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Improvements in Balance in Older Adults Engaged in a Specialized Home Care Falls Prevention Program

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Abstract

Background and Purpose—To determine if persons older than 65 years receiving a combination of physical therapy, occupational therapy, speech, or nursing interventions in their home demonstrated changes in gait/balance function after an episode of home care services.

Methods—Charts from 11 667 persons who were at risk for falling and who were participating in an exercise program in the home were included.

Study design—Data were retrieved from the Outcome and Assessment Information Set, Version B, and the computerized database of physical therapist–collected outcome data. Recorded physical therapist–data may have included a neuropathic pain rating, the Berg Balance Scale (BBS), the Performance Oriented Measurement Assessment (POMA), the Dynamic Gait Index (DGI), and the modified Clinical Test of Sensory Integration and Balance (mCTSIB).

Data analysis—Data were extracted by an honest broker and were analyzed. Mean (SD) change in each performance test and the percentage of participants in the total sample and in the 9 age/health condition strata that exceeded the minimum detectable change (MDC) for each gait/balance measure were described. The value of MDC95 describes the amount of true change in participant status beyond measurement error with 95% certainty.

Results—The gait/balance measures demonstrated MDCs ranging between 68% and 91% for the study sample. Mean (SD) of improvement on the BBS was 12 (8) points, with 88% of all participants exceeding the BBS MDC95 value of 5 points. Mean (SD) of improvement in gait/balance performance as measured by the POMA was 8 (4) points, with 91% of all participants exceeding the POMA MDC95 value of 3 points. Among all patients, mean (SD) of improvement on the DGI was 7 (4) points with 91% of all participants exceeding the DGI MDC95 value of 2 points by discharge. At admission, the median number of mCTSIB conditions that could be

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completed was 1 and the median number of completed conditions on the mCTSIB increased to 3 at discharge, with 81% of all participants demonstrating improvement.

Conclusion—On the basis of established criteria, participants seemed to make clinically meaningful gains after the home care episode of care.

INTRODUCTION

The provision of rehabilitation services in the home is a growing health care trend that was designed by health care providers to decrease overall costs. Older adults often experience functional decline after hospitalization.^{1–3} A home evaluation and fall reduction program has shown decreases in mortality 2 years after intervention.⁴

Home health care is costly, but the overall costs of falls are staggering. Costs related to falls in 2000 were 19 billion,⁵ with projections by 2020 of 54.9 billion US dollars.⁶ Shumway-Cook et al⁷ reported that Medicare home health care costs in the United States for older adults who had fallen 2 or more times with home care costs accounted for 5% of the total Medicare care costs versus 34% of the total health care costs spent on inpatient rehabilitation and another 13% spent on out-patient care.⁷ The cost of a fall was much higher than the cost to prevent falls in older adults over the age of 80 years living in the community in New Zealand.⁸

Home health care utilization in the 6 months after fracture for Medicare recipients in the United States between 2000 and 2004 received a mean of 25 hours of physical therapy (PT) services after acute care hospitalization and 20 hours for occupational therapy.⁹ Home exercise programs that emphasize balance and strengthening in female community-living adults over the age of 80 years seem to reduce medical costs with less fall events.⁸ Campbell et al^{10,11} reported changes in the number of falls in women older than 80 years who participated in a home exercise program customized by a physical therapist. Assessment of physical functioning was performed at the beginning of the study and at 6 months and included the testing of strength, functional reach performance, chair stand ability, step climbing, and distance ambulated.¹¹ Those who continued to exercise for the 2-year follow-up period were less likely to have reported a fall.¹⁰

A recent survey¹² of a representative sampling of physical therapists practicing in a home health setting after hip fracture reported that the interventions most commonly used in home health were teaching bed mobility, transfer, balance and gait training, plus patient education and safety tips. Posthospital discharge programs often involve muscle strengthening, functional retraining, balance and gait exercises, exercises to increase or maintain range of motion, and patient education about their change of medical status plus education about prevention of falls and increasing their mobility gradually.¹² Mangione et al¹² reported that the mean number of home care physical therapist visits after hip fracture was between 6 and 12 visits with most patients discharged from home care 6 weeks postoperatively. The investigators did not report on the use of commonly used outcome measures in home care in their extensive survey of PT care after hip replacement.

The purpose of this retrospective study in a large home care agency was to determine if people older than 65 years who were deemed to be at risk for a fall demonstrated changes in balance or gait function at the conclusion of their multidisciplinary episode of care.

