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Disseminating the Otago Exercise Program in the United States: Perceived and Actual Physical Performance Improvements From Participants

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Abstract

The Otago Exercise Program (OEP) is an evidence-based fall prevention program disseminated internationally. Little is known about the implementation or effectiveness of the OEP in the United States. The purposes were to (a) identify characteristics of older adults enrolled in OEP, and (b) examine perceived and actual functional performance changes after participation in 8 weeks of the program. Baseline and 8-week functional and self-report data were collected on 210 older adults from 2013 to 2015. Linear mixed models and general estimating equations logistic regression models adjusted for socio-demographic factors were performed to assess changes. At 8 weeks, scores dramatically improved on self-report and physical performance tests: Timed Up-and-Go ($p < .001$), 30-Second Chair Rise ($p < .001$), and Four-Stage Balance ($p < .001$). Findings support that participation in the U.S. OEP as part of a plan of care can result in significant improvements in objective functional mobility, balance measures, and self-reported ability.

Keywords

fall prevention, Otago Exercise Program, geriatrics, evidence-based health promotion, aging

Introduction

Older adult falls are a growing public health problem (Stevens, 2016). For community-dwelling older adults, exercise to improve strength and balance is one of the most effective ways to improve mobility and protect against a fall or fall-related injury (Gillespie et al., 2012). The Otago Exercise Program (OEP) is an evidence-based fall prevention program proven to improve strength and mobility and reduce falls and fall-related injuries in high-risk older adults (Campbell, Robertson, Gardner, Norton, & Buchner, 1999; Campbell et al., 1997; Thomas, Mackintosh, & Halbert, 2010). The OEP was developed and evaluated in New Zealand in the late 1990s. The original studies demonstrated improvements in functional outcomes and a reduction in falls by 35% in high-risk older adults (Campbell et al., 1999; Campbell et al., 1997). These results have been replicated in multiple studies in different settings over the past 20 years (Kyrдалen, Moen, Roysland, & Helbostad, 2014; Liu-Ambrose et al., 2008; Skelton, Dinan, Campbell, & Rutherford, 2005; Son, Ryu, Jeong, Jang, & Kim, 2016). In previous studies of the OEP, equivalent outcomes were reported using different delivery systems (group-based, home-based, and video-supported) (Benavent-Caballer, Rosado-Calatayud, Segura-Orti, Amer-Cuenca, & Lison, 2015; Campbell et al., 1997; Duckham et al., 2015; Kyrдалen et al., 2014), as well as among healthy older adults and older adults with impairments such as Alzheimer's disease, stroke, visual impairment, and depression (Campbell et al., 2005; Hill et al., 2009; Kerse et al., 2010; Park & Chang, 2016).

The OEP is an innovative model of low frequency of physical therapy sessions over a long duration. The original program was delivered in six visits over a year by a physical therapist (PT). The first four visits were in the first 2 months of the program (i.e., initial visit, a visit a week later, then 2 weeks, then 4 weeks), then follow-up visits were conducted at 6 and 12 months with monthly "check-in" phone calls between (Campbell et al., 1997). This type of model sets the stage for the patient engagement and ownership of their exercise program (i.e., the program only works if the patient does the exercises). The OEP has achieved high levels of adherence and compliance with more than 35% of participants stating they perform the exercises 3 times a week, 1 year after the start of the program (Campbell et al., 1999; Campbell et al., 1997).

Figure 1. Conceptual model of the OEP.

Note. OEP = Otago Exercise Program; ED = emergency department; TUG = Timed Up-and- Go Test; PT = physical therapist.

