

# Lifestyle Medicine: The Health Promoting Power of Daily Habits and Practices

**Abstract:** *There is no longer any serious doubt that daily habits and actions profoundly affect both short-term and long-term health and quality of life. This concept is supported by literally thousands of research articles and incorporated in multiple evidence-based guidelines for the prevention and/or treatment of chronic metabolic diseases. The study of how habits and actions affect both prevention and treatment of diseases has coalesced around the concept of “lifestyle medicine.” The purpose of this review is to provide an up-to-date summary of many of the modalities fundamental to lifestyle medicine, including physical activity, proper nutrition, weight management, and cigarette smoking cessation. This review will also focus specifically on how these modalities are employed both in the prevention and treatment of chronic diseases including coronary heart disease, diabetes, obesity, and cancer. The review concludes with a Call to Action challenging the medical community to embrace the modalities of lifestyle medicine in the daily practice of medicine.*

**Keywords:** lifestyle medicine; physical activity; nutrition; weight

management; obesity; coronary heart disease; diabetes; cancer

An overwhelming body of scientific and medical literature supports the concept that daily habits and

The strength of the scientific literature supporting the health impact of daily habits and actions is underscored by their incorporation into virtually every evidence-based clinical guideline stressing the prevention and treatment of metabolically related diseases.<sup>2-18</sup> A sampling of the guidelines and

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actions exert an enormous impact on short-term and long-term health and quality of life.<sup>1</sup> This influence may be either positive or negative. Thousands of studies provide evidence that regular physical activity, maintenance of a healthy body weight, not smoking cigarettes, and following sound nutritional and other health promoting practices all profoundly influence health.

consensus statements from various prestigious medical organizations is found in Table 1. All of these statements emphasize lifestyle habits and practices as key components in the prevention and treatment of disease.

Despite the widespread recognition of the important role of lifestyle measures and practices as a key component of the treatment of metabolic diseases,

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**Table 1.**

Sampling of Guidelines That Incorporate Lifestyle Recommendations for the Threat or Prevention of Chronic Disease.

• ACC/AHA Guidelines for the Prevention, Detection, Evaluation and Management of High Blood Pressure in Adults
• Institute of Medicine Guidelines for Obesity Management
• Dietary Guidelines for Americans 2015-2020
• Guidelines from the American Academy of Pediatrics for the Prevention and Treatment of Childhood Obesity
• Guidelines from the American Academy of Pediatrics for Heart Disease Risk Factor Reduction in Children
• American Heart Association Strategic Plan for 2020
• Preventing Cancer, Cardiovascular Disease and Diabetes: A Common Agenda for the American Cancer Society, the American Diabetes Association and the American Heart Association
• Defining Optimal Brain Health in Adults: A Presidential Advisory from the American Heart Association/American Stroke Association
• 2013 AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults
• 2018 Physical Activity Advisory Committee Scientific Report

scant progress has been made in improving the habits and actions of the American population. For example, in the Strategic Plan for 2020 released by the American Heart Association, it was stated that only 5% of the adult population of the United States practice all of the positive lifestyle measures known to significantly reduce the risk of developing cardiovascular disease (CVD).<sup>14</sup>

The power of positive lifestyle decisions and actions is underscored by multiple randomized controlled trials and a variety of cohort studies. For example, the Nurses' Health Study demonstrated that 80% of all heart disease and over 91% of all diabetes in women could be eliminated if they would adopt a cluster of positive lifestyle practices including maintenance of a healthy body weight (body mass index [BMI] of 19-25 kg/m<sup>2</sup>); regular physical activity (30 minutes or more on most days); not smoking cigarettes; and following a few, simple nutritional practices such as increasing whole grains and consuming more fruits and vegetables.<sup>19</sup> The US Health Professionals Study showed

similar, dramatic reductions in risk of chronic disease in men from these same positive behaviors.<sup>20</sup> In fact, if individuals adopted only one of these positive behaviors, their risk of developing coronary artery disease (CAD) could be cut in half.

For decades physicians have emphasized the importance of practicing "evidence-based medicine." Yet when it comes to incorporating the vast amount of evidence supporting positive health outcomes from lifestyle practices and habits, the medical community has been relatively slow to respond. This, despite the fact that virtually every physician would agree with the premise that regular physical activity, weight management, sound nutrition, and not smoking all result in significant health benefits.

The purpose of the current review is to provide a summary of the literature underscoring the benefits of positive health promoting habits and to present some strategies and guidelines for implementing these actions within the practice of medicine and issue a call for increased emphasis on lifestyle medicine among physicians.

### What Is Lifestyle Medicine?

I had the privilege of editing the first, multi-author, academic textbook in lifestyle medicine.<sup>21</sup> In fact, this textbook, published in 1999, coined the term *lifestyle medicine*, which we defined as "the discipline of studying how daily habits and practices impact both on the prevention and treatment of disease, often in conjunction with pharmaceutical or surgical therapy, to provide an important adjunct to overall health."

