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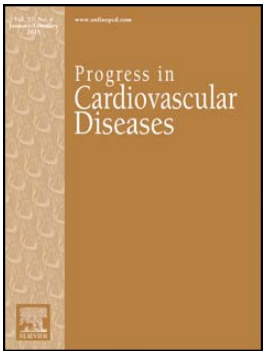

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Training Health Professionals to Deliver Healthy Living Medicine

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Abstract

The growing incidence and prevalence of unhealthy living behaviors leading to compromised health, along with unhealthy supportive environments, are the primary reasons for the current chronic disease crisis in almost all countries. Over the course of health professions training across disciplines, a large amount about information regarding various aspects of chronic disease is introduced, from pathophysiology to a broad array of approaches to examinations (focused on diagnosis and prognosis) and interventions. Currently, a late primary or secondary prevention focus is the primary educational approach in the health professions. In either scenario, the health professional is often trained to approach their discipline from a *catch up* approach, with little focus on how an individual's health condition, at the time of presentation, came to be. It is unfortunate that so little educational time and effort is devoted to train future health professionals on how to practice *Healthy Living Medicine* (HLM) and, deliver *healthy living* (HL) interventions. The primary goal should be to keep individuals healthy where they live, work and go to school and minimize initiating care in the hospital and outpatient clinical setting. The current review describes current trends in training health professionals in HLM and the delivery of HL interventions.

Abbreviation List

AAMC - Association of American Medical Colleges

ABMS - American Board of Medical Specialties (ABMS)

ACCF – American College of Cardiology Foundation

ACP – American College of Physicians

ACPM - American College of Preventive Medicine

AEP - Accredited exercise physiologist (AEP)

AHA - American Heart Association

CME – Continuing Medical Education

CV -Cardiovascular

CVD – Cardiovascular disease

DM- Diabetes mellitus

HL – Healthy Living

HLM – Healthy living medicine

HTN-Hypertension

IOM – Institute of Medicine

LCME - Liaison Committee on Medical Education

LMEd - Lifestyle Medicine Education

MD - Medical Doctor

NHLBI - National Heart Lung and Blood Institute

NIDDK - National Institute of Diabetes and Digestive and Kidney Diseases

NIH - National Institutes of Health

PA –Physical activity

UIC - University of Illinois at Chicago

US – United States

USMLE – United States Medical Licensing Examination

Introduction

The growing incidence and prevalence of unhealthy living behaviors leading to compromised health (i.e., poor diet, sedentary lifestyle, excess body mass, and smoking), along with unhealthy supportive environments, are the primary reasons for the current chronic disease crisis in almost all countries.[1-3] Unfortunately, few individuals around the world are able to pursue *healthy living* (HL) that supports cardiovascular (CV) as well as other key aspects of health (i.e., metabolic, pulmonary, etc.).[4-9] Compared to those with the poorest of characteristics, any movement toward an improved HL phenotype betters prognosis and quality of life, and if done early enough, significantly reduces the risk of chronic disease development and prolongs the healthspan.[4, 10-15]

Over the course of health professions training (i.e., physician, nursing, pharmacy, dentistry, physical and occupational therapy, dieticians, etc.), a large amount about information regarding various aspects of chronic disease [e.g., CV disease (CVD), diabetes mellitus (DM), pulmonary disease and certain forms of cancer] is introduced, from pathophysiology to a broad array of approaches to examination (to ascertain diagnosis, clinical status and prognosis) and interventions. The content and depth to which chronic disease information is integrated into a curriculum is dependent upon the specific health profession and their perceived role within an interprofessional team.[16-18] Currently, a late primary (i.e., multiple risk factors well established) or secondary (i.e., confirmed chronic disease diagnosis) prevention focus is the primary educational approach in the health professions.[19] In either scenario the health professional is often trained to approach their discipline from a *catch up* framework, with little focus on how an individual's health condition, at the time of presentation, came to be. It is unfortunate

that so little educational time and effort is devoted to train future health professionals on how to practice *Healthy Living Medicine* (HLM) and, deliver *healthy living* (HL) interventions: 1) physical activity (PA); 2) healthy nutrition; 3) not smoking; and 4) maintaining a healthy body weight.[10, 20] There is clear evidence that individuals who optimally emulate the HL phenotype throughout life enjoy a profound reduction in risk for chronic disease.[13, 14, 21] In fact, there is broad recognition that there is a need to change our approach to health care, preventing chronic disease, and better yet, preventing modifiable lifestyle risk factors, from ever manifesting is the way forward.[7] Despite a recognition that the delivery of healthcare must change, specifically adopting a HLM approach to a much greater degree, our educational model is lagging behind; we continue to primarily train all the health professions from a late primary/secondary prevention framework where pharmacologic and surgical interventions are a necessity. As such, there is a need to align health professions education and practice to address the population's current needs and desired outcomes, promotion of the healthspan[12, 22], reduction in life-style related risk factors and the prevention of developing a chronic disease. The current review describes current trends in training future and current health professionals in HLM and the delivery of HL interventions.

