New Map of Life Domain Report Chapter: Lifestyle and Fitness
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Introduction:

Lifestyle behaviors reflect ordinary choices throughout everyday life that add up to have extraordinary impact on quality of life, longevity, and health. In this chapter, we will trace the impacts of lifestyle behaviors throughout the expanding life course. Recent increases in longevity have not been followed by relevant disease-free years and we must address this challenge ([Crimmins and Beltran-Sanchez](); [CDC "Chronic Disease in America"]()). In the complete context of 100-year life, lifestyle behavior modifications have the potential to create meaningful, enriching years with increased well-being and resilience.

Lifestyle behaviors are numerous and often interrelated. Physical activity, nutrition, sleep, stress management, social connection, substance use, screen time, work behaviors, and preventative healthcare access all represent lifestyle behaviors that impact well-being throughout the life course. These lifestyle behaviors have the potential to impact one another and to also interact with race, socioeconomic status, and other variables. Putting it all together, there are an infinite number of lifestyle paths individuals can take starting in early childhood and progressing into adulthood and later adulthood.

The complex interplay between lifestyle behaviors themselves and other variables can make this area difficult to study. Studies that focus on a single behavior at a single time point may have more limited utility when contextualizing health patterns and broader social forces ([Onge and Krueger]()). Models and interventions that focus on multiple behaviors simultaneously provide stronger context for the relationship between lifestyle and longevity ([Spring et al.]()). Further, studies on lifestyle behaviors are often challenged by reverse causality ([Wade, Richmond and Davey Smith]()). In epidemiological studies, reverse causality occurs when the cause and effect or exposure-disease relationship is reversed. For example, if a subset of the population is told they may be more likely to suffer a heart attack due to a family history, they may be more likely to reduce their intake of foods high in saturated fat and cholesterol. In this circumstance, the underlying familial risk would bias the association between the heart-healthy diet and heart attack outcome.

Tracing lifestyle behaviors through a 100-year life emphasizes these research challenges but also highlights strong opportunities for evidence-based approaches, technologies, and policy changes for improvement. Let's start in early childhood. Exposures in early childhood set in motion the complex pathways of lifestyle behaviors over the life course. Outdoor play and connection to nature in early childhood are associated with the development of autonomy and independence whereas television viewing time is associated with the development of obesity and increased risk of cardiovascular disease later in life ([Bento and Dias]()). Interventions targeting allocated time for recess and physical transportation to and from schools can influence the trajectories of lifestyle pathways from a young age.

As children advance into the adolescent years, screen time and social media impact self-esteem and self-efficacy with broad impacts ([Keles, McCrae and Grealish]()). In adolescents, self-efficacy and social influences are positively correlated with more intense and consistent physical activity ([Strauss et al.]()), and physical activity is associated with better sleep hygiene

([Desjardins and Tanguary-Labonte](#)). Participation in high-impact-loading sports such as gymnastics, volleyball, and karate, as well as odd-impact-loading sports such as soccer, basketball, and racquet sports during adolescence can enhance bone mass, which can persist into the adult years ([Tenforde and Fredericson](#)). The pathways between lifestyle behaviors become increasingly connected with age. Simple interventions in the adolescent age group such as reduction of screen time and school-based nutrition education courses can intervene on these pathways.

As adolescents transition into young adults and working age adults, substance use and stress become key considerations. Alcohol consumption and smoking at later ages are tied to substance use at younger ages and stress plays a role in determining quality of life ([Hingson, Heeren and Winter](#)). Physical activity in this age group is tied to resiliency in later years as well as the reduction in sarcopenia and osteopenia ([Cho et al.](#)) and ([Carter and Hinton](#)). Workplace-based interventions in this age group focused on technological advances can help target physical activity and stress, setting up increased well-being in the later years.

Middle-aged adults are building on the foundations established in their young adult years. As family life becomes more common, time can become more limited for physical activity and stress management can become more challenging ([Scott et al.](#)). Preventative healthcare resources become more important as individuals think about mammography, colonoscopies, and blood pressure screenings. Workplace- and insurance-based interventions in this population can help reduce sedentary behavior and promote primary healthcare utilization.

Resiliency becomes key as middle-aged adults shift into older adulthood. Physical activity can become more difficult as cardiovascular function declines and joint issues such as osteoarthritis increase, yet many older adults find ways to thrive with benefits to cardiovascular function ([Jakovljevic et al.](#)). Positive lifestyle behaviors in older adulthood help support maintenance of strong cognitive reserve ([Akyol et al.](#)). Interventions centered around social engagement may help older adults increase physical activity and enhance cognition ([Luo et al.](#)).

Tracing these lifestyle behaviors through the life course highlights just a few examples of how lifestyle behaviors are connected. Throughout this chapter we will focus on a few key lifestyle behaviors: fitness, nutrition, and sedentary behavior. After providing a summary of lifestyle behaviors in the United States, we will provide evidence-based approaches and interventions to help support the development of long-lasting, healthy lifestyle behaviors.

Current State of the Domain:

<u>General Overview:</u>

Lifestyle behaviors are intricately linked to health and longevity. The general health of the United States (US) indicates that we need to focus on lifestyle behaviors and chronic disease prevention. In the US, 60% of adults have a chronic disease and 40% of adults have two or more chronic diseases ([CDC "Chronic Disease in America"](#)). Chronic diseases including heart disease, cancer, chronic lung disease, and diabetes are the leading cause of death and disability in the US and contribute to the overall growth in healthcare spending ([CDC "Chronic Disease in America"](#)). In the US in 2019, healthcare spending accounted for 17.7% of the Gross Domestic Product (GDP) reaching 3.8 trillion dollars or $11,582 per individual ([CMS](#)).

