

Insights about Fall Prevention of Older Adults in the State of Hawai'i

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Abstract

The senior population in Hawai'i is growing at a dramatic pace. In the older population, falls and fall-related injuries are leading causes of morbidity and mortality. Moreover, the health care costs for falls are very high. The State of Hawai'i has taken measures to prevent falls through the promotion of medication reviews, vision checks, home assessments, and exercise. However, current published examinations of fall preventive measures have been insufficient, and more research is needed to confirm risk factors, effectiveness of preventive measures, and to explore future objectives. This paper examined the validity of fall risk factors and fall preventive measures for Hawai'i's seniors by conducting mail questionnaire surveys to a sample of seniors using medical alert services from one company in Hawai'i. The results of chi-square analysis suggest that having reduced ability to perform Activities of Daily Living (ADL) and reduced Instrumental Activities of Daily Living (IADL) were associated with a greater risk of falls ($P < .01$). In addition, those who fell were more likely to talk about fall preventions with their family members or friends and health providers compared with those who did not ($P = .048$ and $.003$, respectively). Evidence-based exercise programs for strengthening muscles and controlling physical balance may be needed to improve ADL and IADL. Furthermore, the results suggest that seniors do not accept that they are at risk of falling before they actually fall. Public health providers should consider how they approach seniors, and how they inform them of the importance of fall prevention across the life span.

Keywords

older adults, falls, fall preventions, Activities of Daily Living (ADLs), Instrumental Activities of Daily Living (IADLs)

Introduction

The older adult population in Hawai'i has been growing at a significant pace and faster than the US average.¹ In 2010, only Alaska and Nevada had faster population growth rates than Hawai'i for persons aged 85 years and over.² The proportion of elderly residents aged 65 or older in Hawai'i has increased 300% since statehood (from roughly 5% in 1960 to 15% in 2012) compared with a 33% increase for the US population as a whole (from 9% to 14% over the same period).³ The Hawai'i Long-Term Care Commission Report (2011) projected a 50% increase in the proportion of Hawai'i's population aged 65 or over by 2020.⁴

As the number of older adults in Hawai'i increases, policy-makers, health care providers, and public health professionals are forced to pay more attention to older adults' health and their quality of life.⁵ Older adults are increasingly at higher risk of injury and illness.^{6,7} In particular, falls and fall-related injuries are a major threat to older adults' health and are associated with increased morbidity and mortality.⁸ The "Injuries in Hawai'i: 2007-2011 Report (2012)" shows that among older

adults falling is the number one cause of death from injuries, non-fatal hospitalization, and non-fatal emergency room visits in Hawai'i.⁹ In addition, the report mentions that rates of Emergency Department (ED) visits for Hawai'i residents aged 85 and older were four times more than those who are 65 to 74 years old, and five to eight times higher than rates for other adult-aged residents.⁹ Moreover, financial charges for fall related ED visits and hospitalizations were estimated at \$116.6 million for the period from 2007 to 2011 period in Hawai'i.⁹ Therefore, prevention of falls is crucial to improve older adults' quality of life and to decrease the financial burden in Hawai'i.

To reduce the number of falls, the State of Hawai'i Health Department has promoted four preventive measures: (1) physical activity, (2) medication management, (3) vision checks, and (4) home assessment with needed modifications. Multiple public awareness campaigns on television, buses, radio, and in print are used to disseminate those preventive measures to the community.¹⁰ Physical activity reduces the risk of falls by improving strength, balance, coordination, and flexibility. Likewise, medication reviews completed by trained professionals such as pharmacists reduce harmful effects or drug interactions which may increase fall-risks such as dizziness or drowsiness. Vision checks are crucial in fall prevention because older adults tend to have narrow vision and low vision acuity. Finally, home assessments make homes safer for seniors by recommending grab bars, railings, and ramps reducing hazards such as clutter, rugs, and dim lighting.¹¹

Despite efforts at implementing fall preventative measures, the task of raising awareness regarding fall prevention is difficult for the following two reasons. First, older adults are generally unaware of or underestimate their fall risk. Second, seniors, families, caregivers, healthcare providers, and the community often think that falls are an inevitable consequence of aging, and thus, cannot be avoided.¹¹

There are insufficient scientific evaluations of fall prevention measures in Hawai'i. Only one study evaluated a program that addresses both the physical and mental aspects of exercise to reduce falls in institutionalized older adults,¹² and there are no reports examining the effectiveness of fall preventive measures for community-dwelling older adults. On the other hand, there are a variety of randomized controlled trials conducted elsewhere investigating fall prevention programs.¹³⁻¹⁵ Therefore, as a first step, this study examined how the aforementioned fall preventive measures and other risk and preventive factors are related to fall risk identified by past cross-sectional studies.

