

Balance Confidence and Functional Balance in Relation to Falls in Older Persons with Hip Fracture History

Jenni Kulmala, MSc;^{1,2} Sanna Sihvonen, PhD;^{1,3} Mauri Kallinen, MD, PhD;^{4,5} Markku Alen, MD, PhD;¹
Ilkka Kiviranta, MD, PhD;⁴ Sarianna Sipilä, PhD^{1,2}

¹ University of Jyväskylä, Department of Health Sciences

² University of Jyväskylä, the Finnish Centre for Interdisciplinary Gerontology

³ National Public Health Institute, Injury Prevention Unit

⁴ Central Finland Health Care District, Central Finland Hospital

⁵ The GeroCenter Foundation for Research and Development

ABSTRACT

Purpose: To investigate whether self-assessed balance confidence and functional balance are associated with falls in older persons with hip fracture history. **Methods:** This study is a part of a larger study on functional capacity and exercise rehabilitation in hip fracture patients. Seventy-nine patients, operated at the local hospital for collum or trochanter fracture within one-half to 7 years, participated in the laboratory measurements. Balance confidence was assessed with Activities-specific Balance Confidence scale (ABC) and functional balance using the Berg Balance Scale (BBS). According to self-reported number of falls during the previous 6 months participants were classified as those with falls vs. no falls; recurrent falls (3 or more falls) vs. occasional/no falls (< 3 falls); indoor falls vs. no indoor falls; outdoor falls vs. no outdoor falls. The relationships between ABC, BBS, and fall status were tested by logistic regression. **Results:** Lower BBS score was associated with all falls during previous 6 months (OR 0.929, 95% CI 0.875-0.987). Lower ABC score was associated with recurrent falling (OR 0.974, 0.952-0.998), as well as lower BBS score (OR 0.876, 0.797-0.962). Additionally, lower ABC and lower BBS scores were related to indoor falls (ABC OR 0.975, 0.957-0.993; BBS OR 0.913, 0.852-0.978). Participants with outdoor falls did not differ from those with no outdoor falls in ABC scores or BBS. **Conclusions:** Self-assessed balance confidence and functional balance are related to prevalence of recurrent and indoor falls in older hip fracture patients. Therefore use of Activities-specific Balance Confidence scale and Berg Balance Scale might be reasoned to expand in evaluating the probability for falls among at-risk elders.

Key Words: hip fracture, falls, balance

Address all correspondence to: Jenni Kulmala, Finnish Centre for Interdisciplinary Gerontology, P.O. Box 35 (Viveca), FIN-40014 University of Jyväskylä Ph: +358 14 2602181, Fax: +358 14 2604600 (jenni.kulmala@sport.jyu.fi).

INTRODUCTION

Falls among older adults are a common occurrence. Each year, approximately one third of persons over age 65 experience a fall. About 10% to 25% of falls lead to injuries, including soft tissue injuries and fractures.¹⁻⁵ Fall-related injuries decrease mobility and increase morbidity.⁶⁻⁸ One of the most serious consequences of falling among older people is hip fracture, which occurs in approximately 1% of falls. The incidence of hip fractures seems to be increasing.^{9,10} Hip fracture increases the use of health and social care, need for help in daily activities, and also use of assistive devices.¹¹ Approximately 20% of hip fractures lead to permanent placement in long-term care.¹² Higher mortality rates have also been observed among older adults with hip fracture.¹³

A variety of risk factors for falling have been identified. Falling is often related to higher age, previous falls, and chronic and acute illnesses.^{1,3,14-19} Fear of falling and uncertainty of maintaining balance are also related to fall incidence.²⁰⁻²² Among healthy older people who reported fear of falling, the prevalence of all falls in previous 3 month was 60%, whereas among less fearful elderly it was 30%.²³ Older adults reporting a fall during the previous year, were less confident in maintaining balance in daily activities than other healthy older adults who have not fallen.^{22,24} Fear of falling and uncertainty of maintaining balance may have significant implications on older adults' ability to live independently.

