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RESEARCH ARTICLE

A Comparison of Physical Activity Levels between On-Line and Campus University Students

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Abstract

Background: The purpose of this study was to investigate differences in Physical Activity (PA) levels for course modality (on-campus vs. online).

Methods: A total of 238 participants enrolled at a regional university in Oregon with a significant online presence (58% of student head count).PA levels of on-campus and online students were assessed during April 2014 via an online electronic questionnaire. PA queries were based on the International Physical Activity Questionnaire (IPAQ) questions regarding PA.

Results: 76 on-campus and 162 online students completed the questionnaire. 92.1% (n = 70) of on-campus students reported meeting current PA recommendations compared to 75.3% (n = 122) of online students (p = 0.004). On-campus students reported significantly more time spent in vigorous PA, walking, and MET•min/wk than online students (232.5 vs. 60.0 min/wk, p = 0.004; 360 vs. 127.5 min/wk, p = 0.008; 4,014 vs. 1,935 MET•min/wk, p = 0.000, respectively).

Conclusion: Results indicate a need for physical activity interventions tailored to online university students.

Keywords

Physical activity, Online, Campus, Moderate Vigorous Physical Activity (MVPA)

Introduction

Benefits received from regular physical activity are hard to replicate with any pharmaceutical. There is sufficient scientific evidence which supports Physical Activity (PA) as both a method of prevention and treatment for heart disease [1-3], type 2 diabetes mellitus [4,5], obesity related metabolic syndrome [6-8], both ischemic and hemorrhagic stroke [9-12], and many forms of cancer [13-15]. These benefits extend beyond physical wellness and into one's mental wellbeing. PA has been shown to be a viable option to help prevent the incidence and effectively manage disorders such as clinical depression, stress, and anxiety [16-18].

Costs to treat diseases associated with a lack of regular physical activity have a distinctly negative impact on the American health care system. According to the Centers for Disease Control and Prevention the total costs of treating all cardiovascular disease in 2015 alone was over $650 billion dollars and is estimated to exceed $1 trillion by 2030 [19]. The American Diabetes Association estimates the annual healthcare cost of type 2 diabetes mellitus in 2012 at $245 billion, an increase of 41% from estimates five years prior in 2007 [20]. National expenditures for cancer in 2010 were estimated at just under $125 billion, a figure estimated to increase to over $157 billion by 2020 [21]. In total, it is evident that a few mostly preventable diseases account for a large and growing proportion of American healthcare costs.

In addition to the financial burden due to insufficient physical activity, increased morbidity and mortality must also be considered. Heart disease alone accounts for nearly one-fourth of annual deaths in the United States (US) while cancer accounts for just over

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one-fifth of all deaths [22]. In addition, both stroke and diabetes rank within the top seven causes of death in the US [22]. Aside from their impacts on national death rates, these diseases also profoundly affect daily life for those living with and managing them. Complications related to heart disease, such as heart attack or stroke, negatively affect an individual's ability to maintain a normal lifestyle. Cancer treatments like chemotherapy and radiotherapy can impair not only the patient's life but the lives of their families. Diabetes complications such as diabetic retinopathy, diabetic nephropathy, diabetic neuropathy, and potential amputation of extremities act to greatly reduce quality of life.

Although the benefits of regular PA are well known among health professionals, only 50% of the general American population meets the Center for Disease Control and Prevention's physical activity recommendations of 150 minutes of moderate, or 75 minutes of vigorous aerobic activity per week, with men more likely to meet minimum activity levels (54%) than women (46%) [23]. Similarly, only 45% of American college students meet these physical activity recommendations [24]. College students face challenges such as newfound independence, new environments, and pressures to perform academically that can influence their ability to be physically active. Technological advances can lead to reduced opportunities of physical activity for students in higher education as many classes are now available online and can be taken at home which, for example, lead to less active transportation to/from campus, ambulation/cycling about campus, fewer opportunities to participate in campus based fitness activities (i.e., fitness center, intramural, athletics). As of 2017, 15% of full-time students were enrolled exclusively in distance education representing just over 3 million students [25]. However, the physical activity patterns of college students participating in online coursework have yet to be evaluated. Inadequate physical activity levels are present in campus-based populations of university students; however, physical activity levels of online university students are not well known. Therefore, the purpose of this study was to quantify and compare self-reported physical activity levels of on-campus (course taken at a physical location associated with the university) and online students (course taken via a learning management system with no physical location) from a single university in the Pacific Northwest.

Methods

Students at a regional university in the Pacific Northwest were used for the target population of this study. This institution has a significant number of students primarily engaged in on-line coursework. The short form of the International Physical Activity Questionnaire (IPAQ) was modified to assess the local university population [26]. The survey was designed to measure demographic variables, as well as estimate weekly time spent in sedentary, walking, and in Moderate to Vigorous Physical Activity (MVPA). During the spring of 2014 a survey was developed, and pilot tested. Upon completion of the pilot testing the survey was sent out to both the on-campus and on-line student body via a university survey system. All students (3490, with 2024 [58%] of those students solely online and an additional 350 [10%] taking a mix of physical and online coursework) enrolled for classes at the university received an email with a link to the web based survey generator (which housed the survey for this study), with an informed consent statement (requiring acknowledgement from the recipient), information regarding the purpose of the survey, and the survey itself. All students had 3 weeks to complete the survey.

