USE OF THE HEALTH BELIEF MODEL IN SCREENING FOR CARDIOVASCULAR RISK FACTORS IN THE CLINICAL SETTING

BY

MOLLIE VENTO HUDSON

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Mollie Vento Hudson

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ABSTRACT

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Heart disease kills nearly two Americans in five, but it is largely preventable as many of the risk factors that predispose an individual to heart disease are modifiable. An assessment tool that could be used to screen individuals based on the risk factors of smoking, hypertension, hyperlipidemia, physical inactivity, and obesity would be of great value to the advanced practice nurse in educating patients about their role in preventing heart disease.

This project evaluates three existing tools for how well they address the above risk factors, for clinical utility, and for degree of fit with the Health Belief Model. The tools evaluated are Anderson, Wilson, Odell, & Kannel (1991); Thorsen, Jacobs, Grimm, Keys, Taylor, & Blackburn (1979); and Kannel & Schatzkin (1983).

None of the instruments evaluated address physical inactivity or obesity, and they vary with respect to how they treat smoking. None of the tools takes into consideration the subjective elements that determine an individual's likelihood of adopting change, so they are of comparably low merit when used in context of the Health Belief Model.

This project points to the need for a more comprehensive risk assessment and one that includes elements of the Health Belief Model most predictive of a person engaging in health-protecting behaviors.

For my parents, who taught me to believe in myself, and whose lives directed me toward this profession. And for Rick, for his patience and support along the way.

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Introduction

Despite advances in treatment, heart disease remains the leading cause of death in the United States, claiming more than 700,000 victims in 1995, the latest year for which statistics are available (National Center for Health Statistics, 1995). The American Heart Association reports that nearly two Americans in five will eventually die of heart disease. Coronary heart disease (CHD) also has significant costs beyond mortality. Selig (1991) reports that CHD costs the country more than $60 billion per year in health care, lost wages, and productivity.

Despite the grim statistics, heart disease is largely preventable. It is well accepted that certain risk factors predispose an individual to cardiovascular disease, but a significant number of these risk factors are modifiable. Lifestyle factors such as diet, physical activity, and smoking all contribute to a person's overall risk of developing cardiovascular disease. Hopkins and Williams (1986) state, "The total disease preventable by reducing risk exposure to more nearly optimal levels may be calculated to be 90%." (p.3). Those diseases that can be most affected by a preventive approach are coronary artery disease (CAD), hypertension, cerebrovascular disease, and peripheral vascular disease (Selig, 1991). Paffenbarger, Hale, Brand, and Hyde (1977) concluded from a study of longshoremen in San Francisco that elimination of the adverse influences of inactivity, smoking, and hypertension might have reduced the fatal heart attack rate among participants in the 22-year study by as much as 88%.

The advanced practice nurse (APN) is in a unique position to assist patients in identifying their risk of cardiovascular disease. Central to the role of the APN is health promotion and disease prevention. The 1986 Office of Technology Assessment report concluded that nurse practitioners are more adept than physicians in providing services that depend on communication with patients and preventive actions. Further, the report stated that nurse practitioners perform better than most physicians in the provision of supportive care and health promotion activities.

With the large number of people affected by cardiovascular disease, it is clear that APNs in family practice will encounter clients who either have symptoms of clinical disease or are at significant risk for disease as a result of modifiable or nonmodifiable risk factors. As clinicians, counselors, assessors, and change agents, nurse practitioners in primary care have the opportunity to impact clients' cardiovascular health on an ongoing basis. The goal of APNs is to reduce the incidence of cardiovascular disease by teaching clients about their role in disease prevention and by developing mutual goals and treatment plans specific to their cardiovascular risk factors.

In one study, individuals who received risk factor screening and education had significantly lower risk factor levels, including lower blood cholesterol levels, lower diastolic blood pressure, lower resting heart rate, and increased selection of low-fat and low-sodium meals in restaurants (Murray, Luepker, Pirire, Grimm, Bloom, Davis, & Blackburn, 1986). These data suggest that systematic screening and education may result in lower population risk for coronary heart disease.

Even with clients who do not demonstrate risk factors, prevention of cardiovascular disease is a component of the APN's role. Prevention is viewed as either primary or secondary. Primary prevention focuses on asymptomatic individuals and stresses the importance of a healthy weight, regular exercise, and a low-fat diet. Secondary prevention is aimed at people with modifiable risk factors or those who have developed preclinical disease but have not yet manifested symptoms. Smoking cessation, weight reduction, and control of hypertension and hyperlipidemia are all be goals of the APN with this population. This project will focus on five of the most common modifiable risk factors identified in the literature: smoking, hypertension, hyperlipidemia, physical inactivity, and obesity (Anderson, Wilson, Odell, & Kannel, 1991).

The purpose of this project is to evaluate existing screening tools used to identify individuals at high risk for developing cardiovascular disease. The risk indices to be evaluated are as follows: Anderson, Wilson, Odell, & Kannel (1991); Thorsen, Jacobs, Grimm, Keys, Taylor, & Blackburn (1979); and Kannel & Schatzkin (1983). The tools will be evaluated for completeness regarding known risk factors and also with respect to how well they fit philosophically with the Health Belief Model. Although the targeted population for this project is adults, the ideal risk index should also be able to be used with adolescents as there is evidence that atherosclerotic lesions are not uncommon among teenagers (Kwiterovich, 1995).

The conceptual framework for this project is the Health Belief Model (HBM). Well known in nursing as a paradigm for health-protecting behavior, the

HBM has been used in a number of studies addressing cardiovascular health (Mirotznik, Feldman, & Stein, 1995; Terborg, Hibbard, & Glasgow, 1995; and Sommers, Andres, & Price, 1995). The HBM proposes that there are variables that directly affect an individual's predisposition to take action to protect health.

The Health Belief Model is an appropriate framework for interventions by APNs in the treatment of cardiovascular disease as the roles of the APN directly relate to key concepts within the model. Educator, assessor, change agent, and counselor are but a few roles that APNs apply directly to concepts within the HBM and could be used to help clients develop skills to make behavior changes. By facilitating mutual goals that focus on improved cardiovascular health, APNs can develop successful treatment plans.

Regardless of whether clients present as asymptomatic with no or few risk factors or whether they have preclinical cardiovascular disease with many risk factors, APNs who use the Health Belief Model as a conceptual framework can be of great use to a client interested in improving his or her health.

Review of Literature

Hopkins and Williams (1986) identified 246 coronary risk factors, the most important of which were age, sex, strong family history, cigarette smoking, hypertension, plasma lipoprotein levels, diabetes, and obesity. One study (Rich-Edwards, Stampfer, Manson, Rosner, Hankinson, Colditz, Willett, & Hennekens,

1997) even suggested that birth weight of less than five pounds may be associated with increasing risk of adult coronary heart disease and stroke.

