

# Ascertain the percentage of on Stairs or Escalators - A Survey in Australia

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## Abstract

**Introduction:** The Australian Institute of Health and Welfare, publication titled; 'Injury in Australia: falls' states that in 2017–18, 42% of hospitalized injury cases were due to falls, and 40% of injury deaths were due to falls. In Melbourne City, at various stations, there are extremely long escalators, and alarmingly, one sign previously displayed states there are approximately 2-3 falls/week on train station escalators.

**Objectives:** The aim of the survey was to ascertain the percentage of people who've fallen downstairs and escalators.

**Methods:** Distribution of a general convenience survey [n=125] was performed to ascertain the percentage of people who've fallen downstairs and escalators. Additional questions related to rain, high-risk footwear, poor lighting, and how many falls they have had. Following that, regardless of whether or not they'd had a fall, questions then focused on whether they had a fear of falling and whether they felt uncomfortable around crowds on stairs or escalators.

**Results and Discussion:** Completed survey forms were eighty-two in total. 29% of people had fallen, with 16% of those people indicating rain, 16% in either high heels or thongs, while 25% indicated poor visibility. Of those who had fallen, the estimate of the number of falls down stairs or escalators ranged from 1–20, with the average being three falls. 39% of respondents, irrespective of whether or not they had fallen, had fear, while 43% felt uncomfortable around crowds.

**Conclusion:** Falls downstairs or escalators are relatively common, in addition to a large percentage of people having fear or feeling uncomfortable.

**Keywords:** Accidental falls, Stair climbing, Escalators.

## Introduction / Review of the Literature

In Australia, Safe Work Australia documents the number of slips, trips, and falls in workplaces, and this includes, amongst other injuries, falls downstairs and escalators [Safe Work Australia, accessed 17/9/21].

The World Health Organisation [WHO] published a news report titled; Step Safely in 2021 [World Health Organisation, 2021]. This technical package includes strategies for preventing and managing falls across the life course. It discusses stairs and age as risk factors. Existing frameworks and policies that relate to building codes for staircases are detailed. It mentions prevention strategies such as handrail installation.

More recently, there is a wealth of research on falls in general related to elderly, at-risk persons, or persons with specific health conditions. Soh and colleagues report on the profile of Personal Alert Victoria clients who fall [Soh et al. 2018]. Falls in this group of older people most frequently activated personal response systems (n = 16,822; 44%). Ayton and colleagues also reported on the perceptions of falls and fall prevention interventions among Personal Alert Victoria clients. Usage of a semi-structured telephone interview (n = 12) and a client survey with open and closed-ended questions (n = 46) [Ayton et al. 2018] explored falls experience, risk factors, participation in falls prevention interventions, and access to health and other services. Barriers included poor health, time restrictions, and poor health literacy.

There was also the perception that fall prevention interventions were costly with a long wait time, and some people had difficulty with transport to attend. Some respondents felt that falls were inevitable and that fall prevention interventions were irrelevant. Enablers focused on broader health and well-being benefits, rehabilitation incorporating falls prevention and increased awareness of risk.

Sullivan and colleagues performed a systematic review and meta-analysis on falls in hospital patients with acquired communication disabilities secondary to stroke. A total of 15 studies met inclusion criteria. The meta-analysis included 11 studies. People with communication disabilities had an increased rate of falls in hospitals in three studies [Sullivan, Harding, et al. 2020]. Sullivan and Badros previously had researched that leadership nurses can decrease fall frequency and subsequent injuries that result by instigating falls prevention programs, and they describe one hospital program [Sullivan and Badros, 1999].

Yang and colleagues report that hip fracture risk increases due to landing on the hip [Yang, Mackey, et al. 2016]. Examining contributing factors in long-term care facilities, the authors found a higher odds of a hip impact with falls initially directed forward or sideways compared to backward falls. For people with dependent Activities of Daily Living (ADL) performance, hip impact was more common.

Yang and colleagues studied the videos of real-life falls in long-term patients and reported that 1% to 2% of falls result in hip fracture in older adults [Yang, Komisar, et al. 2020]. Choi and colleagues state that falls cause 95% of hip and wrist fractures and 60% of head injuries in older adults [Choi et al. 2015]. Nasiri Sarvi and Luo state that osteoporotic hip fracture, mostly induced in falls among the elderly, is globally a prime health burden [Nasiri Sarvi and Luo, 2017].

