Improving Bathroom Safety Among Community Dwelling Older Adults

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*We randomly assigned older adults to receive mailed educational materials about prevention of falls in the bathroom (*n = *87), or no materials (*n = *89). After 4 weeks, we contacted participants by telephone to assess self-reported change and intention to install bathroom safety features, as well as self-efficacy for maintaining physical balance. Compared to control participants, intervention participants were more likely to report making actual bathroom safety improvements, intent to take action, and serious intent to add safety features. These intentions were also related to self-efficacy for maintaining balance. Safety intervention materials can be tailored for specific populations while at the same time being fiscally sensitive.*

Approximately 3 out of every 10 older adults will experience some type of unexpected fall in a calendar year. Of those, 5-15% will suffer a serious injury that includes lacerations, bone fractures, serious soft tissue damage, or head trauma. These injuries can lead to a decline in quality of life, inability to successfully age in place, and erosion of financial security (Cook, Yearns, & Martin, 2005; Tinetti, Gordon, Sogolow, Lapin, & Bradley, 2006; Tinetti, Richman, & Powell, 1990). Although the proportion of elderly persons over 65 experiencing a fall is approximately 30%, the ratio dramatically increases to 50% for those persons over 80. Consequently, the sixth leading cause of death for persons aged 65 and over is unintentional injury, most often resulting from a fall. Public health costs for acute care and services for older persons who have fallen were estimated to be $19.5 billion in 2000 (Finkelstein, Fiebelkorn, Corso, & Binder, 2004; Sattin, 1992; Tinetti et al., 2006). Given the individual and societal costs of accidental falls, prevention efforts are critical and merit attention by researchers (Finkelstein et al., 2004).

Falls and fall prevention have been studied extensively using a variety of interventions (Jørstad, Hauer, Becker, & Lamb, 2005; Finkelstein et al., 2004; Sattin, 1992). These actions have included, but are not limited to, free installation of grab bars and other safety devices for the occupant, balance training, and correction of lighting deficiencies (Gitlin et al., 2006; Stevens, Holman, & Bennett, 2001). The approaches, while successful, are not cost effective for use in reducing falls in the general population (Tinetti et al., 2006). Other approaches to fall prevention have implemented exercise programs conducted in senior centers to improve balance, gait, and self-efficacy. These too have displayed some measure of success. However, due to transportation challenges, not every eligible participant is capable of accessing an exercise program located outside the home (Li, McAuley, Harmer, Duncan, & Chaumeton, 2001).

Less expensive interventions involve distribution of educational materials focused on reducing the risks associated with falls. In some cases, informational materials are discussed and given to patients at doctor appointments; in other settings, patients are exposed to educational information via posters and brochures displayed in doctors' waiting rooms. Interventions conducted in this manner have yielded some success, but do not reach those seniors without a primary care

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physician (Chou, Tinetti, King, Irwin, & Fortinsky, 2005).

Several studies have employed mailed educational information and have met with mixed success (Sevick et al., 2007). Using mailed educational items and verbal instructions, Sevick et al. reached 239 voluntary participants and assessed change by a survey returned in the mail. There were no statistically significant differences in behavioral change for those who received verbal instructions compared to those receiving printed materials. In another study, Solomon et al. (2005) mailed educational materials about fall risk reduction to participants over 65 years. No intervention impact was evident after an 8-month follow-up period; however, because the outcome assessment procedure resulted in a modest 54% response rate, the true effect of the intervention is unclear.

Most of the existing literature in fall prevention targets multiple areas of the home, such as kitchens, hallways, interior/exterior stairways, bedrooms, living rooms, and bathrooms (Gitlin et al., 2006; Stevens et al., 2001). Poor intervention results could be due to information overload; when faced with a large number of suggested household renovations, none are undertaken (Cook et al., 2005). In contrast, Heslin et al. (1992) documented an effective fall prevention strategy that focused solely on a single type of fall (e.g., falling out of bed) for residents living in an institutional setting. By emphasizing a single, highly vulnerable area for falls, researchers can increase the likelihood that participants engage in behavior change. Because the bathroom is the highest risk area for falling by community dwelling seniors, targeting this space for a prevention intervention makes sense.

