THE MED
REVIEW

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Knowledge and Habits of Exercise in Medical Students

Abstract: Objective. To examine the exercise habits, knowledge, and self-efficacy of incoming medical students. Methods. Mixed-methods study consisting of (1) cross-sectional surveys and (2) qualitative key-informant interviews. (1) International Physical Activity Questionnaire (IPAQ), American Adult's Knowledge of Exercise Recommendations Survey (AAKERS), and Self-Efficacy for Exercise Scale (SEES) to assess student's physical activity level, knowledge of exercise recommendations, and self-efficacy for exercise. (2) Scripted questions explored exercise habits, sources of exercise knowledge, attitude toward exercise. Results. (1) Results of IPAQ classified students as 50% having high, 40% moderate, and 10% low levels of physical activity ($n = 132$). AAKERS demonstrated a mean total score of 16.2/20 ($n = 130$) (81% correct), similar to the national average (mean = 16/20) ($n = 2002$). SEES mean score of 48.5/90 ($n = 128$) is similar to previous studies (mean = 48.6/90, 52.75/90). (2) Interviews revealed that most students have a consistent exercise routine. Few students received formal education in exercise (10%), while the rest cited either peers, sports, or internet as primary sources of exercise knowledge. Less than half stated they would be comfortable designing an exercise routine for patients. Conclusions.

Incoming medical students live an active lifestyle but have limited knowledge and formal training in exercise. Student's knowledge is predominantly self-taught from independent resources.

Keywords: graduate medical education; exercise prescription; exercise epidemiology; exercise education; lifestyle medicine

burden of cardiometabolic disease is enormous, societal financial implications are equally burdensome.⁵ The United States spends trillions annually on health care, with the majority of this cost going directly to CVD, diabetes, and cancer.⁵ CVD alone cost Americans \$555 billion in 2016, which is projected to increase to \$1.1 trillion in 2035.⁶

The need for effective and practical prevention and treatment of

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In the United States, the rates of lifestyle-associated, preventable cardiometabolic diseases are still increasing. In the past decade, the prevalence of obesity has risen by 5% in adults and 3% in children aged 2 to 19 years.¹ Additionally, 30.2 million adults aged 18 years or older (12.2% of all US adults) are diabetic,² while 47% of Americans older than 20 years are at risk for cardiovascular disease (CVD).³ CVD is the leading cause of death in the United States for both men and women,³ and a leading cause of disability-adjusted life years (DALY).⁴ While the individual

cardiometabolic diseases is evident to physicians who are often the primary source of health information for their patients. Management of obesity, CVD, and diabetes require a balance of both medical intervention and lifestyle modification.⁷ While physicians are trained in the medical management of these diseases, most find medical education lacking adequate training for teaching patients about lifestyle modifications.⁸ Only 6% of US allopathic medical schools provide a course addressing exercise prescription, and only 10% of deans said their students could design one for patients.⁸

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Because of the absence of formal exercise and fitness training in medical school, physicians are having to rely on prior knowledge and personal experience. To date, no study has demonstrated the baseline exercise and fitness knowledge of students on matriculation into medical school or characterized the personal fitness habits of students. Additionally, it is unknown if this baseline exercise and fitness knowledge is sufficient to counsel patients on exercise prescription. This is important because studies have shown doctors who have more exercise knowledge and healthier physical activity levels are more likely to counsel their patients on exercise and physical activity.^{9,10}

As a first step in addressing this issue, understanding the baseline knowledge students have when beginning their medical training can be of benefit, providing educators with a starting point on which to build. The overall objective of this exploratory study is to characterize the baseline exercise and fitness knowledge of incoming medical students at one medical school in North Carolina, as well as physical activity habits. A secondary goal is to determine if students feel their baseline knowledge is sufficient to counsel patients on exercise prescriptions. We hypothesize incoming medical students live an active lifestyle and prioritize fitness but have limited knowledge and formal training in exercise science.