Impaired balance has been recognized as a risk factor for falls.²⁵ Lajoie and Gallagher suggested that elderly persons that score 50 on the Berg Balance Scale (BBS) would present a 10% change of sustaining a fall, whereas a score of 38 or lower indicates 90% change of falling.²²

Hip fractures cause mobility limitations and other adverse health consequences, which together or separately increase the risk for falls. Further, previous fall, which lead to the hip fracture may have affected self-assessed balance confidence. Therefore older people with hip fracture may be considered as the high risk group for future falls.²⁶ Limited research efforts have focused on risk factors based on fall status, specifically occasional versus recurrent falls, or indoor versus outdoor falls.

The purpose of this study was to determine whether balance confidence or functional balance is related to falling prevalence or location of falls among older people with previous hip fracture.

MATERIAL AND METHODS

Participants

This study is a part of a larger study on functional capacity and exercise rehabilitation in hip fracture patients, started in 2004. Study population consists of all 60- to 85-year-old patients operated at the local hospital for collum or trochanter fracture within 6 months to 7 years prior to the baseline measurements. Almost all of the subjects had a low-energy fracture due to falling. Those with neurological diseases (including memory disorders), progressive severe illnesses, or inability to walk outdoors without other person's assistance were excluded. A total of 452 potential participants with previous hip fracture were informed by a letter about the study. Those who were willing to participate were interviewed by telephone (N=132) to insure that inclusion and exclusion criteria were met. Of those interviewed, 79 former patients (54 women and 25 men) were eligible and willing to participate in laboratory measurements. Forty-seven percent of the participants had the hip fracture surgically managed with an internal fixation (ORIF) and 53% had joint replacement. Participants signed an informed consent document prior to baseline measurement. The study plan was approved by the Ethics Commission of the Central Finland Health Care District.

Medical examination

Medical examination by a physician and a research nurse focused on identifying possible neurological, cardiovascular, and musculoskeletal conditions which would be contraindications to take part in measurements. The presence of chronic conditions and use of medications were documented according to health questionnaire, current prescriptions, and medical records. The background data of the study population is presented in Table 1.

Fall status

Participants were classified as having no falls, falls (one or more), no or occasional falls (0-2 falls), recurrent falls (3 or more), indoor falls, and outdoor falls based on self-reported fall history

during the previous 6 months. Four sets of statistical comparisons were performed between (1) participants with falls vs. those with no falls, (2) participants with recurrent falls vs. those with occasional/no falls, (3) those with indoor falls vs. no indoor falls, and (4) those with outdoor falls vs. no outdoor falls.

Self-assessed balance confidence

Activities-specific Balance Confidence scale, ABC²⁷, was used to measure confidence in carrying out specific activities without falling or becoming unsteady. ABC scale consists of 16 items, where subjects were asked to report their confidence levels when they are doing different activities, including those performed outside the home. Answers in every specific activity were rated from 1 (no confidence) to 10 (total confidence). Higher total score (range 16-160) indicates good balance confidence. The ABC scale is used in various studies also among older persons and it has acceptable measurement properties.²⁸⁻³⁰ Among healthy older adults, Chronbach alpha was 0.96 and retest reliability was $r = 0.92$.²⁷

Functional balance

Functional balance was measured using the Berg Balance Scale, BBS³¹, which evaluates a person's ability to perform different tasks related to subjects' skills to sit down, stand up, reach, turn around them, look over the shoulders, and stand on one foot. Ability to perform each of the 14 tasks is rated from 0 (incapable) to 4 (safe and independent). Total score ranges between 0 and 56 and higher scores in BBS represent good functional balance. The results from previous studies have shown that the internal consistency, test-retest reliability, and construct validity of the BBS are adequate for measuring balance in older adults.³⁰⁻³⁴

