# Virtual Mindful Chair Yoga (MCY) Intervention for Older Adults with Dementia and Caregivers: Pilot Randomized Controlled Trial

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"Shoot for the moon. Even if you miss, you'll land among the stars."

- Norman Vincent Peale

#### Abstract (EN)

**Background:** Older adults with dementia or mild cognitive impairments (MCI) have a variety confounding of mental health conditions such as stress, loneliness, depression, and anxiety. Caregivers who care for these individuals are also at risk for these same mental health conditions as well as caregiver burden. Virtual interventions that target these mental health conditions for dyads of older adults and caregivers are infrequent and evidence investigating the feasibility and efficacy is lacking.

For this thesis, a virtual mindful chair yoga (MCY) program for dyads of older adults and caregivers was designed and assessed. The following aims have been proposed: 1) Explore feasibility of a virtual, internet-based intervention for older adults and caregiver dyads, and 2) Explore efficacy of this randomized controlled trial (RCT) on mental health outcomes such as stress, loneliness, depression, anxiety, caregiver burden, and fear of covid-19 compared to a waitlist control group. It should be noted that the development and delivery of this RCT was throughout wave 2 and 3 of COVID-19 in Quebec.

Methods: In this RCT of virtual MCY, caregivers and older adults (≥ 60 years old) with dementia or MCI were recruited in Montreal, Canada. Participants were randomly assigned to either the intervention group or the waitlist control group (received the intervention after study completion) in their respective dyads. The MCY program involved 60-minute zoom sessions, once weekly, for a total of 8-weeks. Participants were assessed at baseline and 8-weeks on study outcomes. The primary outcome was stress measure by the Perceived Stress Scale, the secondary outcome was loneliness measure by the UCLA Loneliness 3-item Scale, and exploratory outcomes were depression measure by Patient Health Questionnaire-9, anxiety measured by the

Generalized Anxiety Disorder Scale, caregiver burden (caregivers only) measure by the Zarit Burden Interview, and fear of COVID-19 measure by the Fear of COVID-19 Scale.

**Results:** The RCT was feasible as 92.8% of the participants in the control group and 75% of the intervention group completed both assessments at baseline and 8-weeks. There were minimal technological problems, any that arose were resolved within the first session. This is likely due to the involvement of the caregiver, suggesting this is a benefit of dyadic virtual programs. Participants reported enjoying the program and no adverse events were reported for the entirety of the study. Stress, loneliness, anxiety, and fear of COVID-19 did not change from baseline to 8-weeks and between groups. Depression and caregiver burden improved in the control group relative to the intervention group ( $np^2 = .35$ , p = .005; and  $np^2 = .54$ , p = .007, respectively). For caregiver burden, it is suspected that this is due to a large difference in baseline scores for the intervention and control group, where the control group had higher scores at baseline. Additionally, a few participants from the intervention group mentioned serious stressful life changes (unrelated to caregiving and dementia) throughout the study.

**Conclusion:** This is the first RCT of a virtually delivered MCY program that includes both caregivers and older adults with dementia/MCI. MCY was found to be feasible and enjoyable. The dyadic portion of the study likely contributed to the feasibility of this virtual program and can be an important factor to consider in future development of virtual MCY programs for this population.

#### Résumé (FR)

Contexte : Les personnes âgées atteintes de démence ou de troubles cognitifs légers (MCI) présentent divers troubles de santé mentale confondus, tels que le stress, la solitude, la dépression et l'anxiété. Les soignants qui s'occupent de ces personnes risquent également de souffrir de ces mêmes troubles mentaux ainsi que du fardeau des soignants. Les interventions virtuelles qui ciblent ces conditions de santé mentale pour les dyades de personnes âgées et d'aidants sont peu fréquentes et les preuves de leur faisabilité et de leur efficacité font défaut. Dans le cadre de cette thèse, un programme virtuel de mindful chair yoga (MCY) destiné à des dyades de personnes âgées et d'aidants a été conçu et évalué. Les objectifs suivants ont été proposés : 1) Explorer la faisabilité d'une intervention virtuelle sur Internet pour les dyades de personnes âgées et d'aidants, et 2) Explorer l'efficacité de cet essai contrôlé randomisé (ECR) sur les résultats de santé mentale tels que le stress, la solitude, la dépression, l'anxiété, le fardeau de l'aidant et la peur du covid-19 par rapport à un groupe témoin sur liste d'attente. Il est à noter que l'élaboration et la réalisation de cet ECR se sont déroulées tout au long des vagues 2 et 3 de COVID-19 au Québec.

Méthodes : Dans cet ECR de la MCY virtuelle, des aidants et des personnes âgées (≥ 60 ans) atteintes de démence ou de MCI ont été recrutés à Montréal, au Canada. Les participants ont été assignés au hasard au groupe d'intervention ou au groupe témoin sur liste d'attente (ils ont reçu l'intervention après la fin de l'étude) dans leurs dyades respectives. Le programme MCY comprenait des séances de zoom de 60 minutes, une fois par semaine, pendant un total de 8 semaines. Les participants ont été évalués au départ et après 8 semaines sur les résultats de l'étude. Le résultat primaire était la mesure du stress par l'échelle de stress perçu, le résultat secondaire était la mesure de la solitude par l'échelle de solitude à 3 items de l'UCLA, et les résultats exploratoires étaient la mesure de la dépression par le Patient Health Questionnaire-9, l'anxiété par l'échelle de trouble d'anxiété généralisée, le fardeau de l'aidant (aidants seulement) par l'entretien de fardeau de Zarit, et la peur du COVID-19 par l'échelle de peur du COVID-19. Résultats : L'ECR était réalisable puisque 92,8% des participants du groupe de contrôle et 75% du groupe d'intervention ont complété les deux évaluations au départ et à 8 semaines. Les problèmes technologiques ont été minimes, et ceux qui se sont présentés ont été résolus dès la première session. Cela est probablement dû à l'implication de l'aidant, ce qui suggère qu'il s'agit d'un avantage des programmes virtuels dyadiques. Les participants ont déclaré avoir apprécié le programme et aucun événement indésirable n'a été signalé pendant toute la durée de l'étude. Le stress, la solitude, l'anxiété et la peur du COVID-19 n'ont pas changé entre le début de l'étude et les 8 semaines, ni entre les groupes. La dépression et le fardeau de l'aidant se sont améliorés dans le groupe de contrôle par rapport au groupe d'intervention (np2 = .35, p = .005; et np2 =.54, p = .007, respectivement). Pour le fardeau de l'aidant, on soupçonne que cela est dû à une grande différence dans les scores de base pour le groupe d'intervention et le groupe de contrôle, où le groupe de contrôle avait des scores plus élevés au départ. En outre, quelques participants du groupe d'intervention ont mentionné de graves changements de vie stressants (sans rapport avec la prise en charge et la démence) tout au long de l'étude.

Conclusion : Il s'agit du premier ECR d'un programme de GCM dispensé virtuellement qui inclut à la fois les soignants et les personnes âgées atteintes de démence ou de MCI. La GCM s'est avérée faisable et agréable. La partie dyadique de l'étude a probablement contribué à la faisabilité de ce programme virtuel et peut être un facteur important à prendre en compte dans le développement futur de programmes de GCM virtuels pour cette population.

## **Author Contributions**

The manuscript titled "Virtual Mindful Chair Yoga (MCY) for Mental Health Symptoms and Caregiver Burden in Older Adults with Dementia and Caregivers during COVID-19: A Pilot Randomized Controlled Trial" was authored by Katie Bodenstein, Paola Lavin, Elena Dikaios, Cyrille Launay, Christina Rigas, Marim Ibrahim, Florence Coulombe, Johanna Gruber, Marouane Nassim, Clare McVeigh, Helen Noble, Bassam Khoury, Marie-Andree Bruneau, Soham Rej, and Harmehr Sekhon. Katie Bodenstein created the protocol, submitted and obtained ethics approval, led recruitment, contacted potential participants, consented participants, collected quantitative data through one-on-one meetings, conducted qualitative interviews, clean and analyzed all data, and wrote the manuscript. Dr. Paola Lavin supported throughout ethics submission, recruitment, and edited the main manuscript. Elena Dikaios contributed to the conception of the research protocol. Christina Rigas contributed in the recruitment and data collection process. Marim Ibrahim and Florence Coulombe facilitated the intervention group as a moderator to assist with the program and contact participants throughout the research study. Johanna Gruber assisted in the creation of the research protocol and ethics submission. Dr. Clare McVeigh, Dr. Helen Noble, and Dr. Bassam Khoury provided guidance and critical feedback as my thesis committee throughout the entirety of the research study and edited the main manuscript. Dr. Soham Rej and Harmehr Sekhon provided one-on-one support, guidance, feedback, and revisions throughout the development of the project and during the data collection, analysis, and writing process. Both last authors have extensively reviewed and edited the contents of this thesis and the main manuscript.

