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Daily Physical Activity Levels between University Students of Different Majors

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Abstract

This study examined daily physical activity (PA) levels among college students to determine if they were achieving minimum PA, were able to accurately identify their PA, and whether PA differed among majors. Eighty-nine students from physical education (PE; n = 20), accounting (Acc; n = 27), hotel and restaurant administration (Hrad; n =15), secondary education (SecEd; n =10), and psychology (Psy; n =17) wore an accelerometer for seven consecutive days and completed the International Physical Activity Questionnaire L7S to recount their perceived PA. Results indicated that participants completed on average 10,013.07 steps per day and 22.91 minutes of moderate to vigorous activity daily.The most active major was Hrad. However, participants significantly overestimated their daily PA (p < .001). Findings suggest that while college students barely achieved minimum PA daily, such large discrepancies between their perceived and actual PA provide college health professionals direction for interventions and education.

Key words: physical fitness, accelerometer, METs (metabolic equivalent of task), college students, physical education

Résumé

Cette étude décrit le niveau d'activité physique (AP) d'étudiants de niveau collégial pour déterminer s'ils atteignent le niveau minimal d'AP, s'ils peuvent identifier de façon juste leur niveau d'AP et si le niveau d'AP est différent selon le programme suivi. Les 80 étudiants participants provenaient des programmes suivants: éducation physique (n=20), comptabilité (n=27), administration hotelière et de restaurant (n=15), enseignement secondaire (n=10) et psychologie (n=17). Ces participants ont porté un accéléromètre pendant sept jours consécutifs et complété le "International Physical Activity Qustionnaire L7S" pour décrire leur perception de leur AP. Les résultats révèlent que les participants ont fait en moyenne 10 013,07 pas par jour et 22,91 minutes d'AP modérée ou vigoureuse quotidiennement. Les participants les plus actifs étaient ceux du programme d'administration hotelière et de restaurant. Les participants ont surestimé de façon significative leur niveau d'AP (p < ,001). Même si les participants ont atteint le seuil minimum d'AP, la surestimation importante de leur AP fournit des indices importants pour des interventions de la part des professionnels de la santé au niveau collegial.

Mots clés: condition physique, accéléromètre, étudiants de niveau collegial, éducation physique, MET (équivalent métabolique).

Introduction

Consistent levels of physical activity (PA) across time are very important for developing and maintaining adequate levels of fitness (Disch & Cavallini, 2000). At this life stage, young adults are developing long-lasting health behaviors (Lerner, Burns, & de Roiste, 2011; Nelson, Story, Larson, Neumark-Sztainer, & Lytle, 2008), with research showing that adolescent physical activity attitudes, behaviors, and habits usually carry over into adulthood lifestyles (Young, Sturts, & Ross, 2015). Furthermore, existing evidence examining the relationship between physical activity and mental health suggests that increased physical activity is associated with better mental health outcomes such as mood, self-esteem, anxiety, and depression (Van Kim & Nelson, 2013; Peluso &de Andrade, 2005). College students may also benefit from physical activity programming through reduced levels of stress (Baghurst & Kelley, 2013).

The frequency of achieving physical activity recommendations declines rapidly between the ages of 18 and 24 when many young adults are undertaking tertiary education (Grim, Hortz, & Petosa, 2011). Strategies to promote physical activity have become an important public health approach for the prevention of chronic diseases (Bonevski et al., 2014). On college campuses worldwide, significant resources are dedicated to fostering health and wellness efforts through student health services, nutritional experts, and fitness centers. In addition, universities and colleges have endorsed a variety of world-class facilities, technology, and qualified health professionals that are ideal for implementing initiatives to target lifestyle-related health issues. Research studies examining the effectiveness of interventions aimed at improving physical activity in the college setting have revealed areas for improvement and has led to increases in physical activity outcomes (Brown, Volberding, Baghurst, & Sellers, 2014; Brown, Volberding, Baghurst, & Sellers, 2015; Plotnikoff et al., 2015; Sellers, Baghurst, Volberding, & Brown, 2015; Sellers, Baghurst, Volberding, Richard, & Brown, 2015). The success of these interventions is contingent on the ease of access for students, cost-effectiveness of existing facilities and resources, and involvement of frequent face-to-face contact with facilitators. In addition, interventions where students receive feedback on their progress prove to be more effective than solely attending lectures or receiving educational resources (Plotnikoff et al., 2015).

