Moving Beyond the Pandemic: Understanding the benefits of virtual versus in-person delivery of Minds in Motion®, a physical activity and brain stimulation program for people with dementia and their caregivers in Saskatchewan

Executive Summary Report

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Introduction

For people living with dementia (PLWD), there is an increased risk and rate of falling compared to the general older adult population (Tolea et al., 2016). This is a significant concern as most falls result in hospitalization and may result in serious injuries such as brain injury, fractures, or even death (Dubljanin-Raspopović et al., 2013). As such, determining and understanding the best ways to prevent falling among PLWD is crucial. The urgency of such research is compounded by the fact that the number of individuals affected with dementia is growing in

Canada. In the years between 2018-2020, unspecified dementia has been the leading cause of deaths in Saskatchewan (eHealth Saskatchewan, 2023).

The percentage of adults over the age of 65 years is expected to go from 16% of the Canadian population in 2014 to 23% in as little as 16 years-time (Wong, 2020). Age is the largest risk factor for dementia with risk jumping from < 1% at age 65 years to > 28% by 90 years (Van der Flier & Scheltens, 2005). Furthermore, the proportion of individuals with dementia increases by 100% as often as every two decades, escalating the urgency of finding solutions to improve quality of life for PLWD and their families (Ferri et al., 2005). Dementia's financial "cost" is another factor worth considering as Saskatchewan is less than two decades away from facing annual healthcare costs upward of six billion dollars (Alzheimer Society, n.d.a).

There is promising evidence that exercise programs can help to improve symptoms of dementia and improve walking, balance, and functional ability, all of which are risk factors for falls (Hauer et al., 2006; Suttanon et al., 2010). The Minds in Motion® (MiM®) program is a cognitive stimulation and physical activity program designed for people living with dementia and their caregivers, which is offered by the Alzheimer Society of Saskatchewan (ASOS) (Alzheimer Society, n.d.b).

The first objective of this study was to measure the impact of participation in the MiM® program on balance and mobility for people with dementia as determined by changes in pre- and post-testing values of walking ability, balance, functional ability, and fall risk. The second

objective was to understand the experiences of participants and their caregivers for both in-person and virtual offerings of the program through interviews.

We hypothesized that after participation in the MiM® program, there would be improvements or at least maintenance in walking balance, overall balance ability, functional ability, and fall risk as measured by changes in pre- to post-testing measures.

Methods

This study received ethics approval (BEH3234) from the University of Saskatchewan Research Ethics Board.

Study participants were recruited through the ASOS by word of mouth, and online messaging to individuals who had registered for the MiM® program in 2021-2022. Participants had one pre- and one post-testing session that took place before and after participating in the 10-week MiM® program. These testing sessions, conducted by 2-3 trained researchers, were approximately two hours in length at a community site such as the recreation centre location of the program or a clinical setting.

To answer objective 1 (quantitative data), the following variables were measured: **walking ability and balance while walking**, **overall balance**, **functional ability**, and **fall risk**.

Walking Ability and Balance while Walking: Mobility Lab® (version 02, APDM., Inc Portland, Oregon, USA), a reliable and valid tool to measure walking parameters was used (Morris et al., 2019; Washabaug et al., 2017). Mobility Lab® consists of seven sensors attached with Velcro straps on the head, chest, waist, both wrists, and both feet (see Figure 1).

