National Review of U.S. Medical Education Curricula for Physical Activity-Related Content

by
Eugene A. Park

A PROJECT

submitted to

Oregon State University

University Honors College

in partial fulfillment of
the requirements for the
degree of

Honors Baccalaureate of Science in Biology (Honors Scholar)

Presented June 27, 2014
Commencement June 2015

AN ABSTRACT OF THE THESIS OF

Eugene A. Park for the degree of Honors Baccalaureate of Science in Biology presented on June 27, 2014. Title: National Review of U.S. Medical Education Curricula for Physical Activity-Related Content.

Abstract approved:

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Purpose

To provide an update on the amount and type of physical activity education that occurs in medical education in the United States.

Methods

All accredited doctor of medicine (M.D., n = 141) and doctor of osteopathic medicine (D.O., n = 29) institutions were reviewed using their publicly accessible websites. Course names and descriptions were used to classify the courses into one of five content domains. The course delivery format was also recorded.

Results

The majority (51.7%) of institutions did not offer any physical activity-related courses in their curriculum. When such courses were offered they tended to be an elective (82.2%) rather than required (17.8%). Courses aimed at sports medicine (45%) or exercise physiology (40.9%) were the most common. The majority (84.5%) of these courses were taught using a clinical approach. No differences were observed between M.D. and D.O. institutions, or between private and public institutions.

Conclusions

Physical activity education is grossly absent from medical education curriculums. Over half of the physicians trained in the United States in 2013 received no formal training in physical activity and may, therefore, be ill-prepared to assist patients in a manner consistent with *Healthy People 2020*, the National Physical Activity Plan, or the Exercise is Medicine® initiative.

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Honors Baccalaureate of Science in Biology project of Eugene A. Park presented on June 27, 2014.

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I understand that my project will become part of the permanent collection of Oregon State University, University Honors College. My signature below authorizes release of my project to any reader upon request.

Eugene A. Park, Author

Acknowledgement

I would like to thank:

Bradley J. Cardinal, Ph.D., my Honors College Thesis Mentor, for all of his assistance, time, and effort in the completion of this thesis. Without whom, none of this would have been possible.

Moo Song Kim, for all of his time and dedication to the completion of data collection and statistical analysis.

The University Honors College at Oregon State University, for providing funding through the DeLoach Work Scholarship.

Contribution of Co-Authors

Author	Contribution
Eugene A. Park	Primary author. Thesis completed as an educational and scientific experience under the direction of the second author.
Bradley J. Cardinal	Assisted primary author with his educational and scientific growth as related to the topic.
Moo Song Kim	Data collection, management and statistical analysis

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DEDICATION

I dedicate my Honors College Thesis to my parents, Sonny and Mary Park, for raising me into who I am today, their continued support throughout my life, and providing me with the opportunity to attend college.

National Review of U.S. Medical Education Curricula for Physical Activity-Related Content

INTRODUCTION

The education of both current and future medical students in the United States relies on the curricula that allopathic medical schools (M.D.) and schools of osteopathic medicine (D.O.) offer their students. The critical importance of medical education in North America was brought to bear more than 100 years ago (Flexner, 1910). Visiting all 155 medical schools in the United States and Canada, Flexner characterized medical education at the time as being in a state of disarray (e.g., emphasizing profit over quality, having inadequate curricula and facilities, providing insufficient training in analytical reasoning and the natural sciences). He concluded that 120 (i.e., 77.42%) of the institutions were grossly inadequate in their preparation of physicians and recommended that they be closed; they were doing more harm than good.

Flexner's (1910) report resulted in revolutionary reforms in medical education – the curriculum began to emphasize cure over prevention, become more scientific, residency training was implemented, and specialization increased. Many of the reforms reflected the need to codify and standardize the medical curriculum for the public's health and safety, as well as treat the common *infectious* diseases of the time (i.e., pneumonia, influenza, tuberculosis, gastrointestinal infections). The medical profession and medicinal science improved as a result of Flexner's work, and by adopting the reductionist paradigm, which is pervasive in and characteristic of the biophysical and/or natural science disciplines.