The body of literature documenting risk factors for cardiovascular disease is significant, and there is consensus among researchers that an individual can greatly reduce his or her risk of coronary artery disease, cerebrovascular disease, and peripheral vascular disease by making appropriate lifestyle changes (Vogler, McClearn, Snieder, Boomsma, Palmer, deKnijff, & Slagboom, 1997; Sutterer, Carey, Silver, & Nash, 1989). The relationship between hyperlipidemia, physical inactivity, obesity, and smoking and an increased incidence of cardiovascular disease is well documented (Hopkins & Williams, 1986; Blair, Kohl, Paffenbarger, Clark, Cooper, & Gibbons, 1995). There is less consensus on hypertension as absolute risk factor, but it remains a reflection of relative risk and one that health care providers must evaluate in light of a client's total cardiovascular risk picture (Alderman, 1995). In addition, nonmodifiable risk factors include family history, age, and male sex, although Hamel and Oberle (1996) have suggested that cardiovascular disease in women may be more common than current statistics show. Studies of twins demonstrate that familial risk of premature coronary heart disease can be attributed substantially to genetics rather than to environmental factors that are common to family members (Vogler et al, 1997).

Atherosclerosis, the process which leads to coronary heart disease and stroke, is intimately linked with hypercholesterolemia, a significant problem in the United States. Data from the National Health and Nutrition Examination Survey showed that 52 million Americans age 20 and older are candidates for dietary or drug therapy, based on blood cholesterol levels of 200 mg/dl or higher (Sempos, Cleeman, Carroll, Johnson, Bachorik, Gordon, Burt, Briefel, Brown, Lippel, & Rifkind, 1993).

Further, the total cholesterol levels of young men have been found to be strongly predictive of cardiovascular disease in midlife (Gotto, 1994). In the Johns Hopkins Precursors Study, members of medical school graduating classes from 1949 to 1964 were followed for 27 to 42 years. Cholesterol levels were measured from one to 11 times while in medical school, and these levels correlated strongly with the development of cardiovascular disease later in life. Risk of coronary heart disease was five times higher for the men with the highest cholesterol levels than it was for men with the lowest cholesterol. A difference of 36 mg/dl in initial total cholesterol was significantly associated with an increased risk of death before age 50 (Klag, Ford, Mead, He, Whelton, Liang, & Levine, 1993).

Almost 30 years ago, information from the Framingham study suggested that independent of other variables, cholesterol was a significant contributor to coronary heart disease and atherothrombotic brain infarctions (Gordon, Sorlie, & Kannel, 1971). Follow-up studies of the Framingham Heart Study showed that for both men and women younger than 50, cardiovascular death rates and deaths due to all causes were directly related to cholesterol levels (Anderson, Castelli, & Levy, 1987).

The Multiple Risk Factor Intervention Trial (MRFIT), concluded that the 6-year risk of death from coronary heart disease in normotensive, nonsmoking, middle-aged men with total cholesterol levels of less than 182 mg/dl was one fourth that of men with cholesterol levels of 245 mg/dl or higher (Multiple Risk Factor Intervention Trial Research Group, 1982).

The National Cholesterol Education Program (NCEP) of the National Heart, Lung, and Blood Institute recommends that adults 20 and older should have a measurement of total blood cholesterol every five years and that lipoprotein analysis should be performed on all clients with coronary heart disease. In the absence of CHD, lipoprotein analysis should be done if: (1) total cholesterol exceeds 240 mg/dl; (2) total cholesterol is 200-239 and the client also has two or more CHD risk factors; or (3) HDL cholesterol is less than 35 mg/dl (Clinician's Handbook of Preventive Services, 1995).

Smoking is an important modifiable risk factor for development of cardiovascular disease and can hardly be overemphasized. Blood pressure and heart rate tend to be higher in smokers. They also have lower levels of protective HDL cholesterol. Nicotine scars the lining of blood vessels, and these roughened blood vessels, coupled with smokers' increased platelet aggregation, hasten atherosclerosis (Fried & Becker, 1993).

The Nurses' Health Study has found that smoking is a dominant contributor to coronary heart disease and that a strong dose-response relationship exists between cigarettes and development of disease (Colditz, 1995). Colditz also reported that for the nurses who quit smoking, the risk of CHD dropped 14% within two years.

Consistent evidence of an association between obesity and cardiovascular disease has been reported in epidemiological studies, but it is not clear whether obesity is an independent risk factor or whether it contributes to other risk factors such as hyperlipidemia and hypertension (Hubert, Feinleib, McNamara, & Castelli, 1983). Several anthropometric measurements have been associated with cardiovascular risk. Excess total body fat is most commonly indexed by body mass index (BMI), but waist/hip ratio (WHR) and waist/thigh ratio (WTR) have also been used. Oshaug, Bugge, Bjonnes, & Ryg (1995) stated that BMI has a direct association with overall mortality in both men and women, but that WHR is the best indicator of visceral fat mass. It is this visceral fat mass that seems to be linked to the development of hypertension, hyperlipidemia, and coronary artery disease. Vogler et al. (1997) proposed that there is a strong genetic component to obesity, regardless of the anthropometric measurement used to index it. Although estimates of the importance of genetic and environmental influences vary among the studies Vogler et al. reviewed, they reported that 40 to 60% of the variability in BMI can be attributed to genetic effects. Colditz (1995) found a strong relationship between weight and risk of heart disease, even concluding that women of average weight are at increased risk.

Regardless of how obesity is measured or whether its cause is behavioral or genetic, it remains predictive of cardiovascular disease. Weight control and the benefits of regular aerobic exercise, therefore, are subjects APNs must address with clients. In one study, mortality rates were compared for men who underwent two physical examinations. Some of the men who were unfit on initial examination became physically fit by the second examination (Blair et al., 1995). In this study, physical fitness was operationalized to exercise test tolerance to a standard treadmill protocol with test duration being the variable of interest. Physical fitness was analagous to aerobic power. The mortality rates of the men who became physically fit by the subsequent exam were 45% lower than the men who were still unfit at the second exam. By comparison, men who were physically fit at both exams had one-third the mortality of the men who were physically unfit at both exams.

Paffenbarger, Lauglin, Gima, & Black (1970) found that longshoremen with more sedentary jobs sustained coronary death rates one third higher than their colleagues with more physically demanding responsibilities. Paffenbarger and Hale (1975) later concluded that repeated bursts of high energy output established a level of protection against coronary mortality.

