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A Feasibility Study of a Multifaceted Walking Intervention to Maintain the Functional Mobility, Activities of Daily Living, and Quality of Life of Nursing Home Residents With Dementia

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Abstract

Purpose: The aim of the study was to evaluate the feasibility, acceptability, and efficacy of a multifaceted walking intervention (MWI) aimed to maintain the functional mobility, activities of daily living function, and quality of life of long-term care home residents with dementia.

Design/Methods: A quasiexperimental time-series design was used. The 4-month intervention provided one-on-one walking 2–4 days a week, guided by an individualized communication care plan and interviews with collaterals and staff.

Results: The MWI was feasible based on high recruitment and adherence rates (86% and 94%, respectively) and highly acceptable to stakeholders. Residents (n = 25) showed significant improvements after the intervention: Timed Up-and-Go (−8.85 seconds, p = .00), Two-Minute Walk Test (27.47 m, p = .00), Functional Independence Measure (0.72, p = .00), and Alzheimer's Disease-Related Quality of Life (2.44, p = .05).

Conclusion: The MWI was feasible and improved functional mobility compared to usual care.

Clinical Relevance: Physical activity delivered with a person-centered care was feasible and may be beneficial to mitigate decline in long-term care home residents with dementia.

Keywords: Geriatric rehabilitation; dementia; long-term care; person-centered care.

Introduction

Dementia is a "public health priority" (Alzheimer's Disease International, 2013). Approximately 60% of older adults living in long-term care (LTC) homes have some form of dementia, such as Alzheimer's disease (AD) (Canadian Institute for Health Information, 2017; Helvik, Engedal, Benth, & Selbæk, 2015), and this proportion is expected to increase (Helvik et al., 2015). Given its high global prevalence, dementia has a substantial global economic impact on families, caregivers, and communities (Daviglus, Bell, Berrettini, Bowen, Connolly, Cox, et al., 2010; Statistics Canada, 2010; Wimo, Guerchet, Ali, Wu, Prina, Winblad et al., 2017), as well as care implications for health-care systems (Alzheimer's Disease International, 2013; World Health Organization [WHO], 2012).

Residents with dementia in LTC homes are particularly vulnerable to mobility and functional decline due to their age and multiple chronic comorbidities (Slaughter, Eliasziw, Morgan, & Drummond, 2011). This population presents unique rehabilitation challenges owing to declining executive function causing ataxia (i.e., inability to initiate movement), apraxia (i.e., inability to follow a verbal command into its motor expression), and aphasia (i.e., inability to speak or understand spoken or written language) that make movement and communication challenging (Attix & Welsh-Bohmer, 2005). Consequently, residents may be unable to understand instructions, articulate preferences

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or discomfort, respond appropriately, or initiate movement to participate in rehabilitation or physical activity (PA). Management of physical decline and deconditioning in residents with dementia is further complicated by responsive behaviors (i.e., behavioral and psychological symptoms of dementia) such as agitation or aggressive behaviors (Gilmore-Bykovskyi, Roberts, Bowers, & Brown, 2015), which are often distressing for those who provide treatment and care (Dupuis, Wiersma, & Loiselle, 2012).

Physical activity is recognized as an effective means to attenuate the loss of muscle protein mass underlying mobility and functional decline in older adults (Cruz-Jentoft et al., 2010; Evans, 2010; Landi et al., 2011; Morley, 2015). Several systematic reviews suggest that PA interventions for LTC home residents with dementia improved physical (Littbrand, Stenvall, & Rosendahl, 2011) and activities of daily living (ADL)-related outcomes (Blankevoort et al., 2010; Forbes, Forbes, Blake, Thiessen, & Forbes, 2015). Physical activity is essential in LTC homes' programming (Morley, 2015, 2016) either in the form of restorative care or rehabilitation therapy commonly organized by registered nurses. Despite the evidence supporting PA, the clinical reality is that most LTC homes provide minimal daily PA, social engagement, and cognitive stimulation to their residents (den Ouden et al., 2015; Scherder, Bogen, Eggermont, Hamers, & Swaab, 2010). Consequently, the majority spend their waking hours in sedentary activities (Ikezoe, Asakawa, Shima, Kishibuchi, & Ichihashi, 2013).

In recent years, person-centered care (PCC) has emerged as a crucial underlying principle for the delivery of quality care in LTC homes (Edvardsson, Winblad, & Sandman, 2008; Kitwood, 1997) and as a dementia care best practice (Alzheimer Society of Canada [ASC], 2011; British Columbia Ministry of Health, 2012). Person-centered care aims to address residents' underlying unmet needs and communication impairments by individualizing care to recognize the abilities, personality, preferences, and values of individual residents (ASC, 2011; British Columbia Ministry of Health, 2012). Principle tenets of PCC include incorporating personhood to individualize each resident's care and environment; prioritizing shared decision-making; and nurturing supportive relationships between the caregiver, the resident (Edvardsson et al., 2008; Kitwood, 1997), and the resident's family (ASC, 2014). Person-centered care is an effective nonpharmacological means to reduce responsive behaviors, such as agitation (Livingston et al., 2014), while facilitating meaningful interactions (Gilmore-Bykovskyi et al., 2015). Furthermore, PA interventions to this population are challenged by the requirement for prolonged, frequent communication with residents in order to instruct, guide, and motivate participants. Examining the impact of personally tailored interventions in LTC is a burgeoning area of research (Möhler, Renom, Renom, & Meyer, 2018). No previous study has investigated the effect of an explicit PCC approach to deliver a PA intervention with the goal to mitigate the mobility and function decline experienced by residents in LTC homes with dementia.