While there have been a number of different constructs concerning these disciplines and many investigators have made important contributions to components of lifestyle medicine such as nutrition, physical activity, weight management, smoking cessation, and so on, it is clear that the field is now going to coalesce around the term *lifestyle medicine*. For example, the American Heart Association changed the name of one its Councils from the "Council on Nutrition, Physical Activity and Metabolism" to the "Council on Lifestyle and Cardiometabolic Health" in 2013.<sup>22</sup> In addition, both the American College

of Preventive Medicine and the American Academy of Family Practice have established working groups and educational tracks in the area of lifestyle medicine. *Circulation*, a major academic journal from the American Heart Association, published a series of multiple articles titled “Recent Advances in Preventive Cardiology and Lifestyle Medicine.” Representatives from a variety of organizations including the American Academy of Pediatrics, the American College of Sports Medicine, the Academy of Nutrition and Dietetics, the American Academy of Family Practice, and the American College of Preventive Medicine sent representatives to a working group that established the first summary of competencies physicians should possess to practice lifestyle medicine, which was published in the *Journal of the American Medical Association*.<sup>23</sup>

Importantly, a new health care organization has been formed called the “American College of Lifestyle Medicine” (ACLM), which is devoted to providing a professional home for individuals who wish to emphasize lifestyle medicine in their practices.<sup>24</sup> This organization has doubled its membership each year for the past 5 years. ACLM has also spawned initiatives to develop curricula and encourage education of medical students in the area of lifestyle medicine. ACLM has also supported the development of Lifestyle Medicine Student Interest Groups at medical schools and has developed criteria for lifestyle medicine certification.<sup>25</sup> The goal of this organization is ultimately to establish certification boards in lifestyle medicine. Lifestyle medicine has also become an international movement with the development of the Lifestyle Medicine Global Alliance.<sup>26</sup>

In addition, a peer-reviewed academic journal has been established, the *American Journal of Lifestyle Medicine*,<sup>27</sup> to provide a forum for individuals interested in exchanging academic information in this growing field.

There are multiple reasons why the term *lifestyle medicine* seems particularly appropriate for this discipline. First, the

field is focused on *lifestyle* and its relationship to health. Second, it is clearly *medicine* based on the wide range and large volume of evidence supporting the health benefits of daily habits and actions.

### The Power of Lifestyle Habits and Practices to Promote Good Health

Multiple daily practices have a profound impact on both long-term and short-term health and quality of life. This review will focus on 5 key aspects of lifestyle habits and practices: regular physical activity, proper nutrition, weight management, avoiding tobacco products, and stress reduction/mental health. This initial section will focus on general considerations related to each of these lifestyle habits and practices. In the subsequent section, this information will be applied to specific diseases or conditions.

#### Physical Activity

Physical activity is a vitally important component to overall health and both prevention and treatment of various diseases. Regular physical activity has been specifically demonstrated to reduce risk of CVD, type 2 diabetes, the metabolic syndrome, obesity, and certain types of cancer.<sup>18</sup> The important role of physical activity in these conditions has been underscored by its prominent role in evidence-based guidelines and consensus statements from virtually every organization that deals with chronic disease. In addition, there is strong evidence that regular physical activity is important for brain health and cognition as well as reduction in anxiety and depression and amelioration of stress.<sup>16</sup>

The recently released 2018 Physical Activity Guidelines Advisory Committee Scientific Report emphasizes that increased physical activity carries multiple individual and public health benefits.<sup>18</sup> This report also catalogs that physical activity contributes powerfully to improved quality of life by improving

sleep, general feelings of well-being, and daily functioning. The report emphasizes that some of the benefits of physical activity occur immediately and most of the benefits become even more significant with ongoing and regular performance of moderate to vigorous physical activity.

In addition, physical activity has been shown to prevent or minimize excessive weight gain in adults as well as reducing the risk of both excess body weight and adiposity in children.<sup>28</sup> Physical activity decreases the likelihood that women will gain excessive weight during pregnancy, making them less likely to develop gestational diabetes.<sup>29</sup> Physical activity may also decrease the likelihood of postpartum depression.

Physical activity has also been demonstrated to lower the risk of dementia and improve other aspects of cognitive functioning. Importantly, as the population in the United States continues to grow older regular physical activity has been shown to decrease the likelihood of falls<sup>30</sup> and fall-related injuries and assist in the preservation of lean body mass.<sup>31</sup>

Other conditions that regular physical activity improves are osteoarthritis and hypertension.<sup>18</sup> All in all, the multiple benefits of regular physical activity make it one of the key considerations that should be recommended to all children and adults as part of a comprehensive lifestyle medicine approach to health and well-being.

Numerous studies have shown that physicians' own physical activity behavior predicts the likelihood that they will recommend physical activity to their patients. Unfortunately, it has been estimated that less than 40% of physicians regularly counsel their patients on the importance of increasing physical activity. The low level of prescription among physicians, as well as the recognized benefits of regular physical activity in health, stimulated the American College of Sports Medicine to launch the “Exercise is Medicine®” (EIM) initiative. This initiative is designed to encourage primary care providers and

health providers to design treatment plans that include physical activity or to refer patients to evidence-based exercise programs with qualified exercise professionals. EIM also encourages health care providers to assess and record physical activity as a vital sign during patients' visits. The initiative further recommends concluding each visit with an exercise "prescription."<sup>32</sup>

### Nutrition

Nutrition plays a key role in lifestyle habits and practices that affect virtually every chronic disease. There is strong evidence for a role of nutrition in CVD, diabetes, obesity, and cancer, among many other conditions.<sup>33</sup> Dietary guidelines and consensus statements from a variety of organizations have recognized the key role for nutrition, both in the prevention and treatment of chronic disease.<sup>4,6,8</sup> These consensus statements are very similar to each other in nature and consistently recommend a dietary pattern higher in fruits and vegetables, whole grains (particularly, high fiber), nonfat dairy, seafood, legumes and nuts.<sup>34</sup> Guidelines further recommend that those who consume alcohol (among adults), do so in moderation. The guidelines are also consistent in recommending diets that are lower in red and processed meats, refined grains, sugar sweetened foods, and saturated and trans fats. All the guidelines also emphasize the importance of balancing calories and also regular physical activity as strategies for maintaining a healthy weight and, thereby, further reducing the risk of chronic diseases.

