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Environmental hazards in the homes of older people

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Abstract

Objectives: to investigate (i) the prevalence of environmental safety hazards in the homes of people aged 70 years and over, (ii) their knowledge of causes of injuries to older people and the safety measures they can implement to prevent such injuries and (iii) the relationship between socio-demographic characteristics of this population group and levels of home environmental hazards.
Method: a cross-sectional survey of 425 people aged 70 years and older living in a defined geographical area of Australia. Participants were recruited through their general practitioners. A structured interview completed with each participant included questions on demographics and home safety issues. A home safety inspection was also undertaken using a predetermined rating format.
Results: 80% ($n = 342$) of homes inspected had at least one hazard and 39% ($n = 164$) had >5 hazards. The bathroom was identified as the most hazardous room, with 66% ($n = 279$) of bathrooms having at least one hazard. Hazards relating to floor surfaces (62% of homes had one 'flooring' hazard) and absence of appropriate grab or handrails (60% of homes had one or more hazards relating to this) were prevalent. Eighty-eight percent ($n = 374$) of older people were able to identify falls as the most common cause of injury and 87% ($n = 368$) were able to accurately name at least one safety measure. Although a significant association was found between the older people's self-assessment of their home's safety and the presence of more than 5 hazards, 30% of those rating their homes as very safe ($n = 289$) had more than 5 hazards. Logistic regression analysis identified one variable—contact with healthcare service providers—as predictive of the hazard level in older people's homes. Older people who were never visited by service providers were twice as likely to have more than 5 hazards as those who were visited weekly or more often (OR 2.12, 95% CI 1.104, 4.088).
Conclusion: many older people are living in potentially hazardous environments. As yet, a causal link between the presence of environmental hazards and falls in older people has not been established. More definitive work in this area needs to be carried out.

Keywords: *elderly people, home environmental hazards, injuries*

Introduction

In both the United States and Australia, injury ranks sixth as a cause of death and morbidity in older people [1, 2]. In the US falls are a leading cause of injury death in people aged 65 years and over, accounting for one-third to two-thirds of all accidental deaths [3, 4]. In 1992, in Australia, falls were the most frequent cause of injury death in those aged 65 years and over, contributing to 43% of deaths from injury [2]. Furthermore, Australian data show that injuries sustained by falls lead to 20% of all hospital admissions in older people [4] and that falls are the leading cause of injury-related hospitalization [5] in this population group. Considering the cost of acute hospital care and treatment of fall injuries—forecast to be A$238.4 million by 2006 [6]—and the personal costs of loss of independence, quality of life and, for some, complete lifestyle change, attention to falls prevention is important.

Studies have found that around one in three of those aged 65 years and older and living in the community fall at least once each year [7–10]. In Australia between a

Table 1. Environmental hazards assessed

Room or area	Hazards assessed
General household	Poor lighting (too dim)
	Lighting too bright
	Light switches hard to reach/find
	No night light(s)
	Carpets/floor coverings torn or in poor condition
	Rugs that slip
	Slippery floors
	Furniture or clutter obstructing walkways
	Cupboards/shelves too high
	Cupboards/shelves too low
	Taps hard to reach or to turn on/off
	Unstable chairs or tables
	Chairs without armrests or with low backs
	Extension cords across walkways
	Unsafe electrical appliances
Kitchen	Dials on stove difficult to see
Bathroom/toilet/laundry	Bathtub/shower recess slippery
	Bathtub/shower recess without grab rails
	Soap, shampoo, etc, not accessible
	Hob on shower recess
	Glass doors not safety glass
	Medicine cabinet poorly lit
	Toilet without grab rails
	Toilet seat too low
	Toilet with inward opening door
	Location of toilet in house
	Toilet located outside
Stairs	Too steep
	Too long
	In need of repair
	Step edges hard to see
	Proper handrails not present
	Handrails unstable or not secured
	Handrails not long enough
	Inadequate lighting
Outside	Sloping, slippery, obstructed or uneven pathways
	Steps, landings, verandas, patios or entrances slippery when wet

half and two-thirds of falls in older people occur in their homes [11, 12]. Older people who have fallen once are more likely to fall again [8, 13].

