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# Cardiology Best Practice – Effective Health Education Meets Biomedical Advances: Reducing the Ultimate Knowledge Translation Gap

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## 1. Introduction

The long-term outcomes of biomedical advances in cardiology and surgery, the focus of this book, fall short of their potential unless coupled with changes in patients' lifestyle behaviors. Within the context of a busy, resource- and time-constrained practice, this chapter presents practical and effective evidence-informed strategies for health education that can be readily implemented by the cardiologist and surgeon. Given the unequivocal link between lifestyle behaviors and ischemic heart disease, 'healthy living' not only promises to augment a patient's health overall and reduce the need for drugs and surgery but, when biomedical interventions are indicated, it can augment their outcomes.

Based on epidemiological indicators this century, effective health education needs to be a clinical competency that is practiced systematically and inter-professionally and whose outcomes are routinely and quantitatively evaluated over time. Strategies that are most amenable to being integrated into cardiology practice involve initiating and supporting such education rather than the cardiologist or surgeon necessarily being the primary educator. Clinicians need practical effective strategies; these include expedient means of assessing the patient's needs, targeting and tailoring health education to these needs, identifying patient learning outcomes, and following-up systematically.

## 2. The ultimate knowledge translation gap

Although the associations among lifestyle behaviors (primarily smoking, nutrition and exercise) and health and ischemic heart disease are well documented (see reviews Dean et

al. 2009a; Dean et al. 2009b; Joint WHO/FAO Expert Consultation, 2002; Neuhouser et al. 2002; World Health Organization, 2002, & 2011; Yusuf et al. 2004; Yusuf et al. 2005), most adults and many children have one or more risk factors for ischemic heart disease. In the adult population, risk factors are often coupled with one or more manifestations of the condition. This trend is projected to reduce life expectancy this century for the first time in recorded history (Olshansky et al. 2005). The persisting gap between the scientific community's knowledge about the associations between lifestyle and health, and the prevalence of chronic lifestyle-related conditions is not acceptable (Glasgow et al. 2004), nor socially and economically sustainable (World Health Organization, [www.who.int/mediacentre/factsheets/fs172/en/](http://www.who.int/mediacentre/factsheets/fs172/en/)). Health education that is effective and seamlessly supported by an inter-professional team is needed to bridge this ultimate knowledge translation gap.

The pandemic of lifestyle-related conditions reflects multiple influences ranging from the capacity of health professionals to educate patients effectively, and the adherence of patients to health recommendations. Patient adherence to the most fundamental evidence-based lifestyle and health knowledge appears marginal at best even when they are confronted by the proverbial wake-up call (Blanchard et al. 2008). Of interest is that adverse lifestyle practices such as smoking, suboptimal nutrition, overweight and obesity, sedentary behavior, lack of regular physical activity, suboptimal sleep and undue stress now contribute to several of the ten leading causes of premature death in North America and in other high-income countries. With westernization this trend is appearing increasingly in middle- and low-income countries (Beaglehole & Yach, 2003; Mortality Country Fact Sheets, 2006) that stand to benefit from the western experience. Given the common lifestyle behavior pathway and associated low-level inflammation associated with a western lifestyle and related conditions (Bruunsgaard, 2005), effectively educating patients about lifestyle changes related to health risks and the risk of ischemic heart disease or its manifestations would help to reduce the prevalence of other chronic lifestyle-related conditions such as hypertension, stroke, type 2 diabetes mellitus, obesity, and even cancer (Dean et al. 2011). Although health professionals have a major role in promoting public health policy, this topic extends beyond the scope of this chapter, hence, is addressed elsewhere.

## **2.1 Lifestyle behaviors associated with ischemic heart disease**

All of the most deleterious health risk lifestyle behaviors, namely, smoking, suboptimal nutrition, obesity, inactivity, sleep deprivation and excess stress, are implicated in the pathoetiology of ischemic heart disease (Soler et al. 2010). Smoking has been described as the leading cause of preventable premature death (Mokdad et al. 2004). About twenty percent of American adults continue to smoke despite widespread public health campaigns and health policy legislation (Dube et al. 2010). Further, two thirds of the population is overweight or obese. And, although physical inactivity has long been known to be deleterious to health and claimed to be the leading public health priority this century (Blair, 2009; Thompson et al. 2003), prolonged periods of being sedentary has been identified as an independent risk factor for lifestyle-related conditions (Healy et al. 2008; Jakes et al. 2003; Stannard & Johnson, 2004; Biddle et al. 2010; Thorpe et al. 2010). Lastly, many North Americans have been reported to be chronically sleep deprived (Coren, 2009), and have stress levels long been known to be deleterious to health (DeLongis, 1988). One or more of these risk factors in combination can contribute to ischemic heart disease.

Although the literature has focused on adults, the pandemic of lifestyle risk factors for ischemic heart disease in children is also well documented (Berenson et al. 1998). Children with adverse lifestyle practices constitute the new wave of adults with this condition who will manifest signs and symptoms at an earlier age; a trend that is changing priorities in pediatric practice. This trend has implications for health education involving the family given the shared lifestyle of adults and their children (Gidding et al. 1999) as well as the need for the health care community to support public health initiatives related to smoking cessation, healthy eating and active living.

## 2.2 Health living is the best revenge

Few clinicians would argue the benefits of a healthy lifestyle to overall health and wellbeing, and risk factor reduction for ischemic heart disease and its prevention. What appears to be less well appreciated however are the effect sizes of healthy living practices. Small changes in weight and physical activity for example can reap appreciable benefits with respect to risk reduction of lifestyle-related conditions, reversing pathology in some cases, as well as managing these conditions (Dean, 2009a; Dean, 2009b; World Health Organization, 2003). Knowledge of these relative effects sizes can provide powerful incentives to clinicians in motivating their patients and to the patients themselves.

In one exemplary study of over 23,000 people between 35 and 65 years old, Ford and colleagues (Ford et al. 2009) reported that over an eight year period, people who did not smoke; had a body mass index of less than 30; were physically active for a minimum of 3.5 hours a week; and ate healthily had an 81% lower risk of myocardial infarction; an outcome few medical advances could achieve. Further, by following these non-stringent lifestyle practices, type 2 diabetes mellitus was reduced by 93%, stroke by 50% and cancer by 36%. Even if not all four health factors were present, risk of developing a chronic lifestyle-related condition decreased commensurate with an increase in the number of positive lifestyle factors.