The Current State of Health Professions Education Related to HLM: Focus on Medical Education

There is currently no health profession that has led the way in developing and implementing a comprehensive HLM theme into their curriculum. There are certain disciplines that certainly have a focus in very specific components of HLM; dieticians and exercise scientists are two examples of training with a very specific focus in their

own discipline, yet they are usually limited on integrating other aspects of HL. Interestingly, Australia integrated exercise scientists into their healthcare model, providing a key portion of HLM to patient populations in need (e.g, DM, HTN, obesity, etc.).[23, 24] A detailed description of the educational and training initiatives undertaken by all health professions in the realm of HLM is beyond the scope of this review. In the following sections, we will therefore focus on initiatives in medical doctor (MD) training as a specific model for HLM education.

HLM Initiatives in Medical Education

Having a broadly accepted and standardized approach to HLM training for up-coming physicians would go a long way to improve the HL phenotype most important to healthspan and chronic disease prevention, from the individual to population level. Physicians are at the forefront of patient care; in the United States (US), more than 80% of individuals see a physician at least once a year, across various settings.[25] Moreover, most patients highly value and trust the recommendations provided by their physicians.[26, 27] There is evidence to indicate that a more rigorous and intensive approach to behavioral counseling to promote the HL phenotype is effective.[28] Thus, having physicians putting more emphasis on the practice of HLM and delivery of HL interventions (i.e., being physically active and moving more throughout the day, consuming a healthy diet, not smoking and maintaining a healthy body weight) is key for improving the health status of every individual receiving care, starting from children with no apparent risk factors (true primordial prevention), to at risk patients for primary prevention of all forms of chronic disease and through to secondary prevention HL interventions, such as cardiac rehabilitation following CVD events or heart surgery.[7, 17, 22, 29-31] Unfortunately, most of

the current MD programs in the US have limited time devoted to HLM and lack integrated comprehensive training to help future physicians to feel adequately prepared to discuss healthy lifestyle with their patients and support them to make sustainable health behavioral changes.[32, 33] In clinical practice, this translates into less than 35% of patients in the US reporting receiving counseling on exercise and nutrition from their physician.[34, 35]

In the recent years, there have been some efforts to improve US medical school curricula as it relates to HLM, at the national level and in individual institutions. In late 1990' and 2000', the National Institutes of Health (NIH) supported over 20 medical schools to integrate nutrition in their curriculum based on request for applications called the Nutrition Academic Award Program [mainly supported by National Heart Lung and Blood Institute (NHLBI) with participation from the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)]. The program also resulted in materials to guide curriculum development for inclusion of nutrition training in medical schools, and provided educational materials shared by some of the individual school awardees.[36] A few years later, NIH also supported awards to integrate behavioral and social science in medical school's curriculum. These opportunities have helped individual institutions to improve their curriculum and raised awareness of the importance of training physicians about nutrition and health behaviors, but have had limited global impact on how physicians practice across the US. First, only a limited number of schools were awardees and not all programs were maintained after the end of funding periods. Second, the importance of other HL components (physical activity, sleep, stress management) in the prevention and management of chronic disease did not receive as much focus in

curriculum improvement, leaving an important gap in medical school training that warrants future attention.

One of the challenges that remains for most medical schools that have initiated efforts to improve their curriculum is to make sure to cover the multiple facets of HL in theory and in practice (i.e., nutrition, PA, sleep, and behavioral change counseling) in an *integrated fashion* that can lead to real and applicable clinical skills. This is essential for the ultimate goal of having future physicians feel competent to deliver HLM and prescribe HL interventions that have a real impact on a patients' health. Many organizations, including the American Heath Association (AHA)[32], American College of Cardiology Foundation (ACCF), American College of Physicians (ACP)[37] and the Institute of Medicine (IOM)[38, 39] have advocated for integrated programs to improve HLM training in medical school curricula.

What are the current resources and programs?

