ISSN: 2469-5858

Taylor-Piliae et al. J Geriatr Med Gerontol 2019, 5:075
DOI: 10.23937/2469-5858/1510075
Volume 5 | Issue 3
Open Access

Journal of
Geriatric Medicine and Gerontology

RESEARCH ARTICLE

A Novel Dual-Task Balance Challenge to Prevent Falls in Older Adults: A Randomized Pilot Study

Ruth E Taylor-Piliae, PhD, RN, FAHA[1*], Chiu-Hsieh (Paul) Hsu, PhD[2], Hanne Dolan, MSN, RN, PhD Student[1], Nima Toosizadeh, PhD[3] and Jane Mohler, NP-C, MPH, PhD[4]

[1]*College of Nursing, The University of Arizona, USA*

[2]*College of Public Health, The University of Arizona, USA*

[3]*Colleges of Medicine and BioMedical Engineering, The University of Arizona, USA*

[4]*Colleges of Medicine and Public Health, The University of Arizona, USA*

***Corresponding author:** *Ruth E Taylor-Piliae, PhD, RN, FAHA, College of Nursing, The University of Arizona, 1305 N Martin Ave, Tucson, AZ 85721-0203, USA, Tel: 520-626-4881, Fax: 520-626-4062*

Abstract

Background: A Matter of Balance (MOB) is a national community-based fall prevention program focusing on cognitive restructuring to manage concerns about falling, though does not include a balance-training component. A dual-task balance challenge (DTBC) comprising weight transfer using fixed and random ordering of ankle-reaching balance tasks was added to MOB, to determine if this would lead to reduced fall risk. The study aims were to assess acceptance, satisfaction, safety and adherence to the interventions, examine changes in fall risk, and monitor incident falls for 3-months post-intervention.

Methods: A single-blind, two-group, randomized pilot study with community-dwelling older adults assigned to MOB (2-hours, twice/week for 4 weeks) with 15 minutes of social time or MOB plus DTBC (15 minutes of fixed and random ordering of ankle-reaching balance tasks). Acceptability and satisfaction obtained by self-report, safety and adherence monitored during class by study staff. Fall risk included objectively assessed balance and gait (LEGSys™, BioSensics, LLC), and fear of falling (Falls Efficacy Scale International). Monthly fall calendars with phone follow-ups for incident falls.

Results: At high fall risk older adults (n = 16, mean age = 74 ± 8 years), mainly retired (95%), women (88%), with > 13 years education (81%), completed the study (drop-outs, n = 1). Acceptability and satisfaction (mean score = 9.0 ± 1.3, 1 = least, 10 = most) were high, no safety issues, and very high adherence rates (> 94%), regardless of group assignment. The MOB group (n = 7) had no within group changes in fall risk post-intervention ($p > 0.05$). Conversely, the MOB plus DTBC group (n = 9) had significant improvements in balance ($p < 0.05$) and gait ($p < 0.05$) with less fear of falling ($p = 0.04$) post-intervention, when compared to baseline.

Conclusions: Reducing fall risk factors and preventing falls are essential for older adults, to ensure that they continue to live safely and independently. The addition of DTBC to the nationally-used MOB curriculum may enhance both balance and gait, and lead to reduced fall risk.

Keywords

Accidental fall, Fall prevention, Fall risk, Older adults

Abbreviations

AP: Anterior/Posterior; AzAHEC: Arizona Area Health Education Centers; COM: center of mass; DTBC: Dual-Task Balance Challenge; EC: Eyes-Closed; El Rio: El Rio Community Health Center; EO: Eyes-Open; FES-I: Falls Efficacy Scale International; LEGSys: Locomotion Evaluation and Gait System; ML: Mediolateral; MMSE: Mini-Mental Status Exam; MOB: Matter of Balance; PHQ-9: Patient Health Questionnaire

Introduction

Fall injuries are responsible for significant health care utilization, disability, loss of independence, and high costs among community-dwelling older adults [1,2]. Impaired postural control (balance) is one of the major risk factors for falling, and methods to improve

Citation: Taylor-Piliae RE, Chiu-Hsieh (Paul) H, Dolan H, Toosizadeh N, Mohler J (2019) A Novel Dual-Task Balance Challenge to Prevent Falls in Older Adults: A Randomized Pilot Study. J Geriatr Med Gerontol 5:075. doi.org/10.23937/2469-5858/1510075

