

Promoting and Sustaining Positive Personal Health Behaviors – Putting the Person First

COL Deydre S. Teyhen, USA*; Dennis Robbins†; LTC Barbara Agen Ryan, USA (Ret)‡

ABSTRACT Amidst the national debate on the future of health care, there must be a focus on how individuals, communities, and the system need to change to promote and sustain health rather than reactively treat sickness and disability. To transition from a health care system to a “System for Health”, we need to move from a patient-focused to a person-focused position. A system that focuses on improving personal decisions related to activity, nutrition, sleep, and tobacco-free living could have a profound impact on health and well-being. The delivery of health, instead of just health care, entails more than just preventing sickness and disability; it requires focusing on building personal wellness, resilience, and endurance. Engaging the individual person to embrace a healthier lifestyle through education, incentives, and technology we can have a positive impact on reducing costs and improving health outcomes. The purpose of this commentary is three-fold: (1) to address the need to implement prescriptions for health, (2) advocate for the need for a person-centric model to help our health care system transition to a system for health, and (3) demonstrate how simple behavior changes can help drive the change to health.

INTRODUCTION

To hamper the morbidity of lifestyle-related diseases, we must move away from focusing on cost strategies to improve our health care system and move towards focusing on health habits, and lifestyle choices as key determinants of health care utilization and health. As the health of our nation worsens health care costs continue to increase at an unsustainable rate.^{1,2} Some of the most common causes of death and disability are from preventable chronic diseases.³ This article will discuss how personal lifestyle habits such as physical inactivity, poor nutritional choices, lack of sleep, and tobacco use are major contributing factors to disease.^{4–11} The U.S. health care system needs to shift from a “sickness-driven system to one of promoting and sustaining health”^{12–14} through better lifestyle choices.^{15,16}

In order for health care to meaningfully improve health, it must focus on the entire person and not just the patient. Health care should not be focused solely on disease, prescriptions, and procedures. With current time-constrained appointments, providers react to a patient’s symptoms, and decide a treatment plan. In this system, patients are often waiting to be treated and cured by the health care provider; even when personal health choices are the underlying cause of the current condition. Shifting the focus from the “patient” back to the *person* can help shape a system that develops strong

relationships between the health care provider and the patient. Adopting a *person-centric* approach, allows health care providers to proactively facilitate a conversation around the person’s goals, options for improving their health, and how to maximize their well-being.

Although research suggests that health behaviors impact a wide range of physical and mental conditions,^{17,18} the optimal way to promote health in a medical setting remains underdeveloped. Small weight losses of 2–5% can decrease risk of type 2 diabetes, and 15–30 minutes of brisk walking a day can cut the risk of heart disease by 10%.¹⁹ Health care providers have a responsibility to help motivate patients to make these lifestyle changes. To do this effectively, health care teams must utilize evidence-based techniques, from motivational interviewing to standard education on nutrition and exercise, to modify patient lifestyle choices.²⁰ Technology can also assist health care providers in achieving better health outcomes for their patients by allowing them to reach outside the brick and mortar facilities to reach people where they live.^{21–23}

Improvements in sleep, activity, exercise, healthy eating, and tobacco-free living can supersede the effectiveness of medications in promoting health, especially when these changes are tied to a sustained lifestyle change. This commentary will address the need to implement prescriptions that promote health, advocate for a person-centric health care model that will be focused on promoting health, and demonstrate how behavior changes are essential to promoting health.

IMPACT OF ACTIVITY, NUTRITION, SMOKING, AND SLEEP

The evidence to support the health benefits of exercise has led the American College of Sports Medicine, the American Heart Association, and the Center for Disease Control and

*Walter Reed Army Institute of Research, 503 Robert Grant Ave, Silver Spring, MD 20910.

†Person-Centric Solutions, 5885 Fontaine St., San Diego, CA 92120.

‡OptumServe, 8270 Greensboro Drive, McClean, VA 22102.

The views expressed are solely those of the authors and do not reflect the official policy or position of the U.S. Army, U.S. Navy, U.S. Air Force, the Department of Defense, or the U.S. Government.

doi: 10.1093/milmed/usy212

© Association of Military Surgeons of the United States 2018. All rights reserved. For permissions, please e-mail: journals.permissions@oup.com.

