

Lighting and falls on stairs in the homes of older people with sight loss

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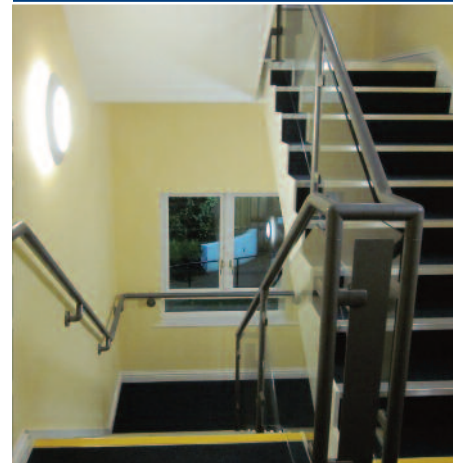
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The publication summarises the findings of a Pocklington-funded research study carried out by Dr Aliah Shaheen, Mr Alexander Sourlas, Dr Khim Horton, Professor David Ewins, Mr David Gould and Dr Salim Ghoussayni at the University of Surrey and Mr Christopher McLean at the Royal Surrey County Hospital.

The research explored the effects of varying lighting conditions on the movement of older people with sight loss as they climb up and down stairs, and in particular the clearance, or distance between their feet and the steps. Clearance, and variation in clearance from one step to another, have been associated with risk of falling.

Summary findings

- Participants were more likely to descend stairs more slowly in dimmer lighting conditions; this is an indication of an increased fear of falling.
- Under dimmer lighting conditions, participants increased their hip joint flexion – moving the thigh upwards – but this movement did not result in an increased clearance between the foot and the step edge.
- Changing the intensity of lighting did not have an effect on the clearance, or distance between the participants' feet and the edge of steps; nor did it affect the variation or changes in clearance from one step to another.
- Although appropriate lighting has been identified as an important factor for the safe use of stairs, an intervention to improve lighting alone is unlikely to reduce the risk of falling in older people with sight loss.
- Interventions to improve muscle strength and balance are likely to be important in reducing the risk of falls.



Background

The consequences of falls in older people cause a considerable social and economic load on society. Using stairs is one of the most challenging activities older people encounter on a daily basis. Previous research has shown that stair-related injuries in people aged 75 and older are five times greater than those in young people. In addition, these injuries can lead to hospitalisation in older people, impacting on their quality of life and independence.

There are a number of factors that contribute to the difficulty experienced by older people when using stairs. Increased sight loss associated with ageing has been identified as one of the main contributors to the higher risk of falling in older people; poor lighting is also an important factor leading to a higher risk of falling in this group of people.

Foot clearance can be defined as the distance between the foot and the stair edge as the person moves up and down the stairs. Reduced clearance has been linked to a greater risk of falling, as an incorrect estimation of where the foot is in relation to the step edge can result in the foot catching on the edge and possibly a fall. Similarly, a variation in foot clearance when moving from one step to the next has also been associated with the risk of falling. Previous studies found that older people change their foot clearance more frequently than younger people, and that older frequent fallers change their foot clearance more frequently than older people with no history of falls.

Research aims

The aim of the study was to explore the effects of a variety of lighting conditions on the movement of older people with sight loss when using stairs.

The study aimed to do the following:

- Establish the differences in the performance of older people when using stairs under optimal, sub-optimal, typical domestic and increased lighting intensity conditions
- Establish the differences in the performance of older people under directed (concentrated on a specific point) versus distributed (spread out over a larger area) lighting conditions

Research methods

Twelve participants (eight males and four females) with an average age of 77 years took part in the study. All participants were aged 60 or over with sight loss of 6/18 or worse and were able to climb up and down the stairs without the use of handrails.

Laboratory stairs and lighting

Participants went up and down a custom-designed staircase of seven steps in the Human Movement Laboratory at the University of Surrey. The staircase was made with rails on one side and a wall on the other to reproduce a home environment.

A series of four 100W lamps were used at the top landing of the stairs and 200W lamp was used at the bottom landing. A dimmer switch was used to allow adjustments to the lighting level.

How movement was measured

Participants climbed up and down the stairs at their usual speed. The lighting conditions were changed after each set of stair climbing. This was repeated until participants went up and down the stairs at least three times under each lighting condition in a randomised order.