Accepted: September 14, 2019: **Published:** September 16, 2019

Copyright: © 2019 Taylor-Piliae RE, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

balance can be integrated into existing fall prevention programs. Fall prevention interventions among community-dwelling older adults are essential [3]. A Matter of Balance (MOB) [4,5] is one of the most commonly used community-based fall prevention interventions nationally, and is considered the 'fall prevention standard of care'. MOB programs are targeted to reduce the fear of falling and promote physical activity among all older community-dwelling adults. Despite its name, MOB focuses on cognitive restructuring to manage concerns about falling and does not include a balance-training component. While evidence indicates that the MOB program leads to small, sustained decreases in older adults' perceived fear of falling, [5,6] there is no evidence of improvement measured by objective balance and gait tests. Among community-dwelling older adults, intact balance and concomitant attention ("dual-tasking") are essential to prevent falls, and dual-task balance training components are now a requisite according to evidence-based fall prevention intervention guidelines [7-9].

A low cost and portable Dual-Task Balance Challenge (DTBC = 15 minutes, twice/week for 4 weeks = 2 hours total) among a group of older adults (N = 10, mean age = 78 years, 78% women) was recently developed and tested, with significant improvements in balance (eyes open test, $p < 0.05$) and gait (velocity, $p < 0.05$) found; establishing DTBC feasibility [10]. Participants in this study were recruited from an assisted-living community for older adults with limited incomes, who reported being at high fall risk or had a fear of falling. The DTBC may enhance balance through weight transfer and ankle-reaching balance tasks, while simultaneously challenging attention by the random ordering of these tasks--leading to reduced fall risk. The long-term goal is to enhance community-based fall prevention programs with evidence-based dual-task balance training components. However, further research is needed using this DTBC intervention among older adults, before widespread recommendations can be made. Therefore, in this randomized pilot study, acceptance, satisfaction, safety and adherence to the MOB and MOB plus DTBC interventions were examined, with objectively measured balance and gait (i.e., LEGSys,™ BioSensics, LLC), [11] fear of falling [12] and 3-month incident falls assessed [13].

Methods

Study design

This single-blind, two-group, randomized pilot study was conducted at a nonprofit Community Health Center, between September 2017 and January 2018.

Participants

Community-dwelling older adults from all sex/gender and racial/ethnic groups, aged ≥ 60 years, at high fall risk (Fall Risk Questionnaire score > 4), [14] and living in the greater Tucson, AZ area were invited to participate. Older adults who were currently attending MOB or other fall prevention classes (e.g. Fall Proof), having a severe mobility disorder (e.g., unable to walk 15 feet with an assistive device), or having a severe visual or hearing impairment were excluded. Further, non-English speaking adults, those with a lack of decision-making capacity, unable to provide informed consent, serious psychiatric disorder (e.g., schizophrenia), moderately-severe depression (PHQ-9 = Patient Health Questionnaire ≥ 15), [15] cognitive impairment (MMSE = Mini-Mental Status Exam ≤ 23), [16] or serious medical condition (e.g., cancer treatments) were excluded from study participation.

Recruitment

Study participants were recruited from an underserved population of community-dwelling older adults at high fall risk, who were partaking in services provided by El Rio Community Health Center (El Rio). Older adults interested in participating in the study contacted the study staff, who screened for eligibility using a standardized checklist, and obtained written informed consent. Approval to conduct the study was obtained from the Institutional Review Boards at the University of Arizona and El Rio in Tucson, AZ. The investigation was carried out according to the principles outlined in the Declaration of Helsinki, including written informed consent from all participants. The study was registered on ClinicalTrials.gov (Identifier: NCT03176511), National Library of Medicine (Bethseda, MD).

Randomization

Following baseline assessments, participants self-selected to attend either Monday/Thursday classes or Tuesday/Friday classes to accommodate their preferences and schedules, in order to promote intervention adherence and study retention. After all participants enrolled in the study and completed baseline assessments, the study investigator "flipped a coin" to determine which class would provide the MOB or the MOB plus DTBC interventions. Participants were unaware of which study intervention they received, until the first day of class. Study outcome assessors were blind to group allocation.

Setting

All data collection and study interventions were conducted in a quiet, private room at El Rio. Trained and certified staff at El Rio provided the study interventions.

Interventions

A matter of balance (MOB): Participants that were randomly assigned to MOB attended classes, used the course materials developed by Maine Health's Partnering for Healthy Aging (https://mainehealth.org/

healthy-communities/healthy-aging/matter-of-balance). MOB is a structured group-based fall prevention education course specifically designed for older adults, and uses cognitive restructuring to manage concerns about falling [4-6]. During the MOB classes, a variety of strategies are used, such as restructuring misconceptions to promote a view of fall risk and fear of falling as controllable, setting realistic goals for increasing activity, changing the environment to reduce fall risk, and learning range of motion exercises to aid in fall prevention [4]. Classes were held twice a week for 4 weeks, with 2-hour sessions, as is routine. An additional 15 minutes of social time followed each class, to provide equivalent time and attention, accounting for the 15-min DTBC training provided in the other intervention. Pima Council on Aging (www.pcoa.org) provides educational programs each year, including MOB, and provided two experienced and certified MOB instructors for this study.