Methods

Study Design and Site

A cross-sectional study was carried out using a structured mailed questionnaire to the client base of a local personal emergency response system (PERS) Company¹⁶ that serves the entire state of Hawai'i.

Participants

Five hundred eighty-five subscribers of the PERS Company were sent a questionnaire. The company started providing PERS services in 2003, and at the time of the study, it was serving about 600 clients daily throughout the state from Kaua'i, O'ahu, and Maui to Hawai'i Island.¹⁶ The company partners with a larger national company, Philips Lifeline, America's largest and most experienced medical alert company.¹⁶

Personal Emergency Response System

The system operated by the company is designed to enable those who are frail and living alone to access immediate help because of illness or having experienced a fall.¹⁶ The system components are a pendant which transmits a radio signal for help, a base communicator that receives and transmits a signal to a Call Center at any time and pre-designated responders who are summoned for help.¹⁶ Such systems have become widely accepted in the U.S., serving millions every day by safeguarding the wellbeing of seniors in the home setting so that immediate access to help can prevent a small problem from becoming a medical crisis.^{16,17}

Data Collection

Self-administered questionnaires were distributed and collected by mail between April and June 2014. Self-addressed stamped envelopes were included with the questionnaires to improve response. There were no extrinsic incentives for participation. Upon receipt, the completed questionnaires were labeled with an identification number and reviewed for completeness. The questionnaire assessed subscribers' service satisfaction level and their functional status. The latter was assessed by their self-reported ability to perform activities of daily living (ADL)¹⁸ for eating, dressing, grooming, bathing, walking, and toileting as well as instrumental activities of daily living (IADL)¹⁹ skills including independence in handling their finances, using the telephone, shopping, and preparing meals. In terms of the ADL and IADL scale, we used a 5-point scale since it provides responders with more gradations and increases our ability to better assess their perceived level of disability. This study assumed that a 5-point disability scale is reliable and valid with more gradations in comparison to a 2 or 3-point scale as it has been typically used in previous studies.²⁰⁻²² However, any scale beyond a 5-point scale would probably introduce less reliability and validity since it would probably not be as meaningful nor as interpretable for respondents. Data were also collected on the number of prescribed and non-prescribed medications taken per day, perceived fall experience, frequency of falls, fear of falling, physical balance, daily exercise, instability after taking

medicines, vision, difficulties with using stairs safely, conferring with family members or friends about how to reduce their risk of falling, talking to a health care provider about how to reduce risk of falling, having vision checked, having medications reviewed by a health care provider, having one's home assessed for safety, and adopted the recommendations of a home safety assessment (See Appendix).

Question items about satisfaction level, functional status, and medication information came from the annual survey of the PERS Company and other questions on fall related factors, came from existing Center of Disease Control Prevention (CDC)'s fall risk questionnaire.²³ Regarding the PERS company's question items, they were not pre-tested. However, those questions were used for 3 years from 2012 to 2014, and the results did not vary in these 3 years.

In addition, to investigate the impact of ethnicity on the utilization of PERS services, demographic data from the parent company were merged and analyzed with data from the questionnaire. The results will be published in another paper.²⁴ In this study, we only analyzed the data from the questionnaire.

Statistical Analysis

Chi-square tests were conducted to examine the associations between fall experience and several variables including sub-categories of ADL and IADL, fear of falling, physical balance, exercise, side effect of medication, vision problem, difficulties with using stairs, talking with family and friends about fall prevention, talking with health providers about fall preventions, vision check, medication review, home assessment, and modification recommendations for home safety assessment.