The relative risk of CHD associated with inactivity varies among studies, but Powell, Thompson, Caspersen, & Kendrick (1987) reported the risk generally ranges from 1.5 to 2.4 with a median of 1.9. They concluded the better studies tend to report higher relative risks associated with inactivity. Further, the risks appear to be similar in magnitude to that of hypertension, hyperlipidemia, and smoking. It is suggested that physical activity may reduce the incidence of CHD by retarding atherosclerosis, altering the structure of coronary arteries, reducing vasospasm, enhancing myocardial electrical stability, or increasing fibrinolysis (Powell et al., 1987).

Hypertension is also considered a risk factor for cardiovascular disease. According to Alderman (1995), there is a linear relationship between blood pressure level and the likelihood of a cardiovascular event, but blood pressure alone is a poor predictor of disease. Among the 325,348 participants in the MRFIT study, those with diastolic pressure of at least 90mm Hg were approximately twice as likely to suffer a heart attack or stroke as those with diastolic pressures less than 90 mm Hg. However, in a 15-year follow-up to the Framingham study, less than one third of the individuals whose only risk factor was a systolic pressure higher than 195 mm Hg (the highest category) had a heart attack or stroke (Madhaven & Alderman, 1981). Alderman (1995) stated that normotensive smokers with an unfavorable family history and high cholesterol are at much higher risk of a cardiovascular event than individuals with low absolute risk, even with significant systolic blood pressure.

In intervention trials, a 5 to 6-mm Hg drop in diastolic pressure was associated with a 42% decrease in cerebrovascular events. Interestingly, this benefit did not vary according to whether the subjects had mild, moderate, or severe hypertension. For coronary events, the protection was less, but the incidence still decreased for all blood pressure reductions, regardless of initial pressure readings (Alderman, 1995).

Current studies seem to suggest that blood pressure reduction in high-risk normotensive clients can decrease incidence of myocardial infarction (The SOLVD investigators, 1991), but that treatment of hypertension should depend on individualized assessment of absolute risk and potential benefit of treatment rather than application of any arbitrary threshold of blood pressure level.

Abnormal glucose metabolism is widely accepted as a risk factor for the development of cardiovascular disease (Hopkins & Williams, 1986; Sutterer, Carey, Silver, & Nash, 1989). Both the Nurses' Health Study and the studies of San Francisco longshoremen concluded that diabetes increases an individual's risk of coronary heart disease and stroke (Colditz, 1995; Paffenbarger, Hale, Brand, & Hyde, 1977). Although a valid risk factor and one that APNs must address in practice, diabetes is outside the scope of this project.

In addition to the risk factors discussed earlier, elevated plasma homocysteine is emerging as a possible cardiovascular risk. Researchers suggest that hyperhomocysteinaemia may be of similar significance to hyperlipidemia as a risk factor for premature atherosclerosis (Still & McDowell, 1998). The mechanism by which homocysteine may cause vascular disease remains poorly defined, but homocysteine levels in the range of 15-30 umol/l have been associated with premature atherosclerosis in several large, case-controlled prospective studies (Still & McDowell, 1998; Bots, Launer, Lindemans, Hofman, & Grobbee, 1997). Folic acid has been implicated as having a role in lowering plasma homocysteine levels, but the optimal folate status has not been determined (Ward, McNulty, McPartlin, Strain, Weir, & Scott, 1997). Research into homocysteine and its relationship to cardiovascular disease continues and warrants attention in the future.

Although the literature abounds with discussion of risk factors and screening of clients at risk of heart disease, few articles discuss screening tools or the questionnaires used to quantify these risks. Laboratory data, anthropometric measurements, even blood pressures all provide quantitative data, but readers are at a loss as to how to determine how many risk factors equals how much risk of cardiovascular disease. A few articles describe assessment tools such as the FANTASTIC Lifestyle Assessment (Mitchell, 1996), the 17-item Duke Health Profile (Parkerson, Broadhead, & Chiu-Kit, 1991), and the Carter Center Health Risk Appraisal used by the HeartSmart Program (Johnson, Powers, Bao, Harsha, & Berenson, 1994), but the assessment tools are either not included in the article or are not specific for cardiovascular disease. Gran (1994) included an interpretation of risk category (below average, about average, somewhat above average, or considerably above average) with the recommended intervention. Gran listed the five classifications of physical activity and how family history of cardiovascular disease was determined ("Did your mother or father or a sibling have a heart attack or stroke before 60 years of age? Yes/No). In summary, the literature is plentiful with respect to the risk factors associated with cardiovascular disease, speficially hyperlipidemia, obesity, physical inactivity, smoking, and hypertension. In general, however, the body of literature lacks a simple, specific, clinically focused tool for evaluation of these cardiovascular disease risk factors.

Conceptual Framework

Theories and frameworks provide direction for research and focus for clinical practice. Understanding the contributing factors of health-protecting behavior is crucial to developing interventions designed to alter clients' behaviors so as to reduce their risk of cardiovascular disease. The Health Belief Model

(HBM) is a psychosocial framework developed to explain individual decision making in terms of health-related behaviors. The usefulness of the Health Belief Model is its ability to examine health beliefs and relationships with other variables, and therefore possibly alter beliefs so that changes in behavior are more likely. See Figure 1.

The HBM was developed in the 1950s by Hochbaum, Kegeles, Leventhal, and Rosenstock as a method for examining why some people take actions to avoid illness while others fail to take protective action (Pender, 1996). The HBM is rooted in select aspects of the theories of Kurt Lewin, who proposed that individuals exist in a life space composed of regions, some of which are positively valued, some of which are negatively valued, while still others are neutral. Diseases were postulated to be areas of negative value, and they could thus be expected to exert a force that would move a person away from that region (Mikhail, 1981). The aspects of Lewin's theories that form the basis of the HBM have to do with goal setting and level of aspiration. Level of aspiration is defined as the degree of difficulty of attaining the goal to which the person is striving (Rosenstock, 1974). When it is necessary to choose between different levels of difficulty, the choice is made based on the relative valence of these levels and the individual's subjective probability of success. According to Lewin, a goal deemed reasonably probable will be chosen over one deemed highly improbable even though the improbable success is more highly valued. The theory holds that most people aspire to levels that are close to or only slightly higher than their performance in the past (Becker, 1974).

The HBM proposes that the likelihood of a person taking action relative to a health problem is determined by the person's readiness to take action and by the perceived benefit of the action minus the perceived barriers to taking the action. That emphasis on subjectivity is the heart of the Health Belief Model. The most important variables in the model deal with the current subjective state of the client. Postulates in the theory include: (1) the degree to which a person is psychologically ready to take action as it relates to a health condition is determined by the individual's perceived susceptibility or vulnerability to contracting the condition and perceptions of the severity of the condition should they contract it; (2) the person's evaluation of the proposed health action is evaluated in terms of its feasibility and effectiveness measured against his or her perception of barriers or costs to the proposed action; and (3) a stimulus, either internal (such as symptoms) or external (such as the experience of family member or friend or media exposure) must serve as a cue to action to trigger the relevant health behavior (Becker & Maiman, 1975). Thus, in order for individuals to take action to avoid heart disease, they would need to believe that they are personally susceptible to heart disease and that its development would negatively affect some aspect of their lives. In addition, they would have to believe that taking a particular action, such as beginning an exercise program, would reduce either their susceptibility to disease or its severity. Finally, they would have to believe that taking the health-protecting action would not entail overcoming important psychological barriers, such as cost, convenience, pain, or embarrassment (Rosenstock, 1974).