Today, however, the leading causes of death are lifestyle-mediated *chronic diseases* (e.g., heart disease, cancer, noninfectious airway diseases, cerebrovascular diseases). Chronic diseases occur over time. They have a history and wholeness about them that infectious diseases may not. As observed by Jones, Podolsky, and Greene (2012):

> In many respects, our medical systems are best suited to diseases of the past, not those of the present or future. We must continue to adapt health systems and health policy as the burden of disease evolves. But we must also do more. Diseases can never be reduced to molecular pathways, mere technical problems requiring treatments or cures. Disease is a complex domain of human experience, involving explanation, expectation, and meaning. Doctors must acknowledge this complexity and formulate theories, practices, and systems that fully address the breadth and subtlety of disease. (p. 2338)

There is mounting recognition and concern that today's medical education – still deeply rooted in Flexner's incisive work – requires a more holistic approach (Cooke, Irby, Sullivan, & Ludmerer, 2006; Whitehead, 2013). Fifteen years after his initial report, Flexner (1925) himself expressed concerns that the medical curriculum was already beginning to overemphasize the medicinal sciences over the humanities and the social and behavioral sciences. This concern continues to this day (Whitehead, 2013).

Today's Diseases, Yesterday's Cures: Medical Education in the 21st Century

One of the most important lifestyle behaviors for preventing chronic diseases is physical activity. In their review of 18 chronic diseases, Pedersen and Saltin (2006) found strong evidence that regular physical activity involvement improves the pathogenesis *and* symptoms specific to the diagnosis of eight conditions: chronic heart failure, coronary heart disease, dyslipidemia, hypertension, insulin resistance, intermittent claudication, obesity, and Type-2 diabetes. They provided further strong evidence that it improves the pathogenesis of osteoporosis, and the symptoms of chronic obstructive pulmonary disease, depression, fibromyalgia, and osteoarthritis. They reported additional benefits for those experiencing asthma, chronic fatigue syndrome, rheumatoid arthritis, and some forms of cancer (e.g., breast, colon). Others support the value of regular physical activity involvement for improving balance, cognitive functioning, life expectancy, and overall quality of life, while concurrently decreasing dementia, falls, sarcopenia, and the overall cost of health care (Lee, Shiroma, Lobelo, Puska, Blair, & Katzmarzyk, 2012; Metzl & Heffernan, 2013).

The medicinal value of regular physical activity involvement is clear. It has widespread preventive, restorative, and curative powers – value superior to any other individual lifestyle intervention or treatment (Matheson et al., 2011). Moreover, as expressed by Kretchmar (2006), the value of physical activity extends beyond its functional and medicinal benefits:

> One of the greatest things about physical activity and play is that they make our lives go better, not just longer. It is the quality of life, the joy of being alive, the things we do

> with our good health that matter to us as much or more than health itself. (p. 6)

However, for all of its known functional and medicinal benefits, as well as its contributions to humanity more broadly, physical activity appears to have a rather sparse presence in the medical school curriculum. To date nine English language studies have examined this topic over the past 42 years (Appendix A), and of those four have been conducted in the United States (Burke & Hultgren, 1975; Connaughton, Weiler, & Connaughton, 2001; Garry, Diamond, & Whitley, 2002; Whitley & Nyberg, 1988), with the others occurring in Canada (Cumming, 1972; Weiler, Chew, Coombs, Hamer, & Stamatakis, 2012; Wiley, Strother, & Lockyer, 1993), the United Kingdom (Zamani, Vogel, Moore, & Lucas, 2007), and the United Kingdom and Ireland (Cullen, McNally, Neill, & Macauley, 2000). Regardless of the country of origin or research approach employed (i.e., administrative survey or content analysis), the take home message of these studies has been remarkably consistent:

> There is an urgent need for physical activity teaching to have dedicated time at medical schools, to equip tomorrow's doctors with the basic knowledge, confidence and skills to promote physical activity and follow numerous clinical guidelines that support physical activity promotion. (Weiler et al., 2012, p. 1025).

Even in the programs that do offer coursework or experiences, instructional time is likely limited to <5 hours (Weiler et al., 2012), with a primary emphasis on the what and why of exercise, and little attention devoted to how to exercise or how to counsel patients to exercise. Similar concerns about the minimal attention given to exercise, physical activity, and sports have been expressed about the medical school curriculums in other countries as well (Ángyán, 2004; Kordi, Moghadam, & Rostami, 2011).