The purpose of this study is to, first, evaluate the feasibility and acceptability of a person-centered multifaceted walking intervention (MWI) and, second, assess the efficacy of the MWI to maintain the functional mobility, ADL function, and quality of life (QOL) of LTC home residents with dementia.

Methods

Design

This feasibility study utilized a quasiexperimental one-group time series design with repeated measures to evaluate changes on functional mobility, ADL function, and QOL after a MWI. Residents received usual care and programming during a 2-month control phase, which was followed immediately by a 4-month intervention phase. We compared the observations at four time points: at baseline and end of the *control phase*, mid-intervention (i.e., 2 months into the MWI), and immediately after the MWI. The repeated measures design allows participants to serve as their own controls (Sidani & Braden, 2011, p. 195) and reduce between-participant variation. The Research Ethics Boards at the University of Toronto and the University Health Network (#14-7737-DE) approved this study.

The International Classification of Functioning, Disability and Health (ICF; WHO, 2001) was the conceptual framework used for this study. The ICF (WHO, 2001) describes disability and functioning as a continuum while accounting for the influence of the environment, individual, and disease, therefore amalgamating the principles of PCC with PA. It has been used extensively to conceptually refocus the design of interventions on the QOL for populations with multiple comorbidities (Cerniauskaite et al., 2011; Worrall & Hickson, 2003).

Setting and Participants

This intervention took place in two nonprofit LTC homes within the Greater Toronto Area. Home 1 is a large 350-bed facility, and Home 2 is a mid-sized 128-bed LTC home. The inclusion criteria for residents were as follows: 65 years old or older, a resident in the LTC home for less than 6 months, diagnosis of dementia (e.g., AD or Alzheimer's type dementia), a Mini-Mental Status Exam (MMSE; Folstein, Folstein, & McHugh, 1975) score of >10 and <24, English speaking,

able to complete the 2-Minute Walk Test (2MWT) at baseline (with or without a gait aid), whose primary physician deemed participation to be safe, not severely hearing impaired (i.e., can hear voices one meter away), and presence of a collateral (the Power of Attorney) to provide consent for the resident to participate.

The exclusion criteria were as follows: nonambulatory (i.e., unable to stand or walk), diagnosis of Parkinson's disease (due to muscle and motor-related impairments), a personality disorder, schizophrenia, focal brain disorder, an unstable cardiac condition that could deteriorate during ambulation, surgery within the last 6 months, a terminal illness with a life expectancy of less than 6 months as indicated in the medical chart or by a physician, considered palliative, or extreme loss of vision or hearing.

MWI Description

The MWI is an evidence-based complex intervention that incorporates PCC to meet residents' physical, social, and psychological needs. The principal investigator (PI, CC), an experienced registered nurse with specialist training in gerontology and dementia care, was responsible for all aspects of the intervention, including developing and delivering the MWI, conducting the walking sessions, and updating the care plans to ensure progression of participants toward their goals. The two components of the MWI are described below:

Walking Sessions

This nurse-led intervention provided low intensity PA in the form of one-to-one walking sessions that were individualized to the physical abilities of each resident. The walking sessions were provided two to four times a week for 16 weeks; the dosage was supported by a previous review that showed this duration of PA interventions as effective in preventing mobility and ADL decline in participants (Littbrand et al., 2011).Walking is a practical, enjoyable (Phillips & Flesner, 2013), and effective low-intensity PA that can improve mobility performance and ADL function in residents with dementia (Roach, Tappen, Kirk-Sanchez, Williams, & Loewenstein, 2011; Tappen et al., 2000), including those with severe cognitive impairment (Venturelli, Scarsini, & Schena, 2011). Functional low-intensity PA for longer durations may be more inclusive to residents of varying cognitive and physical abilities (Littbrand et al., 2011), compared to high-intensity PA that can be too difficult for residents with moderate to severe cognitive and physical impairments.

The individualized walking regimes were developed by the PI, with physiotherapist consultation, based on functional mobility assessments (Timed Up-and-Go [TUG] and 2MWT) to ensure the intensity (walking speed) and duration were appropriate to the resident's walking ability. Residents were encouraged to gradually increase their distance or speed in each session, and the frequency of sessions was also increased up to a maximum of 4 days a week over the duration of the MWI based on the resident's tolerance. Physiotherapist consultation was available as necessary to provide advice regarding PA dosage throughout the study. All aspects of the walking sessions were individualized, including goals of participating in the PA, timing of the sessions (morning, afternoon, evening), route (outdoors, indoors), as well as the number and duration of breaks.

Individualized Care Plan

The interaction during each walking session was informed by a two-page individualized care plan based on the resident's biography and outlines effective communication and interactional strategies to facilitate meaningful engagement and to encourage supportive relationships with the interventionist and the resident as well as with the staff. The care plan outlined PCC approaches to effectively communicate and interact with the resident with dementia (McGilton, 2004; McGilton et al., 2007, 2017). Effective communication between the resident and the interventionist is an essential component to facilitating supportive relationships, which is a principle of PCC (Olsson, Jakobsson Ung, Swedberg, & Ekman, 2013). The communication plan was developed from four data sources: (1) The Functional Linguistic Communication Inventory (Bayles & Tomoeda, 1994) was used to assess functional linguistic communication skills and provide a Reisberg Functional Assessment Staging Score. Test scores were used to inform care plans that promote residents' preserved skills and encourage their highest level of functioning. (2) A 45-minute semistructured interview with the resident's collateral, who was typically a family member familiar with the resident, to collect biographical information (e.g., previous job, where they used to live, what they were interested in, values, personality characteristics), communication abilities, and interactional behaviors to ensure PCC was embedded into the care plan and that collaterals' input were included in the intervention. (3) A 30-minute interview with the LTC home staff, generally a personal support worker (PSW) most responsible for the resident, was also conducted to learn the residents' ADL function and daily activities (e.g., their daily exposure to PA at the facility, their daily routine), communication abilities, and interactional behaviors. (4) A 30-minute observation of the resident interacting with a collateral or PSW staff was conducted to identify any idiosyncrasies and mannerisms. Detailed notes about the interaction were taken by the PI.