In addition to these elements, modifying factors are thought to affect the course of action (Mikhail, 1981). Modifying factors include demographic variables (age, sex, cultural influences), sociopsychological variables (personality, social class, peer or reference group), and structural variables (knowledge about or previous experience with a disease).

Motivation, only assumed in the original Health Belief Model, was added to the model in its second generation (Becker & Maiman, 1975). Defined as "differential emotional arousal in individuals caused by some given class of stimuli, for example, health matters" (Becker & Maimain, 1975, p. 17), motivation is conceptualized as concern about general health matters, willingness to seek and accept medical care, intent to comply, and demonstration of positive health behaviors. In the second generation of the model, modifying factors were expanded and classified as demographic, structural, attitudinal, interactional, and enabling. Cost, duration, complexity of side effects, and accessibility of treatment were added as structural factors.

The Health Belief Model has been used in innumerable articles relating to preventive and health-promoting behaviors. It has been used to predict compliance with antihypertensive medication therapy, exercise behaviors, dietary compliance, use of condoms to prevent sexually transmitted diseases, and determinants of immunization behavior, among others (Becker et al., 1979). Its emphasis on the client's subjective state and its preventive focus make it an appropriate paradigm for assessment of risk factors for cardiovascular disease and development of interventions to reduce clients' risks.

Providing education with the aim of affecting clients' perceived susceptibility is the most obvious arena for APNs to make a difference, and one study suggests that cardiovascular risk-reducing behaviors may be reinforced by knowledge of a positive coronary artery computed tomography scan (Wong et al., 1996). Other studies indicate that knowledge alone is not enough to affect likelihood of undertaking the health-promoting behavior (Sutterer et al, 1989) and suggest that social support (a sociopsychological modifying factor) also plays a role in behavior changes (Terborg et al., 1995). In a study examining the usefulness of the HBM for explaining attendance at a supervised heart disease exercise program, health motivation and perceived severity of CHD were significantly associated with exercise adherence, as operationalized by attendance (Mirotznik et al., 1995). Clearly knowledge alone is not a significant motivating factor. Moylan & Joyce (1993) stressed that nursing professionals need to develop strategies to overcome perceived barriers, which Janz & Becker (1984) considered the most powerful of the HBM dimensions.

In summary, this scholarly project will evaluate three existing indices for the risk of cardiovascular disease with respect to the modifiable risk factors of interest: hyperlipidemia, smoking, hypertension, obesity, and physical inactivity. The project will use the Health Belief Model as the conceptual framework and the risk assessment tools will be evaluated not only for how well they address the modifiable risk factors identified earlier but also for how well they address the central concepts of the Health Belief Model. Those concepts include perceived susceptibility and perceived severity of disease (which together form perceived risk), perceived barriers to risk-reducing behaviors, and perceived benefits of engaging in risk-reducing behaviors.

The outcome of this project will identify the most appropriate and clinically useful tool that APNs can use to identify individuals at highest risk for cardiovascular disease. The most appropriate tool will also take into consideration the critical elements of the HBM, a framework that the APN can use in working with clients to develop interventions to reduce their cardiovascular risk.

Evaluation of Tools

The three tools evaluated have a number of similarities and differences. Each addresses the risk factors of blood pressure, lipid levels, and smoking, although they vary in how the variables are quantified and weighted. The instruments all fail to address two of the risk factor identified in the literature as significant to the development of cardiovascular disease: obesity and physical inactivity. The tools also vary in their ease of use and appropriateness to the clinical setting with the Thorsen device having the most clinical utility and the remaining tools being more appropriate as research instruments.

Although all of the tools yield objective data that may be used by APNs to educate clients about susceptibility to cardiovascular disease, none deals with the client's perception of susceptibility. None of the tools addresses the perceived severity component of perceived risk or barriers to adopting change. The instruments share an ability to show clients numerically how reducing risk factors can reduce probability of heart disease within given time frames, so benefits of change is handled in a quantifiable manner, but none deal with the subjective state of the client that is so fundamental to the Health Belief Model. The subjective state of a patient does not affect true risk, but it does affect the likelihood of the person adopting changes in behavior to reduce risk of cardiovascular disease.

Each instrument was evaluated on a five-point Likert scale for how well it addressed each of the risk factors of interest (hyperlipidemia, hypertension, smoking, obesity, and physical inactivity). The same scale was applied to the instruments relative to clinical utility and degree of fit with the Health Belief Model. In all cases, 1=poor, 2=marginally acceptable, 3=moderate, 4=good, 5=superior. The points were then added and the instrument with the highest total was determined the most appropriate. See Table 1.

Thorsen et al. (1979) developed a slide rule that computes risk of a future coronary event based on age, smoking, serum cholesterol level and blood pressure. The instrument consists of two rotating disks and a movable hairline tab all having a common center. See Figure 2. The APN can show clients quickly and concretely how adopting risk-reducing behaviors, such as lowering cholesterol and quitting smoking, translate into reduced susceptibility to coronary heart disease. Unfortunately, the other risk factor the Thorsen instrument uses is age, which is not modifiable. This lessens its fit with the HBM slightly as even if the client perceives a high degree of risk, high benefits to adopting change and low barriers, he or she cannot do anything to change the risk associated with age. An advantage of this device is that clear instructions for its use appear in the article.

Disadvantages include that the practitioner would have to construct the device or contact the author(s) to determine if a slide rule is available. Computer programs likely make such a device outdated now, but for rapid ease of use in a clinical setting, this instrument could be used much like a pregnancy wheel that calculates estimated date of delivery. Another disadvantage of the Thorsen slide rule is that the data upon which it was constructed was based on a five-year prospective study of 2,571 initially healthy men ages 40-59. This potentially limits its usefulness with men outside that age category, women of all ages, and clients with comorbid illnesses.

The data needed to use the tool are easily obtainable in an office visit through history, physical exam, and simple laboratory tests. The self-reporting nature of number of cigarettes smoked leaves open the possibility of errors introduced through reporting problems. In its favor, the Thorsen tool is the only one of the three that treats the number of cigarettes smoked as ordinal data instead of nominal and allows for the dose-response relationship that the literature supports (Colditz, 1995).