MOB plus Dual-Task Balance Challenge (MOB plus DTBC): In addition to MOB described above, participants that were randomly assigned to MOB plus DTBC received a 15-min DTBC intervention each class, i.e., ankle-reaching balance tasks using either their right to left foot to tap differently colored 9-inch round vinyl markers. Three colored markers (e.g., green, blue, red) were placed on the ground in an arc, with the fourth maker (e.g., yellow) placed a neutral position behind the arc (Figure 1). A chair can be placed in front of the color pattern, as needed for safety. To enhance balance, participants stand with both feet in the neutral position 12 inches behind the pattern, and then perform an ankle-reaching balance task to the colors in the pattern by tapping a foot to the color and then tapping back to neutral (center position); first using a fixed order (green, blue, red) beginning left-to-right each time; then done in reverse order. Cognitively challenging ordering of tasks were then added by calling out randomly selected colors to increase difficulty. This was performed for 15 minutes during each class period. El Rio provided two experienced and certified MOB instructors, with additional training in providing the DTBC intervention, for this study.

Outcomes

Intervention acceptability, satisfaction, safety, and adherence: Immediately post-intervention, participants completed a short survey on the acceptability and satisfaction with the interventions [17]. On a scale from 1 to 10, participants were asked to rate their level of intervention acceptability (1 = least acceptable, 10 = most acceptable) and satisfaction (1 = least satisfied, 10 = most satisfied). In addition, they provided yes/no responses to six questions pertaining to classes being offered at a convenient time, difficulty following the instructor, gaining any personal benefit, if their health got better or worse, and if they would recommend the interventions to others. Study staff were present at all classes to monitor participants' safety and were instructed to report any adverse events. In addition, intervention adherence rates were monitored, with study staff recording class attendance.

Intervention effects on fall risk factors and incident falls: Balance was assessed using LEGSys™ (Locomotion Evaluation and Gait System, BioSensics LLC), a wearable sensor [18]. This system uses five sensors

Figure 1: Dual-task balance challenge set-up (photo used with permission).