METHODS

This multilocation study included 11 251 patients, 65 years and older, admitted to Gentiva Health Services home care Safe Strides program from October 2007 to December 2008. The University of Pittsburgh institutional review board approved the study. Patients presenting with a history of falls in the most recent 12 months and/or 1 or more modifiable fall risk factor were admitted to the Safe Strides program. The referral source, the clinician conducting the Outcome and Assessment Information Set (OASIS) intake, family, or via notation in the hospital record of 2 or more falls within the last year were the criteria used for admission to the home care multidisciplinary exercise program for people at risk for falling. Twenty-four percent of the patients were admitted to the home care program directly from the hospital. Modifiable fall risk factors addressed through this program included home environmental hazards,^{13,14} polypharmacy, use of psychotropic medications,¹³ impaired lower extremity strength and power,¹³ gait and mobility disorders, impaired balance,¹⁵ symptoms of vestibular impairment,¹⁶ orthostatic hypotension, impaired sensation associated with diabetes mellitus,¹³ visual disturbances¹³ and sedative hypnotic use.^{13,17} Interventions may have included, but were not limited to, particle repositioning maneuvers;¹⁸ combinations of therapeutic exercise and neuromuscular rehabilitation that included adaptation, habituation, substitution; as well as static/dynamic balance activities and gait training with manipulation of the sensory environment.¹⁹

All home care staff (physical and occupational therapists, nursing and speech and language pathologists) were trained prospectively. Gait/balance data were collected by trained physical therapists. All physical and occupational therapists participated in a 19.5-hour-long comprehensive falls reduction program designed for persons who are homebound. Training was reinforced by standardized e-learning, comprehension assessments, facilitated training, laboratory skills validation, posttraining laboratories, in-home skills validation, and documentation credentialing. Nursing staff received 2 hours of training in fall risk identification and medications that impact fall risk, and speech and language pathologists received 1 hour of training related to fall risk identification.

Educational materials included training manuals and a DVD, and live instruction was followed by skills demonstration. Physical and occupational therapists participated in hands-on evaluation, intervention, and documentation laboratories plus had their clinical records reviewed.

During the educational program, physical therapists were trained and tested on how to systematically collect neuropathic pain ratings,^{20–23} the Berg Balance Scale (BBS),^{24,25} the Performance Oriented Measurement Assessment (POMA),²⁶ the Dynamic Gait Index (DGI),^{27,28} and the modified Clinical Test of Sensory Integration and Balance (mCTSIB).^{29,30} The therapists were instructed to record data on the data sheet from at least 2 of the earlier-mentioned balance or gait measures. All physical therapists were required to

attempt the mCTSIB with their patients and were permitted to choose at least 1 other appropriate balance and mobility instrument. The physical therapists were permitted to choose what they felt was the most appropriate balance and/or gait measurement tool for the patient that they were evaluating.

Participants were asked to verbally rate their pain on a 0 (no pain) to 10 (emergency department pain) and the score was recorded. In addition to the pain scale, patients may have completed the BBS as one of the required balance tests. The BBS was developed to assess fall risk and consists of 14 tasks ranging from the ability to sit independently to the ability to stand in tandem Romberg.^{24,25} Ordinal scores on the BBS range from 0 to 56, with 56 the optimal score. Generally, as the score drops below 56/56, there is a proportional increased risk of falling in older persons.^{27,31}

The POMA 26 was developed to assess fall risk in older adults. The tool consists of a total score plus a gait/balance subscore for a total of 28 points. Scores range from 0 to 28, with 28 the optimal score and scores of 19 or less indicate higher fall risk.³²

The DGI is an 8-item gait test that has been used with older adults to assess risk of falling. The DGI includes items such as walking, walking at various speeds, around and over objects, turning and stopping quickly, walking with head turns, and stair ambulation.^{27,28,33} Scores range from 0 to 24, with low scores indicating greater difficulty in ambulating. Scores of 19 or less indicate higher fall risk.²⁷

The mCTSIB has been used to attempt to determine how well a person can utilize vision, somatosensation, and vestibular information for the maintenance of postural control.²⁹ The mCTSIB consists of 4 tests.³⁰ Patients are asked to stand in the Romberg position with eyes open and closed on a solid surface and on compliant foam. Persons were timed up to a maximum of 30 seconds during the 4 balance conditions.

Nurses, physical therapists, and speech and language pathologists completing the OASIS version B (OASIS-B) had at least 1 year of professional patient care experience. At discharge, occupational therapists also occasionally performed the discharge OASIS-B. Clinicians recording OASIS-B data had successfully completed a course on documentation education that included competency testing. OASIS-B data were collected by hand and a complete diagnosis list was recorded and coded according to the patient's current disease state, including comorbidities. During the OASIS-B the following data is recorded: patient demographics, history, living arrangement and support, sensation, integumentary, respiration, elimination, behavior, instrumental activities of daily living/activities of daily living, medications, and equipment management.

The OASIS was developed to determine payment for rehabilitation services provided in the home. Reliability and validity ratings for the OASIS have had mixed results.^{34–37} A nurse and a physical therapist independently scored the OASIS within 24 hours of each other with no projected differences in reimbursement rates between the 2 examiners.³⁶ Shew et al.³⁶ reported that 54% of the reimbursement rates were the same for physical therapist and nursing OASIS scores and that overall the reimbursement rates were not statistically different between the 2 raters with no overall reliability scores reported.