This is further brought to bear by studies that have examined medical students' and physicians' knowledge, attitudes, and skills with regard to exercise and physical activity. In a survey of 251 internal medicine residents, only 28% were confident in their skills in prescribing exercise (Rogers et al., 2002). At the University of British Columbia, 69% of fourth-year medical school students surveyed (*n* = 546) felt that exercise counseling skills would be important for their future clinical practice, however 86% did not feel extensively well-prepared in this area (Holtz, Kokotilo, Fitzgerald, & Frank, 2013). Among 4th-year medical school students in the United Kingdom (*n* = 177), 52% felt adequately prepared to give physical activity advice to the general population, but, only 40% were aware of the government guidelines for physical activity (Dunlop & Murray, 2013). Moreover, in a prospective study of 1,658 medical students from 16 different medical schools in the United States, the percentage who felt that physical activity counseling would be relevant in their future practice significantly *decreased* over the 4-year medical school curriculum from 69% to 53% (Frank, Tong, Lobelo, Carrera, & Duperly, 2008).

When it comes to the actual practice of counseling patients in the area of physical activity and exercise, physicians' lack of knowledge, training, and/or skill in this area becomes even more evident. For example, among 1,510 graduating medical students representing 11 out of 17 different Canadian medical schools, only 25% indicated that they usually counseled their patients in the area of exercise (Ng & Irwin, 2013). In United

States, the percentage of physician visits made by both adults and children that included physical activity counseling or education was 9.2% in 2010 (U.S. Department of Health and Human Services, 2013). While slightly higher rates (i.e., 12.3%) were reported by those with cardiovascular disease, diabetes, or hyperlipidemia, getting more physicians to counsel and/or educate their patients with regard to physical activity has been identified as a national priority in *Health People 2020* (U.S. Department of Health and Human Services, 2013). Likewise, increasing the inclusion of such content in the medical education of future physicians – whether following the M.D. or D.O. pathway – has been identified as a national priority in *Healthy People 2020* as well.

At present, though, very little is known regarding the physical activity-related content that is included in contemporary medical education in the United States. These studies and results are summarized in Table 1.

Table 1. Inclusion of Physical Activity-Related Content in United States Medical Education, 1975-2013.

Study	Method	Sample Size (Response Rate)	Percent of Institutions that Do Not Offer A Course	Percent of Institutions that Do Not Require a Course
Current Study	Content Analysis of Institutional Websites (M.D. & D.O)	170 (N/A)	51.7	82.2
Gary et al. (2002)	Administrator Survey (M.D. only)	102 (N/A)	87.25	94.12
Connoughton et al. (2001)	Administrator Survey (M.D. only)	72 (56.25%)	77.0	--
Whitley and Nyberg (1988)	Content Analysis of Medical Bulletins (M.D. only)	105 (73.6%)	61.96	95.65
Burke and Hultgren (1975)	Administrator Survey (M.D. only)	74 (73.29%)	87.78	--

As noted, four studies have addressed this topic in the United States (Burke & Hultgren, 1975; Connaught et al., 2001; Gary et al., 2002; Whitley & Nyberg, 1988). Those studies were published between 1975-2002. Three of those studies were surveys of medical school administrators and one was a review of medical school bulletins (i.e., content analysis). All of the studies were conducted among allopathic schools of medicine (M.D.). Schools of osteopathic medicine (D.O.) have been neglected in the United States studies, though they were the exclusive focus of Zamani et al.'s (2007) study in the United Kingdom. Both M.D.s and D.O.s are eligible to practice medicine in the United States (Chagnon & Cardinal, 2013), so to obtain the most complete assessment possible, the inclusion of both M.D. and D.O. medical education curriculums is important. Furthermore, no study has examined this issues since the joint Exercise is Medicine® initiative of the American College of Sports Medicine and American Medical Association was launched in 2007 (Lobelo, Stoutenberg, & Hutber, 2014).

This study provides an update on the status of physical-activity education occurring in medical education in the United States. The specific research questions addressed in this study were:

1. How many medical schools and schools of osteopathic medicine offer courses pertaining to physical activity?
2. Are the physical activity courses offered by medical schools and schools of osteopathic medicine required or elective?
3. In which content domains (i.e., Behavioral Counseling, Exercise Physiology, Lifestyle Medicine, Preventive Medicine, and Sports Medicine) are the courses most likely to be offered?

4. In what format are these courses taught?
5. Does the physical activity coverage in the curricula of medical schools differ from the physical activity coverage of schools of osteopathic medicine?
6. Is there a difference in physical activity course coverage between public and private institutions?