Methods

Design and Measures

This project utilized a mixed-methods study design consisting of a cross-sectional survey and qualitative, key-informant interviews. The survey assessed student: knowledge of exercise via the American Adult Knowledge of Exercise Recommendations Survey (AAKERS),¹¹ exercise habits through the International Physical Activity Questionnaire (IPAQ) Long Form,^{12,13} and exercise self-efficacy through the Self-Efficacy for Exercise Scale (SEES).¹⁴⁻¹⁶ The AAKERS is a nationally validated

survey used in a large, diverse population of American adults and provides baseline metrics for comparison. The IPAQ has been validated in numerous large group studies with diverse populations, is widely used internationally, as it is available in over 20 languages, and is considered the gold standard for measuring physical activity.^{17,18} The SEES is a validated measure of self-efficacy used with healthy adult populations to serve as means for comparison. Given the lack of previous studies in this area, qualitative key-informant interviews were also conducted to provide more in-depth exploration of students' exercise habits and sources of exercise knowledge. Questions were developed by content experts after review of existing literature and tested for length and clarity in volunteer participants. Participants were also asked the perceived importance of exercise knowledge for physicians.

Subject Recruitment

Questionnaires were administered to the entire first-year class of medical students via Research Electronic Data Capture (REDCap). All completed surveys were included in the results. All second-year students were invited to participate in the qualitative interview sessions. Second-year students were chosen to broaden the breadth of participants and provide in-depth perspective of a medical trainee at a different academic progress point, having had exposure to medical education. No participants who expressed interest were excluded from the study.

Statistical Analysis

Questionnaires were analyzed and scored according to published guidelines or previous research. The IPAQ Long Form was scored by calculating metabolic-minutes per week (MET-min/wk). MET-min/wk is calculated by multiplying the activity-specific coefficient of metabolic activity by the number of minutes per day spent doing the activity, and then again multiplied by the number of days per week spent doing said activity (ie, Walking

MET-min/week at work = $3.3 \times$ walking minutes $\times$ walking days/week at work). Total MET-min/wk for all activities were summated, and results were then classified by categorical scoring as high, medium, or low. The high category had at least 3 days of vigorous activity, +1500 MET-min/wk, or a 3000 MET-min/wk total. Medium activity level is 3+ days vigorous activity, 5+ days moderate activity, or 600 MET-min/wk. Those who did not meet criteria for either the high or medium category are classified as a low activity level.¹³ AAKERS is a 20-item questionnaire, with 1 point earned for each correct answer. Descriptive statistics were used to calculate the mean and standard deviation of responses. The SEES is a 9-item survey, with each item scored on a 10-point Likert-type scale. Possible scores range from 0 to 90. We calculated the mean and standard deviation of responses to be compared with the mean and standard deviation of prior studies.¹⁶ Given the exploratory nature of this study, we did general comparisons of student scores to other published studies.

Qualitative analysis was conducted using systematic content analysis of participant responses.¹⁹ Each question was evaluated by the study team to identify commonalities and differences among responses. Subsequent iterations of analysis yielded a scoring metric to assess each question and develop a coding standard. Each individual response was then scored according to these guidelines. Cumulative analysis yielded frequencies of coded responses. Frequencies were used to identify themes, subthemes, and representative quotations from participant responses.

Institutional Review Board Approval

The institutional review board at the host institution approved the study design and protocol. The REDCap survey was sent to a listserv of all first-year medical students ($n = 147$), with responses being anonymous. Second-year medical students were recruited by requests in online student forums specific to the second-year class at the

home institution. Subject participation in the study was voluntary, and confidentiality was maintained. No incentive was provided to participants.

Results

Demographics

A total of 132 students completed the questionnaires (87% of first-year class). Participants represented demographics of the host institution. Sixty-six percent of participants identified as White, 21% as Asian, 6% as biracial, and 6% as Black or African American. Fifty-two percent of participants identified as female while 48% identified as male. Seventy-one percent were between the ages of 21 and 24 years, 23% were 25 to 29 years of age, 5% were aged 30 to 34 years, and 1% were older than 35 years.