The OEP is a structured and progressive exercise program with the goal of improving lower extremity strength, balance, and mobility, each of which are known risk factors for falling. (Figure 1.) The program consists of 17 exercises (i.e., five focusing on strength and 12 focusing on balance) progressed either by intensity (i.e., increase in weight, increase in number of repetitions) or balance challenge (i.e., doing an exercise with two hand support, one hand support, then no hand support). OEP participants are prescribed exercises appropriate for their abilities, and perform those exercises independently 3 times a week for approximately 30 min on non-consecutive days to avoid fatigue. In addition, when the participant has the balance and mobility to walk safely as an exercise, they are prescribed a walking program 3 times a week for up to 30 min. By progressing the intensity of the exercises over the course of the program, the participant will maximize improvements in strength and balance, in turn improving lower extremity strength, balance, and mobility, ultimately decreasing their risk of falling. These improvements are objectively documented in functional performance tests such as the Timed Up-and-Go Test (TUG; Podsiadlo & Richardson, 1991), the 30-Second Chair Rise (Jones, Rikli, & Beam, 1999), and/or by balance-specific assessments such as the Berg Balance Scale (Berg, 1992) or the Mini-Balance Evaluation Systems Test (mini-BEST Test; Franchignoni, Horak, Godi, Nardone, & Giordano, 2010). As participants see improvement in physical function, perceptions about their abilities to perform various tasks also improve (Simonsick et al., 2001). Subsequently, as the participant's perceptions improve, they may decrease their fear of falling (Smith, Jiang, & Ory, 2012; Tennstedt, 1998; Tinetti et al., 1994), and experience an increase in their abilities to perform activities of daily living. Ultimately, these intervention processes and related functional performance improvements (actual and perceived) should ultimately translate into a lower risk of falling (Cho et al., 2015; Smith, Ory, & Larsen, 2010).

The OEP has been disseminated in New Zealand, Australia, the United Kingdom, and Canada, all countries that offer national health care. To date, adoption and implementation in the U.S. has been limited and not well studied. Given that the U.S. spends more than US\$34 billion dollars in direct medical costs to treat falls in older adults (Stevens, 2014), understanding the implementation and effectiveness of the OEP as it is deployed may contribute much to determining if the OEP will be an effective fall risk management solution in the U.S.

The low frequency and long duration of the OEP poses significant documentation and reimbursement challenges to U.S. PTs billing Medicare for their services (Centers for Medicare & Medicaid Services [CMS], 2016). There exist several system-based challenges inherent to the U.S. health care system to maintaining a patient on a P.T.'s caseload for an extended period of time, including (a) concerns about billing and reimbursement, (b) costs to the patients in the form of co-pays, and (c) the inability to be reimbursed for follow-

up phone (Shubert, Smith, Prizer, & Ory, 2014). These system-based barriers have affected adoption, resulting in little to no information about the impact of the OEP program as part of a rehabilitation episode of care on patient outcomes in the U.S.

The OEP was selected by the Centers for Disease Control and Prevention (CDC) as one of four evidence-based fall prevention programs to be disseminated as part of the State-Driven Fall Prevention Project (Kaniewski, Stevens, Parker, & Lee, 2015). As such, a strategic plan was developed to widely disseminate the program. A training manual, a centralized online training program, and a centralized online database were created for a national rollout and available at a centralized website (Shubert, Smith, Ory, et al., 2014). PTs and health professionals (providers) who completed the online training were eligible to implement the OEP in their practice.

The original OEP implementation consisted of four PT visits in 8 weeks and follow-up visits at 6 and 12 months. For the U.S. implementation study, it was determined the majority of therapists would keep patients on caseload for at least 8 weeks. This decision was based on a typical episode of home health being 60 days in the U.S., and, in the outpatient setting, PTs need to see their patients at least every 30 days to comply with Medicare regulations (CMS, 2016). As such, it was decided, for this translational study, to capture outcomes at baseline and 8 weeks because this is most consistent with current PT practice patterns. We offered PTs the option to capture a final set of measures at discharge if patients were on caseload longer than 8 weeks. For purposes of this article, we reported outcomes at 8 weeks.