Schonnop and colleagues studied videos of 227 falls involving 133 residents over 39 months [Schonnop et al. 2013]. They reported that head impact occurred in 37% of falls and that hand impact occurred in 74% of falls. They concluded that in forward falls, the head impact often occurred in older adults living in long-term care facilities.

If you consider more carefully the literature about stairs, there are also various publications focusing on stairs more specifically. Locomotion on stairs is a challenging and hazardous everyday activity for older individuals [Startzell et al. 2000]. There is a long history of research publications on falls on stairs, including these three references. While the titles and authors are listed online, the historical abstracts were unavailable [Raymond 1953; Svanström 1974; Hein and Schulz, 1983].

Hemenway and authors, in 1989, surveyed a stratified random sample of Austrian residents. Of 55,000 respondents, 147 reported an injury on stairs last year that caused activity restriction for at least 24 hours [Hemenway et al. 1994].

There are various studies that, not only in addition to documenting rates of falls but these studies have also focused on reviewing the safety aspects of hazards associated with stairs.

Wyatt and authors reported on fatal falls downstairs in south-east Scotland prospectively collecting data from 1992 to 1997 [Wyatt et al. 1999]. Deaths resulting from falling downstairs were reported for 51 individuals with mean age [68.9 years], demonstrating that stairs represent a significant hazard for elderly persons. When considering safety aspects, attention should be given to the safety aspects of the stairs and also whether the person can negotiate the stairs safely.

Startzell and authors reviewed older people and stair negotiation and found that stair falls account for more than 10% of fatal fall accidents [Startzell et al. 2000]. Their review explores factors associated with safety and difficulty and additional interventions that could decrease risk.

In 1995 in the UK, falls on stairs resulted in 497 deaths [Roys, 2001], and hence stairs prove to be one of the most hazardous locations in buildings. The authors also report that falling forwards results in the most major injuries.

Authors Blanchet and Edwards, in 2018, published a manuscript that focused on assessing

environmental hazards for falls on stairs [Blanchet and Edwards, 2018]. They included publications evaluating environmental hazard checklists for stairs/steps in homes of older adults ( $\geq 65$  years). They included a pool of 136 published articles and four checklists from the grey literature. They found there was a lack of standard definitions and objective criteria for assessing environmental hazards for falls. Considering more specifically escalators, a search of Pubmed using search terms ‘escalators AND falls’ retrieved 32 records, 10 of which had the word escalator in the article’s title.

The articles assessed causal and risk factors related to visual illusions [Cohn and Lasley, 1990], alcohol [Murphy and Moore, 1992], walking while on the escalator [Murphy and Moore, 1992], children riding the escalators improperly [Platt et al. 1997], falls in children on escalators [McGeehan et al. 2006] and falls in people aged 65 and over while on an escalator [O’Neil et al. 2008].

Larue and colleagues [Larue et al. 2021] published a manuscript titled; Safe trip: Factors contributing to slip, trip, and fall risk at train stations. They investigated 1247 train and station incidents in two Australian jurisdictions. An extension of the project to understand better the contributing factors, involved 40 participants wearing an eye tracker at stations and on trains. The authors found that while searching for information, there may be a disconnect between needed information and information provided, leading to distraction and increased risky behavior.

The Australian Institute of Health and Welfare, in a publication, titled; ‘Injury in Australia: falls’ it states that in 2017–18, 42% of hospitalized injury cases were due to falls, and 40% of injury deaths were due to falls [Australian Institute of Health and Welfare, 2021]. They also stated that hospitalized falls were more likely to occur in the elderly and the home.

In Melbourne City, at various platforms, there are extremely long escalators, and alarmingly, one sign previously displayed states there were approximately 2-3 falls/week hence on train station escalators. Parliament Station states that the escalators are the longest in the southern hemisphere according to Metro trains in 2018; hence these have the highest risk of falls. A report also looked at 600 escalator-related incident reports in the past nine years. The analysis showed that half of the fall-related incidents are people falling backward while traveling upwards [Mills, ABC Radio Melbourne]. 39% of incidents involve people carrying bags. Signage that the author reviewed online included, ‘Get a grip, don’t slip’ and ‘please hold the handrail when using escalators.’

This project included a short survey with a small sample size designed to collect information related to the frequency of falls down stairs or escalators, precipitating or causal factors, and how people generally felt around stairs or escalators.