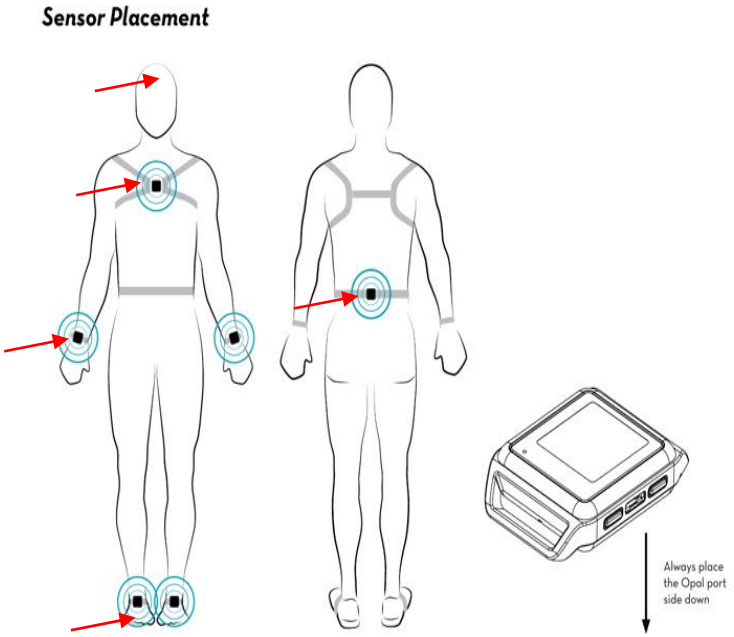


Figure 1: Adapted from https://fccid.io/png.php?id=3025638&page=8

Tasks included walking a distance of ten meters, either turning right or left (3-4 trials of each) to go around a pylon, and then returning to the start line. The variables measured with Mobility Lab®, all markers of dynamic balance, included cadence (steps/min), walking speed (m/s), the percentage of a walking cycle spent on both feet (% Gait Cycle Time), and stride length (m). Timed Up and Go (TUG) dual cost was also used, which is measured as the difference in time for the standard versus the dual task (counting backwards by 3s or calling out animal names if unable to do the cognitive counting task) TUG.

Overall Balance: The mini-Balance and Evaluations Systems Test (mini-BESTest) was used to examine balance control (Horak et al., 2009). Functional balance tasks within the mini-BESTest include sit to stand number and score; rise to toes score; stand on one leg score and time trial (s); compensatory stepping correction - forward, backward, and lateral scores; stance (feet together) - eyes open firm surface score and time trial (s); stance (feet together) - eyes closed, foam surface score and time trial (s); incline - eyes closed score and time trial (s); change in gait speed score; walk with head turns – horizontal score; walk with pivot turns score; step over obstacles score; total score on the mini-BESTest; and TUG standard and TUG with dual task scores and time trials (s). Both the mini-BESTest and TUG have been shown to be highly reliable measures of functional balance and fall risk (Blankevoort et al., 2013; Godi et al., 2013; Ries et al., 2009).

Functional Ability: Tests conducted for functional ability included total mean grip strength of right and left hands (kg), total arm curls, total sit to stands, and sit and reach (in) (Rikli & Jones, 1999).

Fall Risk: This was measured separately using the score assigned by the mini-Falls Risk screening test for Older People (mini-FROP) (National Ageing Research Institute, n.d.).

Descriptive statistics were generated for pre- and post-testing including means, standard deviations, and the consideration of any outliers. Last observation carried forward was used to replace missing post-test values for any participants who did not complete the study. Repeated measures multi-variate or univariate analysis was used for each of the above-mentioned variable categories to determine any statistically significant changes from pre- to post-testing.

To answer objective 2 (qualitative data), one or two researchers used a semi-structured questionnaire to interview either the participant, their caregiver, or both to determine their experience of the program, what they liked and felt could be improved, and recommendations for future programming. These interviews were done remotely via Zoom (zoom.us). Interviewees were given the option to stop the interview at any time and answer to a depth they felt comfortable with. The interviews were recorded and transcribed by a professional third-party transcription organization (University of Saskatchewan Canadian Hub for Applied and Social Research). The transcripts were reviewed independently by two researchers and then consensus was reached on the primary and secondary themes generated from all the interviews.

Results

Objective 1: Quantitative Results

There were ten participants who took part in the physical testing. One participant dropped out due to a medical condition that required hospitalization and did not complete post-testing. Six of the participants identified as female, four male; seven participants resided in Saskatoon, while three were from Regina; seven attended the program in-person, while three attended it virtually; and four had a previous fall within the past year. Of the four participants who had a previous fall within the past year, two of them fell three times and two of them fell once. The participants' ages ranged from 52-86 years old, with a mean age of 73.6 years.

Tables 1 to 4 demonstrate that there were no significant differences noted between pre- and post-testing for each of the variable categories as described above For Walking Ability and Balance while Walking, the multivariate repeated measures analysis was F=62.165; df 4, 1; p value= .095. For Overall Balance, the multivariate repeated measures analysis found F=1.764; df 6, 3; p value= .343. In terms of Functional Ability, the multivariate repeated measures analysis found F=.291; df 4, 4; p value= .870. For Fall Risk, the univariate repeated measures analysis was F=1.875; df 2, 5; p value= .247.

Table 1: Descriptive Statistics for Walking Ability and Balance while Walking (n=6).

