Prevalence of Selected Risk and Protective Factors for Falls in the Home

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**Background:** Falls are the most common cause of both fatal and nonfatal unintentional injury in the home environment. This research describes the prevalence of fall-related risk and protective factors in U.S. homes.

**Methods:** A random-digit-dial survey was conducted of 1003 households in the continental United States to estimate the prevalence of risk and protective factors for falls in homes. Data were weighted to reflect the national distribution of households.

**Results:** Fall hazards such as stairs with four or more steps (70%), absence of railings on stairs (34%), and use of ladders (60%) are common in many households. Use of grab bars and handrails in the bathroom was low, as was the presence of guards and locks on windows (both 25%). However, households with young children and older adults reported greater use of appropriate antifall devices. Sixty-five percent of households with children aged ≤2 years reported using safety gates on stairs. Higher household income and owner-occupied (as opposed to rental) homes had an increased prevalence of fall hazards (more stairs without railings, greater use of ladders).

**Conclusions:** Considerable opportunity exists for increased use of antifall protective devices and reduction of fall hazards.


**Introduction**

Falls are a major source of unintentional injury mortality and morbidity. They are the second most common cause of unintentional injury death (after motor vehicle crashes) and the most common cause of hospitalized trauma.\(^1\)\(^-\)\(^3\) The overall incidence of falls resulting in a visit to an emergency department is 3.1 per 100 person-years; approximately 60% of these falls occur in the home.\(^3\) Using data from the National Health Interview Survey, it was estimated that approximately 45% of all injuries in the home environment resulting in medical attention are falls.\(^4\)

Falls are especially problematic for older adults. It is estimated that one in every three persons aged ≥65 years falls every year in the United States.\(^2\) Many of these falls are associated with co-morbid conditions and environmental hazards. As such, they are considered to be highly preventable.\(^5\) An analysis of trauma registry data from Pennsylvania found that 62% of all trauma to people aged ≥65 years resulted from a fall, with the proportion rising to 81% in those aged ≥85.\(^6\)

Although previous research on specific fall hazards within the home has largely focused on prevention of falls among older adults,\(^7\)\(^-\)\(^9\) home falls are a problem that affects all age groups. In fact, only 20% of nonfatal home falls requiring medical attention occur in the ≥75 age group.\(^4\) Children and youth (0 to 14 years) are also a high-risk subgroup, accounting for 27% of nonfatal falls in the home.

In terms of protective devices, window bars have been shown to be effective in preventing pediatric falls from windows in high-rise apartment dwellings.\(^10\) Studies of households with young children have demonstrated that intensive counseling can increase the use of safety gates on stairwells, although it is not known if this is associated with a reduction in the incidence of pediatric falls.\(^11\) Advice on preventing falls in older adults includes modifying the home environment by installing stairway protective devices such as railings, and installing grab bars in the bathroom.\(^7\) Across all age groups, the products associated with the largest share of the

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cost of home injury are stairs and steps (16%), followed by floors (12%). Ladders, bathtubs, and showers combined are associated with an additional 7% of the cost of home injuries. A household survey was conducted to determine the prevalence of selected fall hazards and protective devices in the home environment, with the ultimate purpose of helping to guide the development of priorities for improving home safety related to falls. This research was part of a larger survey of home safety, and companion papers present findings about hazards associated with poisons, firearms, and fires and burns in the home. The falls portion of the survey focused on the presence of hazards empirically linked to home injury (stairs, railings, and ladders) and protective devices recommended for preventing falls (bathroom grab bars or handrails, bath mats and nonskid bath strips, child safety gates on stairs, window locks/guards).

Methods

A nationwide telephone survey of households was conducted. The data collection instrument elicited information about a wide range of general safety issues in the home. The falls portion of the questionnaire collected self-reported data on the prevalence of stairs and stair railings, window locks/guards, bathroom grab bars and handrails, use of ladders, use of bath mats and nonskid bath strips, and use of child safety gates on stairs. There were two portions of the overall instrument that addressed falls; one that dealt with elements of the physical construction and structure of the house, and the other that dealt with the use of protective devices. Some questions specifically addressed dwellings with multiple levels; these questions were not asked if the respondent resided in a mobile home.