Prevention to advocate that 18–65 year olds need a minimum of 30 minutes of moderate-intensity exercise 5 days a week or a minimum of 20 minutes of vigorous-intensity exercise 3 days a week.²⁴ Healthy People 2020, an initiative from the U.S. Department of Health and Human Services, has set goal to have 47.9% of the population meet this recommendation by 2020.²⁵ While the health benefits of moderate-vigorous activities have been well documented, there is emerging evidence that physical inactivity and sedentary behaviors are an independent risk factor for poor health.²⁶ The impact of sedentary activity on health is concerning given the number of jobs requiring only light activity, the number of miles spent in a vehicle, and the number of hours spent in front of a computer or television continues to increase.^{26,27} In fact sitting may be the “new smoking.” Chau et al found 34% higher overall mortality in those that sat more than 10 hours per day, even after accounting for physical activity levels.²⁸ Approximately 60% of the world’s population gets less than 30 minutes of physical activity a day and the average American spends 7.7 hours a day in sedentary behaviors that expend very little energy.^{27,29} Increased sedentary behavior is associated with increased consumption of soft drinks and unhealthy snacks and decreased vegetable consumption.³⁰ This evidence may help motivate those resistant to initiating a physical fitness program. Walking 10 minutes after sitting for 50 minutes or aiming for 10,000 steps a day may be simple steps for those that are not in the habit of physical fitness training.

Decreased physical activity can also contribute to excessive weight gain. The medical costs associated with obesity totaled \$147 billion in 2008.³¹ Obesity is associated with a greater risk for diabetes, cardiovascular disease, and most causes of death.^{32,33} The odds of sustaining a musculoskeletal injury are 15% greater for those considered overweight, and increase incrementally with each progressive class of obesity (I–III) up to 48% greater.³⁴ In the military, BMI has also associated with a higher prevalence of injury, illness, and cost of care compared with those with normal weight.^{35,36} However, obesity is preventable and reversible. Healthy People 2020 current goal is to have 33.9% of the population have a healthy weight by 2020.²⁵ To achieve this, policy and practices should support affordable and accessible healthy choices including stressing the importance of physical activity.

Despite perceptions, many who are overweight and obese can also be undernourished. Children with chronic malnutrition can have stunted growth despite being overweight.³⁷ Urban areas with fewer grocery stores, more fast food restaurants, and lower rates of fruit and vegetable consumptions are associated with higher rates of obesity and chronic disease.³⁸ Diets with more nutritious foods have even been associated with a decrease likelihood of depression and anxiety.^{39,40} Diet quality in older adults also influences both quality of health and well-being.⁴¹

Smoking is another important modifiable risk factor impairing health. In addition to numerous negative health effects, smoking is also adversely related to functional outcomes of musculoskeletal injury (e.g., low back pain, shoulder conditions, and lower extremity injuries).^{42–47} Recruits with a history of smoking a month prior to the start of basic training had higher rates of injury; the effect was strongest for overuse injuries.^{48,49} Smoking has also been associated with time-loss injuries in both male and female Soldiers in basic training and has been a risk factor for training-related injuries in infantry units.^{50,51} Smoking has also been found to be an individual risk factor associated with premature discharge from the military.⁵²

Despite the increased rates of sedentary behavior, insufficient sleep is a common problem.¹¹ Sleep is vital for health, performance, and well-being. Proper sleep hygiene rituals, that promote optimal sleep duration and sleep quality, are important for adults and children.⁵³ Poor sleep is associated with mental distress, obesity, diabetes, coronary heart disease, stroke, high blood pressure, asthma, and arthritis.¹⁰ Poor sleep quantity and quality have also been associated with other unhealthy habits such as smoking, binge drinking, physical inactivity, and unhealthy food habits.^{54,55} In addition to health effects, fatigue and sleepiness also increase motor vehicle and industrial accidents.^{56,57} Healthy People 2020’s goal is for 70.9% of the population to get 7–8 hours of sleep per night.²⁵

ADVOCATING FOR A PERSON-CENTRIC VS. PATIENT-CENTRIC SYSTEM OF HEALTH

Despite the overwhelming evidence supporting the effect of increased activity,¹⁷ better nutrition,^{31–33} enhanced sleep,¹¹ and tobacco-free living^{4,5,6} on health, preventative medicine in the USA often focuses on cost reduction, improved clinical prediction rules, medication adherence, and imaging utilization. While prescribing medications for lifestyle-related diseases provides a quick solution to shrinking patient appointment times; it does not appear that approach has been successful in improving overall health. Our system should shift focus from “sickness and health care” to one focused on “health”. This requires the health care system to move from reacting to disease and disability to proactively pursuing health and wellness. It compels health care teams to engage people before they become ill. People should engage their health care providers in the decision-making process for their lifestyle choices so they better understand their effect on their overall health.

Part of the art of health and healing is finding how to meet the person in front of you in a manner that will help them move towards health. Each of us is distinct in our definition of family and who we include in our circles of trust and love. We each have our own idiosyncrasies, quirks, likes, dislikes, preferences, values, and essentially our own

stuff that makes us unique and personal. Personalized health plans focused on individual preferences and needs could help move them towards health.

The changes required to create a healthier America and affect costs associated with lifestyle-related diseases needs to happen on a personal level. That mandates that Americans be more mindful and prudent about our lives, activity, and health. Person-centricity requires that each person be vested with the responsibility for their health and become an active agent in the course of their lives. Personal accountability and responsibility is a logical requirement towards promoting health.