The PT length care varies typically in the home care setting. There is no minimum or maximum number of sessions or weeks; the number of sessions or weeks is determined by the medical/clinical need. The patient has access to the home care services as long as they meet the Medicare criteria for home health services. The initial Medicare certification duration is 60 days and the patient could have services every day if needed and if he/she meets the Medicare criteria, that is, homebound and show progress toward goals.

At the end of the PT episode of care, the PT discharge visit included retesting of the gait/balance measures and the OASIS, yet the patient could still be receiving nursing care. In that instance, the nurse would have completed the OASIS discharge. The decision to discharge the patient from care was determined by the clinician for any of the following reasons: (1) the patient has achieved maximum rehabilitation potential possible as judged by the physical therapist; (2) the patient/family were noncompliant; (3) the patient no longer was homebound; (4) the patient refused further services; or (5) the patient required services from a different level of care, that is, long-term care facility.

DATA ANALYSIS

All data were de-identified through an honest, independent data broker. Safe Strides data were recorded onto standardized data collection forms and reviewed for accuracy. Patient demographic characteristics (age, sex, type of residence, and living support) were described on the basis of admission OASIS results for the total study sample and for 9 groups created through stratifying by age (65–74, 75–84, and ≥ 85 years) and the number of coded health conditions (1–2, 3–4, and 5–6 conditions). The OASIS database limits the number of coded health conditions at 6. There is the possibility that patients may have had more than 6 comorbid health conditions.

Diagnoses were described for all patients using each recorded International Classification of Diseases–Ninth Revision (ICD-9) code. All ICD-9 codes were reduced to 1 of the 17 categories based on the first 3 digits (001 through 999) of the ICD-9 coding system. The frequency that a given category was used was described both as a discrete count and as a percentage of the total number of coded conditions. Service visits (total and discipline-specific) were described (mean and SD) for the entire sample and for age/health condition strata.

Self-reported neuropathic pain and gait/balance performance were described at initial evaluation and at discharge. Median self-reported visual analog scale pain levels and number of completed mCTSIB conditions as well as the frequency and percentage of participants in the entire sample and each age/health condition stratum who improved between evaluation and discharge were determined.

Median scores for the DGI, POMA, and BBS were described at evaluation and discharge for patients who were administered during the clinical test. Mean (SD) change in each performance test and the percentage of participants in the total sample and in the 9 age/health condition strata that exceeded the minimum detectable change (MDC) for each gait/balance measure were described. The value of MDC95 describes the amount of true change

in patient status beyond measurement error with 95% certainty. The MDC was estimated with the following formula: the MDC95 = standard error of measurement (SEM) $\times$ 1.96 $\times$ [square root]2, where SEM is a measure of the within-participants variability (error influence on individual scores) due to repeated measures. The SEM is calculated from the intraclass correlation coefficient (ICC) for repeated measures using the formula: SEM = SD $\times$ [square root](1-ICC).³⁸ The value of the ICC for repeated measures of the DGI used to estimate the MDC95 was 0.98 based on estimates in community-dwelling adults as described by Shumway-Cook et al.²⁷

For the POMA, the value of the ICC for repeated measures used to estimate the MDC95 was 0.95 based on estimates by Tinetti²⁶ for community-dwelling older adults with at least 1 risk factor for falls.²⁶ The value of the ICC for repeated measures of the BBS used to estimate the MDC95 was 0.97 as estimated by Conradsson et al.³⁹ in older adults dependent in ADL living in residential care facilities.

RESULTS

Data from admission and discharge OASIS assessments was obtained for 11 251 patients with mean age (SD) 83.8 (7.1) years, receiving home health care services. Seventy-seven percent of the total number of visits into the home were from a physical therapist and 42% of the patients only saw a physical therapist. Upon admission to the home care program, 24% came from a hospital, 14% from skilled nursing, 10% from a long-term rehabilitation facility, and 52% were not discharged from an in-patient facility. Table 1 presents the demographic and residential status for all participants and/or groups created by stratifying by age within categories for the number of ICD-9 coded health conditions. The stratum with 5 to 6 coded health conditions was the largest, comprising 52% of the total sample. The greatest proportion of participants were 85 years and older, accounting for 51% of the total number of participants. Within each health condition strata, the highest proportion of patients was in the oldest age group. The proportion of women ranged from 63% of the youngest participants with 5 to 6 coded health conditions to 73% of the oldest group with 3 to 4 coded conditions.

Graphic Table 1

The total number of ICD-9 codes reported for the entire study sample was 50 066. The codes were reduced on the basis of first 3 ICD-9 coding digits to 1 of the 17 categories and are presented in Table 2. Four ICD-9 categories accounted for 76% of the diagnoses that were coded: nervous and sense organs, circulatory system, musculoskeletal and connective tissue, and signs/symptoms of ill-defined conditions. The ICD-9 category with the highest prevalence of use was “diseases of the circulatory system,” accounting for 24% of the diagnoses described.