Cameras were used that emit infra-red light to track the movements of reflective balls (markers), calculating their positions in three-dimensions. The markers were attached to participants' lower bodies in order to capture movement measurements. The positions of the stair edges were also reconstructed to allow calculations of the distance between the participant's foot and the stair edge as the participant moved up and down the stairs.

How this was used to assess performance

To assess older people's performance in using the stairs, a number of movement parameters were measured and calculated.

- Clearance: the distance between the foot and the edge of the step
- Clearance variation: the changes in clearance as people moved from one step to the next



- Time and distance measures of stair use such as speed, the number of steps per minute and the distance covered by each step
- Joint rotations: the rotations of the hip, knee and ankle joints as participants went up and down the stairs
- Questionnaires were used to assess the participants' views on the lighting of the staircase and their perceptions of safety under the different lighting conditions

Does improved lighting affect the risk of falling?

Previous studies have found links between clearance and variation in clearance and the risk of falling. Clearance measures are often used to assess performance during stair use.

The results of this study showed that there were no statistically significant differences in clearance measures under the different lighting conditions used in the study. This means that the better lighting conditions did not affect the participants' risk of falling.

What are the other effects of changing lighting conditions?

It was interesting to find that participants reduced their speed of movement in dimmer lighting conditions, although this is not a measure of safety and is more likely to be indicative of an increased fear of falling in poor lighting.

In general, the movement of the hip, knee and ankle joints were the same under the different lighting conditions. However, there were some indications that participants increased the flexion of the hip joint under the dimmer lighting conditions, i.e. moving the thigh further away from the ground. It is possible that this was an attempt to increase the distance between the foot and the stair edge and therefore reduce the risk of falling. However, this change in the participants' hip movement did not result in an increase in clearance, possibly because of limited muscle strength.

Why are older people unable to move in a safer way?

In addition to sight loss, older people also have weaker muscles and less flexibility in their joints which may have made it difficult for them to use safer stepping movements when using the stairs. This probably contributes to the greater variation in their movements and an inability to use safer movement behaviour when using the stairs.

Conclusions

The results of the study suggest that changing lighting conditions alone is unlikely to reduce the risk of falling in older people with sight loss. It is suggested that future work to reduce risk in this area also focusses on improving the fitness of older people, e.g. through rehabilitation, to allow them to use safer movements that reduce their risk of falling

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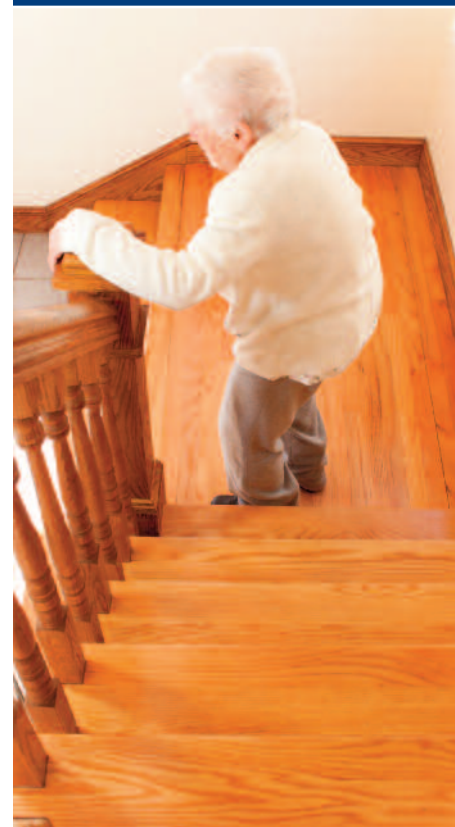
How to obtain further information

This paper is a brief summary of the report "A study into domestic stair lighting and its effect on the risk of falling for the visually impaired" by Dr Aliah Shaheen and Mr Alexander Sourlas of the Centre for Biomedical Engineering, Department for Mechanical Engineering Sciences at the University of Surrey, which is available from:

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In this publication, the terms 'visually impaired people', 'blind and partially sighted people' and 'people with sight loss' are used interchangeably.



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