Examining Worsening Positive Symptoms During the COVID-19 Pandemic in Older Adult Home Care Clients in Ontario

by

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Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Abstract

Background

Across Canada, older adults over the age of 60 account for the majority of COVID-19-related deaths, hospitalizations, and intensive care admissions (Government of Canada, 2023). Thus, since the beginning of the pandemic, older adults were a vulnerable cohort with a high-risk of mortality. However, research highlighting the pandemic effects on the general population of older adult psychological health have had mixed results. In particular, it is not well understood how the pandemic has affected positive symptoms of older adults with mental disorders. Older adults with a mental disorder may be even more vulnerable to worsening physical health and mortality, as well as may experience greater psychological distress or a relapse in symptoms of their diagnosis due to social isolation and loneliness experienced during the pandemic.

Objectives

The goal of part I of this paper was to identify and synthesize existing literature focusing on older adults with mental disorders, their experience throughout the COVID-19 pandemic, and the outcomes that have been researched in this realm. The goal of part II of this paper was to explore the changes in positive symptoms prior to and during the COVID-19 pandemic on older adults experiencing mental disorders in Ontario, and to examine risk factors associated with worsening positive symptoms.

Methods

Part I consisted of a rapid review and critical appraisal of the current research on older adults with mental disorders and COVID-19. Five electronic databases (PubMed, MEDLINE, Scopus, CINAHL, and PsycINFO) were searched. Part II entailed secondary data analysis using Ontario interRAI HC collected between September 1, 2018, to August 31, 2022. The sample was divided into four subsamples, "*Pre-COVID*," "*COVID Year 1,*" "*COVID Year 2*," and "*COVID Year 3*," to conduct bivariate analyses. Bivariate analyses guided the development of three binary logistic regression models that were selected with modified stepwise selection. The final multivariate model identified predictors of worsening positive symptoms at follow-up for the total sample. Two additional models explored stratified logistic regression models of anti-psychotic use.

Results

40 studies were included in part I of this study. The results revealed that most of the existing research has been conducted with older adults with depression, in the first year of the pandemic, and the investigators studied the effect of social isolation on mood symptoms. In part II of this study, risk of worsening positive symptoms was found to be associated with several variables. Risk factors were present in main effects from the final model and were noted as living in Toronto (AOR=1.41), higher MAPLe (3 – AOR=3.26; 4+ - AOR=6.65) & CHESS (3+ - AOR=1.41) scores, financial trade-offs (AOR=1.43), medication adherence less than 80% of the time (AOR=1.75), and difficulty sleeping (1-2 days – AOR=1.46; daily – AOR = 1.48), indicating that these factors had considerable associations with worsening positive symptoms prior to, and during the pandemic. Less than one hour of exercise in the last three days was considered protective against worsening positive symptoms (AOR=0.85). Delirium and anti-psychotic use remained consistent prior to and during the pandemic in the COVID interactions. Older adults aged 64-75 with a diagnosis of schizophrenia had a AOR of 9.99 (reference = 18-64 and no mental illness). Risk factors varied based on the stratified models by anti-psychotic use.

Conclusion

Existing literature points to the pandemic leading to adverse health outcomes for older adults with mental disorders. Age-related risk factors and mental disorders were found to be of notable concern for worsening of positive symptoms, however, these factors did not appear to be exacerbated due to the COVID-19 pandemic. Future research is still needed to unpack this further.

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I would first like to thank my supervisor, Dr. John Hirdes. John, prior to working with you, I never would have thought I would conduct a large quantitative-based analysis for my thesis – in fact, if someone told me that I would want to work in quantitative analysis, I wouldn't have believed them. But you believed in me and gave me the tools to confidently move forward in my academic career. I truly couldn't have finished my MSc without your support and guidance. I have learned a tremendous amount working alongside you over the past two years, and I want to thank you for your guidance, generosity, and for always challenging me. To my committee members, Dr. Chris Perlman, and Dr. Chi-Ling Joanna Sinn, I couldn't have asked for more supportive and great committee members. Thank you for all of your time, and always meeting this project with excitement. Your guidance, direction, and insights were vital to strengthening my work and expanding my view of this topic.

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Dedication

I want to dedicate this thesis to my husband. Without your love, support, and encouragement go back to school, this would have never happened. Thank you for always believing in me, even when I don’t believe in myself.

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List of Abbreviations

AOR – Adjusted Odds Ratio

CAPs – Clinical Assessment Protocol

CBT – Cognitive Behavioural Therapy

CHESS – Changes in Health, End-stage Disease, Signs, and Symptoms Scale

CIHI – Canadian Institute of Health Information

COR – Crude Odds Ratio

COVID-19/COVID – Coronavirus Disease 2019

COVID Yr 1 – Time between September 1st, 2019, to August 31st, 2020

COVID Yr 2 – Time between September 1st, 2020, to August 31st, 2021

COVID Yr 3 – Time between September 1st, 2021, to August 31st, 2022

C/C-Statistic – Concordance Statistic

DSM – Diagnostic and Statistical Manual of Mental Disorders

interRAI HC – interRAI Home Care

JBI – Joanna Briggs Institute

LHIN – Local Health Integration Network

MAPLe – Method for Assigning Priority Levels

OR – Odds Ratio

PE – Parameter Estimates

Pre-COVID – Time from September 1st, 2018, to August 31st, 2019

P-Value – Probability Value

SE – Standard Error

T1 – Time 1 – Time from September 1st to February 28th/29th

T2 – Time 2 – Time from March 1st to August 31st

95% CI – 95% Confidence Interval

Introduction

From the beginning of 2020, the coronavirus (COVID-19) outbreak spread rapidly around the world (Koenders et al., 2021). By December 26th, 2022, there were 732,358,907 confirmed cases globally of COVID-19, and 6,727,085 deaths (World Health Organization [WHO], 2023). Among Canadians, 4,509,471 contracted the virus and 49,029 died (Government of Canada, 2023). Ontarians accounted for 1,550,088 cases, and 15,667 deaths (Government of Canada, 2023). Older adults aged 60+ years account for the majority of COVID-19 deaths, hospitalizations, and intensive care admissions (Government of Canada, 2023). Since the beginning of the pandemic, older adults were a vulnerable cohort with high-risk of mortality and psychological distress.

In response to the outbreak in Ontario, the provincial government implemented strict measures to minimize the rapid spread of infection, such as the closure of schools, restaurants, fitness centres, and non-essential businesses and restrictions on social gatherings (Strikeman, 2022). Lockdown measures occurred between March 2020 to June 2020, and December 2020 to May 2021 (Strikeman, 2022; Canadian Institute for Health Information [CIHI], 2022). Lockdown measures were dependent upon the number of cases in a given area, therefore there are regional differences in lockdown severity and duration (Strikeman, 2022). Lockdown restrictions protected against infection and reduced the risk of viral transmission as close contact between individuals is minimized (Dalkner et al., 2021). Public health guidelines included self-isolation and quarantine when exposed to someone who tested positive for the virus, or when feeling symptoms of COVID-19 (Gomez et al., 2021). Although lockdowns and quarantines are effective in reducing the spread of the virus, there is evidence to suggest the indirect negative consequences lockdowns have on quality of life, mental health, and overall psychological well-being (Batra et al., 2020, Colucci et al., 2022). The evidence of the association between lockdown and quarantine measures and decreased psychological health is not new. In previous disease outbreaks, such as H1N1 and SARS, individuals who were ill and quarantined from society reported higher rates of psychological symptoms and distress (Brooks et al., 2020; Miller et al., 2021; Gomez et al., 2021). In a sample of SARS survivors, lack of emotional support was reported as a significant predictor of depressive symptoms after hospitals discharge (Wu et al., 2005; Gomez et al., 2021). The negative psychological effects can extend to those who may not have contracted SARS themselves but had a loved one who was infected (Lee et al., 2007; Gomez et al., 2021). Similar distress was found in

COVID-19 research from those who lost a loved one or a close relative was infected with the virus (Rodrígues et al., 2021; López et al., 2022; González-Sanguino et al., 2020; Colucci et al., 2022). SARS survivors also reported moderate- to severe-depressive symptoms one year post outbreak (Lee et al., 2007; Gomez et al., 2021). Colucci et al. (2022) stated that lockdown and quarantine restrictions can affect well-being due to environmental changes and alterations in daily routine. This, in conjunction with the uncertainties of the pandemic, it can induce emotional distress (Colucci et al., 2022; Dalkner et al., 2021).

A myriad of psychological effects has been reported to derive from quarantine and lockdown measures during the COVID-19 pandemic, such as adverse changes in sleep patterns and sleep disturbances (Koenders et al., 2021; Zou et al., 2020; Xu et al., 2022b). Multiple studies have reported that quality of life was significantly lower in older adults with mental illnesses that experience fatigue compared to those who do not (Zou et al., 2020; Xu et al., 2022b). Additional psychological outcomes include lowered self-esteem and helplessness (Stefana et al., 2020; Brooks et al., 2020), as well as an increase in depressive and anxiety symptoms and perceived stress (Dalkner et al., 2021; Betini et al., 2021). These effects have been linked to the impact of social isolation. As social support is an important factor for sustaining health and well-being (Yocum et al., 2021; Leigh-Hunt et al., 2017), social isolation can lead to poor mental health (Barrett et al., 2022; Caponnetto et al., 2021). The literature highlights social isolation being the most significant contributor to an increase in depression and suicide rates in older adults (Gomez et al., 2021; Grolli et al., 2021).

Suicidality and suicidal ideation for older adults experiencing mental disorders increased throughout the pandemic (Rana, 2020; Louie et al., 2021; Liu et al., 2022). Suicidality was found to be common in older adults with clinically stable psychiatric disorders (Liu et al., 2022). Louie et al. (2021) found that this could be due to poor coping strategies and loneliness. Rana (2020) highlighted multiple examples of older adults with mental disorders leaving behind suicide notes after completing suicide. One note from an elderly couple after a relapse of depressive disorder stated, “We are finishing our lives. No one is responsible for this. There has been a tension due to coronavirus. We both were also ill.” (Rana, 2020, p. 1251). Sadly, another example had mentioned only two words “corona fear” (Rana, 2020, p. 1251). There is evidence to suggest that older adults with mental disorders, already physically vulnerable to contracting COVID-19, are also vulnerable to the social consequences of the pandemic (Rana, 2020).

Older adults who live alone, although less likely to be exposed to infection (Rodríguez et al., 2021), may be at risk for psychological distress due to social isolation and lack of social connections (Asthana et al., 2021). Living alone is inherently intertwined with potential social isolation and loneliness, however, lockdown measures may exacerbate these feelings (Orhan et al., 2020; Santini et al., 2020; Armitage & Nellums, 2020). Older adults who considered themselves lonely were 1.65 times more likely to develop depressive symptoms during the pandemic (Alhalaseh et al., 2022). Similarly, in another study it was found that those living alone had higher prevalence of depression compared to those who did not live alone (MacNeil et al., 2023). In a case series conducted by Mehra et al. (2020), as pandemic anxiety increased in older adults with depression, who were otherwise maintaining well, they developed a relapse in depressive symptoms. Specifically in their second case study, this was exacerbated by the individual living alone (Mehra et al., 2020). This individual was maintaining well prior to pandemic restrictions, however the lockdown led to increased social isolation, which in turn increased vulnerability (Mehra et al., 2020). Living alone does not always mean the person is lonely or socially isolated, evidence suggests that older adults could adapt to these situations by maintaining their social networks within the boundaries of physical distancing measures (Kremers et al., 2021). This included seeing loved ones outside and standing apart (Hamm et al., 2020), and keeping in contact through phone calls and emails (Kremers et al., 2021).

Longitudinal research looking at the pandemic effects on older adult psychological health have mixed results. Some studies have argued that age is negatively associated with psychological distress (López et al., 2022; Betini et al., 2021), suggesting that older adults managed better mentally compared to younger adults during the pandemic (Webb & Chen, 2021). However, the consequences depression can have in this age group can be devastating (Webb et al., 2021). The literature suggests that older adults with depression are more likely to experience functional impairment and are at a greater risk for death by suicide or physical disorders (Reynolds & Lupfer, 1999), and they also have disproportionately higher rates of hospital admissions (Webb et al., 2021). Additionally, social isolation and loneliness, along with restrictions in movement and in turn, physical exercising, can be highly dangerous for the mental and physical health of older adults (Petrova et al., 2021). Petrova et al. (2021) note that isolation is associated with a sedentary lifestyle, which directly affects physical health, and can have lasting consequences. Colucci et al. (2022) found the biggest decline in psychological health was found in the oldest-old participants,

and attributed this to a greater likelihood of widowhood, smaller social networks, functional declines, and medical conditions that can prevent engagement in physical activity. The literature points to several pre-existing risk factors for psychological distress and poor mental health amongst older adults, such as female sex, lack of education and low income, being single, living alone, poor life satisfaction, severe physical disease, loneliness, and family history of mental disorders (López et al., 2022; Colucci et al., 2022; Petrova et al., 2021).

Literature that focused on older adults with pre-existing mental illnesses throughout the COVID-19 pandemic is sparse. Evidence about older adults experiencing severe mental disorders, such as bipolar disorder and schizophrenia, can be difficult to find. But there is some evidence to suggest that older adults with schizophrenia or other psychiatric disorders could be threatened by social distancing, as the stress from social isolation could alter behavioural and neurochemical responses (Webb et al., 2021). Research on the pandemic and individuals with schizophrenia primarily focused on a younger sample. In their study of younger patients with psychotic disorders, participants experienced worsening positive symptoms during the beginning of the pandemic, specifically with hallucinations (Barrett et al., 2022). Hallucinations, delusions, and abnormal thought processes are known as positive or psychotic symptoms, and to be diagnosed with schizophrenia, at least one of these symptoms should be experienced (Caponnetto et al., 2021). Psychotic symptoms were found to worsen during the pandemic from individuals who experienced insufficient treatment, increased alcohol use, worry about the pandemic consequences, loneliness, and insomnia (Barrett et al., 2022). Not all schizophrenia and pandemic-related research reached this conclusion, for example, Pinkham et al. (2020) found no change in psychotic symptoms, rather they found an increase in overall well-being from individuals with a diagnosis of schizophrenia. Although research on positive symptoms worsening due to the pandemic in those with schizophrenia seem to be mixed, it was found that people suffering from schizophrenia may be more vulnerable to adverse consequences from contracting COVID (Caponnetto et al. 2021). Caponnetto et al. (2021) found that more than 70 percent of their patients with schizophrenia had at least one other clinical condition, such as heart disease, chronic lung disease, or type-2 diabetes. Thus, older adults with a diagnosis of schizophrenia and other health-related comorbidities, are a vulnerable population to COVID mortality, and this could potentially exacerbate their symptoms of distress.

Research Questions and Hypotheses

Part I: Rapid Review

The specific aim of the first part of this thesis is to conduct a rapid review to search and critically appraise current literature focusing on the pandemic experience of older adults with mental disorders. This aim is intentionally broad to search what has been done and identifying potential gaps. The term 'mental illness' is encompassing of all potential mental illnesses. The following are the rapid review research questions:

1. What are the experiences of older adults with mental or psychiatric illnesses throughout the pandemic?
2. What outcomes have been researched in this realm? (e.g., depressive symptoms, mortality, etc.).

I hypothesize that the majority of the pandemic research has been conducted on older adults with pre-existing depression and anxiety, rather than bipolar disorder and schizophrenia. Those with severe mental illnesses have lower prevalence rates, and lower life expectancies when compared to the general population (Wildgust et al., 2010), thus I think the focus will be on older adults with depression, and/or anxiety. Additionally, I hypothesize that the majority of outcomes will be focused on symptoms of mental illnesses, such as depressive and anxiety symptoms.

Part II: Logistic Regression – Odds of Worsening Positive Symptoms

The specific aim of the second part of this thesis is to explore and understand the changes in positive symptoms during the COVID-19 pandemic among older adults experiencing mental disorders and receiving home care in Ontario. Additionally, this thesis aims to explore the risk factors associated with worsening positive symptoms. The following research questions will be addressed to capture these objectives:

1. What factors were predictive of worsening positive symptoms prior to and during three years of the COVID-19 pandemic?
2. Did older adults with a diagnosis of mental disorder experience worse worsening positive symptoms compared to those in the general home care population?

I hypothesize that factors considered predictive of worsening positive symptoms will be similar to risk factors noted in the literature for psychological distress. Furthermore, I think the pandemic may have led to worsening positive symptoms, compared to pre-COVID, due to social isolation experienced from lockdown restrictions. I also hypothesize that those with a diagnosed mental

disorder will experience worse positive symptoms compared to those without a diagnosed mental disorder. As hallucinations, delusions, and abnormal thought processes are listed as symptoms needed for a diagnosis of schizophrenia (Caponnetto et al., 2021), I hypothesize that older adults with schizophrenia will experience the greatest odds in worsening positive symptoms. In addition, I think that older adults with depression, anxiety, or bipolar disorder might also experience greater odds of worsening positive symptoms compared to the no mental illness group.

Part I: Rapid Review

Rapid Review Methods

A rapid review uses systematic review methods to search, and critically appraise existing research within an accelerated timeframe (Grant & Booth, 2009). To shorten the time scale, several techniques can be used, such as focused research questions, broader search strategies, and conducting a review of reviews (Grant & Booth, 2009). The research question for this review derived from the need to better understand the literature surrounding older adults with mental illnesses and their experiences throughout the COVID-19 pandemic.

Inclusion/Exclusion Criteria

The following inclusion criteria were applied: 1) the study population focused on older adults aged 50 and older, 2) studies that occurred during the COVID-19 pandemic (2020-2023) and considered the effect of the pandemic on the study population, and 3) the study population had a diagnosis of a pre-existing mental disorder. The following exclusion criteria were applied: 1) study population was not older adult specific, 2) study did not occur during the COVID-19 pandemic, and 3) the study population did not have a pre-existing diagnosis of a mental disorder.