Regarding ADL and IADL, the 5-point scale was re-categorized into 3 groups as dependent (1), partially independent (2, 3, and 4), and independent (5). The Chi-square tests were then conducted to examine the associations between fall experience and independence level of walking, toileting, bathing, shopping, and preparing meals. These subcategories are strongly associated with lower levels of morbidity and strongly related to gait function. In addition, the gait issue is an important risk factor for physical functional declines and falls.²⁵

The statistical software package SAS, version 9.4 was used for all analysis. *P*-values less than .05 were considered statistically significant.

Ethical Considerations

Ethical approval for research involving human subjects was obtained from the Institutional Review Board at University of Hawai'i at Manoa (#23116). The information gathered was managed in a strictly confidential manner.

Results

Demographic of Respondents

The questionnaire was returned by 244 of the 585 subscribers resulting in a 42% response rate. Demographic data is presented in Table 1. Among the respondents, 47% reported falling within the past 12 months; 43% fell once, 29% fell twice, and 28%

fell greater than or equal to three times within the past 12 months. About 3% did not take any prescribed-medications, 60% took from 1 to 5, 32% took 6-10, and 5% took more than 10 prescribed-medications. About 24% did not take any non-prescribed medications, 68% took 1-5, and 8% took more than 5 non-prescribed medications. About 52% of respondents reported exercising, 58% reported having a vision check, 44% had their medication reviewed, and 48% had a home assessment. About 13% of respondents did all four preventive measures.

Characteristics of Those Who Tend to Fall

Results of the χ^2 tests are shown in Table 2. First, those who fell were more likely to talk with friends or family members about how they can reduce their risk of falling, compared with those who did not fall ($P < .05$). Second, compared with those who did not fall, those who fell were more likely to talk with health providers about how they could reduce their risk of falling ($P < .05$). There were no significant differences between fall experience and four preventive measures.

Those who were partially dependent or dependent of skills of bathing, toileting in ADL, shopping, and preparing meals in IADL were more likely to fall compared with those who were independent of those skills ($P < .01$).

Discussion

Summary of Findings

Overall, 47% of the respondents fell within the past 12 months. Among the 47% who fell, 43% fell once, 29% fell twice, and 28% fell greater than or equal to three times. Those who fell were more likely to talk with friends, family members, and health providers about how they could reduce their risk of falling. These results do not indicate that talking with friends, family members, and health providers about fall preventions confer a greater at risk of falls. Low functional levels of ADL and IADL were associated with risk of falling among older adults.

The Limitations of Fall Prevention Measures

Compared with those who did not fall, those who fell were more likely to talk with friends, family members, and health providers about how they could reduce their risk of falling. These results may suggest that older adults might tend to deny their risk of falls before they actually fall. However, Klein and his associates point out that a substantial proportion of falls occur among people who are neither frail nor at high risk.²⁵ In addition, the self-perceived risk of falling is often judged too optimistically and older adults might regard falls as a relevant problem for others but not for themselves.²⁶ The Hawai'i State Department of Health points out that about 44% of respondents of their survey perceived having a low level of awareness of fall risk and fall prevention.²⁷

Table 1. Respondent Attribute	
Item	n (%)
Fall experience in past 12 months	
Yes	110 (47.0)
No	124 (53.0)
No Answer	10
The number of falls in past 12 months	
Once	45 (42.5)
Twice	31 (29.2)
Greater than or equal to three times	30 (28.3)
No Answer	4
The number of oral medicines	
Prescribed	
0	6 (2.7)
1-5	135 (60.3)
6-10	71 (31.7)
11-12	(5.4)
No Answer	20
Non Prescribed	
0	53 (23.5)
1-5	154 (68.1)
6-	19 (8.4)
No Answer	18 ()
Exercise	
Yes	119 (52.4)
No	108 (47.6)
No Answer	17
Vision Check	
Yes	133 (57.6)
No	98 (42.4)
No Answer	13
Medication Review	
Yes	101 (43.9)
No	129 (56.1)
No Answer	14
Home Assessment	
Yes	110 (47.6)
No	121 (52.4)
No Answer	13
All Four Measures	
Yes	30 (13.0)
No	200 (87.0)
No Answer	14

Percentages do not include "No Answer".

