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Falls in young adults: Perceived causes and environmental factors assessed with a daily online survey

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ABSTRACT

Falls are the third leading cause of unintentional injuries for ages 18–35 years (CDC), but the causes and circumstances of falls in this age group are understudied. The purpose of this study was to document the frequency and circumstances of falls in young adults with a daily online survey. Ninety-four undergraduate students (19.9 ± 0.9 years) received a daily email for 16 weeks regarding slips, trips and falls in the past 24 h (93% response rate). More than half of the participants (52%) fell in the 16-week interval. Injuries were reported in 16% of falls, and medical treatment was received in 4% of all falls. The majority of falls occurred while walking (58%), and the main cause of the fall was a slip (48%) or trip (25%). On average, participants fell once out of every 18 perceived slips and trips. Physical activity level did not distinguish fallers from non-fallers ($p = 0.45$), but for those who did fall, falls were more frequent as physical activity level increased ($p = 0.007$). The high fall and injury rate in a short interval reflects the inherent instability of bipedal locomotion and indicates that falls are not a trivial problem for young adults.

1. Introduction

Falls have been described as a major public health problem (WHO, 2012); they can lead to death, chronic pain, disability and loss of independence (Kannus, Sievanen, Palvanen, Jarvinen, & Parkkari, 2005). Circumstances of falls are described extensively in older adults (Berg, Alessio, Mills, & Tong, 1997; Robinovitch et al., 2013; Rubenstein & Josephson, 2002), but fall surveys in young and middle-aged adults are less prevalent, with one study examining the age group 20–45 years (Talbot, Musiol, Witham, & Metter, 2005), and no studies with an age range limited to adults younger than 25 years. However, falls carry significant risk for both young and older adults, as falls are ranked as the third cause of accidental deaths across all ages (CDC). Further, 28% of traumatic brain injury (TBI) cases were due to falls, and 70% of individuals with TBI are children, adolescents or young adults (Rusnak, 2013). Therefore, increased knowledge is needed regarding falls in young adults.

Control of dynamic equilibrium in humans is challenged by a number of factors, including the large inertial load of the head, arms and trunk, a small base of support, a high center of mass, and the potential for vertical collapse due to the joints in the lower limbs. Since falls in older adults occur most often during walking (Berg et al., 1997; Luukinen, Koski, Hiltunen, & Kivelä, 1994; Talbot et al., 2005), falls are typically ascribed to the inherent instability of biped locomotion combined with age-associated decrements in balance control (Chen, Ashton-Miller, Alexander, & Schultz, 1991; Lee & Chou, 2006; Muir,

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Haddad, Heijnen, & Rietdyk, 2015; Winter, 1991; Woollacott & Shumway-Cook, 2002). However, balance control is presumably not compromised in young adults. Therefore, examination of falls in this group will increase understanding of the relative contribution of bipedal instability versus compromised balance to falls. We can determine if healthy adults younger than 25 years fall most often during walking, or if falls are more likely to result from challenging activities more common in young adults such as athletic activities or texting while walking. Further, in older adults falls are believed to result from the interaction of environmental hazards and individual susceptibility based on subject-specific characteristics (Connell, Wolf, & Atlanta FICSIT Group, 1997; Rubenstein, 2006). Assessing the causes and circumstances of falls in young adults will allow us to determine how environmental factors, such as stairs and icy sidewalks, and individual-specific behaviors, such as physical activity level and alcohol consumption, are related to falls in young adults.

Falls are typically examined by asking participants to recall falls in the preceding month, preceding year, or preceding two years (e.g. Talbot et al., 2005). However, fall memory is known to be problematic (Ganz, Higashi, & Rubenstein, 2005; Peel, 2000), and shorter time intervals (e.g. Berg et al., 1997; Rubenstein & Josephson, 2002) improve accuracy of fall data (Cummings, Nevitt, & Kidd, 1988; Ganz et al., 2005; Hill, Schwarz, Flicker, & Carroll, 1999; Peel, 2000). Therefore, a quick daily assessment of falls may be ideal to record frequency and circumstances of falls. Conventional methods for monitoring falls include postcards, calendars, diaries or telephone calls, but online surveys have not been used even though there are clear benefits. Participant benefit includes ease of responding and researcher benefits include ease of dissemination, reduced costs, and digitally recorded responses. Since young adults readily adopt web-based technologies, a daily online survey provides an ideal mechanism for fall assessment in this age group.

While falls are important to quantify, it is also important to consider perturbations that do not result in a fall, for example slips and trips. The circumstances of these perturbations in the field are understudied, but provide important information such as how many times people successfully recover from perturbations. The purpose of this study was to document the frequency and circumstances of slips, trips and falls in young adults with a daily online survey.

2. Methods

Ninety-four undergraduate students (age 19.9 ± 0.9 years, range 18–22 years, 33 males; height 171.4 ± 9.5 cm; weight 71.1 ± 14.3 kg) participated in this study. All students were taking the same course: 34 students participated in the fall semester (mid-August to mid-December), and 60 students participated in the spring semester (mid-January to mid-May). Participating students received 1% extra credit. In order to limit coercion to participate in the survey, students who wanted to receive the 1% credit were offered the choice of completing a short written assignment or participating in the survey. Of the 114 students enrolled in the courses, 94 chose to participate in the survey (82%). Participants were not provided any instruction regarding completion requirements; all students who agreed to participate received full academic credit even if they did not respond to the daily emails. Participants who responded to less than 35% of the daily emails were excluded from the analysis (Usdan, Schumacher, & Bernhardt, 2004). All participants completed an online consent form approved by the Institutional Review Board.

The slip, trip, and fall survey consists of an initial survey (see Supplemental Digital Content 1, initial survey) (collected once at the beginning of the 16 weeks) and the daily survey (see Supplemental Digital Content 2, daily online survey) (collected daily for 16 weeks). Surveys were developed and distributed using Qualtrics Survey Software (Qualtrics Labs Inc. Provo, UT), and could be completed on any internet-connected device (computer, tablet, or smartphone, Fig. 1).

2.1. Initial survey

The initial survey included participant demographics (e.g. age, sex, height, weight) and physical activity level (see Supplemental Digital Content 1, initial survey). Activity level was measured using the Leisure-Time Exercise Questionnaire (LTEQ) (Godin & Shephard, 1985).

2.2. Daily Survey

In the daily survey, participants received an email every day at 6:00 AM asking if they had slipped, tripped or fallen in the past 24 h. A fall was defined as "An undesired contact of any body part (other than the feet) with the ground or a lower surface" (Weerdesteyn et al., 2006); this definition was provided each day with the first set of questions (Fig. 1a). Similarly, definitions for a slip and trip were provided (Fig. 1a). If a slip, trip, or fall was not reported, the survey concluded. When the participant reported that a fall had occurred, follow-up questions regarding the circumstances of the fall were presented (for example, see Fig. 1b; full set of questions provided in Supplemental Digital Content 2, daily online survey). Briefly, the survey questions were developed from existing literature for causes of falls (Robinovitch et al., 2013) and injuries (Talbot et al., 2005), and to quantify the timing and location of the falls. Alcohol and/or drug use was also assessed with the following questions: "Were you under the influence of any substances that may have affected your balance (e.g. alcohol, drugs)?" If "yes" was selected, a follow up question with a sliding scale was presented: "From the previous question, probability that the fall was related to balance-altering substance (from 0 to 100)."