Search Strategy

Five electronic databases (PubMed, MEDLINE, Scopus, CINAHL, and PsycINFO) were searched in February 2023. Database search was restricted to studies only published from 2020 to 2023. Key words/phrases used included: older adult; elderly; aging; and/with mental illness; mental disorder; depression; anxiety; bipolar disorder; schizophrenia; DSM; psychiatry; psychiatric disorder; psychiatric illness; and COVID-19; pandemic; coronavirus. Search result articles were uploaded into Covidence (Covidence, 2023) for article screening, full-text screening, and data extraction. Scrutiny of reference lists of relevant articles in addition to the database searches was conducted and included in the review.

Assessment of Study Quality

The quality of each of the studies included in this review was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklists. JBI is a leading international organization that promotes and supports evidence-based decisions that improve health (JBI, 2023). They offer several critical appraisal tools and reviewer manuals designed to assess the quality, relevance, trustworthiness, and results of published papers (JBI, 2023). As this review includes all study designs and systematic reviews, the following critical appraisal tools were used: analytical cross-sectional studies, case control studies, case reports, case series, cohort studies, qualitative research, systematic review, and text and opinion.

Rapid Review Results

Article Selection

Once duplicates were removed, the initial search yielded 8,030 articles. A total of 7,748 studies were excluded after the title and abstract screening. Reasons for article exclusion at this stage included: no mention of a mental disorder or psychiatric disorder, not COVID-19 related, and not older adult specific. After title and abstract screening, 274 articles remained for a full-text review. The full-text review yielded 38 articles that met the study's inclusion and underwent data extraction. Reasons for article exclusion after the full-text review were: studied symptoms of mental illness (e.g., depressed mood) rather than mental disorder (71%), general study population as opposed to focusing on older adults (14%), mental health service utilization (6%), the article was unavailable (5%), or the study focused on older adults without a pre-existing diagnosis, but were diagnosed with a mental illness during COVID (4%). The 38 included articles reference lists were reviewed, and 62 articles were gathered for full-text screening. Of those additional 62 articles, only two articles met inclusion criteria. 39 articles did not include a diagnosis of a mental disorder, 20 articles were not focused on the older adult population, and one article did not consider the COVID-19 pandemic. Further details of the process of article selection can be found in ***Figure 1***.

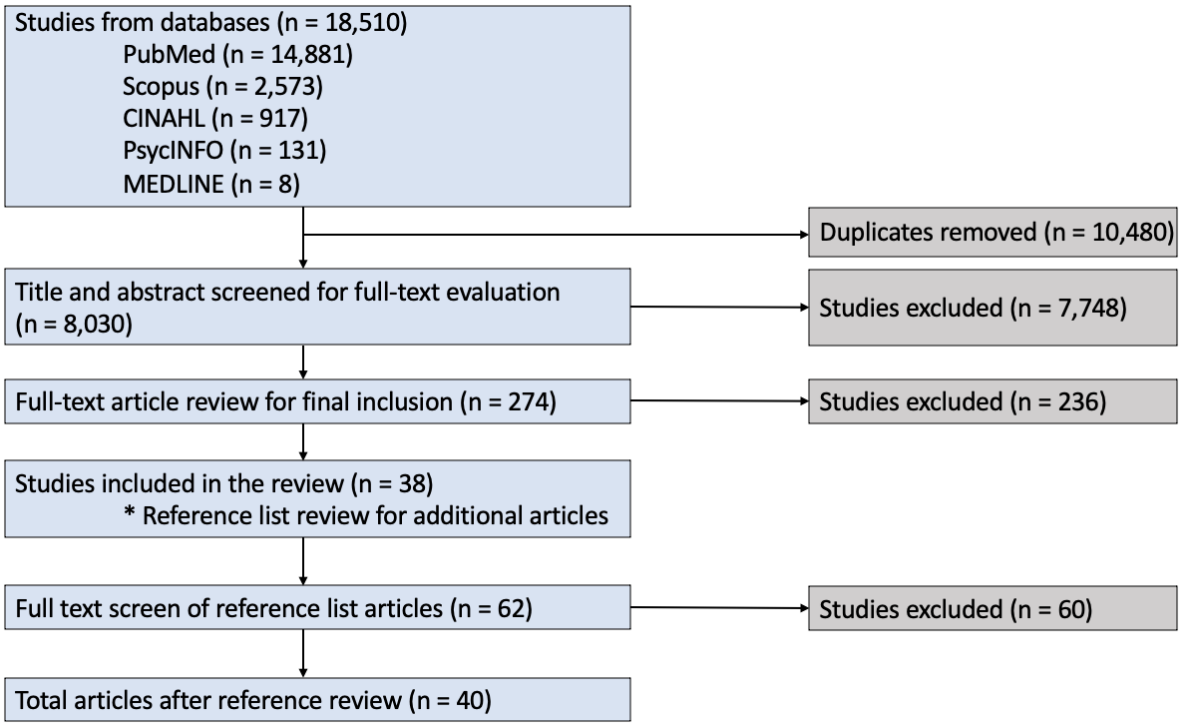

Figure 1. Flow chart of articles identified at each stage of the rapid review

Description of the Studies Included

Table 1 provides summary characteristics for systematic reviews and letter to the editor and opinion pieces included in this review. ***Table 2*** provides summary characteristics for all remaining studies included in this review.

Of the 40 articles, 13 articles were published in 2020 (Penteado et al., 2020; Mehra et al., 2020; Zou et al., 2020; Lee et al., 2020; Hamm et al., 2020; Orhan et al., 2020; Nizama-Vía et al., 2020; Danilewitz et al., 2020; Batra et al., 2020, Serafini et al., 2020; Zhao et al., 2020; Rana, 2020), 11 articles were published in 2021 (Li et al., 2021; Seethaler et al., 2021; Johnco et al., 2021; Louie et al., 2021; Asthana et al., 2021; Almeida et al., 2021; Petrova et al., 2021; Gomez et al., 2021; Grolli et al., 2021; Deshpande et al., 2021; Ayalon et al., 2021; Chen et al., 2021), 13 articles were published in 2022 (Simkin et al., 2022; Fahed et al., 2022; Li et al., 2022; Grohé et al., 2022; Orhan et al., 2022; MacNeil et al., 2022; Miklitz et al., 2022; Curran et al., 2022; Xu et al., 2022a; Liu et al., 2022; Xu et al., 2022b; Dell et al., 2022; Webb et al., 2022), and three articles were published in 2023 (MacNeil et al., 2023; Pongan et al., 2023; Abdulrahman et al., 2023).

The study locations varied in the 40 included articles. Eight articles were located in the United States (Fahed et al., 2022; Xu et al., 2022a; Hamm et al., 2020; Asthana et al., 2021; Dell

et al., 2022; Gomez et al., 2021; Batra et al., 2020; Webb et al., 2022). Six articles were from China (Li et al., 2022; Li et al., 2021; Zou et al., 2020; Liu et al., 2022; Xu et al., 2022b; Zhao et al., 2020). Five articles were from the United Kingdom (Simkin et al., 2022; Nizama-Vía et al., 2020; Deshpande et al., 2021; Chen et al., 2021; Adbulrahman et al., 2023). Four articles were from Canada (MacNeil et al., 2023; MacNeil et al., 2022; Danilewitz et al., 2022; Ayalon et al., 2021). Three articles were from Australia (Curran et al., 2022; Johnco et al., 2021; Almeida et al., 2021), and Germany (Grohé et al., 2022; Miklitz et al., 2022; Seethaler et al., 2021). Two articles were found from Brazil (Penteado et al., 2020; Grolli et al., 2021), the Netherlands (Orhan et al., 2022; Orhan et al., 2020), and India (Mehra et al., 2020; Rana, 2020). One article was found from Russia (Petrova et al., 2021), France (Pongan et al., 2023), Italy (Serafini et al., 2020), Hong Kong (Louie et al., 2021), and South Korea (Lee et al., 2020).

The study designs varied among included articles. 11 study designs were cohort studies (Simkin et al., 2022; MacNeil et al., 2023; Orhan et al., 2022; MacNeil et al., 2022; Curran et al., 2022; Seethaler et al., 2021; Lee et al., 2020; Xu et al., 2022a; Johnco et al., 2021; Orhan et al., 2020; Chen et al., 2021). Nine study designs were cross-sectional (Li et al., 2022; Pongan et al., 2023; Penteado et al., 2020; Li et al., 2021; Miklitz et al., 2022; Zou et al., 2020; Liu et al., 2022; Xu et al., 2022b; Nizama-Vía et al., 2020). Eight studies were letters to the editors, or opinion pieces (Almeida et al., 2021; Dell et al., 2022; Danilewitz et al., 2020; Webb et al., 2022; Serafini et al., 2020; Zhao et al., 2020; Rana, 2020; Ayalon et al., 2021). Four studies were case series or case reports (Fahed et al., 2022; Mehra et al., 2020; Asthana et al., 2021; Deshpande et al., 2021), and systematic reviews (Petrova et al., 2021; Gomez et al., 2021; Batra et al., 2020; Grolli et al., 2021). Two studies were mixed method (Hamm et al., 2020; Abdulrahman et al., 2023). One study was qualitative (Grohé et al., 2022), and one study was case control (Louie et al., 2021).

Of the 40 included articles, 21 articles considered a large variety of mental illnesses (Simkin et al., 2022; Fahed et al., 2022; Li et al., 2022; Pongan et al., 2023; Penteado et al., 2020; Li et al., 2021; Miklitz et al., 2022; Curran et al., 2022; Seethaler et al., 2021; Lee et al., 2020; Xu et al., 2022a; Johnco et al., 2021; Liu et al., 2022; Asthana et al., 2021; Nizama-Vía et al., 2020; Dell et al., 2022; Petrova et al., 2021; Webb et al., 2022; Grolli et al., 2021; Serafini et al., 2020; Chen et al., 2021; Abdulrahman et al., 2023; Ayalon et al., 2021). Eight articles focused primarily on a diagnosis of depression (Gomez et al., 2021; Louie et al., 2021; Hamm et al., 2020; Mehra et al., 2020; MacNeil et al., 2022; MacNeil et al., 2023; Grohé et al., 2022; Rana, 2020). Six articles

did not specify which mental disorder was the focus (Zhao et al., 2020; Danilewitz et al., 2020; Xu et al., 2022b; Zou et al., 2020; Deshpande et al., 2021). Three articles focused specifically on bipolar disorder (Orhan et al., 2020; Almeida et al., 2021; Orhan et al., 2022). Two articles looked at mental illnesses other than depression, anxiety, bipolar disorder, and schizophrenia (Fahed et al., 2022; Penteado et al., 2020).

Critical appraisal scores varied substantially across the 40 included studies in this review. All studies were included in the review, regardless of critical appraisal score – the critical appraisal score is provided in the last column in ***Table 1*** and ***Table 2*** for each article. Note that the critical appraisal tool used was dependent upon the study design, thus different articles had different scoring systems. It should also be noted that systematic reviews with lower scores are because these articles, although providing substantial information, did not specify their literature search strategy.

Table 1. Summary of literature reviews and opinion pieces/letter to the editors included in the review (n = 12)

Authors, Year, and Location	Study Design	Mental Illness	Outcome/Focus	JBI Critical Appraisal Score
Almeida, Jimenez, Rej, Eyler, Sajatovic, & Dols 2021 Australia	Letter to the editor, opinion piece, commentary.	Bipolar disorder.	Commentary on possible complications (direct impact, resource restriction, interrupted care, and delayed consequences) of the COVID-19 pandemic among older adults with bipolar disorder, and mitigating measures.	5/6.
Dell, Sasaki, Stewart Murphy, & Klier 2022 United States	Letter to the editor, opinion piece, commentary.	Older adults with serious mental illnesses such as schizophrenia, bipolar disorder, and major depressive disorder.	Commentary on service needs of older adults with serious mental illness.	4/6.
Petrova & Khvostikova 2021 Russia	Systematic review.	Broadly speaks to mental disorders, specifically mentions major depressive disorder, anxiety, post-traumatic stress disorder, and	Prevalence and risk factors for mental disorders in older people.	3/11.

		cognitive impairment.		
Danilewitz, Ainsworth, Bahji, Chan, & Rabheru 2020 Canada	Letter to the editor, opinion piece, commentary.	Not specified.	Commentary on the challenges and opportunities for virtual psychiatric care for older adults.	4/6.
Gomez, Ridley, & Hernandez 2021 United States	Systematic review.	Depression.	The effect of COVID-19 on depression and suicide risk in older adults.	2/11.
Batra, Morgan, & Sharma 2020 United States	Systematic review.	Depression, anxiety, and post-traumatic stress disorder.	Effects of social isolation and loneliness on the psychological health of older adults.	2/11.
Webb & Chen 2022 United States	Letter to the editor, opinion piece, commentary.	Broadly speaks to pre-existing mental health disorders – anxiety, sleep disorders, obsessive-compulsive disorder, schizophrenia, psychosis, and neuropsychiatric disorders.	Commentary on coping strategies and opportunities for improvement on older adults' mental health during the pandemic.	6/6.
Grolli, Mingoti, Bertollo, Luzardo, Quevedo, Réus, & Ignácio 2021 Brazil	Systematic review.	Major depressive disorder, anxiety, and Alzheimer's disease.	Effects of COVID-19 in the mental health in older adults with mental health disorders.	2/11.
Serafini, Bondi, Locatelli & Amore 2020 Italy	Letter to the editor, opinion piece, commentary.	Mental disorders broadly, but speaks to major depression, psychiatric disorders.	Commentary on experience of Northern Italy psychiatric hospitals and older adults with mental disorders.	5/6.
Zhao, Jian, & Li 2020 China	Letter to the editor, opinion piece, commentary.	Not specified.	Commentary on experience of measures on effective prevention and control of the COVID-19 pandemic in a psychogeriatric ward.	5/6.
Rana 2020 India	Letter to the editor, opinion piece, commentary.	Depression.	Commentary suggesting that family interventions with social cohesion could lead to improving the mental health of	6/6.

			older adults, which can be resiliency. Suicide cases of older adults can be observed more when they experience loneliness.	
Ayalon, Peisah, De Mendonça Lima, Verbeek, & Rabheru 2021 Canada	Letter to the editor, opinion piece, commentary.	Not specified.	The aim of the paper was to articulate the International Psychogeriatric Association and the World Psychiatric Association Section of Old Age Psychiatry response to the call of the Independent Expert on the enjoyment of all human rights by older persons. Older people with mental health conditions and long-term care residents have been particularly affected by ageism and discrimination during the pandemic.	5/6.

Table 2. Summary of study characteristics from cohort, cross-sectional, case reports, case series, qualitative, and mixed method study designs included in the review (n = 28)

Authors, Year, and Location	Study Design	Participants (age, number, setting)	Mental Illness	Outcome/Focus	JBI Critical Appraisal Score
Simkin, Yung, Greig, Perera, Tsmakis, Rizos, Stewart, Velayudhan, & Mueller 2022 United Kingdom	Cohort study.	Age: Mean age = 77.9 (SD 9.5) n = 1,991 Setting: Community dwelling	Dementia, psychotic illness, affective disorder, and delirium.	Presentation of psychosis during the first UK COVID-19 lockdown to mental health services for older adults. There were fewer referrals during lockdown but a higher proportion of presentations with psychotic symptoms.	6/11.
Fahed, Barron, & Steffens 2022 United States	Case report.	Age: 62-year-old, & 83-year-old n = 2 Setting: In-patient psychiatry	Narcissistic personality disorder, and Alzheimer's disease.	Inpatient psychiatry for older adults and measures taken to decrease the risk of transmission and improving screening for infection in older adults.	5/8.
Li, Zhao, Yan, Xu, Wang, Li, Du, Zhang, Zhang, Cheung,	Cross-sectional.	Age: 50+ n = 1,063	Major depressive disorder, schizophrenia, organic mental	Influential nodes of psychiatric problems and their associations. Depression was the most	6/8.

Ungvari, Ng, & Xiang 2022 China		Setting: Outpatients from psychiatric hospitals	disorder, or other psychiatric diagnosis.	influential node followed by anxiety. Attention should be paid to depression and its associations with anxiety, insomnia, and fatigue in the screening and treatment of mental health problems.	
Grohé, Gellert, Phil, & Kessler 2022 Germany	Qualitative research.	Age: 60+ n = 20 Setting: Community dwelling and receiving home care services	Clinical depression.	Experience of community dwelling older adults with clinical depression throughout the COVID-19 pandemic. Community dwelling older adults with depression experienced loneliness but also relief during the pandemic.	10/10.
MacNeil, Li, Jiang, de Groh, & Fueller-Thomson 2023 Canada	Cohort study.	Age: Mean age = 61.3 (SD 9.0) n = 2,017 Setting: Community dwelling	Depression.	Incident and recurrent depression among older Canadian adults with asthma during the COVID-19 pandemic. Among older adults with a history of depression, approximately 50% experienced a recurrence of depression. The risk of incident and recurrent depression was higher among those who were lonely, experiencing family conflict, or who had difficulty accessing healthcare during the pandemic.	8/11.
Orhan, Korten, Kok, Loef, Kupka, Schouws, van Oppen, & Dols 2022 The Netherlands	Cohort study.	Age: 50+ T0 n = 81 T1 n = 81 T2 n = 66 T3 n = 51	Bipolar disorder.	Psychiatric symptoms in older adults with bipolar disorder during the COVID-19 pandemic. Depressive, manic and anxiety symptoms increased over all timepoints.	8/11.