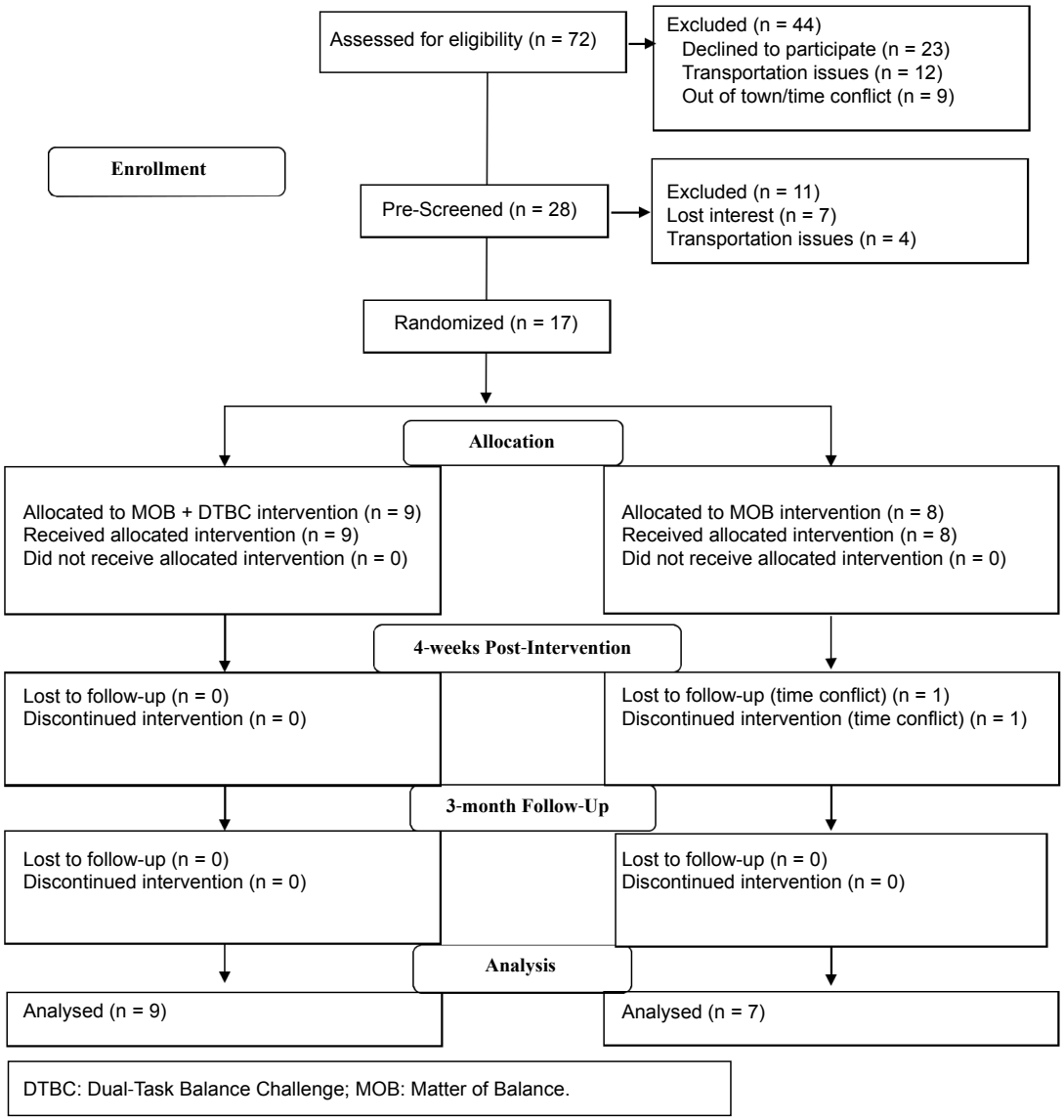

Figure 2: Fall prevention in older adults study flow diagram.

attached to right and left anterior shins, right and left anterior thighs, and to the posterior lower back. Each sensor includes a triaxial accelerometer, magnetometer, and gyroscope (sample frequency 100 Hz), to estimate three-dimensional angles of the hip and ankle joints. A two-link inverted-pendulum model calculates the center of mass from mediolateral (ML) and anterior/posterior (AP) angles of legs (lower link-ankle rotation) and upper-body (upper link-hip rotation) and participants' anthropometric data. Balance measures assessed included changes in sway of ankle, hip, and center of mass (COM) in both ML and AP directions while standing, with feet parallel and in semi-tandem positions, during eyes-open (EO) and eyes-closed (EC) conditions (30 seconds/test) [11,19].

Gait was assessed over a distance of 20 meters using the LEGSys™ wearable sensors. The system estimates spatiotemporal gait parameters based on the participant's height (used to estimate leg length) and a two-link inverse pendulum model described above, including: velocity, stride length, stride time, double support, single support, and stride-to-stride variability, and gait initiation [19,20]. COM range of motion during walking was calculated based on the data from the sensor attached to the lower back. Gait was assessed under usual and maximal walking speeds [19].

Fear of Falling was defined as concerns about falling. The Falls Efficacy Scale International (FES-I) scale was used, a self-report measure that assesses concerns about falling for 16 commonly performed activities at home and in community settings (e.g. get in/out of chair, walk in crowded places) [12,21].

3-month incident fall rates: Participants were provided with monthly fall calendars and asked to mark it daily (X = no fall, F = Fall) and record details of any fall injury/hospitalization on the back of the monthly sheet [13,22]. A fall was defined as: an unexpected event in which the person comes to rest on the ground, floor, or lower level [23]. Participants were provided with prepaid, self-addressed envelopes to return the fall calendars to the study staff each month. Reminder phone calls to participants were instituted for late or missing fall calendars [13,22].

Statistical analysis

Descriptive statistics were calculated for all variables, including range-checking and inspection of missing values. To determine participants' intervention acceptability, satisfaction, adherence and safety (adverse events), t-tests for continuous variables and Fisher's exact test for categorical variables were used. The sample size in this pilot study limited the statistical power and it was not possible to detect any significant differences in fall risk factors between groups. To compare changes in balance, gait and fear of falling from pre- to post-intervention within each group, we used paired t-tests. The number of falls and fallers in the 3-month post-intervention period were recorded as frequencies and percentages.

Results

A total of 72 older adults were assessed for study eligibility, 28 were pre-screened, and 17 agreed to participate, providing a response rate of 24%. The flow of participants in the study including enrollment, group allocation, follow up, and analysis is presented in Figure 2. Participants were on average 74-years-old, mainly retired (95%, n = 16), women (88%, n = 15) with > 13 years education (81%, n = 13), who were at high fall risk (average FRQ score > 6). Participants self-reported medical history included diabetes (25%, n = 4), dyslipidemia (70%, n = 12), and hypertension (63%, n = 10). There were no statistically significant between group differences, apart from the MOB plus DTBC group having more Hispanics than the MOB group (p = 0.03) (Table 1).