Data analysis

Mean differences in baseline characteristics, ABC and BBS between groups were tested with independent sample t-test. Two separate logistic regressions were used to analyze the data

Table 1. Baseline Characteristics of Study Population

Variables	Women (N=54)		Men (N=25)		p-value [‡]
	mean ± SD	range	mean ± SD	range	
Age (years)	76.0 ± 6.2	60-85	73.6 ± 7.4	60-82	0.145
Height (cm)	159.0 ± 5.8	144-174	172.7 ± 7.3	158-187	0.001
Weight (kg)	68.0 ± 11.2	42-99	77.9 ± 12.0	47-100	0.001
Chronic diseases*	3.4 ± 1.9	0-9	2.8 ± 2.0	0-8	0.178
Medications [†]	5.6 ± 2.9	0-11	4.0 ± 3.5	0-14	0.037

*Number of chronic diseases assessed by a physician

[†] Regularly used medication, prescribed by a physician

[‡] Independent samples t-test

with fall status as the dependent variable and self-assessed balance confidence (ABC score) and functional balance (BBS score) as independent variables. The analyses were performed to the whole group. The relationship between different fall status and ABC, and fall status and BBS was examined first unadjusted. Models were then adjusted for age, gender, chronic diseases, and medications. These potential confounders were selected based on previous studies.^{4,14,35} From the logistic regression models odds ratios (ORs) and 95% confidence intervals (CIs) were estimated. A p-value < 0.05 was considered statistically significant. All statistical analyses were performed using SPSS 12.0 version.

RESULTS

Out of 79 participants, 38% (n=30) had experienced at least one fall during the previous 6 months. Ten percent (n=8) were classified as recurrent fallers (3 or more falls). Sixteen percent (n=13) had experienced indoor falls and 21% (n=17) of participants had fallen outdoors. There were no significant differences in age, chronic diseases, or medications according to fall status.

Mean scores in ABC and BBS within groups are presented in Table 2. The mean ABC score was lower, though not significantly, among participants with falls compared to nonfallers. BBS score was significantly lower among participants who had

fallen during the previous 6 months. The ABC score of those with occasional/no falls was significantly higher compared to the recurrent fallers. Also BBS scores were higher among those with no recurrent falls. Among participants with indoor falls, the mean value of ABC score and BBS were significantly lower compared to the participants with no indoor falls. No mean differences were observed between outdoor fallers and those with no outdoor falls in ABC scores or BBS.

Table 3 presents the association between fall status and balance confidence. ABC score was not associated with falls in general. However, in unadjusted models, lower ABC score was associated with recurrent and indoor falls. Adjustment with the confounders did not change the estimates in indoor falls. However the relationship between ABC and recurrent falls was no longer significant after the adjustment.

Table 4 shows the association between fall status and functional balance. In unadjusted models BBS was associated with all, indoor, and recurrent falls. Adjustment with the confounders did not change the estimates. Likewise in ABC, BBS was not related to outdoor falls.

DISCUSSION

This study examined 4 different outcome measures for fall events among hip fracture patients: all falls, recurrent falls,

Table 2. Mean Scores in ABC and BBS for Different Fall Categories in 60- to 85-year-old Men and Women with Hip Fracture History

Variables	Frequency		ABC		p-value	BBS		p-value
	n	(%)	Mean	± (SD)		Mean	± (SD)	
Falls								
No falls	49	(62%)	100	± 31		48	± 6	
Falls	30	(38%)	85	± 39	0.081	43	± 11	0.011
Recurrent falls								
No recurrent falls	71	(90%)	97	± 31		47	± 7	
Recurrent falls	8	(10%)	68	± 51	0.023	36	± 13	0.001
Indoor falls								
No indoor falls	63	(80%)	100	± 32		48	± 7	
Falls indoors	16	(20%)	72	± 35	0.004	41	± 11	0.004
Outdoor falls								
No outdoor falls	58	(73%)	94	± 35		47	± 8	
Falls outdoors	21	(27%)	95	± 34	0.869	46	± 9	0.721

ABC=Activities-specific Balance confidence scale

BBS=Berg Balance Scale

Table 3. Association between self-assessed balance confidence (measured with ABC scale) and fall status. Logistic regression models for risk for fallers vs. non-fallers, recurrent fallers vs. occasional fallers, indoor fallers vs. non-indoor fallers and outdoor fallers vs. non-outdoor fallers (N=79).

