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Self-Efficacy Mechanism in Physiological Activation and Health-Promoting Behavior

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It is now widely acknowledged that people's health rests partly in their own hands. To prevent the ravages of disease, they must exercise control over their health habits and the environmental conditions that impair physical well-being. How well they cope with the demands of everyday life can have significant impact on biological systems that affect the quality of health at any given time and the development of chronic dysfunctions. Psychosocial determinants of biological functioning and health status thus operate, in part, through the exercise of personal agency.

Among the different mechanisms of personal agency, none is more central or pervasive than people's beliefs in their capability to exercise control over their own motivation and behavior, and over environmental demands. Converging evidence from diverse lines of research shows that perceived self-efficacy operates as one cognitive mechanism linking psychosocial influences to health functioning (5). Perceived self-efficacy refers to beliefs in one's capabilities to mobilize the motivation, cognitive resources, and courses of action needed to meet given situational demands.

One can distinguish two levels of research on the psychosocial determinants of health functioning in which efficacy plays an influential role. The more basic level examines the biochemical mediators of efficacy effects on health. The second level is concerned with reducing habits that impair health and promote those that enhance it. Before addressing these two lines of research, I would like to comment briefly on the diverse sources and effects of self-efficacy beliefs.

FUNCTION AND DIVERSE EFFECTS OF SELF-EFFICACY BELIEFS

In their daily lives, people continuously have to make decisions about whether or not to attempt certain courses of action and how long to pursue

those they have undertaken. Such decisions are partly determined by judgments of personal efficacy. Appropriate self-appraisal of capabilities plays an important role in successful functioning. Serious misjudgments of personal efficacy in either direction can produce adverse consequences. People who grossly overestimate their capabilities undertake activities that are well beyond their reach. This begets high disappointments, failures, and many other troublesome consequences. People who underestimate their capabilities also bear costs, although these are more likely to take self-limiting forms. Such individuals shun activities that cultivate competencies and offer potential rewards. When they approach task demands with a sense of inefficacy, they generate debilitating thought patterns and stress reactions that take a toll on the body and create internal obstacles to effective functioning.

Self-percepts of efficacy regulate psychosocial functioning in diverse ways. They affect what people choose to do, how much effort they will mobilize in a given endeavor, how long they will persevere in the face of difficulties and setbacks, whether their thought patterns are self-hindering or self-aiding, and the amount of stress and despondency they experience in coping with environmental demands.

SOURCES OF PERCEIVED SELF-EFFICACY

People's beliefs about their efficacy can be altered in four principal ways (5). The most effective way of instilling a strong sense of efficacy is through *mastery experiences*. Successes build a robust sense of efficacy. Self-efficacy is best developed through a series of subgoals that serve to expand competencies. Subgoal attainments provide indicants of mastery for enhancing a sense of personal efficacy along the way. Failures undermine it, especially if failures occur early in the course of events. Performance accomplishments provide the most influential source of efficacy information because it is based on authentic mastery experiences.

The second method is through *modeling*. People partly judge their capabilities in comparison with others. Seeing people similar to oneself succeed by perseverant effort raises observers' beliefs about their own capabilities. The failures of others coping with similar problems instill self-doubts about one's own ability to manage similar tasks. Vicariously derived information can alter perceived self-efficacy through ways other than social comparison. Competent models can teach observers competencies and effective strategies for dealing with taxing situations. In addition, modeling influences convey information about the nature of environmental tasks and the difficulties they present. Adoption of serviceable strategies and altered perceptions of task demands will change perceived self-efficacy.

For many activities people have difficulty appraising their capability because they are unsure about its indicants, the social criteria by which it is judged, and the nature of task demands. Self-appraisals are, therefore, partly based on the opinions of others who presumably possess evaluative competence. *Social persuasion* is a third mode of influence that is widely used to try to talk people into believing they possess the capabilities to achieve what they seek. Realistic boosts in efficacy that lead people to exert greater effort increase their chances of success. However, to raise unrealistic beliefs of personal efficacy runs the risk of inviting failures that discredit persuaders and undermine perceptions of personal efficacy.