The person-centered communication care plan (McGilton, Davis, et al., 2012) contained five sections to facilitate an individualized approach throughout the intervention: (1) "Resident's biography" described important aspects of their life and personality (conservative, religious, values, and preferences). (2) "Resident's communication" outlined how the resident's communication challenges and how to effectively communicate with the resident (i.e., strategies, like avoiding open-ended questions). (3) "How to engage the resident" listed topics of interest and topics to avoid in order to encourage meaningful engagement and conversation (Cott, Dawson, Sidani, & Wells, 2002). (4) "Resident's behaviors/interactions" described strategies related to resident's behaviors, including those that trigger or calm the resident to mitigate responsive behaviors (Kovach, Kelber, Simpson, & Wells, 2006). (5) "Resident's mobility" described effective prompts and cues to encourage the resident during the session (e.g., "remember to stand tall, shoulders back"). This section listed verbal and nonverbal techniques that were effective for the resident such as speaking in short simple sentences, rephrasing, using gestures, yes/no questions, or closed-ended questions that require a single word for a response. The individual care plans were continually refined over time to incorporate additional strategies, update the walking regime, and to add other relevant information (e.g., resident has a temporary replacement walker).

Data Collection

Demographics

The medical chart was used to extract resident demographic data (age, gender, ethnicity), comorbidities, disabilities (hemiparesis, hearing impairment, visual impairment), number of medications, and types of medications. The LTC home staff member most responsible for the resident (i.e., the PSW most frequently assigned to the resident) was asked to provide information about the resident's exposure to PA during their daily routine and their ADL function. The MMSE was conducted by the PI to assess cognitive function (Cockwell & Folstein, 2002; Folstein et al., 1975; Tombaugh & Mcintyre, 1992). Demographic information regarding LTC home staff (age, gender, and number of months caring for the resident) and resident collaterals (age, gender, relationship to the resident, level of education, and how often they visited the resident) were also collected.

Feasibility

Feasibility referred to the logistics and practicality of implementing the MWI (Sidani & Braden, 2011). Specific metrics to assess feasibility include (1) recruitment rate (percentage of enrolled resident participants out of the total number of eligible residents) and (2) retention rate (percentage of enrolled resident participants who completed the study). Alongside enrolled participants, their associated LTC home staff and collateral were also consented into the study. Reasons for resident nonenrollment, withdrawal, and attrition were noted by the PI for residents throughout the study.

Acceptability

Acceptability referred to the appropriateness and convenience of the intervention from the perspectives of the resident participants as well as their collaterals and LTC home staff (Sidani & Braden, 2011). The acceptability to collaterals and LTC home staff influences recruitment, adherence, attrition, and transferability into clinical practice and is therefore important to consider in feasibility studies (Sidani & Braden, 2011). Specific metrics to assess acceptability included (1) resident adherence to the intervention based on PI's attendance notes and reasons why sessions were missed was used as an indicator of resident acceptability since acceptable interventions are agreeable to the clients expected to receive them (Sidani & Braden, 2011) and (2) the formal evaluation of collaterals' and LTC home staff acceptance using the modified-Treatment Evaluation Inventory (modified-TEI; Landreville & Guerette, 1998). The modified-TEI measures an overall positive or negative reaction to the treatment. The modified-TEI consisted of 11 items on a 7-point scale (1 = *not at all acceptable* and 7 = *very acceptable*), with one question reverse-scored (total score of 71). Prior to the study, the PI pilot-tested the readability of the modified-TEI with three PSWs, and feedback was used to clarify the questions. The survey was collected pre- and post-MWI to identify changes in acceptability over time and determine whether the intervention met participants' expectations (Sidani & Braden, 2011).

Resident Outcome Variables

We measured the TUG, 2MWT, ADL function (Functional Independence Measure [FIM]), and QOL (Alzheimer's Disease-Related Quality of Life [ADRQL] Scale). All resident outcomes were collected four times: at baseline and the beginning, middle (i.e., at Month 2), and end of the intervention phase (i.e., within 1 week after completion of all planned sessions) by a blinded and trained research assistant who was a physiotherapist assistant with extensive experience working with LTC home residents.

The TUG is a reliable measure with high intrarater and interrater reliability scores of in older adults with AD (interclass correlation = 0.985–0.988; Ries, Echternach, Nof, & Gagnon Blodgett, 2009). The 2MWT is also a reliable measure in LTC residents and high test–retest reliability (0.94; Connelly, Thomas, Cliffe, Perry, & Smith, 2009)

and is valid and sensitive for detecting changes in functional mobility. Lastly, gait speed is a predictor of lower extremity function (Guralnik et al., 1994; Studenski et al., 2011) and falls (Kearney, Harwood, Gladman, Lincoln, & Masud, 2013) for those over 85 years old (Toots et al., 2013).

Activities of daily living function was measured by the FIM (Granger, Hamilton, Zielezny, & Sherwin, 1986), which captures disability and outcomes of rehabilitation based on the level of assistance required. The FIM contains items that assess self-care, sphincter control, transfer, and locomotion as well as a cognitive subscale (Granger, Hamilton, Linacre, Heinemann, & Wright, 1993). Quality of life was measured using the ADRQL Scale, a 40-item disease-specific QOL scale (Rabins, Kasper, & Kleinman, 1999).