These numbers are staggering but are not surprising when examining the lifestyle behaviors of the US population. Children and adolescents are experiencing increases in sedentary behavior and increases in recreational screen time. A US-based cross sectional observational study in 4,500 US children ages 8-11 found that 63% of participants were spending more than two hours a day on recreational screen time (Walsh et al.). Sedentary behavior is increasing in schools as well--the number of school recess periods per day and the duration of school recess periods are declining in favor of more academic sessions (IPA/USA).The trend continues into the adolescent years. A US study assessing more than 10,000 adolescents from 2001 to 2016 found that mean daily sitting time increased from 7 to 8 hours for adolescents in that time period (Schwenk).

Sedentary behavior correlates with negative health outcomes and decreased longevity in adults (de Rezende et al.). A US national cohort study of 8,000 middle and older-aged adults found that on average, over 11 hours of the waking day were spent in sedentary behavior (Diaz et al.). In addition to sedentary behavior, physical activity is a factor for health and resilience. In 2018, 53% of US adults met the CDC's Physical Activity Guidelines for aerobic activity and only 23% of US adults met the guidelines for muscle-strengthening activity (CDC "Exercise or Physical Activity"). Weight-bearing aerobic and muscle-strengthening activities are key for preventing osteopenia and limiting sarcopenia.

 In older adults, insufficient exercise is associated with frailty, odds for disability, and mortality (da Silva et al.). A study utilizing the National Health and Aging Trends Study in US adults aged 65 and older found that 15% of the older, non-nursing home population is frail and 45% is pre-frail (Bandeen-Roche et al.). Frailty is considered a geriatric syndrome associated with falls, adverse health outcomes, and dependency (Chen, Mao and Leng). With an expanding older population, preventing frailty is key, but studies also show the benefits of physical activity as an intervention in frail populations. A systematic review on physical activity in frail populations demonstrated a reduction in frailty, improvements in physical performance, and a small improvement in muscular strength (Haider, Grabovac and Dorner).

Physical activity and sedentary behavior are linked to obesity rates along with a myriad of other behaviors and factors including overeating, nutrition quality, and food access. Obesity rates are on the rise in the US. In 2017-2018 the prevalence of obesity in the US was 42.4% compared to 30.5% in 1999-2000. Rates of childhood obesity are also increasing—19.3% of the US population ages 2 to 19 is obese (CDC "Prevalence of Overweight, Obesity, and Severe Obesity among Children and Adolescents Aged 2–19 Years: United States, 1963–1965 through 2017–2018"). Obesity is estimated to increase US healthcare spending by $149 billion annually and the COVID-19 pandemic further highlights the challenges of obesity, as obesity is one of the health conditions associated with hospitalization and death from COVID-19 infection (Kim and Basu) and (Lockhart and O'Rahilly).

Nutritional choices and access impact obesity rates and health starting from a young age. The Feeding Infants and Toddlers study in 4- to 24-month-old children found that 18 to 33% of infants and toddlers consumed no distinct servings of vegetables on a typical day and that reported energy intake exceeded recommendations by 10 to 30%. Studies indicate that feeding and parental modeling in the toddler years significantly impact long-term eating behaviors (Birch, Savage and Ventura). Schools have made efforts to improve nutritional choices of their students, though more focus is needed to support nutrition education. In the K-

12 education system, slightly more than half of US school districts require skill-based nutrition education programs (CDC "Creating Supportive School Nutrition Environments").

In US adults, vegetable intake is lacking along with fruits, whole grains, dairy products, and oils compared to federal guidelines. However, US adults are exceeding the recommended intake levels in calories from solid fats, added sugars, refined grains, and sodium (ODPHP "2015-2020 Dietary Guidelines"). From 1970 to 2008, the average daily consumption of the US adult increased by 600 calories (ODPHP "President's Council on Sports, Fitness & Nutrition"). In older adults the conversation shifts: maintaining a healthy, nutrient-dense diet is important for physical condition and cognitive health. Research indicates that the efficiency of nutrition absorption and utilization in older adults is more limited, emphasizing the need for a strong focus on consuming a high-quality diet with adequate calories (Tucker).

Breaking Down Lifestyle Behaviors Across Populations:

Examining statistics by race, socioeconomic status, and geographic location highlight challenges to behavior change that many populations face due to disparities in resources, inequities in systems and influences of stress among other factors. Race impacts daily life experiences and results in profound differences in health outcomes (Jackson, Knight and Rafferty). Race-based social stressors include perceived discrimination and stereotype threat. Perceived discrimination includes the observation or anticipation of unfair treatment due to race and stereotype threat involves the stress of wanting to perform well to overcome negative expectations related to race (Pascoe and Smart Richman) and (Aronson et al.).

In the US, minority groups report a higher stress burden than white counterparts. Black Americans report both a greater number of stressful events and stronger stress responses compared to White Americans across a number of domains (Council). Researchers believe that greater exposure to stress accounts for a substantial portion of the health disparities seen in racial/ethnic minority populations (Jackson, Knight and Rafferty). Effectively addressing obesity rates in racial/ethnic minority populations will require understanding how stressors interact with health factors and lifestyle behaviors that contribute to obesity. Although the prevalence of childhood obesity continues to rise, differences by race/ethnicity are diminishing, in part due to rising obesity rates in White American children (Caprio et al.). However, the association of childhood obesity with Type 2 Diabetes in adolescents is disproportionately seen in Hispanic, Native American, and Black American adolescents. The SEARCH for Diabetes in Youth Population study assessed the proportion of diabetes diagnosed as Type 2 Diabetes by racial/ethnic group in youth ages 10 to 19 with rates of 6% in non-Hispanic White American, 22% in Hispanic, 33% in Black American, 40% in Asian/Pacific Islander, and 76% in Native American diabetic populations (Hamman et al.).