		Setting: Unspecified			
MacNeil, Birk, Villeneuve, Jiang, Groh, & Fueller-Thomson 2022 Canada	Cohort study.	Age: 50+ n = 22,622 Setting: Unspecified	Depression.	The odds of depression during COVID-19 across a series of risk factors. Individuals with a history of depression had 4x times the risk of depression during the pandemic when compared to those without a history of depression.	9/11.
Pongan, Rouch, Herrmann, Perrot, Lebrun-Givovis, Spirli, Briollet, Saint Martin, Laurent, Bachelet, Haouari, Buisson, Edjolo, & Dorey 2023 France	Cross-sectional.	Age: Mean age = 77.14 (SD 7.08) n = 117 Setting: Out-patient from psychiatric hospital	Schizophrenia, schizotypal, delusional disorder, affective disorder, bipolar disorder, neurotic, stress-related, somatoform disorder, anxiety, personality disorder, & unspecified.	Anxiety symptoms during the COVID-19 pandemic. It was found that coping strategies, living conditions, and personality was associated with generalized anxiety.	7/8.
Penteado, Loureiro, Pais, Carvalho, Sant'Ana, Valiengo Stella, & Forlenza 2020 Brazil	Cross-sectional.	Age: Mean age = 76.8 (SD 8.7) n = 71 Setting: Community dwelling	Pre-existing neuropsychiatric disorders, and aging adults with Down syndrome.	Mental health status (anxiety and depressive symptoms, biological and behavioural symptoms) and caregiver distress during the pandemic. Sleep disorders, psychoses, and apathy were the main psychopathological domains, which determined caregiver burden worsening.	5/8.
Li, Zhao, Yan, Zou, Wang, Li, Xu, Du, Zhang, Zhang, Cheung, Ungvari, Ng, & Xiang 2021	Cross-sectional.	Age: Mean age = 62.8 (SD 9.4) n = 1,063 Setting: Out-patient from	Major depressive disorder, schizophrenia, organic mental disorder, and others.	Prevalence of depressive and anxiety symptoms and their association with quality of life among clinically stable older patients with a psychiatric diagnosis.	5/8.

China		psychiatric hospitals		Depressive symptoms was positively associated with severe insomnia, and pain, while anxiety symptoms was positively associated with physical diseases, poor adherence to treatment, more severe insomnia and pain.	
Miklitz, Westereicher, Lippold, Ochs, Schneider, & Fliessbach 2022 Germany	Cross-sectional.	Age: 60+ n = 219 Setting: Out-patients from department for neurodegenerative diseases and psychogeriatrics	Dementia, subjective cognitive impairment/mild cognitive impairment, mood disorders, and others.	Impact of COVID-19 related distress on depression, anxiety, and quality of life levels. The prevalence of symptoms of depression and anxiety were high. But findings indicate that psychogeriatric patients are not significantly affected by pandemic concerns but suffering from emotional consequences from changed living conditions due to the pandemic.	6/8.
Curran, Nalder, Koye, Hocking, Coulson, Khlaid, Loi, & Lautenschlager 2022 Australia	Cohort study.	Age: 65+ n = 91 Setting: Residential aged care	Schizophrenia spectrum disorders, affective/anxiety disorders, and neurocognitive disorders.	Changes in mental health symptoms throughout the pandemic for residents already living with mental illnesses. They found no clinically relevant evidence of worsening mental health during the pandemic.	6/11.
Mehra, Rani, Shaoo, Parveen, Singh, Chakrabarti, & Grover 2020 India	Case report.	Age: 72-year-old, & 60-year-old n = 2 Setting: Emergency services in hospital	Recurrent depressive disorder.	Relapse in symptoms due to COVID-19 anxiety. Availability of excessive COVID information in the media, especially the consequences of infection in older adults, led to development of anxiety. Both patients, who were maintaining well, developed a relapse of symptoms.	5/8.

Seethaler, Just, Stötzner, Bermpohl & Brandl 2021 Germany	Cohort study.	Age: 60+ n = 32 Setting: Current or former patients from a psychiatric university hospital	Affect or anxiety disorders.	Psychosocial impact of the COVID-19 pandemic. Older psychiatric patients show a negative psychosocial impact of the pandemic and are likely to suffer from an impaired psychosocial situation.	4/11.
Zou, Liu, Yan, Wang, Li, Xu, Du, Zhang, Jackson, Ungvari, & Xiang 2020 China	Cross-sectional.	Age: 50+ n = 1,063 Setting: Outpatient geriatric psychiatry clinics	Unspecified – need a diagnosis with a psychiatric disorder.	Prevalence of fatigue and its associations with quality of life and depressive symptoms among older psychiatric patients during the COVID-19 pandemic. More severe depressive symptoms, insomnia symptoms, and pain were significantly associated with fatigue.	5/8.
Lee, Cho, You, Park, Kim, Lee, Aizenstein, Andreescu, Karim, Hong, Rho, Park, & Son 2020 South Korea	Cohort study.	Age: 65+ n = 781 Setting: Unspecified	Mixture of a variety of different mental illnesses.	Mortality from COVID-19. The mental disorder group showed higher mortality rates but was not statistically significant.	8/11.
Xu, Li, Mehta, Hommel, & Goodwin 2022a United States	Cohort study.	2019 n = 5,200,041 2020 n = 5,140,619 2021 n = 4,889,053 Setting: Community and nursing homes.	Depression, anxiety, bipolar disorder, and schizophrenia.	Mortality from COVID-19 among Medicare beneficiaries with psychiatric diagnoses. Patients with psychiatric diagnoses had more excess deaths than those without a psychiatric diagnosis. The largest increases in mortality risks were observed among patients with schizophrenia and bipolar disorder.	9/11.

Johnco, Chen, Muir, Strutt, Dawes, Siette, Dias, Hillebrandt, Maurice, & Wuthrich 2021 Australia	Cohort study.	Age: 66+ n = 37 Setting: Community dwelling	Anxiety and/or unipolar depression.	Long-term symptom relapse rates among older adults previously treated with CBT for anxiety and/or depression during COVID-19. CBT might be a protective factor in coping with life stressors years after treatment ends.	3/11.
Hamm, Brown, Karp, Lenard, Cameron, Dawdani, Lavretsky, Miller, Mulsant, Pham, Reynolds, Roose, & Lenze 2020 United States	Mixed method.	Age: 60+ n = 73 Setting: Community dwelling	Major depressive disorder.	COVID-19 impacts or older American adults with pre-existing depression. Majority of participants with pre-existing depression showed resilience in the first two months of the pandemic, but there is concerns about the future.	7/10.
Liu, Xu, Zou, Li, Wang, Yan, Du, Zhang, Zhang, Li, Cheung, Ungvari, Ng, & Xiang 2022 China	Cross-sectional.	Age: 50+ n = 1,063 Setting Outpatients from psychiatric hospitals	Major depressive disorder, and other psychiatric diagnoses.	Prevalence of suicidality, and its association with quality of life. Poor treatment adherence, perceived illness worsening during the pandemic, and being diagnosed with depression was associated with higher risk of suicidality.	6/8.
Louie, Chan, & Cheng 2021 Hong Kong	Case-control.	Age: 60+ n = 64 Setting: Psychiatric clinics or inpatient wards	Depression.	Suicidal risk during the COVID-19 pandemic. Older adults with late-life depression are at increased suicidal risk. Important risk factors for suicidal ideation are coping efficacy and loneliness.	7/10.
Xu, Li, Zou, Li, Wang, Yan, Du, Zhang, Zhang, Cheung, Ungvari,	Cross-sectional.	Age: 50+ n = 941	Not specified – principal diagnosis of any type of	Sleep disturbances and associations with depressive symptoms and quality of life in older psychiatric patients	6/8.

& Xiang 2022b China		Setting: Outpatient department of psychiatric hospitals	psychiatric disorder.	during the COVID-19 pandemic. Sleep disturbances were associated with severe depressive symptoms. Compared to patients with major depressive disorder, older adults with other psychiatric diagnoses had a significantly higher prevalence of sleep disturbances.	
Asthana, Mehaffey, & Sewell 2021 United States	Case report.	Age: 66-year-old's n = 2 Setting: Psychiatric department in hospital	Major depressive disorder and schizoaffective disorder.	Report of significant worsening in their psychiatric illness, summary of literature on psychosocial stresses and biological factors on mental health and well-being of older adults.	6/8.
Orhan, Korten, Paans, de Walle, Kupka, van Oppen, Kko, Sonnenberg, Schouws, & Dols 2020 The Netherlands	Cohort study.	Age: 50+ n = 81 Setting: Unspecified	Bipolar disorder.	Psychiatric symptoms during the COVID-19 outbreak in older adults with bipolar disorder. Patients experienced less psychiatric symptoms during the pandemic than at baseline. Not having children, loneliness, passive coping style, and neuroticism were associated with more psychiatric symptoms.	4/11.
Nizama-Vía, Alonso-Sánchez, & Serra-Mestress 2020 United Kingdom	Cross-sectional.	Age: 70+ n = 17 Setting: Psychiatric ward	Affective and psychotic disorders.	Experiences of an acute old age psychiatric ward in the early stages of the COVID-19 pandemic. 64.7% presented with COVID symptoms between March 30th to April 30th, 2020.	4/8.
Deshpande & Livingstone 2021	Case series.	Age: 71-year-old 62-year-old 69-year-old	Unspecified – states psychotic illness.	This case series outlines the clinical presentation of first-onset psychosis in	8/10.

United Kingdom		n = 3 Setting: Hospital		three older adults. The authors postulate that these COVID-19-related psychoses are different compared to psychoses prior to the pandemic.	
Chen, Jones, Underwood, Fernandez-Egea, Qin, Lewis, & Cardinal 2021 United Kingdom	Cohort study.	Age: 65+ n = 3,073 Setting: Unspecified	Severe/serious mental illness, depression, anxiety, eating disorders, personality disorders	During lockdown people with dementia or severe mental illness had a higher risk of death without confirmed COVID-19.	10/11.
Abdulrahman, Al-Balushi, Holdcroft-Long, Khan, Ravindran, Das, & Rajkumar 2023 United Kingdom	Mixed methods.	Age: 65+ n = 81 Setting: In-patient psychiatry settings	Depression, dementia, mild cognitive impairment, Parkinson's disease, & schizophrenia.	Although nearly 30% of participants were asymptomatic, there was high COVID-19-related mortality. Vitamin-D deficiency, anticholinergic burden, and isolation policies within psychiatric wards were significantly related to COVID-19-related deaths. In qualitative interviews, participants emphasized the importance of local support networks, and making vaccine centers more accessible.	7/10.

Of the 28 studies presented in ***Table 2***, majority of respondents were gathered from geriatric psychiatric services. One article was conducted with inpatients and outpatients from a psychiatric hospital (Seethaler et al., 2021). Seven articles referred to recruiting participants from out-patient psychiatric services (Li et al., 2021; Li et al., 2022; Zou et al., 2020; Liu et al., 2022; Xu et al., 2022b; Miklitz et al., 2022; Pongan et al., 2023; Deshpande et al., 2021), and six articles referred to community dwelling participants (Simkin et al., 2022; Grohé et al., 2022; MacNeil et al., 2023; MacNeil et al., 2022; Penteado et al., 2020). Seven articles referred to in-patient psychiatric services (Fahed et al., 2022; Mehra et al., 2020; Louie et al., 2021; Asthana et al., 2021; Nizama-Vía et al., 2020; Deshpande et al., 2021; Adbulrahman et al., 2023). One article referred to

residential aged care (Curran et al., 2022) and one article referred to participants from both in the community and in nursing homes (Xu et al., 2022a; Johnco et al., 2021; Hamm et al., 2021). Lastly, five articles did not specify where participants were located (Orhan et al., 2022; Lee et al., 2020; Orhan et al., 2022; Chen et al., 2021). 15 studies included a sample size $\leq$ 100 (Fahed et al., 2022; Mehra et al., 2020; Asthana et al., 2021; Deshpande et al., 2021; Grohé et al., 2022; Seethaler et al., 2021; Johnco et al., 2021; Nizama-Vía et al., 2020; Orhan et al., 2022; Orhan et al., 2020; Penteado et al., 2020; Curran et al., 2022; Hamm et al., 2020; Louie et al., 2021; Adbulrahman et al., 2023), whereas nine of the articles have a sample size $\geq$ 1,000 (Simkin et al., 2022; Li et al., 2022; MacNeil et al., 2023; MacNeil et al., 2022; Li et al., 2021; Zou et al., 2020; Liu et al., 2022; Chen et al., 2021; Xu et al., 2022a). Four studies utilized the same dataset with different research objectives (Li et al., 2022; Li et al., 2021; Zou et al., 2020; Liu et al., 2022). Similarly, these two studies also used the same dataset with different research objectives (MacNeil et al., 2023; MacNeil et al., 2022). 17 studies reported that their findings may not be generalizable either due to their sample being clinically stable psychiatric patients (Xu et al., 2022b; Liu et al., 2022; Zou et al., 2020; Li et al., 2021; Li et al., 2022), study setting not being generalizable in other settings or populations (Adbulrahman et al., 2023; Grohé et al., 2022; MacNeil et al., 2023; MacNeil et al., 2022; Pongan et al., 2023; Miklitz et al., 2022; Curran et al., 2021; Chen et al., 2021) or the study sample is too small to generalize (Orhan et al., 2022). Johnco et al. (2020) noted that their study took place early in the pandemic, and findings should be generalized with caution. Several studies did not mention generalizability in their findings (Simkin et al., 2022; Fahed et al., 2022; Penteado et al., 2020; Mehra et al., 2020; Lee et al., 2020; Xu et al., 2022a; Hamm et al., 2020; Louie et al., 2021; Asthana et al., 2021; Nizama-Vía et al., 2020; Deshpande et al., 2021).

Of the 28 included articles in ***Table 2***, 10 studies used electronic records to collect the data for their study (Adbulrahman et al., 2023; Simkin et al., 2022; Orhan et al., 2022; Pongan et al., 2023; Penteado et al., 2020; Curran et al., 2021; Lee et al., 2020; Xu et al., 2022a; Orhan et al., 2020; Chen et al., 2021). Two studies followed up with participants in the electronic records to conduct a survey (Pongan et al., 2023; Penteado et al., 2020). The remaining 17 articles conducted a standard research design (Fahed et al., 2020; Li et al., 2022; Grohé et al., 2022; MacNeil et al., 2023; MacNeil et al., 2020; Li et al., 2021; Miklitz et al., 2022; Mehra et al., 2020; Seethaler et al., 2021; Zou et al., 2020; Johnco et al., 2020; Hamm et al., 2020; Liu et al., 2022; Louie et al., 2021; Xu et al., 2022b; Asthana et al., 2021; Nizama-Vía et al., 2020; Deshpande et al., 2021). 22

of the studies were clinical samples, (Adbulrahman et al., 2023; Simkin et al., 2022; Fahed et al., 2020; Li et al., 2022; Grohé et al., 2022; Orhan et al., 2022; Pongan et al., 2023; Penteado et al., 2020; Li et al., 2021; Miklitz et al., 2022; Curran et al., 2021; Mehra et al., 2020; Seethaler et al., 2021; Lee et al., 2020; Johnco et al., 2020; Hamm et al., 2020; Louie et al., 2021; Xu et al., 2022b; Asthana et al., 2021; Orhan et al., 2020; Nizama-Vía et al., 2020; Deshpande et al., 2021), and the remaining studies were sampled from the general population (MacNeil et al., 2022; MacNeil et al., 2023; Lee et al., 2020; Xu et al., 2022a; Louie et al., 2021; Chen et al., 2021).

Description of Outcomes Measured

Sixteen studies evaluated a change in symptoms of mental illnesses, such as depressive or anxiety symptoms, that were experienced by older adults studied during the pandemic (Li et al., 2022; MacNeil et al., 2023; Orhan et al., 2022; MacNeil et al., 2022; Pongan et al., 2023; Penteado et al., 2020; Li et al., 2021; Miklitz et al., 2022; Curran et al., 2022; Mehra et al., 2020; Seethaler et al., 2021; Zou et al., 2020; Johnco et al., 2021; Xu et al., 2022b; Asthana et al., 2021; Orhan et al., 2020). MacNeil et al. (2022) found that older adults with a pre-existing history of depression had four times the risk of depressive symptoms during the pandemic compared to those without a history of depression. Older adults with bipolar disorder experienced greater levels of depressive, manic, and anxiety symptoms throughout the pandemic (Orhan et al., 2022). In their study on a variety of mental disorders, Li et al. (2021) found that 62.3% experienced depressive symptoms, 52.4% experienced anxiety symptoms, and 45.9% experienced both. Additionally, they found that depressive symptoms were associated with more severe insomnia (OR = 1.29) and pain (OR = 1.14), and anxiety symptoms were associated with severe physical disease, (OR = 1.57) poor adherence to treatment (OR = 1.50), severe insomnia (OR = 1.15) and pain (OR = 1.11) (Li et al., 2021). Two studies focused on depressive symptoms and their association with fatigue, sleep disturbances, and quality of life (Zou et al., 2020; Xu et al., 2022b). It was found that quality of life was significantly lower in patients with sleep disturbances or fatigue, compared to those without and that this was common among clinically stable older psychiatric patients (Zou et al., 2020; Xu et al., 2022b).

Not all studies found older adults with mental illnesses to be negatively affected by the pandemic (Miklitz et al., 2022; Curran et al., 2022; Orhan et al., 2020). Orhan et al. (2020) found older adults with bipolar disorder experienced *less* psychiatric symptoms throughout the pandemic when compared to baseline, and there was no difference in loneliness between these time points.

Similar findings were reported by Curran et al. (2022) who found no clinically relevant evidence of worsening mental health for a group of older adults living with mental illnesses in residential aged care.

One article focused on the prevalence and risk factors of mental disorders for older adults in the context of COVID-19 (Petrova et al., 2021) and found that loneliness, severe physical disease, alcohol abuse, family history of mental disorders, less education, financial strain, region of living (ie., cities vs. rural), and being female were risk factors for mental disorders. Three articles highlighted the effect of social isolation and loneliness on psychological health (Gomez et al., 2021; Batra et al., 2020; Grolli et al., 2021).

Eight articles broadly spoke to experiences of COVID-19 (Serafini et al., 2020; Simkin et al., 2022; Grohé et al., 2022; Hamm et al., 2020; Nizama-Vía et al., 2020; Deshpande et al., 2021). It was noted that older adults with clinical depression felt disconnected both before and during the pandemic (Grohé et al., 2022). However, throughout the pandemic, isolation was normalized and although they felt lonely, they also felt a sense of togetherness with the rest of society (Grohé et al., 2022). Similar findings were noted by Hamm et al. (2020), who found that older adults with depression were more concerned about contracting the virus than the risks of social isolation, and that they exhibited resiliency to the isolation of physical distancing. Deshpande et al. (2021) describes clinical presentations of first-onset psychosis in three older adults, noting that although the treatment of one of those patients resulted in remission, the others continued to experience auditory hallucinations and fixed delusionary beliefs.