The Thorsen instrument is of marginal philosophical fit with the Health Belief Model. It shows a bit more easily than the Anderson et al. instrument or the Kannel and Schatzkin tool the benefits of adopting risk-reducing behaviors so it can be used to educate patients about susceptibility and alter their perceptions about benefits of quitting smoking, exercising, and reducing cholesterol, for example. However, it fails to address any of the subjective elements so critical to evaluating the likelihood that the patient will engage in health-promoting or risk-reducing behavior.

The instrument developed by Anderson et al. (1991) is composed of a two sets of tables, one for men and one for women. Each set of tables assigns points based on the patient's age, HDL and total cholesterol levels, systolic blood pressure, smoking status, and presence of diabetes or left ventricular hypertrophy. Points are then totaled and a probability given of developing coronary heart disease with five and 10 years. This instrument also appears in the literature under the name of authors Kannel and Wolf. This Anderson et al. version of the instrument was selected for this project based on the more complete description of its design.

Benefits of this device include the use of both HDL and total cholesterol for determining risk due to dyslipidemia and the inclusion of data to increase applicability to women. However, there is no assessment of obesity and physical inactivity, and cigarette smoking is treated as a nominal variable. The authors provide logistic equations for only the blood pressure risk determination. The computed positive predictive probability is p=.16 for men and p=.22 for women. Because this is a screening device, the low positive predictive probability is acceptable since it is understood that some number of individuals with false positive readings will be included. If the device were intended to be diagnostic, the p values would be unacceptable. The predictive ability of the remaining equations is not included.

The Anderson tool is of similar theoretical fit with the HBM as Thorsen instrument given its exclusion of any method of assessing patient perception of susceptibility, severity, benefits, and barriers. It is slightly more cumbersome to use, and therefore of slightly lower clinical utility than the Anderson tool for showing patients the benefits of adopting health-promoting activities. For example, showing the benefits of lowering cholesterol requires a recalculation of total risk points rather than a simple turn of the slide rule.

The final instrument evaluated is that of Kannel and Schatzkin (1983). Like Anderson et al., it consists of charts for men and women where points are given based on systolic blood pressure, presence of left ventricular hypertrophy and glucose intolerance, age, and serum cholesterol. Points are totaled and the practitioner then finds the corresponding probability of the patient developing coronary heart disease within six years.

There are a number of shortcomings to the Kannel and Schatzkin instrument, the most fundamental being that the tool lacks directions for its use. Although the charts appear straightforward, they are clinically cumbersome. Age and serum cholesterol are combined mathematically to produce one point value, but nowhere on the chart are instructions for making the calculation. Further compounding the confusion is a chart of HDL levels with multiplication factors. It is unclear whether the cholesterol level to be used in computing the age/cholesterol value is total serum cholesterol or HDL level and how the practitioner should use the HDL multiplication factors listed.

Like the other tools evaluated, Kannel and Schatzkin do not address obesity or physical inactivity. Although smoking is addressed, it is treated as a nominal variable in the chart for men and not included in the point calculation for women at all. This is a definite shortcoming in its usefulness.

This instrument performed at the same level as the Thorsen and Anderson tools relative to fit with the Health Belief Model and for the same reasons. It fails to take into consideration the subjective elements that determine likelihood of adopting change. Kannel and Schatzkin discuss that modifiability is not an absolute requirement for a given characteristic to be a risk factor. Although the HBM includes demographic and sociopsychological variables that are permanent, the entire focus of the framework is on the subjective evaluation of risk and the benefits of risk-reducing behavior. In addition, its low clinical utility lessens its impact for use in educating patients about the benefits of adopting risk-reducing behaviors.

In summary, the above instruments all fail to address obesity and physical inactivity as risk factors. They are of comparably low merit when used in context of the Health Belief Model since none of the tools address the patient's subjective state. Ease of use and calculation of lipids and smoking were most pivotal in determining final ranking. The Thorsen tool scored highest, with Anderson next and Kannel and Schatzkin placing third.

This evaluation points to the need for a more comprehensive risk assessment tool that takes into consideration more of the known risk factors for cardiovascular disease. The poor performance of all the tools relative to the Health

Belief Model points out the need for an assessment tool that includes the elements most predictive of a person engaging in health-protecting behaviors. The literature supports the importance of perceived susceptibility and barriers relative to whether an individual engages in health-promoting behavior (Janz & Becker, 1984). To ignore these subjective states of patient is to treat them in a biological model only and not the biopsychosocial model upon which APN practice is based.

Summary and Implications for Practice

Heart disease kills two in five Americans and costs the country billions of dollars in health care and lost productivity. While family history and age are risk factors that patients cannot change, many of the factors that contribute a person's risk of developing cardiovascular disease are products of lifestyle choices. Smoking, obesity, hypertension, hyperlipidemia, and physical inactivity have all been shown to play a role in heart disease, and yet each of these can be modified by adopting risk-reducing behaviors.

Advanced practice nurses in family practice see clients every day who present with these risk factors. They are in a fortuitous position to make an impact on clients' cardiovascular health. By assessing clients for their modifiable and nonmodifiable risk factors, APNs can determine how susceptible a client is to heart disease. Nurse practitioners can then educate clients as to their personal risk profiles and work with them to develop interventions aimed at lowering their risk.

The Health Belief Model is an appropriate conceptual framework on which to base patient counseling regarding risk of disease. If clients lack an internal cue to action such as symptoms of cardiovascular disease, APNs serve as an external cue to action. They provide information to affect the client's perceived susceptibility and perceived severity, which combine to form perceived risk. Nurse practitioners can also demonstrate the positive impact to clients of adopting health-protecting behaviors such as lowering cholesterol or quitting smoking.

The availability of a simple, clinically useful tool that quantifies threat of cardiovascular disease based on modifiable risk factors would be of great benefit to APNs. Unfortunately, although the literature abounds with discussion of known risk factors, the tools either fail to measure up either in specificity for heart disease, in comprehensiveness of risk factors, or in clinical utility. Further, none of the risk assessment devices takes into consideration the subjective state of the client that is so critical to the likelihood of the person actually engaging in risk-reducing behaviors.

Among the tools evaluated, the Thorsen et al. slide rule ranks highest relative to addressing the identified risk factors and ease of use, although it fares no better than Anderson et al. or Kannel and Schatzkin in terms of fit with the HBM. This evaluation supports the need for the development of a comprehensive, simple assessment tool that can be used systematically to gather data about clients' risk factors and their perceptions of susceptibility, benefits to change, and barriers. The ideal tool could be used quickly, making use of data available through history, physical exam, and simple laboratory tests. It should be applicable to men and women of all ages, with or without comorbid illnesses. This device should produce a score that could be recorded in the client's chart and be reevaluated to track progress in reducing risk or heart disease.