Although significant efforts have been aimed to make health and wellness resources available to college students, statistics reveal the need for continued improvement. According to the Healthy People 2020 (n.d.), in 2016, 77.5% of individuals aged 18 and older did not meet minimum recommendations for physical activity. Of those ages 18-24, 27.2% are obese. These levels are concerning, and are supported by data from the National College Health Assessment (American College Health Association, 2012) stating only 19.5 percent of students engage in 30 minutes of moderate-intensity physical activity over five-to-seven days weekly. Furthermore, only 29% reach 20 minutes of high-intensity physical activity on at least five days during a given week.

Obesity is a rising concern among US college campuses. In general, students exhibit low levels of physical activity combined with a high prevalence of unhealthy eating (Whitley et al., 2008). For example, Gropper and colleagues (2012) tracked the weight levels of 131 students over a four-year period and found significant increases in bodyweight and body fat. Furthermore, those classified as overweight or obese increased from 18% to 31% over the four-year period. Racette, Deusinger, Strube, Highstein, and Deusinger (2005) found that students gained 2.5 kilograms of bodyweight over a similar four-year span.

Discrepancies between Perceived and Actual Physical Activity

Some studies have shown that personal awareness of physical activity can positively affect behavior change; participants make efforts to be more physically active (Ronda, Van Assema, & Brug, 2001). However, Baghurst and colleagues (2018) reported physical education teacher education (PETE) students significantly overestimated their time in physical activity, and recent research indicates that even when college students are aware their physical activity is being measured, they do not make efforts to be more physically active (Baghurst, Richard, & Boolani, 2016). Personality differences, in combination with an inability to accurately identify physical activity levels, may result in poor self-reporting techniques (Prince et al., 2008). Therefore, college students' actual physical activity levels may be higher than what they believe, which could in turn contribute to weight gain during the college years.

To date, various methods have been used to measure physical activity including self-report questionnaires, direct observation, heart rate monitors, and motion sensors such as accelerometers and pedometers (Kohl et al., 2000). According to Trost et al. (2001), self-report methods are most commonly used due to their cost-effectiveness and ability to administer. However, such techniques have revealed considerable recall bias and limited validity and reliability (Kohl et al., 2000; Trost et al., 2000). More reliable methods such as accelerometers, which detect and record physical activity on a real-time basis, may be used to mitigate discrepancies discovered between recounted and actual physical activity.

Therefore, to further examine this discrepancy, the current study evaluated physical activity through recounted (physical activity questionnaire) and actual (accelerometer) measures to allow a comparison between perceived and true measures of physical activity. Results provided by this investigation determined the presence and magnitude of such discrepancies among college students. Understanding whether a discrepancy exists, and to what degree, might allow health and PE educators to target their educational programming more effectively.

Modeling Physical Activity in the Health Majors

Physical education (PE) majors were included in this study to evaluate whether they, above other majors, were more physically active. A responsibility of PE teachers is to promote physical activity and fitness among those with whom they have professional contact. However, where does this duty begin? According to Wilmore (1984),

> First and foremost, each of us in the profession must make a personal commitment to achieve or maintain a good level of physical fitness. How can we be effective in promoting health and fitness if our bodies are not living testimonies of our commitment? What we are communicates so much more than what we say! (p. 43)

Such concerns continue in today's physical education profession. For example, Baghurst, Sandlin, Holden, and Parish (2015) reported that collegiate physical education students perceived themselves, their kinesiology professors, and physical educators in the profession to appear no healthier than the general population. Modeling health extends across kinesiology and health professions (e.g., Baghurst & Diehl, 2016), but as Baghurst et al. (2016) stated:

> Physical educators and coaches are not given a free pass when it comes to being judged. Although we, as physical educators and coaches, may be primarily assessed on how effective or successful our students or athletes are, we can also be evaluated through other measures such as our own health and fitness. Therefore, not only should a physical educator or coach have the skills necessary to improve a student or athlete's skills, but they must

> also be able to model other important characteristics that might affect student and athlete outcomes. (p.46)

Modeling health has ramifications. For example, physical educators can influence learning and performance outcomes by modeling health (Baghurst, 2015). Furthermore, health professionals who engage in healthy behaviors themselves are more apt to recommend those behaviors, and patients are more motivated to change their behaviors when the health care provider is a credible model (Black, Marcoux, Stiller, Qu, & Gellish, 2012). Therefore, this study sought to determine whether physical education majors were more active than other majors in which modeling physical activity was not an expectation.