One of the key differences between program implementation in the U.S. and the original research was that subjects in the original study were excluded if they were currently working with a PT (Campbell et al., 1997). However, in the U.S., the most common way for an older adult to be prescribed the OEP would be as part of a physical therapy plan of care. For older adults to receive physical therapy through their Medicare benefit, they must be assessed by a PT and demonstrate significant (a) balance impairments based on their performance on validated objective measures such as the Berg Balance Scale, or (b) risk of falling per an evidence-based fall risk assessment such as the CDC's Stopping Elderly Accidents, Death and Injury (STEADI) Toolkit. Once determined that physical therapy is medically necessary for the older adult to address their balance impairments, the PT can prescribe the OEP as part of the plan of care and be reimbursed for their services by Medicare (CMS, 2016).

We hypothesized that integration of the OEP into a rehabilitation plan of care may be one of the most effective ways to achieve broad dissemination of the program. A major problem in the U.S. has been the significant delay in translation of research to practice due in large part to the limited uptake of evidence-based guidelines by clinicians (James, Cowan, Graham, & Majeroni, 1997; Shubert, Smith, Prizer, & Ory, 2014). Thus, it was unknown whether clinicians in the U.S. would prescribe the OEP to the appropriate patients, and whether implementing the OEP would result in similar outcomes found in earlier international research.

This translational study evaluates the implementation of the OEP in the U.S. The purposes of this study were to (a) identify the personal and functional characteristics of older adults prescribed the program, and (b) assess changes in self-perceived and functional outcomes after participating in the OEP for 8 weeks.

Method

Participants

As this was a translational study of implementation, there were no specific inclusion or exclusion criteria for subjects. The providers implementing the program used their clinical judgment to determine whether a client was appropriate and safe to participate in the program. All providers completed the online training, which reviewed key characteristics of clients who would most benefit from the program. The OEP implementation guide recommends the program is most appropriate for adults age 80 years or older, or those younger than 80 who have a history of falls or balance impairment (Gardner, Buchner, Robertson, & Campbell, 2001). We did not exclude any clients in the database based on age or function. The only inclusion criterion was that individuals in the database should have been prescribed the OEP.

Data Collection

To understand how the OEP would be translated and disseminated in the U.S., we developed a unique

study design in which participation in implementation was “crowdsourced.” Crowdsourcing is a way to “obtain information or input into a particular task or project by enlisting the services of a number of people, either paid or unpaid, typically via the Internet” (“Merriam-Webster Online,” 2015). Relative to other research methods, crowdsourcing can create a large amount of relevant data at fraction of the cost (Woolley et al., 2016). For example, researchers in public health are turning to community residents to capture data about safe neighborhoods (Schootman et al., 2016), and the National Institutes of Health has launched the “Precision Medicine Initiative Program” to create a national research cohort of one million citizens who will provide data about different disease states. For this OEP study, we were interested in engaging as many PTs as possible over a large geographic area. Given that the OEP was already recognized as an evidence-based program with extensive literature to support its efficacy in research settings, we felt that crowdsourcing would provide an opportunity to study the OEP as it was implemented in real time. The study was designed to capture outcomes as they were achieved by providers prescribing and implementing the OEP as part of the plan of care. We felt this would be a far more accurate snapshot of what really happens when an evidence-based program is implemented out of the controlled research setting. We also felt this strategy would provide greater insight into the real world adoption and implementation barriers encountered by providers.