Intervention acceptability, satisfaction, safety, and adherence

Participants reported that the study interventions were mostly acceptable (average score > 9) (Table 2). Similarly, participants reported that the study interventions were mostly satisfactory (average score > 9). There

Table 1: Participant baseline characteristics.

	MOB (N = 7)	MOB + DTBC (N = 9)	p-value†
Age (mean ± SD)	75 ± 8 years	73 ± 9 years	0.63
Women	86% (n = 6)	89% (n = 8)	1.00
White/Caucasian	71% (n = 5)	44% (n = 4)	0.36
Hispanic	0% (n = 0)	56% (n = 5)	0.03
Married	14% (n = 1)	11% (n = 1)	1.00
Retired	100% (n = 7)	89% (n = 8)	1.00
Education > 13 years	86% (n = 6)	78% (n = 7)	1.00
Hypertension‡	86% (n = 6)	44% (n = 4)	0.15
Dyslipidemia‡	71% (n = 5)	78% (n = 7)	1.00
Diabetes‡	29% (n = 2)	22% (n = 2)	1.00
FRQ (mean ± SD)	6.6 ± 1.8	5.9 ± 2.9	0.60
MMSE (mean ± SD)	29.7 ± 0.5	29.1 ± 1.1	0.19
PHQ-9 (mean ± SD)	4.4 ± 4.6	6.6 ± 5.1	0.40

†: derived from two-sample t-tests for continuous variables or Fisher's exact test for categorical variables; ‡: self-reported medical history; DTBC: Dual-Task Balance Challenge; FRQ: Fall Risk Questionnaire; MOB: Matter of Balance; MMSE: Mini-Mental Status Exam; PHQ-9: Patient Health Questionnaire.

Table 2: Intervention acceptability, satisfaction, safety, and adherence.

	MOB (N = 7)	MOB + DTBC (N = 9)	p-value†
Acceptability‡, mean ± SD	8.7 ± 1.8	9.5 ± 0.7	0.31
Satisfaction‡, mean ± SD	8.7 ± 1.8	9.6 ± 0.9	0.24
Convenient Time, %	100% (n = 7)	100% (n = 9)	1.00
Any Difficulty, %	0% (n = 0)	0% (n = 0)	1.00
Gained Benefits, %	100% (n = 7)	100% (n = 9)	1.00
Better Health, %	57% (n = 4)	89% (n = 8)	0.26
Worse Health, %	14% (n = 1)	0% (n = 0)	0.44
Recommend to Others, %	100% (n = 7)	100% (n = 9)	1.00
Safety/Adverse Events, %	0% (n = 0)	0% (n = 0)	1.00
Adherence/Class Attendance, %	95%	94%	0.95

†: derived from two-sample t-tests for continuous variables or Fisher's exact test for categorical variables; ‡: score range: 1-10 (1 = least, 10 = most), DTBC: Dual-Task Balance Challenge; MOB: Matter of Balance.

were no significant differences between groups in terms of the interventions' acceptability or satisfaction (all p-values > 0.20). All participants reported that the interventions were conducted at a convenient time (100%, n = 16), that they gained personal benefits, and would recommend these interventions to others (100%, n = 16). No participants reported that they had any difficulty following the instructor (0%, n = 16). There were no safety issues or adverse events during any of the classes. Participants in both groups had very high intervention adherence, attending ≥ 94% of classes (Table 2).

Intervention effects on fall risk factors and incident falls

Given the statistical power in this pilot study, within group changes for the balance and gait parameters, and fear of falling were examined (Table 3). Participants in the MOB group had no significant within group changes in any of the fall risk factors post-intervention. Conversely, participants in the MOB plus DTBC group had significant improvements in balance (eyes open test = ankle sway, p = 0.02; eyes closed test = hip sway, p = 0.03 and center of mass (AP), p = 0.01) and gait (fast pace = stride time, p = 0.04 and double support, p = 0.02), with less fear of falling (p = 0.04) after the 4-week intervention (Table 3). While the MOB plus DTBC had a 23% reduction in fear of falling, the MOB group had only 4% reduction. Compared to the MOB group, there were more 3-month incident falls and fallers in the MOB plus DTBC group. Fall injuries were reported as either none (n = 3) or minor (n = 7), not requiring medical assistance. The reported reasons for falling were: rapid ambulation, reaching, slipping, and tripping (Table 4).