METHOD

Participants

The 170 accredited doctor of medicine (M.D., *n* = 141) and doctor of osteopathic medicine (D.O., *n* = 29) medical schools located in the United States constituted the study sample. The names of each institution were obtained through the Association of American Medical Colleges website (<<https://members.aamc.org/eweb/DynamicPage.aspx?site=AAMC&webcode=AAMCOrgSearchResult&orgtype=Medical%20School>>). Institutions with branch campuses were analyzed on the basis of the curriculum of their primary campus only.

Measures

Characteristics that were assessed for each school included the type of school (i.e., M.D. or D.O.), whether it was private or public, the website where the data was accessed, the website access date, the total number of courses related to physical activity that were available, the number of these courses that were required, and the number of these courses that were available as electives. The names and descriptions of each identified course, the content domain (i.e., Behavioral Counseling, Exercise Physiology, Lifestyle Medicine, Preventive Medicine, Sports Medicine), and the type of course instruction (i.e., clinical, lecture, or modular) was also recorded for each school.

Procedure

Data were extracted from each institution's website in 2013 and recorded in a spreadsheet (Excel; Microsoft, Bellevue, WA). Institutions that did not offer curricular information were deemed "Not Accessible", and they were not included in the data analysis (*n* = 50; 29.41% of the total); however, in some instances partial data was accessible. When partial data was available, the data that could be extracted was extracted and used in this study. Institutions that offered curricular information were reviewed for physical activity-related course content by searching for the following key words or phrases: athletics, exercise, exercise counseling, exercise stress testing, exercise testing, fitness testing, physical activity, physical activity counseling, sports, and sports medicine. Examples of these data are summarized in Table 2.

Table 2. Sample course designator, name, and description by content domain.

Content Domain	Course Designator and Name	Course Description
Behavioral Counseling	MEDICINE-415C. Clinical Management of Obesity	“The unique blend of clinical and research programs related to obesity at Duke provides an opportunity for students to learn how to evaluate and manage obesity in many ways. This elective involves attendance in outpatient clinics or residential programs related to obesity or obesity-related co-morbidities including Residential Programs (Diet and Fitness Center, Rice Diet), Bariatric Surgery, Pediatric Diabetes, Pediatric Endocrinology, and Lifestyle Medicine.” <https://registrar.duke.edu/sites/default/files/bulletins/2013-14/medbltn2013-14.pdf>
Exercise Physiology	CARD 4001A-Cardiovascular Disease	“The student will perform histories and physical examinations on selected patients. Patients will be presented for discussion at daily attending rounds. Students will attend daily teaching conferences and will have the opportunity to review selected electrocardiograms with the attending physician. Students will observe patients in the cardiac catheterization laboratory, the electrophysiology laboratory, and during performance of cardiac stress tests and echocardiograms.” <https://casemed.case.edu/RegistrarCatalogPublic/CatViewMain.aspx?course_type=TYPE+B>
Lifestyle Medicine	TIME: Obesity, Nutrition and Behavior Change	“Describe how nutrition, physical activity and other lifestyle choices affect lifespan and quality of life.” <http://www.hopkinsmedicine.org/som/curriculum/genes_to_society/curriculum/index.html>

Preventive Medicine	The Art and Practice of Medicine	“Disease prevention- Diet, Exercise, Immunizations, Screening.” <http://www.thecommonwealthmedical.com/md>
Sports Medicine	MFPM 803 Sports Medicine	“This elective consists of a combination of a Sports Injury Clinic and traditional family practice at Resurrection Family Practice Center, as well as training room clinics at Loyola Academy, New Trier and Niles West High School and North Park University. Additional time may be available at various rehabilitation centers and orthopedic offices in the area. A comprehensive overview of sports medicine is offered under the direct supervision of three family practice physicians who are board certified in sports medicine.” <http://www.rosalindfranklin.edu/Portals/0/Documents/Academic%20Catalogues/CMS%202012-2013%20Catalog.pdf>

Reliability Check

Both intra- and inter-rater reliability checks were performed to assure the consistency and quality of the data collected. The reliability check included a re-analysis of 20 randomly selected institutions from the 170 possible schools. The curricula of these 20 schools were re-analyzed by one investigator (EAP) and analyzed for the first time by a secondary investigator (MSK) to determine the intra- and inter-rater reliability, respectively. The resultant reliability coefficients were interpreted using the values suggested by Landis and Koch (1977): 0.0-0.2 = poor, 0.2-0.4 = fair, 0.4-0.6 = moderate, 0.6-0.8 = substantial, and 0.8-1.00 almost perfect.

