



Industry Factsheet

Effectiveness of grabrail orientations during the sit-to-stand transfer

PEER
REVIEWED

Purpose

The purpose of this factsheet is to assist service providers and tradespeople with the installation of grabrails in the homes of older adults and people with disabilities. It summarises available information about the effects of grabrail orientation on the body and personal and environmental characteristics to consider when installing a grabrail at the toilet to assist the sit-to-stand transfer. Most of the information summarised is from quasi-experimental studies (59%) and expert opinion (33%). Anecdotal evidence (4%) and case studies (4%) comprise the remainder. A complete list of references used to develop this factsheet accompanies **Evidence Based Research: Effectiveness of grabrail orientations during the sit-to-stand transfer**. This factsheet supplements the HMinfo Clearinghouse document **Industry Checklist: Effectiveness of grabrail orientations during the sit-to-stand transfer**.

This factsheet highlights critical information about each item on the checklist. It is, however, only a starting point; it does not provide exhaustive detail. An understanding of basic construction principles and building codes and regulations is assumed.

Achieving satisfactory outcomes, as determined by the consumer, service provider, and trades person, is more likely when the safety, dignity, and preferences of consumers are considered at all stages of the project, from conceptualization through post-occupancy.

Background

Grabrails are commonly prescribed, installed, and used to assist the sit-to-stand transfer. The sit-to-stand transfer involves many specific and difficult movements and depends on the range of motion and the body's ability to withstand force at specific places. The way the transfer is performed changes as people age due to a decrease in muscle strength, joint health, range of motion, and consistency of movement. The effectiveness of a grabrail to assist the sit-to-stand transfer appears to depend in part on its orientation. Australian Standards (AS) provide guidance or impose requirements for grabrail selection and installation. AS 1428.1, Design for Access and Mobility, General Requirements for Access, and 1428.2, Design for Access and Mobility, Enhanced and Additional Requirements, apply to public buildings and are referenced in the Building Code of Australia. Two standards that apply to residential buildings, however, make AS 1428.1 and 1428.2 relevant to residential property. AS 4299, Adaptable Housing, applies to new buildings or renovations for residential use and requires that "*all sanitary facilities and components shall be adaptable, at minimum cost, to potentially comply with AS 1428.1 as a minimum, and preferably with AS 1428.2*" (AS 4299, Clause 4.4.1). AS 4226, Guidelines for Design of Dwellings, provides that "*if grabrails are fitted they should be in accordance with AS 1428.1*". (AS 1428.1, Clause 6.2) includes requirements for diameter, force tolerance, and clearance. Section 10.2.8 has additional requirements for grabrails at toilets, including placement and orientation. (AS 1428.2, Clause 10.2), requires compliance with 1428.1 and any additional or different clearance standards specified in 1428.2. AS 1428.2, Clause 15.2, includes specific placement and orientation requirements for grabrails at toilets. Its requirements appear to be identical to the AS 1428.1, Clause 10.2.8, requirement except for an additional requirement regarding distance between the front of the WC pan to the rear wall grabrail. On our review of the Australian Standards, the Building Code of Australia, various international laws, and various published reports. Because applicable law changes over time, service providers and trades people should check current law before recommending or installing a grabrail. Similarly, the recommendations are based on information currently available. Continued research may affect the reliability of the recommendations.

Grabrail basics

The primary purpose of grabrails in the bathroom and toilet is to assist with a difficult transfer in a wet environment. For older adults, grabrails are often a prerequisite for safe and independent toileting. Grabrails improve older persons' transfers from sit-to-stand, improve stability, and decrease the likelihood of falls. If improperly positioned, however, a grabrail does not provide the best assistance. Grabrails may be horizontal, vertical or angled. They also may be multi-directional, combining horizontal with vertical or angled. The orientation of the grabrail affects the user's body, including changes in peak joint angles, range of motion, forces, and torques. Because people have different measurements, limitations and requirements, a single grabrail orientation provides a different level of assistance for each person.

What are the advantages and disadvantages of a horizontal grabrail?

The horizontal grabrail is recommended or required by most of the legislation that we reviewed; it often is recommended in combination with a vertical or angled grabrail. All manufacturer specifications discussed the horizontal grabrail. In one study, more occupational therapists prescribed horizontal grabrails than vertical grabrails. The horizontal grabrail placed beside the toilet provides assistance as a weight bearer; it can support the user's full forearm during the transfer. The horizontal grabrail may not be the most appropriate orientation for all users. Several studies have found a horizontal orientation to be less effective than other orientations in providing assistance during the sit-to-stand transfer. Indeed, one author claimed the horizontal grabrail is "essentially useless". One reason the horizontal orientation may be less effective is because it doesn't enable the hand to move up the grabrail, providing support in all stages of the transfer from sit-to-stand, as do vertical and angled grabrails. Several reports also have noted that the horizontal grabrail does not provide adequate support during the final stabilisation stage of the transfer. In addition, larger forces and more kinetic and kinematic (i.e., motion related) outcomes occur during use of a horizontal grabrail than during use of vertical or angled grabrails.