The database was created and housed at the Center for Health Promotion and Disease Prevention at The University of North Carolina (UNC) at Chapel Hill. Volunteers were recruited from those providers who had completed the 3-hr OEP online training (Shubert, Smith, Ory, et al., 2014). The online training program costs US\$25 and are promoted to PTs through websites and listservs. At the conclusion of the training, all trainees were directed to a website with additional information about implementation including participation in the database project. Interested individuals were encouraged to contact the study team to learn more. Those therapists and agencies that indicated interest in participating in data collection were asked the following: (a) whether they were implementing the OEP with the target population, (b) whether they were implementing the OEP as intended (low frequency and long duration), and (c) whether they were willing to commit to entering outcomes for at least three older adults in the database. If the provider agreed, then they registered with a secure database. Each agency registered at least one provider to track outcomes. Each provider had a unique login and dashboard. Providers entered in de-identified subjective and performance data for each older adult. No personal health information (PHI) was recorded. Only adults participating in the OEP were to be inputted into the database. The provider was responsible for entering in data at baseline and 8 weeks. Each provider had access to their own dashboard and each agency could receive reports on their own providers. No providers or agencies could access data outside of their own agency. This project was deemed exempt by the UNC Office of Human Research Ethics from Institutional Review Board.

The majority of data collected for this study was similar to information typically collected when a patient begins an episode of rehabilitation, such as age, gender, falls history, self-reported health status, self-reported satisfaction with physical activity levels, self-reported mobility abilities, and self-reported fear of falling. During or after an initial encounter with the older adult, the provider would collect baseline information on the demographics and falls history. Providers asked the older adults a series of questions to collect data about self-reported health, satisfaction with activity levels, and difficulty performing different activities. The provider would administer the TUG (Bohannon, 2006; Podsiadlo & Richardson, 1991; Shumway-Cook, Brauer, & Woollacott, 2000), the 30-Second Chair Rise (Rikli & Jones, 1999; Rikli & Jones, 2013), and the Four-Stage Balance test (Rossiter-Fornoff, Wolf, Wolfson, & Buchner, 1995). Each of these tests and corresponding cut points to identify older adults at risk of falling are recommended in the STEADI tool (Phelan, Mahoney, Voit, & Stevens, 2015; Stevens & Phelan, 2013). The TUG measures the time needed to stand up from a standard armchair, walk 3 m, turn around, return to the chair, and sit down again (Podsiadlo & Richardson, 1991). Per the STEADI tool, times greater than 12 s are indicative of increased risk of falling (Phelan et al., 2015). The 30-Second Chair Rise requires the older adult to demonstrate the ability to stand from a standard height chair 1 time without using their arms. If successful, they are asked to stand up and sit down as many times as possible in 30s without using their arms. Their score is compared with age- and gender-based normative values, with scores lower than average considered an increased risk for falling (Phelan et al., 2015). The Four-Stage Balance Test requires the older adult to stand in progressively more challenging positions (Stage 1—feet side-by-side, Stage 2—one foot slightly in front of the other, Stage 3—heel-toe, and Stage 4—single leg stance) and hold each position for at least 10 s. Those who cannot hold either Stage 3 or Stage 4 for at least 10 s are considered at

increased risk of falling (Phelan et al., 2015). Providers were asked to repeat these measures for 8 weeks and discharge and to document additional implementation information such as the number of physical therapy visits, patient adherence and compliance, and number of falls experienced during the episode of care.

Providers would either enter in the de-identified data in real time during the initial evaluation or would complete a paper copy and enter the information. The database automatically assigned an ID number and providers could input in first name and last initial for tracking purposes. Once the data were entered, the researchers had access to the de-identified data for analysis.

Measures

In addition to the functional tests referenced above, providers were asked to collect information on demographic characteristics (e.g., age, sex, race, ethnicity), fear of falling (no or yes), and falls history (the number of falls they experienced in the past year, number of injuries, number of emergency room visits, and number of hospitalizations). Additional questions included self-reported health status (excellent, very good, good, fair, and poor; McGee, Liao, Cao, & Cooper, 1999), satisfaction with current activity levels (very, mostly, somewhat, or not at all), and confidence in their ability to keep themselves from falling (4-point scale ranging from *strongly agree* to *strongly disagree*; Tennstedt, 1998). Self-reported functional ability was assessed by the reported level of difficulty in performing various activities related to mobility disability (e.g., walking across a room, walking one block, stooping, crouching or kneeling, getting out of a straight-back chair, and climbing one flight of stairs) on a 4-point scale ranging from *no difficulty* (1) to *unable to do* (4; Wallace & Herzog, 1995). Finally, participants were asked how often they restrict their activities because of difficulties in walking (always, sometimes, seldom, never).