Dietary guidance over the past 2 decades has moved from specific foods and nutrients to a greater emphasis on dietary patterns. The emphasis has also shifted to the critical aspect of providing practical advice for implementing recommendations.<sup>9</sup> This latter emphasis recognizes that despite consistent guidelines and nutrition recommendations for many decades, a distinct minority of Americans are following these guidelines. For example, in the area of hypertension <20% of individuals with high blood pressure

follow the DASH Diet.<sup>35</sup> It is also estimated that <30% of adults in the United States consume the recommended daily number of fruits and vegetables.<sup>34</sup>

The 2015-2020 Dietary Guidelines for Americans focused on integrating available science and systematic reviews, scientific research, and food pattern modeling on current intake of the US population to develop the "Healthy U.S. Style Eating Pattern."<sup>8</sup> This approach allowed blending recommendations for an overall diet including constituent foods, beverages, nutrients, and health outcomes, while allowing for flexibility in amounts of food from all food groups to establish healthy eating patterns that meet nutrient needs and accommodated limitations for saturated fats, added sugars, and sodium. This approach also allowed for the potential nutritional areas of public health concern. Utilizing this approach to Dietary Guidelines for Americans 2015-2020 indicated the following:

Within the body of evidence higher intakes of vegetables and fruits consistently have been identified as characteristic of healthy eating patterns: whole grains have been identified as well, although slightly less consistently. Other characteristics of healthy eating patterns have been identified with less consistency including fat free or low fat dairy, seafood, legumes and nuts. Lower intakes of meats including processed meats, poultry, sugar sweetened foods (particularly beverages), and refined grains have also been identified as characteristics of healthy eating patterns.

Despite the multiple known benefits of proper nutrition, most physicians feel they have inadequate education in this area. In one survey, 22% of polled physicians received no nutrition education in medical school, and 35% polled said that nutrition education came in a single lecture or a section of a single lecture.<sup>36</sup> The situation does not improve during medical residency. More than 70% of residents surveyed felt they received minimal or no education on nutrition

during medical residency. In the United States, 67% of physicians indicate they have nutritional counseling sessions for patients. However, this education was largely focused on the ill effects of high sodium, sugars, and fried foods. It is noteworthy that only 21% of patients feel they received effective communication in the area of nutrition from their physician.<sup>36</sup>

Issues related to healthy nutrition permeate virtually every condition where lifestyle medicine plays a role and will be treated in detail under each specific condition.

### Weight Management

In many ways overweight and obesity represent quintessential lifestyle diseases. These conditions serve as significant public health problems in the United States and other countries throughout the world.<sup>37</sup> In the United States, the prevalence of overweight (BMI  $\geq$  19-25 kg/m<sup>2</sup>) has been estimated at approximately 70%, while obesity (BMI  $\geq$  30 kg/m<sup>2</sup>) is estimated at 36%, and severe obesity (BMI  $\geq$  35 kg/m<sup>2</sup>) at 16%.<sup>38</sup> These rates are significant since even small amounts of excess body weight have been associated with many chronic diseases including CVD, diabetes, some forms of cancer,<sup>39</sup> muscular skeletal disorders, arthritis,<sup>40</sup> and many others. The cornerstone of obesity treatment relies on lifestyle measures that contribute to balancing energy to prevent weight gain or creating an energy deficit to achieve weight loss. These lifestyle factors including both physical activity and nutrition are cornerstone modalities to achieve these results.

### Tobacco Products

Overwhelming evidence exists from multiple sources that cigarette smoking significantly increases the risk of multiple chronic diseases including heart disease and stroke, diabetes, and cancer. Early in the 20th century in the United States, cigarette smoking was more prevalent in men than women.<sup>41</sup> However, women have rapidly caught up with men. The health risks of smoking in women are the

equivalent of men. Substantial benefits in the reduction of risk of both CVD and cancer accrue in individuals who stop smoking cigarettes. These benefits occur over a very brief period of time.<sup>42</sup>

After years of significant decreases in cigarette smoking, the prevalence of cigarette smoking has appeared to level off in recent years with approximately 15% of individuals currently smoking cigarettes.<sup>43</sup>

It should be noted that secondhand smoke also increases the risk of multiple chronic diseases, since secondhand smoke contains numerous carcinogens and may linger, particularly in indoor air environments, for a number of hours after cigarettes have been smoked.<sup>44</sup>

### Stress, Anxiety, and Depression

Stress is endemic in the modern, fast-paced world. It has been estimated that up to one third of the adult population in the United States experiences enough stress in their daily lives to have an adverse impact on their home or work performance. Anxiety and depression are also very common. Lifestyle measures, such as regular physical activity, have been demonstrated to provide effective amelioration of many aspects of all three of these conditions.<sup>45,46</sup>

Interestingly, in the past decade positive psychology has also emerged as a significant component of lifestyle medicine.<sup>47</sup> This field has demonstrated that positive approaches to psychological issues such as gratitude, forgiveness, and other strategies can play a very important role in stress reduction and amelioration of both anxiety and depression.

Obtaining adequate amounts of sleep has also been demonstrated to be an effective strategy in all these conditions, which proved so troublesome to many individuals.<sup>48</sup>

## Lifestyle Medicine Approaches in the Treatment and Prevention of Chronic Diseases

Lifestyle medicine modalities have been demonstrated in multiple studies to play

an important role in both the treatment and prevention of many chronic diseases and conditions. This section will explore some of the most common diseases or conditions where lifestyle modalities have been studied.

