ago, when a person notices somatic changes they are attributed to an underlying condition. We have proposed that the use of labels and the experience of symptoms follow a *symmetry* rule (Leventhal, Diefenbach and E. Leventhal, 1992), i.e., not only do symptoms require labels, a label must have indicators (symptoms), as the mind does not create constructs from nothingness (Hearst, 1991). Thus, when people are given a disease label (e.g., as hypertensive), they find symptoms to match (Baumann and Leventhal, 1985; Croyle and Sande, 1988; Croyle and Jemmott, 1991). The abstract-conceptual level of the representation is a product of cultural information, and the concrete-sensory level is a product of the individual's perceptual processing of bodily changes. Although each level has intrinsic biases, achieving agreement with respect to information processed at multiple levels should increase the likelihood that representations are shaped to be in accord with biological realities.

One or more levels of a representation can be a valid or invalid guide to treatment. The bi-level nature of representations is non-trivial as individuals may treat the disease as labeled, or treat its symptoms. The non-trivial aspect arises as symptoms often are poorly correlated with the physiological process underlying disease. For example, anti-biotic treatment typically clears the symptoms of infections, such as otitis media in children, before it completely destroys the underlying bacterial pathogens (Becker, Drachman and Kirscht, 1972). As many mothers treat the symptoms rather than the "disease," symptomatic treatment may be incomplete, creating the risk of repeated infection.

The *sensitivity* and *specificity* of symptoms as indicators of disease, hence their utility as motivators and guides for treatment, will vary by disease and by patient. Hypertension is a good example of poor sensitivity and specificity. The belief that one can monitor elevations in blood pressure probably arises because people can detect somatic sensations linked to phasic hemodynamic changes such as exercise-induced increases in heart rate and pressure (Pennebaker and Watson, 1988). There is no evidence, however, that people are able to detect elevations of tonic levels (Baumann and Leventhal, 1985): chronic hypertension is asymptomatic. By contrast, diabetes can be symptomatic and susceptible to monitoring, though the symptoms for the hyperglycemic episodes of diabetes vary from individual to individual (Pennebaker *et al.*, 1981; Gonder-Frederick and Cox, 1991), and diabetic patients may or may not know which of their symptoms co-vary with blood glucose levels (Wiebe, Alderfer, Palmer, Lindsay and Jarrett, 1994). And for conditions such as myocardial ischemia, there are sub-groups of individuals who appear to be entirely asymptomatic (Rosen, Paulesu, Nihoyannopoulos, Tousoulis *et al.*, 1996).

Representations can be activated by stimuli at any level. The representation of an illness can affect behavior only when it is activated, though activation does not imply that the representation will be fully conscious. Activation can occur through various external and internal sources. For example, women exposed to news stories about the detection of cancer in presidents' wives, and women experiencing physical and physiological changes ranging from the detection of lumps to menstrual irregularities, can experience imagery relevant to breast and/or uterine cancer in proportion to their history of concern about cancer (Cacioppo, Andersen, Turnquist and Tassinari, 1989). The meaning or interpretation of a stimulus will vary with its specificity (e.g., a medical diagnosis of uterine cancer is highly specific in comparison to vaginal bleeding which will vary in specificity in relation to its duration and degree of asynchrony with the menstrual cycle), and people

often appear to be motivated toward benign rather than threatening interpretations of ambiguous symptoms. Unless persistent, off-cycle vaginal bleeding is likely to be interpreted as due to menstrual problems rather than to cancer (Cacioppo, Andersen, Turnquist and Petty, 1986).

