Preventive Cardiology by Lifestyle Intervention: Opportunity and/or Challenge?

Presidential Address at the 2005 American Heart Association Scientific Sessions

Robert H. Eckel, MD, FAHA

In our lifetimes, we have witnessed extraordinary advances in our ability to prevent cardiovascular diseases. These gains have been based on the basic, clinical, and population science that all of you in this broad international audience have produced. We have an unprecedented arsenal of weapons, including many potent medications. However, this power is not enough, and, in fact, in some cases, it has led us to ignore some very simple, effective, and human measures.

We live in a toxic metabolic environment that sabotages our patients’ health. Millions of people around the world suffer from cardiovascular diseases as a result. This harsh reality challenges the American Heart Association and each of us to respond. We have only to open our eyes and look around our neighborhoods, our schools, and certainly our hospitals, almost wherever in the world we live, to see people suffering from unhealthy lifestyles. Poor nutrition and lack of physical activity are producing increasing obesity, increasing diabetes, and, inevitably, cardiovascular disease. In many parts of the world, we are seeing a decrease in the quality and an increase in the quantity of our diets. When this nutritional pattern is linked to a less active lifestyle, it is of no surprise that there are more overweight and obese school children than ever before. We cannot simply rely on technological advances and medications to defeat cardiovascular disease. Unhealthy lifestyles threaten to undo all the progress we have made. What can we do?

My goal is for all of us who care for patients to have a greater commitment to conveying to them the importance of lifestyle. There are roles for all of us—in the basic or clinical laboratory, in population studies, in health services and health policy research, and in advocating for the health of the next generation.

Let’s begin by looking at our world from a patient’s perspective. Imagine that you’ve recently visited the emergency department for chest pain and were dismissed with a presumptive diagnosis of gastroesophageal reflux. It was recommended that you get a second opinion, so you are now in the waiting room of a cardiologist. You’ve completed a questionnaire, including a list of your allergies, medications, family history, review of systems, and your current lifestyle. You’ve noted that you have been treated for hypertension for more than 10 years and that your father died of a myocardial infarction at 53 years of age.

Now the doctor sees you. After reviewing your responses to the questionnaire, he or she asks about your cardiac risk factors and the events leading up to your visit to the emergency department. You both review your medical history, tobacco use, alcohol consumption, previous lipid levels, and family history, and you have a physical examination. The cardiologist thinks it’s possible, but not certain, that your symptoms indicate coronary heart disease, and orders an exercise tolerance test and some additional blood tests.

Now imagine you are driving home. As you reflect on your visit, you may wonder why the physician didn’t ask you more about your lifestyle. You’ve been gaining weight in recent years, in part because you eat out more and go to the gym less often, but your heavy work schedule makes changing your lifestyle very difficult. You wonder, “Is my weight gain not important? If I need to lose weight, should I start going back to the gym, or just cut back on desserts? I wonder if one of those low carbohydrate diets would work for me?” If you were a patient, I believe you couldn’t help thinking, “The cardiologist must not believe that my weight, what I eat, and how much time I spend exercising matter.” Perhaps you think that your lifestyle will be discussed at your next visit, when the result of the exercise tolerance test is available. Then you wonder whether the cardiologist just thinks that talking about nutrition and physical activity is useless. I strongly believe that a physician interview without inquiries about nutrition and physical activity sends the wrong message to our patients, and I don’t think that this scenario is too far-fetched. In fact, I’m sure it occurs every day in the United States and in countries around the world.

How important are nutrition and physical activity, especially in an era when our medications are so powerful? Social scientists tell us that our abilities to stop a heart attack or stroke in progress may have led the public to believe that their

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role in managing their own health is unimportant. However, that’s just not true. Observational and randomized trials show that people have lower rates of morbidity and mortality from coronary heart disease when they consume diets low in saturated fat, trans-fatty acids, and cholesterol, and high in fruits, vegetables, and whole-grain products containing fiber. The Adventist Health Study, for example, has shown that a diet rich in vegetables and nuts can reduce coronary heart disease risk and mortality by as much as 50%. In addition, evidence supports the benefit of good nutrition on all-cause mortality.

