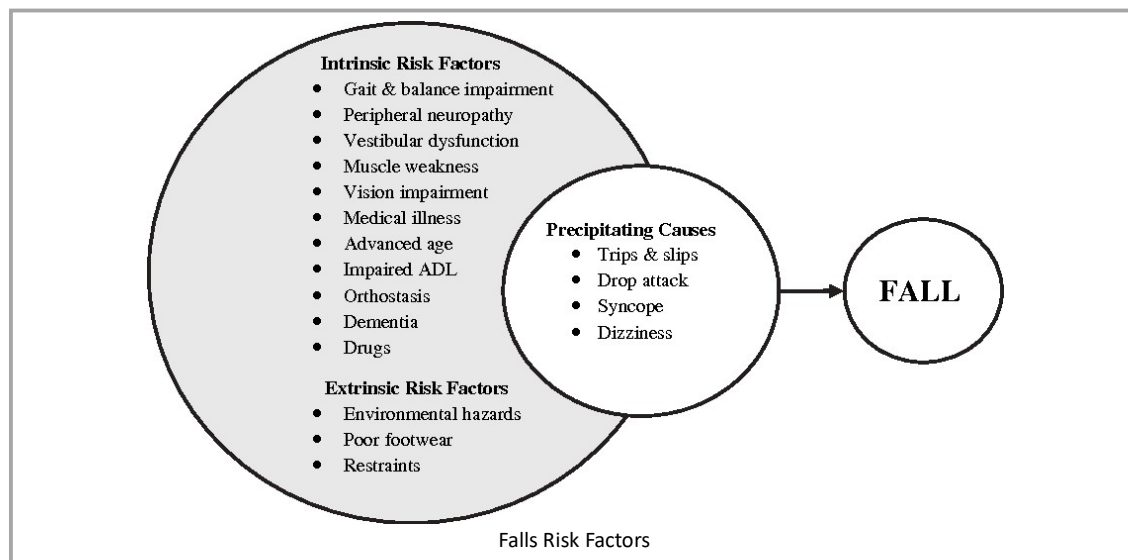


## Flooring – Minimising Slips and Trips

Falls in the elderly rarely have a single isolated cause but typically occur because of the interaction of multiple contributing factors. Researchers often classify these as intrinsic and extrinsic factors.

Extrinsic or environmental risk factors, which include unsafe walking surfaces, obstacles in path, inappropriate footwear, and poor lighting, have been shown to play a part in approximately half of all home falls and their importance in increasing risk has long been recognised by researchers and occupational therapists working with older adults <sup>1</sup>.

Extrinsic factors, such as slippery floors or rugs, re responsible for up to 22% of falls among the older adult <sup>2</sup>.



### FLOORING RISKS

Floor materials in indoor environments are a high risk factor for falls <sup>2</sup>.

The condition of floor materials pose a risk for falls. This includes loose mats, wet floors, torn mats, inadequately maintained mats, and slippery floors. These factors increase the risk of falls among the older adult <sup>2</sup>.

Risk factors involving floor materials include locations of mats within a house: the front door mat, washroom and bathroom mats, kitchen mats, which cause the older adult to slip or trip <sup>2</sup>. Mats on carpet pose an additional risk.

Risk factors in residential environments can, in large part, be solved by modifying or renovating the environment <sup>2</sup>.

### SLIPS ON FLOORS

Slippery floors increase the risk of falls by 71% <sup>2</sup>. Evidence also exists that slippery flooring types may increase risk of serious fall-related injury <sup>1</sup>.

The rational for increased rate and severity of slips in the home is multifactorial and involves both intrinsic and extrinsic factors.

Age-related gait adaptations in walking velocity, step length and heel contact velocity adversely influence friction demand characteristics and the likelihood of slip initiation <sup>3</sup>. Older adults walk slower with slower heel contact velocity, and produced lower friction demand in comparison to younger adults <sup>3</sup>.

Sensory changes in the elderly also increase the likelihood of slips. This is due to incorrect perceptions of floor slipperiness, and uncompensated slip

parameters such as slip distance and adjusted friction utilisation <sup>4</sup>.

When we experience a perturbation from a slip, the body is set in motion and there is a change in momentum. This momentum is ultimately constrained by the generation of joint moment to reduce segmental motion and, hence, the linear momentum of the whole body <sup>5</sup>.

Age impacts on the ability to generate the necessary counterbalancing joint moments either in magnitude or in rate of development to control the body's horizontal and vertical momentum during recovery from slips <sup>5</sup>.