When selecting a theoretical model to guide fall prevention efforts and outcome assessment, it is important to choose a model that conceptualizes change on a continuum, moving from levels of intentionality to actual behavior change. Prochaska's Transtheoretical Model of Change (Prochaska & DiClemente, 1982) is a useful framework for this purpose, and describes five stages: (a) precontemplation with no intention of changing; (b) contemplation with intention to initiate change within the next 6 months; (c) preparation with intention to make a behavioral change in the immediate future, combined with a plan of action; (d) action, marked by specific activities and behavioral change; and finally (e) maintenance with ongoing commitment to maintain the effects of the change (Burbank, Padula & Nigg, 2000; Velicer, Prochaska, Fava, Norman & Redding, 1998). This theoretical model has proven successful in developing and evaluating a wide range of health interventions including smoking cessation, exercise, weight loss, medical compliance, and consistent use of sunscreen (Kristjánsson, Ullén & Helgason, 2004; Prochaska, DiClemente & Norcross, 1992; Takeuchi, Hillers, Edwards, Edlefsen & McCurdy, 2005; Velicer et al., 1998).

Along with investigations of fall prevention, there is a significant body of research that examines the relationship between balance self-efficacy and the fear of falling among older adults. Community-dwelling older adults may avoid certain household tasks due to a fear of falling. In one study, nearly 25% admitted avoiding everyday activities due to the fear of falling (Tinetti et al., 1990). Self-efficacy refers to an individual's perception of his or her own capabilities inside a specific domain of activities (Bandura, Adams, & Beyer, 1977; Bandura, 1994). Thus, in addition to measuring actual change and intentions to change in the area of fall prevention, self-efficacy for maintaining one's balance could prove to be a useful secondary measure of intention to institute fall prevention strategies. We believe there is a reciprocal relationship between balance self-efficacy and efforts to reduce the risk for falling since behavioral change can be influenced through elevated self-efficacy (Bandura, Jeffrey, & Gajdos, 1975). Efforts to improve the safety of their environment should increase balance self-efficacy in older adults. Also, higher initial levels of balance self-efficacy may help individuals take the steps needed to prevent future falls, due to higher levels of confidence in their capability to engage with key aspects of their environment.

This study examined the effects of a fall prevention program consisting of mailed information and suggestions for bathroom safety modifications. Our hypotheses were:

1. Compared to those in the control group, participants who received the mailed intervention materials would be more likely to report both an intention to change, and actual installation of specific bathroom safety devices (i.e., grab bars, bathtub mats, and taped bathroom rugs).

2. Across all study participants, balance self-efficacy would be higher among individuals stating an intention to change (contemplation and preparation stages of change) than among those in the precontemplation stage of change.

Method

Participants

We selected individuals aged 65–97 years (M = 77.7 years, SD = 6.6) from a larger pool of 303 community-dwelling older adults who had completed a previous telephone survey on home modifications. That original sample had been randomly drawn from registered voters living in a specific census district with a high

proportion (21%) of older adults, and who had agreed to further contact regarding research participation. Individuals who had reported in the earlier survey that their bathroom already had grab bars installed were considered ineligible to participate in the current study. Thus, from the original pool of 303, a subset of 176 older adults was identified as eligible for this research. Data from the initial survey indicated that in this subset, 85% of the participants occupied a single-family home (owned or rented) in comparison to a national average of 80.5% home ownership for the identical age bracket of persons age 65 and older (U.S. Census Bureau, 2007).

We randomly assigned these eligible individuals ($N = 176$) to either the intervention group that received mailed prevention materials ($n = 87$), or the assessment-only control group that did not receive any prevention materials ($n = 89$). We did not provide monetary compensation to any participants in either group. At the time of the study, each eligible participant lived independently in the community and provided informed consent via the telephone immediately prior to the telephone interview used to assess outcome.

Measures

Installation of bathroom safety devices. In the outcome assessment conducted via telephone interview, we asked participants, *"Do you currently have installed in your bathroom a grab bar device?"* If they indicated a grab bar was installed, we coded them as being in the action or maintenance stage according to the length of time that the grab bar was installed: last 30 days (action) or 31 days to 12 months (maintenance). The interview continued with the same question regarding installation of a nonskid surface for the tub/shower, and bathroom floor mats that are taped to the floor. For the purposes of the present study, we treated installation (by the participants themselves or someone else under their direction) of any of the three safety devices within the previous 30 days (action stage) as the primary outcome measure.

Intent to install safety devices. Using the Transtheoretical Model of Change (TTM, Prochaska & DiClemente, 1982), we constructed four items that reflect the continuum of intentional change. We asked those participants without safety devices already installed in their bathrooms: *"Are you intending to install any type of grab bar device, non-skid surface in the tub/shower, or planning to tape down the rugs in your bathroom?"* We coded a "no" response as the individual being in the pre-contemplation stage; we followed a "yes" response with an open-ended question asking about the perceived time frame for future change. We coded those stating an intention to install some form of a safety device at some point in the future to be in the contemplation stage, and those stating a serious intent to install a specifically-named safety device within the next 3 months to be in the preparation stage.