Representations evolve over time. The representation of a health problem may change if symptoms worsen or decline, if new symptoms appear and/or if early symptoms fail to respond to intervention. The division of the natural history of disease episodes into periods or stages appears to assist with capturing the texture of the change process. For example, many episodes begin with an *appraisal* stage (the interval from first noticing a symptom to deciding it is an indicator of illness), followed by an *illness* stage (the interval from deciding one is ill to calling for expert assistance), and a *utilization* stage, (the interval from calling to obtaining expert care) (Safer, Tharps, Jackson and Leventhal, 1979; Leventhal, E., Leventhal, Schaefer and Easterling, 1993). Additional stages involving diagnosis, treatment, and rehabilitation have been defined by others (Alonzo, 1980; Suchman, 1965). These stages do not define an immutable sequence (e.g., a person may reinterpret her symptoms and decide she is stressed rather than ill) and the boundaries between the stages are fuzzy. The division, however, has conceptual and analytic utility as the duration of each of these stages is predicted by different factors. For example, appraisal stages are longer for mild, ambiguous symptoms than severe ones, whereas illness stages are lengthened by avoidance of care-seeking that is motivated by fear of life threatening diagnosis (Safer, Tharps, Jackson and Leventhal, 1979; Leventhal, E., Leventhal, Schaefer and Easterling, 1993; E. Leventhal, Easterling, Leventhal and Cameron, 1995). It is very likely that substantial differences will be observed among diseases in the time-lines for appraisal and illness stages reflecting differences in both their presentation (e.g., rate and severity of symptom onset), and beliefs about their causes and unfolding. For example, recurrences of acute illnesses, e.g., the common-cold and flu, are likely to be treated as distinct episodes rather than the expression of a durable, underlying disease. By contrast, recurrences of mental illness (e.g., depression, anxiety attacks, etc.) are likely to be treated as surface reflections of a common, underlying illness.

An empirical example. The responses of patients currently in treatment for hypertension illustrate the bi-level nature of the identity of illness representations (Meyer, Leventhal and Gutmann, 1985). Eighty percent of this group of 50 continuing-treatment patients (i.e., none had a history of dropping out of care) agreed that "people cannot tell when their blood pressure is up," yet 92% also reported that they could tell when their blood pressure was up by monitoring symptoms. None seemed bothered by the conflict between an abstract conception of hypertension and a clear, perceptual awareness of their disorder. More importantly, it was the perceptual level that determined compliance. Patients were more compliant and in better blood pressure control if they perceived that treatment ameliorated their symptoms. Symptom reduction is the common-sense goal of treatment if symptoms are believed to indicate the presence of elevated pressure.

The effects of the representation of hypertension on staying in treatment were observable in a second sample of patients all of whom had begun treatment for the first time (Meyer, Leventhal and Gutmann, 1985). Individuals in this group were much more likely to drop out 6 months later if they monitored symptoms and/or if they believed hypertension to be an acute disorder. The effect of this time-line belief was substantial: 58% of those who perceived their hypertension as acute dropped out in contrast to 17% of those

who believed their hypertension was chronic. The data also showed that representations evolved over time; the percent of newly-treated patients who monitored symptoms increased from 71% at baseline to 92% 6 months later. This suggests that representations are updated in response to feedback from coping procedures, a topic to which we now turn.

What are Coping Procedures for Risk Management?

Coping procedures are the cognitive and behavioral actions we take (or do not take) to enhance health and to prevent, treat (i.e., cure or control), and rehabilitate from illness. To enhance health, we can take steps such as increasing exercise and/or improving our diet. The various steps that are taken in response to somatic changes are aimed at eliminating them and/or at clarifying their meaning. If the change is ambiguous, e.g., increased fatigue or a mild headache, we may wait to see how it evolves, or we may take a specific action, e.g., take time out for a rest or take an aspirin. Either waiting or taking action may support an hypothesis regarding attributes of the threat such as cause (stress; flu) even as it results in (or fails to result in) a change in symptoms. If the sensory change is very painful and a sign of a known condition, we can act to control and to eliminate it. The selection and performance of coping procedures is shaped by the representation of the problem, and the problem representation, in turn, is shaped by the performance and appraisal of coping procedures. Because representation and coping are linked in this manner, there are a select set of procedures for dealing with everyday colds, others for dealing with skin disorders, and still others for preventing and controlling coronary disease and cancer.