People also rely partly on inferences from their *physiological state* in judging their capabilities. They read their autonomic arousal and tension as signs of vulnerability to dysfunction. In activities involving strength and stamina, people interpret their fatigue, windedness, aches, and pains as indicants of physical inefficacy. The fourth way of modifying self-efficacy beliefs is to equip people with skills to reduce aversive physiological reactions and to alter how they interpret somatic information.

Information that is relevant for judging personal efficacy—whether conveyed actively, vicariously, persuasively, or physiologically—is not inherently instructive. Rather, it gains significance through cognitive processing. The cognitive processing of efficacy information involves two main functions (5). The first concerns the types of information people attend to and use as indicators of personal efficacy. Each of the four modes of conveying information has its distinctive set of efficacy indicators. The second concerns the combination rules or heuristics people use for weighing and integrating efficacy information from different sources in forming their self-efficacy judgments. The weight given to new experiences depends on the nature and strength of preexisting self-conceptions into which the new information must be integrated. Self-conceptions of efficacy exert selective influence on attention to efficacy-relevant information, and how it is interpreted, integrated, and coded for memory representation.

ENHANCING PERCEIVED CARDIAC EFFICACY AND POSTCORONARY RECOVERY

Research designed to facilitate recovery of functional capability after a myocardial infarction illustrates how different modes of influence can be enlisted to build perceived self-efficacy for health-promoting behavior. About half the patients who experience myocardial infarctions have uncomplicated ones (36). Their heart heals rapidly, and they are physically capable of resuming an active life. However, the psychological and physical recovery is slow for patients who believe they have an impaired heart. They avoid

physical exertion. They fear that they cannot handle the strains in their vocational, and social life. They give up recreational activities. They fear that sexual activities will do them in.

The recovery problems stem more from patients' beliefs that their cardiac system has been impaired than from physical debility. The rehabilitative task is to convince patients that they have a sufficiently robust cardiovascular system to lead full, productive lives. Each of the four sources of efficacy influence can be used to enhance patients' perceptions of their cardiac capabilities. Physical accomplishments on the treadmill provide telling demonstrations of cardiac capabilities. Modeling influences, in which ex-patients exemplify the active lives they are leading, can strengthen belief in the restorability of cardiac function. Physicians use their expertise to persuade patients of their physical capabilities. They also correct patients' tendency to misread their physiology if they misattribute fluctuations in physical functioning arising from other causes to an impaired heart.

The initial study in this program of research demonstrated that having patients master increasing workloads on the treadmill, and persuasive medical counseling both strengthen patients' beliefs in their physical capabilities (44). The stronger their perceived self-efficacy, the more active they become in their everyday life. Maximal treadmill attainment, itself, is a weak predictor of patients' level and duration of activity. Treadmill experiences, thus, exert their influence indirectly, facilitating recovery by raising patients' beliefs about their physical and cardiac capabilities. Enhanced perceived efficacy, in turn, fosters more active pursuit of everyday activities.

Ewart et al. (43) have further shown that patients' perceived physical efficacy predicts compliance with prescribed exercise programs, whereas actual physical capability does not. This further corroborates the earlier findings that the effect of treadmill experiences on activity level is largely mediated by changes in perceived self-efficacy. Patients who have a high sense of efficacy tend to overexercise; those who doubt their physical efficacy underexercise at levels that provide little cardiovascular benefits.

Psychological recovery from a heart attack is a social, rather than an individual matter. The patients are almost always males. The wives' judgments of their husbands' physical and cardiac capabilities may aid or retard the recovery process. The direction that social support takes is partly determined by perceptions of efficacy. Spousal support is likely to be expressed in curtailment of activity if the husband's heart function is regarded as impaired, but as encouragement of activity if heart function is judged to be robust. A study by Taylor et al. (102) addressed itself to ways in which the treadmill might also be used to raise and strengthen spousal perceptions of the patients' capabilities.

Several weeks after male patients have had a heart attack, they performed a symptom-limited treadmill, mastering increasing workloads with three

levels of spouse involvement in the treadmill activity. The wife was either uninvolved in the treadmill activity; she was present to observe her husband's stamina as he performed the treadmill under increasing workloads; or she observed her husband's performance, whereupon she performed the treadmill exercises herself to gain firsthand information of the physical stamina it requires. We reasoned that having the wives personally experience the strenuousness of the task, and seeing their husbands match or surpass them, should convince them that their husband has a tough heart.