Most studies investigating why older people fall have concluded that a combination of several factors contributes to a fall, and that the presence of certain factors—either 'intrinsic' or 'extrinsic' [8, 9, 13–15]—increases the risk of falling. Risk factors that have been identified include health status, medication use (both of drugs that increase the risk of falling and polypharmacy), vision and environmental hazards [3, 10, 11, 13, 16, 17].

The environment has been found to be a contributory factor in most falls [3, 10, 11, 13, 14]. Uneven or slippery floor surfaces (including the presence of rugs and mats), tripping obstacles, inadequate lighting, poorly designed or maintained stairs without handrails and inappropriate furniture are cited as increasing the risk of falling, tripping or slipping for older people [3, 7, 8, 10, 11, 13, 15]. Other hazards relate to the absence of safety or preventative devices such as night lights and grab rails [3, 13–15].

Some studies have included assessment and modification of environmental hazards as part of a multifactorial intervention aimed at reducing the risk of older people falling or sustaining injuries through falling [18, 19]. One randomized controlled trial found

that a multifactorial approach which included reducing environmental hazards in older people's homes led to a significant reduction in the risk of falling. However, the contribution of reducing environmental hazards in effecting this decrease was not determined [18]. While this study reported the average number of hazards in control and intervention group homes, it did not include details of what type of hazards there were or where they were located. There is a need for further studies on the impact of home hazard modification on falls and for descriptive data on levels of hazards that exist in the homes of older people, the location and type of those hazards.

The aims of the study were to: (i) assess the prevalence and identify the locations and types of environmental safety hazards in the homes of older people; (ii) examine older people's knowledge of the causes of accidents and injuries in their age group and of the safety measures that they perceive can be taken to prevent such accidents and injuries; and (iii) explore the socio-demographic characteristics of older people with high or low levels of environmental safety hazards in their homes.

Methods

Sample and procedure

The study was a cross-sectional survey of people aged 70 years and over. Lists of eligible people were obtained from general practitioners (GPs) in the Lower Hunter area of New South Wales, Australia. Those eligible were contacted and visited in their homes. An interview and safety housecheck were completed.

All GPs in full-time practice in the study area were asked to provide a list of their patients who were 70 years or older, could speak English, were not suffering from a gross psychiatric disturbance and were living independently at home, in rented accommodation, in a hostel or in a retirement village. Of the 55 GPs approached, 37 (67%) agreed to participate. From these GPs a list of 1269 people was generated. The list was checked for duplicates (people visiting more than one doctor) and cohabitants (one was chosen at random and excluded), those who lived outside the study area and those with no phone. This process resulted in the exclusion of 338 people, leaving 931 eligible.

Letters were sent to these people inviting them to participate in the study. They were contacted by phone in the following weeks to see whether they would allow a trained rater to visit them at home to explain the study and gain their consent. All the older people who agreed to participate in the study were interviewed before their homes were inspected and assessed for environmental hazards.

Measures

Safety housecheck

The safety housecheck assessed the presence of hazards in each room or area of older people's homes (including outside areas). Items for the housecheck form were developed following a review of the literature, consultations with experts and investigation of existing falls prevention programmes. The housecheck focused on environmental hazards, sites and safety devices identified as most commonly associated with falls (or the prevention of falls) in older people. Hazards which are thought to increase the risk of falling, slipping or tripping (e.g. scatter rugs on slippery surfaces, inadequate lighting) and the absence of safety devices which may prevent falls (e.g. grab rails in the bathroom and toilet, and night lights) made up the majority of items in the housecheck. Criteria and instructions for deciding whether something was hazardous were printed under each item being assessed.

An inspection of each part of the older person's house was completed. A decision was made about each item and a 'hazard' scored if a potential hazard was present or safety device absent. If a hazard item area was not there to be assessed (e.g. no stairs outside, no dining room) then the hazard items were scored as 'not applicable'. A sample page of the safety housecheck is included as Appendix 1.