Statistical Analysis

Baseline characteristics were examined for all participants. Various analyses were performed to examine change from pre-test to post-test assessment for functional performance and perceived functional performance outcomes. Linear mixed models (using SAS Proc Mixed procedure) were fitted for continuous outcome variables. Linear mixed effects models are likelihood-based approaches that use all available data in model estimation, and provide unbiased estimates of the intervention effects under the assumption of missing at random. General estimating equation (GEE) models with logit link function (using SAS Proc GENMOD procedure) were used to examine changes from pre-test to post-test assessment for binary outcome variables. All the regression models included appropriate covariance structure to account for the correlation among repeated measures from the same participant. To eliminate any systematic bias and examine the direct effects of this intervention, regression analyses controlled for the participant's age and sex as well as the number of falls they reported in the past 12 months, the number of weeks they received physical therapy prior to beginning OEP, and the delivery site where the patient was reached.

An effect size ($d = [\text{post-test mean} - \text{pre-test mean}] / \text{pre-test standard deviation}$) using estimates of changes from the linear mixed models was computed for each continuous outcome variable. Effect sizes of $d = 0.2$ were considered small; $d = 0.5$, medium; and $d = 0.8$, large (Cohen, 1988).

Results

Sample Characteristics

The data were collected from 28 health care providers representing 12 agencies based in eight states (Colorado, Oregon, Pennsylvania, Connecticut, North Carolina, South Carolina, Nebraska, and New Hampshire). Data were collected on 210 older adults. As shown in Table 1, the average age of these participants was 80 years (± 11.67). The majority of participants were female (68.6%), non-Hispanic (96.2%), and White (95.5%). Approximately, 60.2% of participants reported falling in the past 12 months, and 87.5% of participants reported being fearful of falling. On average, participants reported 1.7 (± 1.9) falls in the past year. Furthermore, on average, participants reported 0.6 (± 1.0) falls resulting in injury, 0.3 (± 0.6) falls resulting in an emergency room visit, and 0.2 (± 0.5) falls resulting in hospitalization.

Table 1. Participant Characteristics

		Total (N = 210)
	<i>n</i>	Years (<i>M</i> , <i>SD</i>)
Age	210	80.0 (± 11.7)
		<i>n</i> (%)
Sex	210	
Male		66 (31.4)
Female		144 (68.6)
Hispanic	210	
No		202 (96.2)
Yes		8 (3.8)
Race	202	
White		193 (95.5)
Black or African American		5 (2.5)
Asian		2 (1.0)
Native Hawaiian or Other Pacific Islander		0 (0)
American Indian or Alaska Native		2 (1.0)
Fear of falling	176	
No		22 (12.5)
Yes		154 (87.5)
Falls history and associated complications		
Fall in past 12 months	181	
No		72 (39.8)
Yes		109 (60.2)
		<i>M</i> ($\pm$ <i>SD</i>)/participant
Total number of falls self-reported in past year	185	1.7 (± 1.9)
Number of falls resulting in injuries	178	0.6 (± 1.0)
Number of falls resulting in ED visits	177	0.3 (± 0.6)
Number of falls resulting in hospitalization	178	0.2 (± 0.5)
		<i>n</i> (%)
Living situation and support		
Number of participants who use an assistive device	181	144 (79.6)
Number of participants who live in the community	181	155 (85.6)
Number of participants who live in an assisted living setting	182	31 (17.0)
Number of participants who need a caregiver or other support	180	126 (70.0)
Number of participants who have a friend to support them to do the exercises	181	126 (69.6)