For intra-rater reliability, the results were perfect (i.e., Spearman's rho [20] = 1.00, $p < .001$), whereas for the inter-rater reliability the results were "almost perfect" (i.e., Spearman's rho [20] = .94, $p < .001$). In considering whether the courses were required or elective, the level of agreement was "almost perfect" (i.e., Kappa coefficient [24] = .85, $p < .001$). When considering the focal point of the courses (i.e., Exercise Physiology, Sports Medicine, Behavioral Counseling) there was 80% agreement, and when considering course names and types of course instruction, there was 100% agreement.

Analysis

Data were summarized using descriptive statistics. For between-group comparisons, either *t*-tests (continuous data) or chi-square (χ^2) tests (non-continuous data) were performed with alpha set at the $p <.05$ level. Accompanying probability tests were measures of effect size (i.e., Cohen's *d* or contingency coefficient). Cohen's *d* values were interpreted using the following guidelines: <0.41 = small, 0.41-0.70 = moderate, and >.71 = large (Thomas, Salazar, & Landers, 1991). Contingency coefficient values ≥0.30 were interpreted as being meaningful relationships (Fleiss, 1981).

RESULTS

Of the 170 medical schools identified, the majority offered the M.D. degree (n = 141, 82.9%), with the balance offering the D.O. degree (n = 29, 17.1%). The majority of institutions were public (n = 92, 54.1%), with 76 (44.7%) being private, and 2 (1.2%) unclassified.

Of the 118 (69.41%) institutions for which curriculum information was accessible, the largest percentage offered either no course (n = 61, 51.7%) or a single course (n = 25, 21.2%), though the range was up to seven courses (n = 4, 3.4%). Of these institutions, the majority did not require their students to take a single course (n = 97, 82.2%), whereas 15 (12.7%) required their students to take a one course, five (4.2%) required their students to take two courses, and one (<1.0%) required their students to take three courses. The majority of these institutions did not offer elective coursework in this area (n = 79, 66.9%).

When coursework was offered, the largest percentage was biophysical focused, appearing as either “Sports Medicine” (n = 67, 45.0%) or “Exercise Physiology” (n = 61, 40.9%), with the areas of “Preventive Medicine” (n = 12, 8.1%), “Lifestyle Medicine” (n = 7, 4.7%), and “Behavioral Counseling” (n = 2, 1.4%) being offered significantly less often, χ^2 (4, N = 149) = 133.11, $p < .001$, contingency coefficient = .69. No differences were observed between the offerings at private versus public institutions, χ^2 [4, N = 148] = 5.85, $p > .05$, contingency coefficient = .20. Examples of coursework within each of these content domains appear in Table 2. The available coursework was most likely to be taught using a “Clinical” approach (n = 125, 84.5%) rather than a “Lecture” approach (n

= 23, 15.5%), χ^2 (1, N = 148) = 70.30, $p < .001$, contingency coefficient = .57. No online/modular coursework was found.

M.D. and D.O. institutions were no different in terms of requiring their students to take coursework in this area (i.e., 17.3% vs. 15.8%, respectively; χ^2 [1, N = 117] = 0.03, $p > .05$, contingency coefficient = .02. The number of courses required between M.D. (n = 98; M = 0.20, SD = 0.48) and D.O. (n = 20; M = 0.40, SD = 0.88) institutions did not differ, t (116) = 1.42, p>.05, d = .28. Interestingly, though, while public and private institutions were no different in terms of requiring their students to take coursework in this area (i.e., 7.3%% vs. 12.5%, respectively; χ^2 [1, N = 96] = 0.03, $p > .05$, contingency coefficient = .12, the number of required courses at private institutions (n = 61; M = 0.35, SD = 0.70) was higher than the number required at public institutions (n = 55; M = 0.13, SD = 0.39), t (114) = 1.42, p<.05, d = .39. They also differed in delivery format, with 51.7% of public institutions delivering the content using a clinical approach, whereas only 32.7% of private institutions did, χ^2 [1, N = 147] = 5.57, $p < .05$, contingency coefficient = .19.