The Breast Cancer Detection Demonstration Project was a large prospective study evaluating the association between nutritional quality and the incidence of breast cancer. Nutritional quality was defined using the Recommended Food Score. In this study, age-adjusted mortality was reduced by 50% in women who ate a diet that put them in the top quartile of nutritional quality. All-cause mortality also declined. In the Nurses’ Health Study, Stampfer and colleagues have shown that coronary heart disease in women can be reduced by 90% by an overall healthy lifestyle. In Figure 1, you see that the risk for CHD is reduced across the quintiles of dietary score, reflecting improving nutritional quality. All-cause mortality also declined.

In the Nurses’ Health Study, Stampfer and colleagues have shown that coronary heart disease in women can be reduced by 90% by an overall healthy lifestyle. In Figure 1, you see that the risk for CHD is reduced across the quintiles of dietary score, reflecting improving nutritional quality. The bar on the far right reflects the addition to that optimal diet of other components of a healthy lifestyle, including absence of tobacco use, at least 30 minutes of exercise a day, and a normal body weight (a body mass index less than 25 kg/m²).

I know that these data are from observational, nonrandomized studies and that we need more research in this area. However, the placebo-controlled, randomized, hard outcome clinical trial in nutrition and physical activity is difficult to carry out over long intervals. We also know that weight gain can add substantially to the risk of cardiovascular disease, and many of you know well the list of cardiovascular issues that relate to obesity (Table 1). The level of physical activity can also affect mortality. In a Northern California study in multiple patient groups, including patients with diabetes and patients with obesity, the relative risk of death was higher in those who were physically inactive. Physical activity and physical fitness are also inversely related to cardiovascular mortality in both men and women who have coronary heart disease.

Table 1: Cardiovascular Issues in Obesity

<table>
<thead>
<tr>
<th>Hypertension</th>
<th>Coronary heart disease</th>
<th>Ventricular mass/dysfunction</th>
<th>Arrhythmias</th>
<th>Stroke</th>
<th>Sleep-related breathing disorders</th>
<th>Pulmonary thromboembolic disease</th>
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</table>

In addition to these epidemiological data, nutrition and exercise science has been extended to a deeper understanding of basic mechanisms of physiology and pathophysiology. For instance, there is substantial evidence that gene expression, including transcription, mRNA processing, and translation, are regulated by macronutrients, micronutrients, and exercise, both resistance and aerobic training. An example of nutritional regulation is the control of hepatic gene expression by fasting and re-feeding. During fasting, increases in PEPCK gene expression of the rate-limiting enzyme for gluconeogenesis is markedly upregulated, whereas the genes for fatty acid synthesis and glycolysis are suppressed. After high carbohydrate re-feeding, the opposite is seen. The mechanism for this gene regulation is the effect of dietary carbohydrate on the recently identified carbohydrate-response element binding protein (Figures 2 and 3). Following dietary carbohydrates, this protein becomes de-phosphorylated and active as a nuclear transcription factor.

The data from many sources about the importance of nutrition and physical activity are consistent. So, how are we integrating this into the care of our patients? I am convinced that we don’t focus on lifestyle in the way we should. Why? Here are some reasons I hear physicians cite for not addressing nutrition and physical activity.

- I think I can have much more impact with medications and procedures.
- I don’t think lifestyle changes work.
- I don’t really know how to counsel people to change what they do, and even if I did,
There’s not enough time.

The time isn’t reimbursed.

I don’t have the personnel to do this effectively.

Let me address a few of these issues. First, can talking with your patients about lifestyle truly have an impact? The answer is clearly yes!

Talking to patients about their lifestyle is worthwhile for 3 reasons. First, the patient will understand that you, as their physician, believe a healthy lifestyle is important. Second, an interview about current lifestyle habits opens the door to a productive discussion about ways to modify these habits. Third, patients may be more responsive to lifestyle modifications when the advice comes from their doctor.10,11 Counseling has been proven to be very beneficial in some areas.