Table 2. Association between Fall Experience and Other Characteristics				
Variables	Total	Non-Fell	Fell	P-value
Talked with family and friends				
Yes	83 (36.4)	36 (15.8)	47 (20.6)	.048*
No	145 (63.6)	84 (36.8)	61 (26.8)	
Talked with health providers				
Yes	77 (33.8)	27 (11.8)	50 (21.9)	<.001**
No	151 (66.2)	93 (40.8)	58 (25.4)	
ADL				
Walking				
Dependent (1)	27 (12.1)	13 (5.8)	14 (6.2)	.687
Partially Independent (2,3,4)	197 (87.9)	103 (46.0)	94 (42.0)	
Independent (5)	0	0	0	
Bathing				
Dependent (1)	27 (11.9)	11 (4.9)	16 (7.1)	.008**
Partially Independent (2,3,4)	65 (28.8)	26 (11.5)	39 (17.3)	
Independent (5)	134 (59.3)	82 (36.3)	52 (23.0)	
Toileting				
Dependent (1)	17 (7.6)	8 (3.6)	9 (4.0)	.001**
Partially Independent (2,3,4)	59 (26.3)	19 (8.5)	40 (17.9)	
Independent (5)	148 (66.1)	90 (40.2)	58 (25.9)	
IADL				
Shopping				
Dependent (1)	71 (31.7)	30 (13.4)	41 (18.3)	.001**
Partially Independent (2,3,4)	82 (36.6)	38 (17.0)	44 (19.6)	
Independent (5)	71 (31.7)	50 (22.3)	21 (9.4)	
Prepare Meals				
Dependent (1)	55 (24.4)	23 (10.2)	32 (14.2)	.004**
Partially Independent (2,3,4)	72 (32.0)	32 (14.2)	40 (17.8)	
Independent (5)	98 (43.6)	64 (28.4)	34 (15.1)	

* $P < .05$, ** $P < .01$

The challenge therefore is to determine how health providers can enhance older adult awareness of the dangers of falls. One possibility is to create coordinated community initiatives. The Hawai'i State Department of Health has undertaken such an initiative several years ago. The Department of Health Fall Prevention Task Force initiated an educational awareness campaign built upon the four foundations of fall prevention and specifically targeted fall prevention messages to older adults, families, clinical professionals/paraprofessionals, the public, students, and policymakers.²⁸ The Task Force has also collaborated and partnered with professionals, organizations, agencies and the general public to increase their awareness of fall prevention resources in their community as a crucial way to decrease senior falls.²⁸ The challenge is how to deliver the fall prevention message to older adults and increase the acceptance of the fall prevention tips and to acknowledge that they are really older and at risk of falls. Future objectives include finding

ways of approaching older adults and ways of encouraging them to adopt fall prevention measures. The use of positive slogans such as "Maintain Your Independence" or "Good Balance" might be more persuasive and effective at changing attitudes in comparison to directly referring to "Fall Prevention". Moreover, activities, exercise, and lectures which older adults can enjoy with different age groups may also be effective to increase their motivation for fall prevention and retain their motivation. Exclusive exercise programs for seniors or only for the frail might be avoided to reduce the stigma of aging. An example of an alternative type of approach may be found in the diabetes exercise program in the Marshall Islands.²⁴ Marshall Islands introduced an intergenerational exercise program for diabetes patients and this program has been succeeding in improving glycemic control.²⁹ Diabetes patients do exercise with friends, young adults, and children in the community.²⁹

Association ADL and IADL and Fall Experience

Previous studies mentioned that ADLs and IADLs deficits are predictors of falls.^{25,30} Similar to those previous studies, the present results also suggest a significant association between low ADLs and IADLs levels and the fall experience. For example, those who were dependent or partially independent of skills of bathing, toileting in ADL, shopping, and preparing meals in IADL were significantly likely to fall, compared with those who were independent of these skills. The activities of bathing, toileting, shopping, and preparing meals all involve good mobility. Thus, declining levels of ADLs and IADLs in those skills mean that the mobility has also probably declined.³¹ In addition, declined ADL and IADL measures may also be reflected in gait issues leading to falls.