Fall status	Unadjusted (95%CI)	p-value	Adjusted OR* (95% CI)	p-value
Falls	0.99 (0.97-1.00)	0.084	0.99 (0.97-1.00)	0.114
Recurrent falls	0.97 (0.95-1.00)	0.032	0.98 (0.96-1.01)	0.250
Indoor falls	0.98 (0.96-0.99)	0.007	0.98 (0.96-1.00)	0.037
Outdoor falls	1.00 (0.99-1.0)	0.857	1.00 (0.98-1.01)	0.590

*Adjusted for age, gender, chronic conditions and mediations

Note: OR = odds ratio; CI = confidence interval

ABC=Activities-specific Balance Confidence Scale

Table 4. Association between functional balance (measured with BBS) and fall status. Logistic regression models for risk for fallers vs. non-fallers, recurrent fallers vs. occasional fallers, indoor fallers vs. non-indoor fallers and outdoor fallers vs. non-outdoor fallers (N=79).

Fall status	Unadjusted OR (95% CI)	p-value	Adjusted OR* (95% CI)	p-value
Falls	0.93 (0.88-0.99)	0.017	0.91 (0.85-0.99)	0.019
Recurrent falls	0.88 (0.80-0.96)	0.006	0.87 (0.77-0.98)	0.021
Indoor falls	0.91 (0.85-0.98)	0.010	0.91 (0.83-0.99)	0.027
Outdoor falls	0.99 (0.93-1.05)	0.717	0.97 (0.90-1.04)	0.404

*Adjusted for age, gender, chronic conditions and mediations

Note: OR = odds ratio; CI = confidence interval

BBS=Berg Balance Scale

indoor falls, and outdoor falls. Our results suggest that self-reported uncertainty in maintaining balance and also objectively measured reduced balance ability in daily activities are related to the odds of recurrent and indoor falls in older hip fracture patients. Functional balance was associated also with falls in general. The odds ratio used in our analyses compares the relative odds of falls in each group. An odds ratio below one indicates that increase (that is, a score change in the ABC or BBS scores) is associated with a decrease of probability of falls. Therefore, in this specific group of older people with previous hip fracture, ABC scale and BBS proved to be relevant indicators in identifying persons with higher probability especially for indoor and recurrent falls.

A few previous studies have separated the factors, which are related to outdoor and indoor falls. Bergland et al suggested that factors related to indoor and outdoor falls are different. They found that indoor falls are associated with slower walking speed, the poorer functional capacity, morbidity, and

poor cognition. Older people with faster walking speed and visual impairment were more likely to fall outdoors.³⁶ Further, Close et al reported that indoor falls increased the probability for new falls more than twofold in older people aged > 65.³⁷ In our study older people with indoor falls were less confident in maintaining balance and also had lower scores in functional balance test. Findings from the previous and present study suggest that older people who fall indoors have compromised balance and may have more functional limitations and serious health outcomes compared to those who do not fall.

Some previous studies have compared recurrent fallers and occasional/nonfallers. Factors related to recurrent falls have been identified, including previous falls, dizziness, and fear of falling.³⁸ Low levels of physical activity and poor performance in walking test have also been found to be associated with recurrent falls.³⁹ We found that functional balance was related to recurrent falls in older hip fracture

patients. The test developers consider a BBS score of 45 as a cut point reporting that older adults who scored higher than 45 are less likely to experience a fall than those who scored 45 or below.⁴⁰ In our study the BBS scores for the entire sample ranged between 17 and 56. Among participants who had experienced recurrent falls, the mean BBS score was 36 ± 13 and among those with indoor falls 41 ± 11 . Also when comparing with the suggested cut off point, it seems that in our study population the probability for falls is increased among those with indoor and recurrent falls.