Sample Size Calculation

A sample size calculation with a power level of 0.8 and an alpha of <.1 was applied to accept a 10% chance of Type I error (two-tailed). A medium effect size of 0.355 was assumed based on Toulette and colleagues' previous work using the TUG (Toulotte, Fabre, Dangremont, Lensel, & Thévenon, 2003). A p value of .1 was used to identify the preliminary efficacy of the intervention. The calculation indicated that a sample of 23 resident participants was required to complete the intervention to ensure that the study is adequately powered ($\beta = 0.815$). A modest attrition rate of 30% over the duration of the 6-month study was taken into account (Christofoletti et al., 2008); therefore, a total of 30 participants was the sample size target. G*Power 3.1 software was used for the power analysis and sample size estimation.

Procedures

For recruitment, the restorative care coordinator from each home reviewed residents' medical records (i.e., Resident Assessment Instrument 2.0 data) to compile a list of potentially eligible residents and then called their respective collaterals to assess interest in the study and obtain consent for the study PI to contact them directly. Then the PI subsequently arranged individual meetings with the collateral and the resident to describe the study and obtain informed consent in accordance to an ethical protocol specific to individuals with dementia (Slaughter, Cole, Jennings, & Reimer, 2007). Baseline assessments (MMSE, 2MWT, TUG) for the residents were completed by the PI, and if the resident was eligible, the LTC home staff member most responsible for the enrolled resident was invited by the PI to participate in the study as well. The PI then conducted the audio-taped interviews with the collaterals and LTC home staff and observation to generate the care plan.

During the MWI, the PI would request updates on the resident (e.g., illness or injuries overnight, appointments for the day) from the LTC staff prior to approaching the resident for a walking session. The PI would then meet the resident in their room at a predetermined time according to the resident's preference. An ethical protocol developed a priori was used to discern dissent and assent at the beginning and during each session. For example, the PI was only able to approach the resident three times a day to initiate the walking session to ensure the wishes of the resident are respected, and if the resident had refused three sessions in a row it was assumed they were no longer interested in the study and were withdrawn from the study. Before each session, the PI would engage in 1–2 minutes of dialogue utilizing effective communication techniques outlined in the care plan to ensure the assent of the resident to the walking session. The PI ensured that the appropriate safety precautions were taken, such as ensuring the resident had their glasses, hearing aids, gait aid, and nonslip footwear. Details of the session and the resident's response were recorded (e.g., duration, distance measured by using a calibrated wheel, behavioral response, breaks, adverse events/issues during the session, any changes in resident health, cognition, mobility, modifications, and broad topics of conversations during the walk) by the PI immediately after each session.

Statistical Analysis

Data were analyzed using SPSS for Windows (SPSS Inc, v. 21, Chicago, IL). Descriptive statistics to describe resident, collateral, and LTC staff participants in the study were completed. Descriptive statistics were conducted for each univariate (recruitment rate, retention rate, resident adherence). Resident adherence was expressed as a percentage determined by the number of sessions attended by residents divided by the number of sessions outlined in the walking regime. A multivariate repeated-measures analysis of variance was used to assess the efficacy of the intervention over time (four measurements) on the dependent variables 2MWT, gait speed, and TUG. Assumptions for the repeated-measures analysis of variance were tested, and log transformations were used if the distributions were skewed. An alpha of ≤.1 was applied for all tests in order to identify any positive trends that correspond to the feasibility and efficacy of the intervention. There was no missing data from the quantitative questions.

Results

Table 1 presents the resident demographic information for the final resident sample ($N = 26$). The most common form of regular PA was a daily 30-minute chair-bound

Table 1 Baseline characteristics of enrolled long-term care residents ($N = 26$)

Resident Characteristics	Mean (*SD*), Min–Max	*n* (%)
Age	86.8 (6.9), 76–101	
Female		21 (80.8)
Baseline BMI	23.77 (5.8), 16–37.2	
No. of months in home	2 (1.3), 0.75–5	
Marriage status		
Married		6 (23.0)
Widowed		15 (57.7)
Single/divorced		5 (7.6)
Ethnicity		
Caucasian		25 (96.2)
Other		1 (3.8)
Education level		
Grade school		6 (23.0)
High school graduate		9 (34.6)
College graduate		4 (15.4)
University graduate		5 (19.2)
Graduate school		2 (7.6)
Screening results		
MMSE score	15.5 (5.0), 10–24	
FAST score	5.0 (0.8), 4–7	
Depression score	8 (6.0), 3–26	
Dementia diagnosis		
Alzheimer's		6 (23.1)
Dementia unspecified		20 (76.9)
Comorbidities		
No. of comorbidities per resident	6.1 (3.0), 3–11	
Hypertension		15 (57.7)
Congestive heart failure		9 (34.6)
Arthritis		8 (30.7)
Diabetes		5 (19.2)
Cataracts		5 (19.2)
COPD		3 (11.5)
Medications		
Medications prescribed per resident	9.8 (4.4), 117	
Use of antidepressants		16 (61.5)
Use of analgesics		15 (57.7)
Use of ACE-I:ARBs		12 (46.1):4(15.4)
Use of cognitive enhancers		9 (34.6)
Use of sedatives, antipsychotics		8 (30.7)
Use of diuretics		7 (26.9)
Use of calcium channel blocker		4 (15.4)
Use of insulin		4 (15.4)
Use of narcotics		3 (11.5)
Mobility status and gait aid use		
No gait aid needed		6 (23.0)
Used a walker to mobilize around the unit		11 (42.3)
Spent the majority of the day in a wheelchair or bed		9 (34.7)

Note. BMI = body mass index; MMSE = Mini-Mental Status Examination; FAST = Reisberg Functional Assessment Staging Scale; COPD = chronic obstructive pulmonary disorder; ACE-I = angiotensin-converting enzyme inhibitors; ARBs = angiotensin-II receptor blockers.

class, but the enrolled residents rarely participated. There were no significant demographic differences between the residents from Home 1 ($n = 15$) and Home 2 ($n = 11$).