Study Purposes

This study had multiple purposes. First, we sought to determine whether college students were achieving minimum physical activity levels of 10,000 steps and achieving a minimum of 30 minutes of moderate/vigorous physical activity daily. Second, to determine whether students could accurately identify their physical activity levels, comparisons were made between reported and actual physical activity levels. Third, comparisons of physical activity levels were made across majors to determine whether students in physical education were more active than students in other majors, as might be expected by their choice of profession.

Method

Participants

Eighty-nine students (40 male; 49 female) enrolled in a large university in Southern United States volunteered to participate in the current study from five majors including physical education (PE; n = 20), accounting (Acc; n = 27), hotel and restaurant administration (Hrad; n =15), secondary education (SecEd; n =10), and psychology (Psy; n =17). These majors were chosen to acquire diversity across majors whilst simultaneously representing different colleges at the university. All data collection took place during the same academic school year during the middle of the semester. Due to a limited number of accelerometers, data from each major were collected sequentially, not simultaneously.

The institution where data collection took place has a specific focus on health and wellness (Vlastaras & Baghurst, 2014) and claim to be "America's Healthiest Campus" (Oklahoma State University, n.d.) by providing services for faculty, staff, and students across the Social, Professional, Emotional, Spiritual, and Physical dimensions of wellness (America's Healthiest Campus, n.d.). With respect to physical wellness, the university's Department of Wellness, a non-academic department, offers intramural activities in addition to approximately 100 group activity and fitness classes per week available free of charge. Other paid activities such as personal training are also offered. The university does not require students to complete any physical activity programming within their degree programs; therefore, physical activity classes are voluntary and a separate activity to academic degrees. Within the sample selected, only participants within the PE program engaged in classes where physical activity is a requirement (Oklahoma State University Physical Education, 2018)

Participants were on average 21.45 (SD = 3.62) years old and split by ethnicity between Caucasian (85.48%), African-American (6.45%), Native American (1.61%), Hispanic/Latino (3.22%), and Other (3.22%). Participants classified themselves as Freshman (8.53%), Sophomore (20.73%), Junior (51.21%), Senior (14.63%), and a few 5th Year (4.87%). Participants lived both

on (7.81%) and off-campus (92.19%), and 32% reported being employed in addition to their studies. All participants declared themselves able to participate in physical activity.

Instruments

Demographic survey. Participants completed a demographic survey specifically designed for this study. Questions ascertained student's sex, age, educational classification, work-study status, and whether they lived on or off campus. A question also determined whether participants were physically able to participate in daily physical activity.

International Physical Activity Questionnaire L7S (IPAQ L7S). The IPAQ L7S is comprised of 27 questions that estimate an individual's physical activity levels. In the present study, the long version was used, as it is self-administered and more applicable for the study's design. It is comprised of four physical activity domains: work-related, transportation, housework/gardening, and leisure/sport participation. Questions included examples such as "During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, heavy construction, or climbing stairs as part of your work?" and "During the last 7 days, on how many days did you travel in a motor vehicle like a train,bus, car, or tram?"

The IPAQ demonstrated reliability and validity across multiple physical activity levels and patterns of physical activity in healthy adults (Hagstromer, Oja, & Sjostrom, 2007) as well as across multiple countries and populations (Craig et al., 2003). In addition, the long version of the IPAQ has been reported of having the greatest construct validity out of 260 other Physical Activity Questionnaires (van Poppel, Chinapaw, Mokkink, Mechelen, & Terwee, 2010).

ActiGraph accelerometers. Participants were asked to wear an ActiGraph GT9X Link accelerometer for seven consecutive days on their non-dominant hand. The accelerometer is a small device worn on the ankle, hip, or wrist that measures a variety of variables including steps taken per day, physical activity intensity (sedentary, light, moderate, vigorous), energy expenditure, and the length of time worn (Korpan, Schafer, Wilson, & Weber, 2015). They can distinguish between levels of physical activity through the measurement of acceleration force, static movement, or continuous force (Peterson, Sirard, Kulbok, DeBoer, & Erickson, 2015). This accelerometer was chosen over the traditional pendulum pedometer because it uses a gyroscope to track movement in all directions rather than the two planes of the pendulum pedometer.