Medical School Curriculum Resources

Recently, the Lifestyle Medicine Education (LMEd) Collaborative created an online platform to offer resources and support to faculty, administrators and students interested in introducing or advancing HLM curricula at their schools.[40] The LMEd collaborative offers the opportunity for schools program representatives to share their educational materials and access materials that have been peer-reviewed and build specifically to include in MD training. Some of the materials come directly from individual institutions, other materials are provided through Association of American Medical Colleges (AAMC) MedEdPORTAL.[41] On their website, the LMEd collaborative

also list many courses and programs for post-graduate and continuing medical education (CME) for MDs and other health professionals with appropriate links.[40]

Post-graduate training

Several options are currently available following medical school graduation. The American College of Preventive Medicine (ACPM) is offering accredited residency programs in more than 70 institutions in the US.[42] Over the course of two to four years (depending if combined with family medicine/ internal medicine), residents acquire knowledge and skills of clinical medicine combined with the special skill sets of medical management, research, and population health. Preventive Medicine is one of the recognized American Board of Medical Specialties (ABMS) accredited certifications.[43]

Recently, many CME courses covering HLM concepts have emerged and are available to physicians and other health care professionals that desire to enhance their proficiency in HL behavioral counseling. Some are online modules and courses such as the 30-hour Lifestyle Medicine Core Competency Program.[44] Harvard Medical School Department of Continuous Education offers both in person (2-3 day workshop) or online (1 to 4 hours) courses for MDs and other health professionals.[45] Other formal programs are available at many institutions.[46] This emergence of these CME opportunities demonstrates deep interest from the medical community and a need that many MDs and other health professionals felt unmet during their previous academic and clinical training.

Future Goals for Medical Education and Physician Training

The programs and resources evolving in medical education and post-graduate CME are encouraging and part of a rising interest in HLM, but we are still far from having widespread availability of appropriate training in this area for current and future

physicians. In an ideal world, all medical schools would offer an integrated HLM program within their medical school curriculum and in their post-doctoral residency and fellowships programs. These programs should cover theory and practical aspects of HLM that should be distributed across the curriculum to insure that students learn progressively and integrate knowledge and skills into practice when they reach clinical rotations. Programs should also include education about collaborative care with other health professionals who can and should play a primary role in HLM such as nurses, dieticians, physical/occupational therapists, social workers, pharmacists and exercise scientists. At the end of MD training, physicians should have acquired enough knowledge and skills to start conversations about the desired HL phenotype and appropriate behavioral changes as necessary. Moreover, when more intensive HL interventions are needed, MDs must be cognizant and knowledgeable of when to refer and to whom, while continuing to support their patients through the process.

What is needed to Change the Current Medical Training Model?

To hope for this major paradigm shift in how we train future and current physicians, we will need multiple agents of changes. In many institutions, students are initiating the request for more content and clinical practice opportunities that are central to the practice of HLM and delivery of HL interventions. In most institutions where programs are already enriched with HLM training, leadership originated from passionate faculty members that invested countless time and effort to improve their programs. And of course, no changes are possible without the support of medical school deans and curriculum directors. All these actors, from students to upper level administration, are key to successful medical school curriculum reform.

At the national level, more precise recommendations from the Association of American Medical Colleges (AAMC)[41] and changes in medical school accreditation criteria by the Liaison Committee on Medical Education (LCME)[47] to include clear HLM objectives would have a strong influence on medical school curricula across US and Canada.[32] Finally, there is no doubt that "evaluation drives the curriculum". Including HLM concepts in the United States Medical Licensing Examination (USLME)[48] steps 1, 2, and 3, and in board examinations of specialty certifications such as family medicine, internal medicine, pediatrics and obstetrics would have a major impact on what is included in pre and post-doctoral programs.

The Broader View: A Uniform Healthy Living Education Model for All Health Professions

Even as there is an attempt to add educational content to medical school curricula and grow availability of post-graduate CME modules for physicians and other health professionals, more must be done to appropriately train all health professionals who should all have a role to play in the delivery of HLM. Current training modules for HLM are not uniform and offered at a limited number of institutions and moreover a limited number of health professions with access to such training. As such, a critical issue remains: There are currently too few health professionals who have the necessary academic training to provide HLM and deliver HL interventions.[49] In addition to physicians, health professionals who currently have the potential to participate in the practice of HLM and delivery of HL interventions include but are not necessarily limited to: 1) Pharmacists; 2) Dietitians; 3) Nurses; 4) Physical/Occupational Therapists; 5) Exercise Physiologists/Health Fitness Professionals; and 6) Dentists. None of the core

curriculums of these health professions provide a comprehensive, effective education model and real-life experiences related to maintaining/improving the HL phenotype in a global fashion for patients under their care. Dirks-Naylor et al.[50], for example, recently reported pharmacy students in the US essentially receive no information on the importance of exercise and PA during their training. It seems, that if HLM and HL interventions are two of the most important aspects of healthcare delivery moving forward, which is clear given the current globally predominant unhealthy living phenotype and chronic disease crisis[2, 51-54], there should be a more robust and standardized academic infrastructure to provide training, creating a well-qualified, interprofessional HL team of clinicians.