This project has several limitations. First, it is limited by its exclusion of glucose intolerance as a risk factor. Although Hopkins and Williams (1986) concede that it is common for investigators to focus on their favorite risk factors, diabetes remains a major risk that should be included for the most comprehensive evaluation possible.

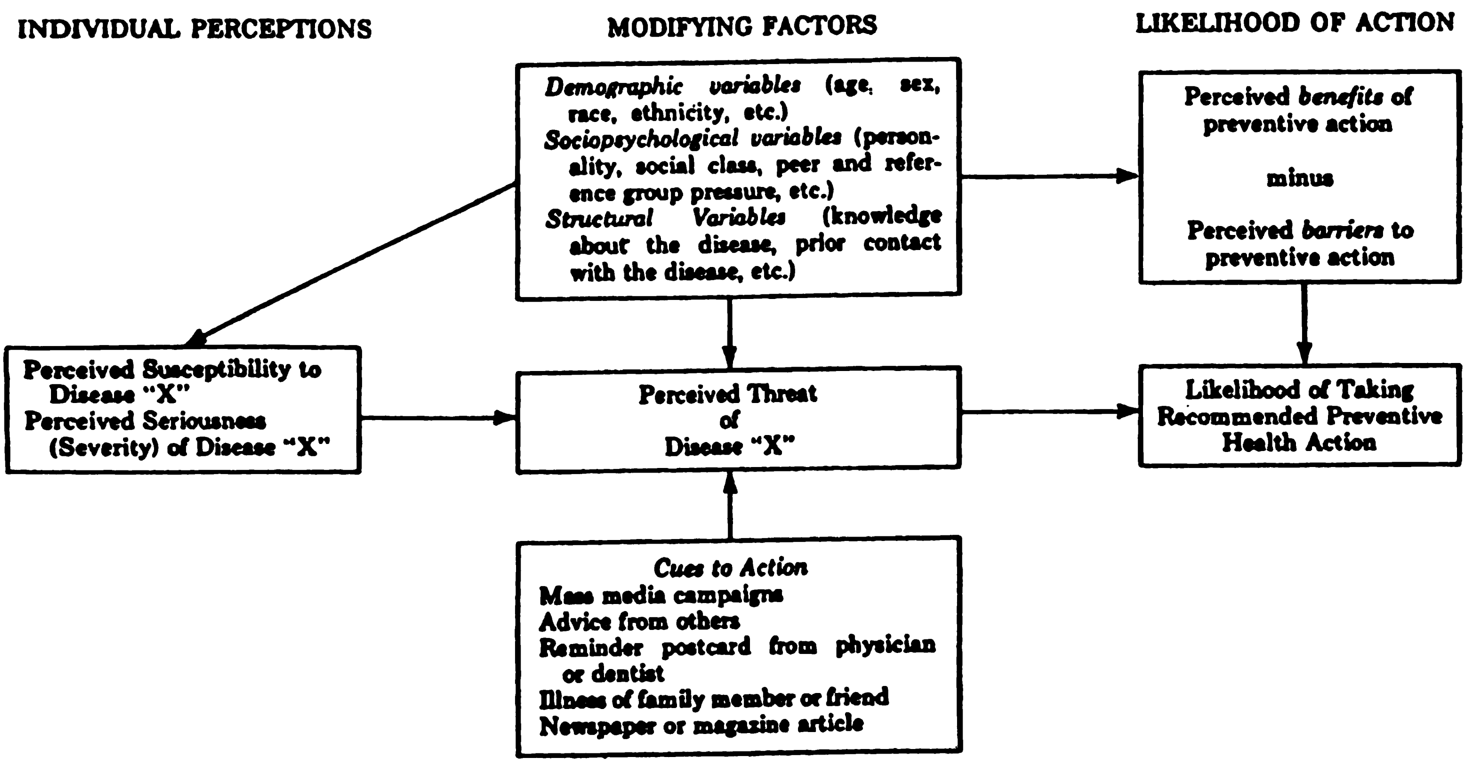
Secondly, although the Thorsen et al., Anderson et al., and Kannel and Schatzkin tools all perform poorly relative to fit with the Health Belief Model, their developers were not concerned with implementation based upon a theoretical model. Rather, they were focused on predictive value of the various risk factors in terms of eventual development of disease. Certainly the tools would be more useful to APNs if they had a theoretical basis, but one must acknowledge the authors' intent in developing the instruments.

Lastly, the Health Belief Model itself has several shortcomings. Behaviors in cardiovascular risk reduction contain both habitual and environmental influences distinct from personal perceptions. Smoking, for example, contains a strong habitual component, and the HBM's emphasis on attitudes and beliefs may make it less useful among smokers whose behavior is largely habitual. Further, although perceived barriers is thought to be the most predictive component of a person adopting change, it remains the most poorly defined dimension of the HBM and can include almost any internal or external negative force working against the desired health-related behavior. Rosenstock, among others, has called for advances in explaining, predicting, and controlling for this catch-all quality.

The major contribution of this project is the support for future research to develop a more inclusive, clinically useful tool that addresses both objective data and the subjective state of the client. The necessary research would first require retrospective studies to determine the most significant risk factors and then long-term prospective studies to evaluate whether interventions to reduce risk factors resulted in less heart disease. Future research could be both quantitative and address incidence of disease or it could be qualitative and measure severity of disease. Advanced practice nurses have a role in research and could be instrumental in such studies.

An assessment instrument that meets the criteria of inclusiveness and clinical utility would be of great assistance to APNs and could play a role in helping clients to reduce their risk of developing cardiovascular disease.