Although it is necessary to describe what people do to enhance health and to combat disease threats, listing available procedures for achieving these ends is insufficient for creating a theory of self-regulation. The theoretical task confronting us is the conceptualization and empirical testing of constructs that describe the organization, i.e., the *classes* and *dimensions* of this vast array of coping procedures, and their integration with representations. An examination of the vast literature on coping suggests that work on the classification of coping procedures has barely begun. We are not alone (see Costa, Somerfield and McCrae, 1996) in recognizing the contrast between the numerous coping procedures used in solving specific problems such as the prevention, control, and cure of disease, and the one or two classes of behaviors for solving real world problems discussed in the coping literature, e.g., problem- and emotion-focused coping (Lazarus and Launier, 1977; Lazarus and Folkman, 1984; Endler and Parker, 1990). For example, Stoller, Pollow and Forster (1994) list 12 categories of behaviors for managing symptoms. Costa *et al.* (1996) speak to the conceptual and empirical poverty of coping research when they assert, "No one would imagine that the same research paradigm would be equally applicable to the processes of deconditioning phobias, forming romantic attachments, and learning French verbs (p. 47) ..." and, we can add, coping with health threats.

It is important to note that the number of coping categories makes a considerable difference in how effectively one might predict behavior. Stoller *et al.* (1994) report very substantial differences in response rates for different symptoms, e.g., respondents would select an over-the-counter medication if they have a headache (93% of respondents), but virtually none would do this for dizziness (3%) or chest pain (12%); calling a doctor is seen as appropriate for dizziness (48% of respondents) and chest pain (74%), though it is inappropriate for a headache (9%). The greater differentiation of coping procedures allows for more precise prediction and reveals the common-sensical connections between representations and procedures.

Coping procedures are embedded in "IF-THEN" rules for disease management. Coping procedures follow from problem representations, i.e., procedures are acts that are embedded in "IF-THEN rules" (Anderson, 1993). The IF part of the rule is the nature of a disease threat, its perceived cause, identity (warning symptoms), consequences, and time-frames (for cause, consequences, etc), all of which define the appropriateness and establish the outcome expectancies for particular actions. The act is the THEN, what we do given the problem definition. The process does not end there, of course, because the individual actively appraises the consequences of coping procedures, and that appraisal may lead to an altered perception of the health threat (e.g., the sore that is not healed by topical ointment becomes a possible cancer; the burning stomach that is not relieved by ant-acid becomes a possible ulcer). This involves another set of "IF-THEN" rules in which the "IF" is an appraisal of the utility of a coping procedure and the "THEN" is a revised problem representation. However, we will focus here on the representation-to-procedure sequence.

As Horne (1997) has also surmised from his insightful review of medication beliefs, the attributes or dimensions of coping procedures should overlap with those of representations. For example, although common sense may define exercise as a health-enhancing activity, it is likely to be defined as a risk factor during recovery from coronary disease if exercise is perceived as a stress the cardiovascular system and a cause of heart attacks. Similarly, if movement-induced wear and tear is perceived as the cause of osteoarthritic pain, it may become unattractive as therapy (Park, 1994). Overlap between features of representations and coping procedures can contribute to the formation of highly domain-specific "IF-THEN" rules (e.g., "It is one of THOSE headaches that only time will cure"). However, because the overlap is never perfect, and because many threats to adaptation require attention to higher-level goals (e.g., conservation of resources; maintenance of highly-valued social roles), many "IF-THEN" rules cut across domains (e.g., "For pain that severe you must see a doctor," "I need something that will allow me to get to work tomorrow").

Coping procedures have a "natural," perceived relevance to cause, e.g., we apply therapy to the source of distress (imbibe acid-reducing tablets for "heart-burn," put antiseptics on open wounds, etc.), and they produce feedback (alleviation or exacerbation of symptoms) that confirm or disconfirm their utility. Folk medicines, as practiced in the presence as well as in the absence of Western medicine, provide vivid illustrations of these linkages. The use of pressure on the soft palette to correct observed depressions in an infant's fontanelle (molera caida) is an excellent example of the application of a mechanical procedure to correct a symptom that has no affect on the underlying condition, dehydration leading to death (Kay, 1993). The following dimensions of self-regulation procedures will need to be considered to complete any self-regulation model designed to understand how people cope with health problems.