The specific questions within the survey addressing falls are shown in Table 1. All survey questions dealing with falls were closed-ended; the response categories are shown in Table 1. For the purposes of this research, “stairs” were defined as four or more steps located together, and a “ladder” as having four or more rungs. Stairs with fewer than four continuous steps and ladders shorter than four rungs were excluded because they were considered to present a minimal fall risk. Although the survey was designed to collect data on injury-related behaviors and risk factors, rather than the incidence of injury, respondents were also asked “Has anyone had a fall requiring medical attention in or around your home during the past year?” in order to quantity whether specific subgroups reported higher prevalence of falls and to examine whether reports of previous falls were associated with the presence of hazards or use of safety measures. Information about household composition and sociodemographics (e.g., household age structure of the household, household income, home ownership), and geographic region of the United States was also collected. The instrument was developed with input from the Home Safety Council staff and advisors and staff at the University of North Carolina (UNC) Survey Research Unit (SRU).

The data were collected via telephone using a computer-assisted telephone interview (CATI) methodology. The sample was designed as a probability sample of households in the 48 contiguous states of the United States. The sampling frame (GENESYS Sampling Systems, Fort Washington PA) included both listed and unlisted residential telephone numbers. Households were systematically selected from the sampling frame by UNC SRU using a list-assisted, random-digit-dial technique. Trained interviewers at the UNC SRU administered a 92-item instrument. The average interview length was 10 minutes. This study was approved by the University of North Carolina School of Public Health Institutional Review Board.

Following a pilot test of the interview with 33 persons, the questions and response options were refined and the full-scale survey began. Interviewers made calls between March 27, 2002 and June 13, 2002, making up to 20 calls to each identified number, with callbacks at varied times of day and days of the week. Alaska and Hawaii were excluded because of feasibility issues associated with distant time zones. A household was considered eligible if it was not an institution (i.e., prisons, nursing homes, assisted living facilities, barracks, and dormitories were excluded), and contained an adult aged ≥18 who could communicate coherently and in English. To be eligible, respondents had to reside in the household and have a role in making safety decisions.

The data were transferred from the CATI system into SAS (version 8e) data files for analyses (SAS Institute, Cary NC, 2002). Two-stage sample weights were calculated by statisticians at the UNC SRU and applied to the data to facilitate valid projections to the overall population of U.S. households. In the first stage, an estimated probability of selection weight was computed based on the number of telephone lines in the respondent household (excluding dedicated home computer, home fax, and home business lines). In the second stage, poststratification weights were used to adjust for differences between the sample and 2001 Current Population Survey (excluding Alaska and Hawaii), on three factors: presence of children aged ≥6 years, presence of adults aged ≥70 years, and home ownership status (owner-occupied vs rental). These characteristics were selected as poststratification factors because they were considered to be related to home safety practices. Unless stated otherwise, all analyses are weighted. National estimates, proportions, and 95% confidence intervals were computed using SAS-callable SUDAAN, version 8.00, to account for the weighting (Research Triangle Institute, Research Triangle Park NC, 2001).

Results

Response Rate

The response rate was estimated to be 50%. A total of 1539 eligible individuals were invited to participate in the study, and interviews were completed with 1003 of these. There were 498 refusals, 38 incomplete interviews, 1144 unanswered calls for which eligibility could not be determined (e.g., no reply, line busy, answering machine response only after repeated callbacks), and 1942 ineligible numbers (e.g., number no longer in service, dedicated fax line, unable to communicate...
coherently or in English) for which calls were attempted. The estimated response rate of 50% assumes that the calls for which eligibility could not be determined had an eligibility proportion identical to the calls for which eligibility could be determined. This conforms to the American Association for Public Opinion Research’s recommended formula RR3.16

Characteristics of Respondent Households

Respondents. Demographically, the 1003 respondents were (after weighting) 81% white and 8% black, with the remaining 11% indicating either no race/ethnicity or reporting another group. Six percent indicated Latino ethnicity. Sixty-six percent of those responding were women and 92% had at least a high school education. Fifty-three percent were married. By comparison, the general noninstitutionalized population in the continental United States aged ≥25 years is 77% white, 51% female, 54% married, and 80% have a high school education.

