Depression and Anxiety in the Pandemic:

A Longitudinal Analysis of Older New Zealanders

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Abstract

There has been widespread concern about the mental health impact of the global COVID-19 outbreak. However, the effect of the pandemic on the psychological wellbeing of older New Zealanders is largely unknown. This longitudinal study aimed to estimate the effect of the crisis on depression and anxiety scores of people aged 55 and older in Aotearoa. The sample included 3,171 people who responded to wave 7 (August-November 2018) and wave 8 (June-September 2020) of the Health, Work and Retirement Study. Analyses were carried out using paired *t* tests, multilevel mediation modelling, two-way mixed analysis of variance and multiple linear regression. Results showed depression scores increased slightly and anxiety scores decreased slightly over time, but neither change was statistically significant. Additional analyses considered the relationship between negative health behaviours and demographic subgroups and mental health change. Physical activity was shown to decrease significantly, albeit to a small degree, and there was evidence of an indirect effect of the pandemic on depression via physical activity. Alcohol use decreased significantly, albeit slightly. Depression scores significantly increased among people with the highest socioeconomic status (SES) and decreased for the lowest SES individuals. Anxiety and depression scores for people reporting a pre-existing mental health condition significantly decreased while depression scores increased for those without a prior condition. Changes in depression and anxiety scores did not differ significantly across gender or ethnicity. These findings suggest a general resilience among older New Zealanders 3 to 6 months into the pandemic. The ongoing collection of robust longitudinal data on mental health is necessary to monitor psychological change and ensure older people are adequately supported in this continuing crisis.

Keywords: COVID-19, mental health, depression, anxiety, older people

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Depression and Anxiety in the Pandemic:
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Chapter 1: COVID-19 as a Mental Health Threat to Older New Zealanders

Introduction

The COVID-19 pandemic is a global challenge that threatens not just the physical health but also the mental wellbeing of humans worldwide. In the early days of the outbreak, serious concerns were raised by health authorities and commentators about the mental health implications, particularly for older people, who faced the greatest risk of severe illness and mortality from the viral infection (Armitage & Nellums, 2020; Banerjee, 2020; Pfefferbaum & North, 2020). The World Health Organization (2020c) cited social isolation and a rise in adverse health behaviours in lockdown as potential precipitants of increased psychological distress. Health specialists have noted that some subgroups of 'at risk' older people could be particularly vulnerable to increases in mental health disorders, especially depression and anxiety (Armitage & Nellums, 2020; Brooks et al., 2020; D'Cruz & Banerjee, 2020).

This thesis explores whether this extraordinary global phenomenon has been associated with greater depression and anxiety among older people, as many academics and commentators in the popular media have suggested. Chapter 1 describes the theoretical and historical reasons why it might be reasonable to expect such negative mental health effects. This includes exploring the potential role of adverse health behaviours, specifically increased alcohol use and decreased physical activity, and demographic factors, namely gender, socioeconomic status, ethnicity and prior mental health status, in increasing mental health risk in the pandemic. Chapter 2 then introduces empirical research about the effects of the COVID-19 pandemic on mental health, and asks whether there is evidence of psychological

effects of the outbreak on older adults, while identifying the gaps in knowledge in this literature. This leads to the current study, outlined in Chapter 3, with the method, results and discussion described in subsequent chapters. This work will help to establish the mental health impact of COVID-19 on older New Zealanders, enabling health authorities to develop and deliver support services targeting those most vulnerable to psychological decline in the event of future public health disasters.

A Key Study Constraint

The present study relies on a quantitative analysis of secondary data drawn from the longitudinal New Zealand Health Work and Retirement (HWR) biennial survey of community-dwelling New Zealanders aged 55 and over. It is important to note that this research was constrained by the specific timing of peri-pandemic data collection, which began on June 11, 2020, six weeks after New Zealanders' release from the first nationwide lockdown, and 3 days after returning to the lowest alert level. As a result, this study will focus on the impact of the pandemic as a broad societal experience, rather than the impact of lockdowns in particular. Most research and commentary on mental health in the pandemic is focused on the effect of stay-at-home orders, but the following review also attempts to investigate the wider impacts of the pandemic post-lockdown.

COVID-19

The SARS-CoV-2 virus has infected 266 million people and killed more than 5.4 million worldwide as of December 30, 2021 (World Health Organization, 2021). From the first reported cases in Wuhan, in China's Hubei province, in late December 2019, the virus spread with alarming speed across the globe before a pandemic was declared on March 11, 2020 (World Health Organization, 2020d). Worldwide, the broad features of the pandemic were similar. Almost all countries experienced COVID-19 infections and deaths. In response, most governments introduced significant restrictions on human movement and interaction,

and stricter health and safety requirements to control the proliferation of the virus and its associated morbidity and mortality. State-mandated directives, some more stringent than others, routinely required businesses and recreation spaces to close, large-scale events to be cancelled and non-essential travel to be banned. Public health messaging was developed to curb the spread and protect the most vulnerable populations from this unprecedented global threat. However, beneath these broad commonalities, the pandemic experience varied considerably from country to country depending on multiple factors; in particular, local rates of infection and death, geographic positioning, national wealth, governmental response and public trust. Around the world, lockdowns, also known as stay-at-home orders, varied substantially in length and in the extent to which human movement was limited and business trading was ceased. Thus, while the global pandemic was felt collectively, unique national factors heavily influenced the way it was experienced in daily life.

COVID-19 in Aotearoa

New Zealand's pandemic exposure and government response differed significantly from most other countries. As an isolated island nation, infection rates were lower and slower moving, and the government moved faster than other jurisdictions when the first COVID-19 case was confirmed in February 2020. On March 25, a national state of emergency was declared and the country moved to alert level 4 lockdown (Ardern, 2020). As in Britain and many European countries, the New Zealand government closed schools and most businesses, and required non-essential workers to stay at home until these strict public health measures were eventually eased on April 28. In the 33 days of alert level 4, most citizens could only leave their household "bubbles" to collect groceries, get medical treatment or exercise in the immediate vicinity. Lockdown conditions were eased gradually through April and May, and restrictions were lifted entirely on June 8 once the virus was eliminated (Baker et al., 2020), albeit temporarily. An additional Auckland-only lockdown was imposed August 12-30, 2020.

COVID-19 uncertainties continued throughout 2021, with subsequent brief Auckland lockdowns ordered in February and March, culminating in a protracted lockdown August to December, largely impacting Auckland only.

Initial Mental Health Concerns

Alongside the extensive physical disease burden, there have been major concerns that the pandemic would negatively impact human psychological health. In the first months of the outbreak especially, health authorities and commentators feared the uncertainty and isolation of the COVID-19 crisis, and accompanying transmission control measures, would have a significant and enduring population mental health impact (Holmes et al., 2020; Pfefferbaum & North, 2020). The World Health Organization (2020c) warned of the urgent need to support psychosocial wellbeing, and advised the public to minimise media consumption, practice empathy and focus on positive, hopeful stories to ease the psychological toll. Certainly, research undertaken in previous large-scale traumatic events like September 11, the Hong Kong civil protests, natural disasters and mass shootings found such experiences caused some psychological impairment for a substantial number, and mental disorder in a smaller proportion (Goldmann & Galea, 2014; Neria et al., 2008). Similarly, a systematic review of the psychological impact of the Christchurch earthquakes found widespread but not universal impairment of mental health (Beaglehole et al., 2019). Of course, the pandemic did not damage property or result from human intent, two major stressors previously linked to mental health decline (Norris et al., 2002). Nevertheless, given COVID-19's dramatic and unprecedented impact on daily life, and evidence of emotional distress based on previous traumatic events, it was unsurprising that mental health advocates, academics and practitioners were concerned.

Commentators identified a constellation of specific stressors that were likely contributing to the emotional distress of COVID-19: fear of contracting the virus; treatment

challenges and death; concerns over the health of others; job losses (actual and threatened); financial instability; and conflicting messages from authorities (Holmes et al., 2020). Furthermore, the pandemic made it more difficult for many with mental health problems to access early diagnosis and treatment, or get continuity of care for pre-existing conditions, both key for recovery (Campion et al., 2020). Perhaps the most substantial stressors, however, were the global public health directives to isolate. Work and school closures, reduced social contact and limitations on movement impinged on public freedom, and delivered their own specific set of stressors that impacted on population mental health (Brooks et al., 2020).

Lockdowns were deemed necessary and effective for saving lives and curbing viral spread, but there was widespread concern the practice would have dire social and emotional consequences (Gunnell et al., 2020; Pfefferbaum & North, 2020). In the latter paper, the authors express fear that lockdown conditions would increase loneliness, and unhealthy behaviours, such as alcohol consumption and drug use, domestic violence, screen time and social media viewing, and poor dietary choices, which have been associated with adverse mental health states (Pfefferbaum & North, 2020). There is some evidence from previous epidemics to suggest a psychological impact from quarantining. In their review of 24 studies carried out during SARS, MERS, H1N1 and Ebola, Brooks et al. (2020) found emotional distress was commonplace. Most studies reported that quarantine routinely invoked stress, depression, insomnia, fear, confusion, anger, frustration, and boredom, with some symptoms remaining months, or even years, after quarantine ended. Furthermore, mental health outcomes were worse for those who had a longer isolation period, insufficient supplies, inadequate information, or had experienced financial loss or poor access to medical treatment. While concerning, these findings should be treated with some caution. These largely cross-sectional or qualitative studies did not follow up participants over time, and thus

relied on comparisons with national prevalence data to suggest a change in psychological state. Furthermore, quarantining in the past involved smaller, often-infected populations, and therefore differed substantially from the sweeping, non-discriminating lockdowns imposed in the COVID-19 pandemic. Nevertheless, there is good evidence to suspect lockdown rules would negatively impact mental health.

COVID-19 as a Mental Health Risk for Older People

The mental health impact of the pandemic on older people is worthy of research attention. While an *older person* is a relative concept, the term is typically used to describe individuals aged 60 or over (World Health Organization, 2018) or, in New Zealand, generally 65 and over, to align with retirement age. This thesis applies the broader definition of 55 and over to capture those in later life as they transition to retirement, a stressful period often marked by poorer mental health (Dave et al., 2006). This is the threshold for older persons used by the HWR study, the data source for the current study. The following sections rationalise the research focus on older people and outline the various psychological threats that COVID-19 poses to this diverse and substantial population of New Zealanders.

Why Focus on Older People?

The mental health of older adults has been a somewhat neglected field of research. Prior to the mid-20th century, life expectancy was around 60, and mental health efforts were understandably focused on younger adults in an overwhelmingly youthful population (Birren & Schroots, 2001). Psychological theorising at the time emphasised the role of early life experiences and child development in determining mental wellbeing and causing mental disorders (Beekman et al., 1997). Fortunately, as the global population has aged, more than doubling the number of people over 60 since 1980 (United Nations, 2017), there has been growing attention paid to older adults as a discrete group with unique needs. Stereotypes about old age have been challenged, the positive ageing movement was born, and older

people are more routinely celebrated as a culturally, socially, economically and psychologically heterogenous group worthy of research attention (Kessler et al., 2014). Of course, the need for such attention is considerable. Demand for specialist geriatric mental health care is expected to grow exponentially, in part due to the ageing "baby boomer" cohort; a recent depression-focused report predicted health services will not be able to meet the future treatment needs of older people with this disorder (Te Pou, 2019). With the proliferation of ageing New Zealanders, it is more important than ever to understand their mental health experiences, to grow knowledge, raise public awareness and inform public policy to support wellbeing in this diverse population.

The Mental Health Threat of COVID-19

There are multiple reasons to expect older people might be psychologically vulnerable in the COVID-19 pandemic.

Disease Susceptibility. Early in the pandemic it became apparent the death toll was heavily biased toward the elderly, increasing fear and stress in this population. Around 95% of COVID-19 related deaths in Europe, and 80% of cases in China and the United States, involved people aged 60 and over (United Nations, 2020). For those aged over 80, fatality rates were 5 times the international average (World Health Organization, 2020c). In New Zealand, 85% of all deaths occurred in those 60 and over, as at November 30, 2021. This increased risk was driven by age-related factors such as physical decline, compromised immune functioning, and higher prevalence of chronic conditions such as diabetes, respiratory and cardiovascular diseases, all shown to increase the likelihood of COVID-19 complications (Mueller et al., 2020). Indeed, modelling by Clark et al. (2020) found 66% of all people aged over 70 suffer from at least one chronic health condition. Moreover, older people are more likely to live in, or attend, facilities with greater COVID-19 risk, such as rest homes and hospitals, further increasing their chances of exposure.

Perhaps unsurprisingly, international research showed high rates of depression and anxiety among people who contracted the virus (Rogers et al., 2021). But there was widespread concern that even the fear of catching COVID-19 would likely cause or exacerbate depression and anxiety, especially among the elderly (Fiorillo & Gorwood, 2020). Indeed, Pearman et al. (2021) found fear of catching the virus was associated with more COVID-related stress in older people when contrasted with younger people. Furthermore, there was widespread, often sensationalised, international media coverage of infection sweeping through residential care homes (Keeley, 2020), and shortages of medical resources needed to save lives (Bendau et al., 2021).

Social Isolation. The requirement to isolate also carried a specific set of mental health threats for older people. Seniors are more likely to live alone, making them more susceptible to social and emotional isolation and loneliness (Jamieson et al., 2018). Friend groups and broader contacts tend to reduce with age, and daily routines become more fixed (Bhattacharya et al., 2016). Therefore, the disruption of already limited socialisation opportunities, such as home visits, church gatherings and peer support groups was likely distressing for many. Few studies have investigated the mental health impact of quarantines in previous epidemics in this age group. In one epidemic, the 2003 SARS outbreak in Hong Kong, suicides among older people increased, with most of the deceased diagnosed with symptoms of depression and anxiety at the time of the outbreak, suggesting concerns about their vulnerability are justified (Chan et al., 2006; Cheung et al., 2008).

The need for social connectedness is a deeply ingrained human instinct, and these social connections enable coping and support wellbeing (Holt-Lunstad et al., 2015). Indeed, overwhelming feelings of isolation have been linked to lower mood and increased sensitivity to threat (Cacioppo & Hawkley, 2009). Furthermore, research shows that cognitive decline, associated with normal ageing, is moderated by social engagement, activities and exercise

(Small et al., 2012), all behaviours that were curbed in lockdown. This suggests that lockdown could potentially impact on cognitive function, which may, in turn, affect mental wellbeing. The global technological phenomenon of online video calls became ubiquitous early in the pandemic as a means of maintaining human connectedness. However, this so-called "Zoom boom" was lost on many older people who were not comfortable with smart phones, video conferencing or social media (Moore & Hancock, 2020). Consequently, lockdown conditions can be supposed to have had negative mental health consequences for many older people.

Health Service Disruption. Physical and mental health problems were a challenge to manage in the pandemic, posing a threat to the mental wellbeing of older people. Given their advanced years, older people are more likely to have chronic medical conditions requiring regular care and medication. In initial lockdowns, in New Zealand and elsewhere, most non-emergency medical treatment was cancelled or postponed, leaving many people, mostly elderly living with chronic illnesses, without healthcare (Holmes et al., 2020). Moreover, health practitioners analysing emergency department presentations at New Zealand hospitals noted dramatic reductions in admissions, and postulated that fear of catching the virus may have deterred those in need from seeking necessary treatment (Christey et al., 2020; Joyce et al., 2021). With good evidence to suggest mental health symptoms can be caused by physical health symptoms, particularly in older populations (Lorem et al., 2017), this poor management of ailments and disease could arguably have impacted psychological wellbeing.

A further aggravating issue in lockdown was the shift to a 'basic needs only' focus. Factors known to support mental and physical wellbeing, such as adequate nutrition and physical exercise, and good personal hygiene, were not prioritised. Access to home carers, who encourage these healthy behaviours and ensure accurate medication intake, was also often limited (Sama et al., 2021), and many elderly people were not comfortable using the

telemedicine services on offer (Lam et al., 2020). Another concern in this population was the poor management of cognitive impairment and dementia. People experiencing irritability, wandering tendencies and psychotic symptoms who were not adequately supported in the pandemic could experience panic and worsening mental and physical health (Banerjee, 2020). Additionally, as this scholar notes, those with psychiatric disorders, including the elderly, are more predisposed to exacerbations during such a crisis. Such health sector issues feasibly impacted mental health in the pandemic.

Perceived Ageism. A further mental health threat was posed by perceived ageism. Commentators contended that the biopsychosocial vulnerabilities of older people were routinely and often unfairly highlighted by the media, government and public (D'Cruz & Banerjee, 2020). For instance, Ayalon et al. (2020, p. 49) asserted the virus spawned "a parallel outbreak of ageism" through routine media portrayals of older adults as homogenous, dependent, feeble, and unable to contribute to society. Likewise, Brooke and Jackson (2020) identify explicitly ageist discourses, such as the denigrating hashtag "BoomerRemover" (Sparks, 2020), which trended on social media in the first months of the pandemic. These academics reason that negative discourses not only complicate the older person's experience of living through COVID-19, but may contribute to a perception of being worthless and a burden to their community, thereby decreasing mental wellbeing. Indeed, stereotype embodiment theory (Levy, 2009) suggests ageism can influence older persons' beliefs about their own ageing, detrimentally impacting both their physical and mental health, a notion supported by empirical research (Levy et al., 2016; Siebert et al., 2020). Viewed through the prism of perceived ageism, the mental wellbeing of older people during COVID-19 is a valid concern.

Depression and Anxiety

Depression and anxiety are the most prevalent psychological problems facing

humankind (American Psychiatric Association, 2013). Based on theorised mechanisms, there is good reason to expect that these common mental health problems are particularly likely to arise as a result of the pandemic. Furthermore, most COVID-19 mental health literature uses depression and anxiety as key outcome variables to measure the level of psychological distress. The following section offers some key definitions and characteristics of depression and anxiety, with particular attention to their presentation in older people. A theoretical framework is then presented to explain the potential development of these psychological states during the COVID-19 pandemic.

Definitions and Characteristics

Depression. Depression is an umbrella term that envelops multiple depressive disorders, each with many symptoms that typically overlap with other prevalent psychiatric conditions (Hammen & Watkins, 2018). Therefore, the way the disorder manifests, and the severity and nature of the symptoms, can differ significantly from one person to another. Depressive disorders are usually characterised by low mood and accompanied by a collection of symptoms that include fatigue, feelings of worthlessness and guilt, disturbed sleep, lapses in concentration and suicidal thoughts (American Psychiatric Association, 2013). As distinct from temporary sadness, a depression diagnosis requires a pervasive pattern of symptoms that cause clinically significant distress.

The literature on the age-related depression risk is inconsistent. While some research suggests prevalence declines with age (Henderson et al., 1998; Wild et al., 2012), most demonstrate that risk remains stable or even increases (Luppa et al., 2012; Snowdon, 2001; Thielke et al., 2010). The World Health Organization (2017) estimates 7% of people aged 60 and over have depression, while other research estimates 5% of older people meet the criteria for the most common subtype, major depressive disorder (MDD; Hasin et al., 2018). Later-life depression is associated with cognitive impairment and dementia, disability, loneliness,

and suicide (Rodda et al., 2011). Depression can also limit recovery from physical illness by reducing motivation to take medications and practice self-care (Matsuzaki et al., 2015). Depression is one of the most common psychological problems seen in older people and there are concerns it often goes untreated in this group (Alexopoulos, 2005). This may be because, rather than exhibiting classic depressive symptoms, older adults tend to predominantly display somatic and cognitive signs, like issues with concentration, memory and decision making, that are also usual features of normal ageing, or could be caused by medications (Fiske et al., 2009).

Studies measuring the effect of the pandemic on depression most commonly used the Patient Health Questionnaire-9 (PHQ-9; Kroenke et al., 2001), its brief version, the PHQ-4 (Löwe et al., 2010) or, less frequently, the Depression Anxiety Stress Scales-21 (DASS-21; Brown et al., 1997).

Anxiety. Anxiety is a psychological state underpinning a range of prevalent diagnostic presentations. Anxiety disorders are characterised by excessive, hard-to-control worry, accompanied by irritability, muscle tension, fatigue, difficulty concentrating, feeling 'keyed up' and sleep disturbance (American Psychiatric Association, 2013). As distinct from normal feelings of nervousness or anxiousness, a diagnosis of an anxiety disorder requires excessive fear or anxiety that causes clinically significant distress. The broadest and most common conception of anxiety is generalised anxiety disorder (GAD), in which worry relates to a variety of things in one's life.

Like depression, findings on later-life prevalence of anxiety are mixed. While some suggest the anxiety disorders decline with age (Canuto et al., 2018), others suggest the risk remains high (Curran et al., 2020; Sousa et al., 2017). In older age, these conditions tend to be chronic and unremitting, highly comorbid with depression and medical illnesses, and cause considerable psychological suffering and life impairment (Wolitzky-Taylor et al.,

2010). Furthermore, anxiety often goes undiagnosed, commonly because older people misattribute their anxiety symptoms to physical problems or illness (Bryant et al., 2008). To complicate matters, anxiety and physical illness have considerable overlap, as illustrated by the high anxiety prevalence among older people with cardiovascular disease and those who are inactive (Wolitzky-Taylor et al., 2010). Later-life anxiety is associated with deficient coping strategies, previous mental illness, a poor social network, stressful life events and female gender (Vink et al., 2008).

Studies measuring the effect of the pandemic on anxiety most commonly used the General Anxiety Disorder 7-item scale (GAD-7; Spitzer et al., 2006) or, less commonly, the aforementioned DASS-21.

Comorbidity. Anxiety and depressive disorders are highly comorbid in older adults, and the two psychological states have a large symptom overlap (Wolitzky-Taylor et al., 2010). Research suggests the conditions are positively related (Jansson-Fröjmark & Lindblom, 2008) and predict one another (Jacobson & Newman, 2017). Interestingly, comorbidity is more common in older age (Almeida et al., 2012), with some suggesting that anxiety symptoms become overshadowed by those of depression in later life (Wetherell et al., 2003). Due to the complex interplay between the two psychological problems, they are commonly used in tandem as outcome variables to gauge levels of psychological distress in research.

It has been suggested that anxiety may be a causal risk factor for depressive symptoms (Lewinsohn et al., 1997; Wittchen et al., 2000). Certainly, in the context of the pandemic, anxiety is arguably the more pertinent mental health consideration. As a widely cited review by Vink et al. (2008) found, while both anxiety and depression are common following disasters, anxiety appears better predicted by such traumatic events. This aligns with an earlier theory that depression may be more strongly linked to loss events, whereas anxiety

may eventuate from actual and more imminent threats (Finlay-Jones & Brown, 1981). Indeed, in their disaster research review, Goldmann and Galea (2014) found symptoms of GAD were often elevated following traumatic events. These papers help to form a conceptual model of how the two conditions may co-occur in the COVID-19 pandemic.

Theoretical Perspective

While no psychological theories exist that specifically explain the development of depression and anxiety during COVID-19, some models offer possible mechanisms by which these disorders could occur in this context. The following section explores the most relevant model for each disorder, with attention, where possible, to older age.

Depression. The cognitive model of depression (Beck, 1963), perhaps the most prominent depression theory, is well placed to explain the development of this disorder in the pandemic. This theory, outlined in Figure 1, postulates that depression symptoms are brought on by negatively biased cognition, including biased attention, interpretation and memory (Disner et al., 2011). Framed thus, it can be conceptualised that a person's thoughts and perceptions of the pandemic will influence how they feel in themselves. Central to the theory is the cognitive triad, three forms of critical thinking seen in depressed individuals: spontaneous negative thoughts about the self, the world and the future (Beck, 1976). In the context of the pandemic, negative thoughts about oneself could take the form of "*I am helpless, hopeless or vulnerable*", while those about the environment could be hypothesised as "*the world is a dangerous place*". Negative thoughts about the future (e.g., "*this situation will only get worse*"), also seem a likely fit amid the unfolding pandemic.

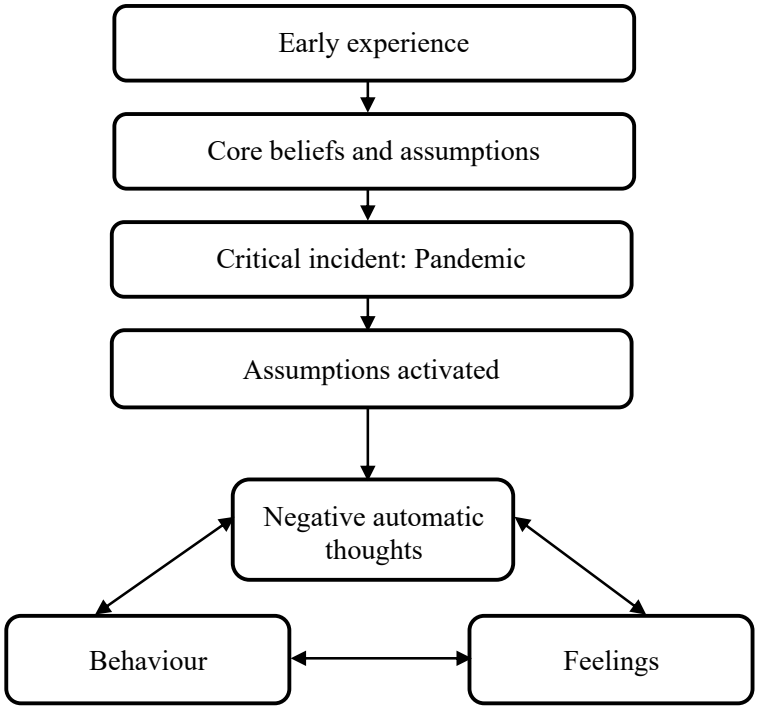
Another important aspect to the theory is a negative self-schema, a set of pessimistic beliefs about oneself that are formed in childhood but are triggered later in life by a stressful life event (Beck, 2002). The pandemic is arguably one such critical incident with a range of specific stressors, such as loneliness, boredom, financial hardship and physical health

concerns, which can activate systematic negative beliefs. It posed a threat to life, especially in those early months, and fear surrounding this new disease, and what might happen, is a powerful source of stress. It could also be argued that older people, as well as dealing with the pandemic, face an additional layer of age-specific negative life experiences which could contribute to activation of negative schemas (Beck, 2002). These experiences, which include relocating into residential care, or to be closer to family, bereavement, functional impairment and ageism, may increase the vulnerability to depressive triggers. As Beck explains it, once the negative self-schema is activated, these individuals become prone to self-defeating cognitive distortions or illogical errors in thinking in which they focus selectively on negative aspects in a situation while ignoring other important information. The pandemic context is particularly conducive to certain cognitive errors, namely black-and-white thinking, jumping to conclusions, overgeneralisation, minimisation and magnification, selective abstraction and catastrophising.

