A Population-Based Study of Environmental Hazards in the Homes of Older Persons

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ABSTRACT

Objectives. This study sought to estimate the population-based prevalence of environmental hazards in the homes of older persons and to determine whether the prevalence of these hazards differs by housing type or by level of disability in terms of activities of daily living (ADLs).

Methods. An environmental assessment was completed in the homes of 1000 persons 72 years and older. Weighted prevalence rates were calculated for each of the potential hazards and subsequently compared among subgroups of participants characterized by housing type and level of ADL disability.

Results. Overall, the prevalence of most environmental hazards was high. Two or more hazards were found in 59% of bathrooms and in 23% to 42% of the other rooms. Nearly all homes had at least 2 potential hazards. Although age-restricted housing was less hazardous than community housing, older persons who were disabled were no less likely to be exposed to environmental hazards than older persons who were nondisabled.

Conclusions. Environmental hazards are common in the homes of community-living older persons. (*Am J Public Health.* 1999;89:553–556)

Among community-living older persons, advancing age and impairments in physical performance and cognitive status have been identified as potent risk factors for disability in activities of daily living (ADLs).[1–5] Other demographic and health-related risk factors include female gender, non-White race, low income, limited education, smoking, abnormal body mass index, hypertension, heart disease, arthritis, and stroke.[6–11]

An implicit assumption underlying these findings is that disability is a personal characteristic. Some investigators have recently argued, however, that disability represents a gap between personal capacity and environmental demand.[12,13] Although intuitively appealing, this hypothesis, to date, has no empirical support. Indeed, in contrast to the wealth of information available on personal characteristics and capacity, relatively little is known about the role of the environment in the day-to-day functioning of older persons,[14] and what little is known is limited largely to falls.[15–18]

As a first step in elucidating the relationship between the environment and ADL functioning, we set out, in the current study, to describe the basic epidemiology of potential hazards in the homes of older persons. Our specific aims were to estimate the population-based prevalence of environmental hazards and to determine whether the prevalence of these hazards differs by housing type or by level of ADL disability.

Methods

Participants

Participants were members of the Project Safety cohort, a probability sample (described previously[19]) of 1103 community-living persons 72 years and older residing in New Haven, Conn, in 1989.[19] The mean age was 79.6 years; 72% of the cohort was female, and 84% was White.[19] Twelve (1.1%) cohort members were missing the entire environmental assessment and were excluded from the current study. As a means of avoiding double counting of homes, an additional 91 persons (8.3%) were excluded from households with more than 1 cohort member, leaving 1000 participants available for the primary analyses on prevalence. The 103 individuals who were excluded did not differ significantly from those in our study population in terms of age, gender, or race.

Data Collection

A room-by-room assessment for potential environmental hazards was completed by a trained research nurse using a standard checklist derived from preexisting environmental assessment instruments.[20,21] Items in the home were considered to be potentially hazardous if they could lead to a fall, largely through 1 of 3 mechanisms: (1) exaggerated body positioning or loss of balance, (2) slipping or tripping, or (3) weight bearing on a material unlikely to withstand the load. The absence of safety devices (e.g., grab bars in the bathtub/shower) was also considered to be potentially hazardous. Of the 14 potential hazards listed in Table 1, 6 were assessed in

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TABLE 1—Population-Based Prevalence Rates of Potential Environmental Hazards, by Room: New Haven, Conn, 1989