Socioeconomic status further impacts behaviors and healthcare access with strong reverse causality indicating that health/behavior and income impact each other bidirectionally (Bor, Cohen and Galea). For example, higher income can enable stronger health and behavior while stronger health and behavior can facilitate success in education and career trajectory. The impacts of socioeconomic status start in early childhood. Individuals with low-income status early in life may experience increased hopelessness, which can influence behavior and motivation for decades (Evans and Cassells). Stronger safety net support and higher-quality

education may help children of low socioeconomic status and current spending trajectories indicate potential for this focus: the US spends 1.5-2% of the GDP on children compared to 9.3% of the GDP on older adults (Hoynes).

Individuals of lower socioeconomic status are less prone to implement lifestyle behavioral change. Statistics related to physical activity at the extremes of socioeconomic status are staggering. 34.8% of individuals living below the federal poverty line (FPL) achieve the CDC's recommended level of aerobic activity compared to 66.8% of individuals who have incomes six times higher than the FPL (CDC "Quickstats: Percentage* of Adults Who Met Federal Guidelines for Aerobic Physical Activity,† by Poverty Status§ — National Health Interview Survey, United States, 2014"). Individuals with lower lifetime earnings may have less reason to invest in future longevity and lifestyle behaviors and more reason to focus on making ends meet in the present. Although finances can aid in the ability to sustain lifestyle behaviors through resources such as gym memberships, access to fresh fruits and vegetables, and counseling/healthcare services, money is not a requirement for development of lifestyle behaviors and innovative approaches can help support lower socioeconomic status groups.

Health and behaviors are also impacted by the economic vitality and built environment of geographic communities and neighborhoods. Food deserts are geographic areas where access to affordable, healthy food options is either restricted or unavailable due to the lack of grocery options within a convenient traveling distance (Food Empowerment Project, 2020). The US Department of Agriculture estimates that 5.6% of the US population lives greater than one mile (urban population) or 20 miles from a supermarket (rural population) (USDA, 2019). Supermarkets and neighborhood stores are increasingly being driven out of urban areas and given economic challenges, many urban neighborhood stores charge between 3% and 37% more than suburban stores (Bullard et al., 2007). In addition, food deserts contain an overabundance of fast-food outlets, convenience stores, and liquor stores. These stores sell cheap, affordable, and processed foods that are also high in fat, sugar, and salt (FEP).

Overall, the current state of the lifestyle and fitness domain is clear: we need to increase physical activity, reduce sedentary behavior, improve nutrition, and prevent chronic disease. Now that we have identified the need, three key questions remain: (1) How do we address these challenges? (2) How can we learn from historical public health campaigns, community interventions, and prior research? (3) What are we working towards for an ideal future?

Evidence for Alternative Approaches:

There are clear challenges in the process of improving lifestyle behaviors, but the existing foundation of research provides exciting opportunities. Examining variables such as long-term behavior change psychology, technological approaches, and cultural considerations can help us contextualize opportunities for change. Further, highlighting historical examples can help us understand approaches that have had success and approaches that have faced challenges before we propose recommendations.

History and research indicate we need to rethink our current approach to helping individuals sustain behaviors over the long term. Studies suggest that individuals have difficulty maintaining healthy behavior modifications over time. Approximately 50% of individuals who start an aerobic exercise program will stop within 6 months (Robison and Rogers). The

triangular relapse pattern—an initial spike in healthy behavior followed by resumption of old behavior—is a challenge in intervention studies and public health campaigns. However, researchers highlight that relapse is not inevitable if the intervention is focused on the autonomy of the individual and the process of breaking and forming healthy habits rather than the outcome of the intervention itself (Wood and Neal). Understanding existing individual and community habits, barriers to change, and goals is paramount for starting this process.

Self-Determination Theory and Motivational Interviewing:

Many research studies highlight that health behaviors that are initiated and regulated via autonomous motivation have stronger success than controlled motivation (Hagger et al.). Autonomous motivation involves feelings of choice, volition, and an understanding of the value of a health behavior. In contrast, controlled motivation involves feelings of coercion or pressure to think or behave in a certain way (Koestner et al.). Self-determination theory (SDT) is a theory of human motivation that explores autonomous vs. controlled motivation and associated topics across research. SDT emphasizes the importance of intrinsic and extrinsic motivators for reaching a goal as well as the value of understanding the "why" behind a goal or action (Deci and Ryan).

Along with SDT, motivational interviewing (MI) used as a counseling style by healthcare professionals and psychologists can create strong, individual behavior change. The overall goal of MI is to assist individuals in developing their own rationale for change in life. MI involves five principles: expressing empathy through reflective listening, developing discrepancy between an individual's goals and their current behavior, avoiding argument, adjusting to resistance of the individual, and supporting self-efficacy and optimism (Miller and Rollnick).

An MI structured encounter often starts with open-ended questions, inviting individuals to share their story through questions such as: "How would you like things to be different?" and "What have you tried before to make a change?" From there, affirmations can be used to recognize behaviors that may support positive change. Examples of affirmations include, "I'm impressed with how you've thought about this situation" or "You demonstrate strong resiliency." Reflective listening and summary statements are important in continuing the encounter. Reflective listening can include rephrasing or emphasizing emotions through feeling statements starting with phrases such as "it seems you feel..." or "let me paraphrase." Summary statements are often used at the conclusion of the encounter to highlight key points and emphasize change statements (SAMHSA).