Figure 1

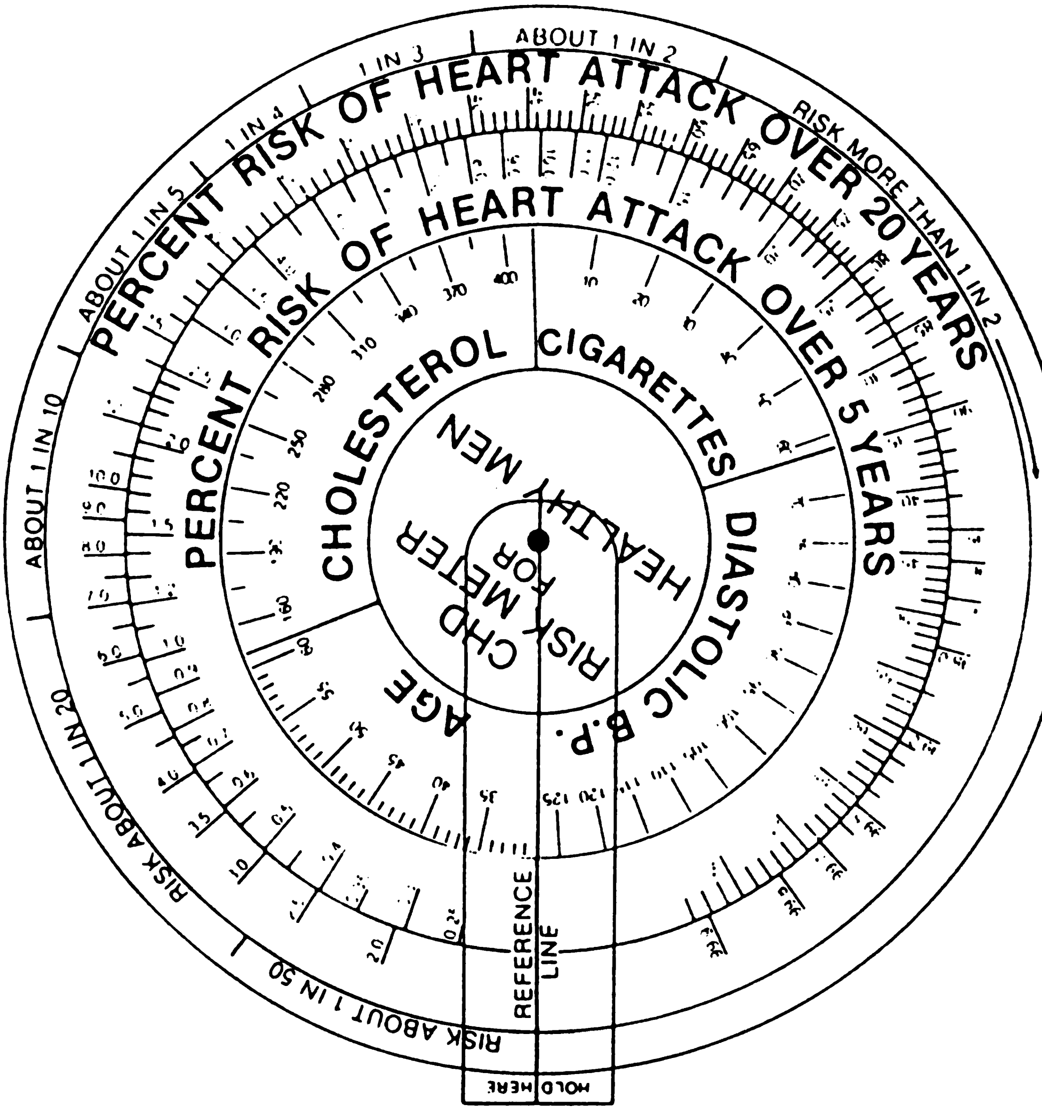


The Health Belief Model (Becker & Maiman, 1975)

Table 1

	Anderson et al.	**Kannel & Schatzkin**	**Thorsen et al.**
Lipids	5	2	3
Hypertension	3	3	3
Smoking	2	1	5
Obesity	1	1	1
Physical inactivity	1	1	1
Ease of use	2	2	4
Fit with HBM	2	2	2
Total	16	12	19

Figure 2



Slide rule for calculating risk of cardiovascular disease

(Thorsen et al., 1979)

BIBLIOGRAPHY

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Alderman, M. (1995). Quantifying cardiovascular risk in hypertension. *Cardiology Clinics, 13*(4), 519-527.

Anderson, K., Castelli, W., & Levy, D. (1987). Cholesterol and mortality: 30 years of follow-up from the Framingham Study. *Journal of the American Medical Association, 257,* 2176-2180.

Anderson, K., Wilson, P., Odell, P., & Kannel, W. (1991). An updated coronary risk profile: A statement for health professionals. *Circulation, 83,* 356-362.

Becker, M (1974). The Health Belief Model and sick role behavior. In M. Becker (Ed.), *The Health Belief Model and personal health behavior*. Thorofare, NJ: Charles Slack.

Becker, M., & Maiman, L. (1975). Sociobehavioral determinants of compliance with health and medical recommendations. *Medical Care, 13,* 10-24.

Becker, M., Maiman, L., Kirscht, J., Haefner, D., Drachman, R., & Taylor, D. (1979). Patient perceptions and compliance: Recent studies of the Health Belief Model. In W. Hayes, P. Talor, & J. Sackett (Eds.), *Compliance in health care* (pp. 78-109). Baltimore: Johns Hopkins University Press.

Blair, S., Kohl, H., Paffenbarger, R., Clark, D., Cooper, K., & Gibbons, L. (1995). Physical fitness and all-cause mortality: A prospective study of healthy men and women. *Journal of the American Medical Association, 262,* 2395-2401.

Bots, M., Launer, L, Lindemans, J., Hofman, A., & Grobbee, D. (1997). Homocysteine, atherosclerosis and prevalent cardiovascular disease in the elderly: The Rotterdam Study. *Journal of Internal Medicine, 242,* 339-347.

Colditz, G. (1995). The Nurses' Health Study: A cohort of women followed since 1976. *Journal of the American Medical Women's Association, 50*(2), 40-44.

Fried, L, & Becker, D. (1993). Smoking and cardiovascular disease. In P. Douglas (Ed.), *Cardiovascular health and disease in women* (pp. 217-230). Philadelphia: Saunders.

Gordon, T., Sorlie, P., & Kannel, W. (1971). Coronary heart disease, atherothrombotic brain infarction, intermittent claudication: A multivariate analysis of some factors related to their incidence. *Framingham Study: An epidemiological investigation of cardiovascular disease*(Section 27). Washington, DC: Government Printing Office.

Gotto, A. (1994). Cholesterol levels in young adults: Screen and intervene? *Hospital Practice, March 15,* 109-116.

Gran, B. (1994). Population based CVD health risk appraisal. *Scandanavian Journal of Social Medicine, 4*, 256-263.

Hamel, L., & Oberle, K. (1996). Cardiovascular risk screening for women. *Clinical Nurse Specialist, 10*(6), 275-279.

Hopkins, P., & Williams, R. (1986). Identification and relative weight of cardiovascular risk factors. *Cardiology Clinics, 4*(3), 3-31.

Hubert, H., Feinleib, M., McNamara, P., & Castelli, W. (1983). Obesity as an independent risk factor for cardiovascular disease: A 26-year follow-up of participants in the Framingham heart study. *Circulation, 67,* 978-987.

Janz, N., & Becker, M. (1984). The Health Belief Model: A decade later. *Health Education Quarterly, 11*(1), 1-47.

Johnson, C., Powers, C., Bao, W., Harsha, D., & Berenson, G. (1994). Cardiovascular risk factors of elementary school teachers in a low socioeconomic area of a metropolitan city: The Heart Smart Program. *Health Education Research, 9*(2), 183-191.

Kannel, W., & Schatzkin, A. (1983). Risk factor analysis. *Progress in Cardiovascular Disease, 26*(4), 309-332.