Hazard	Prevalence, % (SE)					
	Kitchen (n = 994)	Hallways (n = 754)	Living Room (n = 997)	Bedroom (n = 937)	Bathroom (n = 943)	Any Room[a] (n = 1000)
Dim lighting, shadows, or glare	11.6 (1.5)	22.1 (2.4)	18.3 (1.9)	21.5 (2.2)	11.7 (1.7)	44.1 (2.7)
Light switches not clearly marked, cannot be seen in the dark	67.4 (2.4)	...	...	...	...	...
Pathways not clear; small objects, cord, or tripping hazards present	...	21.9 (2.3)	31.0 (2.2)	27.2 (2.3)	...	46.7 (2.5)
Carpet edges curling or tripping hazard	...	16.1 (2.0)	27.1 (2.4)	16.4 (1.9)	...	35.7 (2.6)
Loose throw rugs, runners, mats, slip or trip hazard	32.1 (2.2)	28.3 (2.4)	40.3 (2.4)	34.8 (2.4)	46.0 (2.4)	77.9 (1.8)
Frequently used items stored where there is a need to bend over or reach up	7.8 (1.3)	...	...	...	...	...
Step stool not sturdy	13.0 (1.6)	...	...	...	...	...
Table not sturdy or moves easily	5.1 (1.0)	...	...	...	...	...
Chair not sturdy, moves easily, or needs repair	6.4 (1.1)	...	7.5 (1.2)	...	...	12.1 (1.5)
Use of low chair that is difficult to get out of	...	...	18.1 (1.7)	...	...	...
Toilet seat too low or wobbly	...	...	...	...	17.2 (2.0)	...
Area slippery, if noncarpeted	...	1.2 (0.6)	2.0 (0.8)	4.6 (1.1)	3.5 (0.9)	7.5 (1.3)
Bathtub/shower surface slippery; nonskid mat or abrasive strips not present	...	...	...	...	41.2 (2.7)	...
Grab bars not present in tub/shower	...	...	...	...	61.0 (3.1)	...
Two or more hazards present	39.8 (2.2)	22.6 (2.5)	42.3 (2.5)	32.1 (2.5)	59.0 (2.8)	91.3 (1.3)

Note. Prevalence rates were weighted to adjust for differences in sampling, response, coverage rates, and gender. Not all rooms were present in each home. Specifications and definitions for the hazards are available to interested readers on request.
[a]Values were calculated only for hazards that were assessed in more than 1 room and did not include hazards related to stairs.

more than 1 room. Because only a small proportion of homes had stairs, potential hazards related to stairs were considered separately (Table 2). When more than 1 bedroom, bathroom, or stairway was present, only the participant's bedroom and the most frequently used bathroom and stairway were evaluated. When a room was not present (e.g., no bedroom in the home), the corresponding hazard items were scored as "not applicable" and were not included in calculations of prevalence.

A previously validated index[22] was used to classify participants, by level of ADL disability, as (1) independent without difficulty (if they required no personal assistance and reported no difficulty in any of the ADLs), (2) independent with difficulty (if they required no personal assistance in any of the ADLs but reported difficulty in 1 or more of the ADLs), or (3) dependent (if they required personal assistance in 1 or more of the ADLs).

Statistical Analysis

Prevalence rates of the individual environmental hazards were calculated based on the 1000 participants in our study sample. Since the sample was stratified by housing type, with age-restricted housing determined by census and community housing sampled,[19] weights were assigned to participants to adjust for differences in sampling, response, coverage rates, and gender. With appropriate weighting, the data provided representative estimates for the New Haven community of noninstitutionalized older persons.[23] Weighted prevalence rates were subsequently compared, via the Pearson χ^2 statistic, among subgroups of participants characterized by housing type and by level of ADL disability. SUDAAN software was used to provide design-based variance estimates.[24] To determine the reliability of the environmental assessment, we compared the presence of the individual hazards in the 20 households (with more than 1 cohort member) that had 2 assessments within a 3-week period. During the second assessment, the research nurse was unaware of the results of the first assessment. For the environmental hazards listed in Tables 1 and 2, kappa scores[25] were greater than 0.8 with only 2 exceptions. For dim lighting in the kitchen and light switches not clearly marked, kappa scores were 0.61 and 0.66, respectively.