### Cardiovascular Disease

Daily lifestyle practices and habits profoundly affect the likelihood of developing CVD. Many of these same practices and habits also play a role in treating CVD.<sup>1-4,9,14-16</sup>

Numerous studies have demonstrated that regular physical activity, not smoking cigarettes, weight management, and positive nutritional practices all profoundly affect both CVD itself and also risk factors for CVD.<sup>49,50</sup> Numerous epidemiologic studies have shown that positive lifestyle decisions such as engaging in at least 30 minutes of physical activity on most days; not smoking cigarettes; consuming a diet of more fish, whole grains, fruits, and vegetables; and maintaining a healthy body weight can reduce the incidence of CHD by over 80% and diabetes by over 90% in both men and women.<sup>19,20</sup>

Between 1980 and 2000, mortality rates from CHD fell by over 40%.<sup>51</sup> CVD, nonetheless, remains the leading cause of worldwide mortality, and in the United States, it results in over 37% of annual mortality.<sup>51</sup> Approximately half of the reduction in CVD deaths since 1980 can be attributed to reduction in major lifestyle risk factors such as increasing physical activity, smoking cessation, and better control of blood pressure and cholesterol. Unfortunately, increases in obesity and diabetes have moved in the opposite direction and could jeopardize the gains achieved in other lifestyle risk factors, unless these negative trends can be reversed.<sup>51</sup>

In the past decade a number of important initiatives have been undertaken and comprehensive summaries published linking overall life strategies to reductions in cardiovascular risks. In 2012, the American Heart Association (AHA) released its National Goals for Cardiovascular Health Promotion and Disease Reductions for

2020 and beyond.<sup>14</sup> This important document also introduced the concept of “primordial prevention” (preventing risk factors from occurring in the first place) into the cardiology lexicon as well as introducing the concept of “ideal cardiovascular health.” Daily lifestyle measures were central to both these new concepts. In 2013, the American Heart Association and American College of Cardiology (ACC) jointly issued Guidelines for Lifestyle Management to Reduce Cardiovascular Risk,<sup>52</sup> which also emphasized lifestyle measures to reduce the risk of CVD or assist in its treatment if already present.

Unfortunately, a distinct minority of Americans are following the recommendations from the AHA to achieve “ideal” cardiovascular health. Ideal cardiovascular health was defined as achieving appropriate levels of physical activity, consuming a healthy diet score, maintaining a total blood cholesterol of <200 mg/dL, maintaining a blood pressure of <120/<80 mm Hg, and a fasting blood glucose of <100 mg/dL (the cholesterol, blood pressure, and glucose parameters were all defined as “untreated” values). In the AHA document, it was noted that less than 5% of adults in the United States fulfill all 7 criteria for achieving ideal cardiovascular health.<sup>14</sup>

### Metrics for Cardiovascular Health

*Weight.* Overweight and obesity represent significant risk factors for cardiovascular disease. Guidelines developed by a joint effort from The Obesity Society (TOS), AHA, and ACC<sup>53</sup> were designed to help physicians manage obesity more effectively. Key recommendations include enrolling overweight or obese patients in comprehensive lifestyle interventions for weight loss delivery and programs for 6 months or longer.

*Physical Activity.* Increased levels of moderate or vigorous intensity physical activity have been repeatedly shown to lower the risk for cardiovascular disease. Compared with those who are physically

**Table 2.**

2017 Blood Pressure Guidelines From the American Heart Association and American College of Cardiology.

Normal	Less than 120/80 mm Hg
Elevated	Systolic between 120 and 130 <i>and</i> diastolic less than 80
Stage 1	Systolic between 130 and 139 <i>or</i> diastolic between 80 and 89
Stage 2	Systolic at least 140 <i>or</i> diastolic at least 90 mm Hg
Hypertensive crisis	Systolic over 180 <i>and/or</i> diastolic over 120, with patients needing prompt changes in medication if there are no other indications of problems, or immediate hospitalization if there are signs of organ damage

active, the risk of coronary heart disease (CHD) in sedentary individuals is 150% to 240% higher.<sup>54</sup> Unfortunately, only about 25% of Americans engage in enough regular physical activity to meet minimum standards of the Centers for Disease Control and Prevention of at least 150 minutes/week of moderate intensity aerobic exercise or at least 75 minutes of vigorous exercise and muscle strengthening activities at least 2 days/week.<sup>18</sup>

The greatest reduction in risk for CHD appears to result from those engaging in even modest amounts of physical activity compared with the most physically inactive. Even relatively small amounts of increase in physical activity could potentially result in a significant decrease in CHD for a large portion of the American population. Both the 2008 Physical Activity Guidelines for Americans and the 2018<sup>55</sup> Physical Activity Guidelines Advisory Committee Scientific Report<sup>18</sup> recommend similar levels of physical activity as an important component of the reduction of risk for CHD.

*Nutrition.* There is no question that diet plays a significant role in overall strategies for cardiovascular risk reduction.<sup>56,57</sup> This fact is recognized by numerous scientific statements and documents from the American Heart Association including the AHA 2020 Strategic Plan<sup>14</sup> as well as the AHA/ACC Guidelines for Lifestyle Management<sup>52</sup>

and the 2006 AHA Nutrition Guidelines.<sup>56</sup> All these recommendations are similar and include consumption of increased fruits and vegetables, consuming at least 2 fish meals/week (preferably oily fish), consuming fiber-rich grains, and restricting sodium to <1500 mg/day and sugar sweetened beverages ≤450 kcal (36 ounces) per week. The AHA Dietary Guidelines recommend plant-based diets such as the DASH Diet<sup>55</sup> (Dietary Approach to Stop Hypertension), as well as the Mediterranean-style diets.<sup>58</sup> Definitive evidence-based guidelines for overall dietary health are summarized in the Dietary Guidelines for Americans 2015-2020 Report.<sup>8</sup>