Physical activity was calculated using the formula presented by Freedson, Melanson, and Sirard (1998). Physical activity levels were measured in 60-second epochs, and a data point was recorded every minute for the entire seven days. This epoch length was determined based on the comparison of various epoch length cut points with accuracy in extrapolating predictions in health-related outcomes (Gabriel et al., 2010; Trost et al., 2005).

Metabolic equivalents (METs). Metabolic equivalents are a simple, practical, and easily understood procedure to quantify the energy cost of activities (Jetté, Sidney, & Blümchen, 1990). The term indicates the oxygen requirements of varied activities where one MET is equal to the amount of oxygen the body uses when sitting at rest (Franklin et al., 2017). METs are also routinely utilized to describe the functional capacity or aerobic power of an individual, and are a standardized measure of absolute intensity (ACSM, 2013) that can be used to allow physical activity comparisons across different measurement methods. Scores range between light (< 3), moderate (3-6), and vigorous (> 6) physical activity. In the present study, METs were used to compare actual physical activity, as measured by accelerometers, and perceived physical activity, as measured by the IPAQ. Actigraph Actilife software and the Freedson Adult (1998) equation were used to calculate METs from accelerometers, and were compared to METs calculated from

minutes of activity reported from the IPAQ.

Procedure

Following University Institutional Review Board (IRB) approval, participants were recruited from a course in their specified field of study, which included five disciplines (physical education, accounting, hotel and restaurant administration, secondary education, and psychology). Instructors in each major were contacted to request permission to solicit participants who were in their respected courses. Once permission was obtained, participants were recruited during the instructor's class period. No incentive beyond being provided with their results following data collection was provided. Those that volunteered to participate completed the demographic survey before wearing the accelerometer for seven consecutive days. At the end of the seven days, accelerometers were collected from participants during the same class. They also completed the IPAQ to recount their physical activity levels during the data collection period.

Data Analysis

Analysis of descriptive data occurred through the assessment of frequencies, percentages, means, and standard deviations of the variables. Data were normally distributed and met the assumptions for parametric analysis. Independent samples *t*-tests evaluated whether participants achieved significantly more than 10,000 steps daily and more than 30 minutes of moderate/vigorous physical activity (MVPA) daily. The second aim of comparing MET scores between accelerometer and IPAQ data was tested using the Wilcoxon test, as data did not meet assumptions of normality. One-way ANOVAs were used to determine differences in between participants' steps per day and METs by major. Tukey's post-hoc analysis was used to determine differences between groups.

Results

The current study, which examined daily physical activity levels through self-report and direct assessment methods, aimed to identify the activity levels of college students in differing majors, and to evaluate their potential discrepancies in perceived and actual physical activity. Implications of current findings provide opportunities to increase education or encourage the use of already existing resources available to college students. Increasing the knowledge and utilization of material pertaining to physical activity allows students to more accurately record and monitor physical activity levels while also identifying majors that may need specific intervention. Therefore, several noteworthy findings have been reported.

A particularly interesting finding of the current study revealed that participants living off-campus were not significantly more active than those living on campus ($p = 0.8$). Differences by ethnicity and by employment status were not calculated due to small sample sizes of some groups. There were no significant differences in steps per day by sex ($p > .05$). Participants completed on average 10,013.07 ($SD = 4274.77$) steps per day, which was not significantly greater than 10,000 steps daily ($t(83) = .02$, $p = .09$). Similarly, there were no significant differences by sex ($t(77) = .83$, $p = .41$) with respect to participants' daily time in moderate to vigorous physical activity (MVPA). On average, they only achieved 22.91 ($SD = 12.45$) minutes per day, which is significantly below ACSM's (2013) guidelines of 30 minutes per day ($t(83) = 5.21$, $p < .001$).

