
The Importance of Healthy Living and Defining Lifestyle Medicine

2

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Abbreviations

AHA	American Heart Association
ARIC	Atherosclerosis Risk in Communities Study
BMI	Body mass index
CVD	Cardiovascular diseases
DALY	Disability-adjusted life year
DASH	Dietary Approaches to Stop Hypertension
DSE	Diabetes support and education
EPIC	European Prospective Investigation into Cancer and Nutrition
ILI	Intensive lifestyle-based weight loss intervention
NCD	Noncommunicable diseases
NHANES	National Health and Nutrition Examination Survey
NIH	National Institutes of Health
OR	Odd ratios
PURE	Prospective Urban Rural Epidemiology
SCD	Sudden cardiac death
T2D	Type-2 diabetes
WOH	World Health Organization
YLDs	Years lived with disabilities
YLL	Years of life lost

Introduction

The background and rationale for development of lifestyle medicine as a new model of care was reviewed in Chap. 1. In this chapter, we revisit the burden of noncommunicable diseases (NCD) in greater detail, the associated risk factors and contributing influences that heighten risk, the rarity of good health, and the difference between lifestyle medicine and other closely aligned specialty areas.

Rationale for Development of a New Discipline

Lifestyle medicine is a nascent discipline that has recently emerged as a systematized approach for management of chronic disease. The individual elements and skillsets that define lifestyle medicine are determined, in large part, by the primary contributors to NCD. Unhealthy lifestyle behaviors are among the leading risk factors for increased disability-adjusted life years (DALYs) in the USA [1] and around the world [2]. DALYs have become an important metric to assess health outcome and are defined as the sum of years of life lost (YLLs) due to premature mortality and years lived with disabilities (YLDs). Globally, NCD account for about 63 % of all deaths. By 2030, it is estimated that NCD may account for 52 million deaths worldwide [3]. One of the primary aims of the 2011 United Nations High-Level Meeting of the General Assembly on Non-communicable Diseases was “reducing the level of exposure of individuals and populations to the common modifiable risk factors for NCD, namely, tobacco use, unhealthy diet, physical inactivity, and the harmful use of alcohol, and their determinants, while at the same time strengthening the capacity of individuals and populations to make healthier choices and follow lifestyle patterns that foster good health” [4]. More recently, the World Health Organization (WHO) published the *2008–2013 Action Plan for the Global Strategy for the Prevention and Control of Noncommunicable Diseases* to prevent and control four NCD—car-

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Table 2.1 Individual risk factors contributing to the five leading causes of death in the USA, 2010. [6]

	Heart disease	Cancer	Lower respiratory disease	Stroke	Unintentional injuries
Tobacco	✓	✓	✓	✓	
Poor diet	✓	✓		✓	
Physical inactivity	✓	✓		✓	
Overweight	✓	✓		✓	
Alcohol		✓		✓	✓

Table 2.2 Common themes in current dietary and lifestyle recommendations

	USDA Dietary Guidelines (2010)	American Heart Association (AHA) (2006)	American Diabetes Association (2014)	American Cancer Society (2012)	AHA/ACC guideline on lifestyle management to reduce cardiovascular risk (2014)
Healthy body weight	✓	✓	✓	✓	✓
Engage in physical activity	✓	✓	✓	✓	✓
Increase fruits and vegetables	✓	✓	✓	✓	✓
Choose whole grains (high fiber foods)	✓	✓	✓	✓	✓
Limit salt	✓	✓	✓	✓	✓
Limit saturated fat, <i>trans</i> fat, and cholesterol	✓	✓	✓		✓
Limit consumption of alcoholic beverages	✓	✓	✓	✓	
Minimize intake of added sugars	✓	✓	✓		✓
Limit consumption of processed meat and meat products				✓	✓
Consume fish, especially oily fish		✓			
Limit consumption of refined grains	✓				

USDA US Department of Agriculture, ACC American College of Cardiology

diovascular diseases (CVD), diabetes, cancers, and chronic respiratory diseases and four shared risk factors—tobacco use, physical inactivity, unhealthy diets, and the harmful use of alcohol [5]. These diseases are preventable. It is estimated that up to 80% of heart disease, stroke, and type-2 diabetes (T2D) and over a third of cancers could be prevented by eliminating these four shared risk factors. The four types of diseases and their risk factors are considered together in the WHO action plan in order to emphasize common causes and highlight potential synergies in prevention and control.