Thirty-seven (37) different hazards were assessed (see Table 1). Certain of these were common to all or several rooms or areas throughout the house. For example, some of the items listed under 'general household', including those shown in Appendix 1, applied in up to six rooms. Other hazard items, such as grab rails in the shower, bath or toilet, only applied to one or a few rooms or areas. In total, 99 potential hazards could be assessed if all areas and potential hazards were there to be assessed and if the older person allowed the rater to inspect all parts of the house. A hazard score was calculated for each home as well as for individual rooms and areas.

A randomly selected 14% of housechecks were simultaneously, but independently, completed by trained observers to check the reliability of the data.

Interviews

Socio-demographic information was collected on age, country of birth, marital status, education level, occupation during working years, living conditions, frequency of contact with family, friends and health-care service providers, self-assessment of vision, use of walking aids and pet keeping.

To assess knowledge of safety, the older people were asked to:

1. Name up to three types of accidents common

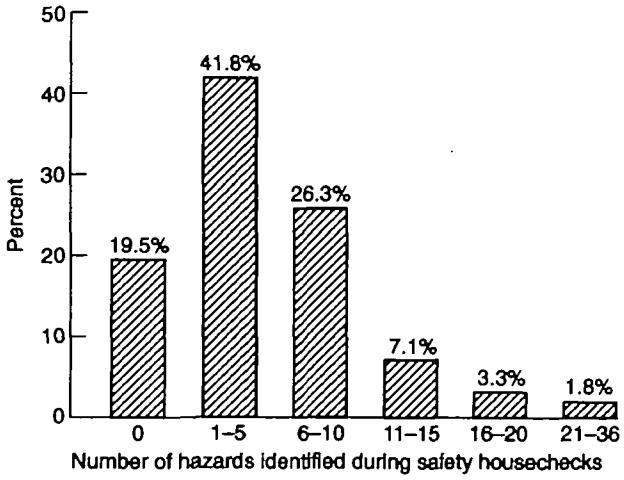

Figure 1. Frequency of hazards during safety housechecks (total number of housecheck = 425).

amongst their age group—and to rank their answers from most common to least common. [Responses considered correct were falls (the most common), followed by burns (liquid or dry), then poisonings, medication overdose or misdose, electrocution or other electrical mishap.]

2. Name five things older people could do to their home environment to decrease their risk of having an accident at home. [Any measures nominated that addressed items in the safety housecheck were considered correct.]
3. Rate their home on safety using a four point scale from 'very unsafe' (1) to 'very safe' (4). [This self-assessment of their home's safety was compared with the number of hazards found in the safety housecheck.]

Results

Sample

Of the 931 older people sent letters, 764 were contactable and of these 425 (56%) agreed to participate. Forty-one percent of the sample were aged between 70 and 74 years, 28% between 75 and 79 years and 32% 80 years or older. Sixty-five percent of participants were female, most were born in Australia (93%), 36% were married and 52% widowed. Seventy-eight percent lived in their own homes, 10% in Department of Housing accommodation, 4% in a retirement village, 4% with children and 1% in rented accommodation. Half lived alone. Five percent had tertiary qualifications while 76% had attended (but not completed) secondary school or had finished primary school only.

The age and gender of the sample population were compared with the 1991 Australia Census age and gender data for the population from which it was drawn. The census values fell within 95% confidence intervals of the sample estimates; thus the sample appeared representative.

Reliability of safety housecheck

This was assessed by means of κs which were adjusted for prevalence and bias [20] and showed significant inter-rater agreement (at $P = 0.05$) on all 99 items ($n = 58$).

Prevalence, location and types of safety hazards

A hazard score was calculated for all homes, including those homes with some hazard items scored as 'not applicable' and those with one or more hazards 'missing' (in general there was a very low number of 'missing' hazards). The frequency distribution of hazard scores is shown in Figure 1. Twenty percent of homes inspected were hazard-free, 80% had at least one hazard, 39% had >5 hazards and nearly 5% of had >15 hazards.

The hazard score was also calculated for each of the rooms or areas assessed by the safety housecheck.