#### Abbreviations

MCI: Mild cognitive impairment; MCY: Mindful chair yoga; RCT: Randomized controlled trial; NPS: Neuropsychiatric symptoms; MBI: Mindfulness-based interventions; MBCT: Mindfulnessbased cognitive therapy; ADL: Activities of daily living; DSM-V: Diagnostic and statistical manual of mental disorder version 5; AD: Alzheimer's disease; BPSD: Behavioural and psychological symptoms of dementia; MMSE: Mini-mental state examination; MoCA: Montreal cognitive assessment; MINI-COG: Mini-cognitive test; PTSD: Posttraumatic stress disorder; HPA axis: Hypothalamic pituitary adrenal axis; ACTH: adrenocorticotropic hormone; USD: US dollars; CAD: Canadian dollars; REACH: Resources for enhancing Alzheimer's caregiver health; GDS: Global Deterioration scale; WHO: World health organization; PSS: Perceived stress scale; PHQ-9: Patient health questionnaire-9; GAD-7: Generalized anxiety disorder-7; ZBI: Zarit burden interview; FC-19S: Fear of COVID-19; MoCA-BLIND Montreal cognitive assessment-blind; SD: Standard deviation; ANOVA: Analysis of variance

## List of tables/figures

## Chapter 1

None

# Chapter 2

None

## Chapter 3

*Table 1.* Baseline clinical and demographic characteristics (mean, standard deviation, n, or percentage) of older adults with dementia/MCI and caregivers (n=30).

Table 2. Mean, standard deviation, p-value, confidence interval, and partial eta squared

for study outcomes in the intervention and control group at baseline and 8-weeks.

Figure 1. CONSORT diagram.

*Figure 2.* Change in depression measured by PHQ-9 scores from baseline to 8-weeks for the control and intervention group.

# Chapter 4

None

#### **Chapter 1: Introduction**

Older adults, especially those living with dementia and mild cognitive impairments (MCI), and their caregivers are at risk of increased stress, loneliness, depression, anxiety, and other negative health outcomes (1). After the onset of COVID-19, this risk tremendously increased and also restricted access to many necessary resources for both older adults and caregivers (2,3). The combination of limited resources and high stress, loneliness, and other mental health outcomes poses a threat to these individuals and warrants the need for new accessible virtual interventions.

The worldwide prevalence of dementia has been steadily increasing with estimates of 115.4 million individuals being impacted by dementia in 2050 (4). Approximately 80% of individuals living with dementia experience neuropsychiatric symptoms (NPS) such as stress, depression, anxiety, agitation, and apathy (1,5). Not only are these symptoms associated with negative health outcomes but they can lead to further decline in their disease and can cause caregiver burden (5). A recent literature review (5) concluded that the most common NPS during the COVID-19 pandemic were apathy, anxiety, and agitation that were mainly triggered by the increased isolation from the government mandated stay at home orders.

Treatments for NPS can be pharmacological and non-pharmacological. Pharmacological treatments of NPS include psychotropic drugs such as antipsychotics, benzodiazepines, antidepressants, or sedatives (6). These can be modestly effective but may be associated with harmful side effects and low drug adherence (6). Existing non-pharmacological interventions include behavioural interventions, learning interventions, light therapy, other forms of therapy, and mindfulness-based interventions (MBIs) (7). Currently, MBIs such as yoga, meditation, and mindfulness-based cognitive therapy (MBCT) have been increasingly used (8). However, there is

limited research on in-person MBI interventions with older adults and the majority of existing research is limited to quasi-experimental designs (8). To date, there are no virtual RCTs examining mindfulness-based interventions. Mindfulness based yoga/chair yoga is an example of these types of interventions. This is a very low-risk activity that has been beneficial to the general population for stress, anxiety, depression, quality of life, and social functioning (9,10). Older adults have shown positive preliminary results (8,11) and given the gentle and low risk nature of chair yoga, this can be a suitable non-pharmacological intervention for older adults with MCI and dementia.

Caregivers of older adults with dementia also struggle with psychological symptoms such as stress and caregiver burden (12,13). However, most interventions or treatments tend to focus on the care-recipient instead of the caregiver themselves. Caregivers can be treated with a similar approach such as, pharmacologically and non-pharmacologically with psychotropic drugs or MBIs.

The use of electronic devices has increased tremendously during the pandemic in hopes to connect individuals who have been isolated from their friends, families, and even healthcare professionals (3). From 2019 to 2020, there has been approximately an 8% increase in older adults owning smartphones and using daily internet (14). Telemedicine is the distribution of health services and information through virtual/electronic means (15). This can be a cost-effective approach and provide greater access to care, however, there has been little research on its efficacy for older adults, especially those with cognitive impairments such as dementia (16). A systematic review of telemedicine for older adults with dementia during COVID-19 concluded that telemedicine is a feasible approach to overcome barriers with traveling to and from medical appointments, such as limited mobility, traffic/distance, transportation, etc. (16).

#### Katie Bodenstein

This research project aimed to assess the feasibility and efficacy of a randomized controlled trial (RCT) of a virtual mindful chair yoga (MCY) program compared to a waitlist control group in older adults with dementia/MCI and caregivers. We hypothesized that the intervention would be feasible and safe with little to no adverse events. Additionally, we expected to see improvements in stress, loneliness, depression, anxiety, caregiver burden, and fear of COVID-19 across the 8-week MCY program compared to the waitlist control group.

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## **Chapter 2: Literature review**



Literature Review Roadmap

### 2.1 Dementia/Mild Cognitive Impairment

## 2.1.1 What is dementia?

Dementia is a cognitive impairment that mainly results in trouble recalling or forming new memories. It is caused by loss of or damage to nerve cells and their connections in the brain (1). Dementia can range in its severity from some individuals who are only mildly affected in activities of daily living (ADLs) to some who need to rely entirely on a caregiver to function throughout the day. Typically, dementia tends to occur later in life ( $\geq$ 65 years old) and increases in risk as the individual continues to age, with the average age of onset being 80 years old (2). However, early onset of dementia can occur in individuals younger than 65 years of age.

In lieu of the term dementia, the Diagnostic and Statistical Manual of Mental Disorder (DSM)-V uses the term major neurocognitive disorder instead, this thesis will use the term dementia. The DSM-V uses four criteria to diagnose major neurocognitive disorder (3):

- There must be evidence of significant cognitive decline in one or more cognitive domains;
- These cognitive deficits must interfere with daily activities, requiring assistance in complex ADLs;
- 3) These deficits do not occur exclusively in the context of delirium; and
- 4) These cognitive deficits are not explained by other mental disorders.

The DSM-V classifies severity of dementia as either mild (difficulties in instrumental activities), moderate (difficulties with basic ADLs), or severe (completely dependent) (3).

## 2.1.2 Types of dementia

There are several types of dementia which can be divided into different categories. For this thesis, all types of dementia were accepted and invited to participate in the research study, however the different types of dementia were not classified into categories. These categories will be described to allow for a better understanding of the background. Dementia can be categorized into cortical dementias and subcortical dementias (4). Cortical dementias are characterized by cognitive function involvement while basic neurologic functioning is preserved (4). In these cases, language may be affected but speech is generally not. Alzheimer's disease (AD), Lewy body disease, and frontotemporal disease (i.e., Pick's disease) fall under the category of cortical dementias (4). Subcortical dementias are characterized by attention and processing deficiencies while core cognitive processes are preserved (4). These dementias include multi-infarct (vascular) dementia, Parkinson disease, and other less common causes such as Huntington disease, Creutzfeldt-Jakob disease, and HIV dementia.

