

## Smart Grab Bars: A Potential Initiative to Encourage Bath Grab Bar Use in Community-Dwelling Older Adults

### INTRODUCTION

Falls among seniors are a growing concern, as they are among the leading causes of injuries, hospitalizations and functional disabilities in this population. Many fall prevention programs promote the use of bathroom aids, including bath grab bars, to minimize the effects of many age-related deficits, such as impaired balance, coordination, range of motion, and muscular strength and endurance, and to allow for safe and independent bathing among the elderly. Although studies report that community-dwelling individuals commonly own grab bars, some results suggest that they may not always use them. In fact, in one study, only one participant reported using the grab bars present at the time of a fall; most participants did not use grab bars because they felt awkward or unsafe to use. Many participants in that same study reported relying on other structures (for example, soap dishes, bath rims or curtain rods). This can be a hazardous practice, as these structures are not intended for such a purpose and may not be able to withstand the person's weight. Other initiatives must be put in place to encourage grab bar use in order to decrease the risk of falls in this population.

### Literature review

Lately, technology and artificial intelligence have been used to make living environments safer and more responsive to the health needs of seniors. Several researchers have used different means of artificial intelligence to monitor the daily activities of seniors. Computerized prompts have been shown to improve the performance of certain tasks in

individuals with dementia. In one study, the computer provided reminders (only when necessary) of the sequence of steps involved in handwashing, and continually monitored the user's progress. The pre-recorded verbal prompts (male voice) decreased the overall number of interactions required with the caregiver. Another study compared verbal with audiovisual prompts. Results showed little difference in efficacy between the number of handwashing steps completed with assistance from audiovisual prompts and the number completed with verbal prompts; however, audiovisual prompts resulted in statistically fewer caregiver interactions. Most of the research has been done with people suffering from different levels of dementia. But such an approach could potentially be useful to community-dwelling seniors. From this hypothesis stems the idea for a smart grab bar. This grab bar has been adapted to provide cues to encourage its use during bathtub transfers. The bars provide a visual cue, an auditory cue or an audiovisual combination of cues activated by a motion detector system to elicit grab bar use.

### Purpose of the study

This study sought to determine the ability of the smart grab bar to increase grab bar use among community-dwelling seniors. More specifically, it assessed the effects of an auditory cue, a visual cue and the combination of both cues on the frequency of use of a grab bar in older adults; recorded the reactions of community-dwelling seniors to these cues; identified any areas for improvement of the prototype; and further explored the potential use of the smart grab bar.

## METHODOLOGY

A total of 86 healthy people aged over 60 were recruited. Participants were randomly divided into four groups: one control group (n=11) and three experimental groups (n=25 each). The control group tested only the no-cue condition. Each experimental subgroup A, B and C tested two different cueing conditions respectively: the no-cue and one of the proposed cues (visual, auditory or audiovisual combination). After giving informed consent, participants were asked to provide information and complete a battery of tests, including socio-demographic characteristics; self-perceived health status; the Falls Behavioural Scale (FaB) for Older People; patterns and difficulties with independent bathing; and utilization and acceptability of bathroom aids.

Participants were asked to approach and climb into the bathtub, stand for a few seconds and climb out of the tub. Instructions were to get in and out of the tub in any manner possible using the grab bars or other structures around the tub, if necessary. Each participant completed 40 trials (enter, stand and exit the tub). Forty transfers were completed without any cues for the control group. For the experimental groups, no cues were presented during the first five transfers to establish a baseline for each participant. During the next 30 trials, cues were presented randomly 25 to 30 per cent of the time. During the last 5 trials, no cues were presented to serve as comparison with the first 5 trials, in order to see any potential learning effects. A camera videotaped the participants as they completed the bathtub trials to record their behaviour as cues were presented. After completing the last trial, participants rated the cueing condition for awareness and helpfulness on 5-point Likert scales. Video data were coded to determine the frequency of grab bar use as well as the use of other surrounding structures (bath rim, wall, and so on). Basic descriptive statistics were used to summarize participant demographic and health characteristics.