Self-assessed balance confidence was also associated with recurrent falls. In previous studies, the association between balance confidence and falls has varied in magnitude. In the same way as in present study, also Lajoie and Gallagher²² reported that fallers had significantly lower scores in ABC scale compared to nonfallers. They reported that an ABC cut-off score of 67% (approximately the score of 107) could be used for identification of older adults who present a substantial probability for falls.²² Conversely Cho et al has reported that there was no significant relationship between balance confidence (measured by ABC scale) and frequent falling in balance-impaired older adults.⁴¹ Previous studies have reported that among older people with history of falls, the mean score of balance confidence ranges between 48 and 54 and in healthy older adults between 68 and 88.^{22,24} In our study the ABC range was much larger ranging from 19 to 157. Our results are probably affected by our exclusion criteria, because persons with more severe health or functional limitations did not participate in this study. On the other hand, a number of our subjects had very low ABC score even though they were community-dwelling and independently living older people. However, lower ABC scores can be considered as the factor, which is associated with recurrent falls. The ABC scale could be a useful tool in identifying persons with increased probability for recurrent falls and fall-related serious consequences on health and functioning.

More than one third (38%) of subjects with previous hip fracture had fallen during the previous 6 months. This rate is higher than the about 30% per year reported in many previous studies, which have focused on healthy older people.^{25,42} This was not surprising, because the study was focused on older people with previous fall-related fracture, who are likely to have a higher probability for falls than the general population. The falling rate was high in this specific group despite the fact that out of 79 participants, 46 persons (58%) used walking aids outdoors and 17 persons (22%) used walking aids indoors.

Previous studies have found interventions which have positive effect on self-assessed balance confidence and functional balance. Exercises that affect on vestibular system, strength training, and postural training have been able to promote significant improvements in functional balance and in balance confidence.⁴³⁻⁴⁷ Education programs with discussions about concerns regarding falling and factors associated with falls have had positive effects on self-assessed balance

confidence.⁴⁸ Because low balance confidence and poor functional balance are related to prevalence of falls, interventions such as these may have potential of preventing falls in older adults.

A few study limitations should be noted. Our findings may not be generalized to all older people, because of hip fracture patients' increased probability for falls. Further, the retrospective design of this study may limit the presented results. There may be recall bias in the self-reported numbers on falls. Cummings has reported that approximately 13% to 32% of older people, depending the period of recall, with falls in the previous year failed to recall them.⁴⁹ This recall bias may underestimate the prevalence of falls in our study population. It should also be noted that our group of recurrent fallers is relatively small ($n=8$). Although we found statistically significant association between recurrent falls and ABC and BBS, further studies with larger sample are warranted.

Self-assessed balance confidence and functional balance are related to prevalence of recurrent and indoor falls in older hip fracture patients. Functional balance is associated also with falls in general. The use of ABC scale and Berg Balance Scale might be reasoned to expand in evaluating the probability for falls among at-risk older people. Interventions targeted to improve these areas may prevent falls, but further experimental studies are warranted.

ACKNOWLEDGEMENTS

This study was funded by Ministry of Education. The authors thank Piia Tarnanen, Merja Rantakokko, Johanna Vaha, and Minna Mård for the assistance with the laboratory measurements.

