

# **ANALYSIS OF THE EFFECT OF A REAR WALL GRAB BAR CONFIGURATION ON THE FALL RISK ASSOCIATED WITH TOILET TRANSFERS IN OLDER ADULTS WITH MOBILITY IMPAIRMENT.**

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## **ABSTRACT**

Twenty-three older adults were recruited for a two-hour in-home study. As a part of the process, the researchers asked questions regarding their process for toilet transfer, asked to provide ratings about toilet transfer in terms of their levels of confidence, difficulty, and how much more challenging it has become with age and with their permission, took photographs of their toilets. The objective of this project is to conduct a secondary analysis of this photographic and interview data to test our hypothesis that the presence of a grab bar on the rear wall prompted older adults to stretch, in order to reach for it across the toilet, consequently increasing the fall risk. The analysis showed us that the presence of a rear wall grab bar, though perceived to ease transfers, might actually prove more challenging to perform transfers with. The rear wall grab bar might only provide an illusion of safety. The results from this analysis may help guide future research undertakings to understand the relationship between a grab bar's configuration and the risk of falling.

## **INTRODUCTION**

People aged 65 years and older represented 14.1% of the entire population in the United States in 2013 and that percentage is expected to increase to 21.7% by the year 2040 (Aging, n.d.). Concurrent with the aging process, abilities of a person to perform crucial activities of mobility and health care gradually diminish (Seton & Bridge, 2006). According to the CDC, falls are the leading cause of injury related death and 80% of falls experienced by seniors are in the toilet (CDC, n.d.). Of all injuries occurring in

the bathroom, falls account for about 81.1% (CDC, 2011).

Falls can diminish function by causing injury, activity limitations, fear of falling, and loss of mobility (Risk, 1992). According to the University of California's Disability Statistics Centre (n.d.), 25% of Americans use wheelchairs to assist with mobility. A majority of Wheeled Mobility Device (WMD) users have impaired lower limb function and are not able to perform complex tasks such as transferring oneself from a wheelchair onto another surface or vice-versa independently (Toro, Koontz, & Cooper, 2013). They rely on external help such as, from another person or an assistive device to perform the transfer. Of these two kinds of assistance, the presence of an assistive device can be more empowering to older adults for transferring independently during their bathroom activities.

Regarding toileting, there are several environmental barriers which can lead to a fall and few facilitators that can assist in reducing possibility of a fall. Bathroom aids such as grab bars when installed and used appropriately can enable safe and independent transfers among seniors (Axtell & Yausda, 1993; Tideiksaar, 1997). Different approaches have been used by researchers to improve usage of grab bars and consequently reduce falls in the toilet. Researchers have studied the relationship between physical characteristics of grab bars such as its shape (Xiang, 2013) and improving usage. Other studies incorporated technology into grab bars so that it provided audio and/or visual cues to influence seniors into using them for fall prevention (Guitard, Sveistrup, Fahim, & Leonard, 2013). Regardless of the materials, design or presence of embedded technology, little literature exists about how the positioning of the grab bars around the toilet affects possibilities of falls.

Of the research studies which explored the link between placement of grab bars and fall rates, a few dealt with studying the relationship between the height, location and usage of grab bars (Jerome, 2013; Kulich, Bass, & Koontz, 2015; Toro et al., 2013). A few others compared different configurations of grab bars to identify if a certain configuration was more effective than others (Guitard, Sveistrup, Edwards, & Lockett, 2011; Sveistrup, Lockett, Edwards, & Aminzadeh, 2006). However, our literature review revealed little information exists about how grab bar configuration is associated with fall risk.

Older adults aging with a long-term, pre-existing mobility impairment are likely to encounter environmental challenges above and beyond normal aging. Older adults who are long-term wheelchair users are likely long-time users of bathroom grab bars; this population provides the unique opportunity to gain insight on toilet grab bar usage and effectiveness over an extended period of time and identify concerns and unmet support needs regarding falls.

Considering the home environment of older adults who are long-term wheelchair users, we hypothesize that the presence of a grab bar along only the rear wall of the toilet, with insufficient space for the users to park their wheelchairs beside the toilet, can make transferring more difficult and challenging, consequently increasing the risk of falling. In this scenario, the user is forced to park the wheelchair in front of the toilet and in order to grab the bar, tends to stretch to reach across the length of the toilet. This stretching to reach the grab bar could increase the risk of falls thereby making the presence of the rear wall grab bar a major safety concern.

To explore this hypothesis, we conducted a secondary analysis of photo and interview data from an in-home study that assessed current processes and challenges with toilet transfer among older adults with long-term mobility impairment (Gonzalez, Fausset, Foster, Cha, & Fain, 2015). This selection of data on toilet transfer was part of larger study that explored home-based challenges with several activities of daily living. This paper analyzes photos of toilet grab bars and ratings of perceived confidence, difficulty, and challenge with age reported by elderly wheelchair users regarding transfers on and off the toilet. This analysis aims to be an exploratory step of a long term study that will investigate environmental factors that contribute

to slips and falls in the bathroom and suggest appropriate design recommendations.

## METHOD

### Participants

Twenty-three older adults were recruited for this two-hour, in-home study. Data from twenty-two participants are presented here; incomplete data from one participant has been excluded. To be eligible, participants had to be 50 years or older and have a mobility impairment that began prior to age 50. For the purpose of this study, participants were classified as having a mobility impairment if they self-identified with "having serious difficulty walking or climbing stairs". Participants were recruited from the Georgia Tech HomeLab database and through outreach at local disability resource organizations.