Health behavior change with respect to diet and exercise has also long been known to normalize blood pressure and blood lipids, and help reverse atherosclerosis (American College of Sports Medicine, 2009 and 2010; American Heart Association, 2003; Ornish, 1998; Ornish et al. 1998). Nutritional regimens such as Mediterranean type diets and the DASH diet (Dietary Approaches to Stop Hypertension) are highly evidence based in terms of their capacity to control risk factors for ischemic heart disease and type 2 diabetes mellitus (Sofi et al, 2008; Sacks et al, 1995; Appel et al, 1997). Given these compelling findings that few if any drugs can replicate systematically, health behavior change needs to be viewed and expediently practiced with the same rigor and precision as the prescription of drugs or conducting a surgical procedure.

Hypertension is a major contributing factor in ischemic heart disease for which diet and exercise can address in many cases (Task Force for the Management of Arterial Hypertension, 2007). Even reducing daily salt intake as little as one-third has been projected to reduce the cases of hypertension in the United States by 11 million cases annually (25% reduction), and associated health care costs by \$1.7 billion (Report of the Institute of Medicine of the National Academy of Sciences, 2010).

Obesity is a strong independent risk factor for hypertension (Shaper, 1996), and both conditions are strongly associated with ischemic heart disease. Strategies for sustained weight management and control have shifted from calorie restriction to good nutrition.

### 2.3 Health education as a clinical competency

Effective patient health education is aimed at not only reducing a patient's need for drug therapy, surgery, or both, but minimizing the social and economic burdens of ischemic heart disease to his or her family and community. Promoting healthy lifestyle behaviors targets the causes or principal factors that contribute to ischemic heart disease, which is distinct to a primary focus on reducing its signs and symptoms. Further, 'healthy living' minimizes the indications for drugs and surgery and the degree of their invasiveness and, if indicated, may augment their outcomes.

### 2.4 Cardiologists as health educators

Medical curricula are overwhelmed and replete with the need to assimilate the exponential growth of biomedical knowledge. Despite the evidence supporting the unequivocal benefits of healthy lifestyle practices on health and curbing chronic lifestyle-related conditions, attention to patient education as a competency pales in comparison with other topics in medical curricula.

Notwithstanding, cardiologists and surgeons are pre-eminently qualified to prescribe drugs or perform surgery. They and the public are bombarded continuously with a dizzying array of new advances. Such advances include that heralded in the popular press recently to announce a new drug class that blocks cholesterol protein, 'Drugmakers are racing to develop a new class of medicines they believe could be the biggest weapon against heart disease since statins were introduced in the 1980s' (Pierson, 2011). Despite the potential contribution of such advances, the unequivocal potency of lifestyle behavior change and inarguably its superior effects, should not be minimized nor lost sight of in the face of such news headlines. However, the discordance between the efficacy of healthy lifestyle behaviors to prevent, in some cases reverse, as well as manage lifestyle-related conditions such as ischemic heart disease, and the effectiveness of people actually changing their lifestyles when fully aware of the detrimental effect of unhealthy lifestyles, is well known to every clinician. This supports the need for health professionals to develop competency in advising and educating patients with respect to long-term multiple health behavior change. Their effectively practicing collectively and seamlessly will help maximize the outcomes of 'healthy living'.

Health professionals practicing in the third millennia remain committed to the Hippocratic tenets of 'first, do no harm', and 'the function of protecting and developing health must rank even above that of restoring it when it is impaired'. To meld the two, that is, practice health promotion within the context of contemporary biomedical practice, elevates health education to a bone fide clinical competency in the interest of best practice. Best practice in cardiology can be described as effective health education coupled with biomedical advances. The goal of the cardiologist and the surgeon is to maximize the outcomes of medical and surgical procedures and prevent recurrences of cardiac episodes, as well as promote the patient's overall health and wellbeing.

Cardiologists and surgeons have become gatekeepers to a substantial proportion of society in need of lifestyle behavior modification. Although patients are often perceived by physicians and surgeons as viewing lifestyle behavior change as arduous, requiring discipline and deprivation, some patients are quite motivated to change (Alegrante et al. 2008), e.g., 70% of smokers have been reported wanting to quit (Centers for Disease Control, 2002). Some physicians believe that if their patients simply adhere to their medications most



of the time, this will have the greatest chance of reducing their complaints. However, even with the proverbial wake-up call with a diagnosis of a chronic lifestyle-related life-threatening condition, adherence of patients to 'healthy living' practices is alarmingly low (Blanchard et al. 2008). A major step toward enabling patients to effect sustained health behavior change is for clinicians to understand their own perceived and actual barriers to successfully educating their patients, as well as those of the patients to changing.

To effect sustained lifestyle behavior changes in their patients, clinicians need basic knowledge about the processes of teaching and learning. Even brief advice by health professionals that is targeted and tailored can be effective in terms of its priming effect on health behavior change (Kreuter et al. 2000). With respect to smoking cessation, brief advice can augment quit rates (Bodner & Dean, 2009). Additional benefits can be achieved when the cardiologist or surgeon has rapport with the patient, personalizes the health education messages, and most importantly follows up (Shah et al. 2008). Further, clinicians who adopt 'healthy living' practices themselves not only are more inclined to advise their patients about lifestyle behavior change, but serve as powerful role models whose advice is viewed by patients as being more credible (Frank et al. 2000; Paice et al. 2002; Watts, 1990).

When viewed as a clinical competency, the elements of health behavior change parallel those of invasive biomedical intervention, and can be applied as systematically and stringently. Thus, comparable to assessing, evaluating and following up with a patient following biomedical intervention, the cardiologist or surgeon can ask questions such as the following to establish whether a health education intervention is making a difference:

- What outcomes can I quantify and chart to monitor the patient's short- and long-term improvements?
- Given changes in the targeted health behaviors can be outcomes themselves, how can I quantify changes over time with respect to smoking, diet, weight, sedentary activity, physical activity and exercise?
- How have the outcomes of my medical/surgical management been augmented by the patient's health behavior changes?
- How might my medical and/or future surgical management need to be modified given improvements in a patient's health behaviors and health outcomes?

### **3. Elements of health education as a clinical competency**

Clinical competencies are described and evaluated under the categories of knowledge and skills.

#### **3.1 Health promotion practice as a clinical competence: Knowledge**

With respect to health behavior change, cardiologists and surgeons as educators need to be knowledgeable about and capable of assessing and evaluating health and health behaviors (in addition to the usual risk factor assessment/evaluations of ischemic heart disease and its manifestations) (Table 1). Also, effective health educators have specific attributes such as rapport with the learner and have the learner's trust. Effective educators also assess their learners so they can target and tailor the information to be learned to their unique needs (Rollnick et al. 1999).