#### *Smoking and Use of Tobacco*

*Products.* Overwhelming evidence from multiple sources demonstrates that cigarette smoking significantly increases the risk of both heart disease and stroke. This evidence has been ably summarized elsewhere<sup>59</sup> and is incorporated as a recommendation for every AHA document including the 2020 Strategic Plan. The good news is that risk of CHD and stroke diminish rapidly once smoking cessation occurs. It should also be noted that secondhand smoke also increases the risk of CHD. It has been estimated that 1 nonsmoker dies from secondhand smoke exposure to every 8 smokers who die from smoking.<sup>60</sup>

*Hypertension.* Hypertension represents a significant risk factor for CHD and is the

leading risk factor for stroke. The recently released 2017 Guidelines for the Prevention and Detection, Evaluation and Management for High Blood Pressure in Adults from the AHA and the ACC defines normal blood pressure as <120 mm Hg/<80 mm Hg, and hypertension as systolic >120 mm Hg and diastolic high blood pressure as >80 mm Hg.<sup>3</sup> The new criteria are found on Table 2. Using these criteria, more than 40% of the adult population in the United States has high blood pressure. Recommendations for treating high blood pressure, particularly in the lowest categories, involve a number of lifestyle medicine modalities such as increased physical activity, weight loss (if necessary), and improved nutrition including a salt reduction to <1500 mg/day.<sup>3</sup>

*Dyslipidemias.* In 2013, the ACC and AHA issued "Guidelines for the Treatment of Blood Cholesterol to Reduce Atherosclerotic Cardiovascular Disease in Adults."<sup>6</sup> These guidelines recommend an increased use of statin medications to reduce atherosclerotic cardiovascular disease (ASCVD) both in primary and secondary prevention and recommended the discontinuation of the use of specific low-density lipoprotein and high-density lipoprotein treatment targets. Within these guidelines for treating blood lipids, it was acknowledged that lifestyle is the foundation of ASCVD risk reduction

efforts. This includes adhering to a heart healthy diet, regular exercise, avoidance of tobacco, and maintenance of a healthy body weight.

## Diabetes and Pre-Diabetes

Dramatic increases in diabetes have occurred around the world in the past 2 decades. Lifestyle medicine modalities to prevent or treat diabetes focus on nutrition therapy, physical activity, education, counseling, and support given the great importance given to the metabolic basis of the vast majority of individuals who have either pre-diabetes or diabetes.<sup>61</sup> The International Diabetes Federation estimates that 387 million adults in the world live with type 1 or type 2 diabetes. Tragically, almost half of these individuals do not know they have these diseases. It is estimated that the number of individuals living with diabetes will increase to 392 million people by 2035.

In the United States in 2011-2012, the estimated prevalence of diabetes was 12% to 14%.<sup>62</sup> There is a higher prevalence in adults who are non-Hispanic-Black, non-Hispanic-Asian, or Hispanic. The proportion of people who have undiagnosed diabetes has decreased between 3.1% and 5.2% during this period of time. The prevalence of pre-diabetes has been reported to be between 37% and 38% of the overall US population. Consequently, 49% to 52% of the US population has either diabetes or pre-diabetes.<sup>63</sup>

### Pre-Diabetes

Multiple lifestyle interventions play critically important roles in preventing pre-diabetes from turning into diabetes. The strongest evidence comes from the Diabetes Prevention Program (DPP), which demonstrated that an intensive lifestyle intervention in individuals with pre-diabetes could reduce the incidence of type 2 diabetes by 58% over 3 years.<sup>64</sup> Other studies that have supported the importance of lifestyle intervention for diabetes prevention include the Da Qing Study, where 43% reduction in

conversion from pre-diabetes to diabetes occurred at 20 years,<sup>65</sup> and the Finnish Diabetes Prevention Study, which showed also a 43% reduction in conversion of pre-diabetes to diabetes at 7 years and a 34% reduction at 10 years.<sup>66</sup>

The 2 major goals of the DPP in the lifestyle intervention arm were to achieve a minimum of 7% weight loss and 150 minutes of physical activity/week at a moderate intensity such as brisk walking. These goals were selected based on previous literature suggesting that these were both feasible and could influence the development of diabetes. Both these goals were largely met in the DPP.

The nutrition plan in DPP focused on reducing calorie intake in order to achieve weight loss if needed. The recommended diet was consistent with both Mediterranean and DASH eating patterns. Conversely, sugar sweetened beverages and red meats were minimized since they are associated with the increased risk of type 2 diabetes.<sup>65</sup> The 150 minutes/week of moderate intensity physical activity was achieved largely through brisk walking, which also contributed to beneficial effects in individuals with pre-diabetes.

Education and support in the DPP was provided with an individual model of treatment rather than a group-based approach including a 16-session core curriculum completed in the first 24 weeks including sections on lowering calories, increasing physical activity, self-monitoring, maintaining healthy lifestyle behaviors, and psychological, social, and motivational challenges.<sup>63</sup>

Recent evidence has also suggested that breaking up sedentary time (such as screen time) further decreases the risk of pre-diabetes being converted to diabetes.

### Diabetes

Lifestyle modalities are a cornerstone for diabetes care. These modalities include medical nutrition therapy (MNT), physical activity, smoking cessation, counseling, psychosocial care, and diabetes self-management education support.<sup>66</sup>

There are many different ways of achieving the nutritional goals. Individuals with diabetes should be referred for individualized MNT. MNT promotes healthful eating patterns emphasizing a variety of nutrient-dense foods at appropriate levels with the goal of achieving and maintaining healthy body weight; maintaining individual glycemic, blood pressure, and lipid goals; and delaying or preventing complications of diabetes. There is not one ideal percentage of calories from carbohydrate, protein, and fat for all people with diabetes. A variety of eating patterns are acceptable for the management of diabetes including the Mediterranean, DASH, and other plant-based diets. All of these have been shown to achieve benefits for people with diabetes.<sup>67</sup>

Weight management, if necessary, and reduction of weight are important particularly for overweight and obese people with diabetes. Weight loss can be attained in lifestyle programs that achieve 500 to 750 kcal daily reduction for both men and women adjusted to the individual based on body weight. For many obese individuals with type 2 diabetes, weight loss >5% is necessary in order to achieve beneficial outcomes for glycemic control, lipids, and blood pressure, while sustained weight loss of >7% is optimal.