	Pre Mean (SD)	Post Mean (SD)
Cadence (steps/min)	101.41 (6.64)	107.90 (8.64)
Walking Speed (m/s)	0.92 (0.25)	0.95 (0.26)
Double Support (% Gait Cycle Time)	26.27 (4.90)	25.87 (5.61)
Stride Length (m)	1.07 (0.24)	1.04 (0.23)
TUG Single Time (s)	13.85 (4.67) *	12.40 (3.57) *
TUG Dual Time (s)	15.28 (3.34)	16.76 (5.29) **

(n=8)*
(n=7)**

Table 2: Descriptive Statistics for Overall Balance (n=9).

	Pre Mean (SD)	Post Mean (SD)
Mini-BESTest Best Stand on One Leg Left (s)	6.56 (7.80)	6.98 (6.30)
Mini-BESTest Best Stand on One Leg Right (s)	5.47 (6.94)	6.36 (7.70)
Mini-BESTest Stance (Feet Together); Eyes Open, Firm Surface (s)	30.00 (0.00)	30.12 (0.25)
Mini-BESTest Stance (Feet Together); Eyes Closed, Foam Surface (s)	16.51 (14.54)	8.50 (10.28)
Mini-BESTest Incline - Eyes Closed (s)	22.91 (12.66)	23.56 (12.90)

Mini-BESTest Total Score	16.11 (5.28)	16.44 (4.16)

Table 3: Descriptive Statistics for Functional Ability (n=9).

	Pre Mean (SD)	Post Mean (SD)
Total Mean Grip Strength R and L (kg)	22.48 (13.07)	22.36 (13.12)
Total Arm Curls	14.25 (4.62) *	14.67 (6.27)
Total Sit to Stands	7.22 (3.42)	6.89 (3.37)
Sit and Reach (in)	5.85 (6.56)	6.61 (3.00)

(n=8)*

Table 4: Descriptive Statistics for Fall Risk (n=9).

	Pre Mean (SD)	Post Mean (SD)
Total mini-FROP	3.00 (3.08)	2.33 (2.50)

Figures 2 to 10 on the next few pages portray the individual changes and group mean changes from pre- to post-testing for each of the walking ability measures as determined by Mobility Lab®, overall balance and mobility measures of the mini-BESTest, as well as the TUG dual task cost. The data available for the tests ranged from 6-8 participants due to inability to process and/or limited data.

Figure 2: Individual and group mean pre- and post-mean sway velocity (m/s).

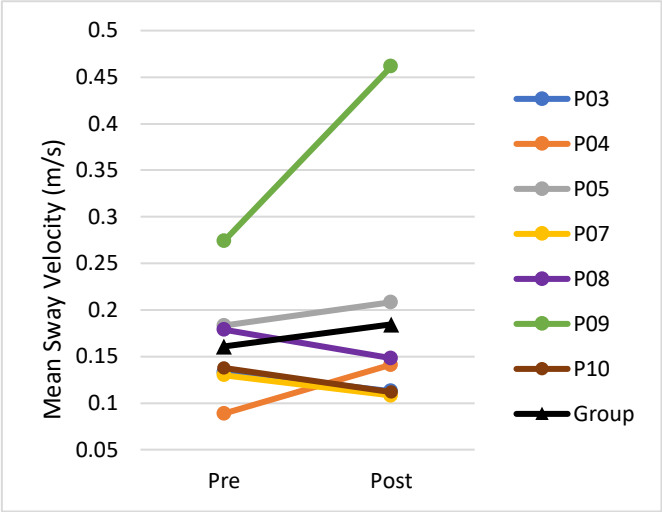


Figure 3: Individual and group mean pre- and post-cadence (steps/min).

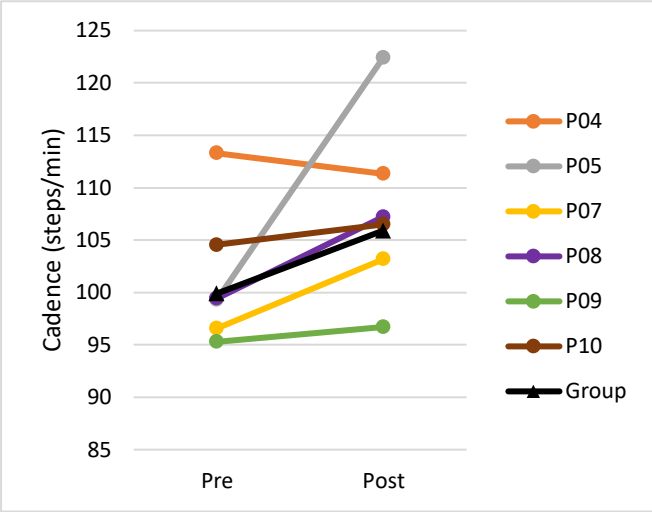


Figure 4: Individual and group mean pre- and post-gait speed (m/s).