The mean age of collaterals was 59 years of age ($SD = 12.3$); children represented 70% of the collaterals compared to spouses and friends, were university-educated (50%), visited an average of twice a week, and rated themselves as knowing the resident "the most" compared to other family members or friends. The mean age of LTC home staff was 49 years old, most were female (97%), and they had worked in the home for an average of 8 years (Table 1).

Recruitment and Attrition Rates

Figure 1 is the flow diagram for participant recruitment and the reasons for participant exclusion and nonenrollment. After screening, 26 residents were eligible, and all 26 residents were enrolled into the study resulting in a recruitment rate of 86.6%. All concomitant collaterals and home staff enrolled when approached for the study (100%). During the study, only one resident entered palliative care and was withdrawn from the study. No adverse events were related to the walking sessions (Figure 1).

Acceptability of the MWI

There were 858 scheduled walking sessions for the residents, of which only 57 sessions (7%) were missed, resulting in a resident adherence rate of 93%. The mean number of sessions per resident was 33 (range = 16–128), and the most common reasons for missing a session were as follows: a change in health status such as diarrhea or influenza (37%), responsive behaviors exhibited earlier that day that initiates a policy of constant observation staff and minimization of social contact (23%), and doctor/dentist appointments (16%).

The average modified-TEI score prior to the beginning of the MWI for collaterals and LTC home staff was 69.2/71 (97.5%), indicating that both groups found the MWI "very acceptable." Post-MWI the collaterals and home staff average scores were 69.2/71 (97.5%) and 65.5/71 (92.3%), respectively. These scores indicate that collaterals and LTC home staff continued to find the MWI "very acceptable" after the intervention, suggesting that the MWI had met their high expectations, was appropriate and effective, achieved satisfactory results, and aligned with their general impression of a PA intervention designed for residents with dementia.

Functional Mobility

Table 2 presents the TUG, 2MWT, and gait speed measured at each time point. A graphical representation of the efficacy outcomes can be found in Figure 2A–E (Table 2; Figure 2).

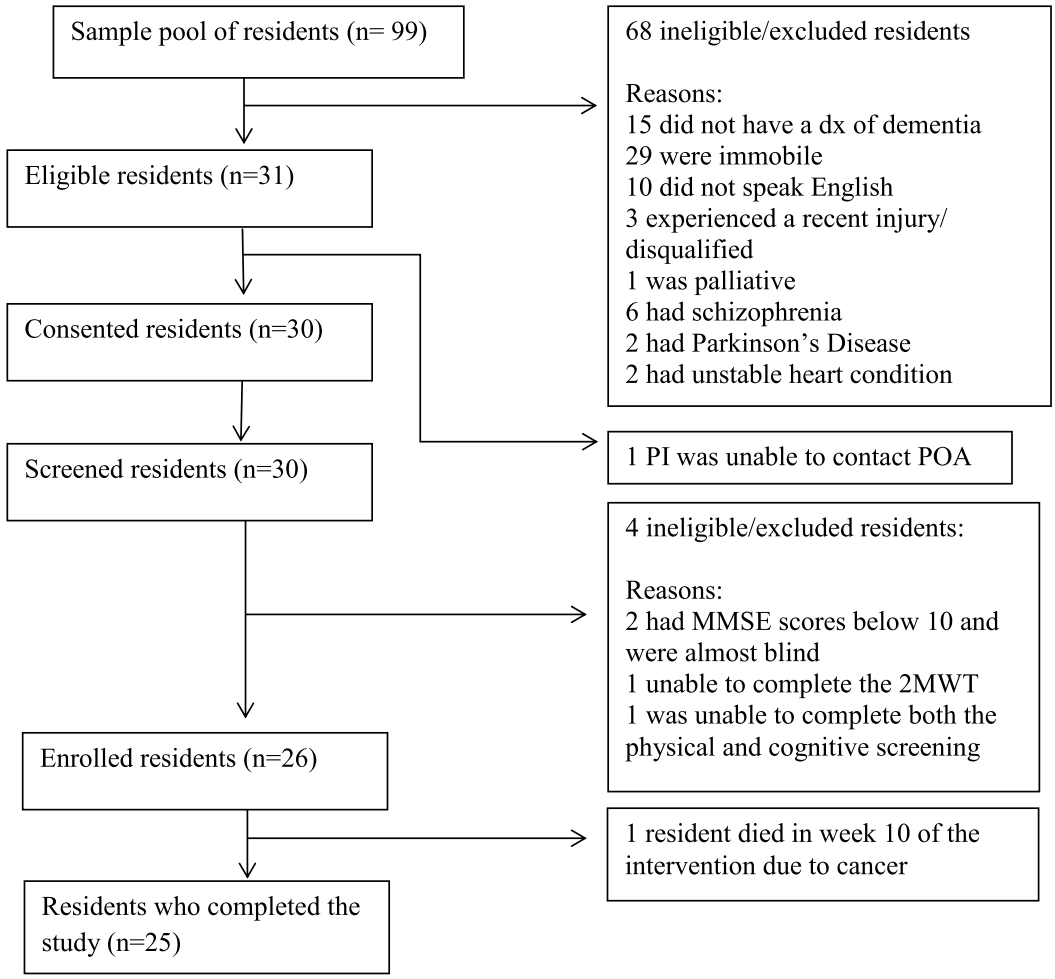

Figure 1. Flow diagram of resident recruitment.