## RESEARCH FINDINGS

### Effects of cueing on bar use

The first specific objective of this project was to assess the effects of an auditory cue, a visual cue and a combination of both cues on the frequency of use of a grab bar in older adults. As previously mentioned, no cues were presented

during all 40 transfers recorded with the control group. With the control group, grab bars were used in 28 per cent of the 440 transfers recorded, while other structures were used 0.7 per cent of the time. For the experimental groups, no cues were presented during the first five transfers to establish a baseline for each participant and for each group. During these 5 transfers, grab bars were used in only 23 per cent of the recorded transfers, while other structures were used 17 per cent of the time. Thus, results were similar to those of the control group for grab bar use (23 per cent, versus 28 per cent), although the use of other structures was very limited in the control group (17 per cent, versus 0.7 per cent).

During the middle 30 trials, cues were presented randomly 32 per cent of the time. With the experimental groups, grab bar use increased from 23 per cent to 61 per cent and other structure use decreased from 17 per cent to 3 per cent. The combination of audiovisual cueing generated the highest frequency of bar use (76 per cent), followed by sound (60 per cent) and lights (48 per cent). In the control group, grab bars were used 28 per cent of the time, and no other structures were used in the middle 30 transfers. The use of grab bars was significantly higher in the experimental groups than in the control group.

No cues were presented during the last 5 transfers with the experimental groups. Grab bar use was 60 per cent and other structure use was 5 per cent. Again, these numbers were quite different from the ones obtained with the control group where, in the last transfers, grab bars were used 27 per cent of the time. This was considerably much lower than for the experimental groups. However, there is little difference between both groups regarding the use of other structures.

When comparing the pre-cue transfers (first 5) and post-cue transfers (last 5), the use of grab bars increased by 37 per cent in group A, by 38 per cent in group B and by 39 per cent in group C. Overall grab bar use increased by 37 per cent. Furthermore, the use of other structures decreased by 19 per cent in group A, by 8 per cent in group B and by 9 per cent in group C. Overall other structure use decreased by 12 per cent. Interestingly, there was no change in the use of grab bars within the control group. Thus, the results suggest that the increase in grab bar use and consequently the decrease in other structure use were due to the presence of cues in the experimental group.

## Appreciation of cues

The second specific objective of the project was to record the reactions of community-dwelling seniors to these cues. The majority of the 69 participants noticed the visual and/or auditory cues during their transfers in and out of the tub. Sixty per cent of the participants in the visual cue group did not react to the cues or ignored the cues, compared to 35 per cent of participants in the auditory cue group and 22 per cent in the audiovisual combination group. Although the participants preferred the visual cue to the auditory cue, the latter was more effective in increasing grab bar use.

As most participants felt they may use grab bars in the future, follow-up interviews were conducted 12 months after the initial interviews with the experimental groups to determine if participants had purchased grab bars following the experience. These interviews were completed with 53 of the 69 participants. Only 7 participants had purchased grab bars since the experiment. Interestingly, 18 participants reported having recommended grab bars to someone else. These recommendations were made mainly to other family members, as well as colleagues in organizations and friends.

## CONCLUSION

The smart grab bar was developed to prompt older adults to use grab bars. A second prototype was tested with 80 older adults. The results suggest that the smart grab bar did increase older adults' use of grab bars by 39 per cent and that the effect was maintained after removal of the cues. Although participants preferred the visual cue, the auditory cue appears to have been more effective in eliciting the desired response (grab bar use). As previously reported, the presence of grab bars increased older adults' sense of security, yet participants were still leery about purchasing and installing grab bars.

In closing, results suggest that artificial intelligence may be an interesting avenue to increase grab bar use in community-dwelling older adults. Although the preliminary results are encouraging, more research is needed with various clienteles to determine the clinical usefulness of the smart grab bar.

## AREAS FOR FUTURE RESEARCH

- Trials with various clienteles, such as clients with dementia or rehabilitation clients.
- Studies to determine how long the cues should be presented to ensure a continuous use of grab bars (automatic response).
- Studies to determine how long the learning effect would last once cue is removed.
- Studies to determine if clients would stop responding to cues, as well as when this would occur, and to find potential solutions to overcome this.

## Research Highlight

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