Table 2. Location of hazards found during safety housecheck

Room/location[a]	Potential no. of hazards	No. of hazards found (%) 1	2	3-5	+5
Bedroom ($n = 422$)	8	14	4	1	-
Hallway ($n = 343$)	9	9	3	1	-
Lounge ($n = 408$)	10	12	3	2	-
Dining ($n = 349$)	11	10	2	1	-
Kitchen ($n = 416$)	16	19	8	6	1
Bathroom ($n = 425$)	19	19	21	23	3
Laundry ($n = 342$)	3	14	2	-	-
Toilet ($n = 422$)	5	27	20	12	-
Stairs ($n = 364$)	16	20	11	7	2
Outside ($n = 376$)	2	11	3	-	-

[a]'Missing' and 'not applicable' not included in figures.

Table 3. Types of hazards found during safety housecheck (n = 425)

Hazard type	Potential no. of hazards	No. of hazards found (%) 1	2	3-5	+5
Lighting	21	14	4	6	1
Flooring[a]	32	21	18	18	6
Reaching/bending	12	13	6	4	1
Grabrails/handrails	8	21	22	17	0.2
Toilet door/design	4	32	15	2	-
Stair design/repair[b]	8	14	5	2	-
Unsafe chairs	7	6	2	1	-

[a]Includes rugs, surfaces, coverings, floor of shower, obstacles.
[b]n = 424 due to missing data.

Table 2 shows the proportion of homes which had one or more hazards in each room or area.

The 37 different hazards were collapsed into seven 'type' groupings: lighting, flooring, reaching/bending, grabrails/handrails, toilet location/door, stair design/repair and unsafe chairs. Three of the hazards—electrical appliances in poor condition, taps difficult to turn on or off and glass doors in shower recess not safety glass—did not fit any of the groupings and were kept separate. The proportion of homes with these hazards were: 4, 8 and 3% respectively.

The proportion of homes with one or more of each type of hazard is presented in Table 3.

Knowledge

Common accidents

Eighty-eight percent (n = 374) of the 425 older people were able to identify falls/slips/trips as the most common types of accidents older people have. When asked to identify three types of accidents that are common in older people, 5% could not identify any common accidents, 34% could identify one, 26% could identify two and 35% could identify three.

Safety measures

Thirteen percent of the older people could not name any measures older people could take to make their homes safer and prevent accidents, 14% could name one, 15% could name two, 17% could name three, 9% could name four and 32% could name five.

Relationship between self-assessment of home safety and low/high hazards

Sixty-eight percent of the older people rated their homes as very safe, 29% as fairly safe, 0.2% as not very safe and 3% as very unsafe. A chi square analysis was used to investigate whether there was a relationship between the older people's assessment of their home's safety and hazard levels. For the purpose of this and further analysis homes with five or fewer hazards were considered low-hazard homes and those with >5 as high-hazard homes. A significant association was detected ($\chi^2 = 28.5$, $d.f. = 1$, $P = 0.000$). Of those rating homes as very safe (n = 289), 30% had >5 hazards. Of those who rated their homes as very unsafe, not very safe or fairly safe, 57% had >5 hazards.

Socio-demographic characteristics of having low/high safety hazards

The relationship between the number of home hazards found and the following socio-demographic characteristics was explored: age; country of origin (Australia, other); marital status (never married, married/living as married, separated/divorced/widowed); education (some/finished primary school, some secondary school, leaving certificate, TAFE/tertiary); occupation (professional/management, trade/skilled factory, clerk/sales, farmer, unskilled worker, housewife); living conditions (own home, retirement village, with family, Department of Housing, rented); visits by family (weekly or more, fortnightly or less, never); visits by friends (weekly or more, fortnightly or less, never); visits by healthcare service providers (weekly or more, fortnightly or less, never); presence of eye disease (yes/no); self-assessment of vision (blind/almost blind, blurry/not as clear, see well close/blurry without glasses, don't need glasses); use of a walking aid (yes/no); pets (yes/no); knowledge of accidents (able to name one, two or three common accidents) and preventative safety measures (no knowledge, some knowledge).