## Methods

Distribution of a general convenience survey [n=125] was performed to ascertain the percentage of people who’ve fallen downstairs or down escalators. Additional questions related to rain, high-risk footwear, poor lighting, and how many falls they have had. Following on from that, regardless of whether or not they’d had a fall, questions then focused on whether they had a fear of falling and whether they felt uncomfortable around crowds on stairs or escalators. An abstract and e-poster by Hilton featured at the Virtual Pre-Conference Global Injury Prevention Showcase [Hilton, Mar 2021 a]. The Injury Prevention Journal subsequently published the abstract [Hilton, Mar 2021 b].

## The Questionnaire is below

### Questionnaire Re; Falls on Stairs or Escalators

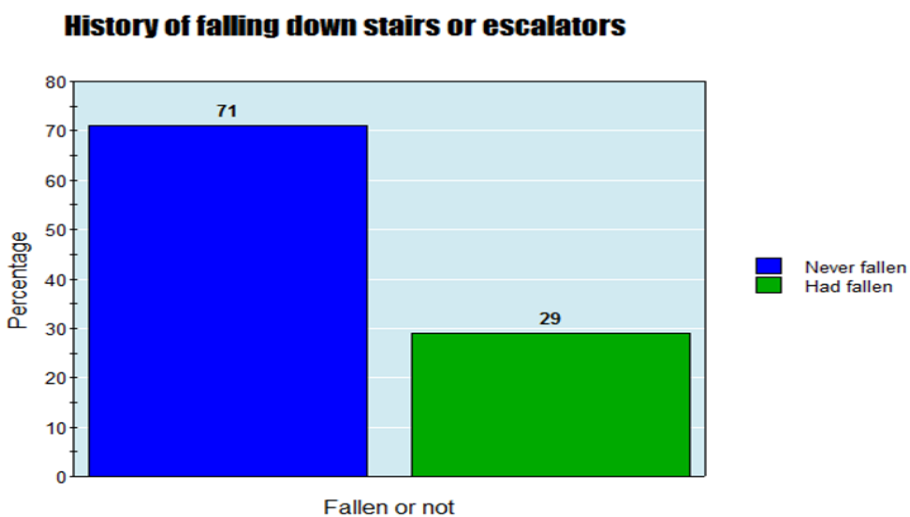
1. Have you ever had a fall down an escalator or a set of stairs? Y N. If you answered YES to the above question, answer questions 2-6, then 7-10 otherwise; if you answered NO, proceed to question 7.
2. If you answered yes, but have had more than one fall, about your most recent fall, was it wet or raining

- at the time? Y N
3. If you answered yes but have had more than one fall, about your most recent fall, were you in highheels or thongs? Y N
  4. If you answered yes but have had more than one fall, about your most recent fall, was there poor visibility? Y N
  5. If you answered yes, have you had more than one fall on an escalator or a set of stairs? Y N
  6. Please indicate how many falls you have had on an escalator or a set of stairs? [estimate the number of falls you've had] \_\_
- Irrespective of whether or not you've had a fall,
7. do you ever have a fear of falling on stairs or escalators? Y N
  8. Do you feel uncomfortable on escalators or stairs if they are crowded [e.g., after festivals, concerts, or around school groups]? Y N
  9. Please indicate your age group [circle the correct answer] 20-29 yrs, 30-39 yrs, 40-49 yrs, 50-59 yrs, older than 60 yrs.
  10. Please indicate your gender [circle the correct answer] male, female

**Results**

There were eighty-two survey forms for analysis. 29% of people had fallen, with 16% of those people indicating rain, 16% in either high heels or thongs, while 25% indicated poor visibility. Of those who had fallen, the estimate of the number of falls down stairs or escalators ranged from 1–20, with the average being three falls. 39% of respondents, irrespective of whether or not they had fallen, had a fear of falling, while 43% felt uncomfortable around crowds. The age groups were 33% [20-29 yrs], 8.0% [30-39 yrs], 17% [40-49 yrs], 19% [50-59 yrs] and 23% [older than 60 yrs].

Figure 1 shows the percentage of persons surveyed who had a history of falling downstairs or down escalators.



**Figure 1**

Figure 2 shows the percentage of persons surveyed who fear falling downstairs or escalators irrespective of whether or not they have ever fallen.