<p><b>Knowledge of Health</b></p> <p>Definition of the World Health Organization: 'A complete state of physical, emotional and social wellbeing' (WHO, 1948)</p> <p>International Classification of Functioning, Disability and Health, 2002)</p> <div><pre>graph TD; HC[Health condition&lt;br/&gt;(disorder or disease)] &lt;--&gt; B[Body Functions and&lt;br/&gt;Structures]; HC &lt;--&gt; A[Activities]; HC &lt;--&gt; P[Participation]; B &lt;--&gt; A; A &lt;--&gt; P; E[Environmental&lt;br/&gt;Factors] &lt;--&gt; B; E &lt;--&gt; A; E &lt;--&gt; P; F[Personal&lt;br/&gt;Factors] &lt;--&gt; B; F &lt;--&gt; A; F &lt;--&gt; P</pre></div>
<p>Tools:</p> <p>Standardized outcomes measures (questionnaires, e g, health-related quality of life and life satisfaction)</p>
<p><b>Knowledge of Health-related Behavior Assessment/Evaluation</b></p> <p>Tools:</p> <p>Health behaviors including smoking questionnaires such as WISDOM and The Why Test, nutrition logs and physical activity logs in accordance with nutrition and activity pyramids that describe optimal serving sizes and parameters of acceptable activity for health, sleep questionnaires and stress questionnaires</p>
<p><b>Knowledge of Risk Factor Assessment/Evaluation for the Lifestyle-related Conditions</b></p> <p><b>Tools</b> (according to usual clinical practice):</p> <p>Ischemic heart disease risk factor assessments such as Grundy, et al. (2002) and Harvard School of Public Health (2011)</p>
<p><b>Knowledge of the Assessment/Evaluation of the Manifestations of Lifestyle-related Conditions</b></p> <p>Tools (according to usual clinical practice):</p> <p>Established medical and surgical history taking, assessment and evaluation methods often related to cardiovascular dysfunction and impairments</p>

Table 1. Health promotion practice as a clinical competency: knowledge.

3.2 Health promotion practice as a clinical competence: Health behavior change skills

Health education interventions and skills that promote ‘healthy living’ can be implemented readily within the context of cardiology practice appear in Table 2. The focus of such approaches to health education of patients within a biomedical framework have evolved from the leading behavior change theories. Emphasis is given to efficient strategies that require minimal time and resources, yet have the potential for substantial benefit to the patient. Behavioral change theories include Reasoned Action and Planned Behavior

(Achterberg et al. 2010; Elder et al. 1999), Social Cognitive Theory (Bandura, 1977; Bandura, 1995), and the Transtheoretical Model (Prochaska and DiClemente, 1982). Attention is paid to the patient’s stage of readiness to change behavior so the education can be tailored to this stage, motivational interviewing which views motivation as dynamic and capable of being augmented, and the tenets of giving meaningful feedback and reinforcement. Although the table identifies health education strategies that frequently appear in the literature because of their clinical feasibility, we do not suggest that one strategy is superior to another. Rather, like medical and surgical interventions, the patient and context are considered.

<b>Physician as Role Model</b> <ul style="list-style-type: none"><li>• Exploit in a professional manner:</li><li>• Position of authority</li><li>• Credibility in delivery health message</li></ul>	Frank et al. 2000 Paice et al. 2002 Watts, 1990
<b>Physician-Patient Relationship</b> <ul style="list-style-type: none"><li>• Respect</li><li>• Rapport</li><li>• Trust</li><li>• Active listening</li><li>• Personal</li></ul>	Clark et al. 1995 Shah et al. 2008 Stott & Pill, 1990
Assessment/Evaluation of Patient’s Health Behavior Related Knowledge and Behaviors (quantitatively, for ease of comparison with the patient over time) <ul style="list-style-type: none"><li>• Baseline (objective tests and outcome measures; patient logs, diaries and graphs)</li><li>• Serial measurements (of variables above)</li><li>• Follow-up (of variables above)</li></ul>	Tulloch et al. 2006
<b>Motivational Interviewing</b> (culturally modified as indicated) <ul style="list-style-type: none"><li>• Identify resistance to change</li><li>• Understand the patient’s motivation (e.g., decision balance analysis)</li><li>• Listen to the patient</li><li>• Empower the patient</li></ul>	Poirier et al. 2004 Lee et al. 2011 Rosengren, 2009 Stewart & Fox, 2011
<b>Stages of Readiness to Change</b> <ul style="list-style-type: none"><li>• Pre-contemplative: not thinking about changing</li><li>• Contemplative: thinking about changing</li><li>• Preparation: preparing to change</li><li>• Action: implementing behavioral change</li><li>• Maintenance: maintaining behavioral change</li><li>• (Relapse: reverted to negative behavior change)</li></ul>	Prochaska & DiClemente, 1982 Steptoe et al. 2001
<b>The 5 A’s of Behavioral Change</b> <ul style="list-style-type: none"><li>• <b>Assess:</b> Evaluate behavior change status (and progress)</li><li>• <b>Advise:</b> Personally relevant behavioral recommendations</li><li>• <b>Agree:</b> Set specific collaborative, feasible goals</li><li>• <b>Assist:</b> Anticipate barriers, problem-solve solutions, and complete action plan</li><li>• <b>Arrange:</b> Schedule follow-up, contacts and resources</li></ul>	World Health Organization, 2004



<b>Decision Balance Analysis</b>	Seymour et al. 2011									
<table><tr><td></td><td>Of Changing Behavior</td><td>Of Not Changing Behavior</td></tr><tr><td>Pros</td><td></td><td></td></tr><tr><td>Cons</td><td></td><td></td></tr></table>		Of Changing Behavior	Of Not Changing Behavior	Pros			Cons			
	Of Changing Behavior	Of Not Changing Behavior								
Pros										
Cons										
Goal: Identify Barriers and Facilitators <ul style="list-style-type: none"><li>Reduce the barriers to health behavior change</li><li>Increase the facilitators</li></ul>										
<b>Feedback</b> Objective, timely, and regular, e.g., body weight, step counts with pedometers, tests, charts, lab and test reports <b>Positive Reinforcement</b> <ul style="list-style-type: none"><li>Clear</li><li>Direct</li><li>Specific</li></ul>	Burke et al. 2011 Tudor-Locke & Bassett, 2004 <5000 steps/day: sedentary lifestyle 7500 to 9999 steps/day: somewhat active lifestyle 10000 steps/day: active lifestyle >12500 steps/day: highly active lifestyle									
<b>Social Contagion Health Effect</b> Framingham Study database: If your friends are overweight you are likely to be overweight, therefore recommend enjoying activities of ‘healthy living’ with likeminded friends	Christakis & Fowler, 2007									
<b>Assessing the Learner</b> <ul style="list-style-type: none"><li>Socioeconomic status</li><li>Literacy and numeracy</li><li>Culture, ethnicity, language, attitudes and beliefs about lifestyle-related health behaviors such as smoking, healthy eating, weight, sedentary behavior, physical activity, sleep and stress</li></ul>	Lantz et al. 1998 Rollnick et al. 1999									
<b>Learner-oriented Teaching and Education</b> Preferred learning styles often one or more: <ul style="list-style-type: none"><li>Auditory</li><li>Visual</li><li>Experiential</li><li>Demonstrational</li><li>Interactive, e.g., web-based instructional material and sources</li></ul>	Rollnick et al. 1999									

Table 2. Health promotion practice as a clinical competency: Health behavior change skills.