After the treadmill activities, couples were fully informed by the cardiologist about the patient's cardiac functioning and their capacity to resume activities in their daily life. If the treadmill is interpreted as an isolated task, its impact on perceived cardiac and physical capability may be limited. In order to achieve a generalized impact of enhanced self-efficacy on diverse domains of functioning, the stamina on the treadmill was presented as a generic indicant of their cardiovascular capability—that the patients' level of exertion exceeded whatever strain everyday activities might place on their cardiac system. This would encourage them to resume activities in their everyday life that place weaker demands on their cardiovascular system than did the heavy workloads on the treadmill. The patient's and spouse's perceptions of his physical and cardiac capabilities, were measured before and after the treadmill activity, and again after the medical counseling.

Figure 1 shows the patterns of changes in perceptions of the patients' physical and cardiac capabilities at different phases of the experiment under varying degrees of spousal involvement in the treadmill activity.

Initially the perceptions of wives and their husbands concerning his physical and cardiac capabilities were highly discrepant—husbands judged themselves moderately hearty, whereas wives judged their husbands' cardiac capability as severely debilitated and incapable of withstanding physical and emotional strain. For spouses who were either uninvolved or merely observers, the treadmill activity did not significantly change their considerable doubts about their husbands' physical and cardiac capabilities. Even the detailed medical counseling by the cardiology staff did not reassure them in this regard. However, wives who had personally experienced the cardiac strain imposed by mounting workloads interpreted their husbands' treadmill attainments as reflecting notable cardiac capability. The participant experience produced a sharp rise in spousal judgments of patients' capacity to withstand physical and emotional strain and high level of heart activity. Patients' treadmill performances were comparable in conditions in which their wives simply observed or participated themselves. The participant experience apparently altered spousal cognitive processing of treadmill information, giving greater weight to indicants of cardiac robustness than to symptomatic signs of cardiac debility. The change in perceived efficacy made the wives more accepting of the medical counseling. Following the medical counseling,

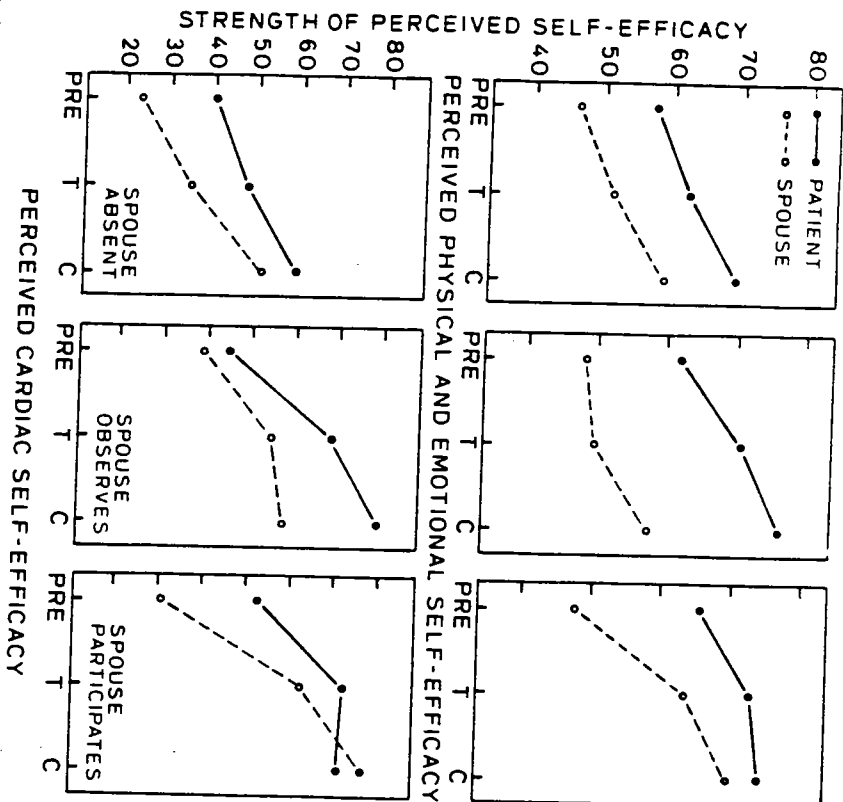


FIG. 1. Changes in perceived physical and cardiac efficacy as a function of level of spouse involvement. Patients' treadmill exercises, and the combined influence of treadmill exercises and medical counseling. Perceived efficacy was measured before the treadmill (PRE), after the treadmill (T), and after the medical counseling (C). (From ref. 102, with permission.)

couples in the participant spouse condition had congruently high perceptions of the patients' cardiac capabilities.