In nutrition, clear evidence shows that counseling can lead to behavioral change. A recent and extensive analysis of multiple studies in primary care settings shows this.12 When moderate- or high-intensity counseling interventions are implemented, including the use of interactive health communication tools, a reduction in the consumption of saturated fat and increased intake of fruits and vegetables was demonstrated.13 In this analysis, even brief counseling of unselected patients by primary care providers appeared to produce some favorable changes in dietary behavior.

Helping sedentary patients to become physically active is more of a challenge, and who can best do this isn’t clear. In the office setting, primary care physicians, physician’s assistants, and/or exercise therapists can implement counseling about physical activity. The results of such interventions have been inconsistent, and the duration of the benefit has varied. Nevertheless, it has been shown that in general practice, counseling patients about exercise can be effective in increasing physical activity and improving quality of life over 12 months.14

Most physicians feel especially ineffective in the area of counseling for weight loss, and there are good reasons for that. This is a tough problem, and most of us received very little training in this area. Compared with other risk factor modifications in heart patients, lasting weight reduction is difficult to achieve, but it’s still important. Reducing weight by 5% to 10% favorably modifies many cardiovascular disease risk factors, such as blood pressure, lipid levels, and glucose tolerance, and we can learn how to help our patients achieve this (Table 2).

I believe that the physician’s ability to influence weight loss in a safe, effective, and long-term manner depends on 3 things:

**Number one**, being better informed about why patients are so often unsuccessful in losing weight;

**Number two**, understanding why, even when they do lose weight, they so often regain it; and, most important;

**Number three**, learning enough about your individual patients to help them successfully modify their lifestyles.

Weight loss is difficult because the body is so effective in fighting it. A complex system of factors interacts to create barrier after barrier to success.

Let me explain (see Table 3). When someone tries to lose weight, they may eat fewer calories, exercise more, or some combination of the two. However, one of the most important things that happens when you’ve lost weight and have been maintaining that weight loss for several months is that your appetite increases. You feel hungry and want to eat. To some extent, exercise can help suppress appetite, particularly in men, but some increase in hunger is inevitable. Worse yet, to compensate for the reduced calories, studies have shown that your body begins to crave the energy-dense components of the diet, the things that you most want to avoid—fat and

### Table 2. Weight Reduction Benefit

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Percentage of Weight Lost</th>
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<tbody>
<tr>
<td>Hypertension</td>
<td>5</td>
</tr>
<tr>
<td>Glucose tolerance</td>
<td>5 to 10</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>10</td>
</tr>
<tr>
<td>Left ventricular function</td>
<td>5</td>
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### Table 3. Adaptations to Reduced Obesity

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<tr>
<th>Energy intake</th>
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<tbody>
<tr>
<td>↑ appetite</td>
</tr>
<tr>
<td>↑ fat, ↑ sucrose</td>
</tr>
<tr>
<td>↓ BMR</td>
</tr>
<tr>
<td>↓ Physical activity</td>
</tr>
<tr>
<td>↑ Insulin sensitivity</td>
</tr>
<tr>
<td>Macronutrient oxidation</td>
</tr>
<tr>
<td>↑ CHO, ↓ fat</td>
</tr>
<tr>
<td>Lipoprotein lipase</td>
</tr>
<tr>
<td>↑ adipose tissue, ↓ skeletal muscle</td>
</tr>
</tbody>
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Because lean body mass also falls with weight loss, your basal metabolic rate drops. Thus, you burn fewer calories, and, in addition, most often you have less desire for exercise.

Many laboratories have shown that insulin sensitivity increases after sustained weight reduction; however, my laboratory has gone on to demonstrate that this increase in insulin sensitivity is predictive of weight re-gain. In the reduced-obese state, after you have lost weight, the body is fighting to preserve weight, not lose it. Your body changes how it processes its fuel, too. To conserve fat, it burns more carbohydrates, again making the loss of excess body fat more difficult.