3.3 Decision-making tree to augment patient health and outcomes with health education

The role and skills required by cardiologists and surgeons to be health educators are somewhat distinct to those of professionally trained health educators given health promotion is practiced within the context of biomedical care. Clinicians need to be able to readily assess a patient’s lifestyle practices, specifically, what needs to change, and then decide how to effect such change most expediently. The extent of health education required and engagement of the cardiologist or surgeon varies from patient to patient.

A schematic of a decision-making tree to augment patient health and outcomes with health education is shown in Figure 1. Health education is effected at two levels: initiated and supported/reinforced or both. After the health education assessment, if education needs to be initiated, the practitioner establishes the degree to which he or she takes responsibility for this and for referring to other professionals who can implement a targeted program. Even if the patient is referred or has been receiving health education, the practitioner supports or reinforces this initiative. He or she continues to monitor the educational strategies that have been implemented, and provides essential follow-up. Such follow-up may be as simple as asking the patient about changes that have been made to requisitioning laboratory testing/imaging to assess its outcomes, comparable to following up drug and surgical interventions.

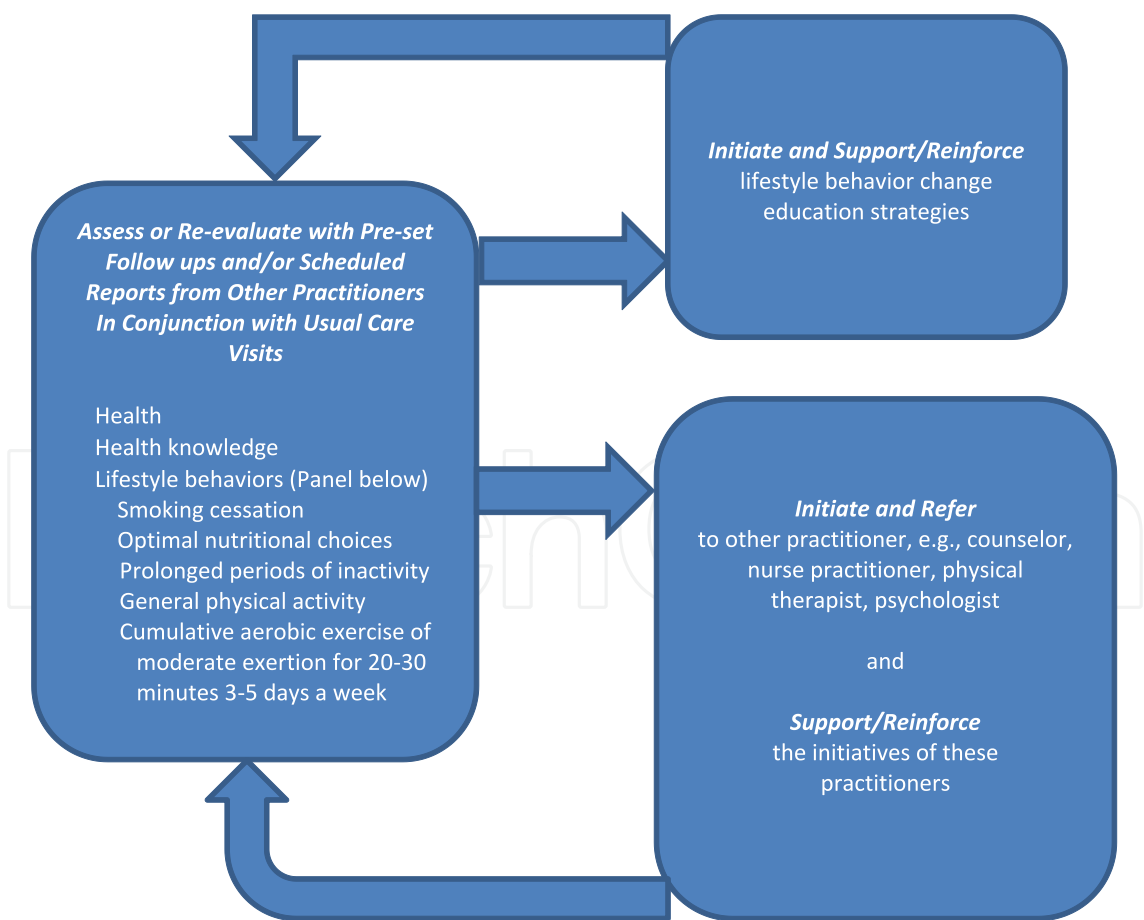


Fig. 1. Decision making tree for cardiologists and surgeons to augment their patient outcomes by initiating and supporting lifestyle-related health behavior changes.

### 3.4 The patient, the strategy, and their interface

Countries where ischemic heart disease is most prevalent tend to be high income. These countries are increasingly multicultural. This dimension influences a patient's perception about his or her heart disease, beliefs about its origins and its management. Interventions that a patient believes in will inevitably have greater benefit due to a placebo effect. Western biomedical interventions may be subject to being both over and undervalued depending on culture and ethnicity as well as individual personal factors. People from collectivistic cultures for example may not perceive they have as much control over the management of their signs and symptoms as someone from an individualistic culture (Hofstede, 2001). Patients who believe that the 'will of God' is paramount may experience less self efficacy in determining the outcome of his or her ischemic heart disease, and potentially less receptive to health education. Cultures vary widely with respect to attitudes about smoking and its social acceptability, food, and physical activity. In addition, cultures vary on the acceptability of sleep deprivation and high stress. These differences are not insurmountable. Rather, knowledge of these individual patient distinctions will better able the health educator including the clinician to tailor and target the educational content consistent with the patient's needs.