MI has shown strong effect in lifestyle behavior change. A systematic review examining motivational interviewing in 25 studies targeting weight loss, lipid levels, diabetes, asthma, smoking cessation, and physical activity found that motivational interviewing had a significant effect in 72% of studies (Rubak et al.). However, specific training in MI is fundamental to the success of the intervention and more clear training programs are needed for healthcare providers and health coaches. More rigorous, long-term studies are needed along with an evaluation of the economic impact of employing widespread MI techniques. MI has shown strongest success in stopping unhealthy behaviors but more research is needed on the impact of MI in promoting healthy behaviors (Frost et al.).

Habit Formation, Intervention Design, and Cultural Considerations:

In addition to SDT and MI, habit formation is key for lifestyle behaviors. Wood and Neal highlight strategies that can help form habits: repetition, associated context clues, and intermittent rewards; and strategies that can help break habits: cue disruption, environmental re-engineering, and vigilant monitoring. Behavior repetition is the process of performing frequent repetition of visual cues for a physical act or performing the physical act itself and can be accomplished in a variety of ways with success. Research indicates that behavioral repetition enables an individual to habitually activate an action upon exposure to context clues. For example, completing a walk at lunch break can be associated with the context clue of finishing a pre-lunch meeting or a co-worker turning on the microwave. Intermittent rewards that are powerful enough to promote consistent action and habit formation are often successful as well. Monetary incentives, discount coupons, and approval of others are examples that have worked well in prior research. Bundling two or three habit forming strategies together in one intervention can provide added success ([Wood and Neal](#)).

The process of breaking habits is also heavily dependent on context clues. Cue disruption involves reducing or eliminating exposure to cues that are associated with habits. Life transitions such as moving, starting a new job, or changing a relationship can provide advantageous opportunities for cue disruption. Environmental reengineering can include cue disruption and involves altering the environment where the health habit occurs by adding friction to unhealthy behaviors or removing friction from healthy behaviors. Environmental reengineering can include eliminating unhealthy items in workplace vending machines or promoting exercise through workplace treadmill desks. Finally, vigilant monitoring uses conscious thought and automatic processes to increase awareness of cues that trigger unhealthy behaviors. Technology may be an asset in vigilant monitoring. For example, GPS watches that instruct wearers to "move!" following periods of sedentary behavior can cue an individual into the importance of taking a quick break from work during the day or getting off the couch at night ([Wood and Neal](#)).

SDT, MI, and the process of breaking/forming habits are foundational to individual lifestyle behaviors, but how can we best translate those principles to population health and communities in need? How can we recognize structural barriers, financial barriers, community norms, cultural preferences, and collective motivation in the process? Most importantly, how can we avoid cultural alienation in the process of creating sustainable behavioral change?

Let's start with intervention design and research. In many situations, behavior change programs have not always carried out pre- or post- assessments to get an understanding of knowledge and attitudes towards behavior change. Often knowledge and attitudes can be intermediate outcomes in achieving behavior change and an important metric for understanding and addressing barriers to change. Further, if we examine lifestyle research, many of the current studies are designed with changes in the health outcome as the primary outcome measure, without measuring the impact of behavior change as the mediator of the effect. These challenges in intervention design and research can likely be attributed to limited funding or organizational capacity, but they still impact the ability of the field to grow and learn.

Further, education and communication gaps can exist in populations and can contribute to challenges of health literacy. Health literacy can be defined as the social and cognitive skills which motivate and enable individuals to use information in a beneficial way for maintaining health ([Nutbeam and Muscat](#)). High levels of health literacy are associated with specific health

promoting behaviors including fruit and vegetable intake, non-smoking status, and physical activity participation whereas low levels of health literacy are associated with reduced participation in cancer screenings or health prevention programs (Berkman et al.). Research indicates that primary care providers can help support health literacy, but often don't have adequate time with patients to improve health literacy (Dennis et al.). Alternative approaches such as workplace-based health assessments and community-based health education may help fill this gap. Online resources may be beneficial, however the sheer quantity of information available and the growing percentage of misleading science on the internet can present challenges for individuals.

Cultural considerations are also fundamental to success and trust for community intervention programs. Appropriate foresight and regulation should be used for interventions and community members and leaders should be consulted as part of the study design. For example, low-income communities often have less access to facilities for regular exercise, safe green space, and recreational programs (McKenzie et al.). "Green gentrification" describes the process where new environmental amenities spur cultural alienation by transforming neighborhoods without considering the impact on housing prices, the preferences of current residents, and the costs of maintenance. Researchers who study green gentrification urge project developers to conduct spatial and qualitative analyses before proceeding with project plans to reduce gentrification, understand reason for investment, and evaluate whether community members even view the project as a desired need (Anguelovski et al.).

Technological Innovation:

Finally, let's evaluate the role of technological innovation in both individual and community lifestyle behavior change. Increases in technological innovation such as wearable devices have the potential to help lifestyle behaviors. In 2019, wearable devices were ranked number one in the top worldwide fitness trends (Thompson). Wearable device popularity increased in 2020 as smartwatches and other wearable devices were studied for early detection methods for COVID-19 infection (Islam et al.). As technology improves and studies increase, there are seemingly endless applications for wearable devices and technology in lifestyle behavior tracking and modification. However, recent studies provide some insight on challenges and the need for continued research with strong methodological design and long-term follow up in this area.

Several studies highlight that technological devices that monitor and provide feedback on physical activity may not be advantageous compared to traditional weight loss methods. For example, the TRIPPA study with 800 participants published in 2016 examined four groups: a fitness tracker (FitBit) group, a FitBit plus cash incentive group, a FitBit plus charity incentive group, and a control group. At 6 months there were significant increases in moderate-to-vigorous physical activity in the FitBit plus incentive groups (29 minutes and 21 minutes respectively) compared to the control group, but no significant increases in the FitBit alone group compared to the control group. At the 12-month follow-up evaluation, the benefits in the FitBit plus incentive group were not sustained (Finkelstein et al.).