DISCUSSION

Our results show that over half of the physicians trained in the United States in 2013 received no formal education in the area of physical activity and may, therefore, be ill-prepared to assist their patients in a manner consistent with *Healthy People 2020*, the National Physical Activity Plan, or the Exercise is Medicine® initiative. They may also be inadequately prepared to assist consumers of commercially available physical activity programs, products, and services who are encouraged to consult their physician prior to beginning a physical activity program, use a physical activity product, or employ a physical activity service (Connaughton, Weiler, & Connaughton, 2001).

Physicians have also been called upon to counsel and support their patients in physical activity behavior acquisition and maintenance. Yet, in spite of this, physical activity education remains grossly absent from the modern medical education curriculum. Even at the institutions that do include physical activity education in their curriculum as either a requirement or an elective, the topics addressed are predominantly biophysical focused (i.e., Exercise Physiology, Sports Medicine), with little attention devoted to Behavioral Counseling, Lifestyle Medicine, or Preventive Medicine (i.e., putting scientific information into practice). Again, this seems inconsistent with the needs of patients and society. Specifically, physicians are being called upon to lead the physical activity bandwagon in medicine and healthcare, as well as routinely counsel and support their patients in adopting and maintaining a physically active lifestyle (Vuori, Lavie, & Blair, 2013). Moreover, physicians themselves are being encouraged to partake in a physically active lifestyle for their own personal health and wellbeing, and for the beneficence of their others for whom they serve as physical activity role models (Ángyán, 2004).

Periodic calls for more formal physical activity education in medical education have occurred over the past 42 years. During this same time the curative, preventative, and restorative powers of physical activity on health, among other humanistic and psychosocial benefits, have become increasingly clear. Some scholars within medicine and science have gone so far as to refer to exercise as medicine (or exercise is medicine; Vuori et al., 2013). However, the message remains much as it did 42 years ago when Cumming (1972) concluded his pioneering work in this area by stating: "The present situation [absence of physical activity instruction in medical schools] is such that one may well ask 'Why consult your doctor before you exercise?'" (p. 731)

There is mounting interest in changing this situation, and not just in the United States (Ángyán, 2004; Kordi, Moghadam, & Rostami, 2011; Lobelo, Stoutenberg, & Hutber, 2014). For example, physical activity assessment is being recorded as a vital sign and included as part of the patients' electronic medical records in some healthcare organizations (Sallis, 2011). Physicians and their staff can then use this information as a form of recognition, encouragement, counseling, and/or referral. When this occurs, it is associated with positive health outcomes for the patient (Coleman et al., 2012; Greenwood, Joy, & Stanford, 2010). An underlying premise of this systematic approach is that the physicians are knowledgeable about the therapeutic value of physical activity, know the physical activity guidelines, and are able to confidently and competently discuss physical activity with their patients. This requires some degree of education, including potential contraindications and drug interactions (e.g., the effects of beta blockers on heart rate response during exercise).

One medical education institution that has taken this to heart is the University of South Carolina School of Medicine Greenville, which has created an “Exercise is Medicine” immersion experience for their students by identifying and incorporating key knowledge, skills, and abilities into all 4 years of their curriculum (Trilk & Phillips, 2014). At graduation their students should be able to demonstrate proficiency in physical activity and fitness assessment, exercise prescription and implementation, counseling for physical activity and behavioral strategies, and physician’s personal health (e.g., role modeling). They are seeking to serve as a model institution for others and, in conjunction with Harvard University School of Medicine, hosted the first ever-national Lifestyle Medicine Think Tank on September 9-10, 2013 (http://www.greenvillemed.sc.edu/LifestyleMedicine.php), with the aim being to explore how to get physical activity education incorporated into the nation’s medical education curricula.

There are several strengths to this study. First, it is the largest study of its type in the English-language, western world. Second, it is the only study to include the simultaneous review of both M.D. and D.O. programs. Third, it is the fifth study of the topic in the United States since the first one was published in 1975, the first one in the United States since 2002, and the only one since the joint Exercise is Medicine® initiative of the American College of Sports Medicine and American Medical Association was launched in 2007. Fourth, given our approach to the study, our results are not influenced by response rate bias issues. Fifth, it is only the third study that employed content analysis methodology to the medical school curriculum. Of course, this latter point raises an important limitation, too. Namely, our analysis was limited to the manifest content of the curriculums and course descriptions that we could obtain online. There may be latent content or experiences that are unaccounted for in our analysis. We were also unable to fully access detailed curricular or course description information for 50 institutions.