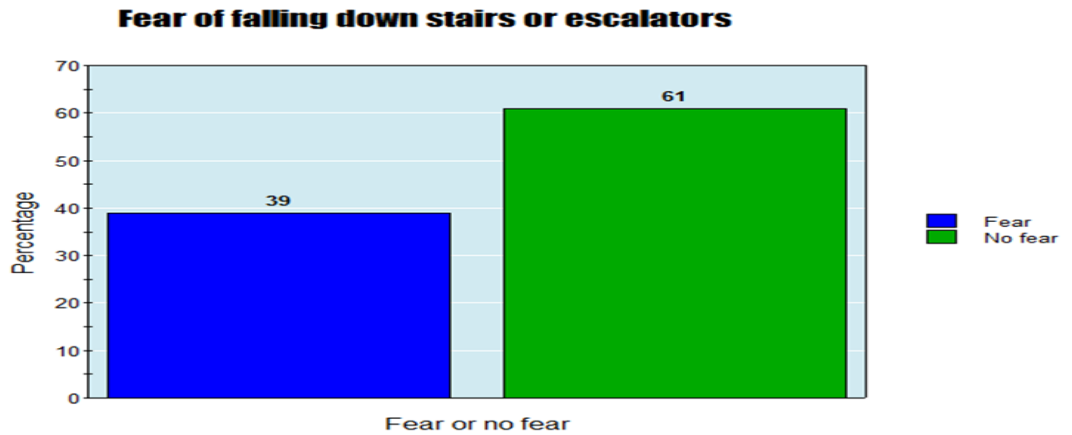


Figure 2

Figure 3 shows the percentage of persons surveyed who were uncomfortable or not uncomfortable around crowds when on stairs or escalators.

**Uncomfortable or not around crowds on stairs or escalators**

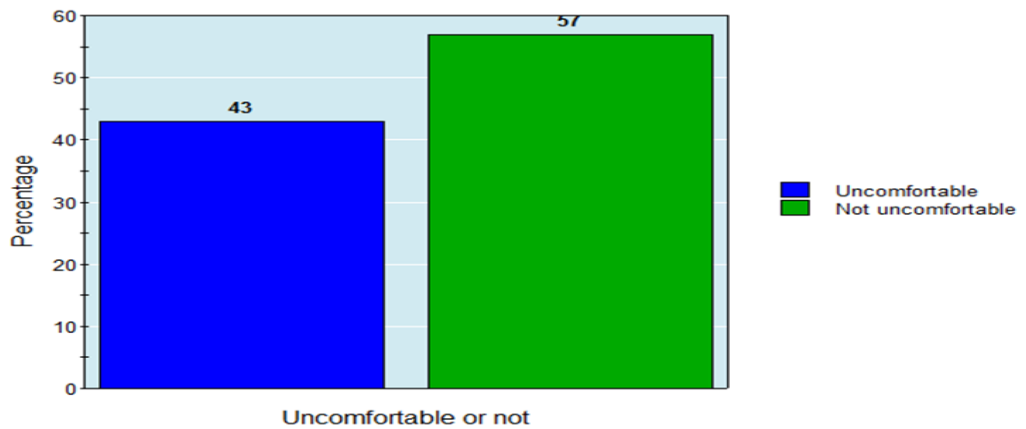
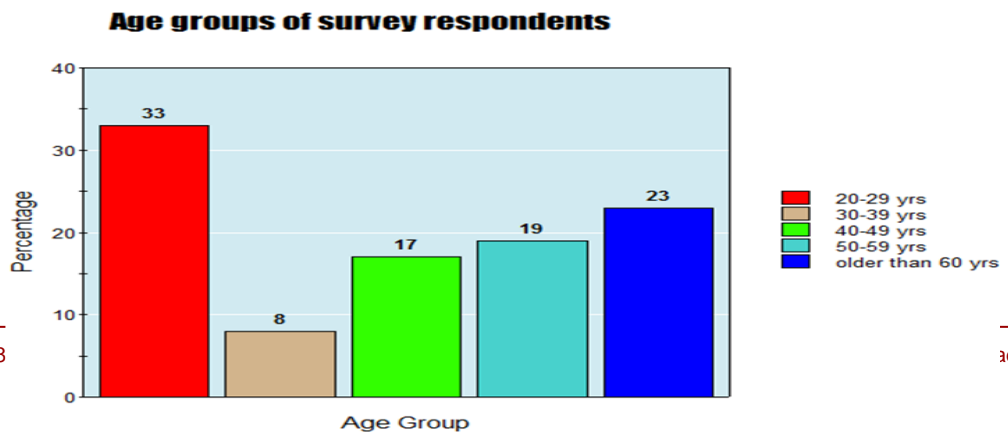


Figure 3

Figure 4 shows the age groups of the people surveyed.