Further, wearable devices are challenged by consumer bias and a lack of diversity in many validation studies. For example, Colvonen et al. highlight the technological limitations of photoplethysmographic (PPG) green light signaling used in heart rate detection for many wrist-

based wearable devices ([Colvonen et al.](#)). They believe that these devices are not as accurate and may not even work at all for individuals of darker skin types given that skin tone affects the absorption of light, compromising prediction algorithms. More research, with inclusion of diverse participants is needed in the wearable device industry.

History of Approaches for Lifestyle and Fitness:

Let's look at successful examples at the institutional, entrepreneurial, and public policy levels to get a better idea of how SDT, MI, health literacy, cultural considerations, and technological advances have been incorporated to get a better understanding of strong approaches. We'll start with programs at the individual level, before examining community-based programs, and federal health programs.

Individually adapted physical activity programs often incorporate multicomponent intervention approaches to encourage individuals to make physical activity a part of their routine. Goal setting, reinforcement through self-reward, and structural problem solving are often components of individual programs and can be more cost-effective than supervised programs. For example, there is an individual program component in the Arthritis Foundation's "Walk With Ease (WWE)" program. The program designs self-paced walking plans and combines with information on health-related and arthritis topics in a simple, six-week course. The online and broad-reaching structure of this program with Spanish translation enables adults with little access to community programs to participate ([CDC "Walk with Ease – Self-Directed"](#)). Numerous studies have evaluated the WWE program and have found that WWE improves arthritis symptoms, self-efficacy, balance, strength, and walking pace in individuals with arthritis with maintenance of many benefits at the one-year evaluation from program start ([Callahan et al.](#)).

Systematic reviews largely support the notion that healthcare provider based individual exercise counseling as stand-alone counseling in one-time or brief sessions is not effective in supporting long term change. However, healthcare provider recommendation with either follow-up over telephone or coordination with clinical or community resources has demonstrated strong impact ([AuYoung et al.](#)). The American College of Sports Medicine's global initiative Exercise is Medicine and Kaiser Permanente's Rx2Move were examples of campaigns that enable primary care providers to identify and compile relevant community health exercise resources for patients ([ACSM](#)) and ([ODPHP "A Prescription to Move"](#)). Cost is another incentive in healthcare. Studies show that providing Medicare-eligible adults with community exercise programs as a health insurance benefit can reduce healthcare costs by 5.9% ([Ackermann et al.](#)).

Nutrition interventions often incorporate a community engagement model, emphasizing participants' contribution in designing and modifying a program. The American Heart Association's Healthy For Life (HFL) Community Nutrition Program is a direct education program designed to encourage healthy food habits as a part of everyday life. HFL interacts with community-based organizations to provide resources for those organizations to equip individuals with the skills to prepare healthy meals, shop with nutrition in mind, and discover new food options. Communities provide education sessions to individuals over a 2- to 3-month period and highlight local resources available to community members. Similar to the exercise counseling model, connection to local resources is thought to drive the success of this approach ([AHA "Healthy for Life"](#)). A 2019 study in 418 HFL participants found that 44% of participants

increased their daily fruit and vegetable consumption and 34% of participants improved their confidence in healthy food preparation (AHA "Healthy for Life Community Nutrition Program (Hfl)").

On a broader level, the "Let's Move!" campaign led by Michelle Obama was a public health campaign starting in 2010 with the goal of reducing childhood obesity by 5% in 2030. President Barack Obama launched the Task Force on Childhood Obesity in conjunction with the campaign to review policies and programs on childhood physical activity and nutrition (Eschmeyer). Some experts note that the efforts of the Obama administration enabled the nation as a whole to recognize childhood physical inactivity and obesity as high priority problems. Many subsequent collaborations and initiations were launched as a result of this awareness. However, the Let's Move! campaign was challenged by effective coordination between levels of government, non-profit organizations, companies, and institutions. Comprehensive lists and paperwork were sent to organizations, trickling down to schools, with little oversight on evaluation or resources for implementation (Simon, Kocot and Dietz).

We can learn from how the Let's Move! campaign enabled the nation to recognize childhood obesity as a fundamental problem and also where the campaign fell short. Let's start with Beyoncé and promotion. Beyoncé, 24-time Grammy award winner and 79-time Grammy nominee, helped bring awareness to the campaign with her "Move Your Body" music video and a recording of her exercise routine. In 2015, Michelle Obama used social media to encourage the "#givemefive" movement to find a way to work in five pushups, five jumping jacks, or five new habits into routines (Eschmeyer).

Public opinion and media framing of the Let's Move! campaign are linked to how Michelle Obama advertised the campaign. Experts consider that public health messages that are most successful contain three components: (1) information connecting the public health issue to larger social and environmental contexts (2) description of risk factors and (3) information on prevention. Examining news publications can provide context for the Let's Move! campaign. Researchers found that in the 201 identified newspaper articles on the Let's Move! campaign 97% connected to a larger context, 84% described risk factors, but only 52% identified preventative measures for childhood obesity. Although the Let's Move! campaign raised awareness, an increased focus on preventative measures may have increased success (Andersen, Wylie and Brank).