However, personal lifestyle choices should not rely on willpower alone. There are many resources a person can utilize to help them reach their health goals. We live in an age of ever-increasing connectedness through social spaces, technology, and apps. The emergence of mobile health in developing nations demonstrates the power that technology has in the lives of people and their health space.^{58,59} Communities are emerging around each of us that we physically or virtually belong to. We cannot underestimate the power of community and connectivity through apps and tech devices. Human beings, the person, bring these to life and it is a basic human desire to be happy. One can argue that good health, or the lack of disease, is strongly relational to mental, spiritual, physical, and financial happiness. In creating a healthier country, we have to begin by finding ways to make the healthy choice the easy choice.

CREATING AND SUSTAINING CHANGES IN PERSONAL HEALTH

Improving health choices is not as simple as increasing access and understanding of reliable health information. Although health literacy may be a necessary foundation to healthier lifestyle choices, it is not sufficient. If knowledge was the only essential ingredient to health, then one would expect health care providers to be healthier than non-health care providers. However, 54% of health care providers ($n = 4,980$) reported being overweight or obese despite knowing the negative health effects of obesity.⁶⁰ Only 35% of medical residents and 52% of medical students reach 10,000 daily step goal,⁶¹ while 3.3% of medical students, 8.8% of dental students, and 13.5% of nursing students continue to smoke.^{62,63} Poor sleep hygiene also persists among health care providers despite the negative health implications and the known increased medical error rate associated with limited sleep.⁵⁷ Modest improvements in healthy lifestyle choices can have a substantial impact on health.⁶⁴

When it comes to creating and sustaining health it may well be that knowledge plus action equals power. However, the lack of time, knowledge, and social support can often prevent the achieving of health goals.^{65,66} The health care team needs to be fluent in interventions that decrease perceived barriers. A critical first step is for the health care team

to understand “why” an individual may be motivated to improve their health. New healthy behaviors have been found to be more readily adopted when the goal matches the individual’s motivation, the advantage is clear, the behavior change matches personal preferences, and the benefits are easy for the individual to observe.⁶⁷ For example, athletes and coaches are more likely to adopt healthy behaviors and injury risk mitigation strategies if those strategies also enhance performance.⁶⁸

Health care providers can prescribe technology to assist with identifying and tracking personal lifestyle choices while providing tools to help make the improvements in these lifestyle choices more achievable. As technology has become more available, there is an opportunity to leverage mobile technology to assist in providing strategies to decrease the barriers to health. It has been estimated that by 2015, two billion smartphones will be in use and 500 million people will be using mobile health care apps.^{69,70} Therefore, there is an opportunity to utilize the leading evidence on creating and sustaining changes for health on a platform that is already being utilized by people seeking health.

If applied properly, technology could assist health care teams to deliver health by reaching people where they live. Technology could help to minimize the barriers to health by providing tailored and personalized health messaging. The use of messaging (e.g., text-messaging) has proven effective for promoting health behavior change, including weight control^{71,72,73,74} and increased physical activity.⁷⁵⁻⁷⁷ Digital diaries that track activity, nutrition, and sleep could link to online health resources; including exercise and meal planners to assist with achieving personal goals. Biosensors that automatically track activity and sleeping patterns can minimize the perceived barrier of time required to track personal habits. Health care providers can use social platforms for people focused on similar goals to improve social support of behavior change.⁷⁸ Finally, utilization of video gaming and virtual world platforms is emerging as an effective means to deliver health behavior change interventions and creates a fun environment for the individual as they work towards meeting their goals.⁷⁹⁻⁸¹

Health care teams can also use technology to help people develop healthier habits. Since 45% of daily life consists of habits and many lifestyle behaviors have a habitual component (e.g., eating habits, sedentary work routines, exercise, smoking, etc),⁸² programs focused on an individual’s intentions often have limited effectiveness.⁷⁸ Smartphone technology with GPS enabled features could provide personalized messages based on your current contextual environment and past behavior to help disrupt poor health habits. For example, if you like to eat popcorn at the movies; technology could provide a warning about potential mindless eating when you enter a movie theater and provide a suggested strategy to limit mindless eating such as eating with the non-dominant hand.⁸³ Technology can also assist in maintaining healthy habits when there is a contextual change. For example, when you

are traveling your smartphone could recommend areas in the vicinity to exercise or healthy places to eat. These types of tailored messages may be more effective in assisting with creating and sustaining changes in health.⁸⁴ For example, 40.5% of the individuals that received a program that combined education, self-monitoring, and personalized messages achieved a 5% or more weight loss compared to 13.2% of the individuals that received education alone.⁸⁵