Discussion

This was the first study, to our knowledge, to integrate a DTBC with the nationally-used MOB program curriculum. Community-dwelling older adults in this pilot study reported high levels of acceptability and satisfaction of the interventions, there were no safety issues, and participants had very high adherence rates, regardless of group assignment. In this pilot study, participants in the MOB plus DTBC group had significant improvements in balance and gait, with less fear of falling post-intervention, when compared to baseline. Our findings are similar to other dual-task intervention studies conducted among older adults, reporting improvements in balance, [24,25] gait, [24,26,27] and less fear of falling [27]. Balance improvements among the participants in the MOB plus DTBC group indicated they had a better ability to maintain their balance as their body moved and swayed while standing in a neutral position, with their eyes open (ankle sway) and eyes closed (hip sway and anteroposterior center of mass). While the improvements in gait at a fast pace Indicat-

Table 3: Intervention effects on fall risk factors, within group changes.

	MOB (N = 7)		MOB+DTBC (N = 9)	
	mean change ± SD	**p-value†**	**mean change ± SD**	**p-value†**
Balance (Eyes-Open Test)				
Ankle Sway, degrees	-2.9 ± 4.4	0.16	-2.6 ± 2.7	0.02
Hip Sway, degrees	0.9 ± 7.8	0.78	0.9 ± 3.2	0.41
Center of Mass (ML), cm	-0.1 ± 0.3	0.48	-0.1 ± 0.2	0.25
Center of Mass (AP), cm	-0.6 ± 0.8	0.11	-0.6 ± 0.8	0.06
Balance (Eyes-Closed Test)				
Ankle Sway, degrees	-1.9 ± 9.7	0.64	-1.2 ± 11.3	0.76
Hip Sway, degrees	0.9 ± 9.5	0.82	4.3 ± 4.9	0.03
Center of Mass (ML), cm	-0.2 ± 0.7	0.50	0.02 ± 0.5	0.92
Center of Mass (AP), cm	-0.3 ± 0.9	0.47	-0.8 ± 0.8	0.01
Gait (Normal Pace)				
Stride Time, seconds	-0.02 ± 0.1	0.68	-0.2 ± 0.3	0.08
Stride Length, meters	0.04 ± 0.1	0.46	0.04 ± 0.2	0.50
Stride Velocity, m/sec	0.06 ± 0.1	0.36	0.1 ± 0.2	0.11
Double Support Total, %	-0.3 ± 3.2	0.82	-8.8 ± 12	0.06
Gait (Fast Pace)				
Stride Time, seconds	0.02 ± 0.1	0.73	-0.1 ± 0.1	0.04
Stride Length, meters	0.1 ± 0.2	0.18	0.05 ± 0.2	0.52
Stride Velocity, m/sec	0.1 ± 0.3	0.42	0.1 ± 0.2	0.12
Double Support Total, %	-2.0 ± 9.5	0.62	-5.6 ± 5.6	0.02
Fear of Falling	-1.0 ± 9.2	0.78	-7.1 ± 8.5	0.04

†: paired t-tests comparing changes pre- to post-intervention; DTBC: Dual-Task Balance Challenge; MOB: Matter of Balance.

Table 4: Incident falls 3-months post-intervention.

	MOB (N = 7)	MOB + DTBC (N = 9)
Fallers, % (n)	14% (n = 1)	22% (n = 2)
Repeat Fallers, % (n)	14% (n = 1)	11% (n = 1)
Number of Falls†, n	3	7
Fall Injuries, n		
None	3	0
Minor (i.e., bruises/scrapes, not requiring medical assistance)	0	7
Moderate (i.e., wounds, bruises, sprains requiring a medical examination)	0	0
Serious (i.e., fracture, or internal injury requiring emergency treatment or hospitalization)	0	0
Reasons for Falling, n		
Rapid Ambulation	1	0
Reaching	0	1
Slipping	0	1
Tripping	2	5

†: a fall was defined as an unexpected event in which the person comes to rest on the ground, floor, or lower level [23]; DTBC: Dual-Task Balance Challenge; MOB: Matter of Balance.

ed a faster stride time (i.e. time between two footsteps for the same foot), and velocity (i.e. how fast waked a specified distance) and less double support. A reduction in double support while walking indicated that participants did less "shuffling" on both feet between steps, and likely felt more stable when walking. The MOB plus DTBC participants reported a 23% reduction in fear of falling, after the intervention.