(1) *Outcome expectations: consequences, time-lines, and dose-response beliefs.* Outcome expectations are key constructs of virtually every self-regulation and/or social learning model; every theory addresses the effects of response feedback, goal accomplishments, and related factors (Bandura, 1969; Cacioppo *et al.*, 1989; Kanfer, 1977). At present, we can identify three important dimensions of outcome expectations, namely, goal-relevance, time-lines, and dose-response expectancies, the second and third of which appear to be absent from the three most widely promulgated models used for the analysis of health-relevant behaviors, i.e., the health belief model (Rosenstock, 1974a,b), social

learning theory (Bandura, 1969), and the theory of planned behavior (Ajzen, 1988). All three of these factors are very much present in people's plans and actions as they go about managing health threats. Goal-relevance is seen in the selection of responses that are perceived to have direct access to the targeted health threat; the perception of a physical or mechanical link of procedure to target as seen in the examples of imbibing substances for treating dyspepsia, using salves for topical injuries, pressure on the soft palette for correcting the fallen fontanelle, beliefs that physical removal via surgery is necessary to cure cancer, and so forth. The examples illustrate how the disease representation and coping procedure share a common *identity*.

Time-lines are also part of the representations of illness and specific coping procedures. For example, people have a time-frame for the expected effects of aspirin or tylenol on their headaches (20 minutes to an hour), and surface infections should show improvement within 12–24 hours of applying medication. Medications also have causal attributes and consequences: people select stronger doses or more potent medications for more severe pain and stronger medications for more severe diseases and injuries (e.g., over-the-counter treatment for the common cold, and antibiotics for pneumonia), but may regret having to do so as the stronger medication may also have risks, e.g., addiction (Horne, 1997). Expectations surrounding invasive procedures such as surgery are yet more complex. There are time-lines and dose-related expectations for the removal of diseased tissue and tumors, e.g., duration and extent of surgery, and the expected time-course and effort of rehabilitation and of prevention of recurrence. Violation of the latter, temporal and dose-related expectations can generate extremely intense emotional distress and loss of hope. For example, the recurrence of cancer after having undergone extensive surgery, e.g., modified radical for breast cancer or colectomy for colon cancer, can violate the expectation for cure and create a sense of regret and futility at having exposed oneself to highly traumatic treatment.

(2) *Risks and benefits associated with specific classes of procedures.* Pharmacological agents and foods form a major armamentarium and a massive industry for the promotion of health and the prevention and treatment of disease. Culture-wide slogans, (e.g., "You are what you eat.") and suggestions made only half in jest (e.g., "Have some chicken soup.") and the thriving natural and organic food market are but some of the highly visible clues to the presence of beliefs that shape procedures for self care. Although theoretically motivated psychologists often appear to enjoy ignoring the obvious, physicians and clinical pharmacists recognize the risk of doing so. Horne and his colleagues (Horne, 1997; Horne *et al.* in press), in their important contributions to the study of medication beliefs, have identified general and treatment-specific beliefs affecting adherence to medication protocols and have related these to beliefs about the sensitivity of the body. Individuals who see risk in the overuse and the addictive potential of medicine are also likely to believe their bodies are sensitive to medications, and both sets of beliefs are negatively related to adherence.

How do Disease Representations and Coping Procedures Become Relevant to the Self?

We live surrounded by problems: Threats of disease, natural calamity, and injury lurk in multiple corners of our worlds. Fortunately (for the smooth conduct of our daily activities), most disease threats are hidden and out of mind: If this was not the case, we would be unable to concentrate on work and family. Out of sight and out of mind also accounts

for the difficulties in motivating health promotive and disease preventive behaviors. As there are occasions when individuals are eager to reduce risk, it behooves us to ask: What conditions are responsible for the transformation of abstract disease threats to personally-relevant threats that motivate action?