Three articles considered the possible complications and challenges that could arise from the pandemic (Almeida et al., 2021; Danilewitz et al., 2020; Webb et al., 2022). Almeida et al. (2021) lists a myriad of pandemic-related challenges, such as direct effects (e.g., increased mortality), resource restriction (e.g., decreased access to medical services), interrupted care, and delayed consequences (e.g., decrease or collapse of supportive networks). They also note mitigating measures that can be implemented such as web-based technologies for assessment, support, and mental health surveillance (Almeida et al., 2021). Similarly, Danilewtiz et al. (2020) and Webb et al. (2022) suggested web-based interventions for those experiencing mental and psychological distress.

Four articles looked at COVID-19-related mortality (Lee et al., 2020; Xu et al., 2022a; Adbulrahman et al., 2023; Chen et al., 2021), and three articles focused on suicidality and suicide

risk throughout the pandemic (Liu et al., 2022; Louie et al., 2021; Rana, 2020). Xu et al. (2022a) conducted a retrospective cohort study of fee-for-service Medicare beneficiaries and found that those with a psychiatric diagnosis had more excess deaths than those without. The largest relative increase in mortality risk was found among patients with bipolar disorder and schizophrenia (Xu et al., 2022a). Similarly, Lee et al. (2020) found that the mental health group showed higher mortality rates when compared to the non-mental disorder group. In terms of suicidality and suicide risk, Liu et al. (2022) found that poor adherence to treatment (OR = 1.86), perceived worsening of illness (OR = 2.07), and being diagnosed with major depressive disorder (OR = 2.79) to be associated with the highest risk of suicidality. Additionally, older adults with psychiatric conditions had lower levels of quality of life than those without (Liu et al., 2022).

Two articles examined prevention measures taken on geriatric wards to protect against the COVID-19 pandemic (Fahed et al., 2022; Zhao et al., 2020). There was consensus in both articles that screening and identifying infection symptoms should be reported accurately and quickly (Fahed et al., 2022; Zhao et al., 2020). Fahed et al. (2022) further elaborates on the ethical and logistical challenges in treating older adults in inpatient psychiatry, such as autonomy and choices about one's own health – for example, "does the good of many outweigh the liberty of the individual?" (p. 833).

Lastly, two studies highlighted the mental health service needs of older adults throughout the COVID-19 pandemic (Dell et al., 2022; Simkin et al., 2022). Dell et al. (2022) was written for mental health care workers in the context of adapting services to a growing number of older adults with mental illnesse. Simkin et al. (2022) examined referrals made to mental health services for older adults in South London, UK. They found that there was a higher percentage of referrals to older adult mental health services with any psychotic symptoms, in particular, a higher proportion of hallucinations, during lockdown (Simkin et al., 2022).

Rapid Review Discussion

This review offers an overview of the current literature focused on the experience of the pandemic by older adults with mental disorders. Only a handful of the literature provides insight into this population. The number of articles that met inclusion criteria quickly decreased when restricting if the sample population to older adults with pre-existing mental illnesses. When looking at the mental disorders focused on from this review, most research has been surrounding older

adults with various mental disorders. However, most of these mixed mental illness studies include depression, as well as majority of studies focusing on a single mental illness, also highlighted depression. It is important to note that no single mental illness studies focused primarily on schizophrenia. Further research could explore this to understand pandemic experiences for older adults with schizophrenia.

With that being said, this study points to the potential negative effects the pandemic has had on older adults with mental illnesses. There is congruence amongst most studies wherein older adults with mental illness experienced adverse effects from the pandemic. This is different than when looking at the psychological effects of the pandemic in the general population of those with mental illnesses, where articles seem to have more mixed results (Pinkham et al., 2020). Older adults with a diagnosis of a mental disorder were more likely to experience symptom relapse (MacNeil et al., 2023; MacNeil et al., 2022), experience higher levels of depressive, manic, and anxiety symptoms (Orhan et al., 2022; Li et al., 2021; Mehra et al., 2020; Asthana et al., 2021), worse psychosocial effects (Seethaler et al., 2021), greater fatigue and lower quality of life (Zou et al., 2020; Xu et al., 2022b), and more suicidal ideation (Asthana et al., 2021; Rana, 2020; Louie et al., 2021; Liu et al., 2022). Johnco et al. (2020), did not find group level changes in anxiety, depression, or quality of life during the pandemic, but they examined the intervention of cognitive behavioural therapy (CBT) five years prior, which they argued that CBT was a protective factor.

Not all included studies found negative pandemic effects. Although the prevalence of depression and anxiety was found to be high in a study conducted by Miklitz et al. (2022), they found that psychogeriatric patients were not significantly affected by the pandemic. However, it is also mentioned that these older adults are still suffering from emotional consequences that have resulted from change in living conditions during the pandemic (Miklitz et al., 2022). Curran et al. (2021) found an increase in psychiatric symptoms between April 30th, and May 15th (Wave 1) compared to pre-pandemic levels, however, symptoms decreased by September 27th, and October 18th. They argued that there was evidence of relatively stable mental health (Curran et al., 2021). Lastly, Orhan et al. (2020) found less psychiatric symptoms in older adults with bipolar disorder during the pandemic than compared to baseline measures – however, their study occurred during the first few months of the pandemic. Additionally, they still found that not having children, passive coping styles, neuroticism, and loneliness were associated with more psychiatric symptoms (Orhan et al., 2020).

The study settings for the articles included in this review varied, with most of the studies focused on older adults living in the community and/or maintaining out-patient treatment with psychiatric hospitals or clinics. The remaining studies were in institutional settings, such as residential aged care or in-patient treatment centres at psychiatric hospitals or clinics. Generalizability was a notable concern, as findings from specific settings are not generalizable to other settings. For example, findings from study settings in the community were noted to not be generalizable to those living in institutional settings, and vice versa. Generalizability is also of notable concern for studies that included a smaller sample size. This may be a problem as too small of a sample size can lead to low statistical power, biased estimates, and increased sampling error (Faber et al., 2014). Thus, findings from studies with smaller sample sizes should not be generalized or generalized with caution. Due to the fact that older adults are not a homogeneous group, generalizability in findings might be hard to achieve. Additionally, it should be noted that studies included in this review may not be representative of their total populations. Although it is not necessary for cohort studies to have a control group, one might argue that in order to provide appropriate context, one should have a reference group to compare numbers and rates of change to. Several cohort studies had a comparison group of older adults with no mental illness (MacNeil et al., 2023; MacNeil et al., 2022; Lee et al., 2020; Xu et al., 2022a; Chen et al., 2021), other cohort studies did not have a comparison group (Simkin et al., 2022; Orhan et al., 2022; Curran et al., 2021; Seethaler et al., 2021; Johnco et al., 2020; Orhan et al., 2020). Future research is needed to compare changes across mental health groups and no mental illness groups, to understand if changes are different amongst groups.

The current literature surrounding older adults with mental illnesses illustrates the negative effects that social isolation and loneliness has on depressive and anxiety symptoms. There is strong evidence in the literature of this association, as well as the clear effect the pandemic has had on older adults experiencing depression. As noted, most of the included studies either focused on depression, or listed depression as one of mental illnesses they were studying. Findings from the studies included in this review were drawn from the first year of the pandemic, meaning that the first year of the pandemic is well covered in the present literature. Another strength found in the literature is the fact that the effects of the pandemic are well explored in a variety of settings. Additionally, the current literature provides substantial information on potential ways to minimize the spread of COVID in psychiatric hospitals, and in-patient settings. There is also clear evidence

of heightened mortality risks in older adults with severe mental illnesses, and how this may contribute to greater COVID fears and anxiety.

Although there are some areas of this research that is well covered in the current literature, there are several gaps and important weaknesses for future research. As previously noted, no studies have focused on older adults experiencing schizophrenia. Rather, current research has grouped schizophrenia with other mental illnesses. Although the findings are mixed, there is evidence of an association in the literature on younger adults with schizophrenia and worsening positive symptoms due to the pandemic (Barrett et al., 2022). Thus, future research is needed to explore pandemic effects and worsening distress for older adults with schizophrenia. Another gap identified in the previous paragraph points to most of the literature being conducted within the first year of the pandemic. Only one study included in this review looked at multiple years of the pandemic (Xu et al., 2022a). As stated earlier in previous outbreaks, SARS survivors reported depressive symptoms one-year post-outbreak (Lee et al., 2007; Gomez et al., 2021). Thus, it is imperative for future research to look at multiple years of the pandemic to understand long-term psychological effects.

Limitations

A limitation from any rapid review is the potential risk of missing articles, especially given the time restrictions (Grant & Booth, 2009). This risk may be mitigated by the using the reference lists provided from each originally included article. It is noted that most of the articles in this review were found to be in each other's reference lists of the other included articles. Articles could have been missed or excluded due to ambiguity in describing older adults with a diagnosis of depression vs. experiencing depressive symptoms. Additionally, gray literature was not searched or included. Lastly, there is a risk of bias as the rapid review was completed by one reviewer for all parts of the review.

Conclusions

This review provided an exploratory analysis of the current pandemic literature focused on older adults with mental disorders. Most of the research in this sphere focused on the beginning of the pandemic, and on older adults diagnosed with depression. Future research should focus on older adults experiencing other mental health conditions, such as schizophrenia, and bipolar disorder. There is evidence to suggest older adults with mental illnesses may have experienced worse pandemic-related distress in comparison to the general older adult population – however, future research is needed to understand this disparity. Future research should also consider multiple

years of the pandemic and should include comparison groups to better calibrate the nature of the consequences of the COVID-19 pandemic.

Part II: Logistic Regression

Logistic Regression Methods

Data Source

The data were derived from the interRAI Home Care (HC) instrument, which is routinely used in clinical practice to gather person-level data on home care clients requiring services for at least two months (McArthur et al., 2022). The data are valid and reliable based on a standardized comprehensive assessment instrument that evaluates home care clients' mood, behaviour, cognition, functioning, disease and health conditions, medical utilization, and health services (Hirdes et al., 2008; McArthur et al., 2022). The assessment captures data on individuals at multiple time points and occasions throughout their use of home care services (Morris et al., 2009; CIHI, 2022).

The dataset sample contains 97,498 Ontario home care assessments collected with the interRAI HC between September 1, 2018, to August 31, 2022. The dataset is divided into four samples. The first sample is the "Comparison" pre-COVID sample and consists of 30,714 assessments conducted between September 1, 2018, to August 31, 2019. The second sample is the "COVID Year 1" sample, which consists of 21,962 assessments conducted between September 1, 2019, to August 31, 2020. The third sample is the "COVID Year 2" sample, which consists of 21,497 assessments conducted between September 1, 2020, to August 31, 2021. The fourth sample is the "COVID Year 3" sample, which contains 23, 325 assessments. Each sample is divided into two subgroups to signify two different time points (T1 and T2). T1 contained assessments from September 1st to February 28th or 29th, and T2 contained assessments from March 1st to August 31st, of each sample. A breakdown of the sample creation is provided in ***Figure 2***. Ethical clearance for the use of the data provided by the interRAI HC has been granted by interRAI Canada's agreement with the University of Waterloo's Research Ethics Boards and CIHI. The study is supported in part by funding from the Government of Canada's New Frontiers in Research Fund (NFRF: NFRFG-2020-00500), the EU Horizon 2020 research and innovation project Individualized CARE for Older Persons with Complex Chronic Conditions in Home Care and

Nursing Homes (ICARE4OLD, Grant Agreement No 965341), and by the Ontario Ministry of Health.

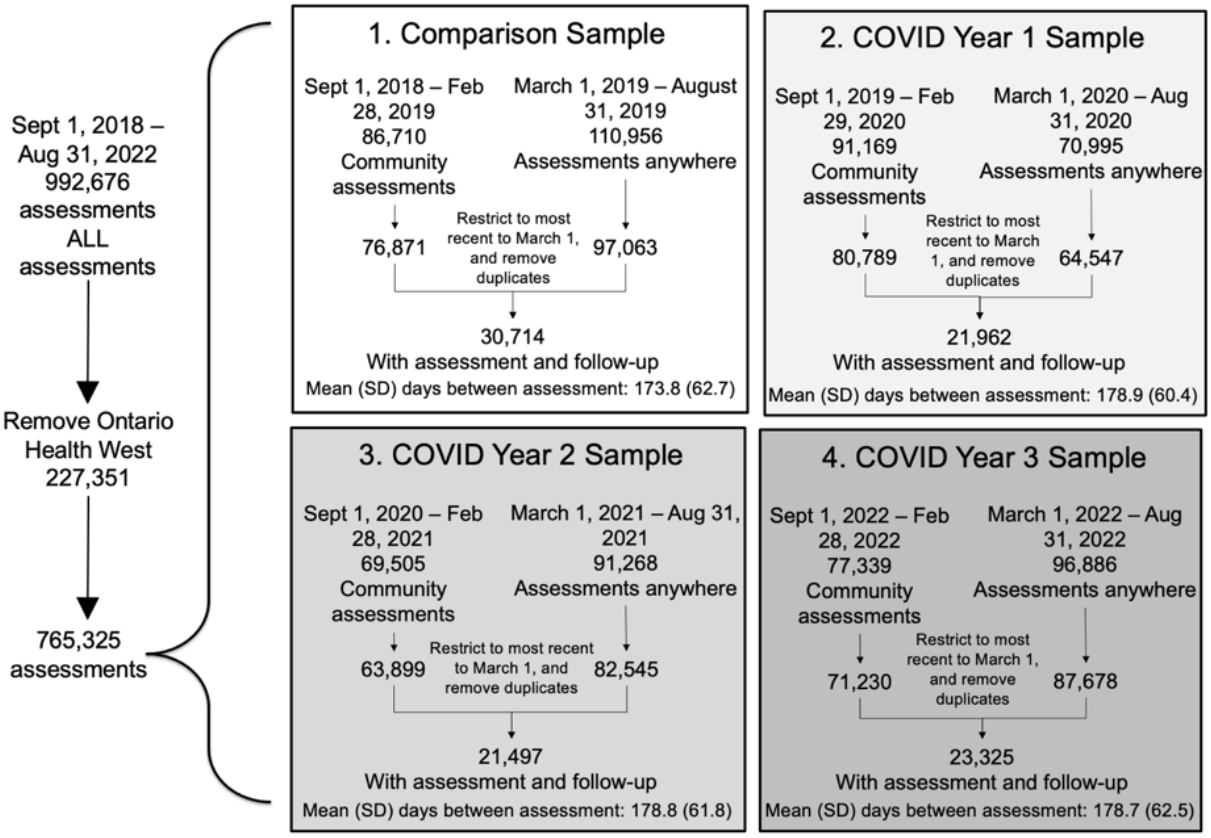

Figure 2. Sample Creation

Inclusion and Exclusion Criteria

The study population included individuals over 18 receiving home care services within Ontario. Only assessments of those living in community settings were included, excluding individuals living in congregate settings (e.g., as long-term care homes, retirement homes) to avoid mediating effects that could arise from living in these settings. Assessments conducted from Ontario Health West were excluded as this Local Health Integration Network (LHIN) region suspended the use of interRAI home care assessments at the beginning of the pandemic. When created, the dataset was restricted to the most recent assessment within the study dates with a corresponding follow-up assessment, therefore multiple individuals were not included multiple times in one assessment period.

Dependent and Independent Variables

The study's ***dependent (outcome) variable*** is worsening positive symptoms. The interRAI HC instrument contains three variables that make up psychiatric positive symptoms: abnormal thought processes, delusions, and hallucinations (Morris et al., 2012). Abnormal thought process indicators include the health-regulated professional's observation of loosening of associations, neologism, incoherence, and flight of ideas, to name a few (Morris et al., 2012). Delusions include false, fixed beliefs that are not shared by others, even when there is obvious evidence of the contrary (Morris et al., 2012). Hallucinations refer to false perceptions that occur in the absence of any real stimuli, and can include auditory, visual, tactile, olfactory, or gustatory (Morris et al., 2012). Psychiatric variables in the interRAI HC are ordinal and classified as *0 – not present; 1 – present but not exhibited in last 3 days; exhibited 1 of last 3 days; exhibited 2 of last 3 days;* and *4 – exhibited daily in the last 3 days.* Positive symptom variables were re-classified as: *0 – not present/present but not exhibited in last 3 days; 1 – exhibited 1 or 2 of last 3 days; and 2 – exhibited daily in last 3 days.* Positive symptom variables were added together to create a positive symptom scale that ranged from 0-6 with a higher score signifying greater psychiatric distress. Positive symptoms at T1 were subtracted by positive symptoms at T2. A new binary variable was created, where if the difference was greater than or equal to 1, positive symptoms worsened, otherwise they did not. Those with a 6 on the positive symptom scale at T1 were removed from the dataset, as you cannot experience worsening positive symptoms at T2 since they are not able to worsen.

Independent variables were chosen by selecting existing variables within the interRAI HC instrument that were representative of concepts related to positive or psychological symptoms within the literature. For this study, several variables were recoded to function as binary and categorical variables. For example, mental illness diagnosis is classified in the interRAI HC as *0 – not present; 1 – primary diagnosis/diagnosis for current stay; 2 – diagnosis present, receiving active treatment; and 3 – diagnosis present, monitored but no active treatment.* Each mental illness variable (anxiety, bipolar, depression, and schizophrenia) is re-categorized as binary, wherein the individual has the disorder, or does not have the disorder. Mental illness variables were collapsed together to make a single mental illness variable classified as: *0 – no mental illness; 1 – depression, anxiety, and/or bipolar disorder; and 3 – schizophrenia*. The mental illness variable remained a stable covariate in all models.

Three interRAI scales derived from the HC assessment, and one of the clinical assessment protocols (CAPs), were considered in the analysis. The delirium CAP is triggered when a client has active symptoms of delirium, which is usually caused by an underlying health problem, such as dehydration, infection, or drug reactions (Morris et al., 2010). The Method for Assigning Priority Levels (MAPLe) is a 5-level scale that is used as a decision-support tool to prioritize clients needing facility- or community-based services and is a powerful predictor of long-term care admission (Hirdes et al., 2008). A higher MAPLe level indicates higher home care needs (Hirdes et al., 2008). The criteria used to calculate MAPLe level includes aggressive behaviour, falls, environmental conditions, cognition, and activities of daily living to name a few (Hirdes et al., 2008). The Changes in Health, End-stage Disease, Signs, and Symptoms Scale (CHESS) measures health instability and ranges from 0-5, wherein a greater score signifies greater health instability (Hirdes et al., 2003; Hirdes et al., 2014). Lastly, the pain scale ranges from 0 to 4, and describes the presence and intensity of pain (CIHI, 2022).