### Procedure

Researchers utilized a structured interview guide to administer questions about select home activities in context. Questions regarding their process for toilet transfer took place in each participant's bathroom. With permission of the participant, researchers took photos of any items related to the home challenges and adaptations (e.g., grab bars). Participants were asked to provide ratings about toilet transfer in terms of their levels of confidence, difficulty, and how much more challenging it has become with age. These ratings were on a scale of 1 to 5, with one being the lowest rating (not at all) and 5 being the highest (extremely).

Photographic data of the participants' bathrooms were used to identify the presence or absence of grab bars and stable support surfaces in the vicinity of the toilet and the configuration of grab bars installed. The grab bars installed in the participants' bathroom in the vicinity of the toilet were classified to fit into two categories for the purpose of calculation and analysis. They were "side wall grab bars", which consisted of grab bars, in any orientation, located on the side wall and "rear wall grab bars", which consisted of grab bars, in any orientation, located on the rear wall. Apart from grab bars, the presence of any stable support surfaces such as counters, sinks and ledges were also used in the data analysis. The photographs were also used to determine the presence of other objects on the grab bar, such

as towels, bathing accessories and toiletries, which could hinder safety.

## RESULTS

Of the 22 participants that met the inclusion criteria, 21 participants used wheeled mobility devices (8 manual wheelchairs, 14 powered wheelchairs, 1 scooter; 3 had both manual and powered wheelchairs; 1 used both a scooter and a powered wheelchair). The participant group had 9 males and 12 females with the average age of the participants being  $62.43 \pm 9.15$  years.

Out of the participants, 16 used the toilet and performed transfers and the remaining ( $n=6$ ) did not perform toilet transfers and used other means such as a catheter and/or colostomy bag. 10 participants had at least one grab bar installed on the side wall of the bathroom, in the vicinity of the toilet. Four participants among them had an additional grab bars installed on the rear wall. People who had installed at least one grab bar reported lower levels of difficulty ( $2.00 \pm 1.33$  vs  $2.67 \pm 1.37$ ) and higher levels of confidence ( $4.30 \pm 1.25$  vs  $3.17 \pm 1.17$ ) than people without any grab bars installed. Similarly, people with a stable support surface (e.g., sink, counter tops) in the vicinity of the toilet reported higher levels of confidence ( $3.75 \pm 1.50$  vs  $3.17 \pm 1.17$ ), lower difficulty ( $1.75 \pm 0.96$  vs  $2.67 \pm 1.37$ ) and lower ratings of transfers being more challenging with age ( $3.25 \pm 0.96$  vs  $4.17 \pm 0.98$ ) than people with no grab bars installed.

Senior participants who had articles placed on grab bars (e.g., shampoo bottles, cleaning supplies) reported higher levels of challenge ( $3.14 \pm 1.35$ ) than people who did not have anything placed on the grab bars ( $3.07 \pm 1.49$ ). An interesting result was that participants with a grab bar installed in both the rear wall and side wall reported a higher challenge rating ( $2.50 \pm 1.29$ ) than participants with a grab bar installed only on the side wall ( $2.33 \pm 1.21$ ). Also, participants with a grab bar installed in both rear and side walls reported a lower confidence rating ( $4.25 \pm 1.50$ ) than participants who had installed a grab bar only on the side wall ( $4.33 \pm 1.21$ ), despite their lower difficulty rating ( $1.50 \pm 0.58$  vs  $2.33 \pm 1.63$ ).

## DISCUSSION

The results show that participants with at least one grab bar were more confident in and challenged less by toilet transfers compared to performing the transfer without grab bars installed. This result is in conjunction with the results of multiple research undertakings (Aminzadeh & Edwards, 1998; Tideiksaar, 1997) and highlights the need and importance of the presence of grab bars around toilets to help reduce and prevent fall related accidents. People who had no grab bars installed in the vicinity of their toilets reported in their interviews that performing toilet transfers were difficult.

Comparison of ratings from participants with a stable support surface in the vicinity of the toilet and ratings from people with no grab bars installed displayed a similar result. Presence of a stable support surface increased confidence reduced difficulty and reduced challenge faced. This also emphasizes the importance of the presence of stable support surfaces in the vicinity of the toilet.

The more challenging with age ratings yielded another interesting result. People with grab bars on both walls reported toilet transfer to be more challenging than people with grab bars only on the side wall. These findings indicate that even though participants felt it easier to transfer with bars at two locations, the presence of a grab bar on the rear wall might have made it more challenging for them to use the set up. Possibly, the presence of a grab bar on the rear wall suggested participants to use it while transferring. Because they had to stretch across the length of the toilet they may have reported higher levels of challenge possibly from a fear of falling. This suggests that the rear wall grab bar, though perceived to ease transfers, may actually prove more challenging to perform transfers with. The rear grab bar might only provide an illusion of safety. This perception of challenge during transfer activity could result in a higher perceived fear of falling thus increasing the risk of accidents.

## LIMITATIONS

There are few limitations of the study to note. First, the sample size for the study was small ( $n=22$ ), with rating data only available for 21 people. Furthermore, the data collected using this study was focused on the user's interaction with their entire residence, which resulted in limited in-depth data gathered about the person's toilet environment. For instance, no

questions were specifically asked about the person's preferences and perceptions towards the grab bar configuration currently installed and used by them. The data used for the analysis was grouped in such a manner that different configurations of side wall grab bars, such as vertical, horizontal and diagonal, were grouped into the broader category termed "side wall grab bars". Owing to a small sample size, this analysis did not study the impact of each of the above configurations on the difficulty, challenge and confidence ratings. Our results suggest that more research is required to generalize these findings to the bigger section of the senior population.

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