Few studies undertaken in the pandemic attempt to understand the development of depression using the cognitive model. That said, key mechanisms of the theory, such as negative thinking and cognitive distortions, have been linked to depression in the outbreak (Hager et al., 2020; Harrison et al., 2021). Furthermore, a growing body of pandemic research suggests that treating depression with Beck's cognitive-behavioural therapy (CBT) is efficacious in a range of populations, including COVID-19 patients, older people and individuals living alone (Li et al., 2020; Perri et al., 2021; Swartz, 2020). CBT can modify maladaptive automatic negative thoughts about the outbreak including, for example, excessive fears of viral contagiousness or hopelessness about social disconnection, while physical inactivity and loss of regular daily routines can be addressed through behavioural activation and pleasurable activity scheduling. Thus, this model provides a conceptualisation for the development and treatment of depression in the COVID-19 context.

Figure 1

The Cognitive Model of Depression as Applied to the COVID-19 Pandemic



Note. Adapted from Beck (1976).

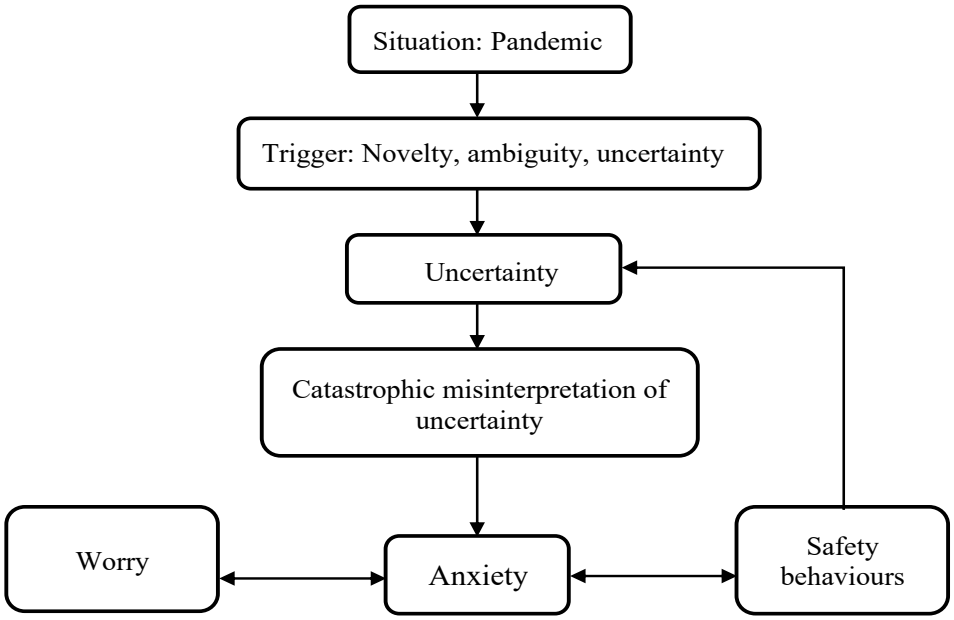
Anxiety. The development of anxiety in a pandemic can be conceptualised by the Intolerance of Uncertainty Model (Dugas et al., 1998), which describes the cognitive tendency to respond negatively to unclear or unpredictable situations (Buhr & Dugas, 2009). The pandemic clearly entails many uncertainties; for instance, the probability of infection and serious illness, means of prevention, and the future course of the outbreak (Durodié, 2020). Consequently, those people who have great difficulty tolerating uncertainty will more likely overinflate the dangerousness of the outbreak. As outlined in Figure 2, Hebert and Dugas (2019) describe the main triggers for uncertainty as novelty, ambiguity, and unpredictability in situations, characteristics all ubiquitous in COVID-19. Once a state of uncertainty is

triggered, these individuals then develop catastrophic beliefs about uncertainty (*"if I'm uncertain it means the risk is high"*) in scenarios where those low in intolerance of uncertainty would not. Consequently, they experience feelings of anxiety, worry about possible outcomes, and use avoidance or information-gathering strategies to try to suppress negative consequences (Dugas et al., 1998). However, these strategies only serve to further reduce a person's tolerance of uncertainty, thereby maintaining the cycle. For instance, asking *"What if…?"* questions may increase the number of possible uncertain outcomes available. Research has established that a higher intolerance of uncertainty is a risk factor for developing GAD (Robichaud et al., 2019). Furthermore, GAD can be successfully treated with a CBT approach aimed at improving the individual's tolerance and acceptance of uncertainty (Robichaud, 2013).

Several studies have explored the role of intolerance of uncertainty in the pandemic using the Intolerance of Uncertainty Scale (Carleton et al., 2007). Bavolar et al. (2021) found the phenomenon was related to higher levels of threat perception, stress and anxiety. The authors note that the high intolerance seen in older adults could reflect the higher danger of COVID-19 for this age group. Rettie and Daniels (2021) found intolerance of uncertainty predicted psychological distress in the pandemic, and this relationship was partially mediated by maladaptive coping. Interestingly, intolerance of uncertainty equally predicted anxiety, depression and health anxiety. Finally, a US longitudinal study (Tull et al., 2020) found higher intolerance of uncertainty predicted higher health anxiety later. The authors hypothesised that the phenomenon probably intensified worry associated with perceived risk of a COVID-19 infection or death, and caused catastrophic misinterpretations of harmless physical sensations as a sign of illness. These examples illustrate that intolerance of uncertainty, and its accompanying components such as catastrophic beliefs about uncertainty and avoidance strategies, can explain the presence of psychological distress in the pandemic.

Figure 2

The Intolerance of Uncertainty Model as Applied to the COVID-19 Pandemic



Note. Adapted from Hebert and Dugas (2019).

Health Behaviours and the Mental Health Impact of COVID-19

Beyond these broad theoretical reasons to expect the pandemic may have had a negative effect on the mental health of older adults, there are also specific health behaviours that are likely to have been negatively impacted by COVID-19, and that may in turn go on to pose mental health risks. In particular, increased alcohol consumption and decreased physical activity are known to exacerbate mental distress, and were often highlighted as features of the pandemic, and in particular the lockdown, in New Zealand and elsewhere. Thus, they could potentially explain the relationship between the pandemic and increased mental distress. The following section explores the likelihood of negative health behaviour changes during COVID-19, and what is known about their association with poorer mental health.

Alcohol Use

Alcohol Use, Depression and Anxiety. Alcohol use and psychological disorders such as depression and anxiety are frequently comorbid. Studies from the United States show 40% of adults with MDD and up to 61% of adults with GAD also have alcohol use disorder (Hasin et al., 2005; Smith & Randall, 2012). There is a considerable literature base suggesting that alcohol use affects mental health. A major review of the alcohol-anxiety link (Kushner et al., 2000) concluded that anxiety and alcohol use disorders are bi-directionally causal, with symptoms for each disorder interacting in a feed-forward vicious cycle to cause comorbidity. Indeed, an early laboratory study (Coffman & Petty, 1985) found chronic alcohol use leads to changes in neuro-chemical systems linked to anxiety; however, it was not clear if this caused more than a temporary anxious state. Likewise, Boden and Fergusson (2011) reviewed the alcohol-depression causal link and found it most plausible that hazardous alcohol use triggers neurophysiological and metabolic changes that increase the risk of depression, not vice versa. More recently, Bellos et al. (2016) investigated the longitudinal links between alcohol use at baseline and the later onset of depression and GAD in 3,201 people from 14 countries. They found that excessive alcohol use was associated with a higher incidence of depression but not GAD, and noted that it was difficult to make any causal interpretations with their observational data.

Alcohol Use in Older New Zealanders. Alcohol use is normalised, and indeed promoted, in New Zealand society. Most older New Zealanders drink alcohol, usually at home, and while they drink more frequently than younger people, often several times a week, they tend to consume less as part of general pattern of later-life alcohol reduction (Hodges & Maskill, 2014). This same review, which focused on studies using the Alcohol Use Disorders Identification Test (AUDIT) alcohol screening tool, found 11% of older drinkers aged 55-64, 7% of drinkers aged 65-74 and 3% of drinkers aged 75-plus, drink hazardously. Moderate to

heavy drinking is associated with some age-specific risks; for instance, exacerbating conditions like osteoporosis, stroke, diabetes and high blood pressure, that are common in older age, and reacting to medications and causing forgetfulness and confusion. These issues all have negative knock-on effects on mental health (Heuberger, 2009; Satre et al., 2020).

Alcohol Use in the Pandemic. At the outset of the COVID-19 pandemic, there was much concern that global lockdowns would lead to an increase in alcohol consumption (Clay & Parker, 2020; Ramalho, 2020). Research indicates that social isolation is linked to increased unhealthy behaviours, including drinking (Elovainio et al., 2017). Studies undertaken in economic crises have established that stress and harmful drinking often go hand in hand (De Goeij et al., 2015), presumably as a way to manage difficult feelings such as uncertainty, loneliness and boredom. Indeed, at the outset of New Zealand's lockdown, several organisations raised fears about the widespread availability and potential misuse of alcohol (Radio New Zealand, 2020). Furthermore, some believed alcohol could protect against COVID-19 (Chick, 2020), prompting warnings from the World Health Organization (2020a).

Prior research suggests older people may drink more alcohol in lockdown. Key risk factors for this age group include having more leisure time, as a response to loneliness, and to counter distress (Hodges & Maskill, 2014), all feasibly triggered by sudden, strict lockdown conditions during the pandemic. Indeed, there is evidence older people are particularly vulnerable to hazardous alcohol use when lonely or isolated (Wang & Andrade, 2013). Whether these risks are also present in the post-lockdown pandemic environment has not been investigated.

Commentators voiced concerns that any potential increased alcohol consumption may have knock-on effects on mental health. In particular, it was feared that the distruption and stress of COVID-19, together with lockdown requirements, would likely exacerbate

hazardous alcohol consumption among people with anxiety and depression symptoms (Clay & Parker, 2020; Galea et al., 2020; Pfefferbaum & North, 2020). Mental health research from terrorist attacks and natural disasters show people with pre-existing mental health diagnoses are more likely to increase their alcohol consumption in response to stressors (Galea et al., 2002; Galea et al., 2020). Indeed, drinking in a crisis situation is known to temporarily relieve feelings of anxiety or depression by inhibiting the central nervous system (Abrahao et al., 2017).

Physical Activity

Physical Activity, Depression and Anxiety. There is considerable evidence showing the benefit of regular exercise across many facets of physical and psychological health, including anxiety and depression (Biddle, 2016; Fletcher et al., 2018). A meta-meta-analysis of 92 randomised controlled trials analysed the effect of physical activity on depression or anxiety in non-clinical populations and found the health behaviour reduced depression by a medium effect (standardised mean difference = -0.50, 95% confidence interval (CI) [-0.93, -0.06]) and anxiety by a small effect (standardised mean difference = -0.38, 95% CI [-0.66, -0.11]) (Rebar et al., 2015). Conversely, physical inactivity is associated with increased depression (Nyström et al., 2019; Patten et al., 2009) and anxiety (Teychenne et al., 2015), although these papers could not determine whether sedentary behaviour increased the risk of psychological symptoms, or vice-versa.

It has been hypothesised that regular exercise produces anxiolytic effects that trigger changes in the hypothalamic-pituitary-adrenal (HPA) axis and endogenous opioid system, which are concerned with stress reactivity, mood, anxiety and emotional responses (Crews & Landers, 1987). Furthermore, exercise is known to increase brain-derived neurotrophic factor, a distress-reducing protein important in anxiety and depressive disorders (Phillips, 2017). It should also be noted that physical activity strengthens the immune system and counteracts

multiple chronic health conditions, including obesity, diabetes, and cardiovascular disease, known to increase mental distress (Nieman & Wentz, 2019).

Physical Activity in Older New Zealanders. Despite the nation's cultivated outdoor image, New Zealanders are not especially active (Global Observatory for Physical Activity, 2021), and those 65 and over are the most inactive (Ministry of Health, 2013). Current guidelines recommend 2.5 hours of moderate physical activity each week for healthy adults, including older adults (Ministry of Health, 2021), yet just 55% of men and 47% of women aged 65-74 years are regularly physically active (Ministry of Health, 2013). These figures decline to 38% and 28% respectively among those 75 years and older. Exercise offers several age-specific benefits, namely increasing energy expenditure and muscle strength and flexibility required for balance and coordination, decreasing systemic inflammation, improving sleep and boosting levels of social interaction, which all have positive knock-on effects on mental health (Vogel et al., 2009). Indeed, a small Spanish study found active older people had fewer symptoms of depression and anxiety than their inactive counterparts (de Oliveira et al., 2019).

Physical Activity in the Pandemic. In the early days of the outbreak, there was much concern internationally that containment strategies requiring limited movement of populations would exacerbate already low levels of physical activity (Hall et al., 2021). Many of the usual opportunities to be active, such as participating in fitness classes, neighbourhood or hospital-run rehabilitation programmes, and use of public parks, were prohibited or curtailed. Furthermore, everyday incidental exercise, like the commute to work, the supermarket, or to social engagements, was now heavily curbed. In New Zealand, under alert level 3 and 4 social distancing directives, citizens were specifically told to exercise in or very near their homes (New Zealand Government, 2021), but were given no guidelines on what to do or how often. The World Health Organization (2020c) was concerned that people,

confined to their homes, might be too busy working or re-organising their lives, unmotivated, or unable to adjust their routine to include physical activity. Furthermore, individuals may lack the space or access to equipment and online exercise programmes required. There is a paucity of research from previous global disasters to support these concerns. Unlike alcohol consumption, few studies examined physical activity levels in these situations, possibly because the COVID-19 pandemic is the first incident to limit movement on a prolonged and global scale in an era where the benefits of physical activity are fully understood. There is, however, some research showing that stressful life events may act as an impediment to achieving adequate physical activity (Lutz et al., 2010). If that is the case, the stress brought on by COVID-19 may indeed have impeded exercise levels.

Commentators raised concerns that lack of exercise would be particularly harmful to older people (Campbell, 2020; Roschel et al., 2020). Certainly, much research suggests lockdown-type conditions could have a larger effect on the activity levels of older people than it did on younger people. For instance, Jansen et al. (2015) found a direct association between inactive time and time spent at home in older populations. Older individuals are also more inclined than their younger counterparts to be active as part of social interactions, like walking with friends, or doing community fitness classes or rehabilitation programmes. Research suggests social interaction offers specific beneficial pathways to improving physical health in the elderly (Sepúlveda-Loyola et al., 2020; Tomioka et al., 2017); thus, the social isolation caused by lockdown acts as a barrier to exercise. Furthermore, many older people lack the technical resources or confidence to access the online fitness classes and smartphone apps heavily consumed by younger people at this time (Son et al., 2021).

Vulnerable Populations and the Mental Health Impact of COVID-19

There is good evidence that some ‘at risk’ subgroups of older people may be particularly vulnerable to the damaging mental health impacts of the COVID-19 outbreak.

These groups, including women, Māori, the socioeconomically disadvantaged and those with pre-existing mental health problems, are already known to face systemic hardships that increase their risk of depression and anxiety. This section discusses reasons why the COVID-19 pandemic could plausibly impact these groups particularly harshly, compared to other subgroups, over and above the higher rates of mental health challenges they already experience. Work to understand the distribution of this mental health burden is critical in order to ensure psychological services target those most in need.

Women

There is a strong theoretical literature base to suggest the mental health impact of COVID-19 might be larger on women than on men. Epidemiological research consistently finds women to be generally at increased risk of developing depression and anxiety (Altemus et al., 2014; Lim et al., 2018). In New Zealand, women are 1.8 times more likely than men to experience psychological distress (Ministry of Health, 2020). However, COVID-19 presents some specific social stressors that are likely to impact more heavily on women. For instance, females may face a disproportional economic impact associated with the pandemic (Alon et al., 2020). These authors highlight that paid work interruptions, job loss and reduced hours during lockdown were more prominent in female-dominated employment sectors, such as hospitality. Meanwhile, women also had to contend with increased domestic responsibilities due to school and day care closures. This stands in sharp contrast to other economic downturns, such as the 2008 global recession, which impacted most heavily on those in standard downturn jobs like construction and manufacturing, which are male-dominated (Alon et al., 2020). Furthermore, the frontline health workforce, which faced long work hours, stress and infection risk, is predominantly made up of women (Rabinowitz & Rabinowitz, 2021). Another gender-based issue is the increase in domestic violence widely reported in COVID-19 (United Nations, 2020). This report states that many women were

locked down with their abusers while services to support them were disrupted. Commentators warned that these economic, professional and domestic circumstances could take a deeper toll on women's mental health (Thibaut et al., 2010).

While older women are less likely to be caring for dependents, many are still reliant on employment income while also dealing with the physical and psychological challenges of ageing. Older New Zealand women are also more likely than men to live alone (Koopman-Boyden & Moosa, 2014) and to act as unpaid carers (Alpass et al., 2013), with both circumstances adding additional emotional distress in the pandemic. Taken together, there is reason to believe the mental health of older women would be disproportionately impacted by the pandemic.

Socioeconomically Disadvantaged

Similarly, it can be argued that the effect of the pandemic on mental health might be larger for people who are more socioeconomically disadvantaged. It is important to note that, outside the COVID-19 context, people with less income tend to have higher rates of mental health problems, which is likely to be, in part, attributable to pre-existing social inequalities (Ribeiro et al., 2017). New Zealand research shows economic challenges are associated with poorer mental health in older people (Stephens et al., 2010). Likewise, pre-pandemic international research explicitly evaluating the role of wealth in depression found people with little money in the bank had about 1.5 higher odds of experiencing symptoms of depression than those with large family savings, after demographic variables were controlled for (Ettman, Cohen, et al., 2020). Interestingly, this was true both in low-intensity periods and during periods of social duress, as the pandemic could be described. Scholars have proposed that, in the pandemic, these poorer individuals experience more difficulties such as job loss, reduced household income, and struggles to pay bills, and have less capacity to comfortably engage in social distancing with adequate food and important resources like access to the

internet (Wright et al., 2020). Furthermore, socioeconomically deprived populations are more likely to contract the virus, and are more likely to have medical conditions that put them at risk of COVID-19 complications (Ahmed et al., 2020). Thus, it is feasible that socioeconomically disadvantaged older New Zealanders experienced disproportionately worse mental health in the pandemic.

Ethnic Minorities and Indigenous Populations

It can be reasoned that those from ethnic minority and indigenous populations are more likely to face fundamental societal disadvantages that put them more at risk of developing mental health problems in a pandemic. Like women and the socioeconomically disadvantaged, rates of mental distress tend to be generally higher in these populations. For instance, minority groups in the United States show comparatively higher rates of depression, possibly due to social stigma and poor access to treatment (Alegría et al., 2008). Indigenous groups, too, have shown worse mental health, possibly explained by intergenerational trauma, spiritual loss and socioeconomic deprivation (Gracey & King, 2009). But, again, the pandemic presents a particular threat to their wellbeing not faced by dominant or colonising cultures. Firstly, as numerous American studies show, the virus disproportionately affects Black (Millett et al., 2020) and Latino (Rodriguez-Diaz et al., 2020) Americans, who are overrepresented in COVID-19 morbidity and mortality statistics. It has also been argued that structural racism amplifies these risks for minority ethnic groups, increasing their risk of viral exposure and underlying health conditions, and limiting access to healthcare (Garcia et al., 2020). Likewise, studies with indigenous populations in Chile (Millalen et al., 2020), Brazil (Palamim et al., 2020) and the United States (Foo et al., 2021) highlight a similar pattern of disease risk. Furthermore, these two broad population groups generally have higher rates of poverty and employment instability, two stressors likely to increase psychological distress in a pandemic.

In Aotearoa, Māori scholars and kaumatua have voiced concerns that the pandemic may reinforce structural inequalities brought on by colonisation (McLeod et al., 2020). It is certainly feasible that Māori, as an indigenous population and minority group, were adversely impacted by the global pandemic in a similar way to populations elsewhere. They, too, have less access to stable housing, good health care and economic opportunities (Parr-Brownlie et al., 2020), suggesting COVID-19 outbreaks are more likely to affect Māori communities. Furthermore, Māori are 2.5 times more likely to be hospitalised with a COVID-19 infection, due to high rates of underlying health conditions, respiratory vulnerability from smoking, and increased likelihood of crowded or multi-generational living situations (Steyn et al., 2021). These factors may disproportionately increase mental health risk among this population during the pandemic.

People with a Pre-Existing Mental Health Condition

Finally, people with pre-existing psychiatric conditions prior to COVID-19 were identified as another potentially vulnerable group at the beginning of this pandemic (Holmes et al., 2020; Pfefferbaum & North, 2020; Vindegaard & Benros, 2020). Of course, this population already had compromised mental health, but these authors argued that their vulnerable psychological state was likely to deteriorate more in the pandemic context when compared with people who were psychologically well. These assertions are based on several factors. People with prior mental health issues are more likely than those without to develop lung infections and may also be more vulnerable to an increased emotional stress response to the outbreak (Yao et al., 2020). As a result, these individuals may have increased risk of mental illness relapse. Furthermore, medical outpatient clinics were largely closed, delaying access to mental health services and effective interventions (Holmes et al., 2020). Another consideration is that, in general, those with a pre-existing condition arguably have fewer mental resources on which to draw and, importantly, less access to regular health care to

support their recovery, making them more vulnerable to internalising symptoms during the pandemic (Vindegaard & Benros, 2020).

Summary

Existing literature drawn from past traumatic events, theoretical perspectives of anxiety and depression causation, and factors impacting older people, paint a credible picture that the mental health of older New Zealanders may well have been negatively impacted by the COVID-19 pandemic. Furthermore, there is much literature and academic commentary that suggests negative health behaviour changes may have been associated with poorer mental health, and that some subgroups of older people likely experienced a disproportionately greater decrease in psychological wellbeing than others. On the back of this discussion, empirical evidence from mental health research in the pandemic will now be reviewed to establish whether these concerns are borne out in quantitative findings.

Chapter 2: COVID-19, Mental Health and Older People: The Empirical Evidence

This chapter assesses quantitative studies that measured the mental health impact of COVID-19 on older people. This is followed by a review of the empirical research from the pandemic on the role of health behaviours, in particular alcohol use and physical activity, and the impact on specific 'at risk' subgroups.

Did Depression and Anxiety Increase Among Older People?

While the theoretical and historic empirical evidence suggests older people would be negatively impacted by the COVID-19 pandemic, the findings of empirical studies directly assessing the impact of the pandemic are more nuanced. The following review critiques pandemic studies that evaluate mental health changes or try to draw inferences about the psychological effect of the pandemic. Literature is organised by design type and focuses, where possible, on research carried out after the initial March-May outbreak period, to match the data collection period of the present study. Attention is given to studies set in countries with stricter lockdowns and with fewer infections and deaths, to align with circumstances in Aotearoa. New Zealand findings are incorporated where available.

Cross-Sectional Studies

Cross-sectional studies make up the majority of research on mental health in the pandemic. While these studies help to identify factors predicting poorer mental health in the pandemic, they reveal little about the effect of the pandemic on psychological state. Indeed, in the absence of pre-pandemic data, they cannot directly establish that the outbreak is correlated with poorer mental health, let alone that it has caused poorer mental health. However, given the dominance of cross-sectional research in this field, this research will be briefly reviewed, with attention given to those works that focus on older people, those undertaken in New Zealand, and those involving explicit comparisons with historical averages in an attempt to measure change.

International Reviews. Multiple large-scale meta-analyses (Luo et al., 2020; Rajkumar, 2020; Salari et al., 2020; Sepúlveda-Loyola et al., 2020; Y. Wang et al., 2020; Xiong et al., 2020) all report that depression and anxiety were elevated on average in the population during the pandemic when compared, often vaguely, to national baseline statistics. Some of these reviews note that adverse psychological symptoms were less pronounced in people aged over 40 compared with younger counterparts (Y. Wang et al., 2020; Xiong et al., 2020). Among these reviews was one lone, highly-cited study from China, reporting that people aged 60 and older had higher psychological distress scores than people aged 30-60 (Qiu et al., 2020). Problematically, however, none of these papers compare the prevalence of psychological distress to pre-pandemic normative data; thus the results say little about the effect of the pandemic.

Among the more than 150 studies from 2020 examined in international reviews, a disproportionate number were conducted in China, where infection patterns differed considerably from New Zealand. Furthermore, respondents were often self-selected, and therefore biased, and the mean age of respondents was generally low, suggesting results may not be reliably generalisable to older people. Additionally, about 90% of surveys included in these reviews, and most of the other studies included in this section, were carried out entirely online, an environment many seniors are reluctant to engage with (Glass et al., 2015). It is also feasible that the tech-savvy older people who did respond differed systematically from their peers without these resources, potentially biasing results. Furthermore, while many of these reviews note that inferences about the COVID-19 effect cannot be drawn from data, change is assumed in their conclusion; for instance, a “high psychological impact” was determined by Luo et al. (2020, p. 6). Actual mental health change is uncertain, and while a relatively lower risk was observed in older people, whether older people were more distressed than before is unknown.

Research in Older People. Some cross-sectional research focused entirely on older populations. Two global studies worthy of mention compared older people's mental health across countries. Kim and Jung (2021) surveyed 13,660 people over 55 years old from 62 countries and found that lockdown conditions were positively associated with psychological distress across national boundaries. However, distress scores were lower in countries with fewer deaths and stricter viral-control rules. New Zealand, with fewer COVID-19-induced deaths and more stringent government policy measures, registered one of the lowest distress levels. The authors theorised that more stringent policies may boost political trust among citizens, which may then shield against the negative mental health effects of social isolation in older age. In relation to this point, Reppas-Rindlisbacher et al. (2021) found older Americans had both higher depression and anxiety symptoms and less governmental trust than older Canadians, concluding that government handling of the pandemic has a considerable bearing on mental health. These works may not shed light on mental health change but they do helpfully describe the influence of infection control and government leadership on how much distress older people experience.

New Zealand Research. Few New Zealand studies have considered mental health changes during the pandemic in the general population, including among older people. Two cross-sectional studies report a predominant resilience among this age group. Every-Palmer et al. (2020) conducted an online panel survey during alert level 4 in April with 2,010 adults, including a representative sample of older people. In line with the aforementioned international research, this comparatively rigorous study found psychological distress well above baseline measures taken from the 2018/19 NZ Health Survey for all age groups (30.3% vs 8.2%). However, observed increases were less in the older age group than in younger people. A second smaller study conducted in May 2020, after lockdown ended, also used a historical baseline and recorded strikingly similar results, reporting inflated levels of mental

health issues and concluding that age was negatively correlated with depression and anxiety (Gasteiger et al., 2021). Both sets of researchers note that their findings might reflect older people's resilience as a result of overcoming past misfortunes, and the fact that they likely experienced fewer financial impacts and lifestyle disruptions. Furthermore, older New Zealanders might have felt safer in Aotearoa compared with elsewhere, given that COVID-19 outbreaks in aged-care facilities were quickly controlled, and the virus did not become pervasive in services for the elderly.