Logistic Regression Analysis

Using the interRAI HC dataset, secondary data analysis was conducted using SAS 9.4 to address the research questions (SAS Institute, 2013).

Bivariate Analyses

The dataset was separated into four samples to perform analyses for the comparison and COVID samples independently. For each of the samples, cross-sectional descriptive statistics were generated to describe the populations and understand the distributions of worsening positive symptoms and associated variables at the beginning of each time points (T1). For the bivariate and multivariate analyses, the full dataset was combined, wherein all time points were merged by client identification numbers. COVID year was kept in the dataset and differentiated into four time points. Bivariate analyses were computed for the entire sample to understand the basic relationships between worsening positive symptoms, and the selected independent variables. Mental health group was included in each bivariate model. Chi-square statistics, crude odds ratios (COR), and their associated p-values were generated, to understand the magnitude and direction of associations between the variables, and the statistical significance. Confidence intervals that did not include 1, and p-values of less than or equal to 0.05 were deemed significant.

Multivariate Analyses: Logistic Regression

Logistic regression is a statistical analysis technique that is used to measure the association between the outcome and independent variables (Kleinbaum et al., 2013). It also tests the main effects of the independent variables on the outcome of interest, and potential interaction effects between independent variables (Kleinbaum et al., 2013). Model 1 was developed with worsening positive symptoms as a binary outcome variable, exploring predictors of worsening positive symptoms in the full sample. There is a COVID covariate remaining in the model, that explores how the odds of worsening positive symptoms changes throughout the timepoints. Additionally, COVID is used as an interaction with several predictor variables to explore the changes in odds of worsening symptoms prior to and throughout the pandemic. The bivariate analysis showed an interesting effect, wherein anti-psychotic use was showed as having greater odds of worsening positive symptoms. Thus, to explore this further, two models (Models 2 and 3) were built that stratified the use of anti-psychotics.

Model Selection

Variables deemed significant through bivariate analysis were grouped into a logistic regression model as independent variables with worsening positive symptoms at T2 as a binary outcome variable. Variables that were not significant within the bivariate analysis but had robust theoretical backing were still tested in the multivariate modelling process. Stepwise selection was then used to develop a preliminary logistic regression model that could be used to predict worsening positive symptoms. Stepwise selection is an automated model selection that selects independent variables to be used in the final model if they maintain significance at the multivariate level (Kleimbaum et al., 2013; Hayes, 2022). Stepwise selection adds and removes potential predictor variables and tests for statistical significance after each iteration (Hayes et al., 2022). Without theoretical logic, an inherent limitation of stepwise selection is that it could exclude meaningful variables (Stoltzfus, 2011). To ensure that meaningful variables with robust theoretical backing were included in the model, additional variables that were not included in the stepwise selection, such as age, were manually entered into the model. The model's c-statistic was considered when adding additional variables to the proposed model. COVID and mental health group interactions were tested on each significant variable and interaction terms achieving significance of $p<0.05$ remained in the final model. The predictors included in the final model for model 1 were replicated in the stratified models 2 (individuals using anti-psychotic medication)

and 3 (individuals not using anti-psychotic medication). Interactions that were not significant in model 1 were not entered into the stratified models.

Logistic Regression Results

Sample Characteristics

Age range varied in the total sample. Most of the sample at T1 was female (61.2%) and over 75 years of age (71.2%). Following was those in the 65 to 74 age group (15.7%), and the remaining individuals were between the ages of 18 to 64 (13%). Most clients at T1 did not have a diagnosis of a mental illness (67.2%). 31.4% of home care clients at T1 were diagnosed with depression, anxiety, and/or bipolar disorder, and 1.4% were diagnosed with schizophrenia.

Cross-sectional demographic and the potentially predictive variables at T1 for each sample is presented in ***Table 3***. Of the 30,714 pre-COVID sample at T1, 2.6% of clients experienced worsening positive symptoms at T2. Of the 21,962 COVID year 1 sample, 2.7% experienced worsening positive symptoms at T2. Of the 21,497 COVID year 2 sample, 3.2% experienced worsening positive symptoms at T2. And lastly, of the 23,325 COVID year 3 sample, 3% experienced worsening positive symptoms at T2. ***Table 3*** presents the demographic and predictive variables at T1 of those with worsening positive symptoms at T2. Demographic characteristics per mental health group can be found in ***Table 9, Table 10,*** and ***Table 11*** in the appendices.

Table 3. Demographic and predictive variables at T1 of those with worsening positive symptoms at T2.

Variable	Level	Pre-COVID (n = 804)	COVID Year 1 (n = 594)	COVID Year 2 (n = 695)	COVID Year 3 (n = 691)
		% (n)			
Mental health group	No mental illness	54.6 (439) ***	57.8 (343) ***	55.2 (384) ***	60.6 (419) ***
	Depression, anxiety, bipolar disorder	42.3 (332) ***	37.4 (222) ***	39.7 (276) ***	35.8 (247) ***
	Schizophrenia	4.1 (33) ***	4.9 (29) ***	5 (35) ***	3.6 (25) ***
Age	18 – 64	9 (72) **	10.1 (60) *	7.9 (55) **	8 (55) **
	65 – 74	17.2 (138) **	16.8 (100) *	16.8 (117) **	16.1 (111) **
	75+	73.9 (594) **	73.1 (434) *	75.3 (523) **	76 (525) **

Female	No	43.5 (350) **	41.9 (249)	40.6 (282)	41.4 (286)
	Yes	56.5 (454) **	58.1 (345)	59.4 (313)	57.6 (405)
Region	Not Toronto	90.2 (725) **	92.6 (55) **	91.6 (637) **	92.2 (637) **
	Toronto	9.8 (79) **	7.4 (44) **	8.3 (58) **	7.8 (54) **
Single	No	48.1 (387) **	41.2 (245)	47.3 (329) **	45.6 (315)
	Yes	51.9 (417) **	58.8 (349)	52.7 (366) **	54.4 (376)
Lives alone	No	76.4 (614) ***	73.1 (434) **	72.3 (523) ***	74.8 (517) **
	Yes	23.6 (190) ***	26.9 (160) **	24.8 (172) ***	25.2 (174) **
Alone for 8+ hours per day	No	84.9 (682) ***	82.7 (491) **	85.3 (593) ***	84.5 (584) ***
	Yes	15.1 (121) ***	17.3 (103) **	14.7 (102) ***	15.5 (107) ***
Lonely	No	78.6 (632)	73.2 (435) **	75 (521)	77.4 (535)
	Yes	21.4 (172)	26.8 (159) **	25 (174)	22.6 (156)
Major life stressors in past 90 days	No	81 (651)	78.8 (468)	74.8 (520) **	77.3 (534)
	Yes	19 (153)	21.2 (126)	25.2 (175) **	22.7 (157)
Made financial trade-offs in past 30 days	No	94.7 (761) ***	95.4 (567) *	96.3 (669)	97.4 (673)
	Yes	5.4 (43) ***	4.6 (27) *	3.7 (26)	2.6 (18)
Alzheimer's or another Dementia	Not present	30.6 (246) ***	31.8 (189) ***	27.6 (192) ***	30.3 (209) ***
	Diagnosis present	69.4 (558) ***	68.2 (405) ***	72.4 (503) ***	69.7 (482) ***
Medication Adherence	Adherent at least 80% of the time	95.1 (765) ***	94.1 (559) ***	93.2 (648) ***	93.3 (645) ***
	Adherent less than 80% of the time	4.8 (39) ***	5.9 (35) ***	6.8 (47) ***	6.7 (46) ***
Anti-psychotic use	No	68.9 (554) ***	70.4 (418) ***	68.4 (475) ***	74.2 (513) ***
	Yes	31.1 (250) ***	28.6 (176) ***	31.7 (220) ***	25.8 (178) ***

Alcohol use in last 3 days	0 – 4	98.3 (790) **	98.1 (583) *	99.4 (691)	98.8 (683)
	5+	1.7 (14) **	1.9 (11) *	0.6 (4)	1.2 (8)
Exercise in last 3 days	None	37.4 (301)	37.2 (221) **	33.4 (232)	27.9 (193)
	< 1 hour	38.6 (310)	35.5 (211) **	39.7 (276)	41.2 (285)
	1+ hours	24 (193)	27.3 (163) **	26.9 (187)	30.8 (213)
Difficulty sleeping in last 3 days	Not present	54.5 (438) ***	57.4 (341) **	57 (396) ***	57.7 (399) **
	1 – 2 days	13.8 (111) ***	12.3 (73) **	16.1 (112) ***	12.9 (89) **
	Daily	31.7 (255) ***	30.3 (180) **	26.9 (187) ***	29.4 (203) **
MAPLe	1 – 2	0.6 (5) ***	0.2 (1) ***	0.6 (4) ***	0.3 (2) ***
	3	11.2 (90) ***	11.3 (67) ***	9.4 (65) ***	8 (55) ***
	4+	88.2 (709) ***	88.5 (526) ***	90.1 (626) ***	91.8 (634) ***
Pain Scale	None	34.6 (278) **	37.5 (223) ***	33.8 (235) ***	32.4 (224) **
	Not severe/not daily	54.4 (437) **	48.3 (287) ***	57 (396) ***	56.4 (390) **
	Daily severe/extreme pain	11.1 (89) **	14.1 (84) ***	9.2 (64) ***	11.1 (77) **
CHESS	0	13.8 (111) ***	13.5 (80) ***	11.1 (77) ***	9 (62) ***
	1 – 2	49.1 (365) ***	50.2 (298) ***	44.9 (312) ***	49.3 (341) ***
	3+	37.1 (298) ***	36.4 (216) ***	44 (306) ***	41.7 (288) ***
Delirium CAP triggered	No	71.4 (574) ***	78.4 (466) ***	72.2 (502) ***	76.3 (527) ***
	Yes	28.6 (230) ***	21.5 (128) ***	27.8 (193) ***	23.7 (164) ***
Note. % = percentage of individuals experiencing worsening positive symptoms. *p<.05, **p<.01, ***p<.0001					

Sex, loneliness, major life stressors in the last 90 days, and exercise in the last three days were only significantly associated with higher rates of worsening positive symptoms at one follow-up period and making a financial trade off in the last 30 days and alcohol use in the last three days were only significantly associated at two time periods. However, other comparable associations were present both in the pre-COVID and COVID samples.

Mental health group was strongly associated with worsening positive symptoms in all samples. Most of those with worsening positive symptoms fell in the no mental illness group and the depression, anxiety, and bipolar disorder group. Age was also significantly associated with worsening symptoms, wherein the oldest-old category (75+) had the highest percentage of worsening positive symptoms. Region was strongly associated with worsening symptoms, and majority of those with worsening symptoms fell in the *Not Toronto* group. The single variable was only significant in pre-COVID and COVID Year 2, whereas the living alone and alone for 8+ hours per day variables were strongly associated with worsening positive symptoms at all time points. Those who were present with others most of the day, and those living with others had substantially higher percentages of worsening positive symptoms at all time points. Difficulty sleeping was significantly associated with worsening positive symptoms at all time points, and majority of those with worsening symptoms did not have difficulty sleeping.

The Alzheimer's and Dementia disease group was also significantly associated with worsening positive symptoms at all time points. Most clients that developed worsening positive symptoms had a diagnosis of Alzheimer's or Dementia present. MAPLe scores were strongly associated with worsening symptoms at all time points. Nearly all individuals experiencing with worsening symptoms fell into the higher MAPLe levels. Additionally, CHESS scores were strongly associated as well, with individuals mostly falling in both the 1 – 2 categories, and the 3+ category at all time points.

The Delirium CAP was strongly associated with worsening positive symptoms at all time points. Majority of those with worsening symptoms did not experience delirium. Medication and anti-psychotic use were also significantly associated with worsening positive symptoms. Majority of clients with worsening positive symptoms were adherent at least 80% of the time. However, it also seems that majority of those experiencing worsening positive symptoms fell into the not using anti-psychotic use category.

Bivariate Results

Bivariate analyses for the relationship between worsening positive symptoms and demographic, clinical, physical, and psychological variables are presented in ***Table 4***. The COR and 95% confidence interval (CI) are also presented, along with the c-statistic for the relationship between each independent variable.

Table 4. Bivariate models from variables at T1 to worsening positive symptoms at T2 among Ontario home care clients.

Variable	Level	PE	SE	COR (95% CI)	P-value	C
COVID	Pre-COVID	*Reference*				0.57
	COVID Year 1	0.033	0.055	1.03 (0.93, 1.15)	0.5520	
	COVID Year 2	0.212	0.053	1.24 (1.12, 1.37)	< 0.0001	
	COVID Year 3	0.127	0.053	1.14 (1.02, 1.26)	0.0156	
Mental health group	No mental illness	*Reference*				0.56
	Depression, anxiety, bipolar disorder	0.387	0.040	1.47 (1.36, 1.59)	< 0.0001	
	Schizophrenia	1.355	0.098	3.87 (3.20, 4.70)	< 0.0001	
Age	18 – 64	*Reference*				0.58
	65 – 74	0.512	0.081	1.67 (1.42, 1.93)	< 0.0001	
	75+	0.614	0.070	1.85 (1.61, 2.12)	< 0.0001	
Female	No	*Reference*				0.57
	Yes	-0.174	0.039	0.84 (0.78, 0.91)	< 0.0001	
Region	Not Toronto	*Reference*				0.56
	Toronto	0.412	0.070	1.51 (1.32, 1.73)	< 0.0001	
Single	No	*Reference*				0.57
	Yes	-0.186	0.039	0.83 (0.77, 0.90)	< 0.0001	
Lives alone	No	*Reference*				0.58
	Yes	-0.363	0.045	0.70 (0.64, 0.76)	< 0.0001	
Alone for 8+ hours per day	No	*Reference*				0.58
	Yes	-0.499	0.061	0.61 (0.54, 0.68)	< 0.0001	
Lonely	No	*Reference*				0.56
	Yes	0.050	0.046	1.05 (0.96, 1.15)	0.2796	
Major life stressors in past 90 days	No	*Reference*				0.56
	Yes	0.130	0.047	1.14 (1.04, 1.25)	0.0055	
Made financial trade-offs in past 30 days	No	*Reference*				0.56
	Yes	0.306	0.098	1.36 (1.12, 1.65)	0.0018	
Alzheimer's or another Dementia	Not present	*Reference*				0.72
	Diagnosis present	1.557	0.042	4.75 (4.37, 5.15)	< 0.0001	
Medication Adherence	Adherent at least 80% of the time	*Reference*				0.57

	Adherent less than 80% of the time	0.937	0.084	2.55 (2.17, 3.01)	< 0.0001	
Anti-psychotic use	No	*Reference*				0.62
	Yes	1.245	0.046	3.47 (3.17, 3.80)	< 0.0001	
Alcohol use in last 3 days	0 – 4	*Reference*				0.56
	5+	0.362	0.170	1.44 (1.03, 2.00)	0.0329	
Exercise in last 3 days	None	*Reference*				0.57
	< 1 hour	-0.185	0.048	0.83 (0.76, 0.91)	0.0001	
	1+ hours	-0.186	0.050	0.83 (0.75, 0.91)	0.0002	
Difficulty sleeping in last 3 days	Not present	*Reference*				0.58
	1 – 2 days	0.398	0.058	1.49 (1.33, 1.67)	< 0.0001	
	Daily	0.358	0.044	1.43 (1.31, 1.56)	< 0.0001	
MAPLe	1 – 2	*Reference*				0.65
	3	1.560	0.295	4.76 (2.67, 8.48)	< 0.0001	
	4+	2.834	0.290	17.02 (9.65, 30.03)	< 0.0001	
Pain Scale	None	*Reference*				0.58
	Not severe/not daily	-0.206	0.042	0.81 (0.75, 0.88)	< 0.0001	
	Daily severe/extreme pain	-0.586	0.066	0.56 (0.49, 0.63)	< 0.0001	
CHESS	0	*Reference*				0.60
	1 – 2	0.186	0.062	1.20 (1.07, 1.36)	0.0028	
	3+	0.692	0.044	2.00 (1.76, 2.26)	< 0.0001	
Delirium CAP triggered	No	*Reference*				0.63
	Yes	1.313	0.045	3.72 (3.40, 4.06)	< 0.0001	
Note. PE = parameter estimate; SE = standard error; COR = crude odds ratio; CI = confidence interval; C = C-statistic						

When compared to pre-COVID, the second year of the pandemic had greater odds of worsening positive symptoms (COR=1.24, 95% CI:1.12 – 1.37). Those with mental illness, compared to those without had greater odds of worsening positive symptoms, where those with schizophrenia had the greatest odds (COR=3.87, 95% CI:3.20 – 4.70). When compared to those in the 18 to 64 age group, being in the 65-74 age group (COR=1.67, 95% CI:1.42 – 1.85) and the 75+ age group (COR=1.85, 95% CI:1.61 – 2.12) showed greater odds of worsening positive symptoms. Females has less odds of worsening positive symptoms than males (COR=0.84, 95% CI: 0.78–0.91). When compared to those not living in Toronto, those living in Toronto had greater odds of worsening symptoms (COR=1.51, 95% CI:1.32 – 1.73). Those living alone (COR=0.70, 95%

CI:0.64 – 0.76) compared to those living with others, and those spending eight hours or more alone per day (COR=0.61, 95% CI:0.54 – 0.68), compared to those spending less time alone, had less odds of worsening positive symptoms. Following the same trend, those in the single group (COR=0.83, 95% CI:0.77 – 0.90), compared to those who are married or are in partnerships, experienced less odds of worsening symptoms. Those who exercised in the past three days (< 1 hour, [COR=0.83, 95% CI:0.76 – 0.91], and 1+ hour [COR=0.83, 95% CI:0.75 – 0.91]), compared to those who did not, had less odds of experiencing worsening positive symptoms. Compared to those without pain, individuals experiencing pain (not severe or not daily [COR=0.81, 95% CI:0.75 – 0.88], and daily severe/excruciating pain [COR=0.56, 95% CI:0.49 – 0.63]), showed less odds of worsening positive symptoms.