Graphic Table 2

The mean number (SD) of total home health care visits was 21 (11). Table 3 presents the mean total and discipline-specific visit frequencies. Mean total visits seemed to increase with the number of health conditions. A higher mean number of total rehabilitation visits as

well as physical and occupational therapy plus nursing visits are seen in the strata with 5 to 6 health conditions.

Graphic Table 3

Table 4 includes mean intervention duration for all patients and for groups stratified by age and number of health conditions. Mean (SD) number of intervention days was 50 (31) for all participants and the mean duration of treatment increased across health condition strata.

Self-Reported Pain

The total number of participants with valid self-reported pain ratings was 10 704 at initial evaluation and 8883 at discharge. Self-reported pain among all patients was documented in 17% of patients at initial evaluation and 14% at discharge. Fifteen percent of all patients who reported pain at admission noted improvement by discharge. Within each health condition stratum, the highest proportion of patients reporting pain at discharge was seen in the 65- to 74-year-old age groups. The highest proportion of patients with pain at admission who reported pain reduction between initial evaluation and discharge was also seen in the youngest age groups (Table 4).

The Modified Clinical Test of Sensory Integration and Balance

At admission, the median number of mCTSIB conditions that could be completed was 1 and the median number of completed conditions on the mCTSIB increased to 3 at discharge, with 81% of all patients demonstrating improvement. The proportion of patients improving ranged from 68% to 84%. Detailed information on static balance performance on admission and discharge with the proportion of patients improving in each age/health condition stratum is presented in Table 4.

Dynamic Balance and Gait Performance

Table 4 presents median scores at admission and discharge, mean (SD) of change and percent of patients exceeding the value of the MDC95 for DGI, POMA, and BBS for all patients and for the age/health condition strata. At least 1 gait/balance assessment was administered at examination and discharge to all but 47 (0.4%) patients. A single balance test was administered to 9654 (85.8%) of the patients, and 2 were received by 1462 (13%). All the 3 gait/balance tests were used in the assessment of 90 (0.8%) of the patients. Among all patients, mean (SD) of improvement on the DGI was 7 (4) points with 91% of all patients exceeding the DGI MDC95 value of 2 points by discharge. The percentage of patients exceeding the DGI MDC95 value of 2 points on the DGI ranged from 88% to 100%.

Mean (SD) of improvement in gait/balance performance as measured by the POMA was 8 (4) points, with 91% of all patients exceeding the POMA MDC95 value of 3 points. Mean (SD) of change in POMA scores across age/health condition strata ranged from 8 (4) points (≥ 85 years, 1–2 health conditions) to 9 points for the 65 to 74 (SD, 4.5) and 75 to 84 years (SD, 4.6) with 5 to 6 health conditions. The percentage of patients exceeding the POMA MDC95 of 3 points between admission and discharge ranged from 86% to 96%.

Mean (SD) of improvement on the BBS was 12 (8) points, with 88% of all participants exceeding the BBS MDC95 value of 5 points. Mean (SD) of change in BBS scores across age/health condition strata ranged from 11 (10) points (65–74 years, 1–2 health conditions) to 13 (8) points (≥ 85 years, 1–2 health conditions; and 65–74 years, 3–4 health conditions). The percentage of patients exceeding the BBS MDC95 of 5 points between admission and discharge ranged from 79% to 91%.

When examining the proportion of participants who received only PT versus services from more than just PT who achieved the MDC for the measures, the differences were as follows:

DGI 74.3% (PT only) versus 77.1% (multiple services);

BBS 52.2% (PT only) versus 56.5% (multiple services); and

POMA 89.6% (PT only) versus 91.6% (multiple services).

DISCUSSION

Participants undergoing home care had positive changes in balance/gait and pain after an episode of care. The magnitude of the changes in balance is large with the postural control measures demonstrating MDC ranging between 68% and 91%. There do not seem to be large differences between those patients who received only PT interventions versus those who received care from multiple disciplines in the home on the gait/balance recorded measures. Others^{8,10} have demonstrated balance improvements with home care services with reductions in cost. The amount of change in the postural control measures demonstrated in this cohort was much larger than anticipated because more than 50% of the patients were older than 85 years with many having multiple comorbidities. Changes in balance have been noted in a recent systematic review of older persons undergoing rehabilitation in long-term care with a mean age of 82 years over 36 visits.⁴⁰ Our patients were seen for an average of 21 visits from various members of the home health care team.

Self-reported neuropathic pain ratings generated from the Safe Strides data collected by the physical therapists were recorded in 17% of the sample with a postdischarge improvement of 15%. It was surprising that in this large cohort only 17% of the patients reported neuropathic pain. Pain in participants older than 70 years has been related to falling, with increased falls rates associated with greater pain sites, more interference with activities of daily living, and the severity of the pain.⁴¹ One of the reasons that this cohort may have done so well overall is that so few people reported neuropathic pain at the onset of care. Because only 4.9% of the sample had dementia, pain ratings were most likely reported accurately.