The findings further show that beliefs of cardiac capabilities can affect the course of recovery from myocardial infarction. The higher the patients' and the wives' beliefs in the patients' cardiac capabilities, the greater was the patients' cardiovascular functioning as measured by peak heart rate and maximal workload achieved on the treadmill 6 months later. The joint belief in the patients' cardiac efficacy proved to be the best predictor of cardiac functional level. Initial treadmill performance does not predict level of cardiovascular functioning in follow-up assessments when perceived effi-

cacy is partialled out. But perceived cardiac efficacy predicts level of cardiovascular functioning when initial treadmill performance is partialled out. It is noteworthy that the degree of recovery was associated more with beliefs about the strength of the heart, than with beliefs about general physical capabilities.

Wives who believe that their husbands have a robust heart are more likely to encourage them to resume an active life than those who believe their husband's heart is impaired and vulnerable to further damage. The positive relation between the wife's perceptions of her husband's cardiac capability and his treadmill accomplishments months later may be partly mediated by spousal encouragement of activities during the interim period. Pursuit of an active life improves the patient's physical capability to engage in activities without overtaxing their cardiovascular system.

COGNITIVE PROCESSING OF TREADMILL EFFICACY INFORMATION

Treadmill experiences affect efficacy judgment through cognitive processing of multiple sources of information indicating cardiovascular capabilities and limitations. Treadmill activity produces a lot of negative signs, such as fatigue, pain, and shortness of breath, and other exercise-induced symptoms which mount as the task continues. Patients who focus on their physical stamina as they master increasing workloads will judge their cardiac system as more robust than will patients who selectively attend to, and remember, the negative signs. Positive indicants of capability can be made more salient by providing patients with ongoing feedback of their performance as they master heavier workloads. Judgment of cardiac efficacy will vary depending on how this diverse symptom information and the indicants of cardiac robustness are weighted and integrated.

This is shown in a study with a group of healthy men and women who completed a symptom-limited treadmill before entering an exercise program (58). Half the participants received concurrent feedback of the workloads they mastered on the treadmill task. The other half received the feedback about their attainments after they had completed the task. Their perceived cardiac efficacy was measured before and after the treadmill performance. They also recorded the physical signs they recall having experienced during the treadmill activity.

As can be seen from Fig. 2, negative signs are inescapable. But concurrent feedback of mastery of increasing workloads makes evidence of one's physical stamina highly salient as well. In the absence of feedback of positive indicants of capability exercise-induced symptoms completely dominate attention and memory representation of the treadmill experience.

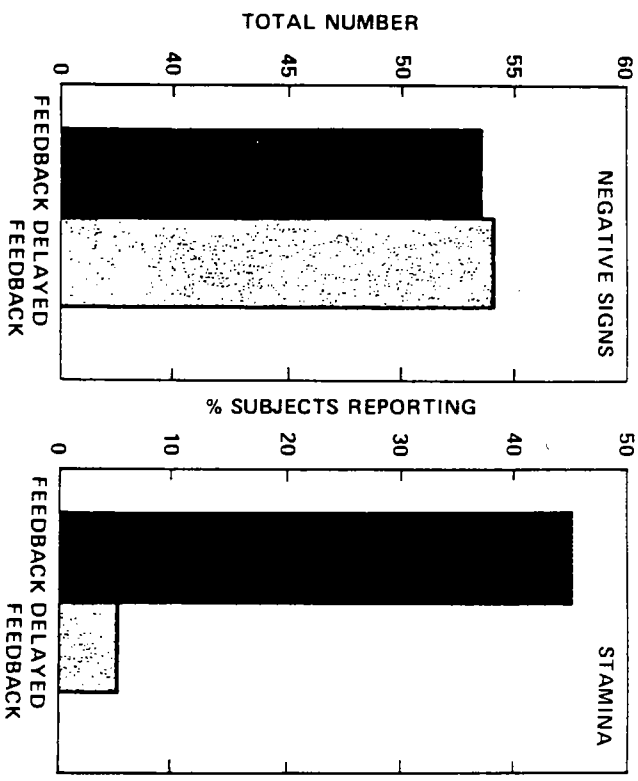


FIG. 2. Memory representation of the treadmill experience in terms of symptoms and indicators of capability as a function of timing of feedback (58).