In conclusion, this study gives a contemporary snapshot of the *quantity* and *type* of physical activity education coursework that is occurring in the medical education in the United States in 2013. The results of this study, along with others before it (Burke & Hultgren, 1975; Connaughton, Weiler, & Connaughton, 2001; Garry, Diamond, & Whitley, 2002; Whitley & Nyberg, 1988), suggest that the majority of physicians have not received, nor will the majority of medical students today receive, any formal education or experiences in the area of physical activity education, which is inconsistent with *Healthy People 2020*, the National Physical Activity Plan, and the Exercise is Medicine® initiative of the American College of Sports Medicine and the American Medical Association.

Given the limited education physicians receive about physical activity, exercise prescription, and physical activity counseling, it seems rather remarkable that people are advised, “Before beginning this or any other physical activity program, consult your physician.” A hauntingly similar conclusion to that reached by Cummings (1972) some 42 years ago – but the winds of change are beginning to blow. For example, the percentage of institutions that offer coursework in physical activity education is at an all-time high, at least relative to the previously conducted studies. In those studies the number of institutions *not* offering physical activity education coursework ranged from

61.96% to 87.78% (Burke & Hultgren, 1975; Connaughton, Weiler, & Connaughton, 2001; Garry, Diamond, & Whitley, 2002; Whitley & Nyberg, 1988), whereas we found it to be 51.7%. Also, the inclusion of physical activity as a vital sign within patients' electronic medical records in some healthcare organizations, the example being set by the University of South Carolina School of Medicine Greenville, and the national Lifestyle Medicine Think Tank, which focused its first meeting on how to get physical activity education incorporated into the nation's medical education curricula are further examples of change. As these changes unfold it will become increasingly clear what knowledge, skills, and abilities are most important.

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APPENDICES

APPENDIX A

Chronological summary table of studies examining exercise content in medical school curriculum.

Author(s), (Date)	Purpose	Method	Sample	Key Findings
Cumming (1972)	Assess whether exercise physiology, exercise testing of patients, and the prevention and care of athletic injuries are being taught in Canadian medical schools.	Mailed questionnaire to the deans' offices of the 15 medical schools in existence at the time.	*N* = 15, responded (100%)	• No school offered a graduate course in general sports medicine. • Undergraduate students receive some instruction in exercise physiology at half of the institutions (consisting of 1-2 hours of lecture).
Burke and Hultgren (1975)	Assess the role that exercise physiology plays in the medical school curriculum.	Mailed questionnaire to chief administrators in 101 medical schools in the USA.	*n* = 74 responded (73.27%)	• 16.22% offered a course on exercise as preventive medicine, with one institution offering two such courses. • "…the typical American medical school does not offer future physicians the skills needed to prescribe specific exercise regimens for their individual patients." (p. 625)

Whitley and Nyberg (1988)	Review of United States medical school bulletins to determine the extent of instruction and requirement status of exercise physiology-related coursework in the 4-year undergraduate curriculum.	Medical bulletins were requested from all 125 medical schools in the United States.	*n* = 105 responded (84%), of which 92 (73.6% of the original population) had sufficiently descriptive bulletins to be included in the study.	• 57 (61.96%) did not formally teach exercise physiology-related coursework in their curriculum. • 35 (38.04%) had opportunities to obtain instruction (e.g., exercise physiology, health sciences, sports medicine) • 9 of the 35 of the schools with opportunities (25.71%) had two courses and no school had three or more. • Only 4 schools (4.35%) required their students to take a course in which exercise information was included. In each of these cases, the exercise information was presented as a single course topic rather than as an independent course devoted entirely to exercise. "…the vast majority of medical students in the United States do not receive

				formal instruction in the medical aspects of exercise during their four-year undergraduate career." (p. 97)
Wiley, Strother, and Lockyer (1993)	Determine the extent that sports medicine is being taught in family medicine programs in Canada.	Mailed questionnaire to the residency program directors of each of the 16 family medicine departments in Canada.	$N = 16$, responded (100%)	• No mandatory courses, however 14 (87.5%) had an elective course, of which about 25% of the trainees enrolled at 12 of the institutions, and between 25%-50% enrolled at two of the institutions. • 10 of the 14 institutions delivered the curriculum over 4 weeks, whereas one delivered it over 2 weeks. • "Very few family medicine residents receive instruction in sports medicine in Canada." (p. 1743) • "Training in exercise medicine, a component of sports medicine, is likely minimal." (p. 1743)
Cullen,	Document the	Mailed	$n = 26$,	• Seven institutions