Regular physical activity is also vitally important for the management of diabetes. People with diabetes should be encouraged to perform both aerobic and resistance exercise regularly.<sup>68</sup> Aerobic activity bouts should ideally be at least 10 minutes, with a goal of 30 minutes/day or more on most days of the week. Recent evidence supports the concept that individuals with diabetes should be encouraged to reduce time spent being sedentary in activities such as working at a computer, watching TV, and so on, or breaking up sedentary activities by briefly standing, walking, or performing light physical activity. Research trials have demonstrated strong evidence for A1C lowering value of exercise in individuals with type 2 diabetes. The ADA Consensus Report indicates that

prior to starting an exercise program medical providers should perform a careful history to assess cardiovascular risk factors and be aware of atypical presentation of CAD in patients with diabetes. Health care providers should customize exercise regimens to individuals' needs.<sup>67</sup>

## Obesity

In many ways obesity represents the quintessential lifestyle disease.<sup>34</sup> Obesity is the result of energy imbalance, since energy expenditure and energy intake are key factors in the energy balance equation.<sup>61</sup> Thus, both nutritional and physical activity components of lifestyle intervention are critically important to both short-term weight loss and also long-term maintenance of healthy body weight.

It is currently estimated that 78 million individuals in the United States are obese. This represents 36% of the population.<sup>37</sup> More than 70% of individuals in the United States are overweight (BMI  $\geq 25$  kg/m<sup>2</sup>), including obese (BMI  $\geq 30$  kg/m<sup>2</sup>) and severely obese (BMI  $\geq 35$  kg/m<sup>2</sup>). While it may seem simple that either decreased caloric intake or increased physical activity may contribute to weight loss, in fact the process is complicated. As emphasized in the Consensus Statement on Obesity from the American Society of Nutrition, metabolism consists of multiple factors including percent body fat, other issues related to metabolism, and a host of environmental factors.<sup>69</sup>

At any time, approximately 50% to 70% of obese Americans are actively trying to lose weight. Sustained weight loss of as little as 5% to 10% is considered clinically significant, since it reduces risk factors for a variety of chronic diseases such as diabetes and heart disease. Both the Diabetes Prevention Program and the Look AHEAD Trial<sup>70</sup> showed that weight loss of 7% in obese individuals resulted in significant improvement in risk factors for both heart disease and diabetes. Nutrition represents a cornerstone of treatment for overweight and obesity.<sup>71</sup> Dietary treatments for disease have been

called MNT. This therapeutic approach has been used in a variety of medical conditions, but there is particularly strong proof that MNT improves waist circumference, waist-to-hip ratio, fasting blood sugar, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, and blood pressure.

Typical nutritional interventions for weight loss in obese individuals involve sustaining an average daily caloric deficit of 500 kcal. Energy recommendations also include that intake should not be <1200 calories/day for male or female adults in order to maintain adequate nutrient intake.

A variety of evidence-based diets have been demonstrated to assist in healthy weight loss. These include the Mediterranean diet, the DASH diet, and the Healthy U.S. Eating Style Pattern. It has also been demonstrated that macronutrient composition of a weight loss plan (eg, low fat vs low carb, etc) do not achieve different results in studies lasting longer than one year.

The Weight Loss Guidelines jointly issued by the US Preventive Services Task Force, the American Heart Association, the American College of Cardiology, the Obesity Society, and the Academy of Nutrition and Dietetics all recommend a multidisciplinary team approach to managing obesity.<sup>53</sup> These approaches include physical activity counseling, MNT, as well as a structured approach to behavioral change utilizing problem solving and goal setting as well as self-monitoring. Most evidence suggests that effective weight loss programs should last at least 6 months and have a minimum of 24 counseling sessions.

There is a prevalent misconception that maintenance of weight loss is virtually impossible. In both the Diabetes Prevention Program and the Look AHEAD Trial, however, individuals who completed the initial 16-week program and then were followed on a monthly basis for the next 3 to 4 years were able to maintain 90% of the weight that they initially lost. The National Weight Control Registry, which is a registry of over 10 000 individuals who have lost at least 50

pounds and kept it off for at least 1 year, also demonstrated that key components of lifestyle measures such as regular attention to monitoring nutritional intake as well as regular physical activity (on average 60 minutes/day) were key components of how these individuals were able to maintain initial weight loss.<sup>72</sup>

It has been argued that physical activity alone is not a powerful tool for initial weight loss. However, abundant evidence supports the concept that regular physical activity is a key component of long-term maintenance of weight loss. Regular physical activity also plays an important role in preservation of lean body mass, which is a key component of maintaining adequate metabolism to support maintenance of weight loss.<sup>28</sup> As already indicated, regular physical activity also conveys a host of health enhancing benefits in addition to its role in weight loss and weight management.