Representations of disease can overlap with representations of the self. Our assumption that a combination of an illness representation (the source of motivation) with an action plan (a concrete image of a series of acts and goals) leads to motivated behavior made good sense when we were accounting for the behavior of patients and/or people who were symptomatic and ill and/or people who thought they were ill (Leventhal, 1970). The approach was successful in our early studies as the representations were based upon symptoms, i.e., somatic sensations within the self (e.g., Johnson, 1975; Johnson and Leventhal, 1974; E. Leventhal, Leventhal, Shacham and Easterling, 1989), and their presence assured the relevance or connection of a disease threat and its representation with the self system. Self-regulatory motivation and self-care processes were natural outcomes of this linkage.

The situation is quite different, however, when we are trying to enhance health-promoting and disease-preventing behaviors among well (i.e., asymptomatic) persons. Disease threats raised in this context may be external to the self: They are someone else's problems! What is needed, therefore, is a more complete conceptualization and operational definition of the conditions that connect disease threats to the self.

Attributes of the self can define risk. Perception of risk, that is, of vulnerability to disease threats, has been a central variable in models examining health motivation from a utility framework, e.g., the Health Belief Model (Becker and Maiman, 1975; Rosenstock, 1974b) and the Protection Motivation Model (Rogers, 1983; Sturges and Rogers, 1996). Motivation is viewed as partially determined by perceived vulnerability to a disease, e.g., breast cancer, and by the perceived severity of the disease. Vulnerability feelings are typically assessed using direct questions such as, "How likely is it that you will get breast cancer in the next (10, 20, etc.) years?" Although responses to these questions may provide us with an individual's overall assessment of vulnerability, including biases introduced by defensive motivations, these answers do not tell us what evidence was used in making these judgments, nor do they tell us how the evidence was evaluated. The absence of this information limits our understanding of the judgment process and will be a serious barrier to efforts to alter vulnerability appraisals and the health related actions that may depend upon them, (e.g., screening for breast cancer, safe sex behavior to avoid AIDS, and so forth).

One way of addressing this issue is to identify features of self perception that overlap with features of disease representations (Hooker and Kaus, 1994; Leventhal, Hudson and Robitaille, 1997; E. Leventhal and Crouch, 1997, Leventhal, E. Leventhal and Cameron, in press). Hooker and Kaus (1994) have approached this problem by examining older person's perceptions of their possible selves. By exploring both positive and negative possible selves, the latter heavily focused on possibilities of suffering from chronic disease, Hooker is able to identify personally-relevant illness threats that motivate health-relevant behavior. Research on the adoption of practices for AIDS prevention (Misovich, Fisher and Fisher, 1997), and on the selection of rooming-in and breast feeding by prospective mothers (Mazen and Leventhal, 1972), illustrates another aspect of self-definition: In this instance, the individual's adoption of health practices is the product of the perception of similarity between him or herself and the communicator recommending the health

practice. If the adolescent exposed to a health message on AIDS is similar in life style to communicators and victims of AIDS, the message is self-relevant: The recommendation that the soon-to-be mother keep her baby in the room with her and breast feed is more effective if its source is also pregnant and similar in ethnicity.

Rather than focusing on global self-concepts, we have attempted to define attributes of the self that might generate a sense of vulnerability because they are perceived to overlap with the attributes of specific chronic diseases. For example, a person may interpret his or her age as a source of risk for cancer or as a barrier against cancer. Because prostate cancer is seen as a disorder of the later years, men are likely to feel increasingly vulnerable to this disease as they move into their sixties and seventies (E. Leventhal and Crouch, 1997). By contrast, many older women believe that breast cancer is more likely to strike during the mid-to-late forties, and report feeling less vulnerable because they are older. The belief is false, however, as breast cancer is more likely among older than younger women.

Family history is another such factor. Knowing that members of one's family have died of coronary disease or cancer can establish a sense of personal vulnerability. This knowledge is likely to have a stronger impact on vulnerability feelings the closer the biological relationship to the deceased, the greater the perceived similarity to him or her, and the more that heredity is involved as a *cause* in the mental representation of the disease.