Alzheimer's disease is the most common type of dementia where the individual has a gradual onset and progression of cognitive dysfunction in one or more of several areas of mental functioning (e.g., learning and memory, language executive function, complex attention, perceptual motor skills, and social cognition) (5). Classic symptoms include amnesia of short-term memories (i.e., anterograde amnesia), disorientation, and visuospatial deficits (5). Roughly 90% of AD have an unknown cause while 10% are associated with known mutations in different proteins (e.g., amyloid precursor proteins) (6). Vascular dementia is the second most common type of dementia (7). It can occur suddenly or gradually over time and results from an interruption in the flow of blood and oxygen supply to the brain which can damage its blood vessels (8). Symptoms of vascular dementia include confusion, reduced attention, inability to form organized thoughts and actions, slowed thinking, memory impairment, and more (9). Lewy body dementia presents early on with vivid hallucinations, fluctuations in cognition, and often parkinsonian signs and postural instability (10). Individuals with this often have daytime drowsiness and disorganized speech (10). In frontotemporal dementia, personalities may significantly change where the individual becomes antisocial or disinhibited from social norms with poor impulse control (11). They may also develop apathy, and emotional blunting (11). In this form of dementia, the memory and intellectual functioning is generally well preserved (11). Multi-infarct (temporal) dementia is characterized by a stepwise decline due to having small strokes that lead to the dementia symptoms (12). These are transient ischemic events that cause focal deficits where symptoms will depend on the area affected and may be similar to the other dementias except for the stepwise progression (12).

#### 2.1.3 Clinical characteristics and screening tests

The clinical presentation of dementia is variable, and it generally correlates to the area of the brain that has been damaged. Symptoms of dementia can be broken down into two categories – Behavioural and psychological symptoms of dementia (BPSD) and cognitive symptoms.

**Behavioural and Psychological Symptoms.** These symptoms can also be referred to as neuropsychiatric symptoms (NPS) and they tend to be changes in personality/behaviour, agitation, paranoia, confusion, emotional blunting, hallucinations, delusions, depression, anxiety, etc. (1). NPS are present in approximately 90% of dementia patients (13). BPSD are associated with increased risk of hospitalizations and emergency room visits, premature institutionalization in nursing home facilities, and increased stress (14). These symptoms can be triggered by both environmental and social factors. For example, changes in routine, relocation, and meeting new individuals can all exacerbate BPSD (14). The most common and distressing type of BPSD are delusions, hallucinations, depression, anxiety, sleeplessness, and aggression. Approximately 60% of AD patients have delusions and these include beliefs that someone is stealing from them, accusing loved ones of being imposters, or beliefs that their home is not theirs (14). Additionally, BPSD are associated with substantial increases in indirect and direct financial costs (14). Approximately 30% (\$4115) of the total annual cost (\$14420) of AD is used for managing BPSD (15).

*Cognitive Symptoms.* Cognitive symptoms include memory impairment, impaired communication or aphasia, disorientation, impaired visual and spatial abilities, difficulties with coordination or motor functioning, etc. (1). These symptoms tend to vary

in their speed and degree of progression depending on the type and severity of dementia that exists.

*Screening Tests.* Screening tests are an important element for early detection of dementia. Missed diagnosis occurs 25-90% of the time and most commonly during the mild stage of cognitive impairments (16). Screening tests such as the Mini-Mental State Examination (MMSE), Mini-Cognitive test, Montreal Cognitive Assessment (MoCA) are efficient and effective tools to assess cognition of patients (16).

The MMSE is a neuropsychological test with 11 questions that are used to gauge the status of cognitive impairment (17). This test is used to assess 6 specific areas of mental cognition: orientation, attention/concentration, short-term memory, language skills, visuospatial ability, and ability to understand and follow instructions. It has a maximum score of 30 with a score of 25+ being classified as normal (17). Anywhere below 24 is classified as abnormal and indicates the presence of possible cognitive impairment (17). The Mini-Cognitive test (Mini-Cog) is a short (3-minutes) and easy test to screen for early signs of dementia (18). It consists of recalling 3 words and a clock drawing. Scores can range from 0-5 with scores from 0-2 meaning there is a higher likelihood of clinically important cognitive impairment and scores from 3-5 indicate lower likelihood (18). The MoCA test is a 30-question test that helps to detect early signs of cognitive impairment (19). This tests consists of domains relating to visuospatial and executive functioning, attention, language, abstraction, delayed recall (short term memory), concentration, working memory, and orientation (19). Scores  $\geq 26$  are considered normal cognition, 18-25 is mild cognitive impairment, 10-17 is moderate cognitive impairment, and <10 is severe cognitive impairment (20).

### 2.1.4 Dementia and stress

Stress has been a topic of research for decades with immense literature on the negative effects of stress on the body. The relationship between stress and dementia can be complex. This relationship is not only unidirectional, but it is bidirectional. Such that, stress on the body can possibly lead to deterioration and risk of dementia and dementia itself can also lead to stress (21,22). Extensive literature suggests that stress and stress related disorders such as posttraumatic stress disorder (PTSD) are risk factors of dementia (23). A meta-analysis of 60 studies suggested that PTSD was associated with impairments in verbal learning and memory, attention, working memory, and processing speed (23). Additionally, a retrospective cohort study, patients with PTSD were more than twice as likely to develop dementia than those without PTSD (24). Neuroticism has been linked to individuals experiencing extreme levels of distress and might also be associated with dementia. One study found that individuals who were prone to distress had a 2.4 times higher risk of developing dementia during at 3-6 year follow up (25). Additional studies have also suggested that high scores of neuroticism are significantly associated with increased risk of dementia (26,27). Anxiety, which is characterized by excessive worry and causes symptoms of stress, is another disorder that may be related to increased risk of dementia (23,28–31).

The physiological response to stress is the activation of the hypothalamic pituitary adrenal axis (HPA axis) (23). When this is activated, it increases the amount of adrenocorticotropic hormone (ACTH) and corticosteroids. If an individual is under chronic stress the functioning of the HPA axis changes, this can be seen in cases of PTSD, neuroticism, and anxiety disorders. Progression to dementia has been linked to

increases in levels of corticosteroids and HPA axis activation which may cause oxidative stress leading to synaptic dysfunction and neuronal cell death (32–36).

#### 2.1.5 Costs, epidemiology, and current treatments

The population of older adults ( $\geq 60$  years old) is continuously growing with expectations to reach 1.4 billion individuals worldwide by 2030 and 2.1 billion by 2050 (37). The risk of dementia increases significantly with age and already affects over 50 million individuals worldwide (23). As the population ages, the risk of dementia increases with an estimation of doubling its prevalence by 2040 (23). This will have a significant effect on the healthcare system, society, and specifically the caregivers who are caring for these individuals. In 2009, the estimated cost of dementia care was \$422 billion USD and \$142 billion USD for informal care worldwide for the prevalence of 34.4 million individuals living with dementia (38). With the expected increase in patients with dementia, it is predicted that dementia will be the most expensive disease in society (39). Pharmacological treatments for dementia are limited and have limited effectiveness. Goals of therapy are to maximize the patient's cognition, delay further functional decline, and to prevent and/or improve behaviour disturbances. Medications may delay disease progression but will not reverse any decline and cognitive damage. The two major classes of drugs used are the cholinesterase inhibitors and the NMDA receptor antagonists. Antipsychotic medications are also used for individuals with severe behavioural symptoms.

Nonpharmacological treatments for dementia also exist. These tend to focus on NPS or BPSD, including stress, depression, and anxiety. Most types of interventions are based on the unmet needs model but some focus on decreasing the level of stimulation or

modifying behaviours (40). Nonpharmacological treatments can be classified under the following domains: standard therapies, alternative therapies, and brief psychotherapies (41). Standard therapies would include behavioural therapy, reality orientation, validation therapy, reminiscence therapy. Alternative therapies are typically activity based such as art, music, meditation, and yoga. They can also include aromatherapy, bright light therapy, and other multisensory approaches. Psychotherapies can include cognitive behavioural therapy or interpersonal therapy (41).