## Cancer

Lifestyle measures play a critically important role both in the prevention of cancer and treatment of individuals who have already established cancer. Moreover, lifestyle measures play a very important role in the ongoing health of cancer survivors. These facts are underscored by the joint statement issued by the American Cancer Society, the American Diabetes Association, and the American Heart Association on preventing cancer, CVD, and diabetes.<sup>15</sup>

Cancer is a generic term that represents more than 100 diseases, each of which has a different etiology. Nonetheless, lifestyle measures can play a critically important role in virtually every form of cancer. In 2016, an estimated 1 685 210 new cases of cancer were diagnosed in the United States and 595 690 people died from the disease.<sup>73</sup> Worldwide it has been estimated that the number of new cancers could rise by as much as 70% over the next 2 decades. Approximately 70% of deaths from cancer will occur in low- and middle-income countries.<sup>74</sup>

Cancer is no longer viewed as an inevitable consequence of aging. In fact,

only 5% to 10% of cancers can be classified as familial. Thus, most cancers are associated with multiple environmental factors including lifestyle issues. For example, the importance of nutrition was emphasized more than 35 years ago by Dahl and Petro. They estimated that approximately 35% (10% to 70%) of all cancers in the United States could be attributable to dietary factors.<sup>75</sup> In 2007, the World Cancer Research Fund and American Institute for Cancer Research (WCRF/AICR) evaluated 7000 studies and concluded that diet and physical activity were major determinants of cancer risk.<sup>76</sup> Thus, on a global scale, 3 to 4 million cancer cases could be prevented each year from more positive lifestyle habits and actions.<sup>76</sup>

The relationship of obesity to cancer is also very strong.<sup>77</sup> This relationship is based not only on hormonal changes associated with obesity but also a variety of other physiologic mechanisms. Adipocytes, which compose the predominant cell in body fat, have been historically thought to be simply passive storage vessels. It is now clear, however, that adipocytes secrete a variety of metabolically active substances that promote inflammation, insulin resistance, and a variety of other factors, all of which may promote cancer cell growth. The AICR and IARC (International Agency for Research on Cancer) have concluded that there is sufficient evidence to link 13 human malignancies to excess body fatness.<sup>78</sup> Excess body fatness is now the second leading preventable cause of cancer, behind only cigarette smoking.<sup>79</sup> The AICR also reported in 2017, that, unfortunately, only 50% of Americans are aware that obesity promotes cancer growth, so there is an important educational issue to combat, as well.<sup>80</sup>

Individuals who are overweight or obese should follow standard cancer screening guidelines. Intentional weight loss lowers cancer risk and improves survival. Individuals with cancer should avoid excess weight gain or, if already overweight or obese, should attempt to lose weight to improve prognosis. The typical program for safe and effective

weight loss involves both regular physical activity and caloric restriction. These programs may need to be modified given the unique aspects of each cancer.

General nutrition guidelines for cancer prevention and treatment are very similar to those for healthy eating, in general. However, some modifications may be necessary to protect against certain cancers or treat various side effects of cancer therapy, such as excessive weight loss. In general, lifestyle nutrition measures for cancer prevention involve increasing the consumption of foods that have been shown to decrease the cancer risk, which include whole grains, vegetables, fruits, and legumes. In addition, individuals should decrease consumption of foods associated with increased cancer risk such as processed meat (including ham and bacon), red meat such as beef, pork and lamb, and decrease alcoholic beverages and salt preserved foods. Individuals should eat a healthy diet rather than relying on supplements to protect against cancer.

Physical activity also plays a key role in the association of lifestyle risk to cancer.<sup>81,82</sup> Although specific biologic mechanisms linking physical activity to cancer reduction remain unknown, there is growing evidence supporting the role of physical inactivity in various cancer diagnoses. According to the World Cancer Research Fund International, 20% of cancer cases in the United States could be prevented through physical activity, weight control, and consumption of a healthy diet.<sup>83</sup> In addition, a pooled analysis of 12 prospective cohort studies involving 1.4 million participants in the United States and Europe demonstrated an association between higher levels of leisure time physical activity and risk reduction of 13 different cancer types.<sup>84</sup>

Among those cancers linked to inactivity, colon, breast, and endometrial cancers are the most studied.<sup>85</sup> The link between physical activity and breast cancer may be through reducing levels of sex hormones and increasing concentrations of sex hormone binding globulin proteins.<sup>86</sup> The relationship between exercise and decreased

endometrial cancer risks may have similar mechanisms.<sup>87</sup> The relationship between physical activity and decreased colon cancer risk may be due to immune function modulation reduction in intestinal transit time, hyperinsulinemia, and inflammation.<sup>88</sup> Despite these postulated underlying factors, the biological link between physical activity and reduced colon cancer risk is not well understood.

There are multiple physical activity guidelines that not only have been demonstrated to reduce the risk of cancer, but may also be employed as a treatment tool for cancer populations. Safety is the key consideration in physical activity for cancer survivors. Guidelines for physical activity and cancer have been issued both by the American Cancer Society<sup>89</sup> and the AICR.<sup>90</sup> While a detailed explanation of these guidelines is beyond the scope of this review, the interested reader is referred to these guidelines for more specific detail.

## Dementia/Cognition

Maintaining cognitive function is vital to maintaining quality of life, functional independence, and is an important component of the aging process. As life expectancy continues to increase in developed countries, the number of individuals over the age of 65 will undoubtedly increase dramatically over the next 15 to 20 years.<sup>16</sup> It has been estimated that there are currently 47 million people with dementia worldwide and this is projected to increase to 75 million individuals in 2030 and 131 million individuals by 2050.<sup>16</sup>

There is a strong linkage between brain health and cardiovascular health. This central fact is underscored by the Presidential Advisory from the AHA and American Stroke Association (ASA) on "Defining Optimal Brain Health in Adults."<sup>16</sup>

Lifestyle measures play a central role in the recommendations from the AHA/ASA for maintaining healthy cognition throughout a lifetime. Modifiable risk factors that may

compromise brain health are also associated with poor cardiovascular health such as uncontrolled hypertension, diabetes mellitus, obesity, physical inactivity, smoking, and depression. Each of these conditions has been shown to be potentially ameliorated, at least to some degree, by positive lifestyle measures. For this reason, the AHA and ASA have identified 7 metrics to define optimal brain health including nonsmoking, physical activity at goal levels, a healthy diet consistent with current guideline levels, and a body mass index of  $<25 \text{ kg/m}^2$ .<sup>16</sup> In addition, the AHA and ASA recommend 3 ideal health factors including an untreated blood pressure of  $<120/<80 \text{ mm Hg}$ , untreated cholesterol  $<200 \text{ mg/dL}$ , and fasting blood glucose of  $<100 \text{ mg/dL}$ .