In the USA, the five leading causes of death in 2010 were diseases of the heart, cancer, chronic lower respiratory diseases, cerebrovascular disease (stroke), and unintentional injuries [6]. Among persons aged 80 years, these five diseases represented 66% of all deaths. Selected modifiable lifestyle risk factors for these diseases are displayed in Table 2.1. Other modifiable risk factors associated with these diseases include hypertension, hypercholesterolemia, and T2D (heart diseases); sun exposure, ionizing radiation, and hormones

(cancer); and air pollutants, occupational exposure, and allergens (lower respiratory disease).

The similarity of modifiable lifestyle risk factors for the five leading causes of death is striking. The strength of the evidence regarding the impact of daily habits on health outcomes is further supported by comparing the leading clinical guidelines on prevention and treatment of disease [7–11] (Table 2.2).

Individual lifestyle behaviors are among the five multiple determinants of health as defined by Healthy People 2020, the science-based, 10-year national objectives for improving the health of all Americans [12]. The other four determinants are environment, social, health care, and genetics and biology. In reality, the occurrence or reduction of individual risk factors are closely aligned with the other major determinants. For example, whether an individual consumes an unhealthy diet or is physically inactive will depend, in part, on social, demographic, environmental, economic, and geographical attributes of the neighborhood where the person lives and works [6].

Impact of a Healthy Lifestyle on Chronic Disease

There is a strong body of evidence that practicing healthy lifestyle behaviors reduces the risk of chronic disease. In 2009, the American College of Preventive Medicine published a comprehensive review of the scientific evidence for lifestyle medicine both for the prevention and treatment of chronic disease [13]. Twenty-four chronic diseases were reviewed in this publication, highlighting the impact of a healthy lifestyle on improving the root causes of disease.

Recently, multiple systematic reviews and meta-analyses have been published that demonstrate the beneficial impact of lifestyle interventions in reducing T2D incidence in patients with impaired glucose tolerance [14, 15], management of T2D [16, 17], hypercholesterolemia [18], CVD [11], and the metabolic syndrome [19, 20]. In the National Institutes of Health (NIH)-AARP Diet and Health Study population-based cohort study among 207,449 men and women, the 11-year risk for incident T2D for men and women whose diet score, physical activity, smoking status, and alcohol use were all in the low-risk group had odd ratios (OR) for T2D of 0.61 and 0.43, respectively, compared to the high-risk group [21]. T2D and obesity are among the two most significant NCDs that currently affect 366 and 500 million people worldwide, respectively [22, 23]. Often called “diabesity” because of their close association, one of the most effective targets for T2D treatment is management of excess body weight by diet and physical activity. The beneficial impact of weight loss on glycemic control and reduction of cardiovascular risk factors has been recently demonstrated in the Look AHEAD (Action for Health in Diabetes) trial. In this prospectively controlled, randomized study conducted at 16 US research centers, 5145 overweight adults aged 45–76 years with T2D were randomized to either an intensive lifestyle-based weight loss intervention (ILI) or a diabetes support and education (DSE) intervention [24]. Although 4-year results showed statistically significant improvements in fitness, glycemic control, and cardiovascular risk factors [25, 26], the trial was discontinued in September, 2012 after a median follow-up of 9.6 years on the basis of a futility analysis [27]. The probability of observing a significant positive result at the planned end of follow-up was estimated to be 1%. Proposed explanations for the lack of significant difference in rates of cardiovascular events between the ILI and DSE groups include a 2.5% difference in weight loss between groups at year 10, intensification of medical management of cardiovascular risk factors, and low event rate [28].

Over the past several years, there has been an increased interest in evaluating the benefit of adhering to “low-risk lifestyle” behaviors on the development of morbidity and mortality. Although the criteria for defining “low-risk lifestyle” factors vary, these studies have shown that adherence

to a healthy lifestyle is associated with improved health outcomes. The following population studies are notable for their size and magnitude in demonstrating the potential impact of fostering lifestyle medicine as a new discipline.