Many other shared or unshared factors can join the self to specific illness representations. Among these are physical make-up (e.g., breast size – breast cancer may be seen as more likely for larger- than for smaller-breasted women, hence small breasted women will be less likely to believe they are vulnerable and less likely to feel the need for screening; obesity – heavier persons may be more likely to see themselves as more susceptible to cardiovascular disease), life stresses and temperament (e.g., subjective stress – people who react strongly to stressors and experience high levels of subjective stress will be more likely to see themselves as vulnerable to cardiovascular diseases), and a variety of health-related behaviors (e.g., diet – a “heart-healthy” diet may reduce feelings of vulnerability to cardiovascular disease; participation in screening – a good result [negative finding] from a colonoscopy can create a sense of safety and invulnerability, encouraging dietary indiscretions). Identifying and understanding how factors such as these become salient, and are processed and integrated in evaluating personal health, will be a major step forward for the elaboration of self-regulation models and the practice of health promotion.

Attributes of the self can moderate procedures for self-regulation. Our studies of age-related changes in health-enhancing and disease-avoidant behaviors have revealed a variety of ways in which age can moderate the self-regulation process. Advancing age is associated with reductions in physiological functioning (pulmonary and cardiovascular capacity) and physical strength for all but the most elite elderly, and changes in work, social roles, and social expectations of older persons can lead to major changes in a variety of self-regulation processes. Chronological age is an indicator, therefore, of a wide range of variables that may directly influence or moderate many of the factors involved in the self-regulation process, ranging from those comprised by representations of diseases to those making up the strategic and tactical procedures for disease management.

Our investigation of age-related changes in self-regulation reveals shifts in strategy for the management of health threats and suggests that two important principles guide the behavior of the older persons whose health and illness behaviors we have studied. The first is that they are *more sensitive to limitations in resources*, biological, psychological, and social (Carstensen, 1992). The second is that older persons appear to be *more motivated to*

avoid risk; they act both consciously and unconsciously to deploy resources where needed for efficient and psychologically optimal solutions to reduce risk associated with potential health threats.

Though these orientations are reflected in numerous health- and illness-related behaviors (see E. Leventhal and Crouch, 1997), they were most clearly reflected in our studies of differences between older (over 65 years of age) and middle-aged persons in delay in seeking medical care for new symptoms. In the first of these age-group comparisons, E. Leventhal, Leventhal, Schaefer and Easterling (1993) contrasted the average time from first noticing a symptom to seeking care for 80, 45–55 year-old participants with that of 83 participants over 65 years of age. Both groups of participants were slow to seek care (16 and 12 days respectively) for symptoms judged at onset as mild, and quick to seek care for symptoms judged at onset as severe (2 and 1 respectively), and the older participants were swifter to seek care overall. When the delay stage was divided into appraisal stage (i.e., the time from first noticing a symptom until deciding one was ill) and illness stage (i.e., the time from deciding one was until calling for care), the data showed that appraisal delays were shorter for the elderly regardless of the initial evaluation of the potential seriousness of the symptom (7 1/2 vs 4 days for mild and 2 1/2 vs less than 1/2 day for serious). Differences in illness delays between the older and middle aged groups vanished for both mild and serious symptoms, i.e., once participants decided they were ill, the time until calling for care was identical for both elderly and middle-aged subjects for symptoms they initially appraised as mild (approximately 3 1/2 days), and for symptoms they initially appraised as serious (approximately 1/2 day). But when participants initially appraised symptoms in the middle range, that is, as potentially serious, middle-aged persons delayed for 7 days before seeking care, whereas delay by the elderly was less than a day. Further questioning revealed substantially more avoidance behavior by the middle-aged than by the older respondents (e.g., "afraid to find out what it might be," "just didn't want to know;" there were no differences for several other factors, such as difficulty finding time to see the doctor). In short, the older respondents sought care quickly and transferred the concern about diagnosis to their expert advisors. They did not exhaust energy by remaining in a state of doubt. The basic findings were replicated in a second study using additional methodological controls (E. Leventhal *et al.*, 1995).