Results

Table 1 provides the population-based prevalence rates of the potential environmental hazards by room. Overall, the prevalence of most hazards was high, ranging from 11.6% to 22.1% for dim lighting to 61.0% for no grab bars in the tub/shower. Two or more hazards were found in the majority of bathrooms and in a sizable minority of the other rooms. Nearly all homes had at least 2 potential hazards. When present, stairs were often hazardous, with nearly half of the homes having 2 or more of the hazards listed in Table 2.

Of the 20 potential hazards (Table 3), 9 were significantly less common in age-restricted housing than in community housing, 2 (chair not sturdy, moves easily, or needs repair and light switches in the kitchen

TABLE 2—Population-Based Prevalence Rates of Potential Hazards Related to Stairs: New Haven, Conn, 1989 (n = 203)

Hazard	Prevalence, % (SE)
Dim lighting, shadows, or glare	26.9 (3.3)
Switches not at top and bottom	21.0 (3.0)
Night light not present or not near stairway	67.6 (3.6)
Handrail not present, not sturdy, or does not extend full length of stairway	14.5 (2.9)
Some steps narrower, higher, or lower than others	15.1 (2.6)
Steps in need of repair; loose treads or carpeting	14.0 (2.6)
Two or more hazards present	44.1 (3.9)

Note. Prevalence rates were weighted to adjust for differences in sampling, response, coverage rates, and gender.

TABLE 3—Population-Based Prevalence Rates of Potential Environmental Hazards, Stratified by Housing Type and by Level of ADL Disability: New Haven, Conn, 1989

Hazard	Housing Type			Level of ADL Disability			
	Age Restricted, %	Community, %	*P*	Independent, No Difficulty, %	Independent, Difficulty, %	Dependent, %	*P*
Any room[a]							
Dim lighting, shadows, or glare	23.3	50.2	<.001	43.7	42.0	48.6	>.2
Pathways not clear; small objects, cord, or tripping hazards present	48.8	46.2	>.2	46.7	45.7	48.2	>.2
Carpet edges curling or tripping hazard	21.5	39.8	.004	35.3	37.2	36.6	>.2
Loose throw rugs, runners, mats, slip or trip hazard	68.5	80.6	<.001	79.7	80.3	67.3	.12
Chair not sturdy, moves easily, or needs repair	16.8	10.7	.046	13.9	11.2	8.0	>.2
Area slippery, if noncarpeted	5.5	8.0	.19	5.3	13.1	8.6	.11
Kitchen							
Light switches not clearly marked, cannot be seen in the dark	76.3	64.8	.02	68.9	62.9	70.1	>.2
Frequently used items stored where there is a need to bend over or reach up	6.3	8.2	>.2	7.6	8.9	6.7	>.2
Step stool not sturdy	11.9	13.3	>.2	12.6	13.7	14.2	>.2
Table not sturdy or moves easily	7.6	4.4	.12	5.7	3.0	6.8	>.2
Living room							
Use of low chair that is difficult to get out of	18.8	17.9	>.2	16.9	20.1	19.7	>.2
Bathroom							
Toilet seat too low or wobbly	15.7	17.6	>.2	19.6	15.9	11.7	.20
Bathtub/shower surface slippery; nonskid mat or abrasive strips not present	32.9	43.8	.07	42.3	41.4	36.2	>.2
Grab bars not present in tub/shower	9.3	77.2	<.001	61.4	64.3	53.1	>.2
Stairs							
Dim lighting, shadows, or glare	3.4	27.3	.002	24.3	29.6	33.0	>.2
Switches not at top and bottom	16.9	21.0	>.2	24.6	16.4	11.0	>.2
Night light not present or not near stairway	0	68.8	<.001	70.1	67.2	54.9	>.2
Handrail not present, not sturdy, or does not extend full length of stairway	0	14.8	.003	15.6	13.4	16.5	>.2
Some steps narrower, higher, or lower than others	0	15.3	.003	13.8	21.5	16.5	>.2
Steps in need of repair; loose treads or carpeting	0	14.2	<.001	16.4	10.8	11.0	>.2

Note. Prevalence rates were weighted to adjust for differences in sampling, response, coverage rates, and gender. After weighting, 22.6% of participants lived in age-restricted housing, 64.2% were ADL independent with no difficulty, 20.4% were ADL independent with difficulty, and 15.4% were ADL dependent. ADL = activity of daily living.