Health care providers often use interventions that track food, exercise, and sleep behaviors because they are often effective in improving health behavior change.^{21,58,86,87} However, time requirements, inability to develop a personal plan, and limited knowledge on how to effectively track caloric intake and expenditure decrease compliance. Health care teams could prescribe digital biosensors (i.e., accelerometers, actigraphs, weight scales, blood pressure cuffs, heart rate monitors, and glucometers) and personalized dashboards on smartphone or web applications to help minimize these barriers. Recent systematic reviews have found that monitoring devices increased physical activity by over 25%, improved weight loss, and systolic blood pressure.^{21,88} Technologies using automated food libraries, digital food diaries, meal planners, and frequent weighing have resulted in increased compliance, improved dietary intake, and successful weight loss.^{22,23,89–94} In regards to sleep, cognitive behavior therapies that incorporate education and a sleep diary resulted in an increase of 50 minutes of sleep per night.⁸⁷

As the evidence that utilization of technology can effectively contribute to behavior change intervention continues to accumulate,^{95–97} it is important to recognize that ultimately it will be essential that individuals have the ability to share appropriate health information with their health care provider(s). Dashboards that ensure patient privacy but share this information with health care providers can help extend their reach outside of the traditional brick-mortar facilities so health care providers can reach people where they live and provide appropriate encouragement and support. An integrated solution that warns health care providers when a patient is either waning or meeting their personalized goals provides an opportunity for appropriate encouragement and possible interventions to occur. If the ultimate goal is to transition from a health care system to a system for health, then technology solutions that allow patients and providers to have timely and effective communication in the person's life and not in the health care facility will be essential.

IT TAKES A VILLAGE

When the Army Surgeon General talks about a System for Health she alludes to the fact that creating and sustaining changes towards health not only involves the individual seeking health but it is significantly influenced by friends, family, neighborhoods, communities, work, and other environmental factors. Although an individual's family, friends, and co-workers have a dramatic impact on creating and sustaining

changes in health, as a system we need to address strategic and national policies to create and sustain environments that make health not only the best choice – but the easy choice.

From the national perspective, the National Prevention Strategy provides the framework for building and creating an integrated System for Health.^{12,13} The National Prevention Strategy involves all agencies within the federal government and includes an aggressive plan for each agency to take action to move the nation from a focus on sickness and disease to one based on prevention and wellness. The Secretary of Defense designated the Assistant Secretary of Defense for Health Affairs (ASD(HA)) as the lead for implementation of the National Prevention Strategy within the DoD. Operation Live Well is the Defense Department's long-term education, outreach and behavior change initiative established to improve the health and well-being of all members of the defense community. Operation Live Well aligns with the Affordable Care Act and the Military Health System Quadruple Aim. Operation Live Well's demonstrative arm, Healthy Base Initiative, is helping to ensure the environments on each military installation support making the healthy option both an available option and the easy option through trying to eliminate food deserts on installations, increasing healthy food options, improved access to farmers markets, and increasing walking paths and bike lanes.

The Army Surgeon General's vision is focused on leading the nation toward better health through the tenets of the Performance Triad initiative, which is the second demonstrative arm of Operation Live Well. The Triad is nested within the Army's Ready and Resilient Campaign and is focused on embedding healthy Activity, Nutrition and Sleep behaviors into the Army's "DNA" like the Army Values (Loyalty, Duty, Respect, Selfless Service, Honor, Integrity, and Personal Courage). The Performance Triad promotes healthy lifestyles and choices through a robust health education campaign. The program design is to share knowledge and increase awareness to impact the health behaviors and performance of Soldiers, Family members, DA Civilians and beneficiary population. Each week there is a weekly challenge that highlights how small and easy changes towards health can result in increased quality of life, health, and ultimately readiness. While each component of the Performance Triad is independently important, it is believed optimal health performance is achieved when all three are addressed and practiced simultaneously. The Performance Triad seeks to promote healthy behaviors that support individual Soldier performance and overall unit readiness, as well as a lifestyle of healthy behaviors for Soldiers and their Families, DA Civilians and retirees. By increasing awareness in these three areas, it is expected that performance and resilience will improve, thus improving the overall health, readiness, and resilience of the Total Army.

The strengths of the Performance Triad are the simplicity of the program design, the seemingly achievable daily targets of sleep, activity and nutrition, the customizable and

robust traditional and social media communication strategy, and the use of technology. While it is too soon to tell the positive outcomes, the groundswell of interest builds as evidenced by senior leaders and organizations within the Army becoming increasingly interested in the Performance Triad and implementing the tenets within their units. There are already numerous stories being captured regarding personal and transformative success because of adapting the tenets and technology the Performance Triad.

CONCLUSION

We have proposed that health care professionals need a person-centric model that focuses on health to address the current health care crisis in our nation. To promote and maintain health and healthy behaviors, we need to move beyond the sick-care paradigm to a model focused on optimizing physical, mental, and emotional well-being. Health care providers can help individuals transition to health by teaching, encouraging, and prioritizing healthy behaviors that move them towards health. This requires health care providers that are able to help individuals learn that their health and well-being are based on the small choices they make daily and that healthy choices can quality to their lives and life to their years. The prescription for health centers on meaningful changes in behavior in concert with person-centric solutions. Strategic policies have to help support this transition by making the healthy choice the easy choice; ultimately resulting in healthier living, healthier persons, and healthier communities.