Participants in the MOB group in this pilot study had no significant within group changes in balance, gait, or fear of falling. These findings are in contrast to other MOB intervention studies reporting significant improvements in balance, [28] gait, [29] and fear of falling [5] post-intervention. In this pilot study, static balance was assessed, whereas Chen and colleagues, [28] assessed dynamic balance, which may in part explain the differences in the findings obtained. In another study, Smith and colleagues [5] reported significant reductions in the fear of falling among older women (mean age = 76 years) following a MOB intervention. In this study, participants had high intervention adherence rates, yet only reported a 4% decrease in the fear of falling after the MOB intervention. Further, incident fall rates following a MOB intervention in prior studies have reported mixed findings, with either fewer incident falls [5,28] or no change in fall rates [29]. In this pilot study, there was one recurrent faller in both the MOB and the MOB plus DTBC groups. The most common reason for falling was due to tripping, suggesting that home safety assessments may be needed in addition to the fall prevention classes [1].

Study strengths and limitations

This study had several strengths. First, both interventions used the standardized MOB curriculum, which is nationally recognized and aimed at preventing falls among older adults living in the community. There were two certified and trained instructors at each class, and there were different instructors teaching the MOB and MOB plus DTBC classes. Finally, balance and gait were assessed objectively using wearable sensors, providing more precise measurements of these fall risk indicators. Study limitations included the sample size, which limited the statistical power, and it was not possible to detect any significant differences in fall risk factors or incident falls between groups. In addition, participants were recruited from one Community Health Center, limiting generalizability.

Future studies with a larger sample size and longer follow-up period are needed, to determine the effects of MOB plus DTBC compared to MOB only on fall risk factors and incident fall rates. Future studies may like to consider comparing different types of DTBC activities that community-dwelling older adults enjoy and are likely to engage in, such as dancing or Tai Chi; as these types of activities require thinking and moving simultaneously.

Conclusions

Reducing fall risk factors and preventing falls are essential for community-dwelling older adults, to ensure that they continue to live safely and independently. Community-based programs that raise awareness about falls, help older adults to increase their strength and balance, and address the fear of falling are the most effective. The addition of DTBC to the nationally-used standard MOB curriculum may enhance both balance and cognitive function, and lead to reduced fall risk among community-dwelling older adults.

Acknowledgements

Special thanks to the study participants, study staff

(Caroline Sutherland Mills, Coco Tirambulo, and Emily Taylor), the MOB Instructors (Tom Pylman and Barbara Benesch), the MOB plus DTBC Instructors (Shelley Whitlatch and Nancy Schulte), Pima Council on Aging, and El Rio Community Health Center.

Source of Funding

This study was funded by a grant from the Arizona Area Health Education Centers (AzAHEC) Program (grant number: RG 2017-13, Taylor-Piliae, PI). The content is solely the responsibility of the authors and does not necessarily represent the official views of AzAHEC.

Disclosure Statement

The authors declare no conflicts of interest.