Twenty-six percent of our sample had “mental disorder” noted as an ICD-9 code, suggesting that most of this sample was cognitively intact. Of those with “mental disorders,” 21% had dementia, reflecting 4.9% of the entire sample. Persons with cognitive impairments can improve their balance, but fall more frequently than those who are cognitively intact.³² Normal cognitive functioning could have positively enhanced performance outcomes.

Interdisciplinary falls reduction programs have been shown to be effective in the home.⁴² There was a large change in balance at discharge from home care services, regardless of age

or medical comorbidities. Falls and long-term care admissions are related in older adults,^{9,43} suggesting that if balance were improved, there may be fewer long-term care admissions. Preventing falls in older adults is more cost effective than paying for hospital admissions.⁸

Nineteen percent of the study sample had diseases of the musculoskeletal system and 15% had disorders of the nervous system/sense organs. Becker et al⁹ reported that the number of home health care visits after various fractures in a sampling of Medicare recipients ranged from 5 to 12 visits. Overall, Becker et al⁹ reported that people after fracture received 25 hours of PT and 20 hours of occupational therapy and typically had home care services after acute care hospitalization. The mean number of visits in our total sample was 21 (SD, 11). In our sample of persons who had musculoskeletal keyed on the OASIS as any 1 of the 6 possible diagnoses (n = 6551), the mean number of PT and occupational therapy visits were 14 (SD, 4) and 2 (SD, 3), respectively, suggesting that the number of visits is comparable or less than what was reported by Becker et al.⁹

Decreased ability to stand on a foam pad with eyes open (a timed score) has been related to increased fall risk in community-living older persons⁴⁴ and increased sway on a foam pad has been noted in persons after hip fracture.⁴⁵ Eighty-one percent of the sample could complete at least 3 of the standing conditions at discharge, 1 of which was to stand on a piece of foam with eyes open. Anacker and DiFabio⁴⁴ had older persons stand for up to 3- to 30-s trials on a foam pad and noted differences in total timed scores of 3 trials in people with no reported falls versus the community-living people who had reported 2 or more recent falls. Only 1 timed 30-s trial was completed in this study rather than the 3 trials reported by Anacker and DiFabio.⁴⁴

Shumway-Cook et al²⁷ reported that older adults in the community with DGI scores 19 or less were at higher risk for falling.²⁷ Because the majority of falls occur during ambulation in older adults, improving gait scores seems to be important.⁴⁶ The median DGI score in our sample had increased to 19 with 51% of people achieving 19 or more on the DGI at discharge, suggesting that many persons were less at risk for falling. An underlying aspect of DGI scoring is gait speed.³³ Seven of the eight DGI items have gait speed as part of the scoring descriptor.²⁸ Recent evidence suggests that gait speed is a predictor of survival in older persons from a cohort of 34 485 persons.⁴⁷ Although gait speed was not directly recorded in our sample, 6 of the 8 DGI items showed significant differences in gait speed when a group of community-living persons and persons with balance and vestibular disorders were compared.³³ Improved gait speed over 12 months predicts reductions in mortality rates⁴⁸ and improved self-efficacy and executive function in older persons.⁴⁹

The median POMA score in our sample was 12 at the onset of care. In a sample of 109 older adults who reported 1 or more falls receiving home services in Canada, 89% of the patients had scores on the POMA of less than 24.⁵⁰ Of those who scored 25 to 28 on the POMA, 50 only 14% reported a fall during their 6-month study. In our sample, 99% of the participants had scores less than 24 at admission. At discharge, the median POMA score was 21 with a mean change of 8 on the POMA, suggesting that the patients were at less risk for falling. Scores of less than 19 have been related to increased falls risk in another study.³² The median POMA score of 21 at discharge suggests that our study sample had a decreased risk

of falling. In an ambulatory rehabilitation center, changes of 5 points on the POMA were reported by at least 2 or 3 of the older adults treated.³² The mean POMA change score was “2” in 15 long-term care centers.⁵¹ Our mean POMA score change for the home care setting was 8.

The BBS has various cut scores for optimal sensitivity for fall risk.^{27,52–54} In persons with Parkinson disease, the optimal cut score was 47 of 56, 54 and 44 of 56.⁵³ Steffen and Seney⁵⁵ suggested that a 5-point change was necessary to confirm a change in balance in persons with Parkinson disease. The median change score of the BBS scale in the study sample was 12, more than double of what is considered to be meaningful in persons living with Parkinson disease. Leddy et al.⁵⁴ reported that the BBS was not able to detect falling in all participants, as several persons with Parkinson disease scored 56 of 56 and had reported a recent fall. Others have reported BBS relative risk for community-living older adults, with all patients at some risk for falling^{27,52} rather than as a discrete cut score. The BBS median score at the onset of care of 31 indicates strong risk of falling^{27,52} that diminished at discharge with a median score for the group of 45. Although our participants were still at risk for falling, there was a mean change in BBS scores of 12, suggesting that they had improved.