In summary, comparisons of older and middle-aged respondents reveal an overall strategy shift, with the older group apparently relieving themselves of fruitless worry by seeking access to expert care quickly, whereas their middle-aged counter-parts maintain their daily routine unabated, willing to bear the stress generated by lingering doubts of a potential threat rather than acting swiftly to confront and resolve the danger. The differences in strategy are key, not age *per-se*, because these strategic differences may not appear in comparisons among the same age groups in other locales and times. It is reasonable to assume that the strategies depend upon a particular history of experience with illness and health care providers as well as on the availability of resources for action, and this strategy for information processing will be found at any age if the sample studied has satisfied the background conditions for its origin.

THE CONTEXT FOR SELF-REGULATION

To this point we have focused on the person level, that is, the system or set of mental mechanisms involved in describing people as health-medical problem solvers, attempting

to improve their health, and coping with disease threats as they define and re-define them. This system operates in a cultural and social context; it adjusts behavioral outputs to achieve goals defined by its representation of the context. Given that the system is in constant interaction with and processing information from this context, a complete model of self-regulation must suggest ways of representing the context and the constant exchange with the self-regulation system.

There are two extremely important ways in which culture defines illness representations and the self: (1) It provides linguistic labels for differentiating and categorizing the broad array of events that define illness and insure culturally-shared views of specific diseases; and (2) It provides the personal contacts that strengthen the perceptual level of schema development and social models for the acquisition of specific procedures for threat management.

Labeling and the Formation of Common-sense Models

Labels do more than reference the biological attributes of a disease: They can create expectations and direct attention to features that are irrelevant and indeed at variance with a valid, biological representation of a disorder. Blumhagen (1980) made this point regarding hypertension: Assigning this label to an individual generates expectations and directs attentional search to specific somatic reactions of tension and hyper-responsiveness and to its environmental elicitors, i.e., life stressors. Not surprisingly, both hypertensives and normotensives share a common view of the causes and symptoms indicating elevated blood pressure (Baumann, Cameron, Zimmerman and Leventhal, 1989). Several studies report that applying the label "hypertensive" leads to increases in absenteeism (Haynes, Sackett, Gibson and Johnson, 1978). The effect has not always been confirmed as investigators did not examine whether respondents viewed their work settings as having the attribute (high levels of stress) associated with the cause of hypertension.

Personal Contacts and the Acquisition of Representations and Procedural Skills

Studies of self care are replete with data illustrating the role of social information and social comparison on the appraisal of symptoms and adoption of self care procedures (Stoller, in press). A visit to a primary care provider for an annual physical is perhaps the best way to convince a person of the role of personal contact in the acquisition of illness representations and procedures for self care. From the opening question (e.g., "Hi, how are you feeling today?"), through the systematic review of systems, to the prescribing of medication (e.g., "Take this for 7 days and then we will see how you feel."), the focus is on the identification and linking of somatic changes to labels. Little wonder, then, that patients engage in symptom searches and build bi-level models in which concrete observations are linked to disease labels. Given the suggestive nature of the label and the systematic questions asked during the review of systems and search for diagnostic clues, there is ample evidence that the medical encounter itself is a potential source of disease representations, and therefore a prime location for implementing interventions that aim to optimize self-regulation by transforming the environmental context.

Social comparison is also a source of information acquisition. Comparisons with others can clarify the representation of a threat and status of the physical self, and serve for the acquisition and honing of procedural skills. Kulik and Mahler (1987) found that patients waiting for coronary bypass surgery showed reduced anxiety levels and speedier post

operative recovery if they roomed with patients who were post-surgical and functional rather than with patients who were similar to themselves and also awaiting surgery, demonstrating how an effortless social comparison can reduce the perceived threat of an invasive procedure. The benefits of enhanced esteem and motivation to engage in daily activities are seen in breast cancer patients who are reassured about their competence by comparisons of themselves to other patients who are doing more poorly (Taylor and Lobel, 1989; Wood and VanderZee, 1997). And Tennen and Affleck (1997) have emphasized the role of social comparison (i.e., modeling) and effort to acquire skills for pain management in leading to improved functioning by patients with severe arthritis. Whereas every component of the self-regulatory system is subject to social influence, it is critical to recognize that the recipients are not passive. The patient awaiting by-pass surgery, the patient deciding whether additional, noxious chemotherapy is worthwhile, the elderly person acquiring procedures for the management of arthritis pain, and the person discussing a new symptom with family and friends to decide if it is serious enough to require health care (Cameron, E. Leventhal and Leventhal, 1993), are actively appraising the utility of social inputs. Is the social other a relevant and/or reliable information source? If "Yes," did adoption of the initial step in a recommended procedure have the anticipated effect or did it produce an unexpected and/or less desirable outcome? The feedback from acts of "trying on" recommendations or observed behaviors is likely to be the final arbiter of the impact of social information, at least in those cases where the individual is not deprived of alternative choices. Greater attention to the interplay between social perception and self-regulation might inform interventions that enhance patients' contacts with former patients, family members, and friends in order to facilitate adaptation to serious illnesses and invasive medical treatments (Conrada, E. Leventhal and Anderson, 1994).