To have the highest potential to make a large-scale impact and make a meaningful change to the health trajectory of a large portion of the population, the practice of HLM and delivery of HL interventions should be embraced and practiced by all health professions. Healthy living medicine and HL interventions should not be exclusively overseen by one profession as there is virtually no side effect profile to the HL polypill.[17, 55] The nature of HLM readily allows for this approach as a number of health professions have the foundational education needed to safely and effectively participate in the delivery of HL interventions, with the necessary additional training. As such, all health professionals should be trained to practice HLM, assessing lifestyle characteristics and provide general guidance on physical activity/movement, healthy nutrition, not smoking and maintaining a healthy weight. In other words, we need all health professionals to simultaneously become HL *generalists.* Moreover, all healthy professions should work together in the practice of HLM and delivering HL interventions. Patients receiving a

unifying message from their physician, dentist, pharmacist and physical therapist, for example, would be a major paradigm shift and have the potential to positively impact lifestyle behaviors and health trajectory in a large proportion of the population. This would require the creation of an educational model that transcends ownership of HLM by any one health profession.

To address this needed paradigm shift in academic training and subsequently the delivery of healthcare in the future, the University of Illinois at Chicago (UIC) will launch the *Healthy Living Practitioner (HLP)* graduate certificate program in the Fall of 2017. This concept was first proposed by Arena et al.[49] in 2016 where HLPs were defined in the following way: ""*Healthy Living Practitioners (HLPs) are health professionals who are actively engaged in assessing lifestyle behaviors and subsequently developing and implementing HL interventions. HLPs focus on the primordial and primary prevention of chronic diseases as well as secondary prevention in those already diagnosed with a lifestyle-related disease. HLPs are committed to supporting behavior changes towards HL phenotype and helping to ensure these changes are maintained over the long-term. HLPs participate in a broad range of activities related to the field including individual/patient care, program development and implementation, teaching, research and leadership activities related to HLM.*"

Table 1 lists the courses and learning objectives of this 22 credit certificate program. Students enrolled in a health professions discipline (e.g., 1) Pharmacy; 2) Nutrition; 3) Nursing; 4) Physical/Occupational Therapy; 5) Medicine; 6) Dentistry; etc.) will be eligible for enrollment as an electives sequence in parallel to their primary education (i.e., stackable credential model). Graduates from these health professions may

also exclusively enroll in the HLP certificate program. The mission of the UIC HLP certificate program is to offer students and graduates from the health professions the skills necessary to: 1) assess HL behaviors (i.e., nutrition, exercise and PA, healthy weight management and weight loss, and smoking cessation) and associated metrics (i.e., blood pressure, lipids and glucose); 2) Provide appropriate HL interventions that are personalized and participatory; and 3) Become leaders for promoting a culture of HL in a variety of environments (e.g., clinical settings, school systems, communities, workplaces, etc.). Following the Fall 2017 launch, partnering institutions both nationally and internationally will be recruited to also offer the HLP certificate program, exponentially increasing the number of health professionals training as HL generalists and able to deliver appropriate HL interventions. An HLP rubric was also approved to provide the training model with a unique identity and uniform branding across partnering institutions. This educational model, or an evolution of this concept over time, may be a viable educational option for HLM across the health professions.

Conclusions

Classic current MD training, as well as training in the other health professions, is most often insufficient for clinicians to feel competent in practicing HLM in their patients, despite a large proportion of the global population that would benefit from this preventive approach to healthcare. Improving health professions curricula by including a well-designed focus on HLM is necessary to shift toward a proactive, preventive care model as opposed to the current status mainly focused on reactionary treatment care, the latter of which oftentimes entirely overlooking the value of HL interventions. To achieve such a shift in education and health care practice, we will need support from agents of

change at all levels, starting with invested stakeholders at individual institutions (students, faculty, and deans), all the way up to national organizations regulating accreditations and evaluations. The change we are promoting to health professions education herein would have the potential for major health benefits at the population level while reducing cost of care over the long term.

Disclosures

Nothing to disclose

References

1. Mortality GBD and Causes of Death C. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2015;385:117-71.

2. Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, Das SR, de Ferranti S, Després J-P, Fullerton HJ, Howard VJ, Huffman MD, Isasi CR, Jiménez MC, Judd SE, Kissela BM, Lichtman JH, Lisabeth LD, Liu S, Mackey RH, Magid DJ, McGuire DK, Mohler ER, Moy CS, Muntner P, Mussolino ME, Nasir K, Neumar RW, Nichol G, Palaniappan L, Pandey DK, Reeves MJ, Rodriguez CJ, Rosamond W, Sorlie PD, Stein J, Towfighi A, Turan TN, Virani SS, Woo D, Yeh RW and Turner MB. Heart Disease and Stroke Statistics—2016 Update: A Report From the American Heart Association. *Circulation*. 2015.