REFERENCES

1. Fuller G. Falls in the elderly. *Am Fam Physician*. 2000;61:2159-2168.
2. Young Y, Myers AH, Provenzano G. Factors associated with time to first hip fracture. *J Aging Health*. 2001;13:511-526.
3. Bootsma-van der Wiel A, Gussekloo J, de Craen AJ, et al. Walking and talking as predictors of falls in the general population: The Leiden 85-plus study. *J Am Geriatr Soc*. 2003;51:1466-1471.
4. Kelly KD, Pickett W, Yiannakoulis N, et al. Medication use and falls in community-dwelling older persons. *Age Ageing*. 2003;32:503-509.
5. Richmond TS, Kauder D, Strumpf N, et al. Characteristics and outcomes of serious traumatic injury in older adults. *J Am Geriatr Soc*. 2002;50:215-222.
6. Donald IP, Bulpitt CJ. The prognosis of falls in elderly people living at home. *Age Ageing*. 1999;28:121-125.
7. Ingemarsson AH, Frändin K, Mellström D, et al. Walking ability and activity level after hip fracture in the elderly – a follow-up. *J Rehabil Med*. 2003;35:76-83.
8. Meyer HE, Tverdal A, Falch JA, et al. Factors associated with mortality after hip fracture. *Osteoporos Int*. 2000;11:228-232.