Other determinants of learning that inform the type of teaching that is indicated include language, literacy, age, and potentially gender (Glanz et al. 2002). Learners also vary with respect to such preferences as reading to learn, experiencing, having someone provide feedback, and interactive learning, or some combination. Thus, a brochure or web-based material even if translated to a patient's native language, may be ineffective due to these other factors. Although it may appear time consuming to evaluate the learner to such a degree, benefits of a teaching moment may be considerably compromised without taking a few moments to evaluate the learner specifically and the learner's preferred learning style. Across all learning preferences however the follow up that is conducted systematically and predictably is important if learning and behavior change is to be effective and sustained over time.

Because of the specialized care that cardiologists and cardiac surgeons provide, the teaching learning process realistically cannot be initiated, implemented and followed up by a single person. Other team members need to partner seamlessly with medical and surgical teams to ensure that health and health behaviors are assessed, and health behavior change strategies that are targeted and tailored to the individual, are followed up. For some patients, little time will be required of the cardiologist or surgeon to ensure the appropriate health education is in place and follow up is conducted over the time the patient is being seen, because of the input of other appropriately qualified support. Patients can readily be referred to well qualified network of professionals including counselors, nutritionists, nurse practitioners, and physical therapists who report back to the referring practitioner to ensure continuity and follow up are sustained.

Some patients from some ethnic groups may prefer practitioners from their cultural group who speak the same language. This may be preferable for not only ensuring accurate information for the medical or surgical history and examination but also for the effectiveness of health education. Without common language, the effectiveness of health education can be compromised significantly.

#### 4. Other factors that influence the provision of best practices

Time, resources and reimbursement are often cited as reasons perceived by physicians and surgeons for not being able to implement new innovations and practice patterns outside the conventional biomedical model. The interview and dialogue conducted systematically between the physician or surgeon and patient can set the stage for effective health education leading to 'healthy living'.

Motivational interviewing is a patient-centered communication tool that has received considerable attention at the clinical level in terms of serving as a basis for health behavior change. The overarching philosophy of motivational interviewing is the partnership between the patient and clinician. Patient behavior change is viewed as a collaboration or shared endeavor between patient and clinician. The patient's internal motivations for change are identified at the outset (Martins & McNeil, 2009; Pollak et al. 2011; Rollnick et al. 2008). Patients are often resistant or ambivalent to change. For example, a patient with ischemic heart disease who smokes may be fearful about his condition yet feels he cannot or will not give up smoking, despite his awareness that smoking is endangering his health. For this patient, a health education message delivered using an 'expert-recipient' style may strengthen his resistance to quit smoking. Clinicians using motivational interviewing are empathetic; they anticipate and recognize their patients' ambivalence about and resistance to quit smoking. Where inconsistencies exist between a patient's values and behavior (e.g., my health is important to me, but I want to continue to smoke), the clinician acknowledges the inconsistency and enables the patient to articulate, explore and resolve such inconsistency. This can be achieved by evoking the patient's internal motivations pertaining to his personal goals and values, and link these to changing health behavior (Britt et al. 2004, Rollnick et al. 2008; Pollak et al. 2011). For example, the clinician may question the patient about how motivated he is to quit smoking, followed by how confident he feels about succeeding. If the clinician determines that her patient is highly motivated but lacks confidence, she may ask him what might explain his high motivation to quit, yet lack of confidence to do so. She can follow up by asking him how she can help to increase his confidence. The autonomy of the patient is acknowledged and respected throughout the interaction, i.e., the patient is free to make his own choices, including whether or not to change his behavior and, if he chooses to do so, how he can (Rollnick et al. 2008; Pollak et al. 2011). Finally, the skills of motivational interviewing can substantially increase the confidence of medical students to effect patient's health behavior change and provide counseling to patients (Poirier et al. 2004).

Although knowledge per se is not a strong predictor of health behavior change, credible reading materials have a role in effectively educating some patients. Simple inexpensive props such as the nutrition and physical activity pyramids (United States Department of Health and Human Services, 2011) can be mounted on the wall in the office and discussed with the patient. Colorful oversized copies for hanging on the wall or refrigerator can be sent home. Personal attention and personalizing of the health messages can be highly effective communication attributes of clinicians.

Reimbursement and fee for service is a concern in some countries. Although best practice is hailed as a priority in most countries, health promotion practice needs to be a central component given it can prevent cardiac events, and augment medical and surgical

outcomes. If the power of 'healthy living' and its promotion are neglected, best practice is forfeited. The health professional community needs to ensure that evidence-based best practices are available to all patients; these extend well beyond drugs and surgery.

## 5. Conclusion

Within the context of busy, resource and time constrained cardiology practices, this chapter presents evidence-informed strategies for effective patient health education. Outcomes of the biomedical advances in cardiology and cardiac surgery, the focus of this book, fall short of their potential unless patients are able to effect long-term lifestyle behavior changes. Given the unequivocal link between lifestyle behaviors and ischemic heart disease, 'healthy living' not only augments a patient's overall health but, in turn, reduces the need for drugs and surgery. When these interventions are indicated, health behavior change may augment their outcomes. Ischemic heart disease is less a pathology and more a physiological response to lifestyle practices. In this century, it behooves health professionals including cardiologists and surgeons to support each other in addressing the underlying causes of ischemic heart disease in addition to addressing the resulting impairments. Clinicians can work with other team members to better solidify their efforts and improve their individual outcomes. Finally, because the lifestyle-related risk factors of ischemic heart disease are common to other leading chronic conditions such as hypertension, stroke, renal dysfunction, type 2 diabetes mellitus, obesity and cancer, cardiologists and surgeons who systematically and aggressively integrate health promotion into their practices, can also reduce the risk factors and potential manifestations of these other prevalent conditions.

## 6. References

- Achterberg, T.V., Huisma-De Waal, G.G.J., Ketelaar, N.A.B., Oostendorp, R.A., Jacobs, J.E., Wolldersheim, H.C.H. (2010). How to promote healthy behaviours in patients? An overview of evidence for behaviour change techniques. *Health Promotion International* doi: 10.1093/heapro/daq050.
- Alegante, J.P., Perterson, J.C., Boutin-Foster, C., Ogedegbe, G., Charleson, M.E. (2008). Multiple health-risk behavior in a chronic disease population: what behaviors do people choose to change? *Preventive Medicine* 46:247-251.
- American College of Sports Medicine. (2009). *ACSM's Resource Manual for Guidelines for Exercise Testing and Prescription*, ed 6. Philadelphia: Lippincott Williams & Wilkins.
- American College of Sports Medicine. (2010). *ACSM's guidelines for exercise testing and prescription*, ed 8. Philadelphia: Lippincott Williams & Wilkins.
- American Heart Association. (2003). Exercise and physical activity in the prevention and treatment of atherosclerotic cardiovascular disease. *Circulation* 107:3109-3116.
- Appel, L.J., Moore, T.J., Obarzanek, E., Vollmer, W.M., Svetkey, L.P., Sacks, F.M., Bray, G.A., Vogt, T.M., Cutler, J.A., Windhauser, M.M., Lin, P.H., & Karanja, N. (1997). A clinical trial of the effects of dietary patterns on blood pressure. DASH Collaborative Research Group. *New England Journal of Medicine* 336:1117-1124.