Longitudinal Studies

The cross-sectional research suggests depression and anxiety levels in the general population may have been higher in the pandemic compared to prior, in New Zealand and elsewhere. Furthermore, while older adults appeared to be less impacted than younger people, the few studies comparing age groups with prior data suggest this population was still affected. It is important to note, however, that studies of this kind lack the methodological precision necessary to inform government policy, clinical practice, and public discourse. For this, longitudinal designs are critical in determining whether a population's reported levels of distress are actually greater or less than at a pre-pandemic time point.

Comparatively fewer studies measured the mental health impact of lockdown over time, and fewer still addressed the effect on older people. While longitudinal research does not conclusively demonstrate causality, as changes over time could be attributed to other events, it is able to establish a statistical relationship between the pandemic and mental health, unlike cross-sectional studies. This section evaluates key studies and meta-analyses with pre-pandemic baseline data collection carried out early in the pandemic, and those undertaken in subsequent months, and then considers the important influence of country-specific factors on results.

Early Pandemic Research. Much of the longitudinal research to date has focused on the mental health impact of the initial outbreak and lockdowns in March-April 2020. The only two meta-analyses that review longitudinal studies on the psychological impact both show an overall increase in depression and anxiety at this early time point. Prati and Mancini (2021) analysed 25 studies with a follow-up data collection during lockdowns in 16 countries worldwide and found stay-at-home orders had a small but significant effect ($g = 0.17$, SE = 0.05, 95% CI [0.07, 0.26], $p < 0.001$) on depression and anxiety symptoms in the general population. The authors warned that their estimate should be interpreted with caution given the relatively wide confidence intervals. No significant moderation effects for mean age were identified. Many of the same studies were also included in Robinson et al. (2022)'s review of 65 longitudinal papers. This meta-analysis reports a more convincing overall increase in mental health symptoms between a pre-pandemic time point and March-April 2020 (Standardised Mean Change = .102, 95% CI [0.026, 0.192], $p = 0.03$). These scholars note that worsening mental health symptoms were more pronounced for depression than for anxiety.

While these meta-analyses suggest mental health symptoms increased early in the pandemic, the only two New Zealand longitudinal studies, both drawing from the same data collected in the first 2 weeks of lockdown, found a resilient population. Bulbulia et al. (2020) compared levels of depression in 940 people who responded to both 2019 and 2020 waves of the New Zealand Attitudes and Values Study. Results showed only a very modest increase in overall summed Kessler-6 psychological distress scores, and there was no increase in severe depression. Anxiety data was not collected. Sibley et al. (2020) compared the same 2020 data with propensity score-matched samples from the 2019 survey, and found only slightly increased psychological distress. Neither study reported age-specific results; however, the sample population was relatively old (mean age 51). Interestingly, Sibley et al. (2020) found

the post-pandemic group had higher levels of government trust and satisfaction, which suggests the country's strict government response may have contributed to lower distress.

Two robust large-scale studies from the United Kingdom also report no significant increase in mental distress. Hyland et al. (2021) used the PHQ-9 and GAD-7 to assess changes in MDD and GAD in a population-representative sample of Irish adults questioned in February 2019 and March-April 2020. They report no change in GAD prevalence and, surprisingly, the number of people with major depression significant declined from 29.8% to 22.8%. Kwong et al. (2020) used the same measures in their analysis of older and younger cohorts enrolled in two large longitudinal population-based studies from the United Kingdom. Results, collected in April 2020, show clinically relevant increases in anxiety in the younger, but not the older, cohort. No change in depression levels was seen across any age groups. This finding conflicts with the large meta-analysis by Robinson et al. (2022), but was reported elsewhere (Wong et al., 2020), and aligns with theory that anxiety, with its associations to threat (Craske & Stein, 2016), may more closely reflect the mental distress experienced during a pandemic.

These findings are not universal, however. Pierce et al. (2020) surveyed 17,452 adults involved in the ongoing UK Household Longitudinal Study, and found a clear step-change increase in April 2020 when compared to annual data collected annually since 2014. Clinically significant levels of mental distress rose from 18·9% (95% CI [17.8, 20.0]) in 2018-19 to 27·3% (95% CI [26.3, 28.2]) in April 2020, one month into lockdown. The increase was proportionately smaller among older people compared with younger people, but it was still considerable. The percentage of those with mental distress increased from 17.0% to 24.7% for those aged 55-69, and 10.8% to 17.6% for people aged 70-plus. The findings are limited by a low 2020 survey response rate (49%).

Research Later in the Pandemic. While early longitudinal studies present a somewhat equivocal picture of mental health change, the relatively smaller number of studies that collected data later in the pandemic present a more unified picture of resilience among older people. Two such studies focused entirely on older cohorts. A Dutch longitudinal study by Van Tilburg et al (2020) compared 2019 data with May 2020 data in 1,679 community-dwelling participants aged 65-102, and found mental health status remained roughly stable. By way of explanation, the authors note the relatively low Dutch COVID-19 death toll, not dissimilar to New Zealand's, and suggest also that the second data collection point may have been too late to capture the height of the psychological impact. When comparing their findings to longitudinal studies showing increased distress in younger age groups, these authors suggested that increased wisdom, life experiences and resilience may allow older people to deal with adversity in a more positive way. Another work by Creese et al. (2021) analysed trajectories of depression, measured with the PHQ-9, and anxiety, measured with the GAD-7, annually between 2015 and 2020 for a sample of 3,281 British adults aged 55-96. Between 2019 and May-June 2020 results showed increases in the proportion of respondents with mild symptoms of depression (13.2%-19%) and anxiety (9.3%-12.6%). However, the numbers of older people with moderate-to-severe depression and anxiety symptoms before and during the pandemic were comparable. Women were heavily over-represented in the sample, as were White people and people with higher education; thus the results may not reflect the experience of most older people.

Importantly, some multi-wave longitudinal studies were able to observe an arc of mental health change from pre-pandemic to early and later time points. These suggest the resilience seen in May, June and July, reflects a recovery phase following an earlier spike in mental health symptoms. For example, Daly et al. (2020) found population-wide mental distress increased from 24.3% in 2017-2019 to 37.8% in April 2020 before slowly reducing

in May (34.7%) and June (31.9%) 2020. This decline was also observed in older people. Across the 3 months, mental health problems reduced from 9.3% to 7.7% to 6.2% among those aged 50-64 years, and from 12.4% to 9.2% to 6.7% for those 65-plus. However, these authors note that while there was some evidence of recovery, mental distress still remained significantly above pre-COVID-19 levels. A meta-analysis by Robinson et al. (2022) reported that symptoms increased in the first 1-2 months of the pandemic before declining from May to July, back to pre-pandemic levels by August for all age groups.

This same trend is observed when looking closely at the many longitudinal cohort studies undertaken during the pandemic only, without pre-pandemic measures. This work, from Germany (Mata et al., 2021), Australia (Batterham et al., 2021), China (C. Wang et al., 2020), United States (Daly & Robinson, 2021) and the United Kingdom (Fancourt et al., 2021), presents a relatively unified trajectory of depression and anxiety symptoms increasing over the initial months of the outbreak, especially in the weeks after the WHO's pandemic declaration on March 11, 2020, before declining. For instance, Fancourt et al. (2021) monitored anxiety and depression symptoms in 36,520 British participants weekly from their highest levels in March 23 (week 1) to the lowest in August 9 (week 20). The fastest decline was recorded in the strictest lockdown period (week 2 to 5), and was most marked among older respondents, indicating that people were able to adapt quite quickly to their new circumstances.

These findings suggest the timing of data collection will have a significant bearing on levels of mental distress reported. Indeed, with these studies as a guide, it appears that increased mental health symptoms registered early in the pandemic were transient in nature and may represent a normal, temporary response to a sudden, unpredictable and extraordinary global threat. However, there is no longitudinal New Zealand research reported from this timeframe to confirm this trend locally.

Country-Level Factors. While these studies build a picture of typical distress trajectories over time, they also show the important role of geographic location in affecting outcomes. Local factors such as COVID-19 mortality and morbidity rates, the extent of lockdown regulations, and levels of government trust and patriotism will all likely influence the extent to which a population experiences distress. Indeed, Santomauro et al. (2021) reviewed 48 longitudinal studies to calculate the global prevalence of depression and anxiety disorders and found settings with proportionately more infections and less human mobility reported a higher prevalence of both disorders. This trend is mirrored in studies from the United Kingdom (Daly et al., 2020; Fancourt et al., 2021) which show the mental health deterioration was pronounced and prolonged, in line with Britain's heavy containment strategy designed to curb fast-rising infections during the April–June 2020 period (World Health Organization, 2020b). Conversely, American literature (Daly & Robinson, 2021) shows an early spike in distress, followed by a relatively quick psychological adaptation given lower infection rates and comparatively relaxed stay-at-home orders. Likewise, Mata et al. (2021) found mental health worsened in their German cohort of 3,500 adults as an immediate response to the pandemic, but distress largely returned to pre-pandemic levels 2 months later. These scholars hypothesise that their results reflect infection rates comparably lower and slower moving than those recorded in the United Kingdom. Furthermore, previously detailed Dutch longitudinal research (van Tilburg et al., 2020) contends that pre- and peri-pandemic mental health change may not have been found because the May data collection was too long after the initial distress spike to capture the impact. Finally, some studies, like the Irish cohort study (Hyland et al., 2021), are at odds with the spike-recovery trend, in reporting no increase at a 'high-stress' time, indicating that unique country-level factors may be at play.

These findings suggest that, like timing, the specific location of data collection will

result in significant variations in mental health response. In New Zealand, a unique combination of lower infection rates, a stringent lockdown, high government trust and patriotism but continued health and economic uncertainty, would likely reduce the impact on mental health status. However, to date, the local impact has not been well researched.

Summary

Despite a credible theoretical and historical literature base suggesting that depression and anxiety would have substantially increased among older people in the pandemic, the empirical evidence generally suggests it did not. Cross-sectional studies tended to show elevated distress compared to national normative data, with lower but still elevated levels in older people compared to their younger counterparts. However, the methodological quality of many of these studies is dubious. There was often an under-sampling of older people, or an over-reliance on web surveys that may preclude subgroups of older people from taking part. Longitudinal studies from abroad generally show small to moderate increases in mental health symptoms in the initial 1-2 months before a recovery period set in from June 2020 onwards. While this spike-and-recovery trajectory is well documented overseas, the evidence in New Zealand is incomplete. To date, there have been just four New Zealand studies on the subject, all from early in the pandemic, and all reporting general resilience. The longer-term effect of the pandemic on mental health has not been reported. Certainly, more high-quality, population-representative longitudinal data is needed, especially in New Zealand, to draw definitive conclusions about the extended impact of the pandemic on the mental health of older people.

Did Health Behaviours Impact Mental Health?

While there is no evidence of a substantial increase in mental distress among older people in the pandemic, there is some convincing evidence that this population engaged in adverse health behaviours known to impact mental health. Fears that alcohol use would

increase and physical activity would decline in COVID-19, and that these changes would be associated with negative psychological shifts, were borne out in empirical research. The following section explores evidence for these key health behaviours during the pandemic, and investigates whether they may have mediated the relationship between COVID-19 and changes in depression or anxiety status in older people.

Alcohol Use

Like the theoretical evidence for increased alcohol consumption in the pandemic, the quantitative evidence from international literature is also convincing. In the United Kingdom, two large longitudinal research report clear increases in alcohol use. Pollard et al. (2020) and Niedzwiedz et al. (2021) surveyed 1,540 and 9,748 British adults respectively in mid-2019 and again in May-June 2020. Results were similar, with the latter reporting that the number of people drinking alcohol four or more a week increased in lockdown (RR = 1.4, 95% CI [1.3, 1.5]), as did binge drinking (RR = 1.5, 95% CI [1.3, 1.7]). However, an adapted version of the AUDIT-C measure was used during the COVID-19 wave, making results not strictly comparable. These results are supported by two less robust cross-sectional British studies in which 14% (Robb et al., 2020) and 17% (Jacob et al., 2021) of respondents self-reported increased consumption. Some research suggests increased alcohol consumption in the United Kingdom might go against a general trend of reduced consumption elsewhere in Europe (Kilian et al., 2021).

In New Zealand only cross-sectional studies exist for this phenomenon, and they indicate that consumption changed little. There were initial reports of panic buying, with one retailer citing a 1,800% increase sales on March 23, just prior to lockdown (New Zealand Alcohol Beverages Council, 2020). However, in cross-sectional work by Every-Palmer et al. (2020), 59.1% self-reported that they had not adjusted their drinking habits, while 22% increased and 18.9% decreased consumption. A Health Promotion Agency (2020a) study of

the same design garnered comparable results, with a follow-up (Health Promotion Agency, 2020b) from July 2020 indicating respondents had not changed their drinking behaviour post-lockdown. Likewise, another one-off study from Australia indicated that alcohol consumption among 1,684 drinkers aged 18-65 years fell (Callinan et al., 2020). Problematically, these studies all rely on participant recollection, thus do not reliably indicate change. Furthermore, none adequately sampled older people.

Few studies investigated whether older people drank more during COVID-19 than they did prior to the pandemic, or how their drinking changed compared to younger people. A small longitudinal study conducted during the Polish lockdown (Chodkiewicz et al., 2020) showed 16% reduced their alcohol intake, 14% increased and the remainder did not change, but noted that 'increasers' were a significantly older group. Just one COVID-19 study examined whether age modified the association between psychological distress and alcohol use. Capasso et al. (2021) found almost a third of 5,850 American adults self-reported increased use, and while younger people were generally more likely to report an increase, the chance of older people reporting increased consumption was much greater among those with poorer mental health. These authors argue that the increased COVID-19 mortality and morbidity risk posed to older people may have modified age-specific patterns of alcohol use, depression, and anxiety.

The role of alcohol consumption as a mediator in the pandemic-mental health relationship has not been explored in the literature. Instead, studies that focused on the pandemic, alcohol use and mental health relationship considered just associations, not mediating effects. For instance, a survey of 1,451 Australians (Stanton et al., 2020) found that increased alcohol use among 26.6% of the sample was associated with more symptoms of depression (adjusted OR = 1.07, 95% CI [1.04, 1.10]) and anxiety (adjusted OR = 1.08, 95% CI [1.04, 1.12]). Other studies identified similar positive relationships (Jacob et al., 2021;

Tran et al., 2020), establishing that increased alcohol use was associated with worse mental health in the pandemic. However, whether changes in alcohol consumption mediated changes in depression and anxiety in this global crisis is, as yet, unexplored.

Physical Activity

The literature overwhelmingly shows that physical activity did decline in the first months of the outbreak. Most cross-sectional research found physical activity was reduced while restrictions were in place, compared to prior levels of activity (Jenkins et al., 2021; Knell et al., 2020; López-Bueno et al., 2020; Mutz & Gerke, 2021). More nuanced analysis (Meyer et al., 2020) found physical activity changed as a function of a person's activity levels pre-pandemic. In this American sample, 32.3% who were active before the outbreak reduced their activity levels during restrictions, but activity remained the same for those who were previously sedentary. In a small cross-sectional New Zealand study, about 85% of respondents self-reported that they regularly exercised prior to the pandemic, with just 49.8% stating that they maintained their usual exercise level. Of these, about half (51.5%) said they exercised less, primarily due to gym closures. Several international cross-sectional studies identified this same trend in older cohorts (Callow et al., 2020; Carriedo et al., 2020; Sasaki et al., 2021), suggesting this population was not immune to the behaviour change.

A meta-analysis of 66 longitudinal studies considering physical activity changes in the pandemic overwhelming reported decreases in this health behaviour (Stockwell et al., 2021). Interestingly, however, the majority of longitudinal studies examined the pandemic only, with no pre-pandemic baseline measure. For instance, in New Zealand, Hargreaves et al. (2021) surveyed 759 adults in the second week of lockdown and 6 weeks after lockdown ended and found the self-reported reduction in exercise in lockdown had not recovered by June 2020. Similar studies from Spain (Martínez-de-Quel et al., 2021) and the United States (Vogel et al., 2021) showed physical activity declined from early to later lockdown, while

research from Singapore found the same among older people (Lee et al., 2021). Perhaps the most conclusive evidence of all came from McCarthy et al. (2021), who tracked the activity of 5,395 British adults using wearable devices from January to June 2020 and found a considerable drop in activity from the first week of lockdown that did not recover substantially across the months. Remarkably, however, they found participants over 65 remained more active than others across the lockdown period and then became more active when stay-at-home orders were eased.

Like alcohol use, physical activity has not been explored as a potential mediator in the COVID-19-mental health relationship. One study (Brailovskaia et al., 2021) comes close, exploring how physical activity buffered the relationship between depression symptoms and psychological health caused by the pandemic, using cross-sectional data from 1,931 people in Germany, Russia, Italy and Spain. Instead, most studies report on the broader association, and conclude reductions in physical exercise were associated with poorer mental wellbeing (Colley et al., 2020; Duncan et al., 2020; Jacob et al., 2020; Maugeri et al., 2020). For instance, Stanton et al. (2020) found self-reported reductions in physical activity in half their sample of 1,491 Australian adults, and this change was associated with increased mental health symptoms. Probably the most insightful, however, was work by Faulkner et al. (2021) that considered how adults in the United Kingdom, Ireland, Australia and New Zealand differed on measures of physical activity and mental health at a point 2-6 weeks into lockdown. Participants who reported doing less exercise than before had poorer mental health in comparison to those who either did not change or increased their exercise behaviour. Interestingly, New Zealand respondents reported the smallest reduction in physical activity and the highest levels of psychological health and wellbeing compared with other citizens.

Studies investigating the physical activity-mental health link in older people during the pandemic found exercise was associated with increased resilience in this population. For

instance, in cross-sectional research comparing older age groups in Israel, being physically active was associated with less depressive symptoms and negative affect across the three age groups analysed (45–59, 60–69, and 70-plus) (Zach et al., 2021). Likewise, cross-sectional studies by Carriedo et al. (2020) and Callow et al. (2020) reported similar findings, and the latter demonstrated that doing even light physical activity could alleviate some of the negative mental health impacts that older adults may experience during COVID-19.

Summary

The empirical evidence suggests physical activity was curbed in New Zealand and abroad in the pandemic. The change in alcohol use is less clear, with research from New Zealand indicating consumption did not change, while studies in the United Kingdom and Europe suggest an increase. Few studies investigating these health behaviour changes considered the impact on older people. Critically, those studies that addressed prevalence tended to have a cross-sectional design, or data collection points during lockdowns only, shedding little light on whether the alcohol consumption and physical activity behaviour patterns identified persisted in a non-lockdown pandemic situation. Furthermore, the roles of alcohol use and physical activity have not been well explored as potential mediators that help explain the increase in mental distress that may have been experienced. Instead, most of the literature is focused on illustrating, convincingly, the association between these increased negative health behaviours and increased psychological distress.

Did Mental Health Deteriorate More for Vulnerable Groups?

Empirical studies suggest the mental health of older New Zealanders might not have been reduced several months into the pandemic, given the globally observed recovery response and important country-level factors. However, there is convincing evidence that while, on average, psychological distress was not elevated, some groups of older people may have experienced substantial mental health deteriorations, while others were unaffected or

possibly even experienced improvements during the pandemic. This section evaluates the empirical evidence for groups traditionally considered to be vulnerable to mental health challenges, specifically women, the socioeconomically disadvantaged, ethnic minorities and people with pre-existing mental health conditions.

Women

More than 50 cross-sectional COVID-19 studies reported that female gender was associated with increased depression and anxiety population-wide (see González-Sanguino et al., 2020; Mazza et al., 2020; Özdin & Bayrak Özdin, 2020; Zhang et al., 2020) and among older people (Cigiloglu et al., 2021; García-Portilla et al., 2020; Robb et al., 2020). Of course, given that women experience higher psychological distress in general, these studies reveal nothing about the effect of the pandemic. Robb et al. (2020) attempted to measure change, albeit with an overreliance on memory recall. They found more women than men reported feeling more depressed (7.8% men and 17.3% women) and anxious (7.8% men and 16.5% women) since lockdown started a month earlier.

Some cross-sectional studies reported no difference in the magnitude of mental health change between genders following COVID-19. For instance, García-Fernández et al. (2020) showed distress levels to have increased no more among women than men, compared with population norms. Significantly, the only New Zealand study to address gender (Every-Palmer et al., 2020) found that the substantially higher rates of psychological distress experienced by women in baseline Health Survey data were no longer evident. The results showed that men and women experienced moderate to severe anxiety equally, suggesting the pre-pandemic gender imbalance in mental health had disappeared. The authors postulate that New Zealand's relatively low transmission rates may have lowered the health anxiety typically experienced by women more than for men. Instead, it was replaced by economic anxiety, which could impact the genders equally via the modern 'double breadwinner' model.

Importantly, most longitudinal research, with measurements before and during the pandemic, found women *did* experience a more significant decline in mental wellbeing (Breslau et al., 2021; Daly et al., 2020; Kwong et al., 2020; Pierce et al., 2020). Daly et al. (2020) reported that mental health problems in the United Kingdom rose by 10.3% for men (95% CI [8.0, 12.5]) and by 16.4% for women (95% CI [14.1, 18.7]). Remarkably similar percentage increases in distress were reported in the United States (Breslau et al., 2021). A smaller Hong Kong study in older people reported a greater increase in anxiety for women (β = 0.86, 95% CI [0.11, 1.61]) but not in depression (Wong et al., 2020). Finally, in their longitudinal study of anxiety and depression trajectories across the first 5 months of British lockdowns, Fancourt et al. (2021) found while women started lockdown with higher distress than men, this gap narrowed significantly as the pandemic progressed. The researchers proposed that women may have experienced a higher initial reactivity to the pandemic, which then dissipated with time.

Overall, current evidence suggests women carried a greater mental health burden during the pandemic. However, most research on the topic was undertaken early in the outbreak, predominantly in lockdown, was carried out abroad, and was cross-sectional in design. It remains unclear what gender effect was in play in New Zealand, with its unique low transmission and comprehensive government response, several months into the pandemic.

Socioeconomically Disadvantaged

People who are socioeconomically disadvantaged were another group habitually found to be overburdened by mental health problems during the pandemic. Certainly, low socioeconomic status (SES) or low income is routinely noted as a risk factor for depression and anxiety in most cross-sectional research carried out in the pandemic. However, most of these studies show the increases in distress reported in the outbreak were similar across SES

groups, when compared with normative data. For instance, Ettman, Abdalla, et al. (2020) found that while depression was substantially elevated in those with the lowest income (47%) compared with the highest incomes (17%), the prevalence had tripled in both groups.

Longitudinal studies are needed to confirm whether mental health worsened proportionately more in this group, but results here are mixed. In France, Andersen et al. (2021) found the likelihood of anxiety and depression symptoms during COVID-19 was more than twice as high for people with low household income compared to those with high income (OR = 2.28, 95% CI [1.29, 4.01]). Likewise, in the United Kingdom, Kwong et al. (2020) noted that the two disorders were more prevalent in those with socioeconomic adversity, even when controlling for pre-pandemic depression and anxiety. However, another British study that measured mental health change found no such pattern of variation based on income (Pierce et al., 2020). Instead, they study found greater change by employment status, noting that job loses, rather than general poverty, could have been a larger stressor in the pandemic context. Finally, a third British study involving 14,393 participants interviewed during COVID-19 reported the opposite trend (Daly et al., 2020). The highest earners had a 5.6% (95% CI [1.8, 9.5]) larger increase in mental distress than those earning the least. The same pattern was reported for those with degrees versus those without. These findings align with other research showing that people with higher education and wealth were more worried about COVID-19 consequences early in the outbreak (Sutin et al., 2020).

In summary, there is no clear evidence that the mental health impact of the pandemic was greater among people with lower SES. No New Zealand research has explored the topic, and the impact on older people has not been considered. Indeed, international studies present a mixed picture of the SES-mental health link through mostly cross-sectional research, and whether COVID-19 makes it worse is not plainly established in the longitudinal literature.

Ethnic Minorities and Indigenous Populations

Fewer studies evaluated the role of ethnicity in mental health change in the pandemic. As for women and the socioeconomically disadvantaged, ethnic minority groups were generally found to have poorer mental health in cross-sectional studies. For instance, a United States government survey of 5,214 adults found Black and Hispanic populations had increased depression and anxiety symptoms in the pandemic (Czeisler et al., 2020). More revealing is a study by Bui et al. (2021) which investigated the ethnicity-emotional distress relationship in 94,550 Americans aged 55 and older using data collected in May 2020. Although the differences were small, mean psychological distress scores were significantly higher for older Black, Asian and Latino people compared to people of European origin. They also found older people of colour were significantly more likely to have lost income, missed rent or mortgage payments, and suffered food insecurity than White people.

It is not clear, however, whether the magnitude of the mental health decline was greater among minority or indigenous groups during the pandemic. Of the longitudinal studies from United Kingdom undertaken in March-April 2020, Kwong et al. (2020) did not address ethnic disparities, and Daly et al. (2020) and Pierce et al. (2020) found, contrary to their hypotheses, no significant independent increase in psychological distress according to ethnicity. In ethnic minorities, pre-pandemic inequities in mental distress were maintained but did not increase. This led the authors of the latter study to hypothesise that differences might have been observed had data collection been carried out later, when socioeconomic inequalities likely widened. A fourth study from the United Kingdom, by Niedzwiedz et al. (2021), reported people from minority Asian cultures had disproportionately large increases in mental health symptoms between mid-2019 and April 2020, from 18.7% (95% CI [16.4, 21.2]) to 34.9% (95% CI [27.3, 43.2]).

The impact on ethnic minority groups in Aotearoa is even less clear. One cross-

sectional study (Every-Palmer et al., 2020) included a substantial 20.3% sample of Māori respondents, and found not only was the magnitude of mental health change no greater among Māori, but the levels of psychological distress in Māori, Pasifika and Pākehā respondents questioned early in lockdown were not significantly different. Those of Asian descent reported lower distress than others. The longitudinal New Zealand study (Sibley et al., 2020) did not assess impact by ethnic group; however, the authors did note the importance of undertaking such work in future.

In sum, most studies suggest minorities and indigenous groups were not particularly impacted by mental health challenges during COVID-19. However, surprisingly few studies have investigated the relationship. No longitudinal New Zealand studies have yet explored whether the patterns of vulnerability found in the United Kingdom were present in New Zealand, where Māori communities are historically disadvantaged but citizens enjoyed low transmission and swift government response. Furthermore, as noted, it is unknown whether ethnicity-driven divides in mental health may have appeared beyond lockdown, later in the pandemic.