χ^2 analyses were used initially to identify any significant associations between the above variables and low/high hazards. As previously stated, a low-hazard home had ≤ 5 hazards and a high-hazard home had > 5 hazards. Two of the variables examined were shown to

have significant associations with hazards: these were living conditions and visits by service providers.

All variables were then entered into a logistic regression using SAS statistical software. A series of regressions were completed with the least significant variable removed at each stage. The variable removed was checked for any confounding effect. The results of this analysis showed that visits by healthcare service providers was a predictor of hazard levels. Older people who were never visited by service providers were twice as likely to have high hazards as those who were visited frequently (OR 2.12, 95% CI 1.104, 4.088). Those older people who were visited less frequently (fortnightly or less) were 1.27 times more likely than those visited frequently to have > 5 hazards, but this difference was not significant (OR 1.27, 95% CI 0.535, 2.999).

Discussion

These results are important because the information obtained does not rely on self-report but on direct observation using an assessment tool that has been shown to be reliable. The large sample size is another strength of the study.

We found that one in five homes was hazard-free. There could be several interpretations of these data. The older people surveyed could have (i) made changes to their homes to eliminate hazards, (ii) been living in purpose-built accommodation specially designed to meet their needs or (iii) been living in homes that never had any hazards in the first place. However, 80% of homes had one or more hazards, and multiple hazards were found in rooms and areas where older people perform complex daily routines (showering/washing in the bathroom, cooking in the kitchen) or which require complicated motor actions (climbing stairs, getting on or off the toilet).

The bathroom was the most hazardous room identified, with multiple hazards common in nearly half of the homes inspected. In previous studies the bathroom, kitchen, bedroom and lounge have been found to be the most common places where older people fall, with the time spent in the area cited as the main contributing factor rather than how hazardous that part of the house was [11, 21, 22]. In other words, the opportunity to fall was greater. In this study the kitchen, lounge and bedroom ranked after the bathroom, toilet and stairs in relation to the number of hazards found.

Hazards relating to floors or surfaces being slippery, uneven or obstructed and to the absence of appropriate grab or handrails to hang on to, were the most prevalent in this study. Both these types of hazards could be direct contributors to falls.

The subjects were aware that falls are the most common accidents in old age and over half were able to readily identify at least one measure they could take to prevent falls. Although many of the older people knew what could be done to prevent falls in general terms, they had not made changes to make their homes safer. It was often stated that they would consider eliminating hazards and increasing their use of safety measures in the future when they needed them. Many of the older people in this study did not think their homes were unsafe (97% of the sample rated their homes as fairly safe or very safe), although they were potentially very hazardous. There is a need to develop strategies to increase older people's willingness to make changes to improve the safety of their homes.

Logistic regression analysis found that older people who were visited frequently (weekly or more) by service providers were more likely to have low hazard levels than those who were never visited. Such a result is not surprising as one would expect healthcare workers visiting older people to make suggestions about how to make their homes safer by reducing environmental hazards and installing safety devices such as grab rails, and that that advice would be acted upon. However, our results are limited in identifying predictors because of the small sample sizes for some of the variables analysed. Also, most of the predictors investigated were individual characteristics whilst the hazard level was a household outcome and, since 50% of the sample were living with other people (36% with a spouse or partner), the results of the analysis may have been different if another older person from the same household had been interviewed.

There are other limitations of the study. Firstly, in interpreting the hazard data several problems arise:

1. There has been no benchmark on what constitutes a hazardous home for older people—does the presence of any hazard make for a hazardous home?
2. Some rooms or areas with multiple hazards may also have had a higher number of potential hazards—the bathroom may have been the room with the greatest number of multiple hazards but it was also the room with the greatest number of potential hazards.
3. The number of hazards found does not necessarily equate with the level of risk—the relative risk of each of the hazard items was not addressed and certain hazards are more likely to contribute to a fall than others. Weighting the relative risk of hazards is difficult as little work has been done in this area.

Secondly, the study may have been limited by the safety housecheck instrument used in the household inspections. The housecheck did not assess an individual's physical and mental ability to deal with their environment or the interaction between the individual and their environment as they carried out their activities of daily living. Also, although the instrument was evaluated for reliability, it was not evaluated for validity. Work is currently being carried out to develop an environmental hazards assessment instrument which addresses some of these concerns [23].