An additional emphasis of my laboratory has been on the tissue-specific regulation of lipoprotein lipase (LPL). The role of LPL is to hydrolyze lipoprotein triglycerides (Figure 4). I believe that important to weight re-gain is the tissue-specific change in LPL in both adipose tissue and skeletal muscle after sustained weight reduction. Using the euglycemic clamp technique, in normal weight subjects, insulin increases adipose tissue LPL, an effect inhibited by dietary fat ingestion. Following a 13.6% weight reduction and 3 months of weight maintenance, the response to insulin is exaggerated, with no inhibition by fat ingestion (Figure 5). In skeletal muscle, the response is reversed. LPL activity in skeletal muscle is similar in obese and normal weight women at baseline (Figure 6). However, after weight reduction and 3 months of weight maintenance, muscle LPL falls by 70%. Thus, following weight loss and months of maintaining it, dietary fats are preferentially partitioned to adipose tissue for storage and away from skeletal muscle, where they would be oxidized. It’s this science about the body’s profound ability to defend fat mass that makes an emphasis on preventing weight gain even more important.

How do we best help our patients with this and other lifestyle changes, and how do we fit this into our busy practices? We must start with information. How much time does it take to learn enough about our patients? For the primary care physician, the median time per visit is 14.5 minutes. For the cardiologist, it’s 18 minutes, but I believe that all the information you need to be conclusive and directive in a specific intervention can be gathered easily, in just 3 minutes. Of course if you have more time, you can do more.

But the key point is that far too often lifestyle questions are not asked at all. These questions on nutrition and activity take only 3 minutes to cover, and besides building a bond of human caring, they tell you a great deal (Table 4). It’s a small investment of time when you consider what you can learn. From this short interview, you learn how active your patients are, and whether they exercise regularly. You want to assess if they are limited in their activity and whether they want to become more active. From these questions, we learn whether their nutritional patterns are reasonable, whether they are interested in losing weight, and what triggers them to eat, whether it is hunger, or instead having food available.

These hints can go a long way in helping you prescribe effective strategies for them. One option may be the materials the American Heart Association has available. This year, we published the AHA’s first-ever weight loss book, the No-Fad Diet, which has effective, evidence-based approaches for moving more, eating well, and staying motivated that can be

![Figure 4. Tissue-specific regulation of LPL. LPL hydrolyzes lipoprotein triglycerides.](image)

![Figure 5. Change in adipose tissue LPL in response to insulin and/or corn oil. Reprinted with permission from Yost et al. Copyright 1988, The Endocrine Society.](image)

![Figure 6. Skeletal muscle LPL activity in normal weight, obese, and reduced-obese women. Reprinted from Eckel et al. with permission from Blackwell Publishing.](image)
personlized to the individual. The americanheart.org website also has a wealth of material for your patients, and they can even get the concepts from the No-Fad Diet book there. If you do this, what will the impact be? First, I think you’ll be better able to help your patients. Through our questions, we can gain essential information about lifestyles and use that knowledge to guide our patients’ understanding and behavior, reduce their cardiovascular risk factors, and extend their lives.

So conduct your own experiment and put this to the test. In just 3 minutes—the time it takes to order and receive a burger, shake, and fries at a fast-food drive-thru—we can do something that may keep our patients out of the drive-thru lane. That’s a big benefit for a 3-minute investment.

Will this 3-minute interview solve all the problems related to lifestyle intervention? Of course not. Reimbursement remains an issue, especially for the services of dieticians and exercise therapists, and for preventive services in general. We need to continue to advocate for change in this area. Many science questions remain unanswered. The opportunity for the future, however, based on advances in basic and clinical science, is exciting.

Imagine a diet or exercise pattern that is personalized. Yes, knowing how your own genetic makeup can influence your response to nutrients and physical activity may have provocative and important outcomes related to heart disease and stroke. With the doors to molecular and cellular biology now wide open including genomics, proteomics, metabolomics, and systems biology, the panorama of personalized medicine related to nutrition and physical activity is a tantalizing vision for the future.

Finally, research funding remains a challenge. We need to persuade our governments that their investment in research is the key to unlocking the great promise of this science. However, while we’re working to make all these things happen, each one of us can start to make an impact on our patients’ lives—3 minutes at a time!

### References


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