Households represented. Table 2 presents additional household characteristics of the study sample. Approximately half the respondents reported household incomes of ≥$50,000. The sample included fewer households in the low-income group (<$25,000 annual income) than the continental United States (20% vs 29%, respectively), and more in the middle-income group of $25,000 to $49,999 (35% vs 29%) and in the group $50,000 to $74,999 (23% vs 20%). Slightly more of the study households were owner occupied than in the continental United States overall (68% vs 66%).17

Housing type varied with the largest proportion being single-family dwellings. One third of households contained two persons, while 22% were single-person households and 26% contained four or more persons. Sixteen percent of households included a child aged <6 years, and 31% contained at least one child aged <15. Seventeen percent of households included a person aged ≥70. Geographically, the sample included households from each of the 48 states. Fifty percent of households were in a major metropolitan area, 23% were in suburban areas, and 27% were in smaller communities or rural areas.

Prevalence of Fall Hazards and Protective Devices

Tables 3 and 4 summarize the findings with respect to the fall hazards and protective devices of interest (stairs and stair railings, use of ladders, bathroom grab bars and handrails, use of bath mats and nonskid bath strips,
use of child safety gates on stairs, and window locks/ guards). Fifty-six percent of households reported having indoor stairs (i.e., four or more steps), and 28% reported having at least four steps on the outside of the home. Seventy percent reported having stairs indoors or outdoors; this percent was lower (59%) in households with older adults (i.e., aged ≥70).

The absence of handrails or banisters on at least one set of stairs was reported for 34% of those homes having steps indoors, outdoors, or both. This percentage was lower for households with older adults (28%), but higher (41%) in households with one or more young children (i.e., aged <6).

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Use of ladders was reported in 60% of the sample. Persons living in owner-occupied dwellings reported using ladders more than those in rental property (74% vs 28%, respectively). Forty-four percent of households in which all residents were aged ≥70 years (n = 94) reported using ladders.

Of households with children aged ≤6 years, and having windows at the second-floor level or above, 34% reported having a window guard or locking device that could prohibit a child from falling. Fifty-three percent of households with children aged ≤6 years, and 65% percent of households with children aged ≤2 years, reported use of child safety gates on stairs.

Twenty-five percent of households reported use of grab bars or handrails in bathrooms, and 64% reported use of bath mats or antiskid strips. Households with older adults reported a higher prevalence of these devices (46% with grab bars or handrails and 80% with nonskid strips or mats). Rental households reported low use of grab bars or handrails (19%), although 55% indicated use of bath mats or antiskid strips. Owner-occupied households reported higher use of these bathroom-based antifall devices (Table 4).

### History of Falls

Overall, 7% (n = 66) of study households reported that someone in or around their home had sustained a fall requiring medical attention in the previous 12 months. This prevalence of reported medically attended falls was higher in households with children aged ≤6 years (9%) or older adults (11%). The reported prevalence of fall hazards was very similar in homes that reported a history of falls and those that did not. However, use of some protective devices was higher in homes reporting a fall than in the other homes (bathroom grab bars: 32% vs 25%; bath mats/antiskid strips: 75% vs 63%; child safety gates: 59% vs 46%).

### Discussion

This study examined selected fall hazards and protective practices in homes throughout the continental United States. Fall hazards were prevalent in many types of households, and use of fall prevention measures was not universal. Clearly, there is ample oppor-
tunity to increase the use of protective devices and limit the presence of fall hazards in many U.S. homes.

Comparison with Previous Literature

The data on older adults parallel those collected as part of the 1990 National Health Interview Survey of 46,000 households. That source reported that handrails were installed in 48% of U.S. households, and in 65% of households with one or more persons aged >75 years.18 Similarly, the results on the use of stair gates in families with young children support earlier work.11 The findings also confirm earlier research on community-dwelling older adults indicating that grab bars/handrails are used less often than slip-resistant surfacing. This parallels other work in New Haven CT, where it was reported that 39% had grab bars in the bathroom, and 59% had nonskid surfacing,19 and in South Miami Beach FL, where a prevalence of 19% for grab bars and 78% for slip-resistant surfacing was reported.7

Limitations

The findings rely on self-report of English-speaking persons having telephones and who were willing to participate in the survey. Residential telephones lines are estimated to be present in 94% of all households in the United States,20 but those without home telephones may not be evenly distributed in the population. Likewise, people who refused to participate may represent a different safety profile than respondents. Limitations in resources meant that data could be collected only from English-speaking respondents and in the continental United States. This may also introduce bias into the results. Finally, it was decided not to address behaviors associated with fall risks that would be problematic to assess using a telephone survey, such as household clutter, length and rise of steps in stairwells, and usage of stairs. A household visit may be the only viable means for collecting those data.