People With a Pre-Existing Mental Health Condition

The literature on the mental health effect of the COVID-19 outbreak on people with a prior psychiatric condition is equivocal. Certainly, several COVID-19-related cross-sectional studies from various countries (Asmundson et al., 2020; Newby et al., 2020; Xiong et al., 2020) report, unsurprisingly, that people with mental illness had more depressive symptoms and anxiety in lockdown. For instance, Andersen et al. (2021), found that respondents reporting anxiety or depression in the 2 years preceding the pandemic were about 7 times more likely to describe symptoms of these conditions in May 2020. Likewise, two New Zealand cross-sectional studies (Bell et al., 2020; Every-Palmer et al., 2020) attempted to measure whether mental health declined in this group. Both found this population had double

the risk of experiencing moderate to high mental distress and anxiety when compared with pre-COVID norms. However, as with all these studies, without a pre-pandemic baseline in the same participants, any reported increase is dubious.

In fact, most longitudinal studies present a picture of resilience and recovery among those with pre-existing conditions. For instance, in the United Kingdom, Daly et al. (2020) found no evidence of an increase in this group. Instead, the prevalence of psychological problems remained very high (51%). In their longitudinal research, Pierce et al. (2020) also found mental health inequities present prior to the pandemic remained but did not increase. Two other longitudinal studies (Daly & Robinson, 2021; Fancourt et al., 2021) did find that individuals with a prior mental illness had small but proportionately increased depression and anxiety symptoms at the start of lockdown, which increased further in the following 2 months. However, importantly, both note that the psychological distress levels of these respondents returned to baseline by June 2020, a result supported by the longitudinal meta-analysis (Robinson et al., 2022). Resilience was also demonstrated in a small mixed methods study tracking 73 older Americans (mean age 69 years) with pre-existing MDD (Hamm et al., 2020). While some participants described feeling more depressed or anxious since the pandemic began, there was no evidence of increased clinical depression or anxiety when compared with symptoms assessed before the lockdown. Both papers hypothesise that prior mental health experiences could have provided participants with strong self-care strategies and coping skills to handle stress in a global crisis.

In conclusion, while there is considerable evidence indicating that people with prior mental health issues were not disproportionately impacted psychologically by the pandemic, to date there has been no New Zealand research to investigate this phenomenon. It is also possible that a later follow-up data collection, at a time beyond lockdown, could reveal disparities not identified early in the pandemic.

Summary

While the historical and theoretical literature puts forward a strong case that the mental health effect of the pandemic may be greater for particular subgroups of older people, the research findings are more nuanced. To broadly summarise, there is good evidence that the impact of the pandemic was greater for women than men, but findings for ethnic minorities, people of low SES and those with a pre-existing mental health condition suggest they are no more vulnerable, and indeed, could even be less impacted. Crucially, however, there is very little New Zealand work investigating these moderation relationships, and the only longitudinal analyses (Bulbulia et al., 2020; Sibley et al., 2020) in this area do not assess the vulnerability of these groups. Furthermore, almost all relevant studies collected data during lockdown, raising questions about whether subgroup vulnerabilities may, in fact, appear later, after the initial response to the crisis passes. Studies measuring mental health in a large, New Zealand population-based sample both before and during the pandemic are needed to draw any conclusions about the extent of vulnerability in these groups.

Chapter 3: The Current Study

The present study aims to identify whether older New Zealanders became more depressed and anxious in the COVID-19 pandemic, whether negative health behaviours mediated that relationship, and whether some subgroups were disproportionately impacted. Importantly, given that the second data collection was after, and not during, lockdown, this study seeks to draw inferences about the impact of the pandemic as a general phenomenon, not of lockdowns per se.

While the historic and theoretical literature presents a convincing narrative of worsening mental health in a pandemic context, the empirical evidence largely suggests otherwise. In particular, large meta-analyses indicate an initial spike in psychological distress, followed by a recovery response among most populations analysed longitudinally. Changes in mental health status also varied widely due to unique country-specific factors, like the death toll, severity of viral spread, and the presence, length and strictness of lockdown, at the time of responding. To date, New Zealand longitudinal research on the topic is lacking, and thus, the mental health effect of the global pandemic on our older people, especially beyond the immediate lockdown period, is as yet unknown.

While there is good evidence to suggest alcohol consumption may have increased and physical activity may have decreased globally during the pandemic, there is very little in the way of New Zealand-specific longitudinal research to say whether changes in these adverse health behaviours occurred in Aotearoa, and among older people specifically. Furthermore, the role of these behaviours in mediating the COVID-mental health relationship is, to date, unexplored. Finally, international studies present a generally nuanced picture of subgroup vulnerabilities, with women appearing to have been disproportionately impacted; more so than the socioeconomically disadvantaged, ethnic minorities and people with a pre-existing mental health condition. However, again, a dearth of longitudinal New Zealand data in older

people leaves questions about these vulnerabilities unanswered. This study aims to address these gaps in the literature.

Rationale for Research Questions

This study presents research questions only, without specifying hypotheses. This approach was taken largely because, as outlined in Chapter 1, while there are multiple theoretical reasons to expect a negative impact, this study was not designed precisely to test one of these theories. Furthermore, as demonstrated, the historic and theoretical literature around mental health changes in traumatic situations largely conflicts with the real-life empirical evidence collected in the pandemic. Therefore posing questions, rather than supposing outcomes, was the more logical approach to framing the precise areas of inquiry.

Research Questions

Based on the historical, theoretical, and empirical literature reviewed in Chapter 1 and Chapter 2, the research questions are as follows.

1. Did depression and anxiety among older New Zealanders increase, decrease, or remain stable during the pandemic?
2. Did New Zealanders drink more and exercise less during the pandemic? If so, did changes in alcohol consumption and physical activity mediate any impact of the pandemic on depression and anxiety?
3. Was the mental health impact of the pandemic greater for ‘at risk’ subgroups of older people: women, the socioeconomically disadvantaged, Māori and people with a pre-existing mental health condition?

Chapter 4: Method

Data Source

The current study uses a pre-test post-test single group design with data drawn from the longitudinal Health, Work, and Retirement (HWR) study. The HWR research programme is conducted by the Massey University Health and Ageing Research Team (HART) and was established to examine relationships between work, retirement, social support, health and wellness in later life (Towers, 2006). The first waves in 2006 and 2008 were primarily interested in the work-retirement transition in 55 to 70 year olds. The project was then developed into a broad-spectrum longitudinal study of ageing that aimed to describe the features associated with health, retirement and positive ageing. The questionnaire had pen-and-paper and online response options, and included a combination of referenced measures and specifically-created questions, with some new additions at each wave. Besides quantitative survey data, several other modes of data collection were employed, including anonymised ACC and health record linkages, in-depth qualitative interviews on a variety of topics, and face-to-face cognitive health screens. The research contributes new knowledge of ageing in Aotearoa, informs national debate and offers focused targets for policy change (Stephens & Alpass, 2018). Large longitudinal data sets such as this are fundamental for characterising the ageing experience and encouraging the creation of health and social services that enrich and improve the lives of older New Zealanders (Parr-Brownlie et al., 2020).

Participants

Participants in the first HWR wave in 2006 were adults aged 55-70 who were selected at random from the New Zealand electoral roll, a compulsory voting register that includes over 90% of all eligible voters (Electoral Commission, 2021). The study employed a biennial design in which people who had previously participated in the survey, known as the ‘existing

cohort', were re-surveyed 2 years later. Participants were not re-questioned if they were deceased, or if they voluntarily withdrew, relocated overseas, or moved address without providing forwarding or contact information (Phillips, 2021). A smaller group of new participants was selected at random through the same electoral roll method to join the study at each wave as a 'refresh cohort'. Such refresh samples help maintain representativeness in longitudinal research, and counteract potential attrition as a result of people leaving the study (Deng et al., 2013). The sample was community-based, thus people living in nursing homes, dependent care facilities or in prison were excluded. Furthermore, the 2006, 2016, 2018, and 2020 survey waves included an oversampling of people identified as Māori on the electoral roll, to ensure sufficient representation of New Zealand's primary minority ethnicity (Phillips, 2021). Statistical modelling undertaken at the outset of the HWR research programme predicted greater attrition in the Māori population sample, which could be corrected by oversampling this population to ensure the greatest recruitment (Towers, 2006).

The Current Study

The sample for the present study was derived from the seventh (2018) and eighth (2020) HWR waves. The 2018 survey followed up people recruited in the 2006, 2009, 2014 and 2016 waves, while the 2020 HWR survey followed up these same recruits and those who joined in 2018. A smaller refresh cohort was added at each wave. Specifically, the current study focused on those individuals who completed both the 2018 and 2020 waves of the survey. This included participants who joined as part of the 2018 refresh cohort, but excluded those in the 2020 refresh cohort, given that no pre-test measures were collected for these respondents.

Exclusion Criteria

The initial participant pool was 3,275; however, 57 respondents were excluded as they had omitted 50% or more responses on the 10-item depression measure (see Measures below)

in either 2018 or 2020. A further 33 were excluded for omitting three or more items on the 5-item anxiety measure at either time point. Given the high percentage of missing responses in these cases, data for these measures was deemed incomplete, and any imputation method could not accurately predict missing values. Finally, a further 14 respondents were excluded for returning overly consistent answers (the same answer on every item, including reverse coded items) for the depression measure in either wave, as it suggested participants were not paying attention to the questions. Applying these guidelines, 104 participants were excluded.

Demographic Characteristics of Participants

The 2018 descriptive data for the final sample of 3,171 participants are displayed in Table 1. Respondents ranged in age from 55 to 91, with a mean age of 67. The sample consisted of 56.7% women, and while 65% were European, Māori made up 27.7% of respondents. Most participants were married or partnered (73.5%). Retirees comprised the largest work status group (33.6%; however, a sizeable portion of the sample was still in full-time (28.6%) or part-time (19.7%) employment. About one in five participants (19.8%) lived alone. With regard to living standards, 12.5% were experiencing hardship, while a similar proportion (11.8%) had pre-existing depression or another mental health condition, as noted in 2018.

Table 1

Demographic Characteristics of the Sample as at 2018 (N= 3,171)

Variables	*n*	%
Gender		
Male	1373	43.3
Female	1798	56.7
Age		
55-64	1344	42.4
65-74	1322	41.7
75-84	501	15.8
85-94	4	0.1
Ethnicity[a]		
NZ European	2061	65.0
Māori	877	27.7
Other	185	5.8
(Missing)	(48)	(1.5)
Marital status		
Married or de facto	2330	73.5
Not married/de facto	789	24.9
(Missing)	(52)	(1.6)
Highest education level		
No qualification	594	18.7
Secondary school	737	23.2
Trade	1071	33.9
Tertiary	705	22.2
(Missing)	(64)	(2.0)
Current work status		
Retired	1064	33.6
Full time	907	28.6
Part time	623	19.7
Other	424	13.3
(Missing)	(153)	(4.8)

Living situation[b]		
Live with spouse	2108	66.5
Live alone	629	19.8
Live with son/daughter	498	15.7
Live with other	533	17.0
Living standards[c]		
Hardship	397	12.5
Comfortable	609	19.2
Good	2027	63.9
(Missing)	(138)	(4.4)
Pre-existing mental health[d]		
No	2594	81.8
Yes	373	11.8
(Missing)	(204)	(6.4)

Note. [a]Other ethnicity includes Pasifika peoples $n = 29$ (0.9%), Asian $n = 25$ (0.8%) and other $n = 132$ (4.1%). [b]The frequency and percentage for living situation includes more than the full sample because some people lived with more than one group (e.g., spouse and son). [c]Three living standards categories from lowest (hardship) to highest (good) as defined by the Economic Living Standard Index-Short Form (ELSI-SF). [d]Respondents who identified that a health practitioner had told them they had depression or other mental illness.

Statistical Power

The sample size was considered to establish whether it was sufficient to undertake the proposed analyses, and would have the required statistical power. Power is determined by significance level, sample size, and signifies the probability of obtaining a statistically significant result, conditional on a specific assumed effect size (Tabachnick et al., 2007). Given the use of secondary data in the current study, the power calculation for the proposed analyses was not strictly *a priori,* but was nevertheless assessed using G*Power 3.1

(Erdfelder et al., 1996). With two-tailed alpha set at .05, desired power at 80% and a sample size of 3,171, the paired samples *t* tests planned in the present study had adequate power to detect very small statistically significant effect sizes (Cohen's $d = 0.05$). Likewise, the two-way mixed analysis of variance (ANOVA) and multiple linear regression (4 predictors), also had adequate power to detect even small true effect sizes (Cohen's f of 0.021 and Cohen's f^2 of 0.004 respectively, with desired power at 80%, and two-tailed alpha of .05). A power analysis was not carried out for the multilevel mediation analysis as the statistical method was deemed both too complex for this calculation, and unnecessary given it was not the primary analysis. Power results indicated the sample size was more than adequate to undertake this study.

Measures

The HWR study uses many measures, of which just a few were of interest in the present study. The following section contains a brief outline and summary of these selected measures, listed in Table 2. All selected measures were included in both the 2018 and 2020 survey waves. The questionnaire and content inventory for each can be viewed online (Massey University, 2021). For background on excluded measures, see Massey University (2018). The independent variable is time (an approximate 22-month lapse from pre-pandemic to peri-pandemic time points). The dependent variables of depression and anxiety were used throughout data analyses. The health behaviour variables of alcohol use and physical activity level were included as potential mediator variables for the second analysis. The sociodemographic variables of gender, SES, ethnicity, and pre-existing mental health status were used as moderator variables for the third analysis, while various other demographic variables were included in descriptive analyses.

Dependent Variables

Depression. Depression was assessed with the 10-item Centre for Epidemiological Studies Depression Scale (CES-D-10; Andresen et al., 1994), an abbreviated version of the original 20-item CES-D (Radloff, 1977). The short-form self-report scale was designed for use within research settings and while it is not a diagnostic tool, it can be used as a screener to indicate whether respondents meet particular criteria for a depressive disorder (Irwin et al., 1999). Items pertain to depressed mood, feelings of guilt, helplessness and worthlessness, appetite loss, sleep difficulties and psychomotor retardation. Respondents are asked to self-rate the frequency in the past week of certain feelings, for instance "*I felt fearful*" and "*I felt that everything I did was an effort*". The measure employs a 4-point scale (from 0 = rarely or none of the time through to 3 = all of the time). All items are negatively phrased except ("*I felt hopeful about the future*" and "*I was happy*"), for which the scoring is reversed. Individual item scores are summed to determine a total score in the 0-30 range. A higher score on the 0-30 scale is indicative of greater depressive symptomatology, with scores of 10 or more considered indicative of depression. The current study treats the depression score as a continuous variable, with a higher total score being a stronger indicator of depression.

The original validation study in well older American adults (Andresen et al., 1994) showed good predictive accuracy in comparison to the CES-D (kappa = .97, $p < .001$) and acceptable test-retest reliability ($r = .71$). The measure was also found to be positively correlated with poorer health status scores ($r = .37$) and negatively correlated with positive affect ($r = -.63$). Further validation by Miller et al. (2008) showed good internal reliability (Cronbach's alpha = 0.86), test-retest reliability (*ICC* = 0.85), and correlation ($r = 0.71$) with the mental health subscale of the SF-36, in a sample of Canadians with spinal injury. A study among South Africans found acceptable internal consistency ($\alpha = 0.69$-0.89), and adequate

concurrent validity in comparison to the PHQ-9 and WHODAS (Baron et al., 2017). In the current study, the Cronbach's alpha coefficient, calculated with 2018 data, was 0.84.

Anxiety. Anxiety was operationalised with a five-item Geriatric Anxiety Inventory-Short Form (GAI-SF; Byrne & Pachana, 2011), an abbreviated version of the original GAI (Pachana et al., 2007) a measure of anxiety severity designed with older populations in mind. The very brief self-report scale includes the five items from the list of 20 with the best scale cohesion (item-total correlation) and item endorsement (item difficulty). It is recommended for use in epidemiological surveys, and in medical settings. Respondents are asked if they agree (1) or disagree (0) with statements such as "*I worry a lot of the time*" and "*I often feel nervous*" with regard to how they have felt in the past week. The measure employs a forced choice response format that is scored in a single direction, thus reducing the confusion that reverse scored items may produce. The total summed score ranges from 0-5, with greater scores indicating increased anxiety symptoms. A score of 3 or more was found by Byrne and Pachana (2011) to be optimal for the detection of GAD in a non-clinical sample. These data are treated as continuous in the present study.

The scale was initially tested on older Australian women (mean age = 72.2 years) and showed high internal consistency ($\alpha = 0.81$) and test-retest reliability ($r = 0.80$), as well as good concurrent validity when compared with the State-Trait Anxiety Inventory ($r_s = 0.48$, $p < 0.001$) (Byrne & Pachana, 2011). The GAI-SF also showed moderate-to-high convergent validity with the Penn State Worry Questionnaire (PSWQ), as well as the original GAI in clinical and non-clinical samples of Australian men and women (Johnco et al., 2015). In the current study, the Cronbach's alpha coefficient, calculated with 2018 data, was 0.85.

Table 2

Selected Demographic, Mental Health and Health Behaviour Items Included in the Health, Work and Retirement Survey

Construct	Item Description
Age	Date of birth
Gender	Male; Female; Gender diverse
Ethnicity	NZ European, Māori, Pasifika peoples, Asian and other
Marital Status	Married; Civil union/de facto/partnered relationship; Divorced or permanently separated; Widow or widower; Single
Education Status	No qualifications; Secondary school; Post-secondary/trade; Tertiary
Employment Status	Full-time paid employment, including self-employment; Part-time paid work, including self-employment; Retired, no paid work; Unemployed and seeking work; Other/full-time student/unable to work due to health or disability
Living Standards	Economic Living Standards Index-Short Form (ELSI-SF)
Pre-existing Mental Health Issue	Created from those who answered 'yes' to a previous indication of depression or other mental illness from a doctor.
Alcohol Use	Alcohol Use Disorders Identification Test-Concise (AUDIT-C)
Physical Activity Level	Single item about frequency of moderate exercise
Depression	Center for Epidemiological Studies Depression Scale (CESD10)
Anxiety	General Anxiety Inventory-Short Form (GAI-SF)

Mediator Variables

Alcohol Use. Alcohol consumption was operationalised with the Alcohol Use Disorders Identification Test-Concise (AUDIT-C; Bush et al., 1998), a brief 3-item screener for detecting risky drinking behaviours at early stages. The self-rating tool is adapted from

the original 10-item Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993). In the short form version, respondents are asked how often they drink, how many drinks they consume in a typical day and how often they have six or more drinks on one occasion, with answers on a 5-point Likert scale. Total scores range from 0-12, with higher numbers indicating a greater alcohol-related risk. In the original validation study, Bush et al. (1998) proposed that a score of 3 or more indicated hazardous drinking, as it captured 90% of people with active alcohol abuse and 98% who engaged in heavy drinking. Subsequent applications in more diverse populations in Germany suggest a threshold of ≥5 for men and ≥4 for women is more appropriate for identifying hazardous drinking in a non-clinical population (Moehring et al., 2019). However, studies in older people in the United States (Ardern, 2020; Dawson et al., 2005) and Finland (Aalto et al., 2011) advocate tailoring the threshold to a stricter ≥4 irrespective of gender in recognition of the increased sensitivity to the impact of alcohol use in this age group.

In the present study, alcohol use was treated as a continuous variable, with higher scores being indicative of more hazardous drinking behaviour. The HWR survey adapted the scale slightly to a 4-question format that allowed non-drinkers to skip to the end. The data were recoded to fit the original scale, but given the non-answering options, the Cronbach's alpha could not be calculated. In previous assessments, the AUDIT-C showed good test-retest reliability (*ICC* = 0.91) and satisfactory convergent validity in Korean medics (Jeong et al., 2017). All items were also found to perform similarly well in recognising unhealthy drinking in older British people, with generally high sensitivity, specificity, and area under the receiver operating characteristic curve for each of the three questions (Stewart et al., 2021).

Physical Activity. Physical activity was operationalised using a question obtained by HART researchers from the English Longitudinal Study of Ageing (ELSA; Hamer et al., 2014). Participants were requested to indicate how often they did vigorous, moderately

energetic, and mildly energetic sports or activities. Responses to each of the three items were measured with a 4-point scale, ranging from "*more than once a week*" to "*hardly ever or never*". The three items could not be combined to create a meaningful total score, as this would entail treating mild, moderate, and vigorous exercise as equally important; thus, the present study employs only the "moderately energetic" HWR item in the analysis. This decision is based on previous research showing moderate intensity exercise, like brisk walking and gardening, is the most common intensity type for older people, and it plays a key role in promoting good health in this age group, (Booth et al., 2000; McGarrah et al., 2016; Walsh et al., 2001). Moreover, guidelines for older New Zealanders specifically recommend moderate-intensity exercise to benefit mental and physical wellbeing (Ministry of Health, 2013). In this study, physical activity was treated as a continuous variable, with higher scores on the 1-4 scale indicative of lower engagement in physical activity.

Sociodemographic Variables

Gender. Responses of participants were originally recorded as either male, female or gender diverse. In the current study, the sample incidentally only included men (coded as 0) and women (1).

Ethnicity. Respondents were asked to name their ethnicity using an adapted version of the 2006 Census question which asks which ethnic group they most identify with. Participants could choose just one from a list of nine: Māori, New Zealand European, Samoan, Cook Island Māori, Niuean, Indian, Chinese, Tongan, and Other. The present study was specifically interested in the impact on Māori. As recommended by Jones (2001), ethnicity was selected as a focus for this study based on prior research, presented in the literature review, indicating that mental health inequities in the pandemic could relate specifically to ethnicity, not only via other variables such as SES. The New Zealand European and Māori populations were the only groups with sufficient sample sizes to make

credible inferences regarding differences. As such, ethnicity was dichotomised to non-Māori (coded as 0) and Māori (1). Problematically, the non-Māori identifier bundles together several disparate ethnicities to form an amorphous group with which to compare Māori. Given the constrained nature of this approach, particular care was taken when interpreting these findings to avoid any spurious interpretations, as required by the profession's ethical guideline 4.1.4 (Code of Ethics Review Group, 2002). Furthermore, cultural guidance was obtained to ensure the treatment of this variable throughout the study was culturally safe, appropriate and mana-enhancing.

Socioeconomic Status. SES was operationalised using the Economic Living Standards Index-Short Form (ELSI-SF; Jensen et al., 2005), a self-report scale derived from New Zealand's Ministry of Social Development full ELSI scale (Jensen et al., 2002). The measure takes a non-income-based approach to living standards in recognition that income often does not account for important factors such as a household's ability to manage resources (Jensen et al., 2002). The 25-item measure assesses the limits of household item ownership and social participation, how much respondents constrain their expenditure, and how satisfied they are with their living standards. Participants answer on a 3- or 4-point scale, depending on the section. Individual item scores are summed to present a 0-41 range. Jensen et al. (2005) state total scores less than 10 should be adjusted to 10 to truncate the outliers at the bottom end of the distribution. Ten points are then subtracted from every score, forming a composite score of 0-31, with higher scores reflecting better economic living standards.

In the current study, socioeconomic status is treated as continuous variable. Scores are also descriptively presented in compact intervals of hardship (1-15), comfortable (16-24) and good (25-31) as defined by Jensen et al. (2005). The ELSI-SF is highly correlated with the ELSI (r = 0.98), and has shown high internal consistency (Cronbach's alpha = 0.88; Jensen et al., 2005). Cronbach's alpha for the current study, calculated with 2018 data, was 0.82.

Pre-Existing Mental Health Status. Pre-existing mental health status was operationalised using a generic HART-created question about chronic illness history. Respondents were asked if they had ever been told they had a medical condition by a health professional. Fifteen conditions were listed, including 'depression' and 'other mental illness', with three possible answers: no, yes in the last 12 months, and yes prior to the last 12 months. In the current study, these responses are dichotomised to no pre-existing mental health condition (participants who responded 'no' to both the 'depression' and 'other mental illness' question, coded as 0) and those with a pre-existing mental health condition (participants who responded 'yes' to either of the two mental health items, coded as 1). The pre-existing condition is not confirmed by medical records, as the variable relies on patient recall of medical feedback, but was deemed the best opportunity among HWR data to measure prior mental health.

Other Descriptive Variables

Age. Respondents were asked at every survey to identify their date of birth (day, month and year). The present study uses participant age in years with decimals as it was recorded in December 2018 (Phillips, 2019).

Employment Status. Employment status was determined with a generic HART-created question on various employment states. The question required participants to select one of 15 states that best described them. In the current study, employment status was analysed for descriptive purposes only and, as such, was collapsed into retired, full time, part time and other.

Marital Status. Marital status was measured with a generic HART-created question asking participants to identify whether they were married, in a civil union/de facto/partnership relationship, divorced or permanently separated from their legal spouse, widowed or single. This variable was analysed for descriptive purposes only and thus was

collapsed to either married/partnered or not married/partnered.

Living Situation. Living situation was measured with a generic HART-created question about household composition. Respondents were asked to describe all the habitants of their household, or indicate if they lived alone. Options for cohabitants included spouse/partner, parents/parents-in-law, children, siblings, flatmates, grandchildren, friends, boarders and others.

COVID-19 Impact. Data from six COVID-19-specific questions are also included in the descriptive analyses. These 2020 questions asked participants about the negative physical and mental impacts of the pandemic, whether they had received a COVID-19 diagnosis, the impact on their work situation and retirement plans, and whether they had sought COVID-19-related government assistance.

Procedure

The following procedural overview is focused on aspects of HWR data collection and sample response relevant to the current study. For further information, see Allen (2019) and Towers (2017). The 2018 and 2020 HWR waves were granted ethics approval by the Massey University Human Ethics Committee (Southern A application 18/34 and 20/07 respectively (Phillips, 2019; Phillips, 2021), and were funded by the Ministry of Business, Innovation and Employment (MAUX1705).

HWR 2018 Survey

The 2018 wave was selected as a pre-pandemic data point as it was the most recent HWR survey prior to the pandemic. This survey comprised a 32-page postal questionnaire sent to the existing cohort who took part in the study between 2006-2016, and a refresh cohort of new participants aged 55-57 (Phillips, 2019). Data were collected according to Dillman's (2011) five-stage tailored design approach, recommended for garnering maximum responses in large scale postal surveys. As in prior waves, the 2018 'refresh cohort' employed

a steady state sampling recruitment design so the HWR programme continued to closely represent older Māori and non-Māori New Zealanders. The sample size was based on the Dillman et al. (2014) formula for representative population surveys, which employs a finite population adjustment to calculate the target sample size. Using data from the 2013 census, analysis determined that a general population sample of n = 538 respondents and a Māori sample of n = 528 respondents was required to effectively represent these populations. Taking into account the 2016 survey response rate of 27% for the Māori sample and 33% for the general sample, survey invitations were sent to 1,638 general population participants and 1,958 Māori participants to reach the required sample size (Phillips, 2019).