**Figure 4****Discussion**

While this survey included just a small number of respondents, it shows that fall downstairs, and escalators do occur reasonably often. There is considerable literature focusing specifically on stairway falls, as was mentioned in the introduction. Most of the manuscripts previously mentioned document fall rates, comorbidities, and associated injuries. Publications documenting functional assessment of stair negotiation are below. Van Iersel and colleagues [van Iersel et al. 2003] reported whether functional assessment scales include an item on stair negotiation, and 43 of the 92 identified scales did so. The scales did not test the validity of this item separately. The authors considered the patient's physical ability to negotiate stairs as important and safety and time changes in ability.

Hamel and Cavanagh performed a cross-sectional study at the Center for Locomotion Studies, The Pennsylvania State University [Hamel and Cavanagh, 2004]. Thirty-two community-dwelling adults completed a stair self-efficacy (SSE) test. Those with a lower score went up and downstairs slower, were more likely to use the handrail, and were closer to the rail. In summary, they conclude that risk-taking propensity during stair use in older adults is determined in a key way by confidence.

Lee and Chou assessed balance control during stair negotiation in older adults [Lee and Chou, 2007]. A significantly greater medial inclination angle during the stair-to-floor transition phase occurred in elderly adults than young adults. Body sway may be compromised as a result of age-related degenerations in the elderly. This may also contribute to an increased risk of falling.

Author Verghese and colleagues reported the self-reported difficulty in climbing up or downstairs in nondisabled elderly [Verghese et al. 2008]. The cross-sectional survey included three hundred and ten older adults without disability or dementia in the community. The findings were that 140 reported difficulties in climbing up and 83 in climbing downstairs, while 59 people had difficulty climbing both up and down.

Herman and colleagues in 2009 found the Dynamic Gait Index to be appropriate in healthy older adults to determine gait, balance, and fall risk. [Herman et al. 2009].

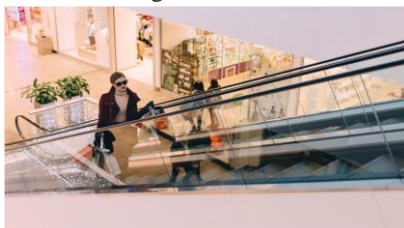
Author Kim assessed the prevention of falls during stairway descent in older adults and found a lighting intervention contributed to increased confidence [Kim, 2009].

Walking downstairs poses a perceptual-motor challenge [Rosenbaum, 2009]. This author videotaped 147 people as they descended a staircase. They found that people in the middle of the stair on average generally looked down every third step [hence vision controlled]. Towards the bottom of the staircase, they looked down with high probability on or around the fourth step [mostly memory controlled].

There are numerous physical activity programs designed to prevent falls. These include HealthySteps in Motion [Pennsylvania Department of Aging, accessed 2021]; healthy steps for older adults [National Council on Aging, 2021]; Stay on your Feet ® [Injury Matters, accessed 4/7/21]; STEADI – Stopping Elderly Accidents, Deaths and, Injuries [Centers for Disease Control and Prevention, 2020]; Evidence-Based Program: A Matter of Balance [National Council on Aging, 2020]; the Tai Chi for Health and Falls Prevention Program [Exercise Medicine Australia, accessed 4/7/21] and Stepping on [Mahoney, 2015].

If you consider the signage in Melbourne and the analysis done by Metro trains, it shows that falls often involve persons carrying bags [Mills, ABC Radio Melbourne. 2018]. If you consider this image below, the lady holds seven or eight designer clothing, shoe, or accessory bags while traveling up the escalators and cannot hold onto the railing. This causes a considerable risk, and one suggestion may be for people on a mission for many designer outfits, whether for conference, resort, beach, or street clothes, they should use a lift/elevator to ensure safety. Not that these shopping bags are generally weighty and carrying

weight up and down escalators [for example, a dumbbell set] without holding on, I would at a guess suggest this may pose considerably more increased risk without providing a reference to this at all. This lady is also traveling upwards. This was shown in the report to be associated with most falls, with people falling backward instead of people falling when traveling down the escalators.



**Photograph 1: Downloaded from Unsplash – See Acknowledgments**

### Research Gap and Conclusion

Falls down stairs or escalators are relatively common, in addition to a large percentage of people having fear or feeling uncomfortable. Crowd control at events should include supervisors on stairs or near escalators. Signage is of utmost importance.

### Acknowledgments

Acknowledgments; Free stocks for the Unsplash photograph. Olsztyn, Poland - Published December 31, 2016. Free to use under the Unsplash License.

### Additional Information Funding

There was no funding source.

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