3. Lavie CJ, Arena R, Swift DL, Johannsen NM, Sui X, Lee DC, Earnest CP, Church TS, O'Keefe JH, Milani RV and Blair SN. Exercise and the cardiovascular system: clinical science and cardiovascular outcomes. *Circ Res*. 2015;117:207-19.

4. Folsom AR, Yatsuya H, Nettleton JA, Lutsey PL, Cushman M, Rosamond WD and Investigators AS. Community prevalence of ideal cardiovascular health, by the American Heart Association definition, and relationship with cardiovascular disease incidence. *J Am Coll Cardiol*. 2011;57:1690-6.

5. Alwan A, MacLean DR, Riley LM, d'Espaignet ET, Mathers CD, Stevens GA and Bettcher D. Monitoring and surveillance of chronic non-communicable diseases: progress and capacity in high-burden countries. *The Lancet*. 376:1861-1868.

6. Andersen LB, Mota J and Di Pietro L. Update on the global pandemic of physical inactivity. *Lancet*. 2016.

7. Arena R, Whitsel LP, Berra K, Lavie CJ, Kaminsky L, Williams M, Hivert MF, Franklin NC, Myers J, Dongel D, Lloyd-Jones DM, Guazzi M, Pinto FJ, Consentino F, Halle M, Gielen S, Dendale P, Niebauer J, Pelliccia A, Giannuzzi P, Corra U, Piepoli M, Lianov L, Guthrie G and Shurney D. Healthy Lifestyle Interventions to Combat Non-Communicable Disease: A Novel Non-Hierarchical Connectivity Model for Key Stakeholders: A Policy Statement from the AHA, ESC, EACPR and ACPM. *Mayo Clin Proc*. 2015;90:1082-1103.

8. Arena R, Harrington RA and Despres JP. A message from modern-day healthcare to physical activity and fitness: welcome home! *Prog Cardiovasc Dis*. 2015;57:293-5.

9. Carlson SA, Fulton JE, Pratt M, Yang Z and Adams EK. Inadequate physical activity and health care expenditures in the United States. *Prog Cardiovasc Dis*. 2015;57:315-23.

10. Lloyd-Jones DM, Hong Y, Labarthe D, Mozaffarian D, Appel LJ, Van Horn L, Greenlund K, Daniels S, Nichol G, Tomaselli GF, Arnett DK, Fonarow GC, Ho PM, Lauer MS, Masoudi FA, Robertson RM, Roger V, Schwamm LH, Sorlie P, Yancy CW, Rosamond WD, American Heart Association Strategic Planning Task F and Statistics C. Defining and setting national goals for cardiovascular health promotion and disease reduction: the American Heart Association's strategic Impact Goal through 2020 and beyond. *Circulation*. 2010;121:586-613.

11. Del Gobbo LC, Kalantarian S, Imamura F, Lemaitre R, Siscovick DS, Psaty BM and Mozaffarian D. Contribution of Major Lifestyle Risk Factors for Incident Heart Failure in Older Adults: The Cardiovascular Health Study. *JACC Heart failure*. 2015;3:520-8.

12. Increasing Healthspan: Prosper and Live Long. *EBioMedicine*. 2015;2:1559.

13. Akesson A, Larsson SC, Discacciati A and Wolk A. Low-risk diet and lifestyle habits in the primary prevention of myocardial infarction in men: a population-based prospective cohort study. *J Am Coll Cardiol*. 2014;64:1299-306.

14. Larsson SC, Akesson A and Wolk A. Primary prevention of stroke by a healthy lifestyle in a high-risk group. *Neurology*. 2015;84:2224-8.

15. Harrington RA, Arena R, Despres JP, Ciarochi A, Croll E and Bloch KD. More than 10 million steps in the right direction: results from the first American Heart Association scientific sessions walking challenge. *Prog Cardiovasc Dis*. 2015;57:296-8.

16. Santschi V, Wuerzner G, Chiolero A, Burnand B, Schaller P, Cloutier L, Paradis G and Burnier M. Team-based care for improving hypertension management among outpatients (TBC-HTA): study protocol for a pragmatic randomized controlled trial. *BMC Cardiovasc Disord*. 2017;17:39.

17. Arena R and Lavie CJ. The Healthy Lifestyle Team is Central to the Success of Accountable Care Organizations. *Mayo Clin Proc*. 2015;90:572-6.