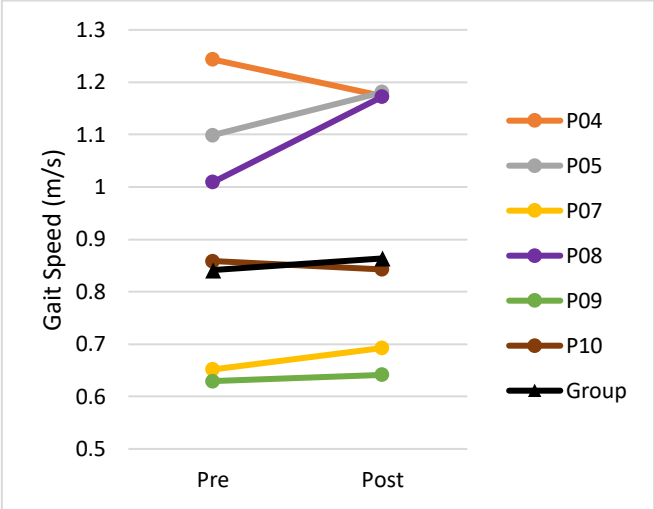


Figure 5: Individual and group mean pre- and post-double support (% gait cycle time).

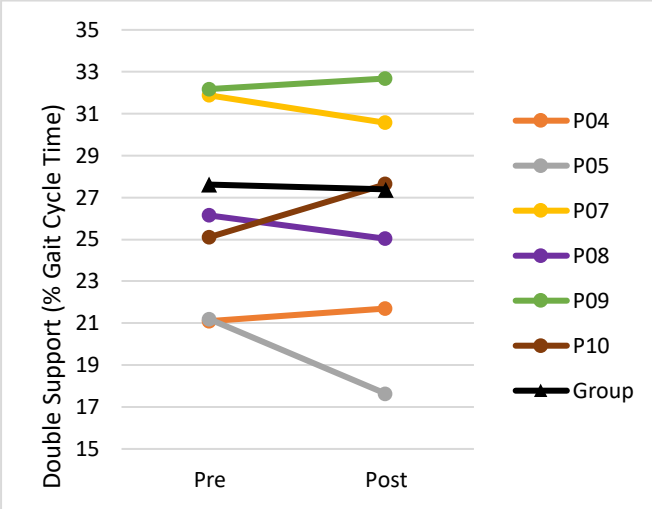


Figure 6: Individual and group mean pre- and post-stride length (m).

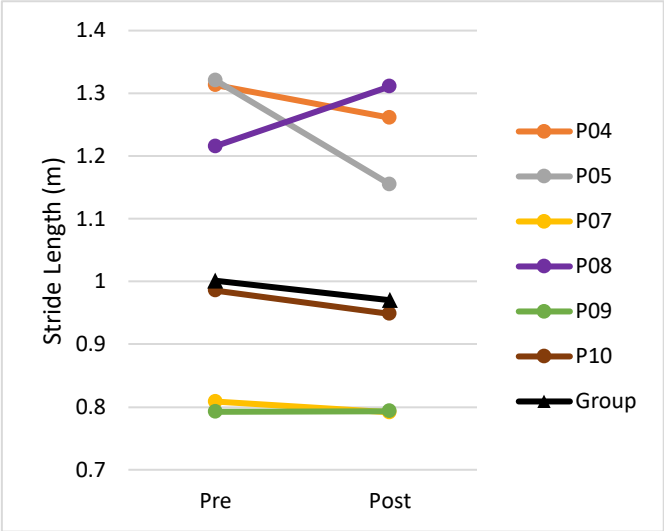


Figure 7: Individual and group mean pre- and post-mini-BESTest score.