Tinetti and Williams⁴³ reported that 25% of older adults who have sustained a hip fracture who were living in the community 1 year later were living in long-term care. Our data suggest that home care services reduced fall risk. Prospective work is needed to determine if health care costs are reduced for those persons who have undergone specialized balance reduction programs such as Safe Strides compared with typical home care services.

Others⁵⁶ have reported that lack of consistent, reliable, and valid measures related to fall risk in persons undergoing home care makes determination of fall risk difficult. The Safe Strides program was designed to remedy the problem of a lack of a systematic data collection process in the home care setting. In the Netherlands, between 1981 and 2008, fall-related hospital admissions increased by 137%⁵⁷ and in the United States the estimated cost of falls by 2020 may reach \$54.9 billion.⁶ A recent systematic review⁵⁸ suggested that exercise or PT interventions reduced fall rates. Reducing fall risk in older persons is a critical health concern.^{43,57} Our study findings seem to suggest that home care services delivered in the home may reduce fall risk.

It was assumed that the treating clinicians used balance and gait training exercises to remediate deficits noted during the initial examination. All physical and occupational therapists had received at least 20 hours of training in the latest ideas about examination and interventions to prevent falls in older people. A limitation of this study was that we are unable to determine which interventions were used with the cohort. It is also possible that the physical therapists encouraged their patients more to perform well on the BBS, DGI, or POMA scores at discharge to attempt to demonstrate greater change in their patients.

Additional limitations of these findings included that the database used was retrospective. The improvements noted may have been due to the passage of time, recovery from illness, or a number of other possible reasons, and may not be necessarily attributed to home care

services received. From the data set, we were not able to determine exercise adherence, dropout rates, or adverse events, which are important uncontrolled factors in this study. Other than the pain rating, which could have been influenced by trying to please the therapist by reporting less pain or trying to be socially desirable (wanting to not be a person who complains), all other measures were more “objective” assessments of balance and postural control.

There were procedures designed to insure that the data were collected in a controlled manner with significant efforts made to train all the health professions involved in systematic data collection and recording. Also, the MDC was calculated from existing studies, but not all were from persons undergoing home care services. It would have been better to calculate the MDC but the investigators were hampered without having an anchor of overall general health on which to base the analyses. Recorded reports of falls either before or during the intervention phase would have significantly enhanced the investigators ability to report changes over time in these patients. Obviously a randomized trial of “typical care” versus specialized balance and falls interventions is needed to definitively answer the question of whether specialized training can enhance outcomes in persons older than 65 years undergoing home care interventions.

CONCLUSION

A structured falls-reduction home care program seems to improve balance and mobility measures that have been associated with fall risk in older persons receiving multidisciplinary home care services, regardless of residence or comorbidities.

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Table 1

Number of Health Conditions		1-2			3-4			5-6		
Age Group, y	Total	65-74	75-84	85	65-74	75-84	85	65-74	75-84	85
n (%)	11,251 (100)	95 (0.8)	226 (2.0)	389 (3.5)	499 (4.4)	1,715 (15.2)	2,387 (21.2)	771 (6.9)	2,271 (20.2)	2,898 (25.8)
Mean age, y (SD)	83.8 (7.1)	70.7 (2.8)	80.4 (2.6)	89.7 (3.5)	70.8 (2.6)	80.4 (2.7)	89.4 (3.5)	70.8 (2.6)	80.4 (2.7)	89.4 (3.5)
Sex (% Female)	69	74	67	68	67	70	73	63	66	72
Residence, n (%)										
Owned or rented	7,288 (64.8)	80 (84.2)	181 (80.1)	233 (59.9)	398 (79.8)	1,222 (71.3)	1,399 (58.6)	587 (76.1)	1,583 (69.7)	1,605 (55.4)
Family member	1,256 (11.2)	9 (9.5)	16 (7.1)	38 (9.7)	47 (9.4)	169 (9.9)	261 (10.9)	90 (11.7)	258 (11.4)	368 (12.7)
Boarding home	108 (1.0)	1 (1.5)	3 (1.3)	2 (0.5)	4 (0.1)	13 (0.8)	30 (1.3)	8 (1.0)	20 (0.9)	27 (0.9)
Assisted living	2,545 (22.6)	5 (5.3)	26 (11.5)	112 (28.7)	48 (9.8)	301 (17.6)	682 (28.6)	83 (10.8)	403 (17.7)	885 (30.5)
Other	55 (0.5)	0	0	4 (1.0)	2 (0.04)	10 (0.6)	15 (0.6)	3 (0.4)	7 (0.3)	13 (0.4)
Living support, n (%)										
Alone	4,230 (77.6)	27 (28.4)	68 (30.1)	162 (41.5)	158 (31.7)	599 (34.9)	968 (40.6)	231 (30.0)	755 (33.2)	1,262 (43.5)
Spouse or significant other	3,550 (31.6)	48 (50.7)	104 (46.0)	105 (26.9)	223 (47.7)	671 (39.1)	593 (24.8)	311 (24.8)	845 (37.2)	650 (22.4)
Family member	2,033 (18.1)	15 (15.8)	38 (16.8)	61 (15.6)	80 (16.0)	271 (15.8)	438 (18.3)	154 (20.0)	452 (18.7)	551 (19.0)
Friend	161 (1.4)	1 (1.1)	2 (0.9)	4 (1.0)	11 (2.2)	16 (0.9)	22 (0.9)	21 (2.7)	42 (1.8)	42 (1.4)
Paid help	1,172 (10.4)	4 (4.2)	13 (5.8)	53 (13.6)	23 (4.8)	144 (8.4)	342 (14.3)	46 (6.0)	186 (8.2)	361 (12.5)
Other	105 (0.9)	0	1 (0.4)	4 (1.0)	4 (0.8)	14 (0.8)	24 (1.0)	8 (1.0)	18 (0.8)	32 (1.1)