References

1. Stevens JA, Mahoney JE, Ehrenreich H (2014) Circumstances and outcomes of falls among high risk community-dwelling older adults. Inj Epidemiol 1.
2. Shumway-Cook A, Ciol MA, Hoffman J, Dudgeon BJ, Yorkston K, et al. (2009) Falls in the Medicare population: Incidence, associated factors, and impact on health care. Phys Ther 89: 324-332.
3. Lee DCA, Pritchard E, McDermott F, Haines TP (2014) Falls prevention education for older adults during and after hospitalization: A systematic review and meta-analysis. Health Educ J 73: 530-544.
4. Healy TC, Peng C, Haynes MS, McMahon EM, Botler JL, et al. (2008) The feasibility and effectiveness of translating a matter of balance into a volunteer lay leader model. J Appl Gerontol 27: 34-51.
5. Smith ML, Ory MG, Larsen R (2010) Older women in a state-wide, evidence-based falls prevention program: Who enrolls and what benefits are obtained? Womens Health Issues 20: 427-434.
6. Smith ML, Jiang L, Ory MG (2012) Falls efficacy among older adults enrolled in an evidence-based program to reduce fall-related risk: Sustainability of individual benefits over time. Fam Community Health 35: 256-263.
7. Cadore EL, Rodriguez-Manas L, Sinclair A, Izquierdo M (2013) Effects of different exercise interventions on risk of falls, gait ability, and balance in physically frail older adults: A systematic review. Rejuvenation Res 16: 105-114.
8. Muir SW, Berg K, Chesworth B, Klar N, Speechley M (2010) Quantifying the magnitude of risk for balance impairment on falls in community-dwelling older adults: A systematic review and meta-analysis. J Clin Epidemiol 63: 389-406.
9. Gobbo S, Bergamin M, Sieverdes JC, Ermolao A, Zaccaria M (2014) Effects of exercise on dual-task ability and balance in older adults: A systematic review. Arch Gerontol Geriatr 58: 177-187.
10. Giroud X, Miramontes M, Powell M, Heasley B, Taylor-Piliae R, et al. (2016) Dual Task Challenge - A novel addition to community-based fall intervention programs. Arizona Geriatrics Society Journal 21: 8-11.
11. Najafi B, Horn D, Marclay S, Crews RT, Wu S, et al. (2010) Assessing postural control and postural control strategy in diabetes patients using innovative and wearable technology. J Diabetes Sci Technol 4: 780-791.
12. Delbaere K, Close JC, Mikolaizak AS, Sachdev PS, Brodaty H, et al. (2010) The Falls Efficacy Scale International (FES-I). A comprehensive longitudinal validation study. Age Ageing 39: 210-216.
13. Hannan MT, Gagnon MM, Aneja J, Jones RN, Cupples LA, et al. (2010) Optimizing the tracking of falls in studies of older participants: Comparison of quarterly telephone recall with monthly falls calendars in the MOBILIZE Boston Study. Am J Epidemiol 171: 1031-1036.
14. Rubenstein LZ, Vivrette R, Harker JO, Stevens JA, Kramer BJ (2011) Validating an evidence-based, self-rated fall risk questionnaire (FRQ) for older adults. J Safety Res 42: 493-499.
15. Kroenke K, Spitzer RL, Williams JB (2001) The PHQ-9: Validity of a brief depression severity measure. J Gen Intern Med 16: 606-613.
16. Tombaugh TN, McIntyre NJ (1992) The mini-mental state examination: A comprehensive review. J Am Geriatr Soc 40: 922-935.
17. Taylor-Piliae RE, Hoke TM, Hepworth JT, Latt LD, Najafi B, et al. (2014) Effect of Tai Chi on physical function, fall rates and quality of life among older stroke survivors. Arch Phys Med Rehabil 95: 816-824.
18. Chen B-R (2011) LEGSys: Wireless Gait Evaluation System Using Wearable Sensors. Conf Proc Wireless Health.
19. Schwenk M, Mohler J, Wendel C, D'Huyvetter K, Fain M, et al. (2015) Wearable sensor-based in-home assessment of gait, balance, and physical activity for discrimination of frailty status: Baseline results of the Arizona frailty cohort study. Gerontology 61: 258-267.
20. Aminian K, Najafi B, Bula C, Leyvraz PF, Robert P (2002) Spatio-temporal parameters of gait measured by an ambulatory system using miniature gyroscopes. J Biomech 35: 689-699.
21. Yardley L, Beyer N, Hauer K, Kempen G, Piot-Ziegler C, et al. (2005) Development and initial validation of the Falls Efficacy Scale-International (FES-I). Age Ageing 34: 614-619.
22. Mackenzie L, Byles J, D'Este C (2006) Validation of self-reported fall events in intervention studies. Clin Rehabil 20: 331-339.
23. Klenk J, Chiari L, Helbostad JL, Zijlstra W, Aminian K, et al. (2013) Development of a standard fall data format for signals from body-worn sensors : The FARSEEING consensus. Z Gerontol Geriatr 46: 720-726.
24. Dorfman M, Herman T, Brozgol M, Shema S, Weiss A, et al. (2014) Dual-task training on a treadmill to improve gait and cognitive function in elderly idiopathic fallers. J Neurol Phys Ther 38: 246-253.
25. Hamacher D, Hamacher D, Rehfeld K, Schega L (2016) Motor-cognitive dual-task training improves local dynamic stability of normal walking in older individuals. Clin Biomech (Bristol, Avon) 32: 138-141.
26. Falbo S, Condello G, Capranica L, Forte R, Pesce C (2016) Effects of physical-cognitive dual task training on executive function and gait performance in older adults: A randomized controlled Trial. BioMed Res Int 2016: 5812092.
27. Wollesen B, Mattes K, Schulz S, Bischoff LL, Seydell L, et al. (2017) Effects of dual-task management and resistance training on gait performance in older individuals: A randomized controlled trial. Front Aging Neurosci 9: 415.
28. Chen TY, Edwards JD, Janke MC (2015) The Effects of the A Matter of Balance Program on Falls and Physical Risk of Falls, Tampa, Florida, 2013. Prev Chronic Dis 12: E157.
29. Mielenz TJ, Jia H, Seefeld E, Schulingkamp M, Smith S, et al. (2014) Translating using RE-AIM of a falls behavior change program among an assisted living population. Fam Community Health 37: 147-154.