



Mobile phone use among college students is a sedentary leisure behavior which may interfere with exercise



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ARTICLE INFO

Article history:

Received 23 October 2015

Accepted 3 November 2015

Available online xxx

Keywords:

Cell phone

Smartphone

Physical activity

Leisure

Exercise

ABSTRACT

Research suggests that cell phone use is related to sedentary behavior, that cell phone use during exercise reduces intensity, and that high frequency cell phone users are less fit than other users. Thus, cell phone use appears connected to health and fitness behaviors and should be better understood within this context. The present study investigated the sedentary nature of cell phone use, and examined the likelihood of cellphone use interfering with exercise behavior.

Design: A validated survey was administered to a random sample of students from a public US university ($N = 226$).

Results: Mean self-reported cell phone use was 380 min day⁻¹, 87% reported cell phone use primarily occurs while sitting, and 70% of use was for leisure. Cell phone use was positively related to sedentary behavior ($\beta = 0.30$, $p < 0.001$). It was not related to physical activity. However, the likelihood of cell phone use during moderate ($p = 0.006$) and mild ($p < 0.001$) intensity exercise increased as cell phone use increased.

Conclusion: Like other screens (e.g., TVs), cell phone use appears to be a sedentary leisure behavior. Furthermore, high frequency use increases the likelihood that it will occur during exercise, likely lowering exercise intensity.

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1. Introduction

Today's cellular telephones (i.e., smartphones, mobile phones, and hereafter cell phones) are no longer simply tools for two-way communication. Rather, they have become hubs for a rapidly evolving digital lifestyle (Bajarin, 2013). For college students, this digital lifestyle centers on near constant access to online social networks, streaming entertainment and e-commerce. As the first generation raised entirely in the digital age, a cell phone centered lifestyle may be second nature for this cohort of young people. Of concern here is that cell phone use, much like the use of other electronic media (i.e., computers, televisions, video games), may primarily be a sedentary behavior (Rosenberg, Norman et al. 2010; Mansoubi, Pearson et al. 2014). As such, it may also distract from physical activity and/or planned exercise (Lepp, Barkley et al. 2013; Rebold, Lepp et al. 2015). In other words, as cell phone use increases, users may become more sedentary and less physically

active (Barkley, Lepp et al. 2015). This is worrisome as increased sedentary behavior and decreased physical activity are associated with numerous negative health outcomes (Tremblay, Colley et al. 2010; Tremblay, LeBlanc et al. 2011; Chaput, Carson et al. 2014). Thus, the purpose of this study was to better understand how college students use their cell phones, and whether college students' cell phone use is related to sedentary behavior and physical activity.

Currently, the average college student report using their cell phone for five to six hours per day while the most active users interact with the device almost constantly (Lepp, Barkley, & Karpinski, 2015). In a previous study, our group used a fixed choice item on a larger questionnaire to ask a random sample of college students ($N = 308$) if their cell phone use was primarily for work, school or leisure (Lepp et al. 2013). In response, 88% of students identified leisure as their primary purpose for cell phone use. In follow-up interviews, students identified online social networking, texting, internet browsing, playing video games, and watching videos as popular cell phone activities. All of these activities have previously been identified as sedentary behaviors when delivered through traditional platforms such as desktop

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computers, televisions and video game systems (Rosenberg et al. 2010; Mansoubi et al. 2014). Thus, it is possible that college students' cell phone use is similar to spending hours per day watching television, playing video games and/or using a computer. That is to say, it may primarily be a sedentary leisure activity. On the other hand, what distinguishes the cell phone from these other traditional forms of electronic media is its mobility. Cell phone users are free to move about both indoors and outdoors and use the device in transit. In addition, an abundance of cell phone software applications ("apps") are designed to encourage physical activity, support planned exercise and reduce sedentary behavior, although their efficacy is not well tested (Azar, Lesser et al. 2013; Middelweerd, Mollee et al. 2014). Therefore, cell phone use has the potential to be, but does not have to be, a sedentary activity. Given the uncertainty around this issue, it is important to better understand how and when college students use their cell phone each day and how this use may be associated with exercise/physical activity and sedentary behavior.