Most nonpharmacological treatments are specific to the individual and their specific symptoms (40). For example, if some stimulus is triggering the individual, the intervention would be camouflaging or removing this stimulus. Sensory stimuli such as music interventions can be used for combatting boredom or increasing relaxation. Other interventions may target loneliness by increasing social stimuli through activities with others. These activities can be anything that brings individuals together, for example, group yoga sessions, art sessions, group therapy, etc. (40). Other treatments can include medical/nursing care interventions where the goal is to decrease pain and discomfort (40). These types of treatments can also be combined and customized to maximize its benefits.

#### 2.1.6 Limitations of existing treatments

Pharmacological treatments of dementia such as antipsychotic use have been associated with negative side effects including increase mortality (40). Additionally, medication nonadherence is a concern for individuals with dementia as they often forget to take medication or experience paranoia or suspicion of the medication (42–44). A systematic review of the literature found that medication adherence in older adults with dementia

ranged from 17-42% and medication discontinuation before the end of the treatment ranged from 37-80% (44). There is a lack of acknowledgment of this factor when prescribing medications and there is a lack of research on interventions to improve nonadherence in general. Due to these limitations, nonpharmacological treatments may be better suited towards older adults with dementia. However, limitations in nonpharmacological treatments also exist. These limitations often pertain to the lack of evidence on its efficacy. Most research for these interventions are lacking clinical trials, control groups, or large sample sizes. Research needs to focus on examining the efficacy of these interventions by using control groups and larger sample sizes.

### **2.2 Caregivers**

#### 2.2.1 Role of informal and formal caregiver

A caregiver can be any person who takes the responsibility of caring after another individual who may need some form of help. This can be a family member, a friend, or a hired individual. When this role is conducted by a family or friend without any payment or training, this is informal caregiving (45). On the other hand, formal caregiving is an individual who is hired, trained to some extent, and paid to care for the person in need (45). Approximately 75% of caregivers are family or friends of the care-recipient (46). The typical caregiver is most likely a spouse, followed by children or children in-law, and most often female and middle-aged (46). At least 60% of informal caregivers are wives, daughters, daughters-in-law, granddaughters, and other female relatives. However, male caregivers are gradually increasing and made up 40% of caregivers in 2008 (46). Caregiving is associated with many negative effects on the carers' mental and physical

health (47,48). For the remainder of this thesis, we will be focussing on informal caregiving of older adults by a family or friend.

#### 2.2.2 Caregiver burnout

Informal carers can range in their amount of training as it is not a formal job. However, the hours, stress, and burden that comes with this role can be as strenuous, if not more, than the average job. On average, caregivers spend 20.5 hours per week providing care and 20% of carers spend more than 40 hours per week (49). Additionally, most caregivers have their own life, jobs, children, and other responsibilities on top of the caregiving role, therefore burnout is extremely common (47,50). The role of the caregiver is critical to the wellbeing and quality of life of their care-recipient, and often delays their institutionalization. Although it benefits the care-recipient it comes at a cost of caregiver distress and poor quality of life, with the caregiver often referred to as the invisible second patient (46). In the 2013, cost associated with informal dementia caregiving was estimated to be \$56,290 USD annually per patient (51). Due to the high demand of this role, caregivers have an increased risk of psychiatric disorders, with anxiety being most prevalent (52–54). This is observed mostly in female caregivers, caregivers with malerecipients, and spousal relationships with the care-recipients (52). Spousal relationships with the care-recipient often have a greater negative impact on the caregiver compared to adult child relationship with care-recipient. This is due to the spouses living together, having less choice in the matter of taking on the role, not being aware of the impact it has on them, and being the approximately the same age as the care-recipient (i.e., older age) (49). Approximately 80% of dementia caregivers state they experience high stress and 50% report experience depression (55). Caregiver burden or burnout is extremely

common with carers of older adults with dementia and often precedes institutionalization of the patient (55). This can occur when the caregiver has insufficient financial resources, responsibility conflicts, multifaceted strain, lack of social activities, or lack of spare time (56). This often results in decreased quality of life, and deterioration of physical and psychological health (56).

## 2.2.3 Caregiver treatment and support

Most support is generally focused on the care-recipient rather than the caregiver themselves. For example, applications and tools related to time management, scheduling, pill reminders, appointment reminders, etc., are most commonly available for caregivers in hopes to alleviate strain. However, there are few types of support for the caregiver such as instrumental support, emotional support, and informational support (46). Instrumental support can be classified as help with daily living needs or housework. Emotional support can be group therapy with other caregivers or one-on-one therapy. Information support is information or knowledge that comes from a health care professional or individual with relevant experience; this can be tips related to caregiving, management techniques, or simply information about the disease itself. Interventions for caregivers also exist. These are generally psychosocial interventions that aim to improve outcomes such as stress, depression, anxiety, isolation, burnout, and quality of life. If these symptoms can be improved, it can delay institutionalization of the patient and reduce costs of long term care (55). One type of intervention focussed on role-training to help the caregivers uphold a more clinical mindset of their role to disassociate from the negative outcomes (57). This intervention decreased in scores of depression and burden, and were less bothered than the control group at 5 months follow-

up (57). This can be classified as an information intervention. Another type of information intervention that has been successful and well known is the Resources for Enhancing Alzheimer's Caregiver Health (REACH) study (58). This intervention provided resources, psychoeducation and skill-based training, group support, in-home environmental strategies, and enhanced technology systems. This study found that caregivers in the intervention had significantly lower caregiver burden compared to the control group (58). Other forms of interventions include activity-based interventions such as mindfulness-based interventions, yoga, art, or music interventions. In one study, mindfulness-based stress reduction was more effective than an education/support program for caregivers at improving mental health, stress, and depression (59). For the best outcome, interventions should be combined and tailored to the caregiver as their needs and preferences may be different.

## 2.3 Mindfulness

### 2.3.1 What is mindfulness?

Mindfulness is the state of being fully aware and conscious in the present moment. It is a principle that comes from Buddhism and is an English translation of the word *sati* (60). Over the years it has been adapted to many practices and has been an important component in psychotherapy (61). It has been beneficial in psychiatric treatments as there are minimal risks, good adherence, little to no side effects, less barriers to access, and can be done from the comfort of home without any travel. Some interventions that include aspects of mindfulness are tai chi, art therapy, music therapy, meditation, and yoga. For this thesis we will be focusing on mindfulness yoga. There is some literature to support

the efficacy of mindfulness yoga but currently no RCT for Zoom based virtual yoga in a population of older adults with dementia.

### 2.3.2 Yoga

Yoga is an ancient Indian mind-body practice that, in the West, most commonly uses physical postures (asanas), breathing exercises (pranayama), and meditation (dhyana) to unite mind, body, and spirit (62). Chair yoga is an effective way to offer modified yoga postures and relaxation techniques to individuals with limited mobility and/or advanced age for whom mat-based classes may not be accessible (63). A growing body of literature examining the effects of yoga on stress reduction suggests the practice may be suitable for individuals with dementia and their caregivers, with positive preliminary results in these populations (62,64–67). Furthermore, yoga, often practiced in a group, can foster feelings of community and social connection (68,69) and may be able to reduce social isolation. To our knowledge, three studies have examined the effects of chair yoga in patients with dementia (70–72). These studies followed a structure of two sessions weekly for 8-12 weeks to be feasible for continued participation. Litchke et al. (2012) found no significant change in balance, anxiety, or cognition for all groups. For this study, participants were grouped as either mild, moderate, or severe dementia based on their score on the Global Deterioration Scale (GDS). Level 4 is mild dementia, level 5 is moderate dementia, and level 6 is severe dementia. The group of participants with moderate dementia showed a more significant increase in depression compared to those with mild or severe dementia, but this finding may be subject to Type II error given that there were only 6 individuals included in the study who had moderate dementia (70). It is also possible that the increase in depressive symptoms was associated with further

cognitive decline over the course of the study, not with the yoga. Thus, this finding should be interpreted with caution, and validated in a larger sample. Despite an increase in affective symptoms, family members noticed that the patients slept better and had improved engagement on yoga days (70). The study conducted by McCaffrey et al. (2014) focused solely on physical outcomes (such as balance and walking ability) in patients with moderate to severe dementia and found the intervention to be beneficial. Additionally, the day care workers noticed reductions in agitation and wandering, and improved attention on yoga days (71). Park et al. (2018) conducted a small trial (n=8) on the feasibility of a 12-week chair yoga course for people with mild, moderate, or severe dementia (72). There were no adverse events reported, and quality of life, depression, anxiety, and physical function all improved by either 6- or 12-weeks. The results are inconsistent and inconclusive as all three studies had small sample sizes (n=32, n=19, and n=8) and lacked control groups. Further research requires a substantial sample size and validated measures to assess the psychological effects of yoga associated with dementia and dementia caregiving.