Activities-specific Balance Confidence Scale. This 16-item self-efficacy scale (Powell & Myers, 1995) measures self-perceived confidence to engage in specific activities "without losing your balance or becoming unsteady" (p. M30). Participants rate their confidence for each item on a continuous scale from 0% to 100% with 0% representing no confidence and 100% representing complete confidence in performing the activity without becoming unsteady. An example question is *"How confident are you that you can pick up a slipper from the floor without losing your balance or becoming unsteady?"* (Powell & Myers, 1995). This scale demonstrates reliability, validity, and responsiveness in assessing an elderly person's fear of falling and has increased sensitivity over other efficacy measures (Jørstad et al., 2005).

Procedures

Intervention components. We mailed educational materials via U.S. Postal Service directly to the homes of the participants in the intervention group. The educational intervention packets included an envelope bearing a return address label of the investigator's university.

There were four informational elements to the educational intervention. The first component of the mailed packet consisted of an introductory letter from a local community partnership, cosigned by the investigators, the local Fire Department Chief, and the local community betterment association. We obtained signed support for the project from these local municipal leaders to increase the authenticity of the study for these community dwelling seniors (Carp, 1989). The letter outlined the consequences of a severe accidental fall, statistics associated with functional decline as a result of falling, the financial expenses that could be incurred following an accidental fall, and a listing of the risk reduction behaviors known to be effective in reducing the risks for falls while promoting bathroom safety.

The second piece of the packet was a single-page, four-color Bathroom Safety Checklist developed by the investigators. It featured two separate images of older persons and a series of questions intended to spark an inventory of the participants' risks in the bathroom and a current safety status assessment. This checklist also included a series of Action Steps for installation of the bathroom safety items. The phone number to the investigator's lab was provided in the case of questions.

The third element of the mailed intervention was a detailed Centers for Disease Control (CDC) 14-page color brochure specifically focused on fall prevention

information and suggestions. It included specific targeted information regarding the installation of bathroom safety devices.

The final component of the educational intervention included a custom-designed store coupon provided by a locally owned and operated family hardware store. The authorized redemption of the coupon at the point of sale was limited to purchases related to bathroom safety: any type of grab bar, any type of nonskid surface device for use in the tub/shower floor, and double-sided tape for securing throw rugs in the bathroom. The promotional price reduction included an expiration date 10 weeks from the time of the mailing. The control group received none of these materials or contact of any kind from the researchers prior to the telephone interview to assess outcome.

Assessment Strategy. Following a 4-week waiting period, we conducted telephone interviews over the course of 10 calendar days to assess bathroom modifications and balance self-efficacy since a telephone interview is a viable means of data collection in this age group (Herzog & Kulka, 1989). We mailed printed questionnaires to participants unavailable by telephone. An investigator blind to the respondent's intervention or control group designation interviewed all participants using the identical questionnaire. If a participant expressed confusion during any portion of the interview, the interviewer asked permission for a licensed clinical geropsychologist to recontact the participant and assess the need for referrals for cognitive assessment and/or intervention.

Results

Of the 176 participants in the eligible sample, 125 (71%) provided informed consent for the telephone outcomes assessment, 14 (8%) refused consent to participate in the telephone assessment, 9 (5%) had a disconnected telephone, 9 (5%) were deceased, 5 (3%) relocated, and 14 (8%) were hospitalized, out of town, or otherwise unavailable. Of those providing informed consent, 58 were in the control condition, and 67 were in the intervention condition. Rates of consent and completion of the outcomes assessment did not differ between the two conditions, χ^2 (1, N = 176) = 1.59, p = .21.

Actual Change Defined by Completed Installation of Any Safety Device

The proportion of intervention participants who completed a safety device installation during the 30-day waiting period was larger (p = .08) than that of the control group (p = .01). A chi-square test determined whether individuals who received the mailed intervention materials were statistically more likely than control participants to have installed a grab bar or another bathroom safety device in the previous month (i.e., since receiving the mailing). The intervention provided a small, yet statistically significant behavioral change during the intervention period that consisted of installing a grab bar or another safety device in the bathroom, χ^2 (1, N = 125) = 4.0, $p \leq .05$.

Intent to Change

The next set of analyses used the responses of those participants who had not yet made any changes to improve bathroom safety (n = 115). Intervention participants displayed a statistically significant increase (p = .39) over the control group (p = .14) for stating an *intent to take action* to reduce risks associated with falling in the bathroom, consistent with reaching a minimum of the contemplation stage of change, χ^2 (1, N = 115) = 8.9, $p < .01$. Intervention participants also displayed a statistically significant increase (p = .12) over the control group (p = .0) for *serious intent to take action* within the next three months, consistent with the preparation stage of change, χ^2(1, N = 115) = 7.1, $p \leq .01$.

