ELDERLY PEDESTRIANS, AGED >65 YEARS, DURING WINTERTIME -ATTITUDES TOWARDS WALKING OUTDOORS, SAFETY EQUIPMENT AND EXPERIENCES OF FALLS. A COMPARISON WITH HEALTHY ADULTS.

Glenn Berggård

Lulea University of Technology - Department of Civil, Environmental and Natural Resources Engineering - Sweden – Lulea

glenn.berggard@ltu.se

Abstract: Pedestrians slipping and falling is a major safety problem in countries with long winters such as Sweden. According to the Swedish questionnaire-based National Traffic Safety Survey, self-reported accidents involving pedestrians without involvement of any vehicle (single-pedestrian accidents) accounted for roughly half, (1 141 962) of the total number of all road transport single accidents (2 335 017) in 1998-2000. This survey covered 23 030 people aged 1-84. Fall accidents during wintertime accounts for a large portion of all single-pedestrian accidents. An intervention study was performed from February to April among 67 healthy adults, aged 27-67, in northern Sweden, examined the obstacles for walking outdoor during wintertime, attitudes towards safety equipment, their previous experiences of outdoor falls during wintertime and the effect of using anti-slip devices on daily walking journeys and their prevention of slip and fall accidents. A intervention study has been made among elderly people, aged more than 75 years, also in northern Sweden. A questionnaire has been distributed to record their background, health status, attitudes towards different conditions to reduce outdoor walking and their usage of safety equipment. A daily travel dairy was distributed during February to April 2009 to record daily walking and experiences of slipping and falling. The results from comparisons of attitudes and previously experiences of outdoor falls among the elderly persons is compared with the results from the pilot study among healthy adults.

Keywords: elderly, pedestrian, winter, slip, fall

Introduction

Pedestrians slipping and falling is a major safety problem in countries with long winters such as Sweden. According to the Swedish questionnaire-based National Traffic Safety Survey, self-reported accidents involving pedestrians without involvement of any vehicle (single-pedestrian accidents) accounted for roughly half, (1 141 962) of the total number of all road transport single accidents (2 335 017) in 1998-2000. This survey covered 23 030 people aged 1-84. Fall accidents during wintertime accounts for a large portion of all single-pedestrian accidents. The frequency of hospital visits due to severe fall injuries is higher during wintertime (about 34,000 people) than during the rest of the year (Berggård and Johansson, 2010; Eriksson and Sörensen, 2015)

Healthy adults experiences of slips and falls

A study, which focused on healthy adults in northern Sweden, examined the effect of using anti-slip devices on daily walking journeys and prevention of slip and falls. The study was limited to 67 respondents in the ages 27–67 years.
The respondents were divided into three groups: an Intervention Group, a Control Group, with similar distribution of gender and age, and a Comparison Group. Four questionnaires were distributed:
- background,
- daily diary of distance walked and occurrence of incidents or accidents reported weekly,
- detailed incident or fall report and
- experiences of using anti-slip devices for those who used these devices during the trial period.

Half of the respondents stated that they had previous experience of using anti-slip devices. In this study, 52% of the respondents used anti-slip devices. Anti-slip devices improve the walking capability during wintertime. The mean daily total walking distance among all of the respondents in this study was similar to the average walking distance according to the Swedish National Travel Survey, which is 2–3km (SIKA Statistics, 2007).

Among subjects using appropriate anti-slip devices, the average daily walking distance was found to be statistically significant longer compared to people not using anti-slip devices.
Respondents aged 45 years and above walked significantly longer distances, in mean daily total walking distance 3.21km compared to 2.48km and when using anti-slip devices 4.19km compared to 1.73km respectively. There are statistical differences between older (45-67 years of age) and younger (27-44 years of age) respondents for both the mean daily total walking distance for all respondents ($df = 1$, $F = 43.277$, $p < 0.05$) and the distance with anti-slip devices ($df = 1$, $F = 44.818$, $p < 0.05$). The elderly walk longer and use anti-slip devices more frequently. This study indicates that an increase in daily walking distance can be made without increasing the risk of slips/falls when using anti-slip devices. The study also indicates that by using appropriate anti-slip devices and having information about when and where to use them, based on their design, people avoid having slips and falls. The respondents experienced in using anti-slip devices in this study will continue to use them and will also recommend others to use anti-slip devises.