How successful was the Let's Move! campaign itself? If we look solely at national childhood obesity rates, there was a varied effect in the context of a rapidly rising prior trajectory. The CDC found that between 2009 and 2012 the obesity rate decreased 3.7% in ages 2-5, decreased 0.3% in ages 6-11, and increased 2.1% in ages 12-19 (CDC "Prevalence of Overweight, Obesity, and Severe Obesity among Children and Adolescents Aged 2–19 Years: United States, 1963–1965 through 2017–2018"). A total of 16.9% of US children ages 2-19 were obese. In 2020, a total of 19.3% of US children ages 2-19 were obese, representing a 2.4% increase (CDC "Prevalence of Childhood Obesity in the United States"). If we look at intermediate achievements, there were strong points of achievement in improving the food landscape and increasing opportunities for physical activity, but evaluating direct success is challenging in such a broad-reaching campaign. Notably, the Let's Move! campaign was linked to offering healthier lunches and snacks for over 50 million children, launching the FDA's

modernization of food labels, and providing free or low-cost beginner sports programming through the US Olympic Committee to 2 million children in 2016 (Eschmeyer).

Taken together, the Let's Move! campaign was extensive and far-reaching, but fraught with challenges and unintended messaging. A dissertation or textbook would be needed to cover the full scope of the Let's Move! campaign, though the brief analysis provided here can help contextualize the inherent challenge in tackling physical activity, sedentary behavior, and nutrition at broad levels.

Opportunities and Recommendations for Change:

As we think about solutions for moving forward at the private, community, and federal levels, it's helpful to have a grounding approach: lifestyle and fitness interventions should be approached from the viewpoint of carefully empowering and supporting individuals and communities in creating their own sustainable change. Along the way, we must have foresight to avoid cultural alienation and approaches that challenge the preferences of individuals and communities. Given the overwhelming need for lifestyle and fitness interventions there are exciting opportunities for meaningful change and strong potential for technological innovation. Let's highlight changes that health professionals/coaches, teachers/schools, parents/families, communities/local governments, and the federal government can make for strong impact and how we can support them with technology and innovation.

Healthcare Professionals, Health Coaches, and Workplace Health Programs:
Although the current state of lifestyle, fitness, and chronic disease in the US can seem overwhelming, healthcare professionals, health coaches, teachers, and parents can all make differences for individual health and well-being. Healthcare professionals and health coaches can become certified in Lifestyle Medicine through the American Board of Lifestyle Medicine and the American College of Lifestyle Medicine respectively. Certification programs are focused on helping patients achieve autonomy for seeking behavioral change through the pillars of Lifestyle Medicine: nutrition, physical, activity, sleep, social connectivity, and avoidance of risky substance use (ACLM). Specific skills in motivational interviewing (MI) can also be valuable for healthcare professionals and health coaches. At this time, most MI skills are taught in graduate-level education courses at the level of Master's degrees or PhD programs. Some private enterprises offer MI training, but there's an unmet need for a leading program, standardization, and certification. An entrepreneurial effort focused on using technology such as interactive modules, mentoring connection, and small group sessions for virtual learning could transform this space and help fill the unmet need.

Time and follow-up are two of the biggest barriers to lifestyle counseling for healthcare professionals and health coaches. A few top universities and medical centers have Lifestyle Medicine specific clinics including The Cleveland Clinic Center for Lifestyle Medicine and the Lifestyle Medicine Clinic at Duke University. An added focus on Lifestyle Medicine specific clinics at other leading institutions could help spur this trend to enable healthcare professionals to have dedicated appointments and added time for Lifestyle Medicine topics.

Many universities have associated free clinics, for example Stanford University has the Cardinal Free Clinics for underserved populations in Menlo Park and San Jose. A Lifestyle

Medicine Clinic within a free clinic could enable underserved populations to access Lifestyle Medicine counseling and could provide medical students, residents, and fellows working at the clinic the chance to practice Lifestyle Medicine counseling. Medical students report low levels of confidence in working with patients with low health literacy (Coleman, Peterson-Perry and Bumstead). Free clinics could enable medical students to practice skills for helping patients improve health literacy, supporting both the knowledge of patients and the skills of future generations of doctors. Further, healthcare professionals and health coaches providing recommendations for lifestyle and fitness can improve adherence to recommendations by connecting patients with local community resources such as YMCAs and community-based intervention programs.

Workplace-based and insurance-based lifestyle programs can also help improve health literacy and lifestyle behaviors. If programs have the resources, they should consider completing an assessment of workplace needs and culture before designing an intervention. Further, programs should set primary and secondary aims at the start of the intervention and have methods of evaluation for determining success. An office fitness challenge incorporating miles walking, biking, or completing other forms of movement could create a fun and motivating environment. Employees could be eligible for prizes along the way or have the option to donate to a charity of their choosing. Currently, there are some entrepreneurial platforms that help structure these challenges for companies, but this area has strong potential for innovation.

Teachers and Schools:

Teachers play a critical role in establishing lifestyle and fitness behaviors and promoting the development of healthy behavior over the life course. Given the role of nature in developing autonomy in kids and active lifestyles, teachers can find creative ways to incorporate nature including nature art areas, schoolyard habitats, and indoor seed growing. The National Wildlife Federation has worked to assist schools in the creation of schoolyard habitats, with over 5,000 K-12 schools enrolled (NWF). Many organizations provide nature resources for low-income, underserved school districts. For example, the Nature Immersion Program in Boulder County, Colorado offers subsidized school programs to more than 7,000 low-income or Latinx youth each year with in-school programs for hands-on environmental education (Thorne). One of the biggest challenges for teachers is determining how to incorporate nature into education while still making time for students to achieve the required academic benchmarks, particularly in low-income areas or for students with special needs. An entrepreneurial effort focused on connecting schools with resources for nature education that can fit into academic models and contribute to academic benchmarks could help improve this area.