Implications for Future Research

Future research should describe differences in interior and exterior stairways in more detail, quantify usage of these stairs by older adults and other high-risk household members, describe the characteristics of floors where falls occur, and detail co-morbid conditions of those individuals who report a history of falling. In addition, detailed data about practices and preferences

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**Table 3. National estimates of prevalence of fall hazards in U.S. households, in millions of households, United States, 2002**

<table>
<thead>
<tr>
<th>Age structure of household</th>
<th>Household tenure</th>
<th>Annual household income</th>
</tr>
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<tbody>
<tr>
<td>Any person aged ≤6 years</td>
<td>Any person aged ≥70 years</td>
<td>No person aged ≤6 or ≥70 years</td>
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<td></td>
<td></td>
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<tr>
<td>Stairs indoorsb</td>
<td>10.0 (8.8–11.0)</td>
<td>58.3% (48.8–67.8)</td>
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<td>(51.1–65.5)</td>
<td>(40.5–57.1)</td>
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<tr>
<td>Stairs outdoorsa</td>
<td>4.5 (3.5–5.5)</td>
<td>26.1% (19.5–30.5)</td>
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<td></td>
<td>(19.8–32.5)</td>
<td>(12.8–26.2)</td>
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<tr>
<td>Stairs indoors or outdoorsb</td>
<td>11.9 (10.6–50.5)</td>
<td>69.0% (58.6–72.9%)</td>
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<td>(62.2–75.8)</td>
<td>(50.3–66.8)</td>
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<tr>
<td>Absence of railings on at least one set of stairsb</td>
<td>5.0 (3.1–16.4)</td>
<td>42.4% (29.7–32.7%)</td>
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<td>(33.9–50.8)</td>
<td>(20.0–39.3)</td>
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<tr>
<td>Use of ladders</td>
<td>10.0 (9.7–42.8)</td>
<td>57.9% (53.8–61.9%)</td>
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<td></td>
<td>(50.6–65.1)</td>
<td>(45.4–62.2)</td>
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</table>

*Estimates per million households, weighted by presence of multiple phone lines, any person aged ≤6 years; any person aged ≥70 years, and tenure (owner-occupied vs rental) in the overall population of U.S. households, excluding Alaska and Hawaii.

bStairs defined as four or more continuous steps.

*Percentage among households with indoor or outdoor stairs, that is, four or more steps.

CI, confidence interval.
of homeowners and residents could further inform efforts to increase the prevalence of protective devices.

**Implications for Prevention**

From a policy standpoint, the findings from this study suggest numerous avenues for control of fall hazards and increasing prevalence of protective devices, such as revising building codes to ensure construction that limits fall hazards (e.g., requiring handrails in all stairwells), and regulations for leasing rental property (e.g., requiring window bars in high-rise apartment buildings). The fact that usage of protective devices is lower in rental households may reflect less commitment or authority on the part of tenants to make changes in housing that they do not own, and/or less interest on the part of landlords to maintain safe environments for tenants.21

For new construction, a wide variety of possible interventions are possible. This could include limiting the number of levels in new dwellings; reducing the fall heights between levels; provision of lighting, handrails, and child safety gates in stairwells; and installation of slip-resistant surfacing and grab bars in bathroom areas. For existing construction, retrofitting protective devices such as stairwell gates, handrails, and grab bars can be relatively low cost and readily implemented. However, it does require that homeowners take an active interest in installing these devices. Rebates and educational campaigns are potential tools for encouraging this behavior change. For urban areas, particularly low-income housing, home visits may provide a means to install and maintain protective devices.22,23 Parents of infants and young children, and families with older adults living in the home, are likely to be particularly receptive to these messages. Ideally, intervention approaches should be tailored to address the specific needs of older families or those of families with young children. However, simple promotion of the significance of fall hazards in the home may help promote the use of protective devices and increase the prevalence of safety behaviors for all types of households.