- Bandura, A. (1977). Towards a unifying theory of behavioral change. *Psychological Review* 84:191-215.
- Bandura, A. (1995). Moving into forward gear in health promotion and disease prevention. Keynote address. Society of Behavioral Medicine, San Diego, CA.
- Beaglehole, R; Yach, D. (2003). Globalisation and the prevention and control of non-communicable disease: the neglected chronic diseases of adults. *The Lancet* 362:7903-7908.
- Berenson, G.S., Srinivasan, S.R., Bao, W., Newman 3<sup>rd</sup>, W.P., Tracy, R.E., & Wattigney, W.A. (1998). Association between multiple cardiovascular risk factors and atherosclerosis in children and young adults. The Bogalusa Heart Study. *New England Journal of Medicine* 338:1650-1656.
- Biddle, S.J.H., Pearson, N., Ross, G.M., & Braithwaite, R. (2010). Tracking of sedentary behaviors of young people: a systematic review. *Preventive Medicine* 51:345-351.
- Blair, S.N. (2009). Physical inactivity: the biggest public health problem of the 21<sup>st</sup> century. *British Journal of Sports Medicine* 43:1-2.
- Blanchard, C.M., Courneya, K.S., & Stein, K. (2008). Cancer survivors' adherence to lifestyle behavior recommendations and associations with health-related quality of life: Results from the American Cancer Society's SCS-II. *Journal Clinical Oncology* 26: 2198-2204.
- Bodner, M.E., & Dean, E. (2009). Brief advice as a smoking cessation strategy: A systematic review and implications for physical therapists. *Physiotherapy Theory and Practice* 25:369-407.
- Bodner, M.E., Miller, W.C., Rhodes, R.E., & Dean, E. (2011). Smoking cessation and counseling: Practices of Canadian physical therapists. *Physical Therapy* 91:1051-1062.
- Britt, E., Hudson, S.M., & Blampied, N.M. (2004). Motivational interviewing in health settings: a review. *Patient Education and Counseling* 53:147-155.
- Bruunsgaard, H. (2005). Physical activity and modulation of systemic low-level inflammation. *Journal of Leukocyte Biology* 78:819-835.
- Burke, L.E., Wang, J., Sevvick, M.A. (2011). Self-monitoring in weight loss: a systematic review of the literature. *Journal of the American Dietetic Association* 111:92-102.
- Centers for Disease Control and Prevention. (2002). Cigarette Smoking Among Adults – United States, 2000. *Morbidity and Mortality Weekly Report* 51:642-5.
- Christakis, N.A., & Fowler, J.H. (2007). The spread of obesity in a large social network over 32 years. *New England Journal of Medicine* 357:370-379.
- Clark, N. M., Nothwehr, F., Gong, M., Evans, D., Maiman, L. A., Hurwitz, M. E., Roloff, D., & Mellins, R. B. (1995). Physician-patient partnership in managing chronic illness. *Academic Medicine*, 70:957-959.
- Conway, T.L., & Cronan, T.A. (1990). Smoking, exercise, and physical fitness. *Preventive Medicine* 21:723-734.
- Coren, S. (2009). Sleep health and its assessment and management in physical therapy practice: The evidence. *Physiotherapy Theory and Practice* 25:442-452.

- Dean, E. (2009). Physical therapy in the 21<sup>st</sup> century (Part II): Evidence-based practice within the context of evidence-informed practice. *Physiotherapy Theory and Practice* 25:354-368.
- Dean, E. (2009). Physical therapy in the 21<sup>st</sup> century (Part I): Toward practice informed by epidemiology and the crisis of lifestyle conditions. *Physiotherapy Theory and Practice* 25:330-353.
- Dean, E., Lomi C., Bruno, S., Awad, H., & O'Donoghue, G. (2011). Addressing the common pathway underlying hypertension and diabetes in people who are obese: The ultimate knowledge translation gap. *International Journal of Hypertension* doi:10.4061/2011/835805.
- DeLongis, A., Folkman, S., Lazarus, R.S. (1988). The impact of daily stress on health and mood: Psychological and social resources as mediators. *Journal of Personality and Social Psychology* 54:486-495.
- Dube, S.R., McClave, A., James, C., Caraballo, R., Kaufmann, R., & Pechacek, T. (2010). Vital signs: current cigarette smoking among adults aged  $\geq 18$  years – United States, 2009. *MMWR* 59(35): 1135-1140, 2010.
- Elder, J.P., Ayala, G.X., Harris, S. (1999). Theories and intervention approaches to health-behavior change in primary care. *American Journal of Preventive Medicine* 17:275-284.
- Ford, E.S., Bergmann, M.M., Kroger, J., Schienbkiewitz, A., Weikert, C., & Boeing, H. (2009). Healthy living is the best revenge. *Archives of Internal Medicine* 169:1355-1362.
- Frank, E., Breyan, J., & Elon, L. (2000). Physician disclosure of healthy personal behaviors improves credibility and ability to motivate. *Archives of Family Medicine* 9:287-290.
- Gidding, S.S. (1999). Preventive pediatric cardiology: tobacco, cholesterol, obesity, and physical activity. *Pediatric Clinics of North America* 46:253-262.
- Glanz, K., Rimer, B.K., Lewis F.M. (2002). *Health behavior and health education* (3<sup>rd</sup> ed). San Francisco:CA: Jossey-Bass.
- Glasgow, R.E., Klesges, L.M., Dzewaltowski, D.A., Bull, S.S., Estabrooks, P. (2004). The future of health behavior change research: What is needed to improve translation of research into health promotion practice? *Annals of Behavioral Medicine* 27:3-12.
- Harvard School of Public Health. Your disease risk. [www.yourdiseaserisk.harvard.edu](http://www.yourdiseaserisk.harvard.edu); retrieved August 2011.
- Grundy, S.M., Pasternak, R., Greenland, P., Smith, S., Luster, V. (1999). Assessment of cardiovascular risk by use of multiple-risk-factor assessment equations: A statement for healthcare professionals from the American Heart Association and the American College of Cardiology. *Circulation* 100: 1481-1492
- Healy, G.N., Dunstan, D.W., Salmon, J., Cerin, E., Shaw, J.F., Zimmet, P.Z., & Owen, N. (2008). Breaks in sedentary time. Beneficial associations with metabolic risk. *Diabetes Care* 31:661-666.
- Hofstede, G. (2001). *Culture's consequences: comparing values, behaviors, institutions, and organizations across nations* (2<sup>nd</sup> ed.). Thousand Oaks, CA: SAGE Publications.