Teachers can also help support physical activity during the school day and communities can reinforce physical activity in the commute to schools. Classroom physical activity in the K-12 education system can help mitigate the reduction in recess time seen in many school districts, though should not be used as a replacement for recess. Strategies include having school-wide short exercise time during morning announcements, replacing standing in line with time for jumping jacks, and working in short dance sessions into planned classroom activities. Encouraging autonomy through the SDT framework and providing incentives can help students

associate physical activity as part of a routine. The CDC's Springboard to Active Schools has developed resources to help support schools in integrating fun and safe classroom physical activity strategies (CDC "Strategies for Classroom Physical Activity in Schools"). Further, incorporating physical activity into school commutes can help launch healthy lifestyle behaviors. The US Department of Transportation's Safe Route to Schools (SRTS) Program promotes walking or biking to school through infrastructure improvements, safety education, and incentive programs through federal grants. SRTS was created in 2005, recognized under the Let's Move! Campaign, and has benefitted more than 15,000 schools in all 50 states (TAP).

Technological advances could help incentivize physical activity in the school day and the school commute. Many teachers use YouTube channels to support classroom physical activity through dance videos or short, kid-friendly workout routines but a consolidated classroom fitness platform may provide a better approach. Through this classroom fitness platform, research could be performed to better understand the impacts of classroom exercise on motivation, lifestyle, and health. Further, kid-friendly wearable devices could make physical activity on the school commute fun--with a focus on incentives during the process, rather than a fitness goal.

These technological advances could even be used for jumping programs to improve bone mass. A study in pre-pubertal and early-pubertal boys and girls found that a 10-minute jumping program featuring 12 different jump styles led to ground reaction forces two-to-five times body weight, which contributed to positive changes across bone health measurements (McKay et al.). These jumping programs can also impact muscular fitness and are particularly important for kids and adolescents participating in non-loading sports that don't have osteogenic benefits such as cycling or swimming (Vlachopoulos et al.).

School lunches and breakfasts provide nearly half the consumed daily calories by students (Cullen and Chen). The USDA has provided standards for school meals including an increase in the quantity of fruits and vegetables, reduction in saturated fats, and better whole grains. Schools can further encourage nutritional choices through creative displays of healthy plates, producing kid-friendly meal recipes, and providing education about nutrients. Food access is another key point for schools. 18% of US kids have families that sometimes or frequently can't afford nutritious food and more than ⅔ of school kids get discounts or meals for free at school (USDA "Find Meals for Kids When Schools Are Closed"). During school closure because of COVID-19, schools were unable to provide meals for children. The USDA worked with states to provide meals for students that could be picked up and taken home and created an interactive map for finding meal resources called "Find Meals for Kids" (USDA "Find Meals for Kids When Schools Are Closed"). This technology could be leveraged in times outside of COVID-19 to provide food access during the summer or during school vacations.

Parents and Families:

Studies in family-based interventions to reduce sedentary behavior in youth highlight that level of parental involvement, rather than setting of the intervention itself, is the most important determinant of success (Marsh et al.). A study in 1,300 parent-child pairings found that accelerometer-measured physical activity and sedentary behavior were correlated in parent-child pairings. For every 20-minute increase in moderate-to-vigorous physical activity (MVPA) in a parent's measurement, there was a 5 minute increase in MVPA in childhood

activity can help set the tone for youth behavior, and in doing so, can promote increased health for themselves (Garriguet, Colley and Bushnik). Fitness trackers often level individual fitness metrics. A fitness tracker devoted to cumulative family metrics could collectively unite a family in achieving fitness metrics in a fun and engaging way.

Wood and Neal's principles of habit formation and habit elimination can help guide choices. For example, parents can encourage behavioral repetition by getting in a routine of following dinner with a short evening walk or can incorporate environmental re-engineering by removing television sets from bedrooms, kitchens, or other locations in the house that may promote increased screen time. Family goal setting with incentives at key benchmarks such as going out for ice cream after spending two weeks with consistent reduced screen time can help keep the process lighthearted and fun.

Every family structure is different, with unique goals, resources, and family dynamics. Black American, Asian American, and Latinx families often have an increased emphasis on extended family and grandparent involvement in kinship networks (Dunifon and Bajracharya). Families who have grandparents or older family members in the household or social unit can encourage social connection with youth. Activities such as hiking, tag, or catch with a ball can encourage physical activity for grandparents and youth while creating a cross-generational sense of play. Many organizations promote foster grandparent opportunities, where underserved children are connected with retired adults to create this cross-generational sense of play. Foster grandparent organizations often provide education for retired adults, covering topics related to mentoring youth as well as topics specific for grandparents including senior mental and physical health support.

Communities and Local Governments:

Community approaches can be foundational in structuring a built environment that is more conducive to walking, biking, or physical activity, but centered around avoiding green gentrification. In underserved communities, stakeholders need to be consulted prior to project planning. Education and future employment related to the construction and operation of parks can help prevent green gentrification. Further, strategies to increase the supply of affordable housing near parks can be beneficial. In Atlanta, Georgia and Greenville, South Carolina, new tax districts were created around infrastructure investments such as parks in order to fund affordable housing developments in the area (Rigolon and Christensen).

The safety and quality of public parks and green spaces are correlated with use (Sallis et al.). Safety and quality assessments can help identify places where community-based improvement projects can be implemented to improve features such as lighting, public restrooms, litter, noise, or high-density vegetation. Assessments should also be conducted to understand how senior and older adults are utilizing park resources. Studies highlight that many park areas are not specifically designed for senior use and that seniors may have interactions with other park visitors that make them feel unwelcome or may lack information on available parks (Ibes et al.). There's a need for easy-to-use Apps highlighting senior-friendly park resources with forums for seniors to provide their park feedback in a safe space or to organize senior meetups in local parks.

Further, community approaches can help address food deserts and issues of food access. Modifications can be made to existing convenience stores to help increase food access.