This work was funded by a contract from the Home Safety Council (HSC) to the University of North Carolina Injury Prevention Research Center, with additional support provided by the National Center for Injury Prevention and Control.

### Table 4. National estimates of prevalence of fall protective devices in U.S. households, in millions of households, United States, 2002*

<table>
<thead>
<tr>
<th>Age structure of household</th>
<th>Household tenure</th>
<th>Annual household income</th>
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<tr>
<td></td>
<td>Rental property</td>
<td>Owner-occupied property</td>
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<td></td>
<td>&lt;$50,000</td>
<td>≥$50,000</td>
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<tr>
<th>Any person any age 6 years</th>
<th>Any person aged 70 years</th>
<th>No person aged ≤6 or ≥70 years</th>
<th>(95% CI)</th>
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<tbody>
<tr>
<td>Grab bars or handrail in bathroom</td>
<td>3.6</td>
<td>21.1%</td>
<td>45.6%</td>
<td>21.0%</td>
<td>6.1</td>
<td>18.7%</td>
<td>28.1%</td>
<td>13.6</td>
<td>27.4%</td>
<td>23.2%</td>
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<td>(15.3–26.9)</td>
<td>(37.3–53.8)</td>
<td>(17.8–24.2)</td>
<td>(13.6–23.8)</td>
<td>(24.7–31.4)</td>
<td>(23.1–31.7)</td>
<td>(19.1–27.4)</td>
<td>(22.6–28.2)</td>
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<tr>
<td>Bath mats or antiskid strips in bathroom</td>
<td>11.0</td>
<td>63.9%</td>
<td>79.8%</td>
<td>59.5%</td>
<td>17.9</td>
<td>55.2%</td>
<td>67.0%</td>
<td>30.7</td>
<td>61.9%</td>
<td>65.0%</td>
<td>63.5%</td>
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<td>(57.0–70.9)</td>
<td>(73.1–86.5)</td>
<td>(55.5–63.4)</td>
<td>(48.8–61.5)</td>
<td>(63.6–70.5)</td>
<td>(57.2–66.6)</td>
<td>(60.3–69.7)</td>
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<tr>
<td>Both grab bars/handrails and mats/antiskid strips in bathroom</td>
<td>2.7</td>
<td>15.5%</td>
<td>39.2%</td>
<td>14.1%</td>
<td>12.2%</td>
<td>21.1%</td>
<td>19.4%</td>
<td>17.9%</td>
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<td>(10.3–20.6)</td>
<td>(31.1–47.2)</td>
<td>(11.4–16.8)</td>
<td>(7.9–16.5)</td>
<td>(18.1–24.2)</td>
<td>(15.6–23.2)</td>
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<td>Use of child safety gates on stairsb</td>
<td>5.1</td>
<td>53.3%</td>
<td>44.6%</td>
<td>44.3%</td>
<td>3.2</td>
<td>43.9%</td>
<td>47.0%</td>
<td>7.4</td>
<td>47.9%</td>
<td>45.9%</td>
<td>46.3%</td>
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<td>(43.9–62.6)</td>
<td>(30.0–59.2)</td>
<td>(37.8–50.7)</td>
<td>(30.9–56.9)</td>
<td>(41.6–52.5)</td>
<td>(39.6–56.3)</td>
<td>(38.9–53.0)</td>
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<tr>
<td>Use of window locks/guards at second floor levelc</td>
<td>3.0</td>
<td>34.4%</td>
<td>34.0%</td>
<td>21.6%</td>
<td>27.7%</td>
<td>23.5%</td>
<td>28.9%</td>
<td>19.7%</td>
<td>24.8%</td>
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<td>(24.7–44.0)</td>
<td>(20.5–47.5)</td>
<td>(17.1–26.1)</td>
<td>(19.7–35.8)</td>
<td>(19.1–27.9)</td>
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*aEstimates per million households, weighted by presence of multiple phone lines, any person aged ≤6 years, any person aged ≥70 years, and tenure (owner-occupied vs rental) in the overall population of U.S. households, excluding Alaska and Hawaii.

bPercentage among households with children aged ≤6 years living in the home, or visiting the home at least once a year.

cPercentage among households with more than one level to the home.
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References