Note. ED = emergency department

Changes in Functional Performance

Table 2 shows changes in functional performance outcomes from baseline to post-intervention. The average TUG test score was 26.2 s (± 23.5) at baseline and decreased to 19.9 s (± 14.7) at post-intervention. This change was significant ($p < .001$), which represents an effect size of 0.215, and also 2 s greater than the minimal detectable change (MDC) for the TUG (improvement of 3 s at 80% power and $\alpha > .05$; Portney & Watkins, 2000). The average 30-Second Chair Rise score was 6.2 (± 4.6) raises at baseline and increased to 8.1 (± 5.2) raises at post-intervention. This change was also significant ($p < .001$), which represents an effect size of 0.353, and greater than the MDC for the 30-Second Chair Rise (0.9 at 80% power and $\alpha > .05$;

Portney & Watkins, 2000). For the Four-Stage Balance test, the proportion of participants capable of reaching Stage 3 or Stage 4 increased from 24.1% at baseline to 41.2% at post-intervention. The odds ratio (OR) of being able to reach Stage 3 or Stage 4 increased significantly (OR = 2.71, $p < .001$).

Changes in Perceived Functional Performance

Table 2 also shows changes in perceived functional performance outcomes from baseline to post-intervention. For self-reported health, the proportion of participants who reported being in excellent or very good health significantly increased from 23.0% at baseline to 36.3% at post-intervention (OR = 1.80, $p = .017$). The proportion of participants who felt confident that they will not fall (*agree* or *strongly agree*) significantly increased from 48.1% at baseline to 82.4% at post-intervention (OR = 5.03, $p < .001$). Significant improvements from baseline to post-intervention were also observed for participants reporting no difficulty in walking across a room (OR = 1.96, $p = .008$), walking one block (OR = 2.16, $p = .003$), stooping/crouching/kneeling (OR = 3.45, $p = .001$), getting out of a straight-back chair (OR = 2.27, $p < .001$), and climbing one flight of stairs (OR = 2.29, $p = .004$). The proportion of participants who never or seldom restricted their activities because of difficulties in walking significantly increased from 23.8% at baseline to 45.1% at post-intervention (OR = 3.05, $p < .001$).

Discussion

To our knowledge, this is the first study to assess the implementation of the OEP in the U.S. with patients from multiple states. This study examined outcome measures collected over a 2-year period from providers implementing the OEP. Although the OEP has been proven in research settings to be a highly effective home (Campbell et al., 1999; Campbell et al., 1997; Liu-Ambrose et al., 2008) or group-based intervention (Duckham et al., 2015; Kyrдалen et al., 2014; Liston et al., 2014; Wurzer, Waters, Hale, & Leon de la Barra, 2014), no one has studied the impact of the translation of OEP in the U.S. on self-perceived and functional outcome measures.

The demographics of subjects who participated in the translation of the OEP were similar to those reported in the literature with the majority of subjects being age 80 and with a history of falls or fear of falling (Campbell et al., 1997; Liu-Ambrose et al., 2008). Subjects did not represent a diverse population of older frail adults. However, according to the 2013 CMS statistics report, 95% of those receiving Medicare services were White. Given this was a translational study, and we had no control over who received the program as part of therapy, our demographics mirror those of the Medicare population.

For a PT to offer the program to patients in the U.S., and be reimbursed for their services by Medicare, the older adult would have to have significant balance impairments to the point where it was medically necessary to work with a PT. However, in several OEP studies, subjects were excluded if they were receiving physical therapy services (Campbell et al., 1997; Campbell et al., 2005; Liu-Ambrose et al., 2008; Son et al., 2016). It was not known whether older adults participating in the OEP as part of a physical therapy plan of care would be significantly more frail than those studied, and if that would affect outcomes.

Our subjects, on average, were more impaired than previous reports in the literature with slower TUG scores and lower Chair Rise scores (Campbell et al., 1997; Campbell et al., 2005; Liu-Ambrose et al., 2008; Son et al., 2016). Subjects were, however, most similar in functional abilities to those studied by Kyrдалen, who compared outcomes of older adults participating in the OEP in the home and group setting 12 weeks after the intervention (Kyrдалen et al., 2014). The group intervention was designed as a twice-weekly class taught by a PT. The results from the group intervention will not be discussed in this article because the design was significantly different than the intervention described in the present study.