Quantitative Surveys

Results of the quantitative survey assessed activity level, knowledge, and efficacy of the participants. IPAQ results demonstrate 50% ($n = 66$) of participants have a high activity level, 40% ($n = 53$) are classified as moderate, and 10% ($n = 13$) as low. AAKERS showed a mean $\pm$ standard deviation score of 16.23 ± 2.66 out of 20 possible points ($n = 130$) (81% correct). The national average for American adults is 16.0 ± 2.2 ($n = 2002$) (80% correct).¹¹ The SEES results have a mean of 48.5 ± 19.9 out of 90 possible points ($n = 128$). The mean from 2 previous studies were 48.6 ± 22.5 and 52.78 ± 22.9 ($n = 2002$).^{15,16} Exercise science or related undergraduate or graduate majors comprised 6% ($n = 8$) of respondents.

Qualitative Interviews

Responses from the qualitative, key-informant interviews addresses exercise habits, knowledge, and the role of the physician in exercise prescription. Sixty percent ($n = 12$) of interview participants reported exercising 5 or more days per week, while 30% ($n = 6$) exercised 3 to 5 days a week and 10% ($n = 2$) exercised infrequently. Eighty percent ($n = 16$) of participants endorsed participating in

cardiovascular exercise, while 75% ($n = 15$) stated they participated in strength training and 45% ($n = 9$) utilized lifestyle exercise. All indicated personal mental health benefits of exercise. When asked about personal knowledge of exercise, 45% ($n = 9$) felt comfortable designing an exercise program for a patient. Ten percent ($n = 2$) states their knowledge of exercise principles came from a formal exercise class, while 90% ($n = 18$) were self-taught from youth sports, friends, and the internet. When asked about the role of the physician in exercise prescription, 55% ($n = 11$) stated knowledge of exercise is important for holistic health care of patients. One hundred percent of interviewees wanted to learn more about exercise and fitness. A full summary of results as well as representative quotations can be found in Table 1.

Discussion

While medical students live an active lifestyle, their knowledge and self-efficacy of exercise and fitness is the same as the average American adult. These findings confirm our hypothesis. This study is significant in that it is the first to characterize the exercise habits and knowledge of incoming medical students. It also demonstrated that students would be willing to incorporate exercise prescription into the curriculum. This study can serve as a basis for study at other medical schools, and consideration of curriculum reform to address the need and desire of students to learn about exercise to benefit health.

Results of the IPAQ interviews demonstrate medical students live an active lifestyle, which is encouraging as studies have shown doctors who exercise frequently are more likely to recommend exercise prescription to their patients.¹⁰ AAKERS showed medical students' knowledge of exercise and fitness is the same as the average American adult.¹¹ This is unlikely to improve during medical school as current research shows a lack of dedicated teaching and curriculum focused on exercise.⁸

Qualitative interviews confirmed this high level of activity, as well as explored the type of exercise medical students preferred, showing a balance of cardiovascular and strengthening exercise. To our knowledge, no other studies have classified the types of physical activity performed by medical students. The overwhelming majority of students claimed their knowledge was predominantly self-taught from resources independent of formal academic instruction. The preferred resources, friends, family, and the internet, are available to most adults and would provide reason as to why knowledge of exercise is the same between medical students and the average American. In conjunction with limited knowledge of exercise, less than half of students felt comfortable designing an exercise program for a patient. This finding is consistent with current literature, as a recent study at the University of British Columbia found 86% of students felt underprepared to counsel patients on exercise prescription.^{8,20} However, most interviewed students reinforced the importance of exercise as an aspect of holistic healthcare. This discrepancy led many students to express interest in learning about exercise and fitness as a part of formal medical education.

The results of this study are similar to those found in available literature. A study from Cyprus found 60.8% of medical students to have high levels of physical activity, while 32.9% had moderate levels and 6.3% had low levels, as evaluated by the IPAQ.²¹ Another study of over 12 000 US medical students found that 62.7% of students engaged in aerobic exercise in accordance with the Centers for Disease Control and Prevention (CDC) guidelines of 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity exercise per week. This same study found 38.5% of students were compliant with (CDC) recommended twice-weekly strength-training routines.²² A study of Californian medical and pharmaceutical students found 36% of females and 52% of males engaged in 150 minutes of

Table 1.

Thematic and Content Analysis of Qualitative Interviews (n = 20).