- Jakes, R.W., Day, N.E., Khaw, K.T., Luben, R., Oakes, S., Welch, A., Bingham, S., Wareham, N.J. (2003). Television viewing and low participation in vigorous recreation are independently associated with obesity and markers of cardiovascular disease risk: EPIC-Norfolk population-based study. *European Journal of Clinical Nutrition* 57:1089-1096.
- Kreuter, M.W., Chheda, S.G., & Bull, F.C. (2000). How does physician advice influence patient behavior? Evidence for a priming effect. *Archives of Family Medicine* 9:426-433.
- Lantz, P.M., House, J.S., Lepkowski J.M., Williams, D.R., Mero, R.P., & Chen, L. (1998). Socioeconomic factors, health behaviors, and mortality. *Journal of the American Medical Association* 279:1703-1708.
- Lee, C.S., López, S.R., Hernández, L., Colby, S.M., Caetano, R., Borrelli, B., Rohsenow, D. (2011). A cultural adaptation of motivational interviewing to address heavy drinking among Hispanics. *Cultural Diversity and Ethnic Minority Psychology* 17:317-324.
- Martins, R.K., & McNeil, D.W. (2009). Review of motivational interviewing in promoting health behaviors. *Clinical Psychology Review* 29: 283-293.
- Mokdad, A. H., Ford, E.S., Bowman, B.A., Dietz, W.H., Vinicor, F., Bales, V.S., & Marks, J.S. Prevalence of obesity, diabetes, and obesity-related health risk factors, 2001. (2004). *Journal of the American Medical Association* 289:76-79.
- Mortality Country Fact Sheets 2006. [www.who.int/whosis/mort/profiles/en/](http://www.who.int/whosis/mort/profiles/en/); retrieved August 2011.
- Neuhouser, M.L., Miller, D.L., Kristal, A.R., Barnett, M.J., & Cheskin, L.J. (2002). Diet and exercise habits of patients with diabetes, dyslipidemia, cardiovascular disease or hypertension. *Journal of the American College of Nutrition* 21:394-401.
- Olshansky, S.J., Passaro, D.J., Hershow, R.C., Layden, J., Carnes, B.A., Brody, J., Hayflick, L., Butler, R.N., Allison, D.B., and Ludwig, D.S. (2005). A potential decline in life expectancy in the United States in the 21st century. *New England Journal of Medicine* 352:1138-1145.
- Ornish, D. (1998). Avoiding revascularisation with lifestyle changes: The Multicenter Lifestyle Demonstration Project. *American Journal of Cardiology* 82:72-76
- Ornish, D., Scherwitz, L.W., Billings, J.H. et al. (1998). Intensive lifestyle change for reversal of coronary heart disease. *Journal of the American Medical Association* 280:2001-2007.
- Paice, E., Heard, S., & Moss, F. (2002). How important are role models in making good doctors? *British Medical Journal* 707 doi: 10.1136/bmj.325.7366.707.
- Pierson, R. New drug class may aid heart disease fight. *Vancouver Sun*, Vancouver, BC, Canada; Saturday, August 27, 2011.
- Poirier, M.K., Clark, M.M., Cerhan, J.H., Pruthi, S., Geda, Y.E., & Dale, L.C. (2004). Teaching motivational interviewing to first-year medical students to improve counseling skills in health behavior change. *Mayo Clinic Proceedings* 79:327-331.
- Pollak, K.I., Childers, J.W., & Arnold, R.M. (2011). Applying motivational interviewing techniques to palliative care communication. *Journal of Palliative Medicine* 14: 587-592.

- Prochaska, J.O., & DiClemente, C.C. (1982). Transtheoretical therapy: Towards a more integrative model of change. *Psychother: Theory, Research and Practice* 19:276-288.
- Report of the Institute of Medicine of the National Academy of Sciences. IOM report declares high blood pressure a neglected disease, calls for strategies to change Americans' lifestyles and diets to curb hypertension. February 22<sup>th</sup>, 2010.
- Rollnick, S., Mason, P., & Butler, C. (1999). *Health behavior change. A guide for practitioners*. New York: Churchill Livingstone.
- Rollnick, S., Miller, W.R., & Butler, C.C. (2008). *Motivational interviewing in health care: helping patients change behavior*. New York: The Guildford Press.
- Rosengren, D.B. (2009). *Building motivational interviewing skills: a practitioner workbook*. New York: The Guildford Press, 2009.
- Sacks, F.M., Obarzanek, E., Windhauser, M.M., Svetkey, L.P., Vollmer, W.M., McCullough, M., Karanja, N., Lin, P.H., Steele, P., Proschan, M.A., Evans, M.A., Appel, L.J., Bray, G.A., Vogt, T.M., Moore, T.J. and DASH Investigators (1995). Rationale and design for the Dietary Approaches to Stop Hypertension trial (DASH). A multicentered controlled-feeding study of dietary patterns to lower blood pressure. *Annals of Epidemiology* 5:108-118.
- Seymour, R.B., Hughes, S.L., Ory, M.G., Elliot, D.L., Kirby, K.C., Migneault, J., Patrick, H., Roll, J.M., Williams, G. (2010). A lexicon for measuring maintenance of behavior change. *American Journal of Health Behavior* 34:660-668.
- Shah, A., Cabeza, Y., Ostfeld, R.J. (2008). Prevention information: Patient perceptions regarding general and race-based instruction. *International Journal of Cardiology* 130:72- 74.
- Shaper, A.G. (1996). Obesity and cardiovascular disease. *Ciba Foundation Symposium* 201:90-103.
- Sofi, F., Cesari, F., Abbate, R., Gensini, G.F., Casini, A. (2008). Adherence to Mediterranean diet and health status: meta-analysis. *BMJ* 337:a1344.
- Soler, E.P., & Ruiz, V.C. (2010). Epidemiology and risk factors of cerebral ischemia and ischemic heart diseases: similarities and differences. *Current Cardiology Reviews* 6: 138-149.
- Stannard, S.R., & Johnson, N.A. (2004). Insulin resistance and elevated triglyceride in muscle: more important for survival than 'thrifty' genes? *Journal of Physiology* 554:595-607.
- Steptoe, A., Kerry, S., Rink, E., & Hilton, S. (2001). The impact of behavioural counseling on stage of change in fat intake, physical activity, and cigarette smoking in adults at increased risk of coronary heart disease. *American Journal of Public Health* 91:265-269.
- Stewart, E.E., Fox, C.H. (2011). Encouraging patients to change unhealthy behaviors with motivational interviewing. *Family Practice Management* 18:21-25.
- Stott, N.C.H., & Pill, R.M. (1990). 'Advise yes, dictate no'. Patients' views on health promotion in the consultation. *Family Practice* 7:125-131.
- Task Force Guidelines for the Management of Arterial Hypertension. (2007). *European Heart Journal* 28:1462-1536.