Timed Up-and-Go

In the control phase, there was a significant increase in the TUG of 4.15 seconds (90% CI [1.61, 6.68], p = .010), which represented a 4.43% decline in functional mobility. Following the MWI, TUG scores improved significantly (p = .000) within the first half of the MWI and continued to significantly improve in the third and fourth month (p = .081). Figure 2A shows that the MWI resulted in 32.14% improvement in TUG scores (mean difference between T_4 and T_2 = −8.58 seconds, 90% CI [−11.57, −5.59], p = .000), and residents recovered the decline in functional mobility they experienced during the control phase.

2-Minute Walk Test

Figure 2B depicts a significant decline in the 2MWT of −5.78 m (90% CI [−10.19, −1.37], p = .034) in the control phase. There was a significant improvement in the 2MWT in the first half of the MWI (p = .000), as well as the second half (p = .080). Cumulatively, residents experienced a significant improvement in 2MWT from 53.60 to 81.07 m, representing a 51.25% improvement during the MWI (p = .000). Moreover, residents showed a significant improvement from their baseline 2MWT measure compared to T4 (p = .000).

Gait Speed

There was a significant decline in gait speed (p = .022) during the control phase. Residents experienced a significant improvement in their gait speed the first 2 months of the intervention and continued to improve, although not to a significant degree. By the end of the MWI, gait speed improved by 55.11% (p = .000). Figure 2C depicts that residents were able to regain the gait speed lost in the control phase and experienced a significant increase in gait speed by the end of the intervention (p = .000).

ADL Function

Figure 2D illustrates the trajectory of the FIM scores. There was a significant decline in the FIM score during the control phase (p = .000). During the intervention, there was a

Table 2 Functional mobility measures throughout the study ($N = 25$)

Outcome	TUG T1	TUG T2	TUG T3	TUG T4	2MWT1	2MWT2	2MWT3	2MWT4	Gait1 T1	Gait T2	Gait T3	Gait T4
Mean (*SD*)	22.56 (9.46)	26.71 (9.38)	20.69 (9.28)	18.13 (10.18)	59.38 (26.86)	53.60 (26.79)	75.91 (30.74)	81.07 (34.31)	0.49 (0.22)	0.43 (0.22)	0.64 (0.26)	0.67 (0.29)
90% CI	19.33, 25.80	23.50, 29.92	17.51, 23.86	14.64, 21.61	50.19, 68.57	44.43, 62.76	65.39, 86.43	69.33, 92.81	0.42, 0.57	0.36, 0.51	0.55, 0.73	0.58, 0.77
Range (min–max)	11–49	11–45	8–41	8–58	20.12–117.04	10.61–106.38	30.11–132.44	29.87–140.21	0.17–0.97	0.08–0.88	0.25–1.12	0.25–1.17

Note. TUG = Timed Up-and-Go Test; 2MWT = 2-Minute Walk Test; CI = confidence interval.

significant improvement in the FIM score in the first half of the MWI ($p = .000$), and the FIM score continued to improve in the second half of the MWI but not to a significant degree ($p = .111$). By the end of the MWI, residents improved their FIM scores by 25% ($p = .000$).

Quality of Life

Figure 2E shows a significant decline in QOL scores during the control phase ($p = .030$) and a significant improvement during the intervention phase. The ADRQL score significantly increased in the first half of the intervention ($p = .057$) and continued to improve, but not to a significant degree ($p = .787$; Table 3).

Discussion

The results of this study support the feasibility and acceptability of the MWI, in addition to the efficacy of the MWI in improving the functional mobility, ADL function, and QOL of LTC home residents with dementia. This intervention is the first to combine an explicitly outlined PCC approach by including the insights of collaterals and LTC home staff to deliver individualized PA to residents with dementia. All participants were recruited in a timely manner, and collaterals and home staff found the MWI highly acceptable before and after the intervention. At the 16-week follow-up, resident adherence to the MWI was high, indicating high resident acceptance with low attrition and no adverse effects, and there were significant improvements in 2MWT, TUG, gait speed, ADL function, and QOL. This suggests that PCC may be a feasible, safe, and promising approach to delivering PA to improve adherence to physical treatment as well as maintain functional mobility. The efficacy results provide the preliminary evidence to inform a future trial.

A concerning finding from this study was the steep declines in functional mobility, ADL function, and QOL experienced during the 2-month control phase when residents were receiving usual care. Previous research has shown similar declines in residents, although over much longer periods of time, spanning from 6 months (Carpenter, Hastie, Morris, Fries, & Ankri, 2006) to 20 years (Boyd et al., 2011). These findings suggest that these declines can happen at a much faster speed than previously reported. Residents spend 75% of their waking hours in sedentary activities (Ikezoe et al., 2013) and up to 92% of their day sitting or lying down (den Ouden et al., 2015). This is in conflict with the International Association of Gerontology and Geriatrics–Global Aging Research Network recommendations, indicating that every resident should have a personalized exercise program