The home intervention in Kyrдалen's study was an exact replication of the OEP as designed by Campbell (Campbell et al., 1997), with participants receiving four visits over 8 weeks by a PT (Campbell et al., 1997). Between the visits and for the final 4 weeks of the intervention, the participant was expected to perform the exercises independently 3 times per week and incorporate a walking program. The home intervention used by Kyrдалen was the same model that the PTs in the current study deployed. The one difference was that in Kyrдалen's study, the participants also received weekly phone calls by the PT, but participants in the current study received monthly phone calls per Campbell's protocol. Participants in the home intervention demonstrated improvements in the TUG (Effect Size = .33) and 30-Second Chair Rise (Effect Size = .23) (Kyrдалen et al., 2014). Subjects in the current study reported similar effect sizes for both the TUG and 30-Second Chair Rise, and significant

Table 2. Adjusted Functional Performance Changes From Baseline to Post-Intervention Survey.

	Baseline		Post-intervention		Adjusted M change ^a M (±SE)	OR ^b	p ^c	Effect size (ES)
	n	M (±SD)	n	M (±SD)				
Functional performance								
TUG times for all participants (s)	188	26.2 (±23.5)	114	19.9 (±14.7)	-5.0 (±1.1) ^d	—	<.001	0.215
30-Second Chair Rise	187	6.2 (±4.6)	110	8.1 (±5.2)	1.6 (±0.3) ^d	—	<.001	0.353
(Number of repetitions completed in 30 s)								
Stage 3 or 4 in Four-Stage Balance Test	174	42 (24.1)	114	47 (41.2)	—	2.71	<.001	—
Perceived functional performance								
Excellent or very good health status	187	43 (23.0)	102	37 (36.3)	—	1.80	.017	—
Very/mostly satisfied with physical activity levels	185	48 (26.0)	99	53 (53.5)	—	3.77	<.001	—
Feel confident not falling (strongly agree or agree)	187	90 (48.1)	102	84 (82.4)	—	5.03	<.001	—
No difficulty in walking across room	186	89 (47.9)	101	64 (63.4)	—	1.96	.008	—
No difficulty in walking one block	186	35 (18.8)	100	32 (32.0)	—	2.16	.003	—
No difficulty in stooping, crouching, or kneeling	184	13 (7.1)	101	20 (19.8)	—	3.45	.001	—
No difficulty in getting out of a straight-back chair	186	71 (38.2)	102	55 (53.9)	—	2.27	<.001	—
No difficulty in climbing one flight of stairs	184	24 (13.0)	102	24 (23.5)	—	2.29	.004	—
Never or seldom restrict activities because of difficulties in walking	185	44 (23.8)	102	46 (45.1)	—	3.05	<.001	—

Note. OR = odds ratio; TUG = Timed Up-and-Go Test; PT = physical therapist; GEE = general estimating equation; MDC = minimal detectable change.

^aMean changes based on linear mixed models adjusted for baseline age, gender, delivery site, number of falls in past year, and number of weeks of PT prior to Otago.

^bORs from GEE logistic regression modeling the probability of response = 1 at an alpha of .05. All models account for repeated measures from the same participant and are adjusted for baseline age, gender, number of falls in past 8 weeks, and number of weeks of PT prior to Otago. An OR greater than 1 represents a positive improvement in functional performance.

^cp value with null hypothesis: adjusted mean = 0 or adjusted OR = 1.

^dMDC for the TUG (at 80% power and alpha = .05) is -3.0; the MDC for 30-Second Chair Rise (at 80% power and alpha = .05) is 0.9.

improvements in the Four- Stage Balance Test, supporting that when the OEP is offered as part of a plan of care, similar outcomes can be achieved as to a research setting.