There is evidence to support the hypothesized link between cell phone use, sedentary behavior and physical activity (Lepp et al. 2013; Barkley et al. 2015). In a previous study, our group interviewed college students about their cell phone use behaviors, measured participants' daily cell phone use, and assessed their cardiorespiratory fitness (i.e., peak oxygen consumption or VO_2 peak) (Lepp et al. 2013). After controlling for other known correlates to fitness (e.g., percent body fat, sex), total daily cell phone use was significantly and negatively related to cardiorespiratory fitness. In other words, high users were significantly less fit than low users. In support of this, interview data suggested that physical and sedentary activity behaviors differed between high and low frequency cell phone users. Notably, high frequency users often described cell phone use as sedentary and believed that it interfered with their physical activity/planned exercise. To the contrary, low frequency users often described how the cell phone encouraged physical activity by keeping them connected with physically active peers. A limitation of this initial study is that physical activity and sedentary behavior were only assessed through qualitative interviews. Recently as a follow-up to this initial study we assessed the relationship between cell phone use, physical activity and sedentary behavior using validated survey instruments (Barkley et al. 2015). In this study there was a significant, positive association between cell phone use and sedentary behavior. After dividing participants into groups based upon cell phone use, the highest cell phone users reported 100 more minutes of daily sitting than the lowest cell phone users. However, there was no relationship between cell phone use and physical activity behavior. Therefore, these initial results suggested that cell phone use is predictive of lower cardio-respiratory fitness and greater sedentary behavior. However, because these are preliminary findings, additional work is needed to further assess the potential relationships between cell phone use, physical activity and sedentary behavior.

In addition to the possible sedentary nature of cell phone use, there is also evidence that using these devices may interfere with a bout of planned exercise. During open-ended interviews collected as part of our group's initial investigation high frequency cell phone users were more likely than others to mention that they use the phone for talking and texting during bouts planned exercise (Lepp et al. 2013). Thus, we consequently assessed the effect of cell phone use on the intensity of treadmill exercise (Rebold et al. 2015). Using a within-subjects experimental design, results demonstrated that cell phone use (talking and texting) significantly reduced average treadmill speed and heart rate relative to a control condition with no cell phone use. Similarly, Rebold et al. found that using the cell phone for texting during treadmill exercise reduces exercise intensity relative to a control condition (Rebold, Sheehan et al. 2016).

As a follow up to these studies, our group observed individuals engaged in free-living walking in a natural setting along a straight 50 m pathway ($N = 1142$) (Barkley & Lepp, 2015). These individuals were unaware of the researchers' presence. In support of the treadmill experiments, when individuals used a cell phone for either talking or texting they walked significantly more slowly than those who were not using a cell phone. Taken together, these studies suggest that cell phone use during exercise may reduce the intensity of that exercise. If high cell phone users are more likely to use the cell phone during planned exercise, this could help explain the previously identified negative relationship between cell phone use and cardiorespiratory fitness. Thus, it is important to further examine if high frequency cell phone users are more likely to use their cell phones during exercise than low frequency cell phone users.

The purpose of the present study is to support and extend this emerging line of research. In support of the previous research (Lepp et al. 2013; Barkley & Lepp, 2015; Barkley et al. 2015; Rebold et al. 2015; Rebold et al. 2016), this study asks the following question:

1. After controlling for age and sex, what is the relationship between college students' cell phone use, sedentary behavior, and physical activity?

To extend the previous research, this study asks the following two questions:

1. When using the cell phone, are college students typically (a) sitting, (b) standing, or (c) moving about?
2. Given the negative effect of cell phone use during exercise on exercise intensity (Rebold et al. 2015; Rebold et al. 2016), does the likelihood of using the cell phone during exercise increase as total daily cell phone use increases?

Answering these questions will help explain the previously reported negative relationship between cell phone use and cardiorespiratory fitness (Lepp et al. 2013) while providing important insights into the health related behaviors of today's college-aged youth.

2. Methodology

2.1. The sample

Spatial locational sampling was used to identify four high foot-traffic areas at a large public university in the Midwestern United States. At each location, systematic random sampling was used to survey undergraduate college students over a six week period in the fall of 2014. As individuals walked past the researcher's position, they were invited to participate in the study using a sampling interval of five with a random entry point. A screening question was used to select only those individuals currently registered as undergraduate college students. Data collection occurred at various times of the day and on various days of the week. Using this method, 268 participants joined the study. Participants' age ranged from 18 to 34 (mean \pm SD = 20 \pm 2). The sample was comprised of 162 females (60%) and 106 males (40%) which nearly matches the university's female to male ratio of 59:41. Finally, participants were enrolled for at least 9 semester credits and the sample average was 15 credits.

2.2. The instrument

The survey instrument was a self-administered fixed choice questionnaire designed to be completed in 10 min or less. After

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