For example, a study funded by the US Department of Agriculture (USDA) called Vida Sana Hoy y Manana (Healthy Life Today and Tomorrow) worked with tiendas, Hispanic convenience stores to educate employees on fruit and vegetable sales, create structural changes in stores centered around fruit and vegetable sales and provide recipes for healthy meals ([NRC](#)) Other approaches have focused on increasing incentives to spending in ways that support local farmers and thus increase access. The Double Up Food Bucks Program, initially launched in Detroit, and now a nationwide model, doubles the value of federal nutrition benefits spent at participating markets to help participants bring home more fruits and vegetables, while supporting local farmers ([FFN](#)).

Online grocery store shopping, autonomous delivery, and more affordable transportation options provide opportunities for improving food deserts and issues of food access. The USDA launched a two-year pilot program in New York state allowing Supplemental Nutrition Assistance Program (SNAP) participants to use benefits to purchase groceries online ([USDA "Snap Online Purchasing to Cover 90% of Households"](#)). Further, Lyft a ride-sharing company, has a Grocery Access Program to allow individuals living in food deserts to receive affordable rides to grocery stores ([Lyft](#)). Health insurance companies are also participating in delivery options. The Health Care Service Corporation partnered with Blue Cross Blue Shield Health Insurance in a pilot program to launch FoodQ, a delivery service for nutritious, affordable meals to people living in food desert ([BCBS](#)). There's a clear need for expanded options for technology to increase access for online grocery store shopping and food delivery, while continuing to research and adapt for the needs of individuals in food deserts. For example, considerations such as the safety of dropping off packages on doorsteps and servicing families that don't have smartphones or internet access should be considered.

Finally, foundations can work together with local communities to educate community members and motivate change. For example, Stephen and Ayesha Curry's Eat. Learn. Play Organization focuses on nutrition and food access for Bay Area families. As part of their organization, they develop programs that feed families struggling with food insecurity, advocate for policy issues impacting food access, and educate families on nutrition ([Curry](#)).

Federal Government Programs:

The challenges faced by the Let's Move! campaign underscore the difficulties in addressing lifestyle behaviors at a broad federal level. However, there are key roles that the federal government must fulfill in supporting healthy lifestyle behaviors and preventing chronic disease. The first key role is funding. Federal government investment in research through the National Institute of Health and CDC support breakthrough advancements in the field of lifestyle behavior and chronic disease. In addition, federal government investment in health insurance, particularly during times of economic struggle can be a safety net for public health, primary care services, and healthcare benefits. Investment in community programs can also boost public health while spurring increased economic vitality and employment in communities. For example, the federally funded National Center for Chronic Disease and Health Promotion provides funds for community projects including a 16 million dollar project to ease health disparities impacting American Indians and Alaskan Natives ([CDC "Community Health Funding"](#)).

Evidence-based policy is another area where the federal government can address lifestyle behaviors. Updating and providing population-level physical activity and nutrition guidelines based on the latest research enables schools, communities, and healthcare centers to have standardized recommendations and to study outcomes. The federal government also plays a critical role in monitoring lifestyle behaviors and health. Surveillance efforts inform implementation of projects and evaluation of programs and include databases such as the National Health and Nutrition Examination Survey, the Behavioral Risk Factor Surveillance System, the School Health Policies and Practices Study, and the National Youth Tobacco Survey (Whitsel).

The role of the federal government in supporting public health will always be a controversial topic--there will be groups who favor individual choice over government involvement and other groups that favor government involvement in supporting individual choice. However, what the COVID-19 pandemic and the Black Lives Matter movement in 2020 have demonstrated is that the federal government must prioritize emphasizing the importance of science and the need for anti-racist movements, for decades and decades to come. For equality, for justice, and also for public health.

Conclusion:

Lifestyles refer to the ways that we live our life in the form of daily choices: from walking to work, to cooking dinner, to family picnics on the weekend. Lifespans are increasing and daily choices are compounding, so that behaviors in young adulthood influence habits in middle adulthood, which impact resilience in older adulthood. Race and socioeconomic status influence access to lifestyle resources often starting in childhood and also interact with lifestyle behaviors to impact health over time.

In this chapter, we traced lifestyle behaviors in the context of 100-year life. We started by addressing the current state of fitness, nutrition, and chronic disease in the US, highlighting a clear need for lifestyle change. In this process, we emphasized disparities in access and outcomes in marginalized communities, highlighting the importance of lifestyle intervention as well as anti-racist movements. Given that 60% of US adults have a chronic disease and 40% of US adults have two or more chronic diseases, we need to make changes at every level, from private sectors, to local governments, to the federal government.

Next, we examined approaches for alternative interventions. History indicates that we need to rethink our approaches to helping individuals sustain healthy behaviors over the long term. Self-determination theory and motivational interviewing can be used to empower individuals to understand the "why" behind lifestyle change while developing their own intrinsic and extrinsic motivators for reaching a goal. Along the way, the process of reinforcing good habits and breaking bad habits through creative approaches can help create sustainable change. Layering in technology can make this process fun and engaging, potentially improving outcomes as well. But most importantly, we must have foresight to avoid cultural alienation as well as approaches that challenge the preferences of individuals and communities.

We used these considerations to propose changes that health professionals and coaches; teachers and schools; parents and families; communities and local governments; and the federal government can make to contribute to lifestyle medicine change. Key ideas include

free clinics in Lifestyle Medicine at leading institutions, healthcare connections to community resources, integrating physical activity into K-12 class sessions, promoting foster grandparent relationships, funding affordable housing around new park developments in underserved areas, subsidizing online grocery shopping in food deserts, and continuing to establish federal guidelines for physical activity and nutrition.

Developing healthy lifestyles is a promising avenue to improve health and meaning in the context of 100-year life. Lifestyle and fitness behaviors improve longevity, but they don't just add years to a life. They are all about adding life to the years.

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