Self-reported measures of health status, satisfaction with physical activity levels, falls-related confidence, and functional ability also improved significantly between baseline and 8 weeks. The largest changes were documented in confidence to prevent a fall with 48.1% of subjects agreeing or strongly agreeing in this statement at baseline and 82.4% at 8 weeks, and in the self-perceived ability to stoop, crouch, or kneel with 7.1% at baseline indicating no difficulty and 19.8% at 8 weeks. These findings are similar to those reported for the dissemination of both Stepping On (Ory, Smith, Jiang, et al., 2014) and Tai Chi: Moving For Better Balance; (Ory, Smith, Parker, et al., 2014).

The data presented support the model of participating in a structured and progressive strength and balance program results in improved outcomes in physical function and perception of abilities. This is clearly demonstrated by the greater number of subjects in the OEP who reported no difficulty in the ability to stoop, crouch, or kneel compared with those in the Stepping On or Tai Chi: Moving for Better Balance programs. Several of the exercises in the OEP focus on functional movements such as rising from a chair and performing squats. As participants saw improvements in these abilities, they were able to translate those improvements into their perception of performing activities that require additional lower extremity strength. These findings further support that the outcomes of this dissemination project are similar to the original research. What is not known at this point is the impact of a longer term intervention on both physical and perceived outcomes, and how that relates to actual falls experienced. This will be explored in future studies.

Limitations

This study is an evaluation of a translational research project. The major limitation was the lack of control over how the OEP was actually implemented which future studies will address. The lack of blinding of the individuals entering the data, and the fact that we had no comparison control group, may bias the results of this study. We expect those not perceiving benefits from the OEP may have stopped the program early and those entering data may not have wanted to enter the data from participants who had not improved. However, given the robust outcomes of the OEP in randomized controlled trials, we feel this translational study does support similar results can be achieved when the OEP is implemented in the U.S. as part of a plan of care. The second limitation was the short duration of data collection. Although the OEP is designed to be a 12-month intervention, there have been few therapists able to keep patients on caseload beyond 8 weeks. Policies about reimbursement and billing practices in the U.S. can make it prohibitive to keep patients on caseload for extended periods of time (Shubert, Smith, Ory, et al., 2014). Some therapists have been able to keep patients on caseload longer, and future studies will assess outcomes at 6 months and 1 year. A third limitation was the inability to capture all data fields and the 40% attrition rate. We had initial baseline data on 210 subjects and complete baseline data on 188. We had follow-up data on 114 subjects. We do not know whether this is a true attrition rate, or whether the therapist simply did not input in the 8-week data. The translational nature of this project made it impossible to determine why some older adults started the program but never finished. Therapists were encouraged to discharge patients from the database at any point in time during the OEP; however, this did not happen in all instances. Many therapists were interested in the database and enrolled one or two patients but, due to time constraints and competing demands, were never able to input 8-week outcome measures. We did not exclude participants based on age or function, because we were interested in assessing whether the PTs enrolled patients who were appropriate for the OEP. Future studies should address key characteristics of participants who are most likely to achieve the greatest intervention benefits. A final limitation was the lack of diversity in our subjects. Although subjects' demographics mirrored Medicare demographics, we are unable to generalize these findings to a more diverse population.

Conclusion

The OEP is an evidence-based fall prevention program delivered as a low frequency of physical therapy visits over a long duration. This model is unique to the current U.S. model of physical therapy practice. The purpose of this study was to evaluate the dissemination of the OEP into clinical practice. The results support that patients at high risk for a fall who receive the OEP as part of a rehabilitation plan of care demonstrate significant improvements in objective functional mobility, and balance measures and self-reported ability. The OEP appears

to be an effective program for PTs to deliver to patients in the U.S. and future studies will assess the impact of the program on a more diverse population over a longer duration of time, and efficacy and efficiency of various delivery models.

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Authors' Note

The findings and conclusions in this article are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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