9. Kannus P, Niemi S, Parkkari J, et al. Hip fractures in Finland between 1970 and 1997 and predictions for the future. *Lancet*. 1999;353:802-805.
10. Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. *N Engl J Med*. 1988;319:1701-1707.
11. Osnes EK, Lofthus CM, Meyer HE, et al. Consequences of hip fracture on activities of daily living and residential need. *Osteoporos Int*. 2004;15:567-574.
12. Marottoli RA, Berkman LF, Leo-Summers L, et al. Predictors of mortality and institutionalization after hip fracture: the New Haven EPESE cohort. *Am J Public Health*. 1994;84:1807-1812.
13. Farahmand BY, Michaelsson K, Ahlbom A, et al. Survival after hip fracture. *Osteoporos Int*. 2005;16:1583-1590.
14. Graafmans WC, Ooms ME, Hofstee HM, et al. Falls in the elderly: A prospective study of risk factors and risk profiles. *Am J Epidemiol*. 1996;143:1129-1136.
15. Norton R, Campbell AJ, Reid IR, et al. Residential status and risk of hip fracture. *Age Ageing*. 1999;28:135-139.
16. Salgado RI, Lord SR, Ehrlich F, et al. Predictors of falling in elderly hospital patients. *Arch Gerontol Geriatr*. 2004;38:213-219.
17. Campbell AJ, Borrie MJ, Spears GF. Risk factors for falls in a community-based prospective study of people 70 years and older. *J Gerontol*. 1989;44:M112-117.
18. Cesari M, Landi F, Torre S, et al. Prevalence and risk factors for falls in an older community-dwelling population. *J Gerontol A Biol Sci Med Sci*. 2002;57:M722-726.
19. Lawlor DA, Patel R, Ebrahim S. Association between falls in elderly women and chronic diseases and drug use: cross sectional study. *BMJ*. 2003;327:712-717.
20. Friedman SM, Munoz B, West SK, et al. Falls and fear of falling: Which comes first? A longitudinal prediction model suggests strategies for primary and secondary prevention. *J Am Geriatr Soc*. 2002;50:1329-1335.
21. Hill K, Schwarz J, Flicker L, et al. Falls among healthy, community-dwelling older women: a prospective study of frequency, circumstances, consequences and prediction accuracy. *Aust N Z J Public Health*. 1999;23:41-48.
22. Lajoie Y, Gallegher SP. Predicting falls within the elderly community: comparison of postural sway, reaction time, the Berg balance scale and the Activities-specific Balance Confidence (ABC) scale for comparing fallers and non-fallers. *Arch Gerontol Geriatr*. 2004;38:11-26.
23. Li F, Fisher KJ, Harmer P, et al. Fear of falling in elderly persons: Association with falls, functional ability, and quality of life. *J Gerontol B Psychol Sci Soc Sci*. 2003;58:P283-290.
24. Lajoie Y, Girard A, Guay M. Comparison of the reaction time, the Berg balance Scale and the ABC in non-fallers and fallers. *Arch Gerontol Geriatr*. 2002;35:215-225.
25. Covinsky KE, Kahana E, Kahana B, et al. History and mobility exam index to identify community-dwelling elderly persons at risk of falling. *J Gerontol A Biol Sci Med Sci*. 2001;56:M253-259.
26. Nguyen ND, Pongchaiyakul C, Center JR, et al. Identification of high-risk individuals for hip fracture: A 14-year prospective study. *J Bone Miner Res*. 2005;20:1921-1928.
27. Powell LE, Myers AM. The Activities-specific Balance Confidence (ABC) Scale. *J Gerontol A Biol Sci Med Sci*. 1995;50A:M28-34.
28. Myers AM, Fletcher PC, Myers AH, et al. Discriminative and evaluative properties of the activities-specific balance confidence (ABC) scale. *J Gerontol A Biol Sci Med Sci*. 1998;53A: M287-294.
29. Botner EM, Miller WC, Eng JJ. Measurement properties of the Activities-specific Balance Confidence Scale among individuals with stroke. *Disabil Rehabil*. 2005;27:156-163.
30. Holbein-Jenny MA, Billek-Sawhney B, Beckman E, et al. Balance in personal care home residents: a comparison of the Berg Balance Scale, the Multi-Directional Reach Test, and the Activities-Specific Balance Confidence Scale. *J Geriatr Phys Ther*. 2005;28:48-53.
31. Berg KO, Wood-Dauphinee SL, Williams JJ, et al. Measuring balance in the elderly: validation of an instrument. *Can J Public Health*. 1992;83:S7-11.
32. Newstead AH, Hinman MR, Tomberlin JA. Reliability of the Berg Balance Scale and balance master limits of stability tests for individuals with brain injury. *J Neurol Phys Ther*. 2005;29:18-23.
33. Sackley C, Richardson P, McDonnell K, et al. The reliability of balance, mobility and self-care measures in a population of adults with a learning disability known to a physiotherapy service. *Clin Rehabil*. 2005;19:216-223.
34. Wang CY, Hsieh CL, Olson SL, et al. Psychometric properties of the Berg Balance Scale in a community-dwelling elderly resident population in Taiwan. *J Formos Med Assoc*. 2006;105:992-1000.
35. Hanlon JT, Landerman LR, Fillenbaum GG, et al. Falls in African American and white community-dwelling elderly residents. *J Gerontol A Biol Sci Med Sci*. 2002;57:M473-478.
36. Bergland A, Jarnlo GB, Laake K. Predictors of falls in the elderly by location. *Aging Clin Exp Res*. 2003;15:43-50.
37. Close JC, Hooper R, Glucksman E, et al. Predictors of falls in a high risk population: results from the prevention of falls in the elderly trial (PROFET). *Emerg Med J*. 2003;20:421-425.
38. Pluijm SM, Smit JH, Tromp EA, et al. A risk profile for identifying community-dwelling elderly with a high risk of recurrent falling: results of a 3-year prospective study. *Osteoporos Int*. 2006;17:417-425.
39. Stel VS, Smit JH, Pluijm SM, et al. Balance and mobility performance as treatable risk factors for recurrent falling in older persons. *J Clin Epidemiol*. 2003;56:659-668.
40. Bogle Thorbahn LD, Newton RA. Use of the Berg Balance Test to predict falls in elderly persons. *Phys Ther*. 1996;76:576-583.
41. Cho BL, Scarpace D, Alexander NB. Tests of stepping as indicators of mobility, balance and fall risk in balance-impaired older adults. *J Am Geriatr Soc*. 2004;52:1168-1173.