Removing slip risk by increasing friction resistance of the surface is an important consideration in a falls prevention plan. Non-slip falls prevention mats should be implemented in lieu of changing the floor type completely.

### TRIPS ON RUGS

The most common fall hazard in the home are floor rugs (Stevens) Research has shown that hazardous rugs and carpets may be the most common environmental hazard in the homes of older adults <sup>6</sup>.

Floor rugs in hallways and bathmats significantly increase risk of hip fractures <sup>7</sup> following a fall. These rugs are likely to get wet, making them potentially even more hazardous, particularly if they are not secured to the floor <sup>1</sup>.

Bathrooms, transitions between rug/carpeted areas and non-rug/carpeted areas, and wet rugs or carpets are particularly dangerous <sup>1</sup>.

Loose throw rugs and area carpets with curled edges or folds are among the extrinsic factors most frequently mentioned in the literature as unsafe and potentially increasing fall risk <sup>1</sup>.

Rugs and carpets may vary dramatically in such characteristics as size, fibre type, pile height, face weight, fibre density, colour, pattern, and padding thickness, all of which may significantly affect the associated risk of fall and fall injury <sup>1</sup>.

The prevalence of loose throw rugs is high at 72-78% of households <sup>8, 9</sup>. Of these

curled carpet edges are found in more than 35% <sup>9</sup>, with an average of more than 11 rugs without nonslip backing in each home <sup>6</sup>.

With such a high presence of unsuitable rugs, the extrinsic risk created in the home has a negative effect on rate of falls and severity of resultant injury.

### DISADVANTAGES OF RUGS

#### 1. Tripping Hazard <sup>10</sup>

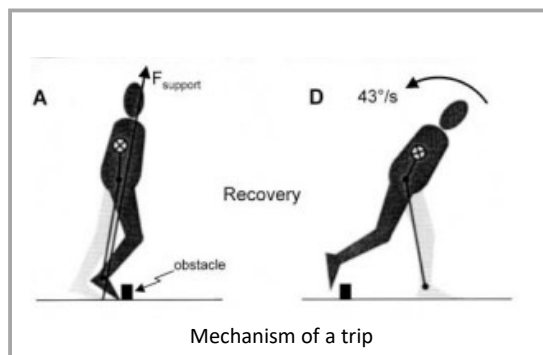
Mats, especially lightweight types, can be torn by handling or excessive wear. The resulting loose or raised areas can catch footwear, creating tripping hazards. Mats that have been moved and not properly re-laid may develop curled or raised edges, which also creates tripping hazards. Mats that are not laid flat or fastened securely may pucker, causing toes or heels to catch, leading to falls

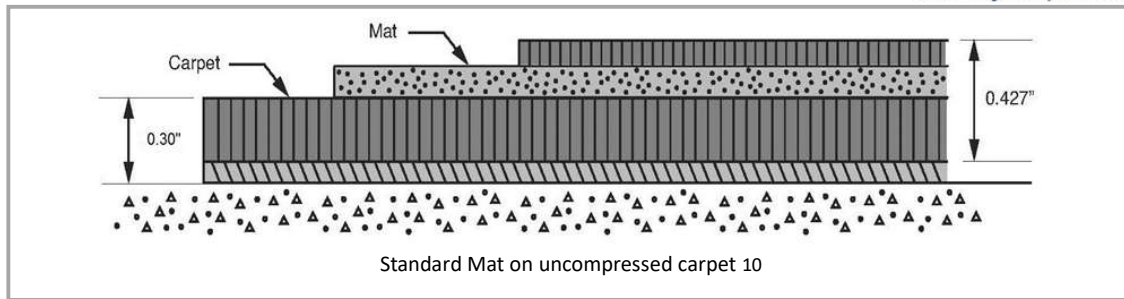
#### 2. Slipping Hazard <sup>10</sup>

Grease, products or water can make mat surfaces slippery. Also, when mats are not suited to the surfaces they cover or are laid with the wrong side down, they may slip, creating greater hazards than the surfaces they cover

#### 3. Change in Level <sup>10</sup>

Any convex elements that protrudes from a flat surface can arrest or delay the tangential motion of footwear moving across the surface. Walking can only be achieved by falling forward. To stabilise this dynamic process, the fall must be continually interrupted by the timely positioning of the walker's trailing leg. Falling will occur if the action of the trailing leg is arrested or unduly delayed by an asperity in the surface.





### MATS ON CARPET

If the mat is placed on a flexible surface, such as a carpet, an unreasonably dangerous trip hazard may be formed by the carpet/mat combination 10.