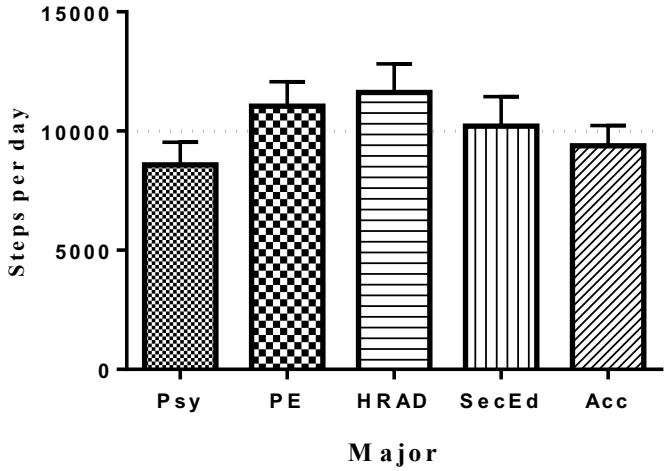

Figure 1. The average steps per day and standard deviation of each major according to accelerometry data. The horizontal dotted line represents 10,000 steps per day.

The second aim of the current study was to determine differences between participants' recounted physical activity levels compared to actual levels as recorded by METs. Participants were found to significantly (Z = -7.56, p < .001) overestimate their daily physical activity when self-reported (M = 3.66; SD = 1.22) compared to actual (M = 1.48; SD = .25). In addition, there were no significant differences in steps per day by academic classification (p = .29; Figure 1), but there were significant differences when comparisons were made using METs [F (4,80) = 7.37, p < .001, d = .27; Figure 2). Post-hoc analysis yielded significant differences between hotel and restaurant administration (Hrad) compared to psychology (Psych; p < .001), accounting (Acc; p < .001) and secondary education (SecEd; p = .02). There were no significant differences between Hrad and physical education (PE), although Hrad was the most active major.

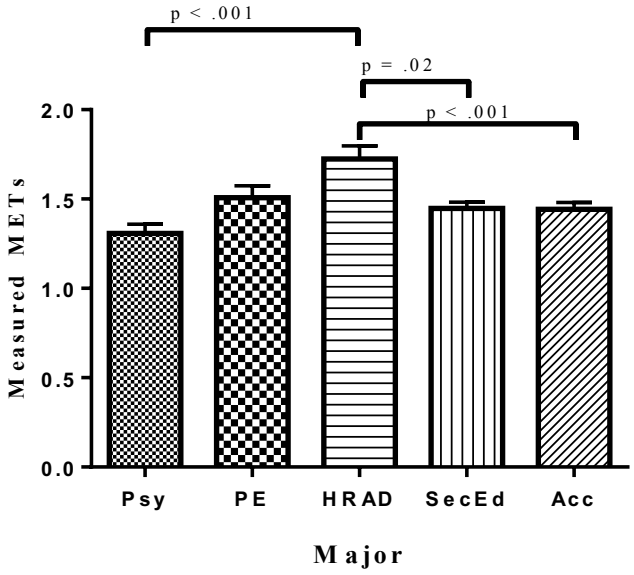

Figure 2. The average METs per day and standard deviation of each major according to accelerometry data. P values represent significant differences found between groups.

Discussion

The purposes of this study were to evaluate the physical activity level of collegiate students to determine whether: (a) they were achieving minimum physical activity levels of 10,000 steps and 30 minutes of moderate/vigorous physical activity daily, (b) they were able to accurately identify their physical activity levels by comparing actual and reported physical activity, and (c) students in physical education, a major where modeling physical activity is expected, were more active than students in other majors.

Participants completed almost exactly 10,000 steps daily but fell significantly below the 30 minutes of MVPA daily. Baghurst, Richard, and Boolani (2016) reported college students completing almost 13,000 steps and 30 minutes of MVPA daily, but the sample was small and represented majors in PE only. Similar to the present study, Behrens and Dinger (2005) reported no significant differences in steps per day by sex of 441 college students, where they averaged 11,473 steps daily. Interestingly, even though the mean was high, only two-thirds exceeded 10,000 steps daily.

In a sample across two university campuses, Sisson, McClain, and Tudor-Locke (2008) reported students achieving only 37 to 70 minutes of MVPA per week, which is well below these standards. Furthermore, these students walked 7,674 and 11,294 steps during the weekday, respectively. Therefore, although the students on one campus exceeded the 10,000 steps threshold, they fell below the 30 minutes of MVPA daily. Therefore, it is important to consider both measures when evaluating the overall physical activity levels of college students. These findings also suggest that, in general, students are struggling to meet minimum guidelines for healthful physical activity.