In association with ADLs and IADLs, most falls in older adults result from inadequate balance.³² Exercise helps improve physical balance and strengthens muscles which are crucial to prevent falls.^{26,32} However, in this study, no difference was observed between daily exercise and fall experience. This result could also imply that the respondents were not be doing appropriate or enough exercise to improve their balance and strengthen muscles. Therefore, as the Fall Prevention State Plan mentions, professional trainers should continue offering older adults more evidence-based exercise programs to specifically increase muscle strength and improve balance and make use of Tai Chi classes for balance training.¹⁰ Add to that, step training which include single or multiple volitional or reactive steps in an upright (standing or walking) position in response to an environmental challenge (e.g., avoiding an obstacle or responding quickly) may be worth introducing since this type of training has been shown to prevent falls by approximately 50% in older adults in both community and institutional settings.³³ Finally, use of a pedometer has been found to be effective in increasing participants' motivation and enhance the benefit of exercise on lower-extremity physical function.³⁴

Limitations

This study has limitations. First, respondents were recruited from only one PERS company. Additionally, all subjects of this study were medical alert users, therefore, they may have already been more sensitized about fall prevention issues in comparison to the general older adult population. Thus, the results may not be generalizable.

Second, reporting bias might also exist. It is not clear if all of the respondents were PERS users. While the target population was seniors, some may have experienced difficulty answering the questions accurately and so family members might have answered the questions on their behalf.

Third, no information was collected about the respondents' present illnesses and age which can influence independence and the need for homecare services. These factors should be examined in future work. In addition, no information about family structure and living arrangements was collected. For example, living alone might influence the desire to use PERS services.

Finally, this study was cross-sectional, thus, causality cannot be determined. For example, it is not possible to determine whether decline in ADLs or IADLs causes falls or fall experiences.

Conclusion

The aging population in Hawai'i continues to accelerate rapidly and injuries among older adults due to falls will continue to affect their quality of life and health care costs. This study found that reduced ADLs and IADLs are associated with falls. However, the problem is that older adults have not adopted broader fall preventive measures such as medical alert services, exercise, medication checks, vision checks, and home assessment while they are still independent. Older adults generally do not acknowledge that they are at risk of falling. To overcome this barrier, it is crucial for public health providers to consider how to conduct more creative and unobtrusive approaches to educate older adults.

Conflict of Interest

Dr. Hayashida had a financial interest as owner of the PERS Company and paid for the mailing and collection of the completed questionnaires. No other authors reported any financial interest with the respondents.

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Appendix

(1) Can you tell us how independent you are as a subscriber or user of our service for the following activities of daily living? (If you are a family member, please provide an assessment of the subscriber's condition.) (Circle)

Skills	Dependent			Independent	
	1	2	3	4	5
Walking	1	2	3	4	5
Eating	1	2	3	4	5
Bathing	1	2	3	4	5
Dressing	1	2	3	4	5
Grooming	1	2	3	4	5
Toileting	1	2	3	4	5
Handle Finance	1	2	3	4	5
Use Telephone	1	2	3	4	5
Shopping	1	2	3	4	5
Prepare meals	1	2	3	4	5

(2) How many prescribed and over-the-counter medications do you as the subscriber take? (eg. eye drops, pills, injectables, herbals, traditional or alternative medications, etc.)

1. _____ Prescribed medications
2. _____ Non-prescribed medications (i.e. over-the-counter medicine)

- | | | |
|--|-------|----|
| (3). Have you fallen in the 12 months? | Yes | No |
| (4). If "yes", how many times have you fallen in the 12 months? enter number → | _____ | |
| (5). Are you afraid of falling? | Yes | No |
| (6). Do you consider yourself to have good balance? | Yes | No |
| (7). Do you exercise daily? | Yes | No |
| (8). Do you feel unsteady after taking your medicines? | Yes | No |
| (9). Can you see clearly? | Yes | No |
| (10). Do you have any difficulties with using stairs safely? | Yes | No |

(11). What have you done to reduce your chance of falling? Check all that apply.

- _____ Talked to a family member or friend about how I can reduce my risk of falling
- _____ Talked to a health care provider about how I can reduce my risk of falling
- _____ Had my vision checked
- _____ Had my medications reviewed by a health care provider or pharmacist
- _____ Had my home assessed for safety
- _____ Adopted the recommendations from home safety assessment (reduce clutter, secured rugs or improved lighting)
- _____ Other. Please describe _____