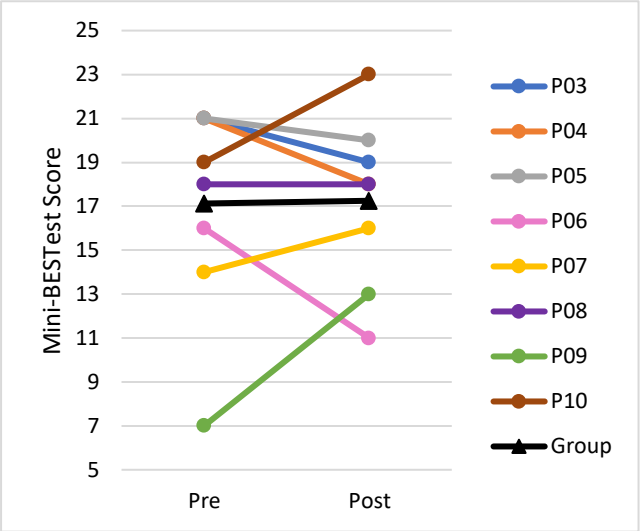


Figure 8: Individual and group mean pre- and post-dual task cost (s).

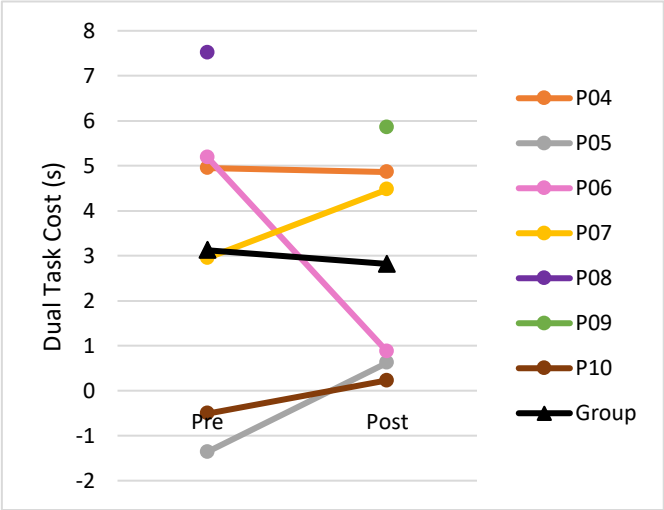


Figure 9: Individual and group mean pre- and post-TUG single time (s).

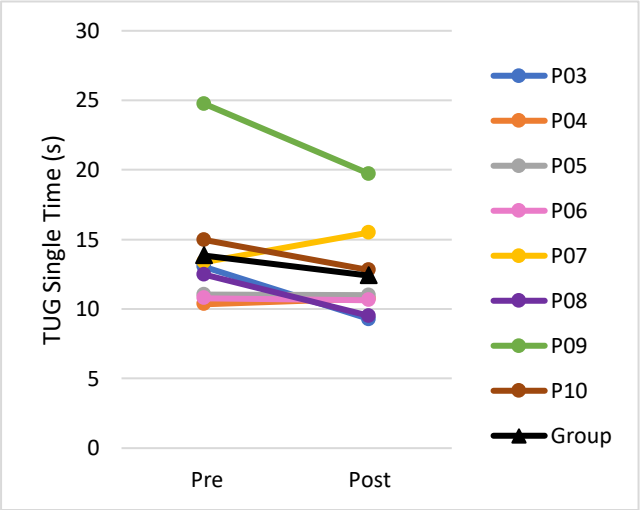
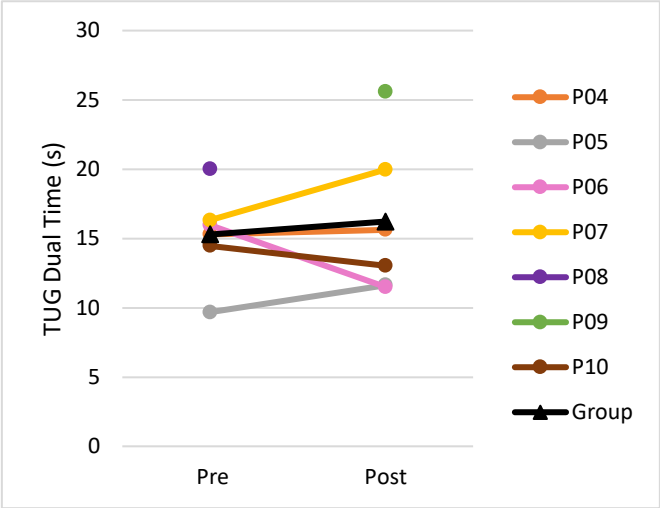


Figure 10: Individual and group mean pre- and post-TUG dual time (s).