## 2.4 COVID-19

#### 2.4.1 Impact of COVID-19

In March of 2020, the World Health Organization (WHO) declared COVID-19 as a global pandemic. It affected all individuals around the world in many different ways. Specifically, older adults were considered high risk due to their age and possible comorbidities such as obesity, diabetes, organ diseases, hypertension, and immunodeficiencies.

Prior to the start of this research project, in December 2020, the novel COVID-19 coronavirus had caused over 7,000 deaths in Quebec, and over 1,533,000 worldwide (73,74). Older adults have accounted for the majority of deaths, largely due to high comorbidities and immune dysfunctions observed in this population (75–77). In an effort to slow the spread of the virus, many countries had introduced physical distancing and social isolation measures, and as of April 2020, there were 4.5 billion people in voluntary confinement globally (78). In Canada, the government had specifically urged individuals over the age of 70 to stay home for the foreseeable future, putting the geriatric population at risk for becoming socially isolated, and those with cognitive impairment or dementia were at an even higher risk for becoming more stressed, anxious, and agitated while in lockdown (79). Caregivers, especially those who were isolating with an individual with dementia or other cognitive impairments, were also likely to experience increased stress during this time (80). There was therefore an urgent need for psychotherapeutic interventions to reduce stress and social isolation in older adults with cognitive impairments and caregivers during COVID-19. Crucially, these interventions had to adhere to the social isolation and physical distancing measures and pose low risk for adverse events.

## **2.5 Internet interventions**

#### 2.5.1 Telehealth

Despite the potential suitability of yoga for addressing stress and social isolation in dementia patients and caregivers, COVID-related physical distancing and social isolation measures preclude the feasibility of in-person group yoga sessions. A proposed means of increasing access to group services while socially distancing is through the use of telehealth, or the use of technology for remote clinical care and health education (37). Interventions and treatments using telehealth technologies (e.g., video-conferencing, telephone) have been effective in improving symptoms of stress (38), depression (39), anxiety (40), and has also been successful in improving social connection in isolated older adults (37, 41, 42).

Group-based yoga classes delivered via zoom software have the potential to engage both individuals with dementia or cognitive impairments and caregivers during COVID-19. This activity may reduce stress, and social isolation by providing an opportunity to share in a relaxing activity with others. In fact, medical professionals are encouraging the employment of self-help practices and psychosocial support, such as mindful exercise, for reducing stress and promoting relaxation in individuals with cognitive impairment and caregivers (43). A systematic review on internet-based interventions for dementia caregivers emphasized the importance of interacting with other caregivers in order to reduce feelings of isolation and found that contact with other caregivers led to improvements in stress, burden, and depression (44). A videoconference-delivered mindfulness-based intervention (MBI) was significantly effective for improving symptoms of anxiety and depression over 6-weeks, with improvements maintained at a 3week follow-up (45). MBIs conducted via videoconferencing may also improve social isolation; one study found that practicing yoga with a partner via video technology fostered feelings of social connection, with one participant reporting "It's just like if someone is in the room with you. Even though you're both meditating, you're not looking at each other, you can feel each other. And the visual does that." (46). A meta-

analysis found that online MBIs had a moderate effect on stress (g = 0.51), with significantly higher effect sizes than unguided MBIs (47). In addition to improving stress, online MBIs significantly improve depression, anxiety, and wellbeing, with smaller effect sizes (47). Due to the low-risk nature of videoconferencing and the potential benefits while keeping COVID-19 risk at bay, this can be a potential alternative to in-person interventions.

#### 2.6 Summary, Aim, Hypotheses

This thesis aims to assess the feasibility and efficacy of an 8-week virtual chair yoga randomized controlled trial for older adults with dementia/MCI and their caregivers. This study will first and foremost assess the feasibility of delivering a chair yoga intervention to older adults with dementia/MCI and caregivers over Zoom. Additionally, this RCT will assess the efficacy of this program on improving symptoms of stress, loneliness, depression, anxiety, and fear of COVID-19 compared to a control group over an 8-week period.

It is hypothesized that the virtual 8-week chair yoga program will be feasible such that, 1) recruitment goals will be met (n = 40-60) within 3 months of starting recruitment; 2) attrition will be  $\leq 20\%$  (i.e.,  $\leq 20\%$  of participants will not be present for 8-week follow-up assessment); and 3) intervention drop-out will be <30% (i.e., less than 30% of participants enrolled will fail to attend 75% of the intervention sessions (6/8 sessions)). Additionally, it was hypothesized that following participation in the virtual 8-week chair yoga program, older adults with dementia/MCI and their caregivers will report lower perceived stress, loneliness, anxiety, depression, fear of COVID-19, and caregiver burden (for caregivers only).

This study, if effective, may be of benefit to knowledge and to society as it may be one viable solution to address the stress associated not only with the growing prevalence of dementia, but also with the COVID-19 global health crisis and physical distancing measures. This intervention may decrease the economic burden on the health system as it can be delivered to large groups online and may therefore be easily scalable and cost-effective as a novel alternative health intervention for managing patient and caregiver mental health during COVID-19. This intervention may also be of benefit to society and the economy by potentially decreasing the number of Canadians suffering from chronic stress and by potentially reducing caregiver burden and delaying institutionalization of individuals with dementia, the latter of which may be particularly impactful given the rapid spread of COVID-19 through long-term care facilities in Canada. The results of this study, regardless of the outcome, will provide essential pilot data for further potential large RCTs to improve stress and mental health in both patients and caregivers.

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## **Chapter 3: Manuscript**

# Virtual Mindful Chair Yoga (MCY) for Older Adults with Dementia and Caregivers: A Pilot Randomized Controlled Trial

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#### Abstract

**Background:** Older adults with dementia or mild cognitive impairment (MCI), and their caregivers, face increased stress, loneliness, mental health symptoms, and these dyads also face barriers in accessing safe interventions during COVID-19. Virtually delivered mindful chair yoga may be a safe and efficacious alternative.

Methods: In a pilot randomized controlled trial (RCT; n=30) we assessed the feasibility and mental health effects of an 8-week Mindful Chair Yoga (MCY) program via Zoom for dyads of older adults (aged 60+) with dementia/MCI (n=15) and their caregivers (n=15), using a waitlist as control. The feasibility outcomes were study recruitment, retention rate, and intervention completion. The primary efficacy outcome was stress (Perceived stress scale), and the secondary efficacy outcome was loneliness. Exploratory outcomes included anxiety, depression, caregiver burden, and fear of COVID-19. All outcomes were measured at baseline and at 8-weeks. **Results:** 92.8% (13/14) of participants in the control group and 75% (12/16) of participants in the intervention group completed the baseline and 8-weeks assessments. Any technological problems that arose were resolved in the first session and participants were able to complete the intervention. Participants reported enjoying MCY and no adverse events were reported. Stress, loneliness, anxiety, and fear of COVID-19 did not change from baseline to 8-weeks. However, depression and caregiver burden had a significant interaction effect (p = .005,  $np^2 = .35$ ; p =.007,  $np^2 = .54$ , respectively) such that depression and caregiver burden improved in the waitlist control group (Mean difference= -2.46; mean difference= -7.00) relative to the intervention group (Mean difference= 1.38; mean difference= 6.00).