Thirdly, the recruitment of participants through their GPs may have been a limiting factor, producing too

narrow a sample. Although over 80% of the Australian population visit a GP approximately five times in a given year [24], it is not known whether most older people have one GP whom they visit frequently. Finally, the consent rate of 56% is less than optimal, although it may be acceptable considering the intrusive nature of the contact made with the older people and the extensive information collected.

The large number of hazards found in the homes inspected suggests a need for further research to evaluate programmes aimed at decreasing hazards in the homes of older people and whether this effects a decrease in falls. Thus far, there has been no definitive work which has established that reducing hazards alone will reduce falls and the risk of falling in older people.

Key points

- Older people's homes are potentially hazardous.
- Older people know that falls are the most common cause of injury sustained in old age.
- Older people are aware of measures they can take to reduce environmental hazards.

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Appendix. A sample page of the safety housecheck

ID NUMBER: | | | | |

HAZARD PRESENT = 1 HAZARD NOT PRESENT = 2 NOT APPLICABLE = 8

BEDROOM	HALLWAY	LOUNGE	DINING	KITCHEN	BATHROOM

1 Poor lighting makes it hard to see tripping/slipping hazards

TURN LIGHT ON. CHECK THE LIGHTING - DO YOU HAVE TO STRAIN TO SEE AROUND THE ROOM? DOES FURNITURE CAST SHADOWS ACROSS WALKWAYS? ASK YOURSELF - IS THE LIGHTING POOR ENOUGH TO CAUSE THIS PERSON TO TRIP OVER OR FALL? IF THE GLOBE IN THE OVERHEAD LIGHT IS LESS THAN 75 WATTS OR THE GLOBE IN THE TABLE OR BEDSIDE LAMP IS LESS THAN 40 WATTS - THE LIGHTING MAY BE POOR ENOUGH TO CAUSE THIS PERSON TO TRIP OVER OR FALL

2 Lighting is too bright, it creates glare

TURN LIGHT ON. CHECK THE LIGHTING - DOES LIGHT REFLECT OFF A MIRROR, POLISHED FLOOR OR OTHER SURFACE MAKING IT DIFFICULT TO SEE? IS THE GLARE LIKELY TO MAKE IT DIFFICULT FOR THIS PERSON SEE? ASK YOURSELF - IS THE LIGHTING TOO GLAREY? IS IT LIKELY TO CAUSE THIS PERSON TO TRIP OVER OR FALL? IF THE GLOBE IS UNSHIELDED, CLEAR AND GREATER THAN 75 WATTS - IT MAY BE TOO GLAREY

3 Light switches which are hard to reach

ARE THE SWITCHES TOO HIGH/LOW FOR THE PERSON? IF THERE IS MORE THAN ONE ENTRANCE IN TO THE ROOM, ASK WHICH ENTRANCE THEY USE THE MOST - IS THE SWITCH HANDY OR DO THEY HAVE TO WALK ACROSS THE ROOM IN THE DARK? ASK THE PERSON WHETHER THE SWITCH IS EASY TO REACH? DO THEY HAVE TO REACH OR BEND TO TURN ON/OFF? HAVE A LOOK YOURSELF - WHAT DO YOU THINK?

4 No night light/s

THIS IS A HAZARD IF THE PERSON HAS TO GET UP AT NIGHT TO GO TO THE TOILET. IF THE PERSON LEAVES ANY LIGHTS ON TO LIGHT THE WAY TO THE TOILET SO THAT THERE IS NO CHANCE OF THE PERSON TRIPPING AND FALLING, OR USES A COMMODE, THIS IS NOT A HAZARD

5 Carpets/floor coverings in poor condition - torn, threadbare, not nailed down particularly where the person walks

CHECK THE CARPET IN THE ROOM AT THE ROOM ENTRANCE/S AND WHERE THE PERSON WALKS. IS THE CARPET RIPPED OR TORN, NOT NAILED DOWN OR WRINKLED?