Frequency counts, age, sex distribution, residence, and support information for all participants and strata created by age groups and number of coded health conditions.

Table 2

Diagnostic Category	No. (%) Times Category Applied
Diseases of the circulatory system	12,037 (24)
Diseases of the musculoskeletal system and connective tissue	9,373 (18.7)
Symptoms, signs, and ill-defined conditions	9,274 (18.6)
Diseases of nervous system and sense organs	7,327 (14.6)
Endocrine, nutritional, and metabolic diseases and immunity disorders	3,369 (6.7)
Mental disorders	2,900 (5.8)
Diseases of the respiratory system	1,702 (3.4)
Diseases of the digestive system	1,048 (2.1)
Injury and poisoning	940 (1.9)
Diseases of genitourinary system	760 (1.5)
Diseases of blood and blood-forming organs	493 (1.0)
Diseases of the skin and subcutaneous tissue	396 (0.8)
Infectious and parasitic diseases	36 (0.07)
Neoplasms	358 (0.7)
Congenital abnormalities	50 (0.10)
Certain conditions originating in the perinatal period	1 (<0.01)
Total coded conditions	50,066 (100)

^a For up to 6 conditions coded per patient on baseline Outcome and Assessment Information Set documentation.

Table 3

Number of Conditions		1-2			3-4			5-6		
Age group, y	Total	65-74	75-84	85	65-74	75-84	85	65-74	75-84	85
n (%)	11251 (100)	95 (0.8)	226 (2)	389 (3.5)	499 (4.4)	1715 (15.2)	2387 (21.2)	771 (6.9)	2271 (20.2)	2898 (25.8)
Total visits, mean (SD)	21.2 (11)	17.9 (9.6)	16.6 (7.1)	17.5 (8.8)	19.7 (11)	19.3 (9.7)	19.2 (10)	23.7 (12.1)	23.3 (11.8)	22.9 (11.2)
Discipline-specific visits, mean (SD)										
Skilled nursing	3.8 (5.4)	3.4 (7.4)	1.6 (3)	1.8 (4.7)	3.1 (4.3)	2.7 (4.6)	2.8 (5.2)	5.3 (5.7)	4.9 (5.4)	4.5 (5.6)
Rehabilitation ^a	15.7 (3.5)	13.1 (4.8)	13.8 (4.7)	14.5 (5.5)	14.9 (6.2)	15.2 (6.0)	15 (5.6)	16.4 (7.8)	16.9 (6.9)	16.5 (6.5)
Physical therapy	13.6 (4.1)	11.6 (3.8)	12.9 (3.8)	13.5 (4.1)	12.8 (4.4)	13.3 (4.0)	13.5 (4)	13.1 (4.3)	13.7 (4.1)	14.1 (4.2)
Occupational therapy	1.8 (3.5)	1.2 (3)	0.9 (2.3)	0.9 (2.6)	1.7 (3.6)	1.6 (3.4)	1.4 (3.1)	2.3 (3.9)	2.1 (3.9)	2.1 (3.7)
Speech-language pathology	0.4 (1.9)	0.2 (1.4)	0.1 (0.6)	0.1 (1.0)	0.4 (1.8)	0.3 (1.6)	0.2 (1.1)	1.0 (3.2)	0.5 (2.3)	0.4 (1.9)
Social services	0.2 (0.7)	0.1 (0.3)	0.1 (0.5)	0.1 (0.5)	0.2 (0.7)	0.2 (0.6)	0.1 (0.6)	0.3 (0.9)	0.3 (0.8)	0.2 (0.6)
Home health aide	1.2 (3.5)	0.9 (2.7)	0.8 (2.6)	0.9 (2.8)	1.1 (3.7)	1.0 (3.1)	1.0 (3.4)	1.2 (3.5)	1.4 (3.8)	1.4 (3.8)
Other	0.4 (1.1)	0.4 (1.1)	0.2 (0.9)	0.2 (0.8)	0.4 (2.1)	0.3 (0.9)	0.3 (1.0)	0.5 (1.2)	0.4 (1.2)	0.4 (1.1)

Mean (SD) for entire sample and strata based on age and number of coded health conditions.