18. Balk EM, Earley A, Raman G, Avendano EA, Pittas AG and Remington PL. Combined Diet and Physical Activity Promotion Programs to Prevent Type 2 Diabetes Among Persons at Increased Risk: A Systematic Review for the Community Preventive Services Task Force. *Ann Intern Med*. 2015.

19. Arena R, Lavie CJ, Cahalin LP, Briggs PD, Guizilini S, Daugherty J, Chan WM and Borghi-Silva A. Transforming cardiac rehabilitation into broad-based healthy lifestyle programs to combat noncommunicable disease. *Expert review of cardiovascular therapy*. 2016;14:23-36.

20. Sallis R, Franklin B, Joy L, Ross R, Sabgir D and Stone J. Strategies for promoting physical activity in clinical practice. *Prog Cardiovasc Dis*. 2015;57:375-86.

21. Younus A, Aneni EC, Spatz ES, Osondu CU, Roberson L, Ogunmoroti O, Malik R, Ali SS, Aziz M, Feldman T, Virani SS, Maziak W, Agatston AS, Veledar E and Nasir K. A Systematic Review of the Prevalence and Outcomes of Ideal Cardiovascular Health in US and Non-US Populations. *Mayo Clin Proc*. 2016;91:649-70.

22. Sagner M, McNeil A, Puska P, Auffray C, Price ND, Hood L, Lavie CJ, Han ZG, Chen Z, Brahmachari SK, McEwen BS, Soares MB, Balling R, Epel E and Arena R. The P4 Health Spectrum - A Predictive, Preventive, Personalized and Participatory Continuum for Promoting Healthspan. *Prog Cardiovasc Dis*. 2016.

23. Soan EJ, Street SJ, Brownie SM and Hills AP. Exercise physiologists: essential players in interdisciplinary teams for noncommunicable chronic disease management. *J Multidiscip Healthc*. 2014;7:65-8.

24. Cheema BS, Robergs RA and Askew CD. Exercise physiologists emerge as allied healthcare professionals in the era of non-communicable disease pandemics: a report from Australia, 2006-2012. *Sports Med*. 2014;44:869-77.

25. CDC. National Center for Health Statistics: Ambulatory Care Use and Physician Office Visits. https://www.cdc.gov/nchs/fastats/physician-visits.htm. Date Accessed: 2/5/2017

26. Balady GJ, Ades PA, Bittner VA, Franklin BA, Gordon NF, Thomas RJ, Tomaselli GF, Yancy CW, American Heart Association Science A and Coordinating C. Referral, enrollment, and delivery of cardiac rehabilitation/secondary prevention programs at clinical centers and beyond: a presidential advisory from the American Heart Association. *Circulation*. 2011;124:2951-60.

27. Pellegrini CA. Trust: The Keystone of the Patient-Physician Relationship. *Journal of the American College of Surgeons*. 2017;224:95-102.

28. Lin JS, O'Connor EA, Evans CV, Senger CA, Rowland MG and Groom HC. U.S. Preventive Services Task Force Evidence Syntheses, formerly Systematic Evidence Reviews *Behavioral Counseling to Promote a Healthy Lifestyle for Cardiovascular Disease Prevention in Persons With Cardiovascular Risk Factors: An Updated Systematic Evidence Review for the US Preventive Services Task Force* Rockville (MD): Agency for Healthcare Research and Quality (US); 2014.

29. Ades PA, Keteyian SJ, Wright JS, Hamm LF, Lui K, Newlin K, Shepard DS and Thomas RJ. Increasing Cardiac Rehabilitation Participation From 20% to 70%: A Road Map From the Million Hearts Cardiac Rehabilitation Collaborative. *Mayo Clin Proc*. 2016.

30. Arena R, Guazzi M, Briggs PD, Cahalin LP, Myers J, Kaminsky LA, Forman DE, Cipriano G, Jr., Borghi-Silva A, Babu AS and Lavie CJ. Promoting health and wellness in the workplace: a unique opportunity to establish primary and extended secondary cardiovascular risk reduction programs. *Mayo Clin Proc*. 2013;88:605-17.

31. Arena R, Williams M, Forman DE, Cahalin LP, Coke L, Myers J, Hamm L, Kris-Etherton P, Humphrey R, Bittner V, Lavie CJ, American Heart Association Exercise CR, Prevention Committee of the Council on Clinical Cardiology CoE, Prevention, Council on Nutrition PA and Metabolism. Increasing referral and participation rates to outpatient cardiac rehabilitation: the valuable role of healthcare professionals in the inpatient and home health settings: a science advisory from the American Heart Association. *Circulation*. 2012;125:1321-9.