**Conclusion:** In this first-ever RCT of virtually delivered MCY for caregivers and older adults with dementia/MCI, MCY was found to be feasible and enjoyable. The dyadic aspect (caregivers

and older adults) of participants likely improved feasibility and lowered technological barriers, which may be an important factor for future large confirmatory RCTs in this population. <u>Keywords:</u> Dementia, Cognitive Impairments, Older Adults, Caregivers, Chair Yoga, Stress, Depression, Anxiety, Caregiver Burden, COVID-19

### Introduction

Older adults with dementia and mild cognitive impairments (MCI) experiencing stress and loneliness are at higher risk of psychiatric comorbidity, poor quality of life, and premature mortality (1). During COVID-19 one in four older adults reported experiencing isolation, anxiety, and depression (2), thus increasing the support they require and caregiver burden (3–5), directly costing the healthcare system over \$9 billion/year (CAD) (6). There is a remarkable need to support older adults with dementia/MCI and their caregivers experiencing stress, loneliness, and other mental health conditions with an accessible, scalable, and nonpharmacological intervention.

Mindfulness, the state of being aware and present in the moment (7), as well as yoga have been found to improve stress (8). Moreover, preliminary improvements on psychological symptoms such as depression and anxiety (9,10) have been demonstrated with older adults. Improvements in loneliness (11,12) have also been reported with mindful yoga programs, which due to its gentle and low-risk nature may be suitable for older adults with dementia and their caregivers (13–15). To date, there is only one yoga randomized controlled trial (RCT) for older adults with MCI; other yoga research studies were limited to quasi-experimental designs (16).

With the impacts of COVID-19 and with an aging population, in-person resources are difficult to obtain and are associated with long waitlists. Virtually delivered programs are a potential alternative to in-person programs that may reduce stress and loneliness (17). Currently, community programs are delivering virtual programs such as chair yoga (18). However, to our knowledge there are no RCTs assessing the efficacy of a virtual chair yoga program including older adults with dementia/MCI and caregivers. If successful, virtual chair yoga may provide

accessible, easy to use, home based programs to improve mental health for older adults with dementia and caregivers.

We conducted a double-blind pilot RCT to assess the feasibility and mental health effects of an 8-week mindful chair yoga (MCY) program on Zoom for older adults with dementia/MCI and their caregivers.

## Methods

*Participants.* This study was approved by the CIUSSS West Central Montreal Research Ethics Board at the Jewish General Hospital, Montreal, Quebec (NCT04884529). All methods were performed in accordance with the relevant guidelines and regulations. Participants were recruited from physicians, clinicians, nurses, and other healthcare workers who referred their patients from the Jewish General Hospital, Douglas Mental Health University Institute, local community organizations (Alzheimer's Society Quebec, Alzheimer's Society Montreal, Alzheimer's Group Inc), and self-referrals. A total of 70 individuals were contacted and screened for this study between June and September 2021, which coincided with Wave 3 of COVID-19. Of the 70 referrals, 35 individuals consented to participating; however, only 30 of them were available to be randomized (1:1) (refer to CONSORT diagram; Figure 1). Participants were older adults (n=15) and caregivers (n=15) who could participate alone or as a dyad. There were 12 pairs of caregivers and older adults, 3 older adults, and 3 caregivers.

*Inclusion/exclusion criteria.* Older adults ( $\geq$  60 years old) were eligible if they had a Montreal Cognitive Assessment-Blind (MoCA-BLIND) score between 8-18 or prior diagnosis of dementia or MCI. Caregivers ( $\geq$ 18 years old) were eligible if they were caring for an older adult with dementia or MCI. All participants provided informed consent, spoke English or French, were

living in Quebec, had sufficient hearing/sight, internet access, and were able to sit comfortably for at least one hour.

Screening for Dementia/MCI. The MoCA-BLIND (19) is an adapted version of the original MoCA. This version contains the same items as the original MoCA except those items requiring visual abilities (i.e., the visuo-constructive component). The MoCA-BLIND is a rapid screening instrument that requires 5-10 minutes and assesses cognitive domains, including attention, concentration, memory, language, conceptual thinking, calculations, and orientation. The maximum score of this instrument is 22 points, with scores  $\geq 18$  considered normal.

*Randomization/Blinding.* Eligible participants were randomly assigned to either group 1 (MCY Intervention) or group 2 (Waitlist Control Group) by an independent party using a computerized algorithm (Figure 1; Consort Diagram). Those who were participating as a pair (i.e., caregiver and older adult) were randomized as a dyad. Additionally, participants were stratified by their stress score on the Perceived Stress Scale (20) (PSS;  $\geq 10$  points = high stress, <10 points = low stress. For dyads, we used the higher score of the dyad to assign them to either low or high stress. The outcome assessor was blinded to participant randomization/allocation status throughout the study.

*Mindful Chair Yoga (MCY) Intervention.* The MCY intervention was a total of 8-weeks consisting of one 60-minute weekly session. These sessions were led by a certified yoga instructor who had 9-years of experience delivering chair yoga classes to seniors. A moderator from the research team was present to troubleshoot technological problems, assist the instructor, and check-in on participants. Each session followed a similar structure: Short meditation focused on bringing awareness to breath and body (10 minutes), warm up with gentle yoga postures in the chair (20 minutes) slowly transitioning to more challenging poses (20 minutes) and ended

with a short mindfulness exercise (10-minutes). The 8-sessions built on one another, slowly increasing in difficulty. Daily practice of 15-minutes/day was encouraged for all participants. *Waitlist Control Group.* The participants who were assigned to the waitlist control group received a mental health resource (https://www.redcross.ca/crc/documents/CRC-Psychological-First-Aid-Guide-2019.pdf). After completion of the study, all participants (i.e., those in the waitlist control) were offered the MCY program outside of the current study (Figure 2; Study Timeline).

*Outcome Measures.* Demographic characteristics, primary, secondary, and exploratory outcomes were measured at baseline and at 8-weeks.

The primary outcome was stress, as measured by the Perceived Stress Scale (PSS). The PSS is a 14-item scale used to measure the degree to which life events are experienced and appraised as stressful. Each item ranges from 0 (never) to 4 (very often). The scale is widely used and has been tested for reliability and validity in patients with dementia, with an internal consistency for this population of  $\alpha = 0.83$  (21).

The secondary outcome was loneliness, as measured by the 3-item UCLA Loneliness Scale (22). This scale measures three different dimensions of loneliness: relational connectedness, social connectedness, and self-perceived isolation. Scores range from 1 (hardly ever), 2 (some of the time), and 3 (often), with total scores ranging from 3-9 (scores of 6 or higher indicate loneliness). The internal consistency is quite good and indicates that the items reliably measure loneliness in a sample that used telephone ( $\alpha = 0.72$ ) (23).

The exploratory outcomes were depression (Patient health questionnaire; PHQ-9) (24), anxiety (Generalized Anxiety Disorder 7-Item; GAD-7) (25), fear of COVID-19 (Fear of COVID-19 Scale; FC-19S) (26), and caregiver burden (Zarit Burden Interview; ZBI) (27).

*Statistical Analysis.* Statistical analyses were conducted by a researcher who was blinded to randomization. Analyses were performed using IBM SPSS Statistics software (version 23.0; SPSS, Inc., Chicago). The Shapiro-Wilks test was used to assess normality of all variables. Demographic and clinical characteristics were compared between groups using independent T-tests. Demographic and clinical characteristics were described using frequency, mean, and standard deviation (SD). Primary, secondary, and exploratory outcomes were assessed by a two-way mixed analysis of variance (ANOVA), where the within group factor was time (baseline, post-intervention) and the between group factor was condition (intervention vs. control).

## Results

All normality assumptions were met, as indicated by a non-significant Shapiro-Wilks statistic for all outcome scores.

*Participants.* After randomization there were 16 participants assigned to the intervention group and 14 in the control group (Refer to Figure 1; CONSORT diagram). The average age of participants at baseline was 73 years old (SD=12.9), with a range between 45-91 years old. The intervention group did not significantly differ from the control group in any of the demographic or clinical characteristics (Table 1).