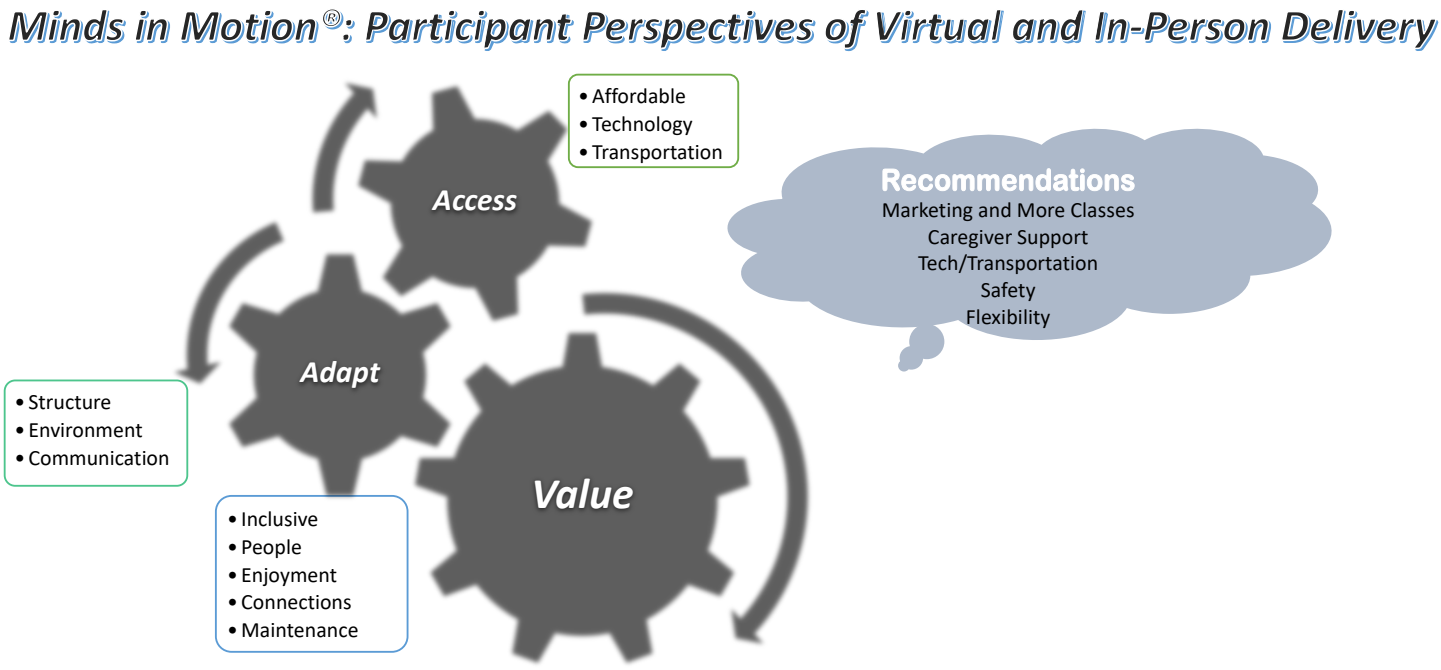
Objective 2: Qualitative Results

Seven interviews were conducted in total. There were six participants and six caregivers that took part in the qualitative portion of the study (four interviews included both the caregiver and participant, two included the caregiver only, and one included two participants together without the caregivers). Five of the interviews were about program experiences for a PLWD who identified as female and three were about experiences from a PLWD who identified as male; five were from Saskatoon and three from Regina; and five attended the MiM® program in-person and three attended it virtually. The ages of the PLWD who were the focus of the interviews ranged from 52-86 years old, with a mean age of 74.3 at the time of the study.

Figure 11 portrays the 3 main themes that were generated: **Access, Adapt, and Value** with the secondary themes describing each of the main themes. **Recommendations** was a separate

theme with five sub-themes. Each of the main themes and sub-themes are described below with selected quotes to support the themes.

Figure 11: Emerging themes from the 7 interviews with participants and/or their caregivers.



Access: This theme was generated to describe both the benefits and challenges participants experienced in the accessibility of the program, which included both virtual and in-person formats. Participants felt both programs were accessible as described across three main sub-themes, including affordability or cost, technology, and transportation both to and within the facility. There were some challenges noted in these sub-themes, primarily for technology and transportation. This brought forward some of the pros and cons of virtual versus in-person formats, as technology support was identified as a recommendation for future virtual classes as well as transportation for in-person classes.