What are the advantages and disadvantages of a vertical grabrail?

Few of the laws reviewed recommend or require only a vertical grabrail. This may be due in part to the small amount of information that has been published about the effects the vertical orientation has on the user's body.

As noted above, the ability to move the hand up vertical and angled grabrails can provide assistance during all stages of the transfer from sit-to-stand, and less force and fewer motion-related outcomes may occur with a vertical grabrail than with a horizontal grabrail. Other research has suggested two drawbacks to the vertical grabrail. First, it does not provide assistance as a weightbearer to the extent that a horizontal grabrail does because it will not support the user's entire forearm. Second, one author suggested that, if placed too far from the toilet seat, a vertical grabrail may require use of the weaker pulling strength of the extended arm rather than the stronger downward push. This suggestion, however, was not supported with any scientific research and should be considered with some caution.

Which orientation provides better assistance to healthy older people?

There is insufficient scientific evidence to be able to say that one orientation is better. The better choice depends in large part on the user's needs. Use of a grabrail affects the user's body; it affects joint torques, peak joint angles, joint forces, and range of motion. In some users, some or all of the effects of a particular orientation may be positive, making the transfer easier to complete. In other users, negative effects can occur, some of which could lead to secondary disabilities. The effectiveness of a grabrail also depends on the grabrail's placement, which depends in part on the environment.

Does Australian law require a particular orientation?

For public buildings, Australian Standard 1428.1, Clause 10.8.2, requires a horizontal grabrail that runs behind and beside the toilet with either a vertical or angled component that begins 100 - 150mm past the front edge of the toilet seat. Sanitary facilities in new residential construction or renovation must be "adaptable to potentially comply" with this standard (AS 4299, Clause 4.4.1), and compliance is recommended for the toilets in all dwellings (AS 4226, Clause 8). Australian law regarding grabrail orientation is consistent with the laws of several other countries. Eight of the fifteen legislative documents we reviewed contained recommendations or requirements for vertical, angled, or horizontal grabrail orientation. Australia is one of five countries that recommend or require multi-directional orientation. The United States and the Philippines recommend or require only a horizontal grabrail, while Minnesota departed from the United States federal standard, opting for a vertical orientation.

What user characteristics affect appropriate grabrail orientation?

A person's functional ability determines the grabrail orientation that provides the best assistance during the sit-to-stand transfer. If a person has a one-sided impairment, the grabrail should not be placed on that side of the toilet. In addition, if a person has a damaged or weak joint and use of the grabrail increases stress on that joint, the grabrail will not provide maximum assistance and could make the user's condition worse. The prescribing therapist must understand the impact that each grabrail orientation has on the body. Table 1 outlines the grabrail orientation most appropriate when there is a reduction in strength or joint integrity at the major joints involved in the sit-to-stand transfer.

Table 1. Appropriate grabrail orientation for reduction in strength and joint integrity at major joints

Joint	Reduction in:	Which Grabrail Orientation?	Why
Wrist	Strength	Vertical	Those people with limited strength cannot effectively use the ADAAG (horizontal) grabrails (Maben, 2003).
	Joint Integrity	Vertical/Horizontal	Greater range of motion is required at the distal joints of the arm when using a horizontal grabrail (O'Meara, 2003).
Elbow	Strength	Vertical	No specific research found relating to strength surrounding the elbow joint.
	Joint Integrity	Vertical	Larger range of motion required at the elbow joint when using a horizontal grabrail (O'Meara, 2003; Packer, Wyss, & Costigan, 1994).
Shoulder	Strength	Vertical	An increase in the required torques noted when using a horizontal grabrail (Schultz, Alexander, & Ashton-Miller, 1992).
	Joint Integrity	Horizontal	Greater range of motion found when using vertical grabrail, compared to the horizontal grabrail (O'Meara, 2003).
Hip	Strength	Vertical	An increase in hip joint kinetics was noted when using a horizontal grabrail (O'Meara, 2003; O'Meara & Smith, 2005). The vertical grabrail decreases the compressive joint forces required (Ongley, 1999).

***This information was correct at time of printing.*