Figure 3 shows how treadmill performances, with and without concurrent feedback, affect judgment of cardiac efficacy.

Healthy men have a more resilient conception of their cardiac capabilities than do healthy women, even though they do not differ all that much in their actual cardiac capabilities. A taxing treadmill test without feedback does not alter men's beliefs that they have a robust cardiac system. Feedback that makes physical attainments on the treadmill more noticeable raises women's judgments of their cardiac capabilities. However, in the absence of such feedback, women read the mounting negative physiological sensations accompanying increasing exertion on the treadmill as indicators of cardiac limitations and lower their judgments of their cardiac capabilities. Women do not report experiencing any more negative physiological sensations than do men. The adverse impact of treadmill experiences without positive feedback stems from negative cognitive processing of symptom information rather than from greater amounts or salience of such symptoms.

Preconceptions tend to bias how information is weighted and integrated (5,88). A similar process is indicated in women's reactions to delayed feed-

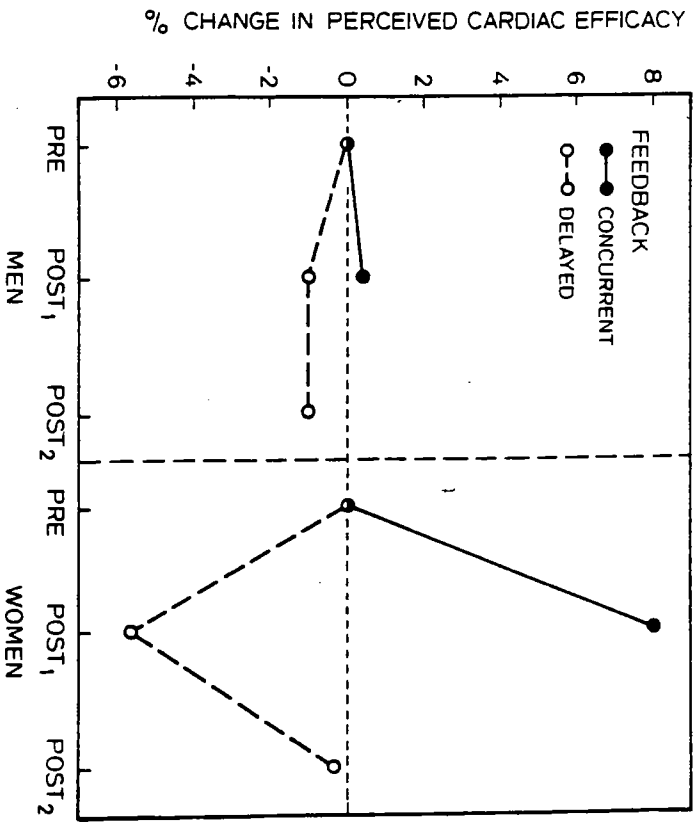


FIG. 3. Impact of treadmill performances on judgment of cardiac efficacy under conditions of concurrent and delayed feedback (58).

back regarding their treadmill performances. Upon being told of their notable physical attainments they raised their perceived cardiac efficacy to their pre-treadmill level, but they achieved no net gain from the treadmill experience. Apparently, positive signs of cardiac capability are difficult to assimilate after conceptions of one's efficacy have already been formed under conditions in which negative signs clearly predominate. A coronary can markedly undermine beliefs concerning one's cardiac efficacy. A strong preconception of cardiac impairment makes negative physiological reactions to exertion on the treadmill highly salient and recallable. Therefore, concurrent positive feedback of physical stamina would be especially important in overcoming beliefs of a frail cardiac capability in postcoronary patients who have not suffered clinical complications. Analysis of how efficacy preconceptions bias the interpretation and cognitive processing of physiological information is thus of considerable clinical import as well as of theoretical interest.