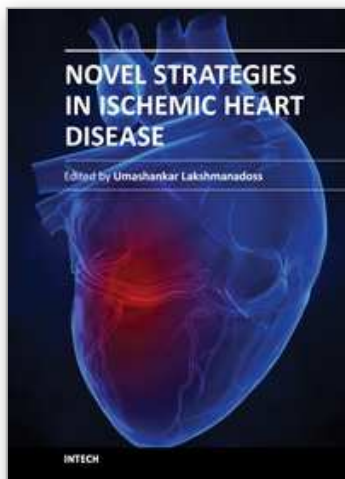
- Thorpe, A.A., Healy, G.N., Owen, N., Salmon, J., Ball, K., Shaw, J.F., Zimmet, P.Z., & Dunstand, D.W. (2010). Deleterious associations of sitting time and television viewing time with cardiometabolic risk biomarkers. *Diabetes Care* 33:327-334.
- Thompson, P.D., Buchner, D., Piña, I.L. et al. (2003). Exercise and Physical Activity in the Prevention and Treatment of Atherosclerotic Cardiovascular Disease A Statement from the Council on Clinical Cardiology (Subcommittee on Exercise, Rehabilitation, and Prevention) and the Council on Nutrition, Physical Activity, and Metabolism (Subcommittee on Physical Activity). *Circulation* 107:3109-3116.
- Tudor-Locke, C., & Bassett D.R. Jr. (2004). How many steps/day are enough? Preliminary pedometer indices for public health. *Sports Medicine* 34:1-8.
- Tulloch, H., Fortier, M., & Hogg, W. (2006). Physical activity counseling in primary care: Who has and who should be counseling? *Patient Education and Counseling* 64:6-20.
- United States Department of Health and Human Services, Consumer Information Center. The food guide pyramid. [www.usda.gov](http://www.usda.gov); retrieved August 2011.
- Watts, M.S. Physicians as role models in society. (1990). *Western Journal of Medicine* 152:292.
- World Health Organization (2002). Physical inactivity leading cause of disease and disability. [www.who.int/mediacentre/news/releases/release23/en/index.html](http://www.who.int/mediacentre/news/releases/release23/en/index.html); retrieved August 2011.
- World Health Organization (WHO)/International Society of Hypertension (ISH) statement on management of hypertension. (2003). *Journal of Hypertension* 21:1983-1992.
- World Health Organization. Definition of Health (1948). [www.who.int/about/definition](http://www.who.int/about/definition); retrieved December 2010.
- World Health Organization. International Classification of Functioning, Disability and Health. (2002). [www.sustainable-design.ie/arch/ICIDH-2PFDec-2000.pdf](http://www.sustainable-design.ie/arch/ICIDH-2PFDec-2000.pdf); retrieved August 2011.
- World Health Organization. Integrating prevention into health care. Fact sheet 172. [www.who.int/mediacentre/factsheets/fs172/en/](http://www.who.int/mediacentre/factsheets/fs172/en/); retrieved August 2011.
- World Health Organization. (2004). The 5 A's Cycle. <http://www.who.int/diabetesactiononline/about/WHO%205A%20ppt.pdf>; retrieved August 2011.
- World Health Organization. Priority noncommunicable diseases and conditions. [Prioritynoncommunicablediseasesanddisorders.pdf](http://www.wpro.who.int/NR/rdonlyres/E72A001F-E6E1-4AB7-B33C-1C77F4FEF8FC/0/13_Chapter8); [www.wpro.who.int/NR/rdonlyres/E72A001F-E6E1-4AB7-B33C-1C77F4FEF8FC/0/13\\_Chapter8](http://www.wpro.who.int/NR/rdonlyres/E72A001F-E6E1-4AB7-B33C-1C77F4FEF8FC/0/13_Chapter8); retrieved August 2011.
- Joint WHO/FAO Expert Consultation on Diet, Nutrition and the Prevention of Chronic Diseases Geneva, 28 January--1 February 2002. [www.who.int/hpr/NPH/docs/who\\_fao\\_expert\\_report.pdf](http://www.who.int/hpr/NPH/docs/who_fao_expert_report.pdf); retrieved August 2011.
- Yusuf, S., Hawken, S., Ôunpuu, S, Bautista, L, Grazia Franzosi, M., Commerford, P., Lang, C.C., Rumboldt, Z., Onen, C.L., Lisheng. L., Tanomsup, S., Wangai, P., Razak, F., Sharma, A.M., Anand, S.S. and on behalf of the INTERHEART Study Investigators.



- (2005). Obesity and the risk of myocardial infarction in 27 000 participants from 52 countries: a case-control study *The Lancet* 366:1640-1649.
- Yusuf, S., Hawken, S., Ounpuu, S., Dans, T., Avezum, A., Lanas, F., McQueen, M., Budaj, A., Pais, P., Varigos, J., Lisheng, L. (2004). Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet* 11-17;364(9438):937-952.

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### **Novel Strategies in Ischemic Heart Disease**

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The first edition of this book will provide a comprehensive overview of ischemic heart disease, including epidemiology, risk factors, pathogenesis, clinical presentation, diagnostic tests, differential diagnosis, treatment, complications and prognosis. Also discussed are current treatment options, protocols and diagnostic procedures, as well as the latest advances in the field. The book will serve as a cutting-edge point of reference for the basic or clinical researcher, and any clinician involved in the diagnosis and management of ischemic heart disease. This book is essentially designed to fill the vital gap existing between these practices, to provide a textbook that is substantial and readable, compact and reasonably comprehensive, and to provide an excellent blend of "basics to bedside and beyond" in the field of ischemic heart disease. The book also covers the future novel treatment strategies, focusing on the basic scientific and clinical aspects of the diagnosis and management of ischemic heart disease.

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