In the European Prospective Investigation into Cancer and Nutrition (EPIC) study, 23,153 German participants aged 35–65 years were followed-up for a mean of 7.8 years. Adherence to four health behaviors (not smoking, exercising 3.5 h per week, eating a healthy diet (high intake of fruits, vegetables, and whole-grain bread and low meat consumption), and having a body mass index (BMI) of 30 kg/m²) at baseline was associated with 78% lower risk of developing chronic disease (T2D 93%, myocardial infarction 81%, stroke 50%, and cancer 36%) than participants without the healthy factors [29].

In the Nurses’ Health Study, a prospective cohort study of 81,722 US women from 1984 to 2010, a low-risk lifestyle was defined as not smoking, BMI of less than 25 kg/m², exercise duration of 30 min/day or longer, and top 40% of the alternate Mediterranean diet score, which emphasizes high intake of vegetables, fruits, nuts, legumes, whole grains, and fish and moderate intake of alcohol. Compared with women with no low-risk factors, the multivariate relative risk of sudden cardiac death (SCD) decreased progressively for women with 1, 2, 3, and 4 low-risk factors to 0.54, 0.41, 0.33, and 0.08, respectively. The proportion of SCD attributable to smoking, inactivity, overweight, and poor diet was 81% [30].

The Atherosclerosis Risk in Communities Study (ARIC), a prospective epidemiological study of 15,792 men and women aged 44–64 years at enrollment, demonstrated that adopting a healthy lifestyle after age 45 results in substantial benefits after only 4 years compared to people with less healthy lifestyles, reducing mortality and CVD risk by 40 and 35%, respectively [31].

To further explore the relationship between change in health behaviors, socioeconomic status, and mortality, Stringhini et al. [32] followed a cohort of 10,308 civil servants from baseline examination (1985–1988) to phase 7 (2002–2004) in the British Whitehall II study. After adjusting for sex and year of birth, those with the lowest socioeconomic position had 1.60 times higher risk of death from all causes than those with the highest socioeconomic position. However, this association was attenuated by 72% when four health behaviors (smoking, alcohol consumption, diet, and physical activity) were entered in the statistical model.

In a population-based, prospective cohort of 20,721 Swedish men aged 45–79 years without history of chronic disease followed for 11 years, five low-risk behaviors (a healthy diet, moderate alcohol consumption, no smoking, being physically active, and having a healthy waist circumference) were associated with 86% lower risk of myocardial infarction events compared with the high-risk group with no low-risk factors [33].

Table 2.3 Definitions of poor, intermediate, and ideal cardiovascular health for each American Heart Association (AHA) metric for adults 20 years of age

Goal/metric	Poor health	Intermediate health	Ideal health
Current smoking	Yes	Former \leq 12 months	Never or quit $>$ 12 months
Body mass index (kg/m ²)	\geq 30	25–29.9	$<$ 25
Physical activity	None	1–149 min/week moderate intensity or 1–74 min/week vigorous intensity or 1–149 min/week moderate + vigorous	\geq 150 min/week moderate intensity or \geq 75 min/week vigorous intensity or \geq 150 min/week moderate + vigorous intensity
Healthy Diet Score ^a	0–1 components	2–3 components	4–5 components
Total cholesterol (mg/dl)	$>$ 240	200–239, or treated to goal	$<$ 200
Blood pressure (mm Hg)	SBP \geq 140 or DBP \geq 90	SBP 120–139 or DBP 80–89 or treated to goal	$<$ 120/ $<$ 80
Fasting plasma glucose (mg/dl)	\geq 126	100–125 or treated to goal	$<$ 100

SBP systolic blood pressure, DBP diastolic blood pressure

^a Healthy Diet Score is based on an overall dietary pattern that is consistent with a Dietary Approaches to Stop Hypertension (DASH)-type eating plan. Individual components are: fruits and vegetables: \geq 4.5 cups per day; fish: \geq two 3.5-oz servings per week; fiber-rich whole grains: \geq three 1-oz equivalent servings per day; sodium: $<$ 1500 mg per day; sugar-sweetened beverages: \leq 450 kcal (36 oz) per week; nuts, legumes, and seeds: \geq four servings per week; processed meats: none or \leq two servings per week; saturated fat: $<$ 7% of total energy intake. Adapted from reference [36].