- **Access, affordable:**

- *"I think the cost of the program is very reasonable"* (P06).

- **Access, technology:**
  - *"Some of the people have had some technology challenges for sure. We've been very fortunate that we're familiar with Zoom and it's worked well for us, we've always had a good connection and our technology has always worked. That has been frustrating for some other people. So, making sure your technology is solid"* (P03).
- **Access, transportation:**
  - *"The only difficulty that we had was transportation. So, if that could be included in the program, or subsidized or offered as one bus would pick up people from different places, that would make it more beneficial for elderly people who have difficulty with transportation"* (P06).

Adapt: This 2nd main theme identified both positives and challenges related to the program adapting to varying levels of dementia, adapting to needs for virtual and in-person formats, and adapting to varying physical activity and cognitive functioning levels. Participants reported the importance of being adaptable as it creates a positive atmosphere that facilitates confidence and motivation to participate. There were three main themes that adaptability fell under: structure, environment, and communication with both benefits and challenges reported for each.

- **Adapt, structure:**
  - *"… everybody can work at their own level; they're encouraged to work at their own level. You can work a little harder if you want to … As long as it kind of adjusts to changing needs here so that we can fit in at whatever level, or participate at whatever level we need to, then we can keep going"* (P08).
- **Adapt, environment:**
  - *"It was always more crowded when we were doing it in our own home and not as convenient. You have to clear a space and use what space you have. In the gym*

it's definitely better. There's more room and the instructors can see everyone better than they can online" (P08).

- **Adapt, communication:**
    - *"Sometimes there's three or four instructions. And that gets to be a little much. And [they] won't ask the instructor and [they'll] just kinda look around and try and follow what others are doing"* (P07).

Value: This third main theme recognized the value of the program that participants and caregivers experienced. There were many positive comments of enjoyment, the welcoming element of feeling valued and included, the connections made, and the diversity of programming to include physical activity, fun, cognitive stimulation, and socialization. These aspects are explored further in the sub-themes below.

- **Value, inclusive:**
    - *"As long as it kind of adjusts to changing needs here so that we can fit in at whatever level, or participate at whatever level we need to, then we can keep going. So far that hasn't been a problem. Exercises you can do at your own level, and the games and stuff we do in pairs, so that accommodates if one needs help or the other needs help. That has worked so far"* (P08).
- **Value, people:**
    - *"I think they're run well. The volunteers are awesome and the instructors. As long as we continue to have instructors that understand that you have to go slower and it takes longer to comprehend"* (P01).
- **Value, enjoyment:**
    - *"It was something that [they] looked forward to and actually, I don't think [they've] ever really forgotten a class. There's lots of things that [they're] forgetting nowadays but Minds in Motion on Tuesday at 1:30 was really stuck in [their] head. That's gotta say something for [their] enjoyment level and to say*

that anything that gets [them] out of the house and involved and [they] like, makes me feel good too" (P07).

- **Value, connections:**
    - *"I think as people talk, you've got a person with dementia and their caregiver, basically. So, it's a good balance for everybody to see other people in the same situation"* (P01).
- **Value, maintenance:**
    - *"… it maintained the baseline [they were] at and that's kind of my goal is to maintain [their] baseline"* (P09).

Recommendations: Participants in the interviews were asked if they could provide recommendations for the MiM® program. These recommendations, some of which emerged from the three main themes were categorized accordingly.

- **Recommendations, marketing and more classes:**
    - *"Maybe expanding your advertising base? I'm just trying to think if I've ever seen any posters for Minds in Motion in doctors' offices and maybe physiotherapists. That might be a good place - to have some information just at the gym"* (P07).
    - *"I think there are a number of people there who perhaps, that's their only exercise in the week. It probably is very important that way. For us it's been one of about three sessions a week, so it contributes. It's not the only thing we do, but for some it is. It can be very important"* (P08).
- **Recommendations, caregiver support:**
    - *"… you need the support of somebody to make sure you're getting to and from the class and doing what you're supposed to there"* (P06).
- **Recommendations, tech/transportation:**
    - Covered above in the main theme "Access" and the subthemes "transportation" and "technology".
- **Recommendations, safety:**

- *"[They] had trouble with the stairs getting to the elevator; there's four stairs there. For people who view the world differently, the stairs really aren't well-marked as steps. [They] did a few times, stumble, 'cause [they] didn't recognize it as a step. I just held on tight to [them] and had [them] hold the rail and I would mention every time there was a step. [They] did good but there are a few times [they] kind of stumbled. There's the wheelchair ramp but that's twice as long. Another thing was … the length of walk from the parking lot to the entrance is quite significant for someone who doesn't have much stamina or energy. Even the handicap parking, it's really poorly designed"* (P09).