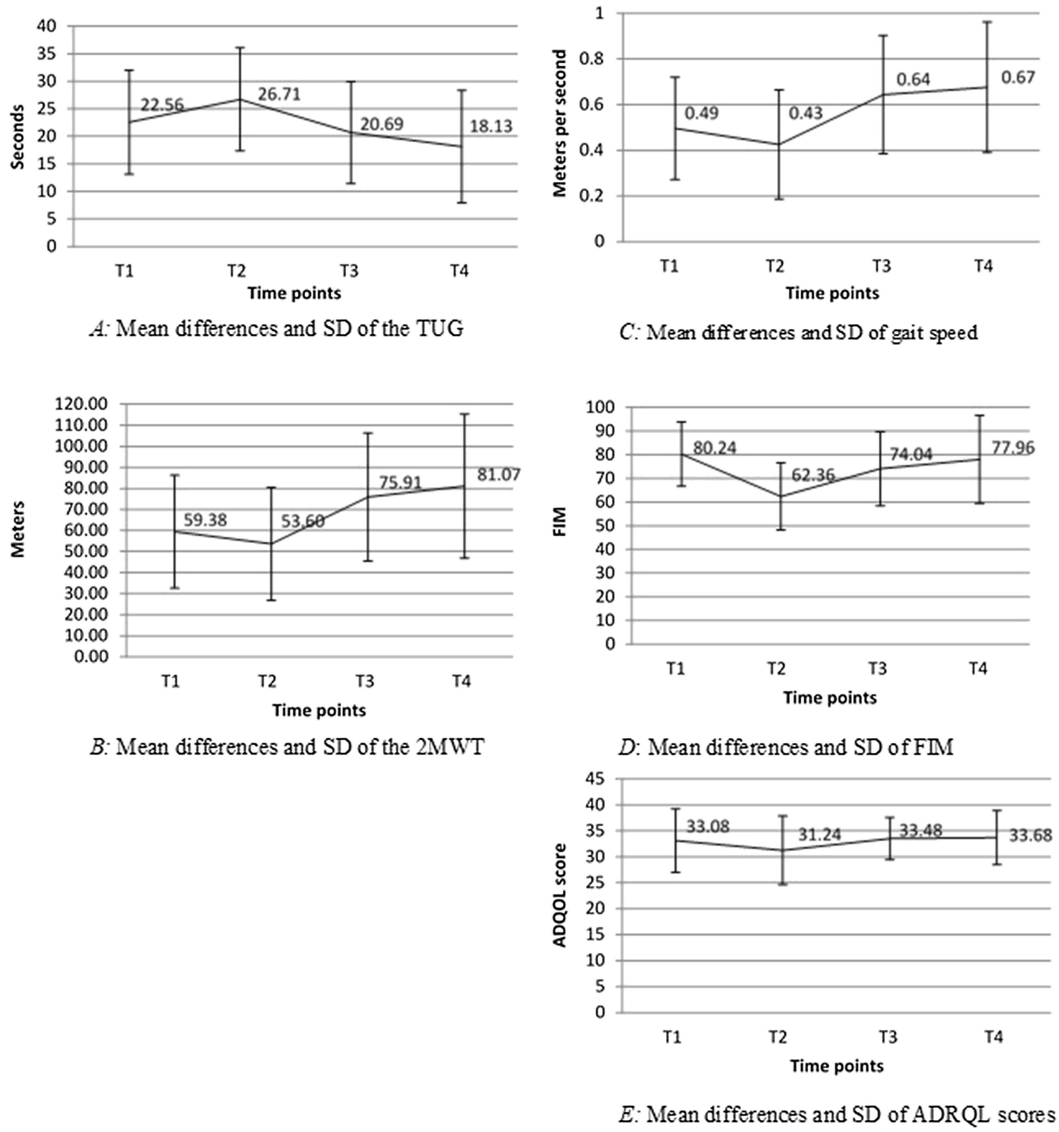

Figure 2. Graphs of resident outcomes measured at baseline, end of control phase, mid-intervention, and end of the intervention. (A) Mean differences and *SD* of the Timed Up-and-Go Test. (B) Mean differences and *SD* of the 2-Minute Walk Test. (C) Mean differences and *SD* of the gait speed test. (D) Mean differences and *SD* of the Functional Independence Measure scores. (E) Mean differences and *SD* of the Alzheimer's Disease-Related Quality of Life Scale.

(de Souto Barreto et al., 2016); however, residents are a highly heterogeneous group with complex clinical and psychosocial needs, and staff may be inadequately prepared to provide this level of care (Baert, Gorus, Guldemont, De Coster, & Bautmans, 2015; Morley, Rolland, Tolson, & Vellas, 2011). Within this context, there are clear opportunities to improve the status quo of restorative care and rehabilitation in LTC homes in order to prevent functional decline and excess disability (Resnick et al., 2009). Attention to newly admitted residents is of particular concern, and PA should be encouraged early after admission into the LTC home.

Physical activity and structured exercises are important components in multiple types of rehabilitation (e.g.,

Table 3 Activities of daily living and quality of life measurement outcomes during the four time points of the study ($N = 25$)

Outcome	FIM T1	FIM T2	FIM T3	FIM T4	ADRQL T1	ADRQL T2	ADRQL T3	ADRQL T4
Mean (*SD*)	80.24 (13.53)	62.36 (14.21)	74.04 (15.58)	77.96 (18.58)	33.08 (6.11)	31.24 (6.60)	33.48 (4.07)	33.68 (5.22)
90% CI	75.61, 84.87	57.49, 67.22	68.70, 79.37	71.50, 84.41	30.99, 35.17	28.98, 33.50	32.08, 34.87	31.89, 35.47
Range (min–max)	44–110	37–90	40–110	45–108	16–40	14–39	26–40	22–40

Note. FIM = Functional Independence Measure; ADRQL = Alzheimer's Disease-Related Quality of Life; CI = confidence interval.