Another approach used to assess the burden of disease is to combine lifestyle and physiological risk factors. This has been extensively applied to CVD. In the INTERHEART study, a case–control study of acute myocardial infarction across 52 countries, 15,152 cases and 14,820 controls were enrolled between 1999 and 2003 to assess the effect of risk factors on development of coronary heart disease [34]. The study showed that over 90% of the proportion of risk for an initial myocardial infarction is collectively attributable to nine measured and potentially modifiable risk factors: cigarette smoking, raised ApoB/Apo A1 ratio, hypertension, abdominal obesity, psychosocial factors, daily consumption of fruits and vegetables, regular alcohol consumption, and regular physical activity.

The concept of “cardiovascular health metrics” has also emerged as a method to assess cardiovascular risk and coined as “Life’s Simple 7” by the American Heart Association (AHA) in their 2020 Strategic Impact Goals to target a 20% relative improvement in overall cardiovascular health in all Americans [35]. The AHA combines four health behaviors (smoking, diet, physical activity, and body weight) with three health factors (plasma glucose, cholesterol, and blood pressure) as their metrics and assesses adherence as poor, intermediate, or ideal by distinct definitions (Table 2.3) [36]. The AHA also recently published 11 comprehensive articles in a themed series entitled “Recent Advances in Preventive Cardiology and Lifestyle Medicine” that emphasize the multiple determinants of cardiovascular health [37]. Finally, Yang et al. [38] analyzed the associations between the number of ideal cardiovascular health metrics and mortality over a median follow-up of 14.5 years using data from the National Health and Nutrition Examination Survey (NHANES). Compared with individuals with 0 or 1 metric at ideal levels, those with six or more metrics at ideal levels had 51, 76, and 70% lower adjusted hazards for all-cause, CVD, and ischemic heart disease mortality, respectively.

The Rarity of Good Health

Despite the importance of following a healthy life, multiple population studies have shown that only a minority of individuals adhere to healthy lifestyle behaviors. In a comparative analysis of middle-aged adults aged 40–74 years participating in the NHANES III 1988–1994 and 2001–2006 surveys, the proportion of adults who adhered to all five healthy habits (\geq 5 fruits and vegetables/day, regular exercise 12 times/month, maintaining a BMI between 18.5 and 29.9 kg/m², moderate alcohol consumption, and not smoking) decreased from 15 to 8% [39]. Adherence to the ideal health metrics was also analyzed by Ford et al. [40] using data from NHANES 1999 to 2002. Overall, about 1.5% of participants met none of the seven ideal cardiovascular health metrics, and 1.1% of participants met all seven metrics; most adults met two, three, or four ideal health metrics. Based on an analysis of the NHANES data, Huffman et al. [41] projects that the AHA goal of reducing CVD by 20% by 2020 will not be reached.

Poor health behaviors are not confined to the USA. Akesson et al. [33] (discussed above) identified five low-risk behaviors (a healthy diet, moderate alcohol consumption, no smoking, being physically active, and having a healthy waist circumference) that were associated with a 86% lower risk of myocardial infarction events compared with the high-risk group with no low-risk factors. Despite the impact of healthy living, only 1% of the population comprised the low-risk group and followed all five healthy lifestyle practices.

In the Prospective Urban Rural Epidemiology (PURE) study, 153,996 adults, aged 35–70 years, from 17 low-, middle-, and high-income countries of the world were surveyed for their health behaviors after a median of 5 years and 4 years after sustaining a coronary heart disease event or stroke, respectively [42]. Despite having known CVD, less