32. Hivert MF, Arena R, Forman DE, Kris-Etherton PM, McBride PE, Pate RR, Spring B, Trilk J, Van Horn LV and Kraus WE. Medical Training to Achieve Competency in Lifestyle Counseling: An Essential Foundation for Prevention and Treatment of Cardiovascular Diseases and Other Chronic Medical Conditions: A Scientific Statement From the American Heart Association. *Circulation*. 2016;134:e308-e327.

33. Forman-Hoffman V, Little A and Wahls T. Barriers to obesity management: a pilot study of primary care clinicians. *BMC family practice*. 2006;7:35.

34. Ahmed NU, Delgado M and Saxena A. Trends and disparities in the prevalence of physicians' counseling on exercise among the U.S. adult population, 2000-2010. *Prev Med*. 2017.

35. Ahmed NU, Delgado M and Saxena A. Trends and disparities in the prevalence of physicians' counseling on diet and nutrition among the U.S. adult population, 2000-2011. *Prev Med*. 2016;89:70-5.

36. NHLBI. Nutrition Academic Award. https://www.nhlbi.nih.gov/research/training/naa/products/. Date Accessed: 2/5/2017

37. Bairey Merz CN, Alberts MJ, Balady GJ, Ballantyne CM, Berra K, Black HR, Blumenthal RS, Davidson MH, Fazio SB, Ferdinand KC, Fine LJ, Fonseca V, Franklin BA, McBride PE, Mensah GA, Merli GJ, O'Gara PT, Thompson PD and Underberg JA. ACCF/AHA/ACP 2009 competence and training statement: a curriculum on prevention of cardiovascular disease: a report of the American College of Cardiology Foundation/American Heart Association/American College of Physicians Task Force on Competence and Training (Writing Committee to Develop a Competence and Training Statement on Prevention of Cardiovascular Disease): developed in collaboration with the American Academy of Neurology; American Association of Cardiovascular and Pulmonary Rehabilitation; American College of Preventive Medicine; American College of Sports Medicine; American Diabetes Association; American Society of Hypertension; Association of Black Cardiologists; Centers for Disease Control and Prevention; National Heart, Lung, and Blood Institute; National Lipid Association; and Preventive Cardiovascular Nurses Association. *Circulation*. 2009;120:e100-26.

38. Institute of Medicine Committee on B and Social Sciences in Medical School C. The National Academies Collection: Reports funded by National Institutes of Health. In: P. A. Cuff and N. A. Vanselow, eds. *Improving Medical Education: Enhancing the Behavioral and Social Science Content of Medical School Curricula* Washington (DC): National Academies Press (US)
National Academy of Sciences.; 2004.

39. IOM report: Improving Medical Education--Enhancing the Behavioral and Social Science Content of Medical School Curricula. *Academic emergency medicine : official journal of the Society for Academic Emergency Medicine*. 2006;13:230-1.

40. LMEd. Lifestyle Medicine Education Collaboration http://lifestylemedicineeducation.org/. Date Accessed: 2/5/2017

41. AAMC. Association of American Medical Colleges https://www.mededportal.org/collections/lifestylemedicine/. Date Accessed: 2/5/2017

42. ACPM. American College of Preventive Medicine http://www.acpm.org/page/pmr. Date Accessed: 2/5/2017

43. ABMS. American Board of Medical Specialties http://www.abms.org/. Date Accessed:

44. ACLM. Lifestyle Medicine Core Competencies Program. http://www.lifestylemedicine.org/Lifestyle-Medicine-Core-Competencies-Program Date Accessed: 2/5/17

45. School HM. Lifestyle Medicine Education http://www.harvardlifestylemedicine.org/. Date Accessed: 2/5/2017

46. LMEd. Curricular Resources. http://lifestylemedicineeducation.org/curricular-resources/. Date Accessed: 2/5/2017

47. LCME. Liaison Committee on Medical Education. https://www.aamc.org/members/osr/committees/48814/reports_lcme.html. Date Accessed: 2/6/2017

48. USMLE. United States Medical Licensing Examination http://www.usmle.org/. Date Accessed: 2/6/2017

49. Arena R, Lavie CJ, Hivert MF, Williams MA, Briggs PD and Guazzi M. Who will deliver comprehensive healthy lifestyle interventions to combat non-communicable disease? Introducing the healthy lifestyle practitioner discipline. *Expert review of cardiovascular therapy*. 2016;14:15-22.

50. Dirks-Naylor AJ, Griffiths CL, Gibson JL and Luu JA. The prevalence of exercise prescription-related course offerings in United States pharmacy school curricula: Exercise is Medicine. *Advances in physiology education*. 2016;40:319-22.