Themes	Subthemes	Representative quotes
Exercise	60% exercised 5+ days a week 30% exercised 3-5 days a week 10% exercised infrequently	"[Exercising] is a great way to challenge myself and see improvements over time"
	80% participated in cardiovascular exercise 75% participated in strength training exercise	"I alternate cardio and strength training while trying to build different muscle groups. Time efficiency is important to me"
	All students indicated personal mental health benefits of exercise	"Having a run helps put things in perspective. It's my time and helps me stop thinking about school. It's my own little escape"
	45% participate in frequent lifestyle exercise	"I bike to school every day and take the stairs to class" "I walk my dog every morning and do yardwork on the weekends"
Knowledge	45% felt comfortable designing an exercise program for a patient	"I don't feel I know enough about exercise to tailor a routine to someone else's specific needs"
	10% formal exercise classes 90% self-taught from youth sports, friends, internet	"Most of what I know comes from youth [sports] coaches growing up" "I work out with my friends and try to learn from them"
Role of physician	55% stated knowledge of exercise is important for holistic health care of patients	"There is an obesity problem in our country and diet and exercise are two major tools to combat that. Having the skills to give them a framework to help them be and stay active is important" "Body well-being is such an integral part of health and we should be able to provide guidance to patients"
	100% want to learn more about exercise and fitness	"Best predictor to whether [a patient] will stick with an activity is if they enjoy it. Physicians need to know what the options are first before they can help."

moderate-intensity exercise per week.²³ Results from a study of a US osteopathic medical school had similar physical activity levels, with 66.4% of students exercising 3 or more days per week and 29.5% exercising 5 or more days per week. Interestingly, over 95% of students indicated exercise prescription was important for their future patients and 75% felt comfortable counseling patients on exercise habits, but only 2% of students correctly identified national

physical activity recommendations for adults in the United States.²⁴

Given the lack of knowledge on exercise prescription among medical students, medical schools should include exercise and fitness prescription classes in the core curriculum. Classes implemented correctly would be well received by the students, as they have expressed interest in learning principles of exercise and fitness. In this medical school, where students had knowledge

similar to the general public, instruction could focus on exercise counseling or prescription instead of content or general knowledge. At this medical school, where incoming students had high levels of physical activity, teaching and counseling can be integrated into the curriculum experientially, teaching students within their own fitness routines. Additionally, as the field of medicine adjusts the spectrum of care to provide for the holistic need of the

patient, medical schools will need to adjust curriculum accordingly to properly prepare the doctors of tomorrow. In this regard, classes on exercise prescription will prepare future doctors to handle the obesity epidemic from a holistic approach.

There are several limitations to the findings in this study. Primarily, the participants in this study were limited to two classes of medical students at one institution. Additionally, there may have been selection bias for the qualitative interview, as participants may have been more interested in exercise and fitness and therefore more likely to participate. Another limitation is the change in lifestyle from the first year to the last year of medical school, as incoming medical students may be more active than fourth-year students as time constraints increase; however, as clinical years tend to be focused on the diagnosis and treatment of disease, it is doubtful additional learning about exercise is integrated into clinical activities.

Future directions would include expanding the sample population to a multi-center study by including multiple medical schools. Additionally, the sample population could be expanded to include clinical clerkship upper level students. An interesting addition to this study would be to interview deans of medical schools and evaluate their perceived importance of exercise prescription for their students. Administrative changes to curriculum could lead to long-term benefits for patients. Past literature has shown physicians who exercise frequently are more likely to prescribe exercise for their patients.¹⁰ This study has shown medical students to be an active group, willing to counsel patients. Now these students need to be given the proper tools to provide high-quality, evidence-based guidelines for exercise prescription in a diverse population with varying medical complications. As health care evolves, future physicians need to be equipped to effectively treat cardiometabolic diseases with a holistic approach.

Acknowledgments

The authors would like to thank to Marcia Wofford, MD and Stacy Schmauss, EdD for their assistance in conducting the study.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research project was funded by the Wake Forest Short-Term Research Training Program (NIH T35 DK007400; PI: McClain).

Ethical Approval

The institutional review board at the host institution approved the study design and protocol (IRB 00057615).

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