A traditional floor mat that consists of a rubber base with or without nubs on the bottom surface and a nap on the top surface. As shown the outside edges of a mat present a vertical obstruction of about 2.79 mm average, when it is mounted on a hard surface such as wood, tile or concrete 10.

This situation alters when a traditional mat is placed on carpet. Under transient loading this carpet behaves elastically, each fabric loop comprising the nap springs erect after compressing it underfoot.

When approaching the edge of the mat the foot sinks down into the carpet and presses down on the underlay. The result is that the foot sits lower relative to the mat 10.

Two consequences will come of this.

Firstly the height of the mat will consequently be the depth of floor depression plus the mat height. This may be up to 1.5cm that the Client needs to negotiate to step up onto the mat.

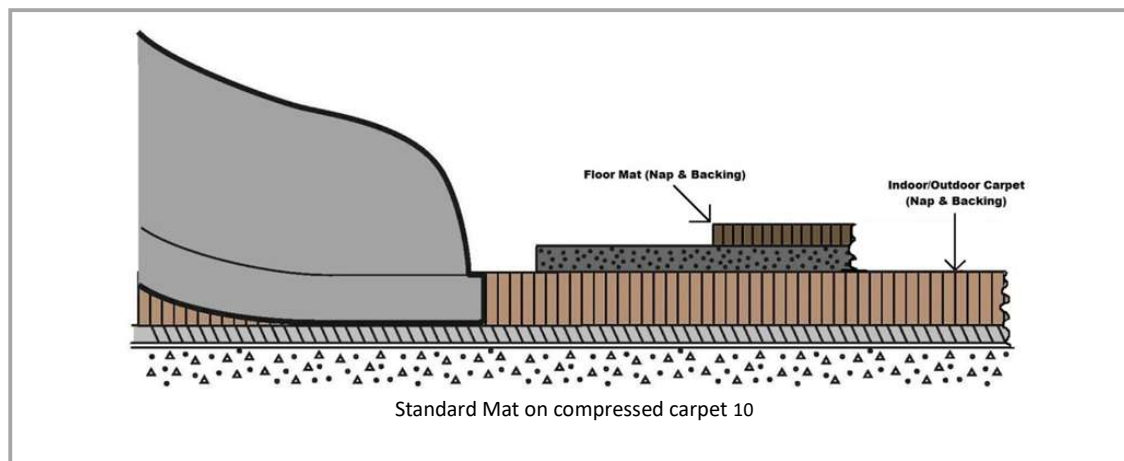
Secondly the sole of the shoe may sit lower than the mat when depressed into the carpet. The leading edge of the sole can easily catch under the edge of the mat causing a trip and fall incident.

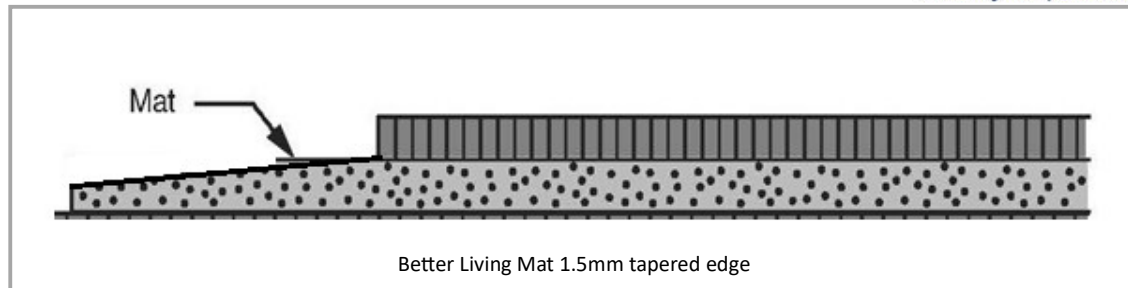
### BETTER LIVING NON SLIP MATS

Informed selection a mat that minimises risks created by rugs and also protects Clients from slippery floors is essential. Ensuring the mat is designed to minimise the multiple risk factors of flooring is fundamental to utilising a mat as part of a holistic falls prevention program.

To minimise slips on wet or slippery flooring the implementation of a non-slip falls prevention mat is highly advantageous. The Better Living Mat Range is designed to withstand the requirements of flooring that can become wet, such as at entry doors, the kitchen or in a bathroom. The ability of the mat to absorb spills and maintain a slip free surface ensures slip risk is minimised.

Placing Better Living Mats at the shower or bath access point, at the vanity and at the toilet ensures the high risk locations of the bathroom have an intervention strategy.