Association Between Intent and Self-Efficacy for Balance

Pooling together the intervention and control participants, those who stated an intention to engage in further installation of any of the three safety devices, consistent with being in either the contemplation or preparation stages of change, reported higher self-efficacy, t(1, 92) = 1.9, $p \leq .05$, than those who were coded as being in the precontemplation stage of change (i.e., no intention to make any further safety installations). Because the self-efficacy scores of those in the precontemplation stage varied more than those of the other participants, equal variances were not assumed in the statistical analyses. There was a higher level of balance self-efficacy for those intending to install a bathroom safety device (n = 33, M = 80.0, SD = 12.6), compared to those not intending to install a bathroom safety device (n = 92, M = 74.0, SD = 20.5).

Discussion

The results support our Hypothesis 1 regarding the positive impact of the intervention on both intent and actual installation of bathroom safety features. Compared to control group participants, older adults receiving educational materials about bathroom safety had significantly higher levels of both intent and serious intent to improve the safety of their own bathrooms. Intervention group participants were more likely than control participants to be in either the contemplation or preparation stages of change; the control group included the largest proportion precontemplators.

Intervention participants also had higher numbers of completed bathroom safety modifications. In addition to demonstrating an impact for the intervention, this study lends further support to the Transtheoretical Model of Change (TTM, Prochaska & DiClemente, 1982) which views levels of intention and action as a process measured along a continuum.

We also found support for Hypothesis 2; regardless of intervention group or control group status, those participants who had higher self-efficacy for maintaining their balance in a range of situations were more likely to state their intent to make bathroom safety improvements. However, we do not have the ability to disentangle the direction of these effects; declaring a plan to make safety improvements may lead to an increase in balance self-efficacy, or higher pre-existing levels of balance self-efficacy may help individuals to consider environmental modifications. Efficacy expectations rise and fall with self-regulated motivation and the expectation that a particular activity will likely result in a successful outcome (Bandura, 1994). Increased adherence to behavioral change has been associated with additional home modifications and maintenance of fall risk reduction behaviors (Finkelstein, et al., 2004; Li et al., 2001). Yardley and Kempen (2006) state that clinical interventions designed to reduce the risk for falls can improve self-efficacy via strategies that include environmental improvements. And, it is also the case that persons with a low perceived self-efficacy have an increased tendency to avoid specific activities (e.g., reach at eye level, walk about the house, get in/out of a car, sweep the floor) considered essential for everyday living (Powell & Myers, 1995). Future research that specifically enrolls participants on the basis of low levels of balance self-efficacy may help demonstrate that the intervention has a direct impact on increasing levels of self-efficacy, as well as influencing fall safety behaviors.

Because individuals with higher self-efficacy appear more likely to plan environmental renovations, as suggested by our findings, how can community dwelling older adults with lower self-efficacy be encouraged to make the necessary changes to reduce the risks associated with falling in the bathroom? Bandura's (1994) self-efficacy theory suggests that perceived similarities between the individual and role models allow for greater influence on both beliefs and behaviors. Future interventions might use existing social networks of older friends and family members who are already engaging in safety behaviors as role models for home improvements.

There were some measurement issues that could be improved in future studies of balance self-efficacy of older adults. Lach (2006) suggests that using Bandura's theory and measuring outcome expectancies with the Activities-specific Balance Confidence Scale (ABC, Powell & Myers, 1995) can offer an expanded understanding of the reciprocal associations between self-efficacy beliefs and safety behaviors. Adding bathroom-specific items on the balance self-efficacy instrument would improve outcome assessment. A sample question might be, *"How confident are you that you can step out of the bathtub or shower without holding onto the wall or towel rod without losing your balance or becoming unsteady?"* This level of specificity in measurement would be helpful in research that targets bathroom safety and fall prevention.

Because this study focused primarily on risk reduction associated with falling in the bathroom, we cannot speak to the direct costs and benefits associated with the change experienced by the participants. However, the CDC asserts that the average cost per fall injury in 2000 was $17,500, excluding doctors' fees (Roudsari, Ebel, Corso, Molinari, & Koepsell, 2005), and predicts that by 2020 the national costs associated with adult falls to reach $54.9 billion (Englander, Hodson, & Terregrossa, 1996). Even small changes associated with preventive interventions have the capacity to produce a significant impact on health care costs.

Further study is warranted to determine what is necessary for transition from intent to change to increased actual behavioral change, defined by completed installation of at least one bathroom safety device. It might be the case that combining mailed educational materials with a local vocational education center or trade union apprenticeship program that offered free, supervised installation of bathroom safety features would increase levels of behavioral change. Targeting geographic regions having the largest number of older residents with strategically placed billboards, public service announcements, or advertising on or near public transportation would move this intervention from the individual to the community public health level.

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