REFERENCES

1. U.S. Congressional Budget Office: U.S. Congressional Budget Office's 2013 Long Term Budget Outlook. Washington D.C, 2013.
2. Himmelstein DU, Warren E, Thorne D, Woolhandler S: Illness and injury as contributors to bankruptcy. *Health Aff (Millwood)* 2005Suppl Web Exclusives: W5-63-W65-73.
3. Murray CJ, Abraham J, Ali MK, et al: The state of US health, 1990–2010: burden of diseases, injuries, and risk factors. *JAMA* 2013; 310: 591–606.
4. Godtfredsen NS, Prescott E: Benefits of smoking cessation with focus on cardiovascular and respiratory comorbidities. *Clin Respir J* 2011; 5: 187–194.
5. Cena H, Fonte ML, Turconi G: Relationship between smoking and metabolic syndrome. *Nutr Rev* 2011; 69: 745–753.
6. Tamimi A, Serdarevic D, Hanania NA: The effects of cigarette smoke on airway inflammation in asthma and COPD: therapeutic implications. *Respir Med* 2012; 106: 319–328.
7. Must A, Spadano J, Coakley EH, Field AE, Colditz G, Dietz WH: The disease burden associated with overweight and obesity. *JAMA* 1999; 282: 1523–1529.
8. Centers for Disease Control NCFCDP, Health P: Physical activity and good nutrition: essential elements to prevent chronic diseases and obesity 2003. *Nutr Clin Care* 2003; 6: 135–138.
9. Vuori IM: Health benefits of physical activity with special reference to interaction with diet. *Public Health Nutr* 2001; 4: 517–528.
10. Liu Y, Croft JB, Wheaton AG, et al: Association between perceived insufficient sleep, frequent mental distress, obesity and chronic diseases among US adults, 2009 behavioral risk factor surveillance system. *BMC Public Health* 2013; 13: 84.
11. Shankar A, Syamala S, Kalidindi S: Insufficient rest or sleep and its relation to cardiovascular disease, diabetes and obesity in a national, multiethnic sample. *PLoS One* 2010; 5: e14189.
12. Horoho PD: Maintaining, restoring, and improving the Health of our nation. *J Orthop Sports Phys Ther* 2014; 44: 318–319.
13. Horoho PD: A system for health: essential element of national security. *US Army Med Dep J* 2013; 4.
14. Schoomaker E: Evolving Army Medicine: optimizing care for the war-fighter and the Army family. *Army* 2011; Oct: 129–133.
15. Fielding J, Kumanyika S: Recommendations for the concepts and form of Healthy People 2020. *Am J Prev Med* 2009; 37: 255–257.
16. Koh HK: A 2020 vision for healthy people. *N Engl J Med* 2010; 362: 1653–1656.
17. Warburton DE, Nicol CW, Bredin SS: Health benefits of physical activity: the evidence. *Can Med Assoc J* 2006; 174: 801–809.
18. Penedo FJ, Dahn JR: Exercise and well-being: a review of mental and physical health benefits associated with physical activity. *Curr Opin Psychiatry* 2005; 18: 189–193.
19. Golay A, Brock E, Gabriel R, et al: Taking small steps towards targets—perspectives for clinical practice in diabetes, cardiometabolic disorders and beyond. *Int J Clin Pract* 2013; 67: 322–332.
20. Hardcastle SJ, Taylor AH, Bailey MP, Harley RA, Hagger MS: Effectiveness of a motivational interviewing intervention on weight loss, physical activity and cardiovascular disease risk factors: a randomised controlled trial with a 12-month post-intervention follow-up. *Int J Behav Nutr Phys Act* 2013; 10: 40.
21. Burke LE, Wang J, Sevick MA: Self-monitoring in weight loss: a systematic review of the literature. *J Am Diet Assoc* 2011; 111: 92–102.
22. Tate DF, Wing RR, Winett RA: Using Internet technology to deliver a behavioral weight loss program. *JAMA* 2001; 285: 1172–1177.
23. Stewart T, Han H, Allen RH, et al: H.E.A.L.T.H.: efficacy of an internet/population-based behavioral weight management program for the U. S. Army. *J Diabetes Sci Technol* 2011; 5: 178–187.
24. Haskell WL, Lee I, Pate RR, et al: Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Med Sci Sports Exerc* 2007; 39: 1423.
25. U.S. Department of Health and Human Services: Healthy People 2020. Washington, DC, US Department of Health and Human Services, 2013.
26. Matthews CE, George SM, Moore SC, et al: Amount of time spent in sedentary behaviors and cause-specific mortality in US adults. *Am J Clin Nutr* 2012; 95: 437–445.
27. Matthews CE, Chen KY, Freedson PS, et al: Amount of time spent in sedentary behaviors in the United States, 2003–2004. *Am J Epidemiol* 2008; 167: 875–881.
28. Chau JY, Grunseit AC, Chey T, et al: Daily sitting time and all-cause mortality: a meta-analysis. *PLoS One* 2013; 8: e80000.
29. Consultation W: Obesity: preventing and managing the global epidemic. *World Health Organization Technical Report Series* 2000; 894.
30. Gebremariam MK, Bergh IH, Andersen LF, et al: Are screen-based sedentary behaviors longitudinally associated with dietary behaviors and leisure-time physical activity in the transition into adolescence? *Int J Behav Nutr Phys Act* 2013; 10: 9.
31. Signs CV: Adult Obesity, Obesity Rises Among Adults. Atlanta, GA, Centers for Disease Control and Prevention, 2010.
32. Park MH, Sovio U, Viner RM, Hardy RJ, Kinra S: Overweight in childhood, adolescence and adulthood and cardiovascular risk in later life: pooled analysis of three British birth cohorts. *PLoS One* 2013; 8: e70684.
33. Tirosh A, Shai I, Afek A, et al: Adolescent BMI trajectory and risk of diabetes versus coronary disease. *N Engl J Med* 2011; 364: 1315–1325.
34. Finkelstein EA, Chen H, Prabhu M, Trogon JG, Corso PS: The relationship between obesity and injuries among US adults. *Am J Health Promot* 2007; 21: 460–468.