42. Talbot LA, Musiol RJ, Witham EK, et al. Falls in young, middle-aged and older community dwelling adults: perceived cause, environmental factors and injury. *BMC Public Health*. 2005;5:86.
43. Hess JA, Woollacott M. Effect of high-intensity strength-training on functional measures of balance ability in balance-impaired older adults. *J Manipulative Physiol Ther*. 2005;28:582-590.
44. Ribeiro Ados S, Pereira JS. Balance improvement and reduction of likelihood of falls in older women after Cawthorne and Cooksey exercises. *Rev Bras Otorrinolaringol (Engl Ed)*. 2005;71:38-46.
45. Sattin RW, Easley KA, Wolf SL, et al. Reduction in fear of falling through intense tai chi training in older, transitionally frail adults. *J Am Geriatr Soc*. 2005;53:1168-1178.
46. Lajoie Y. Effect of computerized feedback postural training on posture and attentional demands in older adults. *Aging Clin Exp Res*. 2004;16:363-368.
47. Li F, Harmer P, Fisher KJ, et al. Tai Chi: Improving functional balance and predicting subsequent falls in older persons. *Med Sci Sports Exerc*. 2004;36:2046-2052.
48. Brouwer BJ, Walker C, Rydahl SJ, et al. Reducing fear of falling in seniors through education and activity programs: a randomized trial. *J Am Geriatr Soc*. 2003;51:829-834.
49. Cummings SR, Nevitt MC, Kidd S. Forgetting falls. The limited accuracy of recall of falls in the elderly. *J Am Geriatr Soc*. 1988;36:613-616.

Aquatics in Sprint

ADAPTED BATHING SUIT
PATENT PENDING




Step in panty Pull straps on shoulders



Hook Velcro fasteners
Blue Sizes: 18-28 / Black Sizes: 30 - 6X

Fabric: 45% Polyester/ 55% PBT / PBT Yarns provide superior stretch. Chlorine resistant fabric with shape retention, quick drying and with no fabric degradation. Superior Velcro closures

Patented Water Walking Assistant



I had a brain hemangioma which left me with right side weakness. I was afraid I would drown in the pool. After being lifted into the pool, I hop around with one leg and feel safe in my Water Walking Assistant. God is good!!

Available in: Extra-small, Small, Medium and Large

FOR MORE INFORMATION

Visit: www.sprintaquatics.com

Call: **1-800-235-2156**

Fax: **1-805-541-5339**

E-mail: info@sprintaquatics.com

P.O. Box 3840
San Luis Obispo, CA 93403
4554 Broad St Suite#140
San Luis Obispo, Ca 93401



Available in Women's sizes 5-14 and Men's sizes 3.5 - 12.5.

The Sprint Aqua Shoes will protect your feet in or out of the water. They've been designed with vents in soles, tie strings for secure footing, good arch support, comfortable shoe, durable uppers.

APTA Foundation GERIATRIC FUND

Supporting Geriatric PT Research

2007 MATCHING CAMPAIGN

The Section on Geriatrics will match up to \$50,000 in donations made this year!

We have raised \$9,528 towards our goal. Thank you to everyone who has donated so far! You can assist us by making a contribution of money, or of your time/knowledge. If even half of our members respond to this ad, we will easily reach our goal. Please read on for more details.

- 1. ALL donations to the APTA Foundation can be allocated to the Geriatric Fund.**
The Geriatric Fund supports physical therapy research related to the aging adult. Please consider a donation and encourage friends, colleagues, and patients to do the same. Every little bit helps. Together we can advance physical therapy practice for the older adult!

To have your Foundation contributions earmarked for geriatrics, just write "Geriatric Fund" in the memo portion of your check or on the credit card form.

Geriatric Fund 

- 2. Give us names of potential corporate donors.**
Many of you are aware of, or have contacts at, companies or institutions that might consider making a donation to the Geriatric Fund. Please take a moment to send company names (and the names of colleagues/individuals who might have a relationship with them) to jessicasabo@apta.org.

More information about the Geriatric Fund: www.apta.org/foundation