In all, 7,965 people were sent an initial approach on August 1, 2018. The package for existing participants comprised a letter of introduction, information sheet and survey booklet, while new participants were posted the introductory letter and information sheet only, with an invitation to complete the survey online (Phillips, 2019). A physical booklet was sent if requested, or in the second reminder. The survey consisted of 120 questions asking respondents to provide information across multiple areas, including physical and mental wellbeing, health behaviours, life satisfaction, quality of life, health service use, disability and illness, employment, social participation, housing and spirituality. Existing participants who did not complete the survey following the initial approach were sent reminders on August 24 and November 1, and non-responding new participants were followed up on November 1 and November 23, 2018. Overall, 3,964 responses to the 2018 survey were received.

Existing Cohort. Of the existing respondents surveyed in 2018, n = 3,366/4,369 (77.0%) returned a survey.

Refresh Cohort. All people on the electoral roll born between May 11, 1961 and May 10, 1963 (aged 55-57 in 2018) were considered for inclusion in the study. Of the new

2018 refresh cohort sample, *n* = 598/3,596 (16.6%) returned a survey.

HWR 2020 Survey

The 2020 wave was used as a peri-pandemic data collection point. This survey comprised a 36-page postal survey package sent to past respondents and a new refresh sample of people aged 55-65 invited to take part for the first time (Phillips, 2021). As the 2020 refresh cohort is not included in the current study, no details are provided here. In all, 8,166 people, including 4,614 from the existing cohort, were sent an initial approach on June 11, 2020, two weeks after the first nationwide lockdown ended, with further reminders sent on July 7 and September 17, 2020. The 2020 survey comprised 144 questions, including six COVID-19 questions asking about the physical, mental, financial and employment implications of the pandemic. Overall, 4,351 completed responses to the 2020 survey were received, including 3,480 from the existing cohort.

Existing Cohort. Of the existing respondents surveyed in 2020 *n* = 3,480/4,614 (75.4%) returned a completed survey. Most survey responses (69.2%) were obtained within a month of the initial mail-out (June 11-July 13, 2020). A further 24.9% were received after the first reminder (July 14-September 3, 2020) and 8.7% following the second, September 14 reminder.

Data Analysis

Data analysis was undertaken using IBM SPSS Statistics for Mac version 28.0, with the additional use of an SPSS multilevel mediation macro (Hayes & Rockwood, 2020).

Missing Values

A missing data analysis was carried out on untransformed variables in the final sample, showing that items making up the dependent variables (depression and anxiety at 2018 and 2020) had low missingness (1% or less). Missingness was less than 1% for both time points of the physical activity and alcohol use variables, with the latter including only

the single scale item all participants were prompted to answer. Gender had no missing data, while missingness was relatively low for ethnicity (1.5%), SES (less than 2%), and pre-existing mental health status (3.3%). Overall, 0.9% of data was missing across all the variables used in the main analyses. This includes only those items which all participants were prompted to answer, not those which some participants were required to skip based on prior responses.

Little's MCAR was significant, suggesting the data were not missing completely at random (MCAR). Assuming data was missing at random (MAR), a decision was made to perform expectation maximisation (EM), given that it has weaker assumptions than listwise deletion, which only produces unbiased estimates when data is MCAR. All quantitative variables were added, including the CES-D-10 with its 4-point Likert items. The method, in which each missing variable is replaced with a single best estimate based on the participant's responses to other variables, is a common and well-accepted approach to missingness (Everitt & Dunn, 1991). However, EM does not take into consideration the presence of uncertainty surrounding the values of imputed data points and, as such, there may be slightly more uncertainty surrounding parameter estimates than is apparent from the *p* values and confidence intervals reported (Tabachnick et al., 2007).

Given that EM treats variables as continuous when imputing values, categorical variables were not included. Missing values on the 5-item GAI-SF scale, which has agree/disagree responses, and the 25-item ELSI scale, which has a mix of yes/no and Likert items, were addressed through replacement with mean values. In this approach, for respondents with missing values, the mean score across their scale responses is calculated and imputed. This approach avoids removing participants with very small quantities of missing data, but does reduce the variances of variables (Tabachnick et al., 2007). To limit this impact, mean replacement was permitted on the GAI-SF only in cases where a maximum of

one of five items was missed. Similarly, the ELSI estimation allowed for a maximum of one missing value in each of the three multi-item ELSI subscales (ownership, participation, economising), and no missing data in the final three self-rating scales.

Variable Transformations

Variables were then reverse recoded, collapsed, totalled, and otherwise adjusted according to coding rules as outlined in the Measures section. Difference scores were calculated for the two dependent variables (2020 scores minus 2018 scores).

Main Analyses

Research Question 1. The main analysis consisted of two paired-samples *t* tests performed to examine participants' change in depression and anxiety scores from 2018 to 2020. This bivariate test is suitable for use when each subject in a sample is measured on two occasions, resulting in pairs of observations (Pallant, 2020). It was deemed appropriate for use in this instance given the HWR surveyed the same group twice, each time on the same measures; the CES-D-10 measuring depression and the GAI-SF measuring anxiety. As a special case of the multiple regression model, the paired *t* test does not assume a lack of outliers, a lack of multicollinearity, or require that the dependent variable is an interval level type (Gelman & Hill, 2006; Williams et al., 2013). It does assume, however, that the difference scores are normally distributed, a requirement that was checked with visual inspections of the normal quantile-quantile (Q-Q) plot. The test is very robust to violations of this assumption in large samples such as this one.

Research Question 2. The first set of follow-up analyses focused on the potential mediating role of negative health behaviours in changes of depression and anxiety. First, two paired *t* tests were performed to assess whether alcohol use increased or physical activity decreased from 2018 to 2020. As described above, this analysis is well suited to continuous, approximately normally distributed difference scores calculated by comparing two time

points. Reported increases were then followed up with a multilevel mediation analysis using Hayes and Rockwood's (2020) MLmed macro for SPSS. The goal of this analysis was to determine whether these particular health behaviours mediated the effect of the COVID-19 pandemic on depression and anxiety scores. Like Hayes' (2013) PROCESS macro, MLmed estimates the effect of the independent variable on the mediator variable (*a* path), the effect of the mediator on the dependent variable (*b* path), the direct effect of the independent variable on the dependent variable while controlling for the mediator (*c'* path), as well as the indirect effect of the independent variable on the dependent variable via the mediating variable (*ab* path). Importantly, MLmed allows analysis of repeated measures; in this case, the two data points on the mediator and dependent variables for each participant. A random intercepts model was selected, in which slopes are fixed but intercepts vary across participants, thereby taking into account the dependence between observations caused by using repeated measures.

Multilevel models are a popular choice in longitudinal research as they permit repeated measures on psychological instruments to be nested within participants. That is, the longitudinal waves are appointed the lowest level of analysis (level 1), while participants become the grouping variable (level 2), thereby negating the need for univariate or multivariate analysis of repeated measures (Tabachnick et al., 2007). Multilevel models are an extension of multiple linear regression and thus have comparable limitations and assumptions such as homoscedasticity, normality, linearity, and independence of errors, an absence of perfect multicollinearity, and a lack of measurement error for the predictor variables. Additionally, multilevel models also assume normal distribution of the random effects, although this cannot be empirically tested.

Of the assumptions that can be checked, linearity is important because it is required for the estimates of parameters to be unbiased. The MLmed macro does not produce residuals to facilitate checking the assumption of linearity, so plots of the predicted vs residual values

were created by refitting the models for dependent variables using the Mixed procedure in SPSS. Normality of errors and homoscedasticity, while comparatively less important, were also checked by refitting both the mediator and outcome variable models created in Mixed. Scatter plots, and Q-Q plots for each model were then visually inspected to see whether assumptions had been met. Measurement error of predictors could not be checked in this instance given that reliability could not be tested for a single item variable (physical activity) or for a variable with optional questions (alcohol use). Finally, MLmed also requires large sample sizes and outcome data that use a common metric, thus offering the assurance that observed score changes signify real change and not changes in measurement scale (Bryk & Raudenbush, 1987), both of which were achieved in this case.

Prior to analysis, data for depression, anxiety, physical activity and alcohol use at each time point were converted from wide to long format. MLmed was then run twice, once for depression and again for anxiety. In each model, the between-effects on the *x* variable, time, were removed ($xB = 0$) to indicate that *x* has no between-variability, or rather, that there are no differences between people in time. The macro automatically performs within-group centring of lower-level predictor variables, and handles missing data using case-wise deletion. As the data is stacked (Bauer et al., 2006) prior to the model being fitted, a case in MLmed corresponds to the data at one time point for one person. The output included within-group direct and indirect effects, as well as Monte Carlo confidence intervals around these effects. Where significant indirect effects were found, the proportion of the pandemic's effect on mental health mediated by the health behaviour was computed with this equation: Within indirect effect/(time within direct effect + within indirect effect).

Research Question 3. The second set of follow-up analyses examined whether the mental health impact of the pandemic was greater for 'at risk' subgroups of older New Zealanders. In particular, the analyses sought to investigate whether being female, Māori,

having a pre-existing mental health condition or lower SES would predict negative change in mental health status between 2018 and 2020. This was investigated with a series of eight mixed two-way ANOVAs to determine whether changes in mental health were greater for some groups compared to others. These ANOVAs investigate marginal effects, thus describing which groups are more or less vulnerable irrespective of other confounding factors. The ANOVAs, four for depression and four for anxiety, used time as a within-group factor and a categorical demographic variable – dichotomised ethnicity, gender and pre-existing mental health status or polytomous SES – as a between-group factor. When a statistically significant two-way interaction was found, a post hoc Tukey's test was performed using SPSS GLM command syntax to correct for familywise type I error rates and determine simple main effects. Where the interaction was not significant, main effects were interpreted. Descriptive statistics including means and standard deviations were also reported.

Assumptions for two-way mixed ANOVA include the requirement that the error terms for the dependent variable be approximately normally distributed for each combination of within-subjects between-subjects factors. This assumption was checked with visual inspections of the Normal Q-Q plot. The assumption of homogeneity of variances was also checked as unequal variances can affect the Type I error rate. This assumption is deemed met with a non-statistically significant Levene's test result; however, a breach of this requirement likely reflects inconsequential differences in group variances in a large sample such as this (Field, 2013). A final assumption, that of sphericity, was not required as the within-subjects factor had fewer than three categories.

Following this analysis, regression models were run to assess whether any of the demographic differences in anxiety and depression identified in the mixed ANOVAs might be over- or under-estimated due to confounding from the other demographic variables. This supplementary analysis helped to establish whether any apparent relationship between a

demographic variable and vulnerability to COVID-19 mental health impacts remained when other demographics were controlled for. By taking this additional step, the researcher was able to build a tentative model of the causes of vulnerability to pandemic-related decreases in mental health. This analysis was carried out with two standard multiple linear regressions in which all four independent variables – dummy-coded ethnicity, gender, pre-existing mental health status and scale-measured SES – were entered together at step 1 alongside the scale-dependent mental health variable as expressed by a difference score, to account for the difference across time. A difference score allows the researcher to run a multiple regression rather than a general linear model with repeated measures. The index has been widely maligned, largely because it is less reliable than original scores; however, some methodologists have defended its use in regression (e.g., Allison, 1990), while others argue that it should not be assessed in terms of reliability (Thomas & Zumbo, 2011).

Assumptions for multiple linear regressions are similar to those of ANOVAs, as they are effectively the same statistical model (Field, 2013). Neither model assumes equal group sizes. Nevertheless, the smallest group sizes present in this study (Māori and pre-existing mental health condition groups were 27.7% and 11.8% of the whole respectively), may limit the statistical power and precision of some of these analyses (Tabachnick et al., 2007). As previously noted, the multiple regression assumes linearity, homoscedasticity, normality and independence of errors, an absence of perfect multicollinearity, and a lack of measurement error for the predictor variables. It was possible to empirically check just a few of these assumptions. Measurement error was assessed for the SES predictor variable, ELSI-SF. Normality of residuals was assessed with visual inspections of a Q-Q plot, and linearity and homoscedasticity with a visual inspection of a plot of studentized residuals against the predicted values.

Statistical Significance and Effect Size

An alpha level of $p < .05$ (two-tailed) was employed throughout as the threshold for statistical significance. Effect sizes were calculated and presented in tables for all relationships, significant and non-significant. Effect size was measured as follows for various analyses.

Paired *t* tests: Cohen's *d*

Mediation analyses: (not advisable to calculate effect size)

Mixed ANOVAs: partial η^2

Multiple linear regressions: R, R^2

Chapter 5: Results

Descriptive Statistics

Mean and standard deviation statistics for the mental health and health behaviour variables at each time point are displayed in Table 3. Mean depression scores increased slightly from 6.04 (*SD* = 4.85) in 2018 to 6.16, (*SD* = 4.68) in 2020. Conversely, mean anxiety scores decreased slightly from 0.87, (*SD* = 1.47) to 0.86 (*SD* = 1.46) in 2020. The percentage of respondents with suspected depression or anxiety increased fractionally from the first wave to the second (an increase of 20.9 to 21.4% and 15.1 to 15.2% respectively). Participants demonstrated a small decrease in alcohol use, which is also reflected in fewer hazardous drinkers reported in 2020 (a decrease from 35.5 to 34.7%). Conversely, levels of moderate physical inactivity increased slightly over time. Those exercising 1-3 times a month or less increased from 19.3% to 21.1%.

Regarding responses to COVID-19-related questions in the 2020 survey, most participants (59.1%) stated the pandemic had had no negative impact on their overall mental health. A substantial group (29.7%) noted ‘a little’ impact, while fewer thought the impact had been moderate (6.2%), quite a bit (3.5%), and extreme (1.1%). Results were similar for impact on economic wellbeing (55.6% no impact, 24.2% ‘a little’). Of the sample, 22.6% were deemed essential workers, 4.3% had lost or left their job due to COVID-19, and about 11% had reduced wages or reduced work hours. Just three respondents had been told they had contracted the virus.

Table 3

Descriptive Statistics for Mental Health and Health Behaviour Variables Before and During the COVID-19 Pandemic (N = 3,171)

Variables	2018	2020
	M (*SD*)	*M* (*SD*)
CES-D-10[a]	6.04 (4.85)	6.16 (4.68)
GAI-SF[a]	0.87 (1.47)	0.86 (1.46)
AUDIT-C	2.99 (2.40)	2.95 (2.41)
Physical Activity[b]	1.63 (0.95)	1.67 (0.99)

Note. CES-D-10 = Center for Epidemiologic Studies Depression Scale-10, GAI-SF = Geriatric Anxiety Inventory-Short Form, AUDIT-C = Alcohol Use Disorders Identification Test-Concise, *SD* = standard deviation. [a]Scales refer to respondents' experience in the past week. [b]Higher scores indicate greater physical inactivity.

Research Question 1: Paired *T* Tests

Did depression and anxiety among older New Zealanders increase, decrease or remain stable during the COVID-19 pandemic?

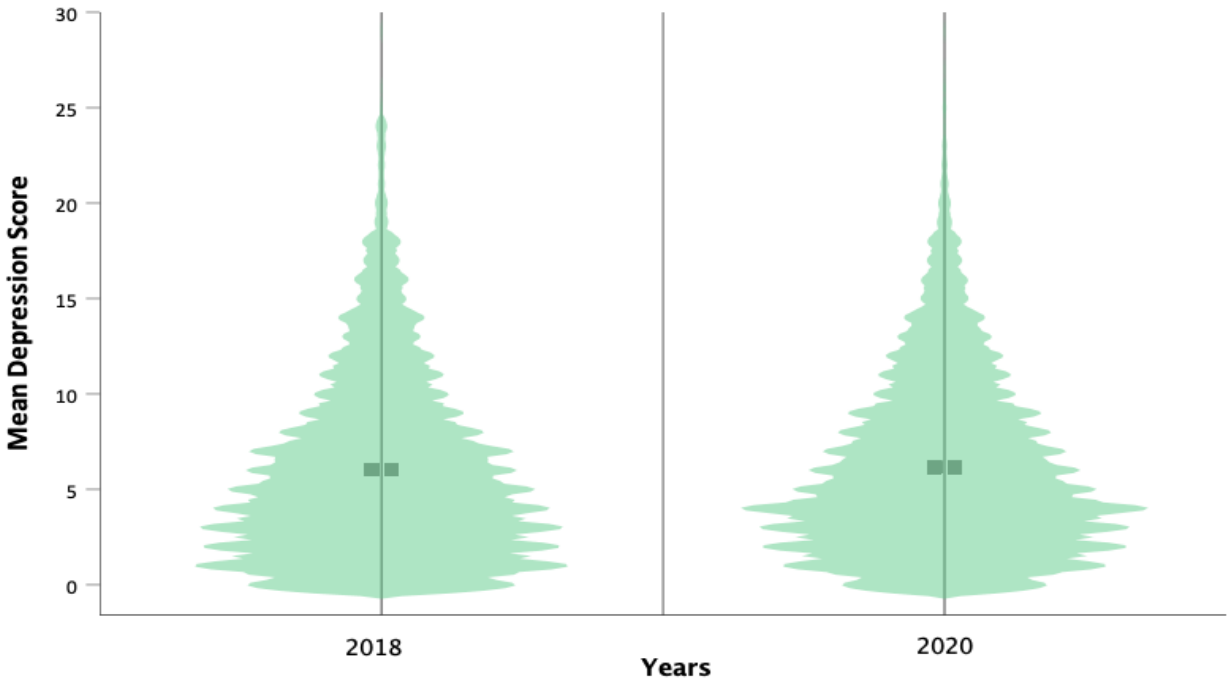
A paired-samples *t* test was conducted to determine whether there was a statistically significant mean difference between 2018 and 2020 depression scores on the CES-D-10. A visual inspection of a normal Q-Q plot showed some evidence of a mild violation of the assumption of normality (See Appendix A for all plots generated for assumption testing). However, the normality assumption is the least important assumption of *t* tests and other regression models (Gelman & Hill, 2006; Williams et al., 2013), and the large sample size of

this study provides strong robustness to this assumption. As such, no transformations were used. Results showed the mean increase of 0.12, 95% CI [−0.001, 0.234] was not statistically significant, $t(3170) = 1.94$, $p = .052$, $d = 0.03$. Therefore, the null hypothesis that there was no change in depression scores between 2018 and 2020 was accepted.

Similarly, the same test was run to determine whether there was a statistically significant mean difference between 2018 and 2020 anxiety scores on the GAI-SF. A visual inspection of a Normal Q-Q plot indicated a mild violation of the assumption of normality, however, no transformations were used given the aforementioned large sample size and relatively low importance of this assumption. Respondents' anxiety scores decreased between 2018 ($M = 0.87$, SD = 1.47) and 2020 ($M = 0.86$, $SD = 1.46$). However, the mean decrease of 0.01, 95% CI [−0.05, 0.37], was not statistically significant, $t(3135) = −0.27$, $p = .789$, $d = −0.01$. Therefore, the null hypothesis that there was no change in anxiety scores between 2018 and 2020 was accepted. The results are presented in Figure 3 and 4.

Figure 3

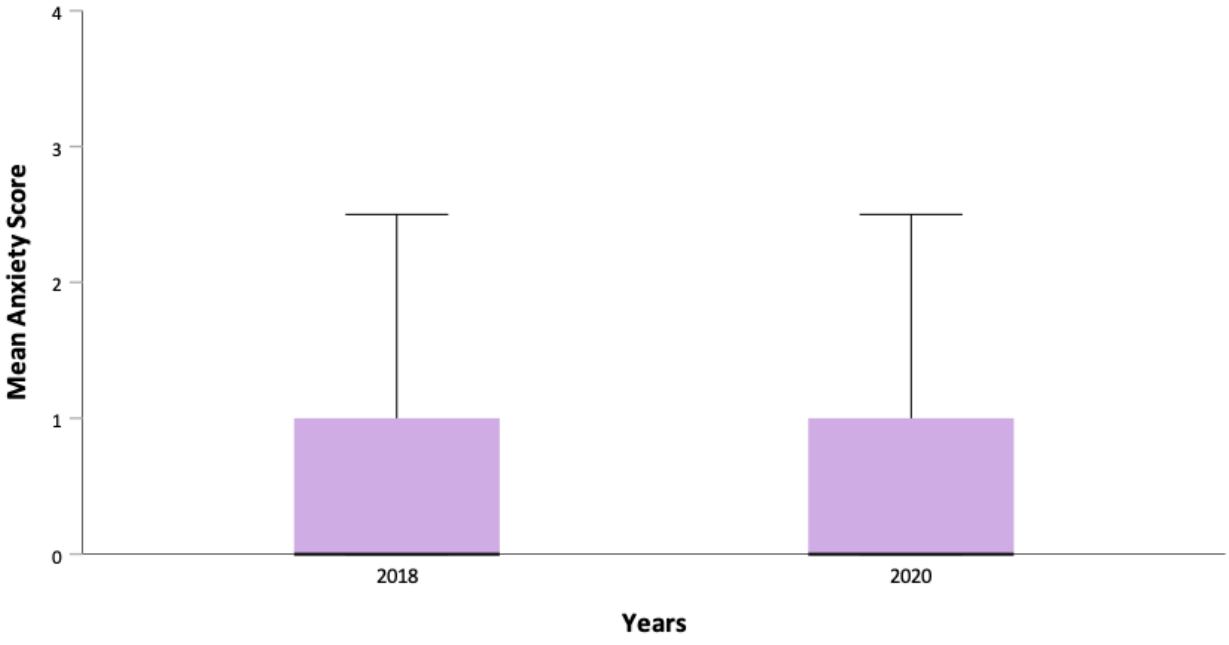
Violin Plot of Mean Depression Scores from Before to During the Pandemic (N = 3,171)



Note. The shaded area represents the mean.

Figure 4

Boxplot of Mean Anxiety Scores from Before to During the Pandemic (N for 2018 = 3,152, N for 2020 = 3,154)



Research Question 2: Paired *T* Tests and Multilevel Mediation

Did older New Zealanders drink more and exercise less during the pandemic? If so, did changes to alcohol consumption and exercise mediate any impact of the pandemic on depression and anxiety?

First, a paired *t* test was conducted to determine whether there was a statistically significant mean increase in alcohol-related risk between 2018 and 2020. A visual inspection of a normal Q-Q plot of AUDIT-C difference scores showed evidence of a moderate violation of the assumption of normality. However, for reasons previously outlined, no transformations were used. Respondents had lower alcohol-related risk scores in 2020 ($M = 2.97$, $SD = 2.44$) when compared with 2018 ($M = 3.02$, $SD = 2.42$). The mean decrease of 0.05, 95% CI [−0.089, −0.004] was statistically significant, $t(2624) = -2.13$, $p = .033$, $d = -0.04$ (very small effect). Therefore, the null hypothesis that there was no change in alcohol-related risk between 2018 and 2020 was rejected, although the observed change was seen in the opposite direction to that posed in the research question.

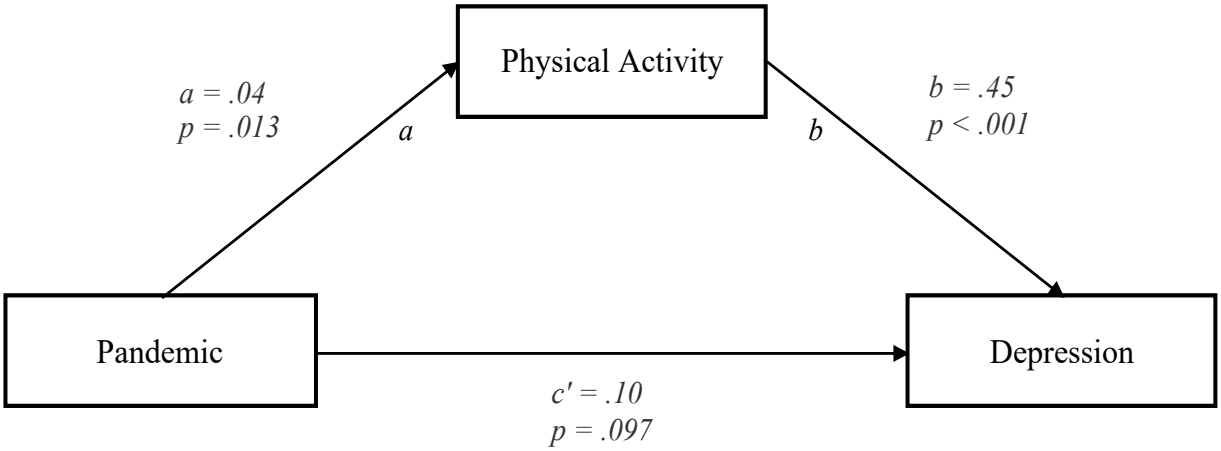
Similarly, the same test was run to determine whether there was a statistically significant mean difference in engagement in physical activity between 2018 and 2020. A visual inspection of a normal Q-Q plot showed mild violations of the assumption of normality for physical activity difference scores, but transformations were unnecessary. Higher scores on this variable indicated lower engagement in physical activity. Respondents showed decreased engagement in physical activity in 2020 ($M = 1.67$, $SD = 0.99$) when compared with 2018 ($M = 1.63$, $SD = 0.95$). This change of 0.04, 95% CI [0.01, 0.07] was statistically significant, $t(3170) = 2.47$, $p = .013$, $d = 0.04$ (very small effect). Therefore, the null hypothesis that there was no change in physical activity between 2018 and 2020 was rejected.

Next, two multilevel mediation analyses were carried out, the first to examine the

mediation effects of physical activity on the relationship between the COVID-19 pandemic and depression, and the second repeating the same analysis with anxiety. As alcohol use did not increase over time, this health behaviour was excluded from the models. The depression model was fitted first, with assumption checks confirming there was homoscedasticity and linearity, and only mild breaches of normality. The direct effect of time on depression was positive but not significant (unstandardised *c'* = .10, *p* = .097, 95% CI [−0.02, 0.22]. Thus, the pandemic did not significantly predict depression when the effect of physical activity was controlled for. However, the indirect effect of the pandemic on depression through physical activity was positive and significant (unstandardised *ab* = .02, *p* = .022, 95% CI [0.004, 0.033]. The proportion of the pandemic's effect on depression mediated by physical activity was then computed as 0.0174/(0.0988 + 0.0174) = 14.97%, based on the equation: Within indirect effect/(time within direct effect + within indirect effect). Results of the analysis are presented in Figure 5.