35. Knapik JJ, Canham-Chervak M, Hauret K, Hoedebecke E, Laurin MJ, Cuthie J: Discharges during US Army basic training: injury rates and risk factors. *Mil Med* 2001; 166: 641–647.
36. Peake J, Gargett S, Waller M, et al: The health and cost implications of high body mass index in Australian defence force personnel. *BMC Public Health* 2012; 12: 451.
37. Iriart C, Handal AJ, Boursaw B, Rodrigues G: Chronic malnutrition among overweight Hispanic children: understanding health disparities. *J Immigr Minor Health* 2011; 13: 1069–1075.
38. Larson C, Haushalter A, Buck T, Campbell D, Henderson T, Schlundt D: Peer reviewed: development of a community-sensitive strategy to increase availability of fresh fruits and vegetables in Nashville's urban food deserts, 2010–2012. *Prev Chronic Dis* 2013; 10: E125.
39. Jacka FN, Mykletun A, Berk M, Bjelland I, Tell GS: The association between habitual diet quality and the common mental disorders in community-dwelling adults: the Hordaland Health study. *Psychosom Med* 2011; 73: 483–490.
40. Weng T-T, Hao J-H, Qian Q-W, et al: Is there any relationship between dietary patterns and depression and anxiety in Chinese adolescents? *Public Health Nutr* 2012; 15: 673–682.
41. Samieri C, Sun Q, Townsend MK, et al: The association between dietary patterns at midlife and health in aging: an observational study. *Ann Intern Med* 2013; 159: 584–591.
42. Langley J, Davie G, Wilson S, et al: Difficulties in functioning 1 year after injury: the role of preinjury sociodemographic and health characteristics, health care and injury-related factors. *Arch Phys Med Rehabil* 2013; 94: 1277–1286.
43. Mikkonen P, Leino-Arjas P, Remes J, Zitting P, Taimela S, Karppinen J: Is smoking a risk factor for low back pain in adolescents? A prospective cohort study. *Spine (Phila Pa 1976)* 2008; 33: 527–532.
44. Behrend C, Prasarn M, Coyne E, Horodyski M, Wright J, Rehtine GR: Smoking cessation related to improved patient-reported pain scores following spinal care. *J Bone Joint Surg Am* 2012; 94: 2161–2166.
45. Carbone S, Gumina S, Arceri V, Campagna V, Fagnani C, Postacchini F: The impact of preoperative smoking habit on rotator cuff tear: cigarette smoking influences rotator cuff tear sizes. *J Shoulder Elbow Surg* 2012; 21: 56–60.
46. Rechart M, Shiri R, Karppinen J, Jula A, Heliovaara M, Viikari-Juntura E: Lifestyle and metabolic factors in relation to shoulder pain and rotator cuff tendinitis: a population-based study. *BMC Musculoskelet Disord* 2010; 11: 165.
47. Van Middelkoop M, Kolkman J, Van Ochten J, Bierma-Zeinstra SM, Koes BW: Risk factors for lower extremity injuries among male marathon runners. *Scand J Med Sci Sports* 2008; 18: 691–697.
48. Grier TL, Morrison S, Knapik JJ, Canham-Chervak M, Jones BH: Risk factors for injuries in the US Army Ordnance School. *Mil Med* 2011; 176: 1292–1299.
49. Altarac M, Gardner JW, Popovich RM, Potter R, Knapik JJ, Jones BH: Cigarette smoking and exercise-related injuries among young men and women. *Am J Prev Med* 2000; 18: 96–102.
50. Knapik JJ, Sharp MA, Canham-Chervak M, Hauret K, Patton JF, Jones BH: Risk factors for training-related injuries among men and women in basic combat training. *Med Sci Sports Exerc* 2001; 33: 946–954.
51. Reynolds KL, Heckel HA, Witt CE, et al: Cigarette smoking, physical fitness, and injuries in infantry soldiers. *Am J Prev Med* 1994; 10: 145.
52. Leyk D, Rütther T, Witzki A, et al: Physical fitness, weight, smoking, and exercise patterns in young adults. *Dtsch Arztebl Int* 2012; 109: 737.
53. Mindell JA, Meltzer LJ, Carskadon MA, Chervin RD: Developmental aspects of sleep hygiene: findings from the 2004 National Sleep Foundation Sleep in America Poll. *Sleep Med* 2009; 10: 771–779.