McNally, Neill, and Macauley (2000)	amount of formal and informal teaching of sport and exercise medicine in undergraduate medical schools.	questionnaire to the deans each of the 30 medical schools in the United Kingdom and Ireland.	responded (86.67%)	(26.92%) taught sport and exercise medicine content within their formal core curriculum, an additional six (23.08%) offered it as an optional module. Overall, 50% (*n* = 13) of the institutions offered it either formally or informally. • The most common instructional modes for teaching sport and exercise medicine content were study modules, lectures, and clinical attachment. • Five institutions indicated that they planned to begin teaching this content in the next five years, whereas nine indicated they did not. • Common barriers to its inclusion were that there is no room in the curriculum, it is already sufficiently covered through informal means, and there is nobody available to teach the content.

Connaughton, Weiler, and Connaughton (2001)	Surveyed allopathic medical school deans and directors of medical education to determine their perceptions about the importance of physical activity and exercise topics in the medical school curriculum and the competence of graduating medical students in exercise prescription. They also inquired about the delivery of such content in their curriculum.	Mailed questionnaire to the deans and medical directors of each of the 128 allopathic medical schools in the United States.	*n* = 72, responded (56.25%)	• 23% of the respondents indicated that physical activity and exercise topics were covered in at least one core course, with 51% indicating the material was covered, but that it was not the primary focus of any core course. • 44% of the respondents felt that there was sufficient coverage of exercise and physical activity in the medical school's curriculum, whereas 27% did not and 29% were unsure. • In those institutions where the content was covered, the focus was primarily on the what and/or why (e.g., disease prevention and health promotion) rather than the how (e.g., exercise testing and prescription).
Garry, Diamond, and Whitley	Assessed allopathic	Mailed questionnaire to	*n* = 102 (response rate	• 13 (12.75%) of responding schools provided instruction

(2002)	medical school curricula for content related to physical activity.	the assistant deans of medical education at allopathic medical schools in the United States.	not available)	related to the health benefits of physical activity, with six (5.88%) requiring this in their curriculum. • 89 (87.25%) of the institutions did not offer instruction related to the health benefits of physical activity, and of those, 68 (76.40%) had no plans to introduce this into their curriculum. • 62 (60.78%) of the respondents believed that medical schools should educate their students about physical activity. • 24 (23.53%) believed their graduates were prepared to counsel their future patients about the health benefits of physical activity.
Zamani, Vogel, Moore, and Lucas (2007)	Describe the exercise content within osteopathic medical school curricula in the	Curricular documents were requested from the eight osteopathic medical schools	Seven (87.5%) of the institutions responded.	• Exercise content was organized into nine categories. Six (85.71%) of the curricula covered “movement and muscular system,” “principles of

	United Kingdom.	recognized by the General Osteopathic Council.		exercise," and "response to exercise"; five (71.43%) covered "exercise as treatment general," "exercise as treatment specific," and "descriptors of exercise"; two (28.57%) covered "measures" and "population and environment"; and only one (14.29%) covered "health education". • While some exercise content was contained in many of the curricula, it was offered in an idiosyncratic and sporadic manner. • The least covered knowledge and skill domain was "health education," which is where topics pertaining to assessing and helping to facilitate exercise behaviors would occur (i.e., learning how to counsel patients).
Weiler, Chew, Coombs, Hamer, and Stamatakis	Assessed the inclusion of physical activity	Mailed questionnaire to the curriculum	*N* = 31 (100% response rate; however, the	• 5 out of 29 responding institutions taught nothing specific about physical

(2012)	content in the curricula of medical schools in the United Kingdom.	lead/director of medical studies at each of the 31 medical schools in the United Kingdom.	response rate for individual items varied from 38.7% [*n* = 12] to 93.5%) [*n* = 29].	activity in their curriculum. • 4 out of 26 responding institutions taught something about physical activity in their curriculum across all 5 years of medical school. • 15 out of 27 taught their curriculum in accordance with the Chief Medical Officer guidance for physical activity. • Among 12 responding institutions, the average time spent on teaching physical activity in the medical school curriculum was 4.2 (*SD* = 2.6) hours. • "There is an urgent need for physical activity teaching to have dedicated time at medical schools, to equip tomorrow's doctors with the basic knowledge, confidence and skills to promote physical activity and follow numerous clinical guidelines that support physical activity promotion." (p. 1025)