Those who experienced a major life stressor in the past 90 days (COR=1.14, 95% CI:1.04-1.23), compared to those who did not, and those who made a financial trade-off in the past 30 days (COR=1.36, 95% CI:1.12 – 1.65), compared to those who did not, had greater odds of worsening positive symptoms. Difficulty sleeping and restlessness in the last 3 days (1-2 days [COR=1.49, 95% CI:1.33-1.67], and daily [COR=1.43, 95% CI:1.31-1.56]), showed greater odds of worsening positive symptoms, compared to those who did not have trouble sleeping.

Medication adherence less than 80% of the time (COR=2.55, 95% CI:2.17-3.01), and anti-psychotic medication use (COR=3.47, 95% CI:3.17 – 3.80) showed greater odds compared to those who were adherent at least 80% of the time, and individuals who were not using anti-psychotic medication, respectively.

Individuals in the higher CHESS categories, (1-2 [COR=1.20, 95% CI:1.07 – 1.36], and 3+ [COR=2.00, 95% CI:1.76 – 2.26]), compared to the 0 group, showed greater odds of worsening symptoms. When compared to individuals without delirium, individuals with delirium (COR=3.72, 95% CI:3.40 – 4.06) had greater odds of worsening positive symptoms. Those with a diagnosis of Alzheimer's or another Dementia (COR=4.75, 95% CI: 4.37, 5.15) showed greater high odds compared those without a diagnosis present. MAPLe scores of four or higher had the highest odds of worsening positive symptoms (COR=17.02, 95% CI:9.65-30.03), and MAPLe scores of 3 (COR=4.76, 95% CI:2.67 – 8.48) had the second highest odds of worsening positive symptoms, compared to those with MAPLe scores of 1–2. Indication of loneliness was the only variable found to be insignificant.

Multivariate Results

The following section outlines the multivariate logistic regression analyses that were conducted. Three final binary logistic regression models were specified. Model 1 was built to determine predictors at T1 and its effect on worsening positive symptoms at T2. Models 2 and 3 were built to stratify and consider the effects of anti-psychotic use based on the interesting direction found in bivariate analysis. The parameter estimates, corresponding p-values, adjusted odds ratios, and c-statistics are provided for each model. The c-statistic, or concordance statistic, is equal to the area under the ROC curve, and is a measure of goodness of fit for binary outcomes in a logistic regression model (LaValley, 2008). The closer the c-statistic is to 1, the better the fit (LaValley, 2008). ***Table 5*** presents the main effects for the final model that was selected. Interaction effects are displayed in ***Figure 3, 4, 5, and 6***.

Table 5. Model 1 – predictors (T1) of worsening positive symptoms at T2 in full sample.

Variable	Level	PE	SE	AOR (95% CI)	P-value
Sex	Female	-0.076	0.040	0.92 (0.86, 1.00)	0.0614
Region	Toronto	0.346	0.072	1.41 (1.23, 1.63)	< 0.0001
MAPLe	3	1.183	0.296	3.26 (1.83, 5.83)	< 0.0001
	4+	1.895	0.292	6.65 (3.76, 11.78)	< 0.0001
Made financial trade-offs in past 30 days	Yes	0.359	0.103	1.43 (1.17, 1.75)	0.0005
Exercise in last 3 days	< 1 hour	-0.164	0.049	0.85 (0.77, 0.93)	0.0009
	1+ hours	-0.085	0.052	0.92 (0.83, 1.02)	0.1012
CHESS	1 – 2	0.093	0.064	1.10 (0.97, 1.24)	0.1451
	3+	0.347	0.067	1.41 (1.24, 1.62)	< 0.0001
Medication Adherence	Adherent less than 80% of the time	0.561	0.086	1.75 (1.48, 2.08)	< 0.0001
Difficulty sleeping in last 3 days	1 – 2 days	0.377	0.060	1.46 (1.30, 1.64)	< 0.0001
	Daily	0.394	0.046	1.48 (1.36, 1.62)	< 0.0001
COVID	Year 1	0.158	0.072	*See figures 3 and 4 for interactions*	0.0287
	Year 2	0.192	0.071		0.0068
	Year 3	0.259	0.069		0.0002
Delirium CAP triggered	Yes	0.946	0.085	*See figure 3 for interaction*	< 0.0001
Anti-psychotic use	Yes	0.971	0.083	*See figure 4 for interaction*	< 0.0001
Mental health group	Depression, anxiety,	0.060	0.155	*See figures 5 and 6 for interaction*	< 0.0001

	bipolar disorder				
	Schizophrenia	1.856	0.199		< 0.0001
Age	65 – 74	0.446	0.141	*See figure 5 for interaction*	0.0016
	75+	0.267	0.127		0.0353
Alzheimer's or another Dementia	Diagnosis present	1.351	0.062	*See figure 6 for interaction*	< 0.0001
Model c-statistic = 0.79					
Note. PE = parameter estimate; SE = standard error; AOR = adjusted odds ratio; CI = confidence interval					

Main Effects

While controlling for the other variables, those living in the Toronto (AOR=1.41, 95% CI:1.23 – 1.63) region compared to those not living in Toronto, experienced worsening positive symptoms. Those with higher MAPLe scores (3 [AOR=3.26, 95% CI:1.83 – 5.83], and 4+ [AOR=6.65, 95% CI: 3.76 – 11.7]) experienced the greatest odds of worsening positive symptoms, compared to those in the lowest MAPLe level. Those who made a financial trade-off (AOR=1.43, 95% CI: 1.17 – 1.75) in the past 30 days had higher odds of worsening positive symptoms than those who did not make a financial trade. Those who were adherent with their medication less than 80% of the time (AOR=1.75, 95% CI: 1.48, 2.08) had a greater likelihood of worsening positive symptoms compared to those who were adherent at least 80% of the time. Having difficulty sleeping in the last three days (1-2 days [AOR=1.46, 95% CI: 1.30 – 1.64], and daily [AOR=1.48, 95% CI: 1.36 – 1.62]) had greater odds of worsening symptoms than those who did not have difficulty sleeping. Those experiencing the highest CHESS scores (3+ [AOR=1.41, 95% CI: 1.24 – 1.62) had greater odds than those in the lowest CHESS category (0). Individuals who exercised for less than one hour in the last three days had lower odds (AOR=0.85, 95% CI:0.77 – 0.93), than those who did not exercise. CHESS scores 1-2, exercise greater than 1 hour and sex became insignificant in the final model.

COVID Interactions

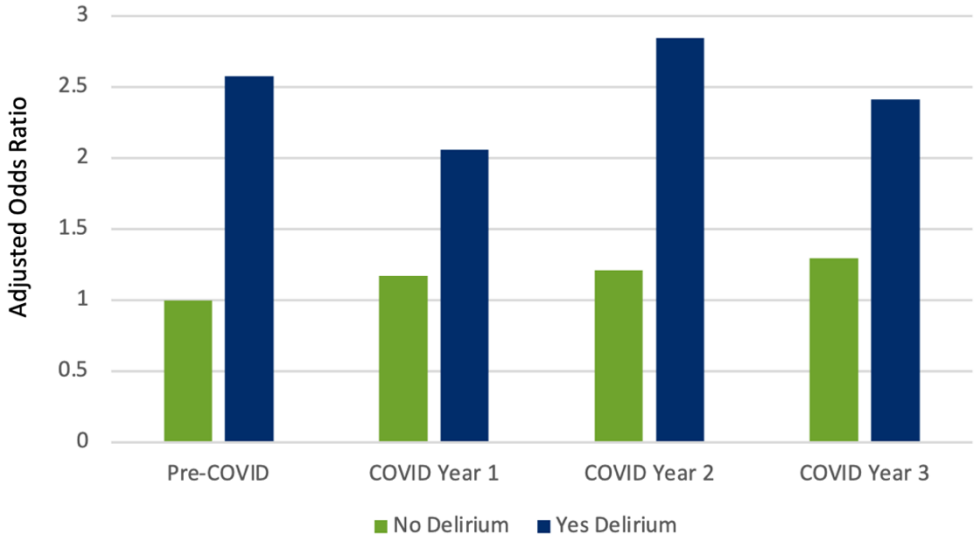

Figure 3. Adjusted odds ratio for worsening positive symptoms at T2 by pre-COVID & COVID years and delirium at T1

Figure 3 displays the interaction of COVID and delirium against worsening positive symptoms at T2 in the total sample. In all years of the sample, delirium had greater odds of worsening positive symptoms. It should be noted that the COVID year 2 and the delirium interaction is not significant.

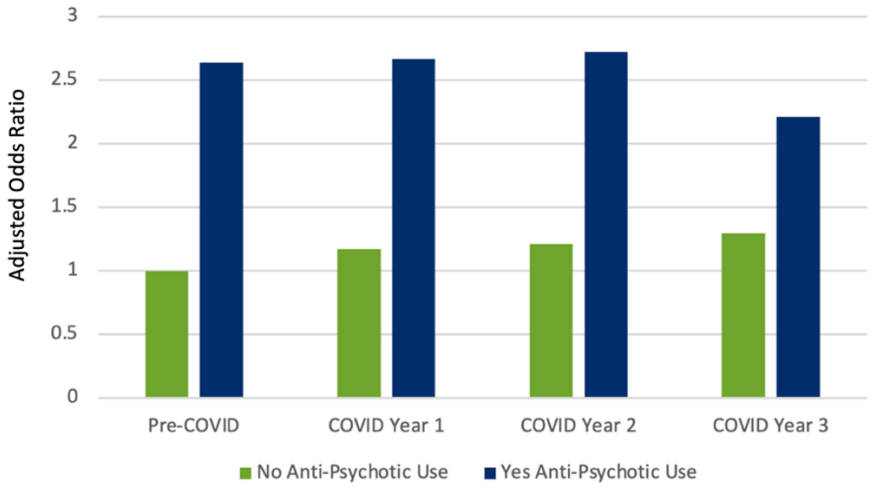

Figure 4. Adjusted odds ratio for worsening positive symptoms at T2 by pre-COVID and COVID years and anti-psychotic use at T1

Figure 4 displays the interaction of COVID and anti-psychotic against worsening positive symptoms at T2 in the total sample. In all years of the sample, anti-psychotic use had greater odds

of worsening positive symptoms. Because of this finding, stratified logistic regression modelling was used for Models 2 and 3 to examine the difference in odds of worsening positive symptoms for those using anti-psychotic medication, and those who are not. It should be noted that the COVID year 1 and 2, and the anti-psychotic interaction is not significant. The effect was only significant in Year 3.

Mental Health Group Interactions

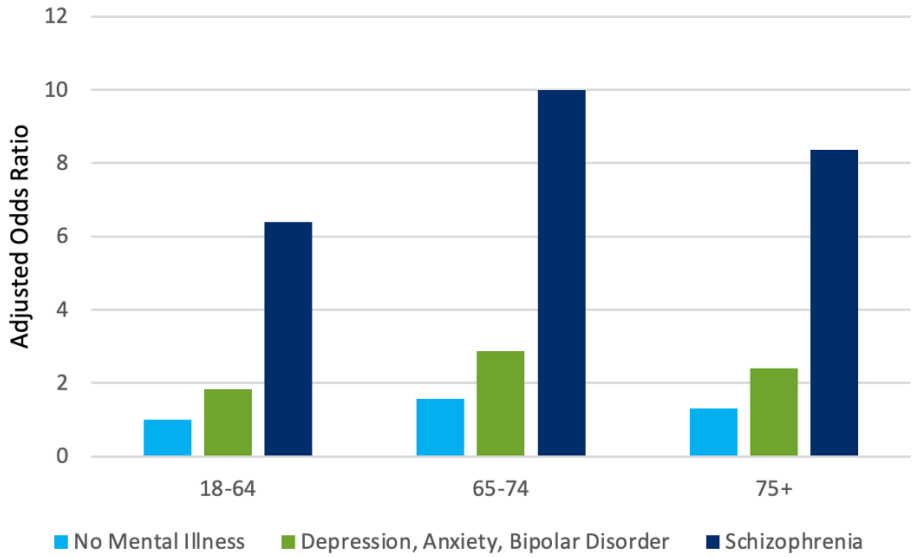

Figure 5. Adjusted odds ratio for worsening positive symptoms at T2 by mental health group and age at T1

Figure 5 displays the interaction of mental health group and age at T1 against worsening positive symptoms at T2 in the total sample. It should be noted that the mental health group, and the 75+ age group interaction was not significant. However, there is a clear difference on the effect of mental health on worsening positive symptoms in the 18-64 and 65-74 age category. The odds of worsening positive symptoms are highest (AOR=9.99; reference=18-64 and no mental illness) among the middle age category with schizophrenia. The odds of worsening positive symptoms are also high (AOR=6.40; reference=18-64 and no mental illness) amongst those with schizophrenia in the 18-64 category.

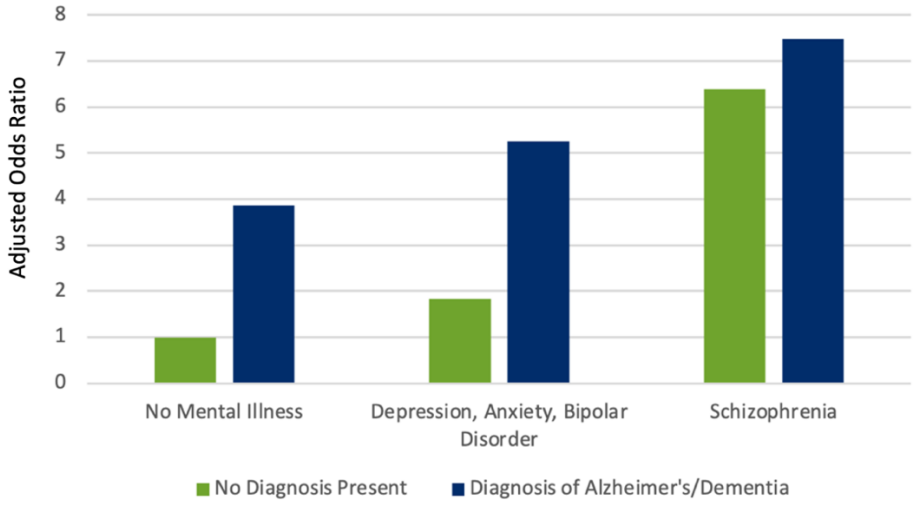

Figure 6. Adjusted odds ratio for worsening positive symptoms at T2 by mental health group and diagnosis of Alzheimer's and Dementia at T1

Figure 6 displays the interaction of mental health group and diagnosis of Alzheimer's or Dementia at T1 against worsening positive symptoms at T2 in the total sample. There is a clear difference between having a diagnosis of Alzheimer's or another Dementia vs. no diagnosis and worsening positive symptoms in all mental health groups. However, those with a diagnosis of Alzheimer's or another Dementia and schizophrenia had the greatest odds of worsening positive symptoms (AOR=7.47) compared to those without a mental illness or a diagnosis of Alzheimer's or Dementia. Without a diagnosis of Alzheimer's or another dementia, those in the schizophrenia mental health group had greater odds of worsening positive symptoms (AOR=6.40; reference = no mental illness or diagnosis of Alzheimer's or another Dementia).

Anti-Psychotic Use Stratified Models

Table 6 presents the model for those using anti-psychotic medication, and ***Table 7*** presents the model for those not using anti-psychotic medication.

Table 6. Model 2 – predictors (T1) of worsening positive symptoms at T2 in full sample for those using anti-psychotic medication.

Variable	Level	PE	SE	AOR (95% CI)	P-value
Sex	Female	-0.148	0.075	0.82 (0.74, 0.99)	0.0487
Region	Toronto	0.332	0.133	1.39 (1.07, 1.81)	0.0123
MAPLe	3	0.789	0.520	2.02 (0.79, 6.10)	0.1291
	4+	1.177	0.511	3.24 (1.19, 8.82)	0.0212
Made financial trade-offs in	Yes	0.144	0.193	1.15 (0.79, 1.69)	0.4564

the past 30 days					
Exercise in the last 3 days	< 1 hour	-0.095	0.096	0.91 (0.75, 1.10)	0.3217
	1+ hours	0.056	0.098	1.06 (0.87, 1.28)	0.5691
CHESS	1 – 2	0.252	0.112	1.29 (1.03, 1.60)	0.0249
	3+	0.450	0.122	1.57 (1.23, 1.99)	0.0002
Medication Adherence	Adherent less than 80% of the time	0.390	0.086	1.48 (1.04, 2.10)	< 0.0001
Difficulty sleeping in last 3 days	1 – 2 days	0.380	0.109	1.46 (1.18, 1.81)	0.0005
	Daily	0.340	0.086	1.40 (1.19, 1.66)	< 0.0001
Alzheimer's Diagnosis or another Dementia	Diagnosis present	0.833	0.010	2.30 (1.89, 2.80)	< 0.0001
Delirium CAP triggered	Yes	0.482	0.089	1.62 (1.36, 1.93)	< 0.0001
Age	65 – 74	0.029	0.134	1.03 (0.81, 1.32)	0.8274
	75 +	0.036	0.125	1.04 (0.81, 1.32)	0.7738
Mental health group	Depression, anxiety, bipolar disorder	-0.097	0.081	0.91 (0.77, 1.07)	0.2349
	Schizophrenia	0.644	0.130	1.90 (1.48, 2.46)	< 0.0001
COVID	Year 1	-0.092	0.104	0.91 (0.74, 1.12)	0.3762
	Year 2	0.015	0.099	1.02 (0.84, 1.23)	0.8782
	Year 3	-0.247	0.104	0.78 (0.64, 0.96)	0.0174
Model c-statistic = 0.67					
Note. PE = parameter estimate; SE = standard error; AOR = adjusted odds ratio; CI = confidence interval					

For those using anti-psychotic medications, MAPLe 3, financial trade-offs in the last 30 days, exercise in the last 3 days, age, depression, anxiety, or bipolar disorder, and COVID years 1 and 2 became insignificant. Females, in comparison to males (AOR=0.82, 95% CI:0.74 – 0.99), and the third year of the pandemic, in comparison to pre-COVID (AOR=0.78, 95% CI:0.64 -0.96), had lower odds of worsening positive symptoms.