CONCLUDING REMARKS

While the characteristics of the "perceptual-cognitive" approach to self-regulation that we advocate is similar in some respects to other such models, it differs in many. The basic form, involves the differentiation of cognitive representation and affect, the separation of representational and procedural components, which dates back to our early work on fear communications (Leventhal, 1970), overlaps with other self-regulation models (Carver and Scheier, 1981; Kanfer, 1977), and reflects similarities in conceptual structure to that of the Health Belief model (Becker and Maiman, 1975) and social learning theory (Bandura, 1969). The notion of multi-level cognitive processing is similar to but less differentiated than that proposed by Carver and Scheier (1981: See also Powers, 1973), though at this point in time it is unclear whether greater differentiation of cognitive processing levels will add to our ability to understand and to predict health relevant behaviors. The hypothesis and empirical demonstration that fear can inhibit behavior by undermining self-competence (Leventhal, 1970) is one of several indicators of the similarity of the model to aspects of social learning theory (Bandura, 1969).

This model differs from the others, however, in three critical areas. First, we have identified the specific content of representations (e.g., *identities* [labels and symptoms], *time-lines*, *causes*, *consequences*, and *control*), and coping procedures (e.g., wait and see; conduct a casual search of the physical and social environment, test time-lines and both general and dose-related medication beliefs, and so forth). Second, representations have

bi-level organization, i.e., they are both abstract and concrete, and procedures can be programmed abstractly and automatically (implicit, motor memories). The content attributes and the distinction between concrete and abstract representations are initial, critical steps toward transforming this self-regulation model from a frame of reference into a theory. Third, we have begun the analysis of processes involved in the overlap among representations of disease threats and representations of the self. This is not unique to our model, as Hooker and Kaus (1994) and others have taken steps in this direction, and the construct of self-efficacy is clearly an example of this development, but we believe the framework here proposed offers a more complete and detailed perspective on the self-regulation process.

We think it premature, at best, to express a concern that we are focusing on subjective representation and placing the burden on individuals to self regulate while accepting the environment as unchangeable. If reality is defined to include somatic changes, culturally-shared meaning categories, and interactions with health care providers, then reality constitutes a major source of input for the construction of illness representations. Certainly, procedures for managing health threats are often very real in their effects, as are the consequences of failing to act upon those threats. And people are highly motivated, with good reason, to be veridical in their understanding of health and effective in their responses to illness. Thus we see no void between the critical components of the self-regulation view proposed here and factors in the real world that control behavior and whose control may ameliorate physical health problems.

In summary, the constructs represented in this particular brand of self-regulation model provide an increasingly explicit guide for modeling both the motivational and procedural factors guiding health relevant behaviors in specific settings. It bears repeating that the conceptual differentiation here proposed are based upon three simple propositions: (1) People are active problem solvers, they see and define their worlds, select and elaborate procedures to manage threats, and change the way they represent problems when they obtain disconfirming feedback; (2) Problem solving process occurs in context; and (3) The energy expended on motivation to enhance health, and to prevent and cure disease is directed to what is perceived to be the most immediate and urgent threat and is limited by resources and a satisfaction rule. Further differentiation and specification of constructs guided by these themes will allow more precise tests and explicit rejection of particular hypotheses pertaining to the factors that mediate and moderate health relevant behaviors.

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