The second purpose of the study was to evaluate whether participants could accurately recount their physical activity levels. Using METs as a comparison measure, participants significantly overestimated their physical activity levels throughout the week. This finding is particularly concerning given the rise in body weight and body fat levels among college students over a four-year span (Gropper et al., 2012). Over a similar four-year period, Racette and colleagues (2008) reported not only did college students gain weight, but they also exhibited poor dietary and exercise patterns.

Inaccurate comparisons of actual MVPA are supported by Downs et al. (2014), who found that college students overestimated their physical activity using the short form of the IPAQ. Although the sample was from first-year students that were predominantly male, the present study's findings suggest that inaccurate evaluations of physical activity should concern those working in collegiate health education, but also provide direction for targeted programming. Furthermore, the present study's findings support those of Baghurst et al. (2018) who reported PETE students in their sample significantly overestimated their time in physical activity also.

The final purpose was to determine whether students in a major in which modeling physical activity is an expectation (Baghurst, 2015; Baghurst & Diehl, 2016) would be more physically active. Although PE majors just about attained the commonly suggested 10,000 steps per day, and thereby achieved minimum standards for health (Hatano, 1993; Le Masurier et al., 2003), they were not the most physically active major. This type of comparison across majors is novel in research, and why Hrad were significantly more active than other majors is unclear. It is possible that the physically active climate of the university may help explain why a major not typically associated with physical activity may have more physically active students than other majors that emphasize physical activity. Further investigation at other institutions is warranted.

Previous research supports the finding that PE majors are not particularly good role models for health. Baghurst, Sandlin, Holden, and Parish (2015) found that PE majors perceived themselves, their professors, and those teaching PE in the profession to be no healthier than the general population. Therefore, this data may not be surprising, but should be a concern for those developing physical fitness (Baghurst & Mwavita, 2014) and skills testing (Baghurst, Richard, Mwavita, & Ramos, 2015) in collegiate PE programs.

Limitations and Future Research

Although this study provided some novel findings, particularly across college majors, they should be considered in light of its limitations, which provide opportunity for future research. First, participants recounted physical activity for the previous seven days, which may have affected accuracy. Therefore, future research should consider asking participants to record their activity each day. Second, as previously noted, data were acquired from an institution that has a specific focus on health and wellness (Vlastaras & Baghurst, 2014). Research specific to physical activity and wellness at this institution (e.g., Baghurst, Mwavita, Tapps, Volberding, & Jayne, 2014; Brown et al., 2014, 2015; Sellers et al., 2015) have provided the university's Department of Wellness with recommendations grounded in empirical data that have led to programmatic changes. Perhaps this university-wide focus on health and wellness accounts for the physical activity levels of students in programs that do not have physical activity as a requirement. Clearly, more research is needed at other institutions and geographic regions. Third, only one major in which modeling physical activity and health is an expectation was assessed. Therefore, future research should consider comparing other majors with similar expectations such as sports coaching, exercise science, and nursing.

Conclusion

There is ample evidence to suggest that weight gain and decreased physical activity occurs during the collegiate years (Gropper et al., 2012). This study reinforces previous research that college students do not achieve minimal standards for health when both steps per day and MVPA are considered (American College Health Association, 2012). This is particularly concerning considering college students may have more time than at any other point during their working life to commit to a physically active lifestyle. If they are not achieving these standards as students, what is the likelihood of a physically active working life? There is a need to foster these beneficial habits at an early age to better educate and facilitate continued healthy living.

It is also concerning that students held to an expectation of modeling health and fitness were not more active than students in other majors. This current finding mirrors other recent research (Baghurst et al., 2016), yet highlights the need for future research investigating whether such discoveries extend to other health professions and the causality of such limited physical activity.

Perhaps the most notable finding of the study was the apparent discrepancy between perceived and actual physical activity. Participants grossly overestimated their daily physical activity. Such findings should be considered during collegiate physical activity education and interventions. Future research could investigate how such knowledge affects continued physical activity and whether the use of accelerometers aids in increasing physical activity levels.

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