Those living in Toronto (AOR=1.39, 95% CI:1.07 – 1.81), the highest MAPLe scores (AOR=3.24, 95% CI:1.19 – 8.82), higher CHESS scores (1-2 [AOR=1.29, 95% CI:1.03 – 1.60], and 3+ [AOR=1.57, 95% CI:1.23 – 1.99]), had difficulty sleeping in the last three days (1-2 days [AOR=1.46, 95% CI:1.18 – 1.81], and daily [AOR=1.40, 95% CI:1.19 – 1.66]), had a diagnosis

of Alzheimer's or another Dementia (AOR=2.30, 95% CI:1.89 – 2.80), was delirious (AOR=1.62, 95% CI:1.36 – 1.93), or had schizophrenia (AOR=1.90, 95% CI:1.48 – 2.46), had greater odds of worsening positive symptoms compared to individuals living outside of Toronto, those with lower MAPLe scores, those who fall into the 0 CHESS category, individuals who did not have difficulty sleeping, clients without a diagnosis of Alzheimer's or Dementia, was not delirious, or did not have a mental illness, respectively.

Although this group is using anti-psychotics, those who were adherent with their medication less than 80% of the time, compared to those who were adherent at least 80% of the time, had greater odds of worsening positive symptoms (AOR=1.48, 95% CI: 1.04 – 2.10).

Table 7. Model 3 – predictors (T1) of worsening positive symptoms at T2 in full sample for those not using anti-psychotic medication.

Variable	Level	PE	SE	AOR (95% CI)	P-value
Sex	Female	-0.047	0.048	0.95 (0.87, 1.05)	0.3254
Region	Toronto	0.354	0.086	1.42 (1.21, 1.68)	< 0.0001
MAPLe	3	1.297	0.361	3.66 (1.80, 7.42)	0.0003
	4+	2.104	0.356	8.20 (4.08, 16.48)	< 0.0001
Made financial trade-offs in the past 30 days	Yes	0.446	0.121	1.56 (1.23, 1.98)	0.0002
Exercise in the last 3 days	< 1 hour	-0.187	0.058	0.83 (0.74, 0.93)	0.0012
	1+ hours	-0.128	0.061	0.88 (0.78, 0.99)	0.0352
CHESS	1 – 2	0.047	0.077	1.05 (0.90, 1.22)	0.5443
	3+	0.313	0.081	1.37 (1.17, 1.60)	0.0001
Medication Adherence	Adherent less than 80% of the time	0.634	0.098	1.89 (1.55, 2.28)	< 0.0001
Difficulty sleeping in last 3 days	1 – 2 days	0.381	0.071	1.46 (1.27, 1.68)	< 0.0001
	Daily	0.426	0.054	1.53 (1.38, 1.70)	< 0.0001
Alzheimer's Diagnosis or another Dementia	Diagnosis present	1.256	0.053	3.51 (3.16, 3.90)	< 0.0001
Delirium CAP triggered	Yes	0.882	0.056	2.42 (2.16, 2.70)	< 0.0001
Age	65 – 74	0.276	0.110	1.32 (1.06, 1.36)	0.0120
	75 +	0.141	0.099	1.15 (0.95, 1.40)	0.1552
Mental health group	Depression, anxiety,	0.225	0.050	1.25 (1.14, 1.38)	< 0.0001

	bipolar disorder				
	Schizophrenia	0.962	0.248	2.62 (1.61, 4.25)	0.0001
COVID	Year 1	0.078	0.067	1.08 (0.95, 1.23)	0.2425
	Year 2	0.166	0.064	1.18 (1.04, 1.40)	0.0100
	Year 3	0.184	0.063	1.20 (1.06, 1.36)	0.0035
Model c-statistic = 0.77					
Note. PE = parameter estimate; SE = standard error; AOR = adjusted odds ratio; CI = confidence interval					

For those not using anti-psychotic medication, sex, CHESS score of 1-2, aged 75+, and COVID year 1 became insignificant. Exercise in the last three days, compared to no exercise, was a protective factor against odds of worsening positive symptoms (< 1 hour [AOR=0.83, 95% CI:0.74 – 0.93], and 1+ hours [AOR=0.88, 95% CI:0.78 – 0.99]).

Individuals with high MAPLe scores (3 [AOR=3.66, 95% CI:1.80 – 7.42], and 4+ [AOR=8.20, 95% CI: 4.08 – 16.48]), compared to those that fell into the 1-2 MAPLe level, had the greatest odds of worsening positive symptoms. Following was those with a diagnosis of Alzheimer's or another Dementia (AOR=3.51, 95% CI:3.16 – 3.90), compared to those without. Individuals with a diagnosis of a mental disorder (depression, anxiety, or bipolar disorder [AOR=1.25, 95% CI: 1.14 – 1.38], and schizophrenia [AOR=2.62, 95% CI:1.61 – 4.25]), compared to those without a mental illness, had greater odds of worsening positive symptoms. Individuals with a CHESS score of 3+, compared to 0, were more likely to experience worsening positive symptoms (AOR=1.37, 95% CI:1.17 – 1.60).

Region differences were observed, wherein individuals living in Toronto, compared to those outside of Toronto, experienced worsening positive symptoms (AOR=1.42, 95% CI: 1.21 – 1.68). Older adults who fell into the 65–74 age category had greater odds of worsening symptoms compared to 18-64 group (AOR=1.32, 95% CI:1.06 – 1.36). Additionally, those who made a financial trade off in the last 30 days (AOR=1.56, 95% CI: 1.23 – 1.98), had difficulty sleeping in the last three days (1-2 days [AOR=1.46, 95% CI:1.27 – 1.68], and daily [AOR=1.53, 95% CI:1.38 – 1.70), or were delirious (AOR=2.42, 95% CI:2.16 – 2.70), had greater odds of worsening positive symptoms compared to those who did not make a financial trade-off, individuals who did not have difficulty sleeping, or were not delirious, respectively. COVID years 2 (AOR=1.18, 95% CI:1.04 – 1.30), and 3 (AOR=1.20, 95% CI:1.06 – 1.36) had slightly greater odds compared to the pre-pandemic year.

Logistic Regression Discussion

This paper sought to determine the predictors of worsening positive symptoms in older adults receiving home care services, and how these relationships differed by mental health disorders prior to and during the COVID-19 pandemic in Ontario. Bivariate analyses, and three multivariate logistic regression models were developed. Bivariate analyses and model 1 explored what predicted worsening positive symptoms prior to and during the COVID pandemic. Consistent with the first hypothesis, the risk of worsening positive symptoms was associated with several risk factors noted to be of importance in the literature. Several variables had strongly significant associations in the bivariate crosstabs, such as a diagnosis of a mental disorder, a diagnosis of Alzheimer's or another Dementia, medication adherence, anti-psychotic use, the MAPLe assessment, health instability (CHESS), and delirium. Bivariate models presented several key variables that had a strong significance with an outcome of worsening positive symptoms. These variables were the same variables mentioned as strongly significant in the bivariate crosstabs, as well as age, sex, the pain scale, difficulty sleeping, being alone for majority of the day, living alone, being single, and living in Toronto.

Several of the risk factors identified in bivariate modelling remained significant and included in the final model. Of the main effects, age-related factors were the biggest risk factors, with MAPLe levels 4+ displaying the greatest odds (AOR=6.65, 95% CI:3.76 – 11.78) of worsening positive symptoms. MAPLe level 3 was also a big risk factor in worsening symptoms (AOR=3.26, 95% CI:1.83 – 5.83). As noted previously, the MAPLe decision-making tool encompasses several challenges, such as number of medications, cognitive performance, activities of daily living, and environmental concerns like significant disrepair of the home (Hirdes et al., 2008; Morris et al., 2010). Thus, there may be an age-related component when considering worsening positive symptoms. An interaction between age and mental illness was tested, and included in the final model, to consider how this might result in worsening positive symptoms. Although the 75+ age group became insignificant, those in the 64-75 age group and a mental health diagnosis had the greatest odds of worsening positive symptoms (schizophrenia [AOR=9.99; reference=18-64 with no mental illnesses] and depression, anxiety, or bipolar disorder [AOR=2.86; reference=18-64 with no mental illnesses). Another age-related significant interaction was found between a diagnosis of a mental disorder, and a diagnosis of Alzheimer's or another Dementia. Those with both a mental and cognition diagnoses, in comparison to those without either diagnosis,

had substantially greater odds of worsening symptoms (schizophrenia [AOR=7.47], and depression, anxiety, or bipolar disorder [AOR=6.40]). With that being said, those with a schizophrenia diagnosis that did not have a diagnosis of Alzheimer's or Dementia, still had high odds of worsening positive symptoms (AOR = 6.40; reference = no mental illness or diagnosis), meaning that the dementia diagnosis might not be as important to this group. Although there is literature to suggest that older adults were more resilient than younger adults throughout the COVID-19 pandemic (López et al., 2022; Webb & Chen, 2021), this study finds that there are more complex age-related factors that need to be explored that could be associated with greater psychiatric distress for older adults living with mental illnesses.

Interestingly, bivariate modelling revealed that those living with others, those spending less time alone, or those who are married or are in partnerships experienced greater odds of worsening positive symptoms. This is contrary to what is noted in the literature, as several studies have indicated worsening distress for older adults living alone (Asthana et al., 2021), isolated (Orhan et al., 2020; Santini et al., 2020; Armitage & Nellums, 2020), and single (Colucci et al., 2022). Although these variables became non-significant in multivariable analyses.

The second research question explored the ways in which mental illness may affect worsening positive symptoms, and it was hypothesized that those with schizophrenia would experience greater odds of worsening symptoms. The bivariate crosstabs by worsening distress indicated that those with no mental illnesses had higher percentages. However, when bivariate models, and the three multivariate binary logistic models were conducted, those with schizophrenia had higher odds, compared to those without mental illness, every time. This finding is not surprising, as delusions, abnormal thought processes, and hallucinations are noted in the DSM-5 as needed for a schizophrenia diagnosis (Caponnetto et al., 2021). Interestingly, individuals in the other mental health group (depression, anxiety, or bipolar disorder), was significant in all bivariate models, as well as the final model and the no anti-psychotic use model.

Interactions between the pandemic and risk factors of worsening positive symptoms were not as interesting as initially expected. In ***Figure 3*** the interaction of COVID and delirium at T1 against worsening positive symptoms at T2 looks like delirium remains relatively stable throughout the time points. This may mean that, although delirium seems to be a significant risk factor of worsening positive symptoms, there might not have been a COVID interaction making delirium, and in turn positive symptoms, worse. Similar findings were noted in ***Figure 4*** the

interaction of COVID and anti-psychotic use at T1 against worsening positive symptoms at T2. All other variables were tested as an interaction with COVID and were found to be insignificant.

Bivariate modelling revealed an interesting finding that was explored in this paper – the use of anti-psychotics and increased odds of worsening symptoms. This is contrary to what was expected, as anti-psychotic use should theoretically be a protective factor against the worsening of positive symptoms. There might be a confounding issue, and to control this, Models 2 and 3 were built. In both models, the greater odds of worsening positive symptoms were still found at the highest MAPLe level. The c-statistic for each model was drastically different – meaning that the model chosen for those using anti-psychotic medication might not be the best fit.

Strengths and Limitations

This appears to be the first study to focus on schizophrenia and older adults during the pandemic. According to the rapid review, although studies may have had older adults with schizophrenia in their studies, schizophrenia was never focused on, nor did it have its own category. Additionally, this is the first study that considered ways in which multiple years of the pandemic may have affected psychiatric symptoms. Given the large sample size of the dataset, as well as the scope of the interRAI HC instrument, several risk factors related to worsening positive symptoms were examined in a large number of observations. An additional strength of this research would be the comparison pre-COVID sample, and the no mental illness group category. Pre-COVID data allow client characteristics to be tracked over the course of the pandemic, and the no mental illness group category allows to explore the changes amongst different mental illness groups. Both of these strengths were limitations found in several smaller-scale studies.

An inherent limitation of secondary analysis is that only pre-determined concepts are captured as potential risk factors. Thus, COVID-specific risk factors, such as a loss of a loved one from the pandemic, or pandemic anxiety, were not included. However, the interRAI HC encompasses a wide variety of variables that were used to mitigate this limitation, such as having had a major life stressor in the last 90 days. Additionally, data derived from the interRAI HC may be skewed, as most of the sample do not have a mental illness diagnosis and/or do not experience worsening positive symptoms. However, according to Thompson & Forbes (1989), skewed data may still be analyzed using logistic regression, thus, this study can report on adjusted odds ratios and the associations between predictor variables and worsening positive symptoms.

Implications and Next Steps

First and foremost, this study contributes to the sparse literature surrounding pandemic-related outcomes for older adults with mental illnesses. Mental health disorders can affect up to 17% of Canadians aged 65 and older (Cosco et al., 2022). This percentage may be much higher as older adults are less likely to report their mental health concerns (Lavingia et al., 2020), and are less likely to seek mental health treatment and services (Cosco et al., 2022). As the older adult population in Canada continues to grow (Government of Canada, 2014), the need for mental health treatment and services may continue to grow. Thus, the risk factors found in this study may help guide future targeted mental health services for older adults.

Pandemic-related research on adverse outcomes experienced in the older adult with mental illnesses population is still scarce. This study can be replicated in other Provinces or Territories of Canada, or other countries that have implemented the interRAI HC. Research could be conducted in various subpopulations, such as in long-term care homes, and analyze if the environment may be a catalyst for worsening positive symptoms. Future research can also consider a treatment-effect analysis of the use of anti-psychotics. As noted, the pandemic did not seem to influence worsening positive symptoms, however future research may still be necessary, such as stratified logistic regression modelling by COVID year, to determine specific pandemic-related effects.

Summary

This paper started with a rapid review that provided an exploratory analysis of the existing literature surrounding older adults with mental disorders. 40 studies were included in the final review. Existing research that highlighted the effects of the pandemic on the general older adult population has been mixed, however, the first part of this paper found that most studies of older adults with mental disorders argued the adverse effects the pandemic has had on this population. This was described as a relapse in symptoms (Mehra et al., 2020; Johnco et al., 2021), increased depressive, manic, anxiety symptoms (Orhan et al., 2022; MacNeil et al., 2022; MacNeil et al., 2023; Li et al., 2021), increased insomnia and difficulty sleeping (Li et al., 2022; Zou et al., 2020); Xu et al., 2022b) increased feelings of loneliness (Grohé et al., 2022; MacNeil et al., 2022) or increased suicidality (Liu et al., 2022; Louie et al., 2021). Additionally, it was found that the largest increases in mortality risk were found among patients with schizophrenia and bipolar disorder (Xu et al., 2022a; Chen et al., 2021). Most of the research in this field was conducted at the beginning

of the pandemic and with older adults diagnosed with depression. This means there may be gaps in the knowledge of potential delayed pandemic consequences and from other mental health diagnoses.

The second part of this paper focuses on older adults with a diagnosis of a mental disorder, and the potential negative effect the pandemic might have had on positive symptoms. In the bivariate analysis, several variables were deemed significant. Preliminary findings in bivariate modelling showed mental health diagnoses, as well as age-related variables, such as a higher CHESS scores representing greater health instability, a diagnosis of Alzheimer's or Dementia, and MAPLe scores representing greater home care needs, demonstrating the highest crude odds ratios for worsening positive symptoms. Bivariate modelling revealed that the use of anti-psychotic medication was associated with increased odds of worsening positive symptoms. Thus, stratified logistic regression was used to determine how predictors may have changed based on anti-psychotic use. In both of the models, the greatest odds of worsening positive symptoms were found to be high MAPLe scores (4+). The final model produced several variables that were significantly predictive of worsening positive symptoms: living in Toronto, MAPLe scores of 3 or 4+, making financial trade-offs, exercise, CHESS scores of 3+, medication adherent less than 80% of the time, and difficulty sleeping. Preliminary findings through the interaction effect of COVID indicate that the pandemic might not have influenced delirium and anti-psychotic use. All other potential interactions were tested with COVID and found to be insignificant. Interactions between older adults with mental disorders and age demonstrated a significant interaction in the 65 to 74 age group and a diagnosis of a mental disorder, compared to the 18 to 64 age group with no mental illness, on worsening positive symptoms (AOR = 9.99). Interactions between Alzheimer's or dementia diagnosis and mental health diagnosis were also found to be significant for worsening positive symptoms. A diagnosis of schizophrenia was found to be a significant predictor in each final model for worsening positive symptoms, and interestingly a diagnosis of another mental disorder (depression, anxiety, and/or bipolar disorder) was found to also be a significant predictor in Models 1 and 3.