Figure 5

Unstandardised Regression Coefficients for the Relationship Between the Pandemic and Depression as Mediated by Physical Activity (N = 3,171)

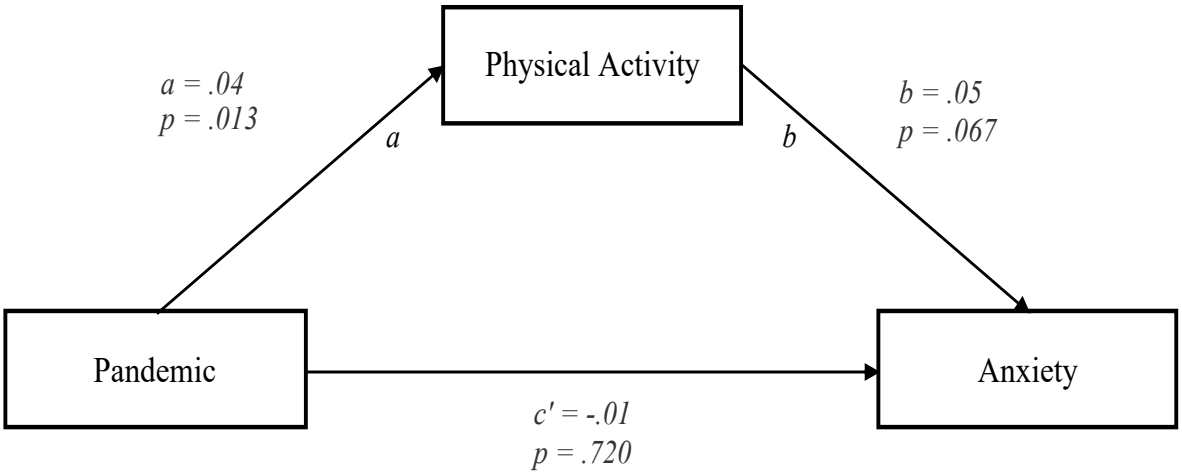


Note. There was a significant indirect effect of the pandemic on depression through physical activity, unstandardised $ab = .02$, $p = .022$, 95% CI [0.004, 0.033].

The anxiety model did not show any evidence of breaches of the assumptions of homoscedasticity or linearity, and the moderate breaches of normality observed were not deemed problematic (Williams et al., 2013). The direct effect of time on anxiety was negative and not significant (unstandardised $c = -.01$, $p = .720$, 95% CI [−0.05, 0.04]) when the effect of physical activity was controlled for. In addition, the indirect effect of the pandemic on anxiety through physical activity was positive but not significant (unstandardised $ab = .002$, $p = .161$, 95% CI [−0.0002, 0.0046]). Results are presented in Figure 6.

Figure 6

Unstandardised Regression Coefficients for the Relationship Between the Pandemic and Anxiety as Mediated by Physical Activity (N = 3,152)



Note. There was no significant indirect effect of the pandemic on anxiety through physical activity, unstandardised *ab* = .002, *p* = .161, *SE* = .0013, 95% CI [−.0002, .0046].

Research Question 3: Mixed ANOVAs and Multiple Linear Regressions

Was the mental health impact of the pandemic greater for 'at risk' subgroups of older people, that is, women, the socioeconomically disadvantaged, Māori and people with a pre-existing mental health condition?

Mixed ANOVAs

Two-way mixed ANOVA analyses were conducted to establish whether some subgroups of older New Zealanders, specifically women, Māori, those with lower SES or a pre-existing mental health condition, experienced significantly greater changes in mental health scores over time than others. Assumptions are discussed, and key results, including the

interaction effect and main or simple main effects are summarised, with interaction effects reported in Table 4. Figures depicting changes in mean mental health scores over time on some demographic variables are also included.

Depression - Gender and Time. Assumption checks showed a mild breach of the assumption of normality for both 2018 and 2020 data, as assessed by Q-Q plots of residuals, deemed unproblematic in this case (and for the other depression-related ANOVAs that follow). A Levene's test showed the assumption of homogeneity of variances was met ($p >$ .05) for both time points. There was no statistically significant interaction between gender and time in predicting depression scores, $F(1, 3169) = 3.40$, $p = .065$, partial $\eta^2 = .001$. The main effect of gender showed that there was no statistically significant difference in mean depression scores between males and females at baseline, $F(1, 3169) = 1.88$, $p = .170$, partial $\eta^2 = .001$.

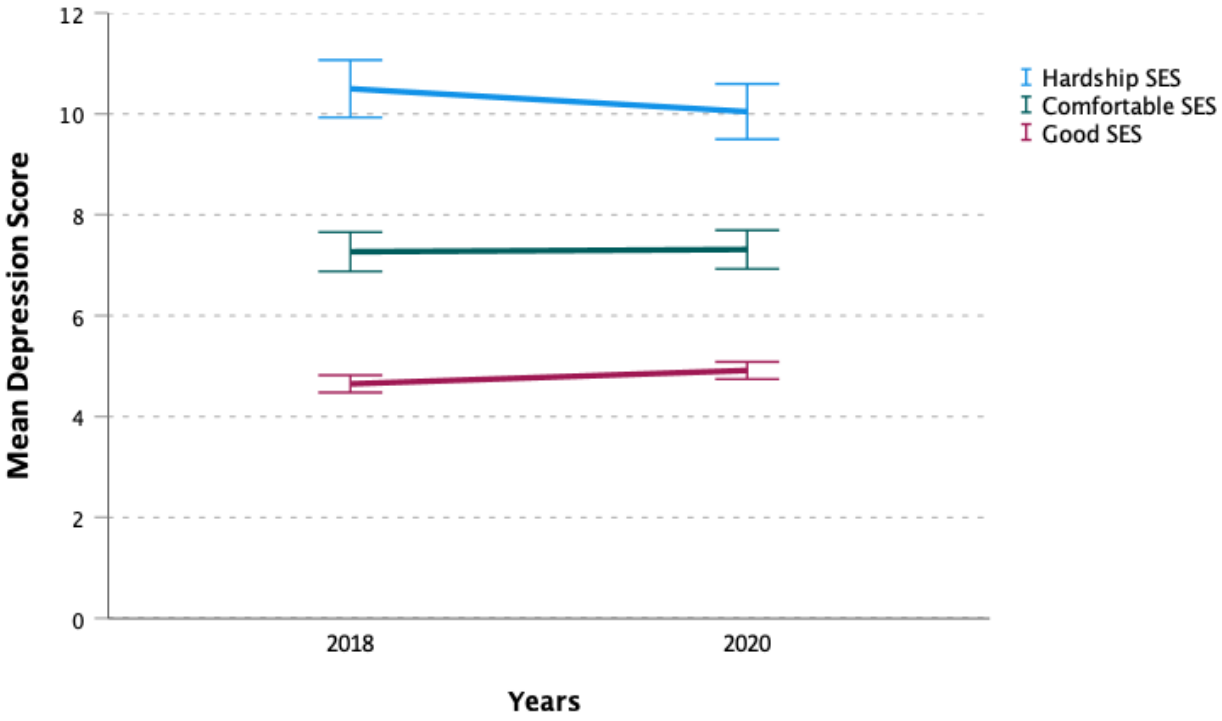
Depression - SES and Time. A visual inspection of a Q-Q plot of residuals for 2018 and 2020 data showed mild violations of the assumption of normality. A Levene's test showed the assumption of homogeneity of variances was not met ($p < .001$) for either time point. This may imply some loss of efficiency of the ordinary least squares estimation algorithm, but would not result in biased estimates (Gelman & Hill, 2006). Since the consequences of breaches of homoscedasticity are relatively mild, it was decided not to apply any transformations or other strategies to respond to the assumption violation in this case, and for such violations in the following ANOVA analyses.

There was a statistically significant interaction between SES and time in predicting depression scores, $F(2, 3030) = 7.91$, $p < .001$, partial $\eta^2 = .005$. A post hoc Tukey's test was performed to determine simple main effects, which found a statistically significant difference between all three SES groups in 2018 and 2020. In 2018, participants with the lowest SES (hardship) had the highest depression scores ($M = 10.50$, $SD = 5.57$), while scores were lower

for those with a comfortable (M = 7.27, SD = 4.82) and good SES (M = 4.65, SD = 3.85). Over time, depression scores for respondents with hardship-level SES decreased (Mean difference = −0.45, SE = .17, p = .007), while depression scores for respondents in the highest SES group increased (Mean difference = 0.27, SE = 0.07, p <.001). Scores for the lower 'comfortable' SES group did not change significantly between the two time points. Mean scores are shown in Figure 7.

Figure 7

Line Graph Showing Changes in Depression Between 2018 and 2020 for SES (N = 3,030)



Note. Error bars show standard errors.

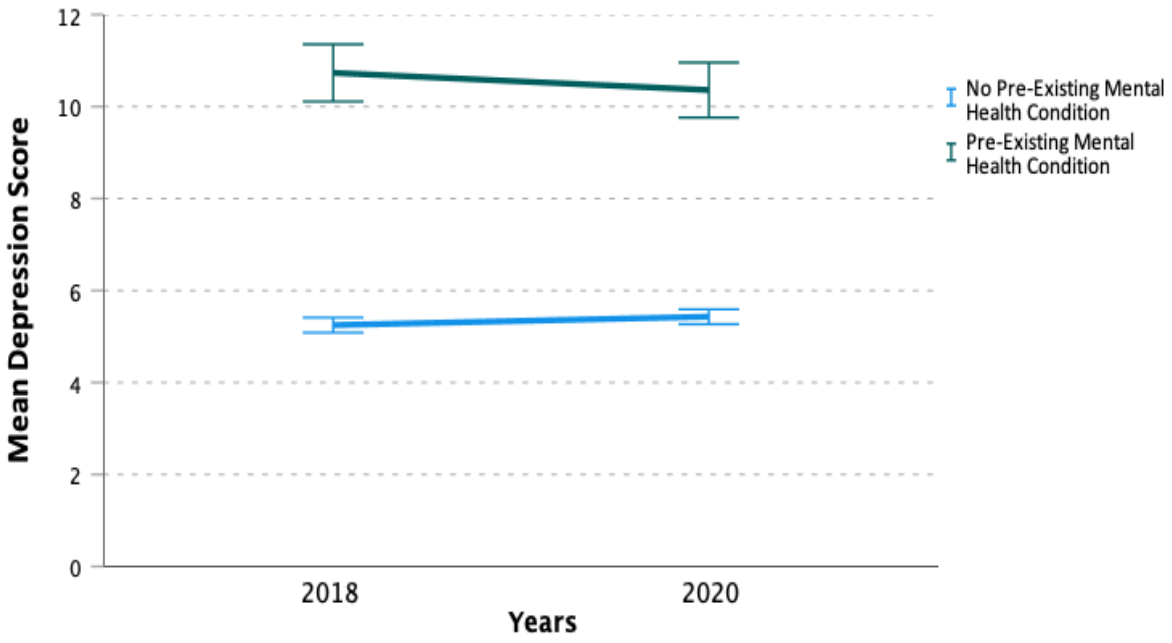
Depression - Ethnicity and Time. A visual inspection of a Q-Q plot of residuals for 2018 and 2020 data showed mild violations of the assumption of normality. The assumption of homogeneity of variances was not met (p < .05) for either time point. There was no

statistically significant interaction between ethnicity and time in predicting depression scores, $F(1, 3121) = 2.68$, $p = .102$, partial $\eta^2 = .001$. The main effect of ethnicity showed that there was a statistically significant difference in mean depression scores between Māori and non-Māori at 2018, $F(1, 3121) = 22.07$, $p < .001$, partial $\eta^2 = .001$. Being Māori was associated with a mean depression score 0.83 (95% CI [2.20, 8.30]) points higher than non-Māori, a statistically significant difference, $p < .001$.

Depression - Pre-Existing Mental Health Status and Time. A visual inspection of a Q-Q plot of residuals for 2018 and 2020 data showed mild violations of the assumption of normality. A Levene's test showed the assumption of homogeneity of variances was not met ($p < .001$) for either time point. There was a statistically significant interaction between pre-existing mental health status and time in predicting depression scores, $F(1, 2965) = 9.09$, $p = .003$, partial $\eta^2 = .003$. This interaction was followed up with a post hoc Tukey's test which indicated there was a significant difference between the two groups in 2018 (Mean difference = 5.49, $SE = 0.25$, $p < .001$) and 2020 (Mean difference = 4.93, $SE = .25$, $p < .001$). In 2018, the mean depression score for respondents with a pre-existing mental health condition was 10.74 ($SE = 6.01$) compared to 5.25 for those who did not have a pre-existing mental health condition ($SE = 4.16$). Over time, mean depression scores for respondents with a pre-existing mental health condition decreased (Mean difference = −0.37, $SE = 0.17$, $p = .031$) while scores for those without a pre-existing mental health condition increased (Mean difference = 0.18, $SE = 0.07$, $p = .005$). Mean scores are shown in Figure 8.

Figure 8

Line Graph Showing Changes in Depression Between 2018 and 2020 for Pre-Existing Mental Health Status (N = 2,965)



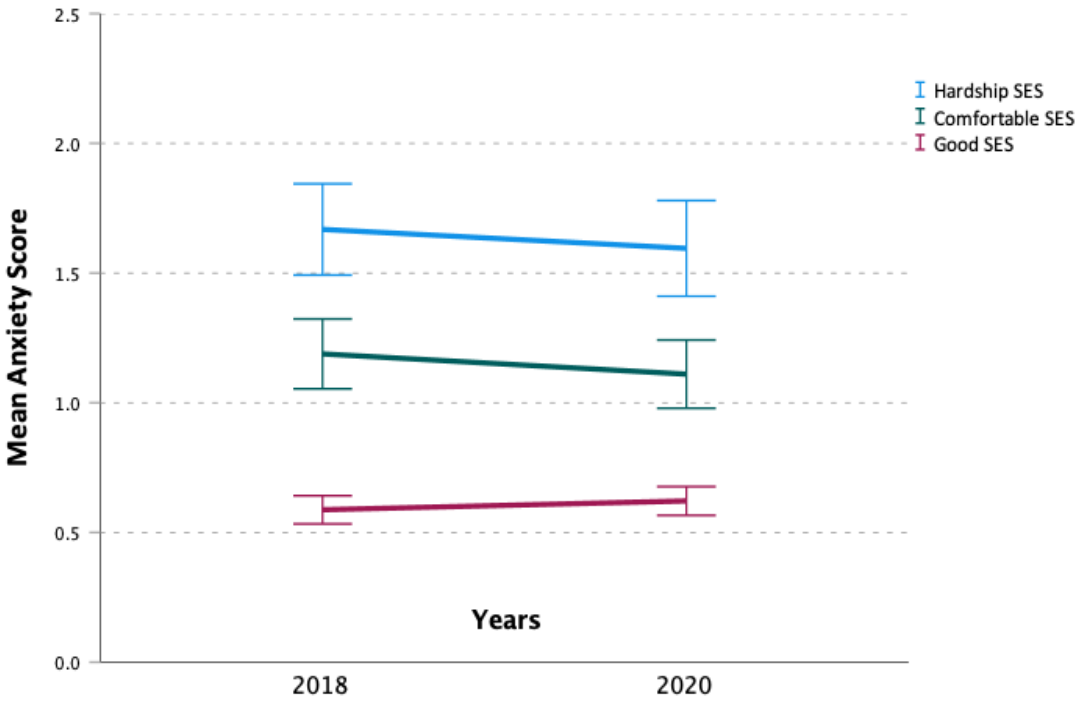
Note. Error bars show standard errors.

Anxiety - Gender and Time. Assumption checks showed a moderate breach of the assumption of normality for both 2018 and 2020 data, as assessed by Q-Q plots of residuals, deemed unproblematic in this case (and for the following anxiety-related ANOVAs). A Levene's test showed the assumption of homogeneity of variances was not met ($p < .001$) for either time point. There was no statistically significant interaction between gender and time in predicting anxiety scores, $F(1, 3134) = 0.041$, $p = .839$, partial $\eta^2 = .000$. The main effect when comparing men and women was a statistically significant difference between the groups at 2018, $F(1, 3134) = 20.13$, $p < .001$, partial $\eta^2 = .006$. Scores were considerably higher among women ($M = 0.96$, $SD = 1.53$) than men ($M = 0.75$, $SD = 1.36$).

Anxiety - SES and Time. A visual inspection of a Q-Q plot of residuals for 2018 and 2020 data showed moderate violations of the assumption of normality. A Levene's test showed the assumption of homogeneity of variances was not met ($p < .001$) for either data collection point. There was no statistically significant interaction between SES and time in predicting anxiety scores, $F(2, 3001) = 2.68$, $p = .069$, partial $\eta^2 = .002$. The main effect when comparing the SES groups was a significant difference between the groups at baseline, $F(2, 3001) = 131.21$, $p < .001$, partial $\eta^2 = .080$). Scores were considerably higher for the lowest 'hardship' SES group ($M = 1.67$, $SE = 1.74$) compared to those in the 'comfortable' group ($M = 1.19$, $SE = 1.65$) and those in the highest 'good' group ($M = 0.59$, $SE = 1.21$). Mean scores are shown in Figure 9.

Figure 9

Line Graph Showing Changes in Anxiety Between 2018 and 2020 for SES (N= 3,001)

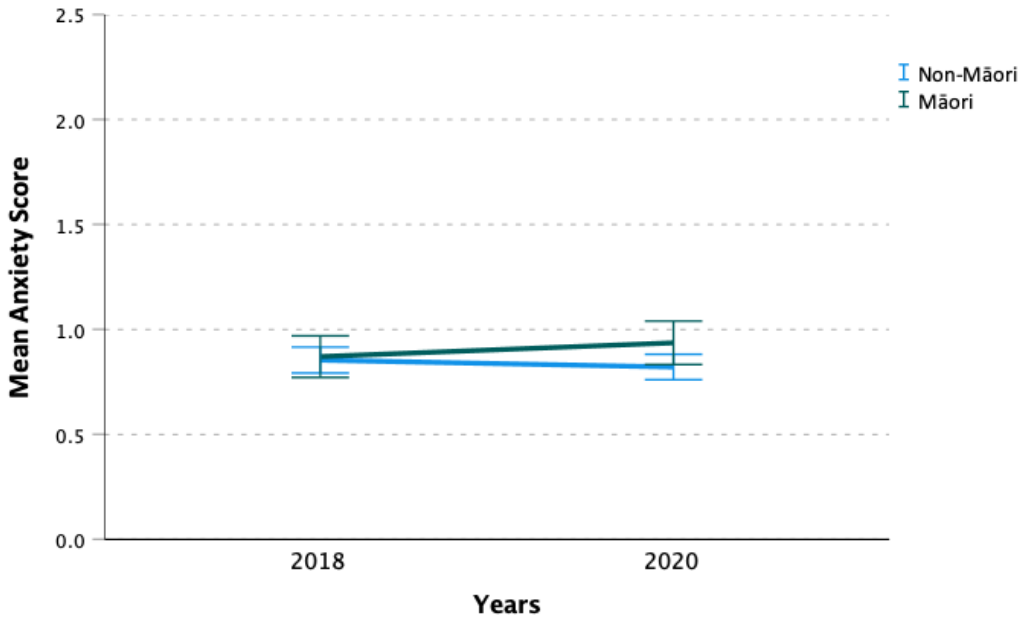


Note. Error bars show standard errors.

Anxiety - Ethnicity and Time. A visual inspection of a Q-Q plot of residuals for 2018 and 2020 data showed moderate violations of the assumption of normality. A Levene's test showed the assumption of homogeneity of variances was met for 2018 data ($p > .05$) but not for 2020 data ($p < .05$). There was a statistically significant interaction between ethnicity and time in predicting anxiety scores, $F(1, 3{,}087) = 3.98$, $p = .046$, partial $\eta^2 = .001$. This interaction was followed up with a post hoc Tukey's test which found no significant differences between Māori and non-Māori in 2018 (Mean difference = 0.02, $SE = 0.06$, $p = .773$); however, the difference was significant in 2020 (Mean difference = 0.12, $SE = 0.06$, $p = .048$). Over time, mean anxiety scores for Māori respondents increased (Mean difference = 0.7, $SE = 0.04$), while scores for non-Māori decreased (Mean difference = −0.3, $SE = 0.03$); but neither change was statistically significant. Mean scores are shown in Figure 10.

Figure 10

Line Graph Showing Changes in Anxiety Between 2018 and 2020 for Ethnicity (N = 3,087)

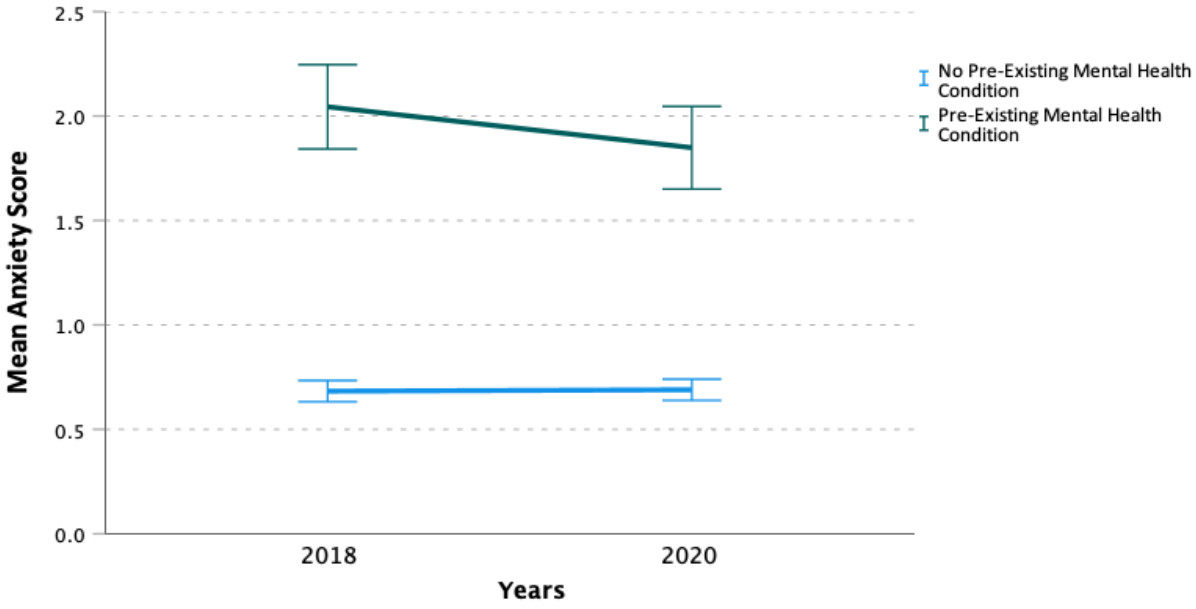


Note. Error bars show standard errors.

Anxiety - Pre-Existing Mental Health Status and Time. A visual inspection of a Q-Q plot of residuals for 2018 and 2020 data showed moderate violations of the assumption of normality. A Levene's test showed the assumption of homogeneity of variances was not met ($p < .001$) for either time point. There was a statistically significant interaction between pre-existing mental health status and time in predicting anxiety scores, $F(1, 2{,}933) = 8.58$, $p = .003$, partial $\eta^2 = .003$. A post hoc Tukey's test found a significant difference between the two groups in 2018 (Mean difference = 1.36, $SE = 0.08$, $p < .001$) and 2020 (Mean difference = 1.16, $SE = 0.08$, $p < .001$). In 2018, the mean anxiety score for respondents with a prior mental health condition was 2.04 compared to 1.29 for those without a pre-existing condition. Over time, anxiety scores significantly decreased for those with a pre-existing mental health condition (Mean difference = −0.20, $SE = 0.07$, $p = .002$). There was no significant change for those without prior mental health issues. Mean scores are shown in Figure 11.

Figure 11

Line Graph Showing Changes in Anxiety Between 2018 and 2020 for Pre-Existing Mental Health Status (N = 2,933)



Note. Error bars show standard errors.

Table 4

Results of Mixed ANOVAs Showing Interaction Effect of Demographic Variables and Time for Depression and Anxiety

	n	*df*	*F*	*p*	*partial* η^2
Depression					
Gender	3,169	1	3.40	.065	.001
Ethnicity	3,121	1	2.68	.102	.001
Pre-Existing Mental Health	2,965	1	9.09	.003	.003
SES	3,030	2	7.91	<.001	.005
Anxiety					
Gender	3,134	1	0.04	.839	.000
Ethnicity	3,087	1	3.98	.046	.001
Pre-Existing Mental Health	2,933	1	8.58	.003	.003
SES	3,001	2	2.68	.069	.002

Multiple Linear Regressions

Multiple regression analyses were then undertaken to identify whether the significant differences between groups over time identified in the mixed ANOVAs would still hold when controlling for the remaining demographic variables. All four independent variables were entered at step 1 of each model, irrespective of whether a significant interaction effect was previously found. The following section presents a summary of assumption testing for each regression, as well as model fit and tables displaying both significant and non-significant predictors.

Depression Regression. A multiple regression was run with depression difference scores as the dependent variable. Assumption testing illustrated that the assumption of normality was met, as assessed by a Q-Q plot. The requirement for linearity was also met

after visual inspection of a plot of studentized residuals against the predicted values. The assumption of homoscedacity was violated as there was less variance in the residuals for higher predicted values. This may indicate that ordinary least squares is no longer the most efficient estimator, however, as previously argued, homoscedasticity does not, in itself, cause biased estimates (Gelman & Hill, 2006), thus no transformations were used. The results showed the model explained very little variance in depression change scores (adj. $R^2 = .01$). As illustrated in Table 5, SES was the only statistically significant predictor of depression difference scores ($p < .001$). The model predicted that for every one unit increase in SES, depression change scores increased by 0.04 points, when holding all the other predictor variables constant.

Table 5

Multiple Linear Regression Results for Depression Change and Predictor Variables

	B	*95%* CI *for B*		*SE B*	β	*p*
		LL	*UL*			
Model						
Constant	−1.07	−1.68	−.46	.31		<.001
Gender	.24	−.003	.49	.13	.04	.053
Ethnicity	.22	−.06	.50	.14	.03	.123
Pre-Existing Mental Health Issue	−.36	−.74	.02	.20	−.04	.064
SES	.04	.20	.06	.01	.07	<.001

Note. Model = "Enter" method in SPSS Statistics; *B* = unstandardised regression coefficient; CI = confident interval; *LL* = lower limit; *UL* = upper limit; *SE B* = standard error of the coefficient; β = standardised coefficient; *p* = probability value; $R^2 = .01$; Adjusted $R^2 = .007$.

Anxiety Regression. A multiple regression was also run with anxiety difference scores as the dependent variable. Assumption testing showed that the requirements for linearity and homoscedasticity were met after visual inspection of a plot of studentized residuals against the predicted values. The assumption of normality was also met, as assessed by a Q-Q plot. The results showed that the model explained very little variance in anxiety change scores (adj. $R^2 = .003$). As shown in Table 6, none of the independent variables were significant predictors of anxiety change scores ($p < .001$).