- **Recommendations, flexibility:**
  - *"I did feel that it was more centered for people with beginning stages of the dementia whereas [they are] more mid-stage. [They] enjoyed the exercise part, but [they] really didn't get anything out of the second part: the games and activities. It was too much for [them] to take in and follow"* (P09).
  - *"Even another thing they could maybe do is, at that halfway point, as people want to leave, let them leave. I know we could've, but you would've felt awkward 'cause it really wasn't set up for someone to leave halfway through. You weren't made to feel anything, but you felt obligated to stay and see it through"* (P09).

Discussion

The overall objectives of this study were to explore physical and functional changes after participating in a program designed for people living with dementia and their caregivers, and to better understand their experiences of the program, both virtual and in-person deliveries. We found that although there were no significant differences noticed in the group between pre- and post-MiM® program testing sessions, we did observe some trends, such as positive but small improvements in group mean values for walking balance, overall balance, and mobility.

The results suggest that at least maintenance of balance and mobility occurred. Given that there is no control comparison group, we cannot determine if this maintenance is due to the program itself or other factors. One must be cautious interpreting these trends as changes observed were not statistically significant, which was not surprising with a small sample size. The targeted participant number was not reached due to the COVID-19 outbreak and challenges with recruitment post-COVID-19, leading to a smaller than anticipated sample size. Nor were the observed changes of clinical relevance as interpreted by known meaningfully detectable changes supported in the literature. A meaningfully detectable change for the mini-BESTest score could only be concluded if there was an increase or decrease in this score by 3.5 or 3.8 units (Godi et al., 2013; Marques et al., 2016). The meaningfully detectable changes reported by some studies were 2.42 or 4.09 s for the TUG single time (Ries et al., 2009; Suttanon et al., 2011). As for the TUG dual time, the meaningfully detectable change was identified as 4.69 s (Suttanon et al., 2011).

To our knowledge, this is the first study to measure a number of outcomes for walking ability and balance before and after the MiM® program. This study is helpful and encouraging to guide future research to further determine the impact of the program on walking and balance in relation to fall risk with larger sample sizes and a control group. Given that the recommendation for physical activity and balance practice for fall prevention is no less than three hours in length across a given week, the approximately one hour spent exercising during the two-hour once per week program may not be adequate to see changes (Sherrington et al.,

2017). MiM® programming should consider increasing frequency or effectively encouraging participants to continue practicing at home or in other programming during the week.

The qualitative findings of the study obtained from people directly involved in the MiM® program (participants and/or their caregivers), regardless of whether they attended virtually or in-person, were overwhelmingly positive speaking to the important role that the program played in their lives. Both virtual and in-person programming had merit in meeting the needs of participants and caregivers in different ways. The virtual delivery was positive in assisting caregivers to not have to transport and travel, while also allowing for greater reach to more rural communities. The in-person delivery was noted as more positive for socialization, viewing the instructor, and volunteer support to assist.

Noteworthy recommendations that emerged from the interviews with participants and/or their caregivers, included expanding the program and marketing it to a broader audience; supporting caregivers with availability of volunteer support when a caregiver is unable to attend; addressing technology and transportation challenges; increasing safety considerations particularly at the site for navigating outside hazards, such as winter ice and snow, indoor stairs, and signage; and ensuring program flexibility.

In summary, this small sample study showed encouraging results to support continued development of MiM® programming to help improve functional ability and decrease fall risk for people living with dementia. Based on the results of this study, the authors would recommend

consultation with professionals, such as a physiotherapist to ensure exercises stimulate balance control reflexes and are individually tailored to the range of a person's functional ability, which may help to improve programming to address fall risk. Education to continue exercising at home and to identify and mitigate other fall risk factors, we believe, would also be a valuable addition to programming. The findings of this study should be helpful to guide future research and programming intended to reduce falling in individuals affected with dementia and support their caregivers.

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