Kannel, W., & Wolf, P. (1992). Pulling it all together: Changing the cardiovascular outlook. *American Heart Journal, 123,* 264-266.

Klag, M., Ford, D., Mead, L., He, J., Whelton, P., Liang, K., & Levine, D. (1993). Serum cholesterol in young men and subseqent cardiovascular disease. *New England Journal of Medicine, 328*(5), 313-318.

Kwiterovich, P. (1995). Detection and treatment of elevated blood lipids and other risk factors for coronary artery disease in youth. *Annals of the New York Academy of Sciences, 748,* 313-330.

Madhaven, S., & Alderman, M. (1981). The potential effect of blood pressure reduction on cardiovascular disease: A cautionary note. *Archives of Internal Medicine, 141,* 1583-1588.

Mikhail, B. (1981). The Health Belief Model: A review and critical evaluation of the model, research, and practice. *Advances in Nursing Science, October,* 65-82.

Mirotznik, J., Feldman, M., & Stein, R. (1995). The Health Belief Model and adherence with a community center-based, supervised coronary heart disease exercise program. *Journal of Community Health, 20*(3), 233-247.

Mitchell, J. (1996). Patient health questionnaire: Using a patient-focused assessment tool. *Canadian Family Physician, 42,* 505-511.

Moylan, G., & Joyce, P. (1993). The achievement of dietary goals in patients with documented CAD: A test of Nola Pender's Health Promotion Model. *Nursing Scan in Research, 6*(6), 3-4.Multiple Risk Factor Intervention Trial Research Group (1982). Multiple Risk Factor Intervention Trial: Risk factor changes and mortality results. Journal of the American Medical Association, 248(12), 1465-1477.

Multiple Risk Factor Intervention Trial Research Group (1982). Multiple Risk Factor Intervention Trial: Risk factor changes and mortality results. *Journal of the American Medical Association, 248*(12), 1465-1477.

Murray, D., Luepker, R., Pirie, P., Grimm, R., Bloom, E., Davis, M., & Blackburn, H. (1986). Systematic risk factor screening and education: A community-wide approach to prevention of coronary heart disease. *Preventive Medicine, 15,* 661-672.

National Center for Health Statistics (1995). Leading Causes of Death.

Office of Technology Assessment (1986). Nurse practitioners, physician assistants, and certified nurse midwifes: A policy analysis. *Health Technology Case Study #37*, December.

Oshaug, A., Bugge, K., Bjonnes, C., & Ryg, M. (1995). Use of anthropometric measurements in assessing risk for coronary heart disease: A useful tool in worksite health screening? *International Archives of Occupational and Environmental Health, 67,* 359-366.

Paffenbarger, R., & Hale, W. (1975). Work activity and coronary heart mortality. *New England Journal of Medicine, 292*(11), 545-550.

Paffenbarger, R., Hale, W., Brand, R., & Hyde, R. (1977). Work-energy level, personal characteristics, and fatal heart attack: A birth-cohort effect. *American Journal of Epidemiology, 105*(3), 200-213.

Paffenbarger, R., Laughlin, M., Gima, A., & Black, R. (1970). Work activity of longshoremen as related to death from coronary heart disease and stroke. *New England Journal of Medicine, 282*(20), 1109-1114.

Parkerson, G., Broadhead, W., Chiu-Kit, J. (1991). Development of the 17-item Duke Health Profile. *Family Practice, 8*(4), 396-401.

Pender, N. (1996). Motivation for health behavior. *Health promotion in nursing practice* (3rd ed., pp. 35-37). Stamford, CT: Appleton & Lange.

Powell, K., Thompson, P., Caspersen, C., & Kendrick, J. (1987). Physical activity and the incidence of coronary heart disease. *Annual Review of Public Health, 8,* 253-287.

Public Health Service's Office of Disease Prevention and Health Promotion (1996). *Clinician's handbook of preventive services: Put prevention into practice.* Washington, DC: Author.

Rich-Edwards, J., Stampfer, M., Manson, J., Rosner, B., Hankinson, S., Colditz, G., Willett, W., & Hennekens, C. (1997). Birth weight and risk of cardiovascular disease in a cohort of women followed up since 1976. *British Medical Journal, 315,* 396-400.

Rosenstock, I. (1974). Historical origins of the Health Belief Model. *Health Education Monographs, 2*(4), 328-335.

Selig, P. (1991). The prevention and screening of cardiovascular disease: An update. *Nurse Practitioner Forum, 2*(1), 14-18.

Sempos, C., Cleeman, J., Carroll, M., Johnson, C., Bachorik, P., Gordon, D., Burt, V., Briefel, R., Brown, C., Lippel, K., & Rifkind, B. (1993). Prevalence of high blood cholesterol among US adults. *Journal of the American Medical Association, 269*(13), 3009-3014.

The SOLVD Investigators (1991). Effect of enalapril on survival in patients with reduced left ventricular ejection fractions and congestive heart failure. *New England Journal of Medicine, 325,* 293-302.

Sommers, J. Andres, F., & Price, J. (1995). Perceptions of exercise of mall walkers utilizing the Health Belief Model. *Journal of Health Education, 26*(3), 158-166.

Still, R., & McDowell, I. (1998). Clinical implications of plasma homocysteine measurement in cardiovascular disease. *Journal of Clinical Pathology, 51*(3), 183-188.

Sutterer, J., Carey, M., Silver, D., & Nash, D. (1989). Risk factor knowledge, status, and change in a community screening project. *Journal of Community Health, 14*(3), 137-147.

Terborg, J., Hibbard, J., & Glasgow, R. (1995). Behavior change at the worksite: Does social support make a difference? *American Journal of Health Promotion, 10*(2), 125-131.

Thorsen, R., Jacobs, D., Grimm, R., Keys, A., Taylor, H., & Blackburn, H. (1979). Preventive cardiology in practice: A device for risk estimation and counseling in coronary disease. *Preventive Medicine, 8,* 548-556.

Vogler, G., McClearn, G., Snieder, H., Boomsma, D., Palmer, R., deKnijff, P., & Slagboom, P. (1997). Genetics and behavioral medicine: Risk factors for cardiovascular disease. *Behavioral Medicine, 22,* 141-149.

Ward, M., McNulty, H., McPartlin, J., Strain, J., Weir, D., & Scott, J. (1997). Plasma homocysteine, a risk factor for cardiovascular disease, is lowered by physiological doses of folic acid. *Quarterly Journal of Medicine, 90,* 519-524.

Wong, N., Detrano, R., Diamond, G., Rezayat, C., Mahmoudi, R., Chong, E., Tang, W., Puentes, G., Kang, X., & Abrahamson, D. (1996). Does coronary artery screening by electron beam computed tomography motivate potentially beneficial lifestyle behaviors? *American Journal of Cardiology, 78,* 1220-1223.