Table 2.4 Current definitions of lifestyle medicine

American College of Lifestyle Medicine 2011 [50]	Lifestyle medicine is the therapeutic use of evidence-based lifestyle interventions to treat and prevent lifestyle related diseases in a clinical setting. It empowers individuals with the knowledge and life skills to make effective behavior changes that address the underlying causes of disease
Egger et al. 2012 [51]	The application of environmental, behavioral, medical, and motivational principles to the management of lifestyle-related health problems (including self-care and self-management) in a clinical setting
Lianov and Johnson [52]	Evidence-based practice of assisting individuals and families to adopt and sustain behaviors that can improve health and quality of life
Rippe 1999, 2014 [53]	The integration of lifestyle practices into the modern practice of medicine both to lower the risk factors for chronic disease and/or, if disease already present, serve as an adjunct in its therapy. Lifestyle medicine brings together sound, scientific evidence in diverse health-related fields to assist the clinician in the process of not only treating disease, but also promoting good health

than 1 in 20 individuals adhered to the three healthy lifestyle behaviors of avoiding cigarette smoking, undertaking regular physical activity, and eating a healthy diet. The investigators also noted that, overall, individuals from upper-middle-income and low-income countries had a lower prevalence of three of the healthy lifestyle behaviors than those from high-income and lower-middle-income countries.

Defining Lifestyle Medicine

The literature reviewed in the chapter presents a strong argument for the benefits of healthy living and a need to increase the number of people engaging in those health behaviors. However, it is important to consider how a proposed new discipline of lifestyle medicine differs from other closely aligned fields in medicine, such as preventive medicine, individualized or personalized medicine, or integrative medicine. Certainly, there is overlap in the targets of intervention but there are also important differences in philosophy and scope of practice. *Preventive medicine* focuses on the health of individuals, communities, and defined populations. Its goal is to protect, promote, and maintain health and well-being and to prevent disease, disability, and death [43]. *Individualized or Personalized Medicine* tries to tailor medical interventions in terms of stratifying care by genetic characteristics [44]. A recently suggested definition was offered by Schleidgen et al. [45] as a discipline that “seeks to improve tailoring and timing of preventive and therapeutic measures by utilizing biological information and biomarkers on the level of molecular disease pathways, genetics, proteomics as well as metabolomics.”

Integrative medicine is closely aligned with lifestyle medicine in its core tenets. It has multiple definitions that describe a specialty that incorporates both conventional and alternative therapies. Rakel [46] defines it as “healing-oriented medicine that takes account of the whole person (body, mind, and spirit), including all aspects of lifestyle. It emphasizes the therapeutic relationship and makes use of all appropriate therapies, both conventional and alternative.” According to Rees and Weil [47], “integrated medicine selectively

incorporates elements of complementary and alternative medicine into comprehensive treatment plans alongside solidly orthodox methods of diagnosis and treatment. It focuses on health and healing rather than disease and treatment.” The core competencies in integrated medicine for medical school curricula defines integrative medicine as “an approach to the practice of medicine that makes use of the best available evidence, taking into account the whole person (body, mind, and spirit), including all aspects of lifestyle” [48]. Finally, Snyderman and Weil [49] define integrative medicine as “preventive maintenance of health by paying attention to all relative components of lifestyle, including diet, exercise, and well-being.”

Similar to integrative medicine, several definitions of *lifestyle medicine* have been proposed and are listed in Table 2.4 [50–53]. Common elements in all of these definitions are the application of evidence-based lifestyle interventions that promote self-management for promotion of well-being, prevention of illness, and management of chronic disease. To support this new initiative, the *American Journal of Lifestyle Medicine* was launched in 2007 along with creation of a new academic medical society (the American College of Lifestyle Medicine, <http://lifestylemedicine.org/>) and an educational track in lifestyle medicine at the American College of Preventive Medicine’s annual meeting. Societies promoting lifestyle medicine have also been formed in Europe (ESLM, <https://eu-lifestylemedicine.org/>) and Australia (ALMA, <http://lifestylemedicine.com.au/>). For the purposes of this book, we define lifestyle medicine as “the nonpharmacological and nonsurgical prevention and/or management of chronic disease.”

Conclusion

There is a significant body of literature that demonstrates that adoption of low-risk lifestyle behaviors and ideal cardiovascular health metrics are associated with reduced mortality. However, there is also considerable evidence that healthy lifestyle behaviors are incorporated by a minority of the population. Lifestyle medicine presents a new and chal-

lenging approach to address the prevention and treatment of NCD, the most important and prevalent causes for increased morbidity and mortality worldwide.

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