Elderly pedestrians, aged >65

In an intervention study among elderly people in Boden Municipality in North of Sweden data from a survey has been analyzed. The municipality distributed anti-slip devices to elderly citizens, aged over 65 years. Questions were asked among the elderly citizens about their ability to move, activity level and the effect of weather conditions on their mobility. Questions were also asked on using safety devices (e.g. bike helmet, safety belts in cars, …) and number and explanations of falls during winter. The research attempted to analyze different factors that influence activity of elderly during winter conditions. In total the answers from110 subjects were analyzed.

The structure of the questions were:
- Gender and age
- Walkability, balance and general health level
- Activity level

- Factors affecting walkability (slippery, snow, rain, wind, minus degree)
- Usage of safety devices in all modes of transport (bicycle helmet, anti-slip device, seatbelt, boat life jacket, luminous tag, …)
- The relative importance of each type of safety devices
- Occurrence and number of fall during wintertime

An overall hypothesis was that age, health and activity level might correlate with occurrence of fall during wintertime. In a first model a regression analysis was performed with the number of fall without anti-slip device as dependent variable and age, walkability and physical activity level.
Examining first model regarding relation between the number of falls without anti-slip device with health and age factors, did not illustrate a high degree of correlation between dependent and independent variables. Among 108 subjects, 33% had experienced fall during that winter. The analysis showed that experience of fall is not an appropriate variable to be explained by age and health variables.

In a second model the attention was drawn toward the activity level. The aim was to analyze if activity level can be explained by factors such as age, balance level and walkability level. This model displays relatively higher significance ($p<0.05$) compared to the first model.

In a third model, the aim was to test if the relation between age, activity level, and health significantly correlate with the usage of anti-slip devices. The hypothesis was that the use of anti-slip devices is significantly correlated with age group and health conditions. This model reveals weaker results. Therefore age and health do not offer a significant variance in the usage of anti-slip device. Does it suggest that usage of safety devices is independent of health and age.

Besides the three models described above, many other relations were analyzed between health and age of respondents and their usage of safety devices. The results did not show significant correlation between usage of anti-slip devices and age or walking and balance. It seems that using safety devices is an accepted norm among subjects regardless of their health conditions. A conclusion is that occurrence of fall and use of anti-slip device cannot be explained by age, walkability and balance ability with strong significance. On the other hand, the level of physical activity is indicated to correlate with age and walkability.

Discussions

A further step in this research can be to focus on the impact of gender in using safety devices. In this regard, a multi-regression model was conducted to study the impact of gender that did not generate clear interpretable results and hence is not presented in this paper.

There still is a lack of knowledge concerning pedestrians' perceptions of safety aspects related to the use of anti-slip devices during community walking. A case study aimed to explore pedestrians perceptions of walking safety, balance, slipping risk, priority for own use and subjective criteria for a well functioning anti-slip device has been made. Results indicate that both anti-slip properties and balance enabling properties of the device need to be considered for safe community walking. (Gard *et al*, 2018)

Since not everyone is not using anti-slip devices all the time the environment should be adopted to all users. We need to rethink the definition of the concept 'design for all' in the context of all weather conditions. A new integrated and multi-dimensional framework for understanding the accessible built environments for all, in all weather conditions, has to be developed. A framework should be developed by integrating three different disciplines urban design, social and behavioral studies, and the maintenance aspects (Pasupuleti and Berggård, 2014).

Issues of accessibility are more evident in the Nordic countries with long winters and where public spaces, streets and open spaces are covered with snow and ice for several months of the year. Based on preliminary findings, we can conclude that such a framework can been useful to study different environments and how people try to adapt to such changes in weather conditions by using anti-slip devices, kick sledges etc. More importantly, it reveals that the designers should take a good account of site considerations while planning for design for all in all weather conditions.

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