Table 6

Multiple Linear Regression Results for Anxiety Change and Predictor Variables

	B	*95%* CI *for B*		*SE B*	β	*p*
		LL	*UL*			
Model						
Constant	−.23	−.46	−.004	.12		.046
Gender	.03	−.06	.12	.05	.01	.550
Ethnicity	.10	−.003	.20	.05	.04	.057
Pre-Existing Mental Health Issue	−.14	−.28	.01	.07	−.04	.063
SES	.01	.000	.02	.004	.04	.060

Note. Model = "Enter" method in SPSS Statistics; *B* = unstandardised regression coefficient; CI = confident interval; *LL* = lower limit; *UL* = upper limit; *SE B* =standard error of the coefficient; β = standardised coefficient; *p* = probability value; $R^2 = .004$; Adjusted $R^2 = .003$.

Chapter 6: Discussion

The present study examined whether depression and anxiety increased among older New Zealanders during the pandemic. It also sought to explore whether negative health behaviours increased in this global crisis and whether these behaviours mediated changes in mental health status. Finally, analyses were carried out to assess whether the mental health impact was greater for some potentially vulnerable subgroups of older people. While a considerable body of research on COVID-19 and mental health is amassing, this work fills an important research gap in providing some of the first New Zealand longitudinal findings on the topic. Furthermore, the study is focused on older people, with their many age-related vulnerabilities in a pandemic environment, and considers the mental health implications of the pandemic beyond the initial lockdown.

This chapter begins with the key findings, including a summary and discussion of the results for each research question. This is followed by an elucidation of the study's limitations, and practical and clinical implications.

Key Findings

Research Question 1

> *Did depression and anxiety among older New Zealanders increase, decrease or remain stable during the COVID-19 pandemic?*

The results show no evidence that depression or anxiety symptoms increased among older New Zealanders in the pandemic. Specifically, scores on mental health measures did not increase significantly between mid-2018, when first questioned, and the second data collection in June-September 2020. That depression and anxiety did *not* increase in this population, despite the magnitude, unpredictability and deadliness of the fast-unfolding global pandemic in mid-2020, is the central and most remarkable finding of this study.

In many ways, this was to be expected. The two other New Zealand longitudinal studies on this topic (Bulbulia et al., 2020; Sibley et al., 2020) also found only very modest increases in psychological distress in the general population, and no change in severe depression. Anxiety was not measured. Likewise, the two local cross-sectional studies (Every-Palmer et al., 2020; Gasteiger et al., 2021) similarly report no increase in mental distress among older New Zealanders when compared with normative data. It should be noted that these results closely align with the COVID-19 finding in this study showing that almost 60% of respondents felt no negative impact of the pandemic on mental health, and less than 5% felt the impact had been 'quite a bit' or 'extreme'.

There are several potential explanations for these findings. Firstly, unique factors were at play in New Zealand in mid-2020 that likely contributed to lower distress; in particular, the very low rates of COVID-19 morbidity and mortality in the country at the time. On June 8, 2020, just 3 days before the survey's release, it was announced the virus had been eliminated (Baker et al., 2020), albeit temporarily. It is feasible that this relatively low-risk environment may not have posed the level of uncertainty required to trigger the catastrophic misinterpretations necessary to cause GAD or other anxiety disorders (Hebert & Dugas, 2019). Likewise, the circumstances may not have been stressful enough for most to activate the negative self-schemas seen in the development of MDD or related depression disorders (Beck, 2002). Instead, older people – the population most likely to experience COVID-19 infection, hospitalisations and death (United Nations, 2020) – might have felt comparatively safe in Aotearoa at this time. Furthermore, participants had been out of lockdown for at least 6 weeks, and therefore were less likely to be impacted by the social isolation and loneliness that have been associated with mental health issues in older people in pandemic research (Palgi et al., 2020). Given the time lapse since stay-at-home orders were lifted, it is possible that any earlier feelings of loneliness and accompanying mental health

symptoms may have since dissipated as people re-joined society. This would align with findings from the meta-analysis by Robinson et al. (2022), which reports a clear spike in mental distress early in the pandemic followed by a recovery response.

While the relatively mild pandemic circumstances in Aotearoa at the time of data collection may help to explain the lack of elevated mental distress, other explanations should also be considered. It is plausible that the COVID-19 pandemic and the ensuing societal response delivered not just negative but positive psychological effects for citizens. Literature from the SARS epidemic (Lau et al., 2006) shows that as well as mental distress, it was not uncommon for people to experience post-traumatic growth; in particular, personal (feelings of relaxation and good health), spiritual (feelings of gratitude) and social growth (feelings of togetherness). Arguably, many New Zealanders could have responded similarly given the government's swift, decisive and ultimately successful initial response to the pandemic. Certainly, levels of national pride, government trust and satisfaction appeared to be very high, even in lockdown (Sibley et al., 2020), and qualitative data also collected from the 2020 HWR wave show that a sizable proportion of older people felt well supported by their family, fellow citizens, and the government (Stephens & Breheny, 2021). This hypothesis is supported by Vazquez et al. (2021) who examined different pathways to traumatic responses and traumatic growth in the outbreak. These authors found primal faith in a good world, optimism and identification with humanity – all beliefs arguably prevalent among New Zealanders in mid-2020 – were associated with post-traumatic growth.

The findings may also reflect particular resilience among older people. While this study does not compare older and younger cohorts, those that did almost universally found older people had comparatively lower increases in mental distress (Every-Palmer et al., 2020; Kwong et al., 2020; Pierce et al., 2020). Some literature suggests that older people's life experiences in overcoming adversities increase resilience, wisdom and ability to cope in

difficult times (Eshel et al., 2016; van Kessel, 2013). Indeed, studies from the pandemic showed that, while anxious about contracting COVID-19, older people more readily employed proactive coping skills to relieve stress (Pearman et al., 2021). Another large cross-sectional study found older individuals were more resilient and held fewer unrealistic fears than younger groups (Bruine de Bruin, 2021). Of course, it should also be noted that some of the key pandemic stressors, in particular, daily disruptions and economic impacts (Holmes et al., 2020), may not have been as heavily felt by the sizeable retired portion of participants.

Research Question 2

> *Did older New Zealanders drink more and exercise less during the pandemic? If so, did changes in alcohol consumption and physical activity mediate any impact of the pandemic on depression and anxiety?*

Alcohol Use. Results showed that, contrary to popular wisdom, older New Zealanders drank less alcohol, not more, during the pandemic, although the effect was very small (d = -0.04). This is in line with New Zealand research from Every-Palmer et al. (2020) in which participants self-reported no overall change in drinking patterns in lockdown compared with pre-lockdown. Another international study that reported a reduction, Kilian et al. (2021), pointed to decreased beverage availability and increased distress, two explanations that do not appear relevant to the present study, given there was no significant mental health change, and alcohol remained widely available in New Zealand (Huckle et al., 2020). Of course, it is possible that a proportion of older New Zealanders were less familiar with online alcohol sales channels routinely used by generally younger patrons. The reduction could also reflect a reluctance among older people to return to social drinking venues like bars, restaurants, Returned Services Associations and sports clubs in the wake of lockdown. Finally, it cannot be discounted that the post-lockdown data collection came too late to depict an increase.

Physical Activity. Conversely, physical activity decreased between the two time points, albeit only marginally (d = 0.04, very small effect). This reduction aligns with the overall finding of a systematic review of 66 longitudinal studies on physical activity in the pandemic (Stockwell et al., 2021). It is also in keeping with longitudinal data collected at two time points in the pandemic (Vogel et al., 2021) showing physical activity remained reduced beyond lockdown.

This result suggests people who reduced or stopped exercising while staying at home did not resume all activity even after facilities and socialising had recommenced, possibly because the key habitual aspect of exercise was disrupted (Kaushal et al., 2017). Importantly, the reduction was small, which perhaps reflects some resumption of physical activities like group exercise classes and walking with friends, since strict stay-at-home orders were lifted. Of course, it is also feasible that lockdown may not have caused a substantial decrease in physical activity among older people in the first place, as some studies suggest (McCarthy et al., 2021; Smith et al., 2020). The former study employed wearable trackers to monitor activity and found older people, when compared with younger counterparts, had smaller decreases in physical activity when lockdown was introduced, and then regained physical activity faster during lockdown and beyond.

Findings from the mediation analysis showed physical activity partially mediated the effect of the pandemic on depression, but not anxiety. This suggests that despite the lack of evidence of an overall increase in depression scores over time, there was some evidence of an indirect effect of time on depression scores via physical activity. There is some literature indicating that a significance test of an indirect effect can have higher power than one of the total effect and, as such, mediation can be cautiously interpreted where evidence of a total effect is lacking (O'Rourke & MacKinnon, 2015). However, others warn against such interpretation (Loeys et al., 2015). Regardless, little interpretation is necessary in this instance

given that the indirect effect on depression was very small, and only barely statistically significant. Looking to other research, no similar mediation analyses have been undertaken, although numerous studies show strong associations between increased depression and reduced physical activity in the COVID-19 crisis (Colley et al., 2020; Duncan et al., 2020; Jacob et al., 2020; Maugeri et al., 2020). For instance, Stanton et al. (2020) found self-reported negative changes in physical activity for half of their sample of 1,491 Australian adults, and this change was associated with higher depression and anxiety symptoms. Results also align with older studies (Nyström et al., 2019; Patten et al., 2009) showing that sedentary behaviour is associated with increased depression, although the causal direction of the association could not be determined. It was interesting that there was no evidence of indirect effects for anxiety, given that the literature shows physical activity was strongly associated with both psychological states (Ströhle, 2008).

Research Question 3

> *Was the mental health impact of the pandemic greater for 'at risk' subgroups of older people; that is, women, the socioeconomically disadvantaged, Māori and people with a pre-existing mental health condition?*

Women. Analyses found that the degree to which depression and anxiety scores changed over time was not significantly greater for women than for men. These results contradict most overseas longitudinal research, which found mental health deterioration was greater for women (Andersen et al., 2021; Daly et al., 2020; Kwong et al., 2020; Pierce et al., 2020). Importantly, however, the finding is consistent with the cross-sectional work of Every-Palmer et al. (2020) who found New Zealand women's anxiety scores were lower in the pandemic compared with pre-pandemic normative data. It is plausible that the comparatively low COVID-19 transmission rates in Aotearoa at the time may have lowered the health

anxiety typically experienced by women more than men. It is also possible women were not more impacted than men because older women, many of whom are retired, were somewhat shielded from the key factors hypothesised to increase distress in this group: school closures and work disruptions in female-dominated industries. Finally, it might be that there *was* a disproportionately larger mental health impact among women earlier in the pandemic, which had dissipated by June-September 2020, when many of the initial fears around the pandemic were allayed, as longitudinal findings by Fancourt et al. (2021) suggest.

Socioeconomically Disadvantaged. Contrary to the majority of the research, it was people with high SES, not low SES, who experienced increasing depression scores during the pandemic. Conversely, depression among people with the lowest SES significantly decreased, while scores for people in the middle 'comfortable' SES group did not change. The same SES-depression change relationship was also significant in the multiple regression model, indicating the trend exists even when the other demographic variables are held constant. No significant interaction was observed for anxiety.

It is feasible that low SES individuals were not disproportionately affected because key factors hypothesised to increase distress in this group – higher infection rates and disease complication risks (Ahmed et al., 2020) – were not relevant in a low transmission environment. Another possibility is that older people with low SES were somewhat sheltered from the financial insecurity experienced by younger cohorts, as many had retired, and continued to receive a pension. Regarding the increased depression scores in the highest SES group, while unusual, this was observed in one other large longitudinal study (Daly et al., 2020), which reported the same pattern in people with degrees versus those without.

This finding aligns with research by Sutin et al. (2020), which found that higher educational attainment was associated with increased concerns about the impact of the global crisis. Other research suggests that people with higher education, which roughly aligns with

higher SES, tend to engage more with health information (Saha, 2006), which could be potentially distressing for some. It is also feasible that the pandemic placed demands on the population that individuals with higher SES are less likely to have experienced before; for instance, financial uncertainty. Finally, as high SES individuals are more likely to work from home in the pandemic (Saltiel, 2020), it is possible that negative aspects of home-based work, such as ambiguous or extended work hours and unclear physical and organisational boundaries, may have adversely impacted wellbeing (Allen et al., 2015). However, to date there is surprising little research on the links between mandatory work-from-home measures and mental health.

Māori. ANOVA results indicated that the change in anxiety scores over time appears to have been different in Māori respondents compared with non-Māori respondents. However, given that the increase in Māori participants and the decrease in all other participants was not significant, no firm conclusions about this change can be reached. Furthermore, depression scores in the two ethnicity groups changed even less, with no significant interaction found for this mental health issue over time. These results suggest that the pandemic did not worsen the symptoms of depression or anxiety for Māori. However, it should be noted that Māori had higher depression (but not anxiety) scores at baseline, in line with data showing Māori adults are 1.5 times more likely to experience one of these disorders (Ministry of Health, 2018). Furthermore, while scores for these specific disorders did not increase, the pandemic was shown in other research (Houkamau et al., 2021) to challenge psychological, spiritual and relational wellbeing in Māori whānau, adversely impacting relationships, tikanga and financial stability.

Research on the mental health effect of COVID-19 based on ethnicity has been mixed, with large longitudinal studies split on whether indigenous groups or minority groups were more vulnerable. Early pandemic research undertaken in the United Kingdom (Daly et

al., 2020; Pierce et al., 2020) also found no change. The latter authors suggested that differences may have been observed later, when socioeconomic inequalities likely widened; however, the current findings suggest not. Of course, given that unique cultural features vary substantially between nations, Aotearoa comparisons are preferable. The only New Zealand study similarly found that the magnitude of mental health change was not greater among Māori, when compared with normative data. Like people with low SES, it is feasible that Māori experienced no significant additional independent increase in mental distress because some of the aspects of the pandemic hypothesised to increase distress in this population – for instance, the 2.5 times higher risk of hospitalisation (Steyn et al., 2021) – were less relevant in a low-transmission environment.

Pre-Existing Mental Health Condition. Anxiety and depression scores for people with a pre-existing mental health condition decreased, rather than increased, in the pandemic. Conversely, depression scores for people with no prior disorder increased. Anxiety scores for this group did not change significantly.

While there is considerable evidence from longitudinal studies that a pre-existing mental health condition does not put an individual at increased psychological risk in the pandemic (Robinson et al., 2022), including specifically in older people (Hamm et al., 2020), no other research to date shows that risk declined in this group, and rose for others. By way of explanation, it is possible that those individuals with a pre-existing disorder had better access to treatment that helped mitigate the trauma of the pandemic, as hypothesised by Ettman, Abdalla, et al. (2020). Furthermore, instead of having fewer mental resources on which to draw, as some have argued (Vindegaard & Benros, 2020), it is feasible that an individual's prior mental health experiences bolster self-care and coping strategies to deal with stress in a global crisis. Conversely, those without experience of mental illness were less familiar with psychological distress and therefore less equipped to deal with the emotional

stressors they faced. It is also possible that the later data collection missed a time of elevated mental health concerns in people with pre-existing issues. However, research by Pan et al. (2021) suggests lockdown itself may have been less distressing for this population, given that structured routines and reduced social interactions minimised exposure to external stressors, like large gatherings. Finally, these results could also be explained, in part, by regression to the mean as those with mental health issues naturally improve over time (Streiner, 2001).

Limitations

The present study has many strengths; in particular its use of a large, well-powered, nationally-representative sample that offers some assurances in the reported relationships between depression, anxiety, health behaviours and demographic groups over time in older New Zealanders. The work also has limitations that must be considered when interpreting the results.

Causal Inferences

The longitudinal design allowed the researcher to demonstrate covariation between the pandemic and the dependent variables, anxiety and depression, and temporal precedence of hypothesised cause before hypothesised effect. However, the findings could still be affected by time-varying confounding variables. It is impossible to say with any certainty that it was the advent of the COVID-19 outbreak, and not other unobserved confounders on the pandemic-mental health relationship, that affected depression and anxiety scores. To address this troublesome issue of causal inference, the present study does as Grosz et al. (2020) recommend and explicitly states causal assumptions, such as the absence of time-varying confounding variables, as well as the researcher's interest in causal effects.

Data Collection Timing

This study focused on inferences about the impact of the pandemic as a general phenomenon, and did not include a data collection point during a lockdown. Participants

responded to the survey in June-September 2020, while the country was still in the midst of a global pandemic but after the nationwide lockdown had ceased. As such, it cannot be used to draw inferences about the impact of lockdowns per se. This positioning is unusual among current longitudinal mental health literature in the pandemic, which has predominantly focused on the implications of lockdowns (Robinson et al., 2022).

Additionally, the study is limited by including just two waves of data. This decision was made largely because the GAI-SF anxiety measure was only introduced to the HWR study in 2018. As a result, any trajectories identified are less certain. Nevertheless, given the magnitude of the pandemic, the timing of collection, and the quality and size of the longitudinal sample, it is likely these observational findings are, to some extent, related to COVID-19, and events associated with the pandemic. Perhaps future longitudinal research could avoid these pitfalls with multiple survey waves and shorter time lags to better confirm changes in mental health and health behaviour status over time.

Finally, the COVID-19 pandemic was, and still is, unfolding, with populations responding to the unique factors they face at the precise time and place of data collection. Therefore, the findings should be viewed through the lens of their temporality. Levels of depression, anxiety, alcohol use and physical activity were captured at a particular point in the outbreak, after lockdown conditions had eased, and may not reflect levels of negative mental health and health behaviour change experienced earlier, or later. Indeed, since this 2020 data collection, COVID-19 threats have continued unabated in New Zealand, including small localised lockdowns in February 2021, followed by an outbreak of the highly virulent Delta variant that triggered an extended 4-month lockdown of Auckland (and to a lesser extent, other regions) from August to December, 2021. A COVID-19 weary country is now braced for further restrictions and disruptions with the arrival of an even more infectious variant, Omicron (Karim & Karim, 2021). Thus, despite the general picture of resilience

portrayed in these results, it should be viewed as a snapshot in time and not a reflection of general ongoing resilience. Continued efforts are needed to track people throughout the varying stages of the pandemic and lockdown states to monitor changes in mental distress.

Secondary Data

The study was a secondary analysis of existing data. Therefore, decisions regarding the constructs, measures and variables were made prior, and could not be adjusted for the present study. Some variables may have had limitations as measures of the constructs of importance in the current research. For instance, the HWR study catered to the broader aims of a longitudinal study of health and ageing, but had no item pertaining to pre-existing mental health status, and therefore the variable needed to be fashioned from a question listing multiple health conditions. Similarly, the HWR study did not use a validated measure for physical activity, so the selected moderate physical activity variable had uncertain validity and reliability and a higher proportion of missing data than would be the case had the survey been built for purpose. Ideally, future work in this area would employ custom-made survey questions with validated measures to reduce missing data and ensure they are valid and reliable measures of the constructs being surveyed.

The Sample

While the sample was relatively large and nationally representative, it was underpowered to detect change for all ethnic groups. As a compromise, several ethnicities were grouped together to create a non-Māori group with which to compare Māori participants. Additionally, the Pasifika sample was small (0.9%), and analyses could not be extended to include this potentially vulnerable group (Steyn et al., 2021). Another issue is that the HWR study only questioned those living in in private homes. By excluding at-risk sites such as retirement homes, prisons, and hospital in-patient mental facilities, the findings may not be generalisable to these important contexts. Furthermore, while the response rate to

the 2020 HWR survey was relatively high (75.4%), it is feasible that the proportion who did not respond were experiencing higher COVID-19-related distress. Lastly, the average age of respondents was a relatively youthful 67, with just four respondents in the 'oldest old' group of people aged 85-plus. As such, it is reasonable to suggest these results may lack generalisability to the oldest New Zealanders. Future studies should work to capture their experience, especially because the COVID-19 virus presents the greatest physical threat to the oldest citizens (World Health Organization, 2020c).

Practical and Clinical Implications

The present study is, to date, the only longitudinal work to focus on the mental health effect of the pandemic on older New Zealanders. The findings advance the fast-growing COVID-19 and mental health literature and have important implications for supporting positive health and wellbeing during the ongoing pandemic and future global crises.

While mental distress did not increase significantly in general, results did identify a particular depression risk for older individuals who were less physically active during the outbreak. This finding may reflect a transient state of lower exercise levels as people resume habits vacated in lockdown, and may thus be benign. Nevertheless, it is concerning to find some evidence of an indirect effect of time on depression via physical activity 1-4 months after lockdown. This finding reinforces the growing knowledge about the strong association between physical activity and depression, both in 'normal life' (Rebar et al., 2015), and during COVID-19 (Stockwell et al., 2021), and suggests increased attention should be paid to promoting physical exercise among older people during the pandemic as a means of decreasing depression risk. Physical activity must continue to be actively promoted among older people during this crisis, including the considerable health benefits of heavy housework (Adjei & Brand, 2018). Additionally, the government should invest in improving existing sport and recreation options targeted at this age group. While there has been a proliferation in

free online exercise resources since the pandemic began (Hall et al., 2021), improvements to technological literacy among older people may be needed to boost uptake (Son et al., 2021). A pre-pandemic meta-analysis found online physical exercise interventions targeted at older adults are generally highly successful, especially those that address sleep health, fear of falling and lack of social support (Kwan et al., 2020).

The present study also helps to establish an understanding of how the pandemic is experienced by distinct subgroups of older people in Aotearoa. Contrary to most mental health research undertaken in COVID-19, it was people with a high SES and no mental health condition prior to the pandemic who were most likely to experience increased depression. These groups are not typically viewed as psychologically vulnerable, and, indeed, were not identified as 'at risk' in early pandemic commentary, making these findings all the more important. These results curiously imply the pandemic may have had a balancing effect, reducing rather than widening some pre-pandemic inequalities, although this finding requires replication as it has not been reported elsewhere. Regarding SES, given that possible explanations include higher exposure to financial disruptions and greater consumption of COVID-19-related media in people with higher SES, mental health interventions should consider the particular vulnerability these exposures might pose. With regard to people without recent prior mental health issues, it is important that programmes instituted to support mental health in the pandemic do not assume that those without a prior diagnosis are more protected from depressive conditions. Future research could evaluate what skills mental health experience bestows on an individual, with a view to helping this substantial and diverse group better prepare ahead of future crises. Importantly, psychological interventions designed to reach these groups may necessarily be delivered online in pandemic times, and thus careful adaptations may be needed to engage this population (Conroy et al., 2020).

That older New Zealanders largely maintained their pre-pandemic levels of

depression and anxiety in the face of an unprecedented global health crisis is remarkable. Several studies suggest this population may have been less psychologically impacted than younger people (Czeisler et al., 2020, González-Sanguino et al., 2020, Klaiber et al., 2020). Therefore, future research should investigate the role of unique age-related resources such as increased wisdom (Grossmann et al., 2010) and resilience (Gooding et al., 2012), which may enable this population to cope well in the face of pandemic-related adversity. Other features of older age worthy of further research include lower stress reactivity and better emotional regulation (Lee et al., 2019), and greater acceptance among older people of their own mortality (Bellamy et al., 2014). Understanding the mechanisms by which older people cope well in times of hardship could lead to the development of interventions to strengthen protective resources in future crises.

Finally, while these findings largely paint a picture of resilience among older New Zealanders in mid-2020, enduring resilience in this population should not be assumed. With the arrival of Delta, followed by the Omicron variant, the pandemic has shown little sign of abating, and ongoing collection of robust data on psychological wellbeing is necessary to monitor mental health changes into the future. Such research should employ validated measures, random population sampling and multi-wave data collection to accurately guide mental health policy and ensure psychological interventions are offered to those older New Zealanders most at risk. These efforts will ensure better support for this diverse, heterogenous population, not just during COVID-19 but in the event of inevitable future pandemics (Taylor, 2019).

Conclusion

Despite warnings that the pandemic poses considerable risk to health and wellbeing, these results suggest that, 3 to 6 months into the crisis, older New Zealanders were relatively resilient. Nonetheless, subgroups of this population, namely those with a higher SES and no

recent prior mental health issues, did experience increases in depression. Furthermore, reduced physical activity presented a particular depression risk in older people. This study represents the first longitudinal investigation of mental health changes in this population in Aotearoa, and is one of just a few such studies to investigate the psychological impact of the pandemic outside lockdown on New Zealanders of any age.

Two years after the SARS-CoV-2 virus first appeared, the pandemic continues to cause illness, death and large-scale disruption to human existence. Efforts should continue to monitor depression and anxiety trajectories over time to determine whether this general picture of resilience is enduring or represents a transient state of wellness among older New Zealanders in the pandemic. The role of SES, prior mental health status and physical activity should also be further investigated to confirm these findings and develop relevant programmes and therapeutic interventions designed to help sustain health and wellbeing in this population.

References

Aalto, M., Alho, H., Halme, J. T., & Seppä, K. (2011). The Alcohol Use Disorders Identification Test (AUDIT) and its derivatives in screening for heavy drinking among the elderly. *International Journal of Geriatric Psychiatry, 26*(9), 881-885. https://doi.org/10.1002/gps.2498

Abrahao, K. P., Salinas, A. G., & Lovinger, D. M. (2017). Alcohol and the brain: Neuronal molecular targets, synapses, and circuits. *Neuron, 96*(6), 1223-1238. https://doi.org/10.1016/j.neuron.2017.10.032

Adjei, N. K., & Brand, T. (2018). Investigating the associations between productive housework activities, sleep hours and self-reported health among elderly men and women in western industrialised countries. *BMC Public Health, 18*(1), 110. https://doi.org/10.1186/s12889-017-4979-z

Ahmed, F., Ahmed, N. e., Pissarides, C., & Stiglitz, J. (2020). Why inequality could spread COVID-19. *The Lancet Public Health, 5*(5), e240. https://doi.org/10.1016/S2468-2667(20)30085-2

Alegría, M., Chatterji, P., Wells, K., Cao, Z., Chen, C. N., Takeuchi, D., Jackson, J., & Meng, X. L. (2008). Disparity in depression treatment among racial and ethnic minority populations in the United States. *Psychiatric Services, 59*(11), 1264-1272. https://doi.org/10.1176/appi.ps.59.11.1264

Alexopoulos, G. S. (2005). Depression in the elderly. *The Lancet, 365*(9475), 1961-1970. https://doi.org/10.1016/S0140-6736(05)66665-2

Allen, J., Alpass, F. M., & Stephens, C. V. (2019). New Zealand Health, Work and Retirement Longitudinal Study. In D. Gu & M. Dupre (Eds.), *Encyclopedia of Gerontology and Population Aging* (pp. 1-7). Springer International Publishing.

Allen, T. D., Golden, T. D., & Shockley, K. M. (2015). How effective is telecommuting?