*Feasibility.* 83.3% of the participants completed the trial (attrition: intervention n=4, control n=1). Participants reported enjoying the intervention, except for 2 participants reporting the sessions to be physically challenging or different than they expected. No technological challenges nor adverse outcomes related to the intervention were reported.

*Efficacy Outcomes.* The primary outcome, stress, as well as loneliness, symptoms of anxiety, and fear of COVID-19 had no significant differences in the change from baseline to 8-weeks

between the intervention and control group (Table 2). The ANOVA revealed a significant interaction effect for depression measured by PHQ-9, F(1,19) = 10.25, p = .005,  $\eta p^2 = .35$ , such that those in the intervention group increased in severity of depression scores relative to the control group (Figure 2).

The ANOVA revealed a significant interaction effect for caregiver burden measured by ZBI, F(1,10) = 11.53, p = .007,  $\eta p^2 = .54$ , such that those in the intervention group increased in severity of caregiver burden scores, relative to the control group (Figure 3). Pairwise comparisons revealed the change in ZBI scores from baseline to 8-week follow-up in the intervention group was not significant (mean change = -6.00, 95% CI: -12.816-0.416), p = 0.063. The change in ZBI scores for the control group was significant (mean change = 7.00, 95% CI: 1.409-12.591), p = .019. No other significant effects were found (stress, loneliness, anxiety, and fear of COVID-19).

## Discussion

This is the first RCT of virtually delivered mindful chair yoga (MCY) by Zoom for older adults with dementia/MCI and their caregivers to assess its feasibility and efficacy. MCY was found to be feasible and enjoyable by older adults and caregivers. There were no significant changes in stress, loneliness, anxiety, and fear of COVID-19 from baseline to week-8, suggesting symptoms did not worsen even during wave 3 of COVID-19. Interestingly, depression and caregiver burden improved in the waitlist control group. These findings may be due to differences in baseline scores, major life stressors that occurred for several participants in the intervention group, and small sample sizes driving this effect. Overall, this virtual MCY intervention was a feasible, well-tolerated alternative to in-person programs.

This novel MCY pilot RCT was feasible in older adults with dementia and their caregivers, which is remarkable given the challenges of online interventions previously reported in older adults with dementia (28). For this Zoom-delivered MCY program there was an 83.3% completion rate (25/30 participants) with very few technological problems (e.g., request for improving lightning and higher quality camera to ease viewing the instructor). Initial technological problems that arose were resolved within the first session and participants were still able to complete the intervention. Most participants reported enjoying the convenience and safety of staying at home during the winter season. This finding supports the feasibility of virtual programs for older adults with dementia/MCI, which also benefits caregivers. It is suspected that the needs during the COVID-19 pandemic encouraged older adults to use technology and thus contributed to the success of the delivery of this intervention. Prior to COVID-19 this urgency for technology use did not exist and would therefore explain the lack of technology-based interventions for older adults. The feasibility of delivering this intervention through Zoom may also be explained by our encouragement of dyadic participation with the caregiver and the older adult with dementia. This may have encouraged participation, and provided additional support if technological challenges arose, as caregivers liaised with the team.

Stress, loneliness, anxiety, and fear of COVID-19 did not significantly worsen with MCY relative to the waitlist control, suggesting the intervention may be well-tolerated from a mental health perspective. However, studies prior to the pandemic reported a significant decrease in stress, loneliness, and anxiety (16). It is important to note that during this intervention there were a high number of COVID-19 cases in Quebec, as it was concurrent with the third wave. Fear of COVID-19 has not been evaluated in yoga studies and these results are therefore new to the

field. Future studies could benefit from a socializing component to this intervention, as in this study participants only briefly interacted with the instructor at the beginning and end of sessions.

Interestingly, depression and caregiver burden significantly improved in the control group compared to the intervention group. Given the overwhelmingly positive feedback (qualitative paper is in preparation), we suspect this was due to a small sample size and disproportionate number of participants in the intervention group going through major life stressors (e.g., cancer diagnoses within family, changing house locations). Additionally, there was approximately a 9.4-point difference in the baseline mean ZBI (caregiver burden) scores for the intervention and control group, with the control group reporting the higher severity in caregiver burden. This suggests a regression to mean pattern. Depression scores had a similar interaction effect where depression decreased for the control group compared to the intervention group. Without a clinically depressed population, it is hard to explore whether the intervention can have an effect on the participants. PHQ-9 is more reliable in detecting changes when the baseline score is  $\geq 10$  (24). Future RCTs could explore virtual yoga interventions with a clinically depressed population.

## **Strengths and Limitations**

This manuscript has strengths and limitations, notably, this study is the first RCT to date for virtual mindful chair yoga for dyads of older adults with dementia/MCI and caregivers. A major strength of this study is its design as a double-blind RCT. Additionally, the technological portion allowed for the delivery of an accessible home intervention during the devastating COVID-19 pandemic. Some limitations include the small sample size and brief 8-week followup. Future studies could benefit from a larger sample, extended intervention/follow-up periods, and could explore the effects on older adults with clinical depression and/or other mental health diagnoses.

## Conclusion

This novel pilot RCT of an 8-week virtual mindful chair yoga in dyads of older adults with dementia/MCI and caregivers was found to be feasible, safe, and accessible. The dyadic component of this intervention may have contributed to the feasibility of the Zoom delivered intervention and the minimal amount of technological issues.

**Ethics approval and consent to participate:** This study was approved by the CIUSSS West Central Montreal Research Ethics Board at the Jewish General Hospital, Montreal, Quebec. All methods were performed in accordance with the relevant guidelines and regulations. All participants provided informed consent.

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*Table 1.* Baseline clinical and demographic characteristics (mean, standard deviation, n, or percentage) of older adults with dementia/MCI and caregivers (n=30).

	Intervention (n=16)	Control (n=14)	
Age (mean, SD)	74.3 (12.6)	71.3 (13.7)	
Sex (n, %)	Female: 10 (62.5%)	Female: 10 (71.4%)	
	Male: 6 (37.5%)	Male: 4 (28.6%)	
Gender (n, %)	Female: 10 (62.5%)	Female: 9 (64.3%)	
	Male: 6 (37.5%)	Male: 4 (28.6%)	
	Non-binary: 0 (0%)	Non-binary: 1 (7.1%)	
Caregivers (n, %)	8 (50%)	7 (50%)	
Older adults with	8 (50%)	7 (50%)	
dementia/MCI (n, %)			
Marital status (n, %)	Single: 1 (6.3%)	Single: 1 (7.1%)	
	Married: 15 (93.8%)	Married: 7 (50%)	
	Common-law: 0 (0%)	Common-law: 2 (14.3%)	
	Widowed: 0 (0%)	Widowed: 4 (28.6%)	
Living status (n, %)	Alone: 0 (0%)	Alone: 1 (7.1%)	
	With others: 16 (100%)	With others: 13 (92.9%)	
MoCA Score (older adults with	13.3 (3.7)	14.4 (4.5)	
dementia only (n=15))			

*Table 2.* Mean, standard deviation, p-value, confidence interval, and partial eta squared for study outcomes in the intervention and control group at baseline and 8-weeks.

Outcome Variable	Time	Intervention	Control	Statistics (p-value,
				95% confidence
				interval, ηp <sup>2</sup> )
Stress	Baseline	14.64 (8.42)	15.54 (7.26)	p>.05
(mean, SD)	8-weeks	16.00 (6.72)	15.15 (7.09)	-
Loneliness	Baseline	4.82 (1.89)	5.23 (1.79)	p>.05
(mean, SD)	8-weeks	5.09 (1.87)	5.08 (1.61)	
Anxiety	Baseline	6.13 (4.58)	6.00 (3.95)	p>.05
(mean, SD)	8-weeks	6.00 (4.50)	4.00 (3.41)	-
Depression	Baseline	5.25 (4.23)	6.38 (3.93)	F(1,19)=10.25,
(mean, SD)	8-weeks	6.63 (5.48)	3.92 (3.25)	p=.005, ηp <sup>2</sup> =.35
Fear of COVID-19	Baseline	10.57 (2.76)	13.42 (3.85)	p>.05
(mean, SD)	8-weeks	8.71 (1.11)	11.92 (3.83)	
Caregiver Burden	Baseline	33.00 (11.58)	42.43 (14.93)	F(1,10)=11.53,
(mean, SD)	8-weeks	39.00 (14.69)	35.43 (11.96)	p=.007, ηp <sup>2</sup> =.54



Figure 1. CONSORT diagram.