hip rehab, cardiac rehab), yet low treatment adherence to recommendations for older adults can negatively impact outcomes (Verheijden Klompstra, Jaarsma, & Strömberg, 2014). This study provides preliminary evidence that PCC could be used to increase adherence and motivate the participation of older adults with dementia in PA. Long-term care residents with dementia who do not engage in PA exhibited worsened cognitive function, physical function, and more responsive behaviors compared to their counterparts who exercised (Cancela, Ayán, Varela, & Seijo, 2015). Nurses in LTC have the clinical excellence and expertise to lead a person-centered approach in all aspects of care (McGilton et al., 2012), including rehabilitation. Given the increasing medical complexity of LTC residents and LTC homes leaning toward more person-centered deinstitutionalized models of care (McCormack, Roberts, Meyer, Morgan, & Boscart, 2012), more sophisticated care is now required. The use of PCC and individualization may increase adherence in research studies to improve the short- and long-term mobility and functional outcomes of this complex population (van der Wardt et al., 2017). The MWI uniquely operationalizes and provides a reproducible mechanism for the delivery of PCC with PA and effectively partnering with collaterals and staff to gain resident-specific knowledge to mitigate responsive behaviors and evaluate functional mobility outcomes using clinically validated assessments.

The incorporation of PCC into PA was perceived by the collaterals and staff to be highly acceptable and made PA meaningful, enjoyable, and relevant for residents. Meaningful activities need to provide either physical or cognitive stimulation and improve the resident's sense of well-being (Morley, Philpot, Gill, & Berg-Weger, 2014). For individuals with dementia, meaningful activities tend to be activities that are physical (Messinger-Rapport, Sanford, Morley, & Gammack, 2015). Given the present rarity of meaningful activities in LTC (Morley et al., 2014), the MWI could provide meaningful PA to those with dementia and may be an appropriate starting point for nursing practice to support residents in engaging in more PA to prevent decline, restore function, and improve mobility (de Souto Barreto et al., 2016).

Important findings will inform a future trial of the MWI. This pilot required a generous time commitment from the PI to accommodate the preferences of residents and to abide by the intervention protocol, whereby residents could be approached several times throughout the day. Scaling the intervention across multiple sites would involve assessing the available resources of each study site to determine the most appropriate and plausible skill complement. One potential adaption is for a nurse to oversee the program, conduct the clinical assessments, develop the communication plans and PA regimes with physiotherapist consultation, while trained volunteers assisted in delivering the PA regimes. Volunteer-led exercise interventions (Chen, Li, Chang, Huang, & Cheng, 2015) and interventions with family members as interventionists in LTC have demonstrated high adherence rates (Venturelli et al., 2011); however, this would only be feasible in homes with robust volunteer programs or family involvement. Another more equitable opportunity to use technology in the form of electronic assessments and PA regimes records in order to increase the scalability and effective implementation of the MWI in LTC homes. Future work should investigate intervention sustainability with a cost–benefit analysis and longitudinal follow-up after the intervention. An additional area for future research is to further address PCC by the integration of culture and languages other than English to include residents who speak other languages. The increasing diversity and acuity of residents who are admitted into LTC necessitates different PA interventions and strategies to meet their disparate needs, especially for those who are often excluded from research.

We acknowledge several limitations. First, the sample size and lack of a true control group may be considered limitations; however, the sample size and study design were appropriate for a feasibility study intended to establish proof of principle and provide preliminary evidence of the MWI on functional mobility measures. Instead, we used a control condition where usual care was provided rather than a control group in order to ensure equivalence in comparison groups and to strengthen what can be extrapolated from the findings (Cook & Campbell, 1979). Another limitation was that the inclusion criteria restricted our findings to residents with the ability to rise from chair and walk for 2 minutes with or without a gait aid. Also requiring a diagnosis of dementia may have excluded many undiagnosed residents with behavioral and cognitive signs of dementia. As one interventionist provided the MWI, it is possible the participants experience positive effects due to their relationship with the interventionist. Next, although the study was conducted in two LTC homes, the results may not be generalizable to other homes. More hypothesis testing with a larger sample powered to find differences in ADL function and QOL in a definitive trial is required to further validate the results from this study. Despite these limitations, this study had several methodological strengths. First, a sample size calculation was used to ensure that the results would address efficacy of the intervention on the primary functional mobility outcome. Second, the design was based on a theoretical foundation, the ICF (WHO, 2001), that identified the

Key Practice Points

- Providing physical activity to residents who have dementia can pose unique rehabilitation challenges due to their decline in executive function, which makes the initiation of movement and communication difficult.
- Person-centered care is a dementia care best practice and was operationalized in the multifaceted walking intervention as engaging collaterals and long-term care home staff, effective communication, and individualization of care to reflect the abilities, values, and goals of the resident.
- An individualized care plan that outlined resident's biographical history, effective communication strategies, topics of interest, behavioral responses, and prompts to encourage mobility was used in tandem with a physical activity regime over a 4-month walking intervention
- Applying a person-centered care approach when providing physical activity to individuals with dementia was feasible and acceptable to stakeholders. It may also increase adherence to rehabilitation treatment to improve functional mobility.

relationships between outcome measurements, which were standardized and validated clinical measures. Finally, there was minimal attrition, and all follow-up assessments were completed with no missing data.

Conclusion

The results of this study indicate that the MWI is feasible and acceptable to multiple stakeholder groups related to LTC home residents with dementia. The efficacy results are promising and suggest that a person-centered approach to deliver PA that is individually tailored to each resident can maintain the functional mobility, ADL function, and QOL of this vulnerable population. More research to determine the effectiveness of the MWI in a larger clinical trial is required to further test this hypothesis.

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Conflict of Interest

The authors have reported no conflicts of interest.

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