BIOCHEMICAL MEDIATORS OF SELF-EFFICACY EFFECTS

Anxiety and Stress Reactions

People's beliefs about their coping efficacy affect their emotional reactions in taxing situations as well as their motivation and behavioral functioning. Among the psychosocial factors that can modulate the operation of biological systems, psychological stressors have attracted the greatest attention. Stress arises from a relational condition in which perceived demands strain or exceed coping capabilities in areas of personal import. Research from different perspectives has underscored the influential role of perceived control in stress reactions (3,65,86). A sense of controllability can be achieved either behaviorally or cognitively. In behavioral control, individuals take action that forestalls or attenuates aversive events. In cognitive control, people operate under the belief that they can manage environmental threats or stressors should they arise. These two forms of controllability are distinguished because actual and perceived control can differ substantially.

Being able to exercise control over potential threats can diminish stress because the capability is used to reduce or to prevent painful experiences. But there is much more to the process of stress reduction by behavioral control than simply curtailing painful events. In some studies of controllability, ordinarily stressful events occur undiminished, but they are promptly transformed to pleasant ones when their occurrence is personally controlled (52). Here it is the exercise of personal control, not the curtailment of the events themselves, that reduces stress. That a sense of controllability diminishes stress, even across domains of functioning, is strikingly demonstrated by Mineka et al. (87) in a developmental study. Monkeys who had been reared under conditions in which they exercised control over food months later showed little fear of novel threats, whereas the same threats were highly stressful to monkeys who could not develop a sense of control because food was given to them independently of their actions. In situations in which the opportunity to wield control exists but is unexercised, it is the self-knowledge that one can exercise control should one choose to do so rather than its application that reduces stress reactions (47). These converging lines of evidence suggest that much of the stress reductive effects of behavioral control stem anticipatorily from perceived capability to wield control over troublesome events rather than simply from attenuating aversive events.

The impact of perceived control alone on stress reactions has been the subject of study. Perceived control without the actuality has been shown to reduce stress reactions. People who are led to believe they can exercise some control over painful stimuli display lower autonomic arousal and less

impairment in performance than do those who believe they lack personal control, even though they are equally subjected to the painful stimuli (46,48). Repeated failures create stress reactions when ascribed to personal incapability, but the same painful experiences leave people unperturbed if ascribed to situational factors (112).

In social cognitive theory, perceived self-efficacy operates as a cognitive mechanism by which controllability reduces stress reactions (5). This theory conceptualizes anxiety and stress reactions in terms of perceived inefficacy to exercise control over potentially aversive situations. If people believe they can deal effectively with potential threats, they are not perturbed by them. But if they believe they cannot control threatening situations, they have much cause for distress. They tend to dwell on their coping deficiencies, and see the environment as fraught with danger. In so doing, they distress themselves, and constrain and impair their level of functioning (17,65,84,96).

Aversive arousal in situations involving some risks is affected not only by perceived coping efficacy, but also by perceived efficacy to control distressing cognitions (91). Dysfunctional cognitions are not distressing if one can exercise cognitive control over them so that they do not become ruminate. Therefore, people are more perturbed by their perceived inefficacy to control aversive cognitions than by the cognitions themselves (61).

There is a growing body of evidence that exercise of control over stressors is a critical factor influencing biological functions that govern health and illness. Controllability appears to be a key organizing principle regarding the nature of these stress effects. Exposure to stressors without the ability to control them activates stress-related hormones, release of endogenous opioids, and impairs various components of the immune system (51,78). Exposure to the same stressors with a concomitant ability to control them has no adverse physiological effects. These findings are based mainly on experimentation with animals involving uncontrollable physical stressors. Efforts to verify these effects with humans have relied extensively on correlational or quasi-experimental studies in which occurrences of life stressors are related to indices of biological functioning or infectious illnesses. Such studies leave some ambiguity about the direction of causality.

We have devised a research paradigm combining strong phobic stressors with mastery modeling that enables us to examine causal relationships under laboratory conditions with a high degree of control over confounding sources of influence. Participants cope with a uniform stressor that can be varied in intensity. Because a high sense of controlling efficacy can be quickly instilled through mastery experiences, we can create conditions incorporating phobic stressors with, and without, perceived controlling self-efficacy. By the end of each study, the phobia is eradicated in all participants so they all gain lasting relief from chronic phobic stressors while contributing to knowledge.