[a]Includes hazards that were assessed in more than 1 room but not hazards related to stairs.

not clearly marked) were significantly more common in age-restricted housing than in community housing, and 9 were equally common in the 2 housing types. The greatest difference between the 2 housing types was found for grab bars in the tub/shower, which were absent in 77.2% of community housing but in only 9.3% of age-restricted housing. When stratified by disability level (Table 3), the prevalence of the potential hazards differed little, even after the results had been further stratified by housing type (data not shown).

Discussion

In this population-based study, we found that environmental hazards are common in the homes of community-living older persons. Furthermore, although age-restricted housing appears to be less hazardous than community housing, older persons who are disabled are no less likely to be exposed to environmental hazards than older persons who are nondisabled.

To our knowledge, this is the first study to report population-based estimates of environmental hazards. One of the few studies to have investigated the prevalence of environmental hazards in the homes of older persons evaluated a nonrepresentative sample, had a low response rate, included little functional information, and presented summary statistics only.[26] Despite these limitations, the reported prevalence of environmental hazards was comparable to that found in our study. As in our study, the bathroom was found to be the most hazardous room, with 66% of bathrooms having at least 1 potential hazard.[26]

The term *hazard* portends a danger or chance of injury or harm. Because firm evidence linking potential hazards to adverse functional outcomes is relatively scant, an argument could be made that the items in our environmental assessment are not necessarily hazardous. To date, the best evidence supporting a causal association exists for falls.[15–17,27] The evidence, however, is conflicting, with a recent case–control study suggesting that most potential hazards are not associated with an increased risk of injurious falls.[18]

Our finding that older persons who are disabled were no less likely to be exposed to environmental hazards than older persons who are nondisabled was surprising and suggests that safety awareness in the home may not differ on the basis of one's personal capabilities. The cross-sectional design of our study did not permit us to confirm or refute the capacity–demand hypothesis of disability,[12,13] which would predict that environmental hazards are more likely to lead to disability among frail than vigorous older persons. Longitudinal studies will be needed to test this hypothesis and to adequately address the more fundamental, albeit related, question of whether environmental hazards contribute to functional decline and disability among community-living older persons.

Our study has several important strengths. First, in contrast to most previous studies, which relied on self-reported information or loosely structured home evaluations,[28] our study used a standard assessment instrument, completed by a trained research nurse, to identify the presence of environmental hazards. Second, our assessment of potential hazards included items recommended by previous investigators and expert panels[20,21] and was highly reliable, with most kappa scores greater than 0.8. Third, our sampling strategy allowed us to compare the prevalence of potential hazards between age-restricted and community housing. Although most hazards were less prevalent in age-restricted housing than in community housing, several hazards were surprisingly common in age-restricted housing, which often serves a more frail subpopulation of community-living elders. Based on these findings, it would be a mistake to presume that age-restricted housing is inherently safe and devoid of potential hazards. While our population-based estimates of environmental hazards represent an important strength of our study, they may not be generalizable beyond other small urban communities.

Enhancing the independence and mobility of an aging population is a fundamental challenge in public health and clinical care. Because a single pathway from health to disability is unlikely to exist, an array of strategies will probably be needed to prevent functional decline and disability among community-living older persons. If the epidemiologic link between environmental hazards and functional decline and disability can be strengthened, then interventions designed to enhance the everyday functioning of older persons will need to focus on the environment as well as the individual. □

Contributors

T. M. Gill and M. E. Tinetti were responsible for the conception and design of the study. J. T. Robinson and C. S. Williams conducted the data analysis and assisted T. M. Gill and M. E. Tinetti in interpreting the results. T. M. Gill led the writing of the manuscript, in which all 4 authors participated.

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