Results of the survey were entered into a spreadsheet where total weekly activity time was found using the formula, ((*number of days activity*) × (*number of* × $\frac{hrs}{day}$ 60)) + total MET minutes × days. Total Metabolic Equivalents (MET) were found using the formula *MET level* × ((*number of hours per day* × 60) + *number of MET minutes per day*) × *number of days per week*. MET levels were determined using the average of either vigorous or moderate activities [27], similar to methods used in recent work [26]. Total weekly MET minutes were then calculated by adding total reported MET minutes for vigorous, moderate, and walking intensities. IPAQ responses were categorized in accordance with previously published work of Craig, et al. [26]. Compliance to moderate intensity or vigorous intensity activities were identified as those achieving a minimum total physical activity of at least 600 MET- minutes/week. Participants who were classified as receiving high levels of PA were categorized with one of two criteria: vigorous- intensity activity on at least 3 days achieving a minimum total PA of at least 1500 MET-minutes/week, or 3 or more days of any combination of walking, moderate-intensity and/or vigorous-intensity activities achieving a minimum total PA of at least 3000 MET-minutes/week. Those who did not fit criteria for moderate or high categories were classified as low.

Descriptive statistics were calculated to characterize the sample. Distributions for most variables calculated from the IPAQ assessment evidenced significant deviations from normality. As such, we performed all between-group comparisons of continuous variables using the Mann-Whitney U test. On-campus vs. online comparisons of proportions were conducted using the chi-square test (i.e., percentages meeting physical activity guidelines and accumulating PA at a gymnasium or fitness center) or fisher's exact test (i.e., percentages reporting access to a gymnasium or fitness center). All statistical test and analyses were performed using R (version 3.4.0; R Foundation for Statistical Computing, Vienna, Austria) and significance was defined as $p < 0.05$.

Table 1: IPAQ survey results for physical activity. All values represent the proportion of respondents in the indicated group as a percentage (%).

	Met 2008 PA guidelines for Americans	Met 2007 ACSM/AHA PA recommendations	Reported no gym access	Reported no PA performed at a gym
Campus overall	92.1**	72.4*	0	38.2*
Online overall	75.3	56.8	8.6	53.7
Campus men	95.8	70.8*	0	25
Online men	78.7	68.1	6.4	48.9
Campus women	90.4*	73.1*	0*	44.2
Online women	73.9	52.2	9.6	55.7

*= $p < 0.05$; **= $p < 0.005$.

Results

A total of 236 participants completed the online questionnaire, reflecting a response rate of 7%. 68% (N = 160) of respondents reported themselves as taking classes primarily online (which reflects the demographics of the target institution). Of the total respondents, 29% (N = 70) reported as male, representing 32% (N = 24) of online respondents and 29% (N = 46) of campus respondents. A total of 75.3% (N = 122) of online students met the 2018 PA Guidelines for Americans compared to 92.1% (N = 70) of on-campus students (Table 1). In comparison to online students, on-campus students reported significantly higher median values (Median [IQR]) of vigorous PA (232.5 [450] vs. 60 [265] min/day, p = 0.004), walking (360 [457.5] vs. 127.5 [371.3] min/day, p = 0.008), and MET·min/wk (4,014 [4,853.6] vs. 1,935 [3,757.4], p < 0.001). Additionally, on-campus women reported significantly higher median values that online women for walking and weekly activity (420 vs. 120 min and 3564 vs. 1356 MET min/week, respectively).

Discussion

In the population assessed, the total reported minutes spent walking and in vigorous PA were significantly higher for an on-campus population and total MET min per week were reported to be significantly higher than online students. Additionally, on-campus women reported a significantly higher median minutes spent walking per day, as well as significantly higher MET minutes per week. Overall, both on-campus students and on-campus women were significantly more likely to meet both the 2008 PA guidelines for Americans, and the 2007 American College of Sports Medicine/American Heart Association PA recommendations. On-campus men were significantly more likely to meet the just the latter (Table 1). On-campus courses require students to walk to and from class which may be a direct factor in the outcomes of the current study. However, it is unlikely to be the sole factor considering significant portions of class time are spent sedentary. Interestingly when asked about potential barriers to receiving adequate PA, on-campus respondents, in comparison with on-line students, were more likely to report more barriers such as a lack of time, class conflicts, no motivation for PA, and being too tired. Yet, these same students still reported higher levels of physical activity than their on-line counterparts. On-line students would not have class conflict, but may experience the other factors (time, lack of motivation for PA, fatigue). Additionally, on-line students have been shown to be older and more likely to work and have families [28,29]. It should be noted that on-campus participants were significantly less likely to report that they performed no PA at a gym than those who took classes online, suggesting a relationship between the two. Perhaps, this reflects the importance of the exercise facilities to which campus-based students have ready access. It is not apparent if this is the only significant variable influencing fluctuations of PA differences between these two populations.

Limitations in this study include the use of web-based questionnaires as the sole means for data collection. While this allowed for significant reach within the target population, it should be noted that there was a limited timeframe in which the survey was available and that emails including the survey could easily be ignored by potential respondents. Perhaps these factors also reduced the response from self-identified males, preventing a more robust comparison. Due to the nature of the study and limited questions asked, no pre-existing diseases or age-specific differences were assessed. The use of self-reported PA over objective measures can be seen as a limitation to our study however the IPAQ has proven to have reasonable PA measurement properties for adults across diverse settings [26].

Further research is needed to help elucidate other possible variables affecting enrollment modality (on-line or on-campus) and PA. While this study illustrated that there is a relationship between overall PA levels and course modality, further research is needed to determine the underlying reasons for this observation.

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