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Appendices

Appendix A: Mental Health Group T1 and Mental Health Group T2 for Total Sample

	No mental illness (T2)	Depression, anxiety, and/or bipolar disorder (T2)	Schizophrenia (T2)
No mental illness (T1)	96.9 (29,627)	2.9 (885)	0.2 (55)
Depression, anxiety, and/or bipolar disorder (T1)	3.8 (2,465)	96.2 (62,907)	0.04 (27)
Schizophrenia (T1)	2.5 (35)	1.7 (23)	95.8 (1,334)

Appendix B: No Mental Illness Demographics for all years at T1

Table 8. No mental illness demographics for pre-COVID and COVID years at T1

Variable	**Level**	**Pre-COVID (n = 20,782)**	**COVID Year 1 (n = 14,742)**	**COVID Year 2 (n = 14,247)**	**COVID Year 3 (n = 15,762)**
		% (n)			
Positive symptom scale	0	92.4 (19,208) ***	92 (13,564) ***	90.7 (12,927) ***	90.9 (14,335) ***
	1 – 2	5.8 (1,213) ***	6.1 (901) ***	6.8 (968) ***	6.7 (1,052) ***
	3+	1.7 (361) ***	1.9 (277) ***	2.5 (352) ***	2.4 (375) ***
Age	18 – 64	10.5 (2,190) ***	11.6 (1,709) ***	10.4 (1,483) ***	10.1 (1,585) ***
	65 – 74	13 (2,698) ***	13.3 (1,952) ***	13.4 (1,912) ***	12.8 (2,012) ***
	75+	76.5 (15,894) ***	75.2 (11,076) ***	76.2 (10,848) ***	77.2 (12,161) ***
Female	No	41.5 (8,620) ***	42 (6,193) ***	42.3 (6,026) ***	41.9 (6,598) ***
	Yes	58.5 (12,162) ***	58 (8,549) ***	57.7 (8,221) ***	58.1 (9,164) ***
Region	Not Toronto	93.1 (19,354) *	94.8 (13,980) **	94.2 (13,419) ***	94.8 (14,942) ***
	Toronto	6.9 (1,428) *	5.2 (762) **	5.8 (828) ***	5.2 (820) ***
Single	No	43 (8,935) ***	42.9 (6,326) ***	43.8 (6,241) ***	44 (6,881) ***
	Yes	57 (11,847) ***	57.1 (8,416) ***	56.2 (8,006) ***	56.3 (8,881) ***

Lives alone	No	69.7 (14,484) ***	69.6 (10,258) ***	70.1 (9,991) ***	70.4 (11,096) ***
	Yes	30.3 (6,298) ***	30.4 (4,484) ***	29.9 (4,256) ***	29.6 (4,666) ***
Alone for 8+ hours per day	No	79.2 (16,454) ***	78 (11,500) ***	78.7 (11,203) ***	78 (12,294) ***
	Yes	20.8 (4,316) ***	22 (3,236) ***	21.3 (3,041) ***	22 (3,467) ***
Lonely	No	84 (17,441) ***	82.6 (12,171) ***	82.1 (11,687) ***	80.9 (12,753) ***
	Yes	16 (3,329) ***	17.4 (2,565) ***	17.9 (2,557) ***	19.1 (3,007) ***
Major life stressors in last 90 days	No	84.7 (17,586) ***	82.2 (12,106) ***	81.1 (11,553) ***	80.1 (12,611) ***
	Yes	15.3 (3,184) ***	17.8 (2,630) ***	18.9 (2,691) ***	19.9 (3,139) ***
Made financial trade-offs in last 30 days	No	97.9 (20,354) ***	97.9 (14,428) ***	98 (13,963) ***	98.1 (15,457) ***
	Yes	2.1 (428) ***	2.1 (304) ***	2 (284) ***	1.9 (305) ***
Alzheimer's or another Dementia	Not present	33.8 (7,026) ***	32.3 (4,766) ***	34.5 (4,916) ***	33.2 (5,232) ***
	Diagnosis present	66.2 (13,756) ***	67.7 (9,976) ***	65.5 (9,331) ***	66.8 (10,530) ***
Medication adherence	Adherent at least 80% of the time	98.2 (20,410) ***	98 (14,447) ***	97.8 (13,933) ***	98 (15,449) ***
	Adherent less than 80% of the time	1.8 (372) ***	2 (295) ***	2.2 (314) ***	2 (313) ***
Anti-psychotic use	No	94.2 (19,569) ***	93.9 (13,848) ***	93 (13,253) ***	93.7 (14,766) ***
	Yes	5.8 (1,213) ***	6.1 (894) ***	7 (994) ***	6.3 (996) ***
Alcohol use in last 3 days	0 – 4	99.3 (20,637) ***	99.2 (14,622) *	99.2 (14,137) *	99.3 (15,650) **
	5+	0.7 (145) ***	0.8 (120) *	0.8 (110) *	0.7 (112) **
Exercise in last 3 days	None	22.5 (4,670)	22.2 (3,277) *	23.8 (3,393) **	25.8 (4,059) *
	< 1 hour	37.8 (7,858)	39.4 (5,807) *	43.1 (2,992) **	42.7 (6,733) *
	1+ hours	39.7 (8,254)	38.4 (5,658) *	32.4 (2,247) **	31.5 (4,970) *
Difficulty sleeping in last 3 days	Not present	71.7 (14,900) ***	67.8 (9,996) ***	66.9 (9,528) ***	66.5 (10,478) ***
	1 – 2 days	9.6 (1,984) ***	10.5 (1,541) ***	10.9 (1,548) ***	10.4 (1,641) ***

	Daily	18.8 (3,989) ***	21.7 (3,205) ***	22.3 (3,171) ***	23.1 (3,643) ***
MAPLe	1 – 2	6.4 (1,319) ***	5.7 (837) ***	5.8 (827) ***	5.7 (901) ***
	3	27.8 (5,771) ***	28.1 (4,137) ***	26.8 (3,814) ***	26.9 (4,235) ***
	4+	65.9 (13,692) ***	66.3 (9,768) ***	67.4 (9,606) ***	67.4 (10,626) ***
Pain scale	None	34.4 (7,144) ***	31.5 (4,648) ***	30.8 (4,389) ***	30.6 (4,820) ***
	Not severe/not daily	52.1 (10,824) ***	54.2 (7,993) ***	55.9 (7,968) ***	55.4 (8,731) ***
	Daily severe/extreme pain	13.5 (2,814) ***	14.3 (2,101) ***	13.3 (1,890) ***	14 (2,211) ***
CHESS	0	20.3 (4,227) ***	17.5 (2,581) ***	15.9 (2,265) ***	15.2 (2,397) ***
	1 – 2	55.8 (11,601) ***	55.8 (8,224) ***	55.5 (7,909) ***	56.1 (8,837) ***
	3+	23.8 (4,954) ***	26.7 (3,937) ***	28.6 (4,073) ***	28.7 (4,528) ***
Delirium CAP triggered	No	92.5 (19,223) ***	92 (13,558) **	91.3 (13,011) ***	91.4 (14,412) ***
	Yes	7.5 (1,559) ***	8 (1,184) **	8.7 (1,236) ***	8.6 (1,350) ***
Note. % = percentage of individuals experiencing worsening positive symptoms. *p<.05, **p<.01, ***p<.0001					

Appendix C: Depression, Anxiety, and Bipolar Disorder Demographics at T1

Table 9. Depression, anxiety, and bipolar disorder demographics for pre-COVID and COVID years at T1

Variable	Level	Pre-COVID (n = 9,490)	COVID Year 1 (n = 6,917)	COVID Year 2 (n = 6,937)	COVID Year 3 (n = 7,229)
		% (n)			
Positive symptom scale	0	89.1 (8,457) ***	88.7 (6,133) ***	87.2 (6,048) ***	87.7 (6,336) ***
	1 – 2	7.9 (753) ***	8.4 (584) ***	9.1 (628) ***	8.8 (639) ***
	3+	2.9 (280) ***	2.9 (200) ***	3.8 (261) ***	3.5 (254) ***
Age	18 – 64	16.6 (1,575) ***	18.5 (1,282) ***	16.5 (1,145) ***	16.5 (1,195) ***
	65 – 74	20.6 (1,950) ***	21.2 (1,466) ***	20.8 (1,444) ***	20.4 (1,473) ***

	75+	62.9 (5,965) ***	60.3 (4,166) ***	62.7 (4,347) ***	63.1 (4,559) ***
Female	No	32.4 (3,079) ***	32.9 (2,279) ***	32.1 (2,230) ***	32.2 (2,330) ***
	Yes	67.6 (6,411) ***	67.1 (4,638) ***	67.9 (4,707) ***	67.8 (4,899) ***
Region	Not Toronto	93.7 (8,896) *	95.8 (6,627) **	94.8 (6,578) ***	94.7 (6846) ***
	Toronto	6.3 (594) *	4.2 (290) **	5.2 (359) ***	5.3 (383) ***
Single	No	41.7 (3,957) ***	41.3 (2,856) ***	40.2 (2,788) ***	40.2 (2,909) ***
	Yes	58.3 (5,533) ***	58.7 (4,061) ***	59.8 (4,149) ***	59.8 (4,320) ***
Lives alone	No	65.9 (6,253) ***	65.3 (4,514) ***	66.1 (4,587) ***	66.1 (4,779) ***
	Yes	34.1 (3,237) ***	34.7 (2,403) ***	33.9 (2,350) ***	33.9 (2,450) ***
Alone for 8+ hours per day	No	75.6 (7,179) ***	74.1 (5,122) ***	75.1 (5,207) ***	73 (5,275) ***
	Yes	24.3 (2,311) ***	25.9 (1,794) ***	24.9 (1,728) ***	27 (1,953) ***
Lonely	No	71.2 (6,753) ***	69.6 (4,817) ***	68.6 (4,756) ***	67.6 (4,885) ***
	Yes	28.8 (2,737) ***	30.4 (2,099) ***	31.4 (2,179) ***	32.4 (2,343) ***
Major life stressors in last 90 days	No	79.2 (7,518) ***	76.4 (5,287) ***	75.3 (5,224) ***	75.2 (5,433) ***
	Yes	20.8 (1,972) ***	23.6 (1,629) ***	24.7 (1,711) ***	24.8 (1,795) ***
Made financial trade-offs in last 30 days	No	95.7 (9,086) ***	95.3 (6,592) ***	95.1 (6,597) ***	96.2 (6,955) ***
	Yes	4.3 (404) ***	4.7 (325) ***	4.9 (340) ***	3.8 (274) ***
Alzheimer's or another Dementia	Not present	36.1 (3,427) ***	34.8 (2,406) ***	37.8 (2,622) ***	36.9 (2,669) ***
	Diagnosis present	63.9 (6,063) ***	65.2 (4,511) ***	62.2 (4,315) ***	63.1 (4,560) ***
Medication adherence	Adherent at least 80% of the time	97.1 (9,213) ***	97.2 (6,723) ***	96.6 (6,701) ***	96.8 (6,998) ***
	Adherent less than 80% of the time	2.9 (277) ***	2.8 (194) ***	3.4 (236) ***	3.2 (231) ***
	No	84.9 (8,059) ***	83.4 (5,765) ***	82.4 (5,718) ***	81.8 (5,911) ***

Anti-psychotic use	Yes	15.1 (1,431) ***	16.6 (1,152) ***	17.6 (1,219) ***	18.2 (1,318) ***
Alcohol use in last 3 days	0 – 4	98.7 (9,368) ***	98.8 (6,834) *	98.9 (6,859) *	98.8 (7,141) **
	5+	1.3 (122) ***	1.2 (82) *	1.1 (78) *	1.2 (88) **
Exercise in last 3 days	None	21.9 (2,078)	23.1 (1,595) *	24.5 (1,698) **	26.2 (1,894) *
	< 1 hour	39 (3,701)	39.8 (2,753) *	43.1 (2,992) **	44.1 (3,187) *
	1+ hours	39.1 (3,711)	37.1 (2,569) *	32.4 (2,247) **	29.7 (2,148) *
Difficulty sleeping in last 3 days	Not present	62 (5,885) ***	58.2 (4,027) ***	58.5 (4,055) ***	57.8 (4,179) ***
	1 – 2 days	11.4 (1,085) ***	12 (829) ***	11.8 (819) ***	12.1 (871) ***
	Daily	26.6 (2,520) ***	29.8 (2,061) ***	29.7 (2,063) ***	30.1 (2,179) ***
MAPLe	1 – 2	5.6 (533) ***	4.6 (316) ***	4.3 (295) ***	4.2 (304) ***
	3	24.5 (2,329) ***	26.3 (1,816) ***	24.1 (1,671) ***	25.5 (1,840) ***
	4+	69.8 (6,628) ***	69.2 (4,785) ***	71.7 (4,971) ***	70.3 (5,085) ***
Pain scale	None	24.2 (2,296) ***	21.7 (1,499) ***	22 (1,526) ***	23.3 (1,684) ***
	Not severe/not daily	54.9 (5,209) ***	57.1 (3,952) ***	57.8 (4,011) ***	56.2 (4,062) ***
	Daily severe/extreme pain	20.9 (1,985) ***	21.2 (1,466) ***	20.2 (1,400) ***	20.5 (1,483) ***
CHESS	0	15.9 (1,505) ***	14.2 (983) ***	12.1 (838) ***	12.5 (903) ***
	1 – 2	55.2 (5,238) ***	55.8 (3,859) ***	54.9 (3,809) ***	54.5 (3,939) ***
	3+	29 (2,747) ***	30 (2,075) ***	33 (2,290) ***	33 (2,387) ***
Delirium CAP triggered	No	89.7 (8,514) ***	90.9 (6,288) **	89.3 (6,194) ***	89.1 (6,438) ***
	Yes	10.3 (976) ***	9.1 (629) **	10.7 (743) ***	10.9 (791) ***

Note. % = percentage of individuals experiencing worsening positive symptoms. *p<.05, **p<.01, ***p<.0001

Appendix D: Schizophrenia Demographics at T1

Table 10. Schizophrenia demographics for pre-COVID and COVID years at T1

Variable	Level	Pre-COVID (n = 442)	COVID Year 1 (n = 303)	COVID Year 2 (n = 313)	COVID Year 3 (n = 334)
		% (n)			
Positive symptom scale	0	71.5 (316) ***	69.6 (211) ***	66.8 (209) ***	68.9 (230) ***
	1 – 2	16.1 (71) ***	19.8 (60) ***	19.8 (62) ***	19.2 (64) ***
	3+	12.4 (55) ***	10.6 (32) ***	13.4 (42) ***	12 (40) ***
Age	18 – 64	36.4 (161) ***	37.6 (114) ***	34.8 (109) ***	41.3 (138) ***
	65 – 74	29.6 (131) ***	29.4 (89) ***	32.6 (102) ***	32.6 (109) ***
	75+	33.9 (150) ***	33 (100) ***	32.6 (102) ***	26.1 (87) ***3
Female	No	35.8 (158) ***	30.7 (93) ***	33.9 (106) ***	38.3 (128) ***
	Yes	64.3 (284) ***	69.3 (210) ***	66.1 (207) ***	61.7 (206) ***
Region	Not Toronto	91.6 (405) *	91.8 (278) **	87.6 (274) ***	87.1 (291) ***
	Toronto	8.4 (37) *	8.2 (25) **	12.5 (39) ***	12.9 (43) ***
Single	No	22.2 (98) ***	22.1 (67) ***	21.4 (67) ***	21.6 (72) ***
	Yes	77.8 (344) ***	77.9 (236) ***	78.6 (246) ***	78.4 (262) ***
Lives alone	No	60.2 (266) ***	57.1 (173) ***	54.9 (172) ***	61.4 (205) ***
	Yes	39.8 (176) ***	42.9 (130) ***	45.1 (141) ***	38.6 (129) ***
Alone for 8+ hours per day	No	74.9 (331) ***	68.3 (207) ***	68.7 (215) ***	67.4 (225) ***
	Yes	25.1 (111) ***	31.7 (96) ***	31.3 (98) ***	32.6 (109) ***
Lonely	No	78.7 (348) ***	74.3 (225) ***	67.4 (211) ***	76.9 (257) ***
	Yes	21.3 (94) ***	25.7 (78) ***	32.6 (102) ***	23.1 (77) ***

Major life stressors in last 90 days	No	86.4 (382) ***	82.5 (250) ***	75.7 (237) ***	83.5 (279) ***
	Yes	13.6 (60) ***	17.5 (53) ***	24.3 (76) ***	16.5 (55) ***
Made financial trade-offs in last 30 days	No	94.6 (418) ***	95.1 (288) ***	94.9 (297) ***	93.4 (312) ***
	Yes	5.4 (24) ***	4.9 (15) ***	5.1 (16) ***	6.6 (22) ***
Alzheimer's or another Dementia	Not present	28.6 (126) ***	21.1 (64) ***	26.5 (83) ***	21.6 (72) ***
	Diagnosis present	71.5 (316) ***	78.9 (239) ***	73.5 (230) ***	78.4 (262) ***
Medication adherence	Adherent at least 80% of the time	95.5 (422) ***	92.7 (281) ***	93.3 (292) ***	94 (314) ***
	Adherent less than 80% of the time	4.5 (20) ***	7.3 (22) ***	6.7 (21) ***	6 (20) ***
Anti-psychotic use	No	26.7 (118) ***	25.4 (77) ***	24.3 (76) ***	18.9 (63) ***
	Yes	73.3 (324) ***	74.6 (226) ***	75.7 (237) ***	81.1 (271) ***
Alcohol use in last 3 days	0 – 4	98.6 (436) ***	99.3 (301) *	99.4 (311) *	98.2 (328) **
	5+	1.4 (6) ***	0.6 (2) *	0.6 (2) *	1.8 (6) **
Exercise in last 3 days	None	20.8 (92)	29 (88) **	31 (97) **	26.9 (90) *
	< 1 hour	37.8 (167)	34.7 (105) **	38 (119) **	45.8 (153) *
	1+ hours	41.4 (183)	36.3 (110) **	31 (97) **	27.3 (91) *
Difficulty sleeping in last 3 days	Not present	70.1 (310) ***	67 (209) ***	67.4 (211) ***	68 (227) ***
	1 – 2 days	8.4 (37) ***	9.9 (30) ***	12.1 (38) ***	11.1 (37) ***
	Daily	21.5 (95) ***	21.1 (64) ***	20.5 (64) ***	21 (70) ***
MAPLe	1 – 2	4.7 (21) ***	2.3 (7) ***	4.1 (13) ***	3.6 (12) ***
	3	22.4 (99) ***	26.1 (79) ***	24.6 (77) ***	21 (70) ***
	4+	72.9 (322) ***	71.6 (217) ***	71.3 (223) ***	75.4 (252) ***
Pain scale	None	36.9 (163) ***	37.6 (114) ***	34.2 (107) ***	35.6 (119) ***
	Not severe/not daily	50.9 (225) ***	48.2 (146) ***	48.6 (152) ***	52.7 (176) ***

	Daily severe/extreme pain	12.2 (54) ***	14.2 (43) ***	17.3 (54) ***	11.7 (39) ***
CHESS	0	24.9 (110) ***	27.1 (82) ***	18.2 (57) ***	18.9 (63) ***
	1 – 2	55 (243) ***	55.5 (168) ***	58.5 (183) ***	59 (197) ***
	3+	20.2 (89) ***	17.5 (53) ***	23.3 (73) ***	22.2 (74) ***
Delirium CAP triggered	No	91 (402) ***	88.1 (267) **	89.5 (280) ***	88.3 (295) ***
	Yes	9 (40) ***	11.9 (36) **	10.5 (33) ***	11.7 (39) ***
Note. % = percentage of individuals experiencing worsening positive symptoms. *p<.05, **p<.01, ***p<.0001					