Mats at the toilet need to be long enough for a Client's feet to be positioned fully on the mat in sitting and standing at the toilet. A mat too short will create unnecessary risk. The Better Living Toilet Mat is designed in Australia to meet these needs.

To prevent risk of tripping the Better Living Mats have a tapered edge, the leading edge a small 1.5mm, to prevent undue catching of a foot. The mat itself is less than 5mm thick at the carpeted surface, thus able to be positioned under doors without impact to their function.

Fully machine washable to ensure sanitation and cleanliness, a wide variety of sizes and colours allow for individualisation for personal preference, whilst functioning as Assistive technology for safety.

#### **MAT ADVANTAGES** <sup>10</sup>

1. Mats provide high friction resistance that can improve slippery surfaces such as polished wood floors
2. Mats absorb water from footwear to ensure that building entrances and interior walkways are kept dry during inclement weather
3. Mats help remove foreign particles and other contaminants from the bottom of pedestrian footwear that may become dangerous when tracked on floors
4. Mats may reduce fatigue (ergonomics)
5. Mats reduce noise
6. Mats reduce breakage of dropped frangible objects such as glass bottles

#### **MAT SELECTION**

The criteria for selecting a floor mat include: <sup>11</sup>

- Impact Attenuation: the degree in which the mat reduces the impact force during a fall.
- Stability: How well a person can stand on the mat without losing their balance

- Friction: The mat surface slipperiness
- Thickness: The overall thickness of the mat
- Weight: The overall weight of the mat
- Overall Size: Refers to the mat's length and width.

#### **COMPLIANCE**

Clients often fail to implement the recommendations of a Therapist when it comes to adaptation of flooring and implementation of falls prevention mats <sup>12</sup>.

With such a low rate of acceptance, strategies to improve compliance need to be adopted in a formal education strategy.

There is a strong need to maintain a sense of control and autonomy and to arrange our environments in a way that is personalised <sup>12</sup>.

Exerting control is a behavioural, cognitive and affective process whereby Clients make decisions about whether or not to follow through with environmental modification recommendations based on their knowledge of environmental risks, perceptions of degree of risk, perceived ability to mediate these risks through behaviour and the degree of freedom she had in decision making <sup>12</sup>.

Health professionals need to understand and work with the phenomenon of exerting control, in order to work with clients to reduce environmental hazards <sup>12</sup>.

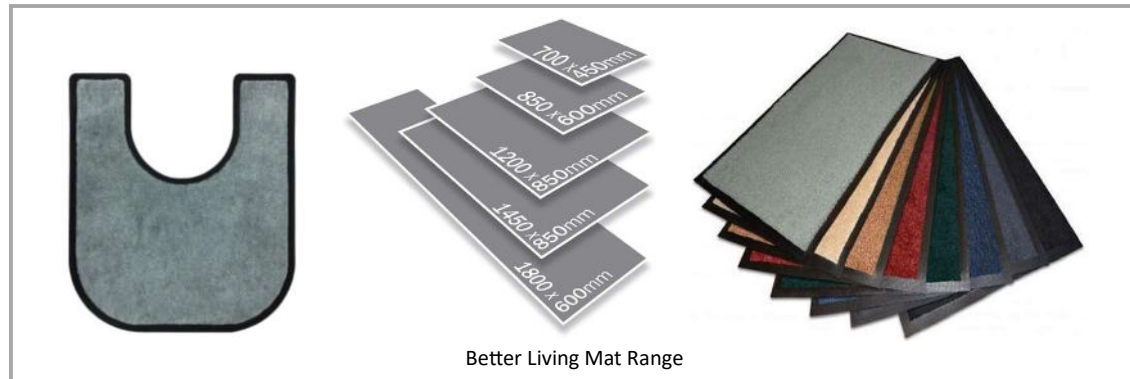
A major barrier to adherence to home modification recommendations is that many older people do not believe that home modifications can reduce their risk of falling <sup>13</sup>. Increasing education, participation in choices and empowerment will positively impact the process of modifying the environment.

## CONCLUSION

Falls in the elderly are an important public health problem, and our research demonstrates that a significant number of these falls are associated with rugs and carpets 1.

Falls occur as a result of a combination of biological, behavioural, socioeconomic, and environmental risk factors. In particular, environmental risk factors have a significant impact on falls 2.

Increasing awareness of the potential hazards associated with rugs and carpets, combined with simple environmental changes may benefit older adults by decreasing the risk for fall injuries 1.



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