*Figure 2.* Change in depression measured by PHQ-9 scores from baseline to 8-weeks for the control and intervention group.



*Figure 3.* Change in caregiver burden measured by ZBI scores from baseline to 8-weeks for the control and intervention group.

#### **Chapter 4: Discussion**

For this manuscript-based thesis, one research project was conducted. This study was an RCT of a virtual mindful chair yoga (MCY) program for older adults with dementia/MCI and their caregivers during COVID-19. It was hypothesized that older adults living with dementia and their caregivers would improve in their symptoms of stress, loneliness, depression, anxiety, fear of COVID-19, and caregiver burden (caregivers only). It was also expected that this RCT would be feasible given the low-risk nature of chair yoga and the presence of caregivers for support with the MCY program and using the Zoom software itself.

After the 8-week MCY intervention, participants reported enjoying the program and felt that it was an easier alternative to travelling to in person classes and a great compromise due to the COVID-19 virus. There were minimal problems and any problems that arose were resolved fairly quickly in the first sessions. The feasibility of this program will be important to the development of future virtual programs with older adults who have dementia and their caregivers. A significant part of the program was the role of the caregiver, which was also demonstrated in a homebased program conducted by Teri and colleagues for patients with Alzheimer's disease (1). These caregivers likely contributed to the feasibility of the program as they were able to provide support on the other end of the screen to connect with the instructor and the rest of the class. Additionally, the role of the instructor was to interact with the participants and monitor their poses and provide corrections as needed to ensure optimal efficacy of the class. The moderator also played a role in the feasibility of these sessions as their role was to focus on the chat function to troubleshoot any issues and relay any questions to the yoga instructor.

Future RCTs may benefit from there being an acceptability scale regarding the program. However, there are two parts of this research project with part 1 being quantitative analysis results and part 2 being qualitative interviews. For part 2 of this RCT, qualitative interviews were conducted after completion of the RCT but still remain in the early phases of data analysis. These will be assessed to gain a better understanding of the perceived likeability of the program. Another outcome that may be of benefit is motivation to participate and motivation to improve. These outcomes may be interesting to analyze as this may contribute to participants' perception of the program and further influence their scores (2). Rapoliene et al (2018) found that stroke patients who demonstrated a motivation to improve from an occupational therapy program had significantly higher improvements than those who did not demonstrate motivation. This suggests that participants with higher motivation may be more open to experiencing improvements, and thus actually observe these beneficial effects in study outcomes. In addition, it may be beneficial for future studies to identify and categorize the type of dementia that the participants have. It may be possible that different types of dementia are affected differently.

Stress, loneliness, anxiety, and fear of COVID-19 all remained stable throughout the intervention relative to the waitlist control group. This suggests that over the 8-week MCY program symptoms did not progress or worsen. This is an important finding as progression to worse symptoms is typical for dementia and especially applicable during times of high stress (e.g., COVID-19). A recent study by Park et al. (2022) conducted a single-arm virtual chair yoga program for older adults with dementia and also measured loneliness (3). They found that loneliness increased after 8-weeks of intervention (two hours per week) (3). The authors suggest that this is due to COVID-19 and the resulting isolation.

Interestingly, caregiver burden and depression both increased for the intervention group relative to the waitlist control group. This was a surprising result and there may be a few culprits. One important consideration is the idea that this mindfulness program may have made participants more aware of how they were actually feeling (4). Another important factor to consider, were the baseline differences in depression and caregiver burden between the intervention and waitlist control group. For depression, the intervention group had a mean score of 5.25 while the waitlist control group had a mean score of 6.38 at baseline. In most cases, when the scores are more severe, they have more room to show improvements. For the Patient health questionnaire-9 (PHQ-9), most improvements are seen when scores are  $\geq 10$  (5), which represents patients with at least moderate depression. In this sample of patients, they were not prediagnosed with clinical depression, and this may be one reason why there were no improvements. The categorizations for the PHQ-9 are 1) 0-4: None; 2) 5-9: Mild; 3) 10-14: Moderate; 4) 15-19: Moderately severe; and 5) 20-27: Severe depression. Although there was a statistically significant difference from baseline to 8-weeks in depression, the classifications of the depression score at 8-weeks (6.63) for the intervention group did not change to a higher classification of depression, suggesting there is no clinically important difference (6). Löwe et al. (2004) suggest that the minimal clinically important difference for the PHQ-9 is a 5-points change. Therefore, it can be concluded that the change of the scores (Baseline: 5.25; 8-weeks: 6.63) may be due to natural oscillations across time.

Compared to the literature, few studies also observed an increase in depression. Litchke et al. (2012) conducted a single armed 10-week chair yoga intervention with older adults who had Alzheimer's disease and they found that depression scores increased at follow-up (7). Additionally, Steinberg et al. (2009) also observed depression increasing after participating in a

physical activity for older adults with Alzheimer's disease (8). However, some physical activity programs detected improvements in depression for these individuals (9,10). More research needs to be conducted with large sample sizes and control groups to confirm the benefits of chair yoga activities in person and virtually as results appear to be mixed.

For caregiver burden the baseline scores had huge variations between the intervention and waitlist control groups. The intervention group had a mean score of 33.00 while the waitlist control group had a mean score of 42.43. This nearly 10-point difference is important to consider when interpreting the results. Like depression, it is easier to detect improvements when baseline scores are more severe. However, when looking at the actual classifications of the Zarit Burden Interview (ZBI) for caregiver burden (0-21: little or no burden; 21-40: mild to moderate burden; 41-60: moderate to severe burden; 61-88: severe burden) it can be seen that the intervention score at 8-week (39.00) did not change classifications (11). Instead, it stayed between the mild to moderate burden score (Baseline: 33.00; 8-weeks: 39.00). This may suggest that the increase in caregiver burden was not clinically relevant.

Future research may want to focus on the dose relationship of virtual mindful chair yoga programs. Since there were no midpoint assessments throughout, it cannot be clear whether the depression and caregiver burden outcomes decreased and then increased or whether it was a steady increase from start to finish. According to the Yerkes–Dodson law of optimal arousal (12), a variable can have a positive effect however if it is overdone it can have negative consequences. In this case, future RCTs can explore with various timepoints to determine the optimal dose of mindfulness chair yoga. In addition, it may be possible that the mental health resource that was provided to the waitlist control group may have been helpful in a way that the MCY program was not. This resource provided participants with information to assess

psychological first aid for themselves and others. Some examples include creating a selfcare plan, assessing the situation, and understanding their own emotions. Regardless of this resource, all participants were actively seeking help (e.g., research studies) to improve their symptoms and may therefore be involved in other programs, etc.; this is a bias that must be considered in every RCT study. Given that there were some null results in this RCT study, interventions such as psychotherapy, cognitive behavioural therapy, psychoeducation, art therapy are a few other psychological interventions that can be incorporated in future studies to improve mental health symptoms.

The potential of chair yoga programs to be conducted virtually for older adults with dementia is promising. This will be especially important as healthcare begins to move towards more digital means. This virtual chair yoga study is the first of its kind to assess a virtual mindful chair yoga program through an RCT that engages both older adults with dementia/MCI and caregivers during COVID-19 for mental health outcomes. This is consistent with the potential for decreasing costs and increasing accessibility of novel alternative health interventions during and beyond the pandemic.

## References

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## **Chapter 5: Conclusion**

The virtual mindful chair yoga program was a feasible, safe, and accessible alternative to inperson mindful chair yoga programs for older adults with dementia and their caregivers. There were no adverse events and participants reported enjoying the program. This study will add to the growing field of virtual programs and be of benefit to clinicians and caregivers who care for older adults with dementia. Future large RCTs are encouraged to evaluate the efficacy of mental health outcomes for this program.