51. Barquera S, Pedroza-Tobias A and Medina C. Cardiovascular diseases in mega-countries: the challenges of the nutrition, physical activity and epidemiologic transitions, and the double burden of disease. *Current opinion in lipidology*. 2016;27:329-44.

52. Organization WH. Global action plan for the prevention and control of NCDs 2013-2020. 2013.

53. Wagner KH and Brath H. A global view on the development of non communicable diseases. *Prev Med*. 2012;54 Suppl:S38-41.

54. Beaglehole R, Bonita R, Horton R, Adams C, Alleyne G, Asaria P, Baugh V, Bekedam H, Billo N, Casswell S, Cecchini M, Colagiuri R, Colagiuri S, Collins T, Ebrahim S, Engelgau M, Galea G, Gaziano T, Geneau R, Haines A, Hospedales J, Jha P, Keeling A, Leeder S, Lincoln P, McKee M, Mackay J, Magnusson R, Moodie R, Mwatsama M, Nishtar S, Norrving B, Patterson D, Piot P, Ralston J, Rani M, Reddy KS, Sassi F, Sheron N, Stuckler D, Suh I, Torode J, Varghese C and Watt J. Priority actions for the non-communicable disease crisis. *The Lancet*. 377:1438-1447.

55. Arena R, Lavie CJ and Guazzi M. Prescribing a Healthy Lifestyle Polypill With High Therapeutic Efficacy in Many Shapes and Sizes. *American Journal of Lifestyle Medicine*. 2015 (In Press).

Table 1: Healthy Living Practitioner Graduate Certificate Curriculum

Course	Learning Objectives	Credit Load
	Fall Courses	
Upstream Prevention: Epidemiology, Economics and Policy	- Describe the incidence and prevalence of behaviors that lead to disease states and key health measures and how they begin early in the life course. - Describe the relationship between LS7 score and other evidence-based risk calculators (e.g., Framingham, ASCVD risk calculator, Reynolds, etc.) and chronic disease risk - Describe the intersection between unhealthy behaviors, social determinants of health, policy, systems and environment on population health outcomes and economic ramifications. - Describe policy initiatives centered on improving healthy living characteristics and other preventive measures at a population level	3
Health Communication and Literacy	- Read as a critical thinker to better translate nutrition and exercise science, both regulated and non-regulated (e.g., supplements for general health and exercise) for a wide and varied audience - Understand the role of pragmatism to support a two-way health dialogue - Appreciate the distinction between scientific and anecdotal evidence as it relates to health and wellness and how this distinction influences the two-way health dialogue - Appreciate that there are many forms of literacy that lack hierarchy but can be orchestrated to effectively and respectfully foster a transaction of health information	3
Preventive Health Screening	- Be able to use perform a basic health screening assessment, using evidence-based tools, to ascertain the risk for or potential presence of one or more chronic diseases - Become familiar with current evidence-based risk prediction tools (e.g., LS7, Framingham, ASCVD risk calculator, Reynolds, etc.)	1
Nutrition for Healthy Living	- Understand basic principles of nutrition throughout the life cycle (from embryo to elderly - Understand basic concepts of nutrition and chronic disease, for both deficiency and degenerative diseases (arthritis, osteoporosis—non trauma related) - Be able to perform a basic nutritional assessment - Be able to provide basic guidance on healthy nutrition	3

	- Be able to provide common nutrition substitutions for culture-specific foods behaviors and values (food focused)	
Spring Courses		
Exercise and Physical Activity for Healthy Living	- Understand basic principles of exercise and physical activity in health and disease states - Be able to interpret exercise and physical activity assessments - Be able to provide basic guidance on exercise and physical activity	3
Behavioral Counseling for Healthy Living	- Understand challenges surrounding adoption of a healthy living behaviors - Be able to employ basic behavioral counseling strategies focused on improving LS7 scores, mental health and well-being - Be able to employ basic behavioral counseling strategies to those facing socioeconomic challenges (e.g., food stamps, government assistance, etc.)	2
Use of Technology for Healthy Living	- Understand basic principles of health information systems and informatics with implications for tracking and managing LS7 characteristics - Be able to effectively utilize technology (i.e., web, social media, mobile applications, wearable devices, etc.) to track LS7 characteristics and enhance healthy living interventions - Understand the role of technology in a citizen science approach (e.g., taking photos of built environment - how does the environment promote/hinder healthy living)	2
Healthy Living Seminar	- Through an inter-professional group project, develop and present a healthy living program proposal in a broad array of settings and environments (e.g., community, workplace, school system, healthcare organization, etc.)	2
Practical Component		
Summer Course		
Healthy Living Practicum	- Participate in the development and/or implementation of a healthy living program in a broad array of settings and environments (e.g., community, workplace, school system, healthcare organization, etc.)	3