^aCombined number of physical therapy, occupational therapy, and speech-language pathology visits.

Table 4

Number of Health Conditions		1-2			3-4			5-6		
Age group, y	Total	65-74	75-84	85	65-74	75-84	85	65-74	75-84	85
Mean intervention duration, days (SD)	50.3 (30.9)	44.6 (30.3)	44.4 (29.3)	44.9 (29.3)	45.9 (32.5)	47.8 (29.3)	48.1 (30)	53.1 (31)	53.9 (34.1)	52.4 (30)
Self-reported pain n (%)										
Total initial	10,704	88	213	375	480	1,650	2,262	738	2,157	2,741
Initial with pain	1,833 (17.1)	20 (23.7)	36 (16.9)	38 (10.1)	101 (21)	286 (17.3)	334 (14.8)	162 (22)	412 (19.1)	444 (16.2)
Total discharge	8,883	77	183	300	389	1,344	1,867	635	1,798	2,290
Discharge with pain	1,208 (13.6)	12 (15.6)	29 (15.8)	27 (9.0)	69 (17.7)	198 (14.7)	204 (10.9)	107 (15.9)	274 (15.7)	279 (12.2)
Improved (%)	15	22	14	10	18	16	13	19	17	14
Median CTSIB										
Initial (n)	1 (11,178)	1 (92)	1 (224)	1 (383)	1 (494)	1 (1,702)	1 (2,378)	1 (769)	1 (2,256)	1 (2,880)
Discharge (n)	3 (11,127)	3 (93)	3 (223)	3 (384)	3 (489)	3 (1,698)	2 (2,356)	3 (762)	3 (2,250)	2 (2,872)
% improved	81	68	79	82	84	82	81	80	82	79
Median DGI (0-24)										
Initial (n)	11 (3,942)	13 (36)	13 (102)	11 (169)	11 (192)	11 (655)	11 (793)	12 (286)	11 (804)	11 (887)
Discharge (n)	19 (3,902)	21 (36)	19 (102)	18 (166)	20 (191)	20 (651)	18 (783)	20 (288)	19 (799)	18 (886)
Mean change (SD)	7.2 (3.7)	7.7 (3.9)	6.9 (3.5)	6.7 (3.8)	8.0 (4.4)	7.5 (3.7)	6.8 (3.6)	6.9 (3.9)	7.4 (3.9)	7.2 (3.6)
% MDC95 ^a	91	100	94	89	92	92	91	88	91	92
Median POMA										
Initial (n)	12 (6,362)	12 (46)	13 (99)	12 (195)	13 (255)	13 (937)	12 (1,416)	12 (428)	12 (1,263)	12 (1,723)
Discharge (n)	21 (6,320)	21 (45)	22 (95)	20 (194)	21 (250)	21 (933)	20 (1,404)	21 (427)	21 (1,257)	20 (1,715)
Mean change (SD)	8.2 (4.4)	7.9 (3.8)	7.8 (4.7)	7.7 (4.1)	8.5 (4.7)	8.0 (4.3)	7.8 (4.6)	8.6 (4.5)	8.6 (4.6)	8.1 (4.3)
% MDC95 ^a	91	96	86	91	92	92	90	93	92	90
Median BBS										
Initial (n)	31 (2,761)	33.5 (20)	32 (54)	30 (73)	33 (213)	33 (412)	31 (586)	32 (184)	31 (602)	30 (707)
Discharge (n)	45 (2,739)	48.5 (20)	44.5 (52)	44 (73)	47 (125)	46 (407)	44 (578)	47 (183)	46 (599)	42.5 (702)
Mean change (SD)	12.3 (7.9)	10.7 (10.0)	12.4 (7.9)	12.9 (8.0)	12.9 (8.0)	11.8 (7.3)	12.2 (7.2)	12.7 (8.7)	12.7 (8.0)	12.1 (7.5)
% MDC95 ^a	88	79	89	79	91	86	89	85	90	87

Service duration, admission, and discharge measures of self-reported pain, static (CTSIB) and dynamic balance, and gait function (DGI, BBS, POMA) with indicators of improvement.

BBS, Berg Balance Scale; CTSIB, Clinical Test of Sensory Integration and Balance; DGI, Dynamic Gait Index; ICC, intraclass correlation coefficient; MDC, minimum detectable change; POMA, Performance Oriented Mobility Assessment.

^aMDC95 = (SEM) $\times$ 1.96 $\times$ 2, where SEM = SD $\times$ (1-ICC); ICC for repeated measures.