54. Haario P, Rahkonen O, Laaksonen M, Lahelma E, Lallukka T: Bidirectional associations between insomnia symptoms and unhealthy behaviours. *J Sleep Res* 2013; 22: 89–95.
55. Hoefelmann LP, Lopes ADS, Silva KSD, Silva SGD, Cabral LGA, Nahas MV: Lifestyle, self-reported morbidities, and poor sleep quality among Brazilian workers. *Sleep Med* 2012; 13: 1198–1201.
56. Philip P: Sleepiness of occupational drivers. *Ind Health* 2005; 43: 30–33.
57. Mountain SA, Quon BS, Dodek P, Sharpe R, Ayas NT: The impact of housestaff fatigue on occupational and patient safety. *Lung* 2007; 185: 203–209.
58. Burke LE, Styn MA, Sereika SM, et al: Using mHealth technology to enhance self-monitoring for weight loss: a randomized trial. *Am J Prev Med* 2012; 43: 20–26.
59. Turner-McGrievy GM, Beets MW, Moore JB, Kaczynski AT, Barr-Anderson DJ, Tate DF: Comparison of traditional versus mobile app self-monitoring of physical activity and dietary intake among overweight adults participating in an mHealth weight loss program. *J Am Med Inform Assoc* 2013; 20: 513–518.
60. Miller SK, Alpert PT, Cross CL: Overweight and obesity in nurses, advanced practice nurses, and nurse educators. *J Am Acad Nurse Pract* 2008; 20: 259–265.
61. Rye PL, Reeson ME, Pekrul CM, et al: Comparing health behaviours of internal medicine residents and medical students: an observational study. *Clin Invest Med* 2012; 35: E40–44.
62. Patkar AA, Hill K, Batra V, Vergare MJ, Leone FT: A comparison of smoking habits among medical and nursing students. *Chest J* 2003; 124: 1415–1420.
63. Aina B, Oyerinde O, Joda A, Dada O: Cigarette smoking among health-care professional students of university of lagos and lagos university teaching hospital (luth), idi-araba, lagos, nigeria. *Nig Q J Hosp Med* 2009; 19: 42–46.
64. Sodergren M, McNaughton SA, Salmon J, Ball K, Crawford DA: Associations between fruit and vegetable intake, leisure-time physical activity, sitting time and self-rated health among older adults: cross-sectional data from the WELL study. *BMC Public Health* 2012; 12: 551.
65. Murray J, Craigs CL, Hill KM, Honey S, House A: A systematic review of patient reported factors associated with uptake and completion of cardiovascular lifestyle behaviour change. *BMC Cardiovasc Disord* 2012; 12: 120.
66. Heesch KC, Masse LC: Lack of time for physical activity: perception or reality for African American and Hispanic women? *Women Health* 2004; 39: 45–62.
67. Rodgers WM, Brawley LR: Using both self-efficacy theory and the theory of planned behavior to discriminate adherers and dropouts from structured programs. *J Appl Sport Psychol* 1993; 5: 195–206.
68. Hrysmallis C: Injury incidence, risk factors and prevention in Australian rules football. *Sports Med* 2013; 43: 339–354.
69. Bicheno S: Global Smartphone Installed Base Forecast by Operating System for 88 Countries: 2007 to 2017. *Strategy Anal* 2012, Boston, MA.
70. Mearian L: Healthcare I: 500 million people will be using mobile health apps by 2015. 2010. <https://www.computerworld.com/article/2514426/healthcare-it/500-million-people-will-be-using-mobile-health-apps-by-2015.html>.
71. Cole-Lewis H, Kershaw T: Text messaging as a tool for behavior change in disease prevention and management. *Epidemiol Rev* 2010; 32: 56–69.
72. Napolitano MA, Hayes S, Bennett GG, Ives AK, Foster GD: Using Facebook and text messaging to deliver a weight loss program to college students. *Obesity (Silver Spring)* 2013; 21: 25–31.
73. Gerber BS, Stolley MR, Thompson AL, Sharp LK, Fitzgibbon ML: Mobile phone text messaging to promote healthy behaviors and weight loss maintenance: a feasibility study. *Health Informatics J* 2009; 15: 17–25.