Virtually all of these factors are affected by positive lifestyle decisions, making cognition and reducing the risk of dementia strongly linked to lifestyle factors. Furthermore, it is important to stress that while many of the manifestations of the spectrum ranging from diminished cognition to dementia occur in individuals in their 50s, 60s, and beyond, paying attention to these risk factors should occur throughout a lifetime, thus enhancing the importance of lifestyle measures in maintaining positive brain health.

A variety of dietary habits have also been shown to decrease the risk of cognitive decline and risk of dementia. These include Mediterranean style diets (MST) and the Dietary Approach to Stop Hypertension (DASH) diet.<sup>91</sup> A combination of MST and DASH (the so-called MIND diet) has also been observed to be associated with decreased risk of dementia with aging. All of these diets are plant based as their principle sources of energy and involve a high intake of grains and cereals, fruits, vegetables, legumes, nuts, olive oil, and fish as fat sources. In addition, a recent study demonstrated that consumption of cocoa, both in individuals over the age of 60 with maintained cognition and also mild cognitive impairment, may improve

levels of cognition.<sup>92,93</sup> A number of studies have shown that regular physical activity is associated with improved cognition.<sup>16</sup>

### Anxiety, Depression, and Stress Reduction

Anxiety, depression, and stress are all endemic in the modern, fast-paced world. Lifestyle interventions have been demonstrated to play an effective role in ameliorating all three of these conditions.

Within all of the mental health disorders, anxiety is the most common.<sup>94</sup> The overall prevalence of anxiety disorders has been reported at more than 30%. Regular physical activity has been demonstrated in multiple studies to lower anxiety levels. While the *state* of anxiety has been shown to be reduced immediately after performing a single bout of exercise, the *trait* of anxiety appears to require a training period of at least 10 weeks. The exact level of physical activity has not been determined. However, most studies employ the general guidelines of 30 minutes of moderate intensity physical activity/session.

Depression is also quite common with a lifetime prevalence of significant depression of approximately 10% in the US population.<sup>95</sup> Even in the absence of significant depressive disorder, symptoms of depression can negatively influence health and quality of life. Physical activity has been repeatedly shown to decrease symptoms of depression. Typical levels of physical activity employed once again have involved at least 30 minutes of moderate intensity physical activity performed on a regular basis.

Stress is endemic in our modern world.<sup>96</sup> While exact prevalence figures for stress are difficult or impossible to determine, most people experience at least moderate stress in their daily lives. It has been estimated that up to one third of individuals experience enough stress in their daily life to decrease their performance at either work or home.

While a certain level of stress may be protective, excessive stress may be harmful through a variety of physiologic and psychological effects.

A variety of approaches to ameliorate stress have been studied and found effective. These include the relaxation response and other mind-body therapies. Certainly, these mind-body therapies play an important role in the delivery of lifestyle medicine. One other aspect of modern psychological therapy that has gained increased prominence in the past decade is positive psychology involving modalities and concepts such as gratitude and forgiveness, which may help reduce stress.

### Lifestyle Medicine and Pediatrics

A detailed discussion of lifestyle medicine in the pediatric population is beyond the scope of this review. However, it should be noted that many of the conditions that manifest themselves in adulthood have their roots in childhood. In particular, there has been a dramatic increase in the prevalence of overweight and obesity in children<sup>97</sup> and a corresponding increase in the prevalence of type 2 diabetes. Dyslipidemia<sup>98</sup> and hypertension<sup>99</sup> have also increased in prevalence in the pediatric population.

There is emerging evidence that many of the conditions now increasing in prevalence in children may actually begin in utero.<sup>100</sup> The same types of lifestyle measures that are applicable both for the prevention and treatment of chronic disease in adults are also very relevant to children. Good information on physical activity in children can be found in the recently revised Physical Activity Guidelines for Americans.<sup>18</sup> Nutritional guidance may also be found in the 2015-2020 Dietary Guidelines for Americans.<sup>8</sup> Since many of the lifestyle medicine modalities employed in adults are highly relevant to families, issues related to physical activity, nutrition, and weight management should be addressed in the family setting.

## Conclusions

There is no longer any serious doubt that daily habits and practices profoundly affect the short-term and long-term health and quality of life. Increased physical activity, proper nutrition, weight management, avoidance of tobacco, and stress reduction are all key modalities that can lower the risk of chronic disease and improve quality of life. Despite the overwhelming evidence that these practices have a profound impact on health, the medical community has been slow to respond in addressing these modalities and in encouraging patients to make positive lifestyle changes. This represents a significant missed opportunity since more 75% of Americans see a primary care doctor every year. Employing the principles of lifestyle medicine in the daily practice of medicine represents a substantial opportunity to increase the value of proposition in medicine by improving outcomes for patients, while controlling costs.<sup>101</sup> The time has come to employ the vast body of evidence in lifestyle medicine and encourage positive lifestyle medicine not only for our patients but also in our own lives.

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The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Dr Rippe is the editor in chief, *American Journal of Lifestyle Medicine*, and editor of *Lifestyle Medicine* (CRC Press). He is also founder and director, Rippe Lifestyle Institute, a research organization that has conducted multiple studies in physical activity, nutrition, and weight management.

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