74. Patrick K, Raab F, Adams MA, et al: A text message-based intervention for weight loss: randomized controlled trial. *J Med Internet Res* 2009; 11: e1.
75. Kim BH, Glanz K: Text messaging to motivate walking in older African Americans: a randomized controlled trial. *Am J Prev Med* 2013; 44: 71–75.
76. Stephens J, Allen J: Mobile phone interventions to increase physical activity and reduce weight: a systematic review. *J Cardiovasc Nurs* 2013; 28: 320–329.
77. Shapiro JR, Koro T, Doran N, et al: Text4Diet: a randomized controlled study using text messaging for weight loss behaviors. *Prev Med* 2012; 55: 412–417.
78. Webb TL, Sheeran P: Does changing behavioral intentions engender behavior change? A meta-analysis of the experimental evidence. *Psychol Bull* 2006; 132: 249–268.
79. Johnston JD, Massey AP, Devaneaux CA: Innovation in weight loss programs: a 3-dimensional virtual-world approach. *J Med Internet Res* 2012; 14: e120.
80. Baranowski T, Baranowski J, Thompson D, Buday R: Behavioral science in video games for children's diet and physical activity change: key research needs. *J Diabetes Sci Technol* 2011; 5: 229–233.
81. Baranowski T, Buday R, Thompson DI, Baranowski J: Playing for real: video games and stories for health-related behavior change. *Am J Prev Med* 2008; 34: 74–82.
82. Neal DT, Wood W, Quinn JM: Habits – a repeat performance. *Curr Dir Psychol Sci* 2006; 15: 198–202.
83. Neal DT, Wood W, Wu M, Kurlander D: The pull of the past: When do habits persist despite conflict with motives? *Pers Soc Psychol Bull* 2011; 37: 1428–1437.
84. Kreuter MW, Wray RJ: Tailored and targeted health communication: strategies for enhancing information relevance. *Am J Health Behav* 2003; 27: S227–S232.
85. Wing RR, Crane MM, Thomas JG, Kumar R, Weinberg B: Improving weight loss outcomes of community interventions by incorporating behavioral strategies. *Am J Public Health* 2010; 100: 2513–9.
86. Guare JC, Wing RR, Marcus MD, Epstein LH, Burton LR, Gooding WE: Analysis of changes in eating behavior and weight loss in type II diabetic patients. Which behaviors to change. *Diabetes Care* 1989; 12: 500–503.
87. Prestwich DJ, Rankin LL, Housman J: Tracking sleep times to reduce tiredness and improve sleep in college students. *Cal J Health Prom* 2007; 5: 148–156.
88. Bravata DM, Smith-Spangler C, Sundaram V, et al: Using pedometers to increase physical activity and improve health. *JAMA* 2007; 298: 2296–2304.
89. Krukowski RA, Harvey-Berino J, Bursac Z, Ashikaga T, West DS: Patterns of success: online self-monitoring in a web-based behavioral weight control program. *Health Psychol* 2013; 32: 164–170.
90. Arem H, Irwin M: A review of web-based weight loss interventions in adults. *Obes Rev* 2011; 12: e236–243.
91. Acharya SD, Elci OU, Sereika SM, Styn MA, Burke LE: Using a personal digital assistant for self-monitoring influences diet quality in comparison to a standard paper record among overweight/obese adults. *J Am Diet Assoc* 2011; 111: 583–588.
92. Turner-McGrievy G, Tate D: Tweets, apps, and pods: results of the 6-month mobile pounds off digitally (mobile POD) randomized weight-loss intervention among adults. *J Med Internet Res* 2011; 13: e120.
93. Newton RL Jr., Han H, Stewart TM, Ryan DH, Williamson DA: Efficacy of a pilot Internet-based weight management program (H.E.A. L.T.H.) and longitudinal physical fitness data in Army Reserve soldiers. *J Diabetes Sci Technol* 2011; 5: 1255–1262.
94. Stewart T, May S, Allen HR, et al: Development of an internet/population-based weight management program for the U.S. Army. *J Diabetes Sci Technol* 2008; 2: 116–126.
95. Webb TL, Joseph J, Yardley L, Michie S: Using the internet to promote health behavior change: a systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery on efficacy. *J Med Internet Res* 2010; 12: e4.
96. Bennett GG, Herring SJ, Puleo E, Stein EK, Emmons KM, Gillman MW: Web-based weight loss in primary care: a randomized controlled trial. *Obesity (Silver Spring)* 2010; 18: 308–313.
97. Kennedy CM, Powell J, Payne TH, Ainsworth J, Boyd A, Buchan I: Active assistance technology for health-related behavior change: an interdisciplinary review. *J Med Internet Res* 2012; 14: e80.