Assessing the status of our scientific findings. *Psychological Science in the Public Interest, 16*(2), 40-68. https://doi.org/10.1177%2F1529100615593273

Allison, P. D. (1990). Change scores as dependent variables in regression analysis. *Sociological Methodology, 20*, 93-114. https://doi.org/10.2307/271083

Almeida, O. P., Draper, B., Pirkis, J., Snowdon, J., Lautenschlager, N. T., Byrne, G., Sim, M., Stocks, N., Kerse, N., Flicker, L., & Pfaff, J. J. (2012). Anxiety, depression, and comorbid anxiety and depression: Risk factors and outcome over 2 years. *International Psychogeriatrics, 24*(10), 1622-1632. https://doi.org/10.1017/S104161021200107X

Alon, T. M., Doepke, M., Olmstead-Rumsey, J., & Tertilt, M. (2020, April). *The impact of COVID-19 on gender equality* (National Bureau of Economic Research Working Paper No. 26947). https://www.nber.org/papers/w26947

Alpass, F., Pond, R., Stephens, C., Stevenson, B., Keeling, S., & Towers, A. (2013). The influence of ethnicity and gender on caregiver health in older New Zealanders. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 68*(5), 783-793. https://doi.org/10.1093/geronb/gbt060

Altemus, M., Sarvaiya, N., & Epperson, C. N. (2014). Sex differences in anxiety and depression clinical perspectives. *Frontiers in Neuroendocrinology, 35*(3), 320-330. https://doi.org/10.1016/j.yfrne.2014.05.004

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). American Psychiatric Association.

Andersen, A. J., Mary-Krause, M., Bustamante, J. J. H., Héron, M., El Aarbaoui, T., & Melchior, M. (2021). Symptoms of anxiety/depression during the COVID-19 pandemic and associated lockdown in the community: Longitudinal data from the TEMPO cohort in France. *BMC Psychiatry, 21*(1), 381. https://doi.org/10.1186/

s12888-021-03383-z

Andresen, E. M., Malmgren, J. A., Carter, W. B., & Patrick, D. L. (1994). Screening for depression in well older adults: Evaluation of a short form of the CES-D. *American Journal of Preventive Medicine, 10*(2), 77-84. https://doi.org/10.1016/S0749-3797(18)30622-6

Ardern, J. (2020). *PM address— COVID-19 update* [Speech]. https://www.beehive.govt.nz/speech/pm-address-covid-19-update

Armitage, R., & Nellums, L. B. (2020). COVID-19 and the consequences of isolating the elderly. *The Lancet Public Health, 5*(5), e256. https://doi.org/10.1016/S2468-2667(20)30061-X

Asmundson, G. J., Paluszek, M. M., Landry, C. A., Rachor, G. S., McKay, D., & Taylor, S. (2020). Do pre-existing anxiety-related and mood disorders differentially impact COVID-19 stress responses and coping? *Journal of Anxiety Disorders, 74*, 102271. https://doi.org/10.1016%2Fj.janxdis.2020.102271

Ayalon, L., Chasteen, A., Diehl, M., Levy, B., Neupert, S. D., Rothermund, K., Tesch-Römer, C., & Wahl, H.-W. (2020). Aging in times of the COVID-19 pandemic: Avoiding ageism and fostering intergenerational solidarity. *The Journals of Gerontology: Series B, 76*(2), e49-e52. https://doi.org/10.1093/geronb/gbaa051

Baker, M. G., Wilson, N., & Anglemyer, A. (2020). Successful elimination of Covid-19 transmission in New Zealand. *New England Journal of Medicine, 383*(8), e56. https://doi.org/10.1056/NEJMc2025203

Banerjee, D. (2020). The impact of Covid-19 pandemic on elderly mental health. *International Journal of Geriatric Psychiatry, 35*(12), 1466-1467. https://doi.org/10.1002/gps.5320

Baron, E. C., Davies, T., & Lund, C. (2017). Validation of the 10-item Centre for

Epidemiological Studies Depression Scale (CES-D-10) in Zulu, Xhosa and Afrikaans populations in South Africa. *BMC Psychiatry, 17*(1), 6. https://doi.org/10.1186/s12888-016-1178-x

Batterham, P. J., Calear, A. L., McCallum, S. M., Morse, A. R., Banfield, M., Farrer, L. M., Gulliver, A., Cherbuin, N., Rodney Harris, R. M., & Shou, Y. (2021). Trajectories of depression and anxiety symptoms during the COVID-19 pandemic in a representative Australian adult cohort. *Medical Journal of Australia*, *214*(19), 462-468. https://doi.org/10.5694/mja2.51043

Bauer, D., Preacher, K., & Gil, K. (2006). Conceptualizing and testing random indirect effects and moderated mediation in multilevel models: New procedures and recommendations. *Psychological Methods, 11*(2), 142-163. https://doi.org/10.1037/1082-989X.11.2.142

Bavolar, J., Kacmar, P., Hricova, M., Schrötter, J., Kovacova-Holevova, B., Köverova, M., & Raczova, B. (2021). Intolerance of uncertainty and reactions to the COVID-19 pandemic. *The Journal of General Psychology*, 1-28. https://doi.org/10.1080/00221309.2021.1922346

Beaglehole, B., Mulder, R. T., Boden, J. M., & Bell, C. J. (2019). A systematic review of the psychological impacts of the Canterbury earthquakes on mental health. *Australian and New Zealand Journal of Public Health, 43*(3), 274-280. https://doi.org/10.1111/1753-6405.12894

Beck, A. T. (1963). Thinking and depression: I. Idiosyncratic content and cognitive distortions. *Archives of General Psychiatry, 9*(4), 324-333. https://doi.org/10.1001/archpsyc.1963.01720160014002

Beck, A. T. (1976). *Cognitive therapy and the emotional disorders*. International Universities Press.

Beck, A. T. (2002). Cognitive models of depression. *Clinical Advances in Cognitive Psychotherapy: Theory and Application, 14*(1), 29-61.

Beekman, A., Deeg, D., Braam, A., Smit, J., & Van Tilburg, W. (1997). Consequences of major and minor depression in later life: A study of disability, well-being and service utilization. *Psychological Medicine, 27*(6), 1397-1409. https://doi.org/10.1017/s0033291797005734

Bell, C., Williman, J., Beaglehole, B., Stanley, J., Jenkins, M., Gendall, P., Rapsey, C., & Every-Palmer, S. (2020). Psychological distress, loneliness, alcohol use and suicidality in New Zealanders with mental illness during a strict COVID-19 lockdown. *Australian & New Zealand Journal of Psychiatry,* 48674211034317. https://doi.org/10.1177/00048674211034317

Bellamy, G., Gott, M., Waterworth, S., McLean, C., & Kerse, N. (2014). 'But I do believe you've got to accept that that's what life's about': Older adults living in New Zealand talk about their experiences of loss and bereavement support. *Health & Social Care in the Community*, 22(1), 96-103. https://doi.org/https://doi.org/10.1111/hsc.12069

Bellos, S., Skapinakis, P., Rai, D., Zitko, P., Araya, R., Lewis, G., Lionis, C., & Mavreas, V. (2016). Longitudinal association between different levels of alcohol consumption and a new onset of depression and generalized anxiety disorder: Results from an international study in primary care. *Psychiatry Research, 243*, 30-34. https://doi.org/10.1016/j.psychres.2016.05.049

Bendau, A., Petzold, M. B., Pyrkosch, L., Mascarell Maricic, L., Betzler, F., Rogoll, J., Große, J., Ströhle, A., & Plag, J. (2021). Associations between COVID-19 related media consumption and symptoms of anxiety, depression and COVID-19 related fear in the general population in Germany. *European Archives of Psychiatry and Clinical Neuroscience, 271*(2), 283-291. https://doi.org/10.1007/s00406-020-01171-6

Bhattacharya, K., Ghosh, A., Monsivais, D., Dunbar, R. I., & Kaski, K. (2016). Sex differences in social focus across the life cycle in humans. *Royal Society Open Science, 3*(4), 160097. https://doi.org/10.1098/rsos.160097

Biddle, S. (2016). Physical activity and mental health: Evidence is growing. *World Psychiatry, 15*(2), 176-177. https://doi.org/10.1002%2Fwps.20331

Birren, J. E., & Schroots, J. J. (2001). *History of geropsychology*. Academic Press.

Boden, J. M., & Fergusson, D. M. (2011). Alcohol and depression. *Addiction, 106*(5), 906-914. https://doi.org/10.1111/j.1360-0443.2010.03351.x

Booth, M. L., Owen, N., Bauman, A., Clavisi, O., & Leslie, E. (2000). Social–cognitive and perceived environment influences associated with physical activity in older Australians. *Preventive Medicine, 31*(1), 15-22. https://doi.org/10.1006/pmed.2000.0661

Brailovskaia, J., Cosci, F., Mansueto, G., Miragall, M., Herrero, R., Baños, R. M., Krasavtseva, Y., Kochetkov, Y., & Margraf, J. (2021). The association between depression symptoms, psychological burden caused by Covid-19 and physical activity: An investigation in Germany, Italy, Russia, and Spain. *Psychiatry Research, 295*, 113596. https://doi.org/10.1016/j.psychres.2020.113596

Breslau, J., Finucane, M. L., Locker, A. R., Baird, M. D., Roth, E. A., & Collins, R. L. (2021). A longitudinal study of psychological distress in the United States before and during the COVID-19 pandemic. *Preventive Medicine, 143*, 106362. https://doi.org/10.1016/j.ypmed.2020.106362

Brooke, J., & Jackson, D. (2020). Older people and COVID-19 isolation, risk and ageism. *Journal of Clinical Nursing*, *29*(13-14), 2044-2046. https://doi.org/10.1111/jocn.15274

Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., &

Rubin, G. J. (2020). The psychological impact of quarantine and how to reduce it: Rapid review of the evidence. *The Lancet, 395*(10227), 912-920. https://doi.org/10.1016/S0140-6736(20)30460-8

Brown, T. A., Chorpita, B. F., Korotitsch, W., & Barlow, D. H. (1997). Psychometric properties of the Depression Anxiety Stress Scales (DASS) in clinical samples. *Behaviour Research and Therapy*, 35(1), 79-89. https://doi.org/10.1016/s0005-7967(96)00068-x

Bruine de Bruin, W. (2021). Age differences in COVID-19 risk perceptions and mental health: Evidence from a national US survey conducted in March 2020. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences, 76*(2), e24-e29. https://doi.org/10.1093/geronb/gbaa074

Bryant, C., Jackson, H., & Ames, D. (2008). The prevalence of anxiety in older adults: methodological issues and a review of the literature. *Journal of Affective Disorders, 109*(3), 233-250. https://doi.org/10.1016/j.jad.2007.11.008

Bryk, A. S., & Raudenbush, S. W. (1987). Application of hierarchical linear models to assessing change. *Psychological Bulletin, 101*(1), 147-158. https://doi.org/10.1037/0033-2909.101.1.147

Buhr, K., & Dugas, M. J. (2009). The role of fear of anxiety and intolerance of uncertainty in worry: An experimental manipulation. *Behaviour Research and Therapy, 47*(3), 215-223. https://doi.org/10.1016/j.brat.2008.12.004

Bui, C. N., Peng, C., Mutchler, J. E., & Burr, J. A. (2021). Race and ethnic group disparities in emotional distress among older adults during the COVID-19 pandemic. *Gerontologist, 61*(2), 262-272. https://doi.org/10.1093/geront/gnaa217

Bulbulia, J. A., Piven, S., Greaves, L., Osborne, D., Troughton, G., Yogeeswaran, K., & Sibley, C. G. (2020). Longitudinal study of pandemic and natural disaster distress

[Preprint]. *PsyArXiv*. https://psyarxiv.com/erfhp/

Bush, K., Kivlahan, D. R., McDonell, M. B., Fihn, S. D., & Bradley, K. A. (1998). The AUDIT alcohol consumption questions (AUDIT-C): An effective brief screening test for problem drinking. Ambulatory Care Quality Improvement Project (ACQUIP). Alcohol Use Disorders Identification Test. *Archives of Internal Medicine, 158*(16), 1789-1795. https://doi.org/10.1001/archinte.158.16.1789

Byrne, G., & Pachana, N. (2011). Development and validation of a short form of the Geriatric Anxiety Inventory - The GAI-SF. *International Psychogeriatrics, 23*, 125-131. https://doi.org/10.1017/S1041610210001237

Cacioppo, J. T., & Hawkley, L. C. (2009). Perceived social isolation and cognition. *Trends in Cognitive Sciences, 13*(10), 447-454. https://doi.org/10.1016/j.tics.2009.06.005

Callinan, S., Smit, K., Mojica-Perez, Y., D'Aquino, S., Moore, D., & Kuntsche, E. (2020). Shifts in alcohol consumption during the COVID-19 pandemic: Early indications from Australia. *Addiction*, *116*(6), 1381-1388. https://doi.org/10.1111/add.15275

Callow, D. D., Arnold-Nedimala, N. A., Jordan, L. S., Pena, G. S., Won, J., Woodard, J. L., & Smith, J. C. (2020). The mental health benefits of physical activity in older adults survive the COVID-19 pandemic. *The American Journal of Geriatric Psychiatry, 28*(10), 1046-1057. https://doi.org/10.1016/j.jagp.2020.06.024

Campbell, A. D. (2020). Practical implications of physical distancing, social isolation, and reduced physicality for older adults in response to COVID-19. *Journal of Gerontological Social Work, 63*(6-7), 668-670. https://doi.org/10.1080/01634372.2020.1772933

Campion, J., Javed, A., Sartorius, N., & Marmot, M. (2020). Addressing the public mental health challenge of COVID-19. *The Lancet Psychiatry, 7*(8), 657-659. https://doi.org/10.1016%2FS2215-0366(20)30240-6

Canuto, A., Weber, K., Baertschi, M., Andreas, S., Volkert, J., Dehoust, M. C., Sehner, S., Suling, A., Wegscheider, K., Ausín, B., Crawford, M. J., Da Ronch, C., Grassi, L., Hershkovitz, Y., Muñoz, M., Quirk, A., Rotenstein, O., Santos-Olmo, A. B., Shalev, A., … Härter, M. (2018). Anxiety disorders in old age: Psychiatric comorbidities, quality of life, and prevalence according to age, gender, and country. *The American Journal of Geriatric Psychiatry, 26*(2), 174-185. https://doi.org/10.1016/j.jagp.2017.08.015

Capasso, A., Jones, A. M., Ali, S. H., Foreman, J., Tozan, Y., & DiClemente, R. J. (2021). Increased alcohol use during the COVID-19 pandemic: The effect of mental health and age in a cross-sectional sample of social media users in the U.S. *Preventive Medicine, 145*, 106422. https://doi.org/10.1016/j.ypmed.2021.106422

Carleton, R. N., Norton, M. P. J., & Asmundson, G. J. (2007). Fearing the unknown: A short version of the Intolerance of Uncertainty Scale. *Journal of Anxiety Disorders, 21*(1), 105-117. https://doi.org/10.1016/j.janxdis.2006.03.014

Carriedo, A., Cecchini, J. A., Fernandez-Rio, J., & Méndez-Giménez, A. (2020). COVID-19, Psychological well-being and physical activity levels in older adults during the nationwide lockdown in Spain. *The American Journal of Geriatric Psychiatry, 28*(11), 1146-1155. https://doi.org/10.1016/j.jagp.2020.08.007

Chan, S. M. S., Chiu, F. K. H., Lam, C. W. L., Leung, P. Y. V., & Conwell, Y. (2006). Elderly suicide and the 2003 SARS epidemic in Hong Kong. *International Journal of Geriatric Psychiatry, 21*(2), 113-118. https://doi.org/10.1002/gps.1432

Cheung, Y., Chau, P. H., & Yip, P. S. (2008). A revisit on older adults suicides and Severe Acute Respiratory Syndrome (SARS) epidemic in Hong Kong. *International Journal of Geriatric Psychiatry, 23*(12), 1231-1238. https://doi.org/10.1002/gps.2056

Chick, J. (2020). Alcohol and COVID-19. *Alcohol and Alcoholism, 55*(4), 341-342. https://

doi.org/10.1093/alcalc/agaa039

Chodkiewicz, J., Talarowska, M., Miniszewska, J., Nawrocka, N., & Bilinski, P. (2020). Alcohol consumption reported during the COVID-19 pandemic: The initial stage. *International Journal of Environmental Research and Public Health, 17*(13), 4677. https://doi.org/10.3390/ijerph17134677

Christey, G., Amey, J., Campbell, A., & Smith, A. (2020). Variation in volumes and characteristics of trauma patients admitted to a level one trauma centre during national level 4 lockdown for COVID-19 in New Zealand. *New Zealand Medical Journal, 133*(1513), 81-88. https://pubmed.ncbi.nlm.nih.gov/32325471/

Cigiloglu, A., Ozturk, Z. A., & Efendioglu, E. M. (2021). How have older adults reacted to coronavirus disease 2019? *Psychogeriatrics, 21*(1), 112-117. https://doi.org/10.1111/psyg.12639

Clark, A., Jit, M., Warren-Gash, C., Guthrie, B., Wang, H. H., Mercer, S. W., Sanderson, C., McKee, M., Troeger, C., & Ong, K. L. (2020). Global, regional, and national estimates of the population at increased risk of severe COVID-19 due to underlying health conditions in 2020: A modelling study. *The Lancet Global Health, 8*(8), e1003-e1017. https://doi.org/10.1016/S2214-109X(20)30264-3

Clay, J. M., & Parker, M. O. (2020). Alcohol use and misuse during the COVID-19 pandemic: A potential public health crisis? *The Lancet Public Health, 5*(5), e259. https://doi.org/10.1016/S2468-2667(20)30088-8

Code of Ethics Review Group. (2002). *Code of ethics for psychologists working in Aotearoa/New Zealand*. https://www.nzccp.co.nz/assets/Uploads/Code-of-Ethics-English.pdf

Coffman, J. A., & Petty, F. (1985). Plasma GABA levels in chronic alcoholics. *The American Journal of Psychiatry, 142*(10), 1204-1205. https://doi.org/10.1176/ajp.142.10.1204

Colley, R. C., Bushnik, T., & Langlois, K. (2020). Exercise and screen time during the COVID-19 pandemic. *Health Reports, 31*(6), 3-11. https://doi.org/10.25318/82-003-x202000600001-eng

Conroy, K. M., Krishnan, S., Mittelstaedt, S., & Patel, S. S. (2020). Technological advancements to address elderly loneliness: Practical considerations and community resilience implications for COVID-19 pandemic. *Working with Older People*, 24(4). https://doi.org/10.1108/wwop-07-2020-0036

Craske, M. G., & Stein, M. B. (2016). Anxiety. *The Lancet, 388*(10063), 3048-3059. https://doi.org/10.1016/s0140-6736(16)30381-6

Creese, B., Khan, Z., Henley, W., O'Dwyer, S., Corbett, A., Vasconcelos Da Silva, M., Mills, K., Wright, N., Testad, I., Aarsland, D., & Ballard, C. (2021). Loneliness, physical activity, and mental health during COVID-19: A longitudinal analysis of depression and anxiety in adults over the age of 50 between 2015 and 2020. *International Psychogeriatrics*, *33*(5), 505-514. https://doi.org/10.1017/S1041610220004135

Crews, D. J., & Landers, D. M. (1987). A meta-analytic review of aerobic fitness and reactivity to psychosocial stressors. *Medicine & Science in Sports & Exercise, 19*(5), S114-120. https://doi.org/10.1249/00005768-198710001-00004

Curran, E., Rosato, M., Ferry, F., & Leavey, G. (2020). Prevalence and factors associated with anxiety and depression in older adults: Gender differences in psychosocial indicators. *Journal of Affective Disorders, 267*, 114-122. https://doi.org/10.1016/j.jad.2020.02.018

Czeisler, M., Lane, R., Petrosky, E., Wiley, J., Christensen, A., Njai, R., Weaver, M., Robbins, R., Facer-Childs, E., Barger, L., Czeisler, C., Howard, M., & Rajaratnam, S. (2020). Mental health, substance use, and suicidal ideation during the COVID-19 pandemic - United States, June 24-30, 2020. *Morbidity and Mortality Weekly Report,*

69(32), 1049-1057. https://doi.org/10.15585/mmwr.mm6932a1

D'Cruz, M., & Banerjee, D. (2020). 'An invisible human rights crisis': The marginalization of older adults during the COVID-19 pandemic – An advocacy review. *Psychiatry Research, 292*, 113369. https://doi.org/10.1016/j.psychres.2020.113369

Daly, M., & Robinson, E. (2021). Psychological distress and adaptation to the COVID-19 crisis in the United States. *Journal of Psychiatric Research, 136*, 603-609. https://doi.org/https://doi.org/10.1016/j.jpsychires.2020.10.035

Daly, M., Sutin, A. R., & Robinson, E. (2020). Longitudinal changes in mental health and the COVID-19 pandemic: Evidence from the UK Household Longitudinal Study. *Psychological Medicine*, 1-10. https://doi.org/10.1017/S0033291720004432

Dave, D. M., Kelly, I. R., & Spasojevic, J. (2006). The effects of retirement on physical and mental health outcomes. *Southern Economic Journal, 75*(2), 497-523. https://doi.org/10.1002/j.2325-8012.2008.tb00916.x

Dawson, D. A., Grant, B. F., Stinson, F. S., & Zhou, Y. (2005). Effectiveness of the derived Alcohol Use Disorders Identification Test (AUDIT-C) in screening for alcohol use disorders and risk drinking in the US general population. *Alcoholism: Clinical and Experimental Research, 29*(5), 844-854. https://doi.org/10.1007%2Fs11606-008-0594-0

De Goeij, M. C., Suhrcke, M., Toffolutti, V., van de Mheen, D., Schoenmakers, T. M., & Kunst, A. E. (2015). How economic crises affect alcohol consumption and alcohol-related health problems: A realist systematic review. *Social Science & Medicine, 131*, 131-146. https://doi.org/10.1016/j.socscimed.2015.02.025

de Oliveira, L. d. S. S. C. B., Souza, E. C., Rodrigues, R. A. S., Fett, C. A., & Piva, A. B. (2019). The effects of physical activity on anxiety, depression, and quality of life in elderly people living in the community. *Trends in Psychiatry and Psychotherapy,*

41(1), 36-42. https://doi.org/10.1590/2237-6089-2017-0129

Deng, Y., Hillygus, D. S., Reiter, J. P., Si, Y., & Zheng, S. (2013). Handling attrition in longitudinal studies: The case for refreshment samples. *Statistical Science, 28*(2), 238-256. https://doi.org/10.1214/13-STS414

Dillman, D. A. (2011). *Mail and internet surveys: The tailored design method*. John Wiley & Sons.

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, phone, mail, and mixed-mode surveys: The tailored design method*. John Wiley & Sons.

Disner, S. G., Beevers, C. G., Haigh, E. A., & Beck, A. T. (2011). Neural mechanisms of the cognitive model of depression. *Nature Reviews Neuroscience, 12*(8), 467-477. https://doi.org/10.1038/nrn3027

Dugas, M. J., Gagnon, F., Ladouceur, R., & Freeston, M. H. (1998). Generalized anxiety disorder: A preliminary test of a conceptual model. *Behaviour Research and Therapy, 36*(2), 215-226. https://doi.org/10.1016/s0005-7967(97)00070-3

Duncan, G. E., Avery, A. R., Seto, E., & Tsang, S. (2020). Perceived change in physical activity levels and mental health during COVID-19: Findings among adult twin pairs. *PLOS ONE, 15*(8), e0237695. https://doi.org/10.1371/journal.pone.0237695

Durodié, B. (2020). Handling uncertainty and ambiguity in the COVID-19 pandemic. *Psychological Trauma: Theory, Research, Practice, and Policy, 12*(S1), S61-S62. https://doi.org/10.1037/tra0000713

Electoral Commission. (2021). *Enrolment statistics* [Fact sheet]. https://elections.nz/stats-and-research/enrolment-statistics/

Elovainio, M., Hakulinen, C., Pulkki-Råback, L., Virtanen, M., Josefsson, K., Jokela, M., Vahtera, J., & Kivimäki, M. (2017). Contribution of risk factors to excess mortality in isolated and lonely individuals: An analysis of data from the UK Biobank cohort

study. *The Lancet Public Health, 2*(6), e260-e266. https://doi.org/10.1016/S2468-2667(17)30075-0

Erdfelder, E., Faul, F., & Buchner, A. (1996). GPOWER: A general power analysis program. *Behavior Research Methods, Instruments, & Computers, 28*, 1-11. https://doi.org/10.3758/BF03203630

Eshel, Y., Kimhi, S., Lahad, M., & Leykin, D. (2016). Individual, community, and national resiliencies and age: Are older people less resilient than younger individuals? *The American Journal of Geriatric Psychiatry, 24*(8), 644-647. https://doi.org/10.1016/j.jagp.2016.03.002

Ettman, C. K., Abdalla, S. M., Cohen, G. H., Sampson, L., Vivier, P. M., & Galea, S. (2020). Prevalence of depression symptoms in US adults before and during the COVID-19 pandemic. *JAMA Network Open, 3*(9), e2019686. https://doi.org/10.1001/jamanetworkopen.2020.19686

Ettman, C. K., Cohen, G. H., & Galea, S. (2020). Is wealth associated with depressive symptoms in the United States? *Annals of Epidemiology, 43*, 25-31. e21. https://doi.org/10.1016/j.annepidem.2020.02.001

Everitt, B. S., & Dunn, G. (1991). *Applied multivariate data analysis*. Wiley.

Every-Palmer, S., Jenkins, M., Gendall, P., Hoek, J., Beaglehole, B., Bell, C., Williman, J., Rapsey, C., & Stanley, J. (2020). Psychological distress, anxiety, family violence, suicidality, and wellbeing in New Zealand during the COVID-19 lockdown: A cross-sectional study. *PLOS ONE, 15*(11), e0241658. https://doi.org/10.1371/journal.pone.0241658

Fancourt, D., Steptoe, A., & Bu, F. (2021). Trajectories of anxiety and depressive symptoms during enforced isolation due to COVID-19 in England: A longitudinal observational study. *The Lancet Psychiatry, 8*(2), 141-149. https://doi.org/10.1016/S2215-0366(20)

30482-X

Faulkner, J., O'Brien, W., McGrane, B., Wadsworth, D., Batten, J., Askew, C.D., Badenhorst, C., Byrd, E., Coulter, M., Draper, N., Elliot, C., Fryer, S., Hamlin, M. J., Jakeman, J., Mackintosh, K. A., McNarry, M. A., Mitchelmore, A., Murphy, J., Ryan-Stewart, H., … Lambrick, D. (2021). Physical activity, mental health and well-being of adults during early COVID-19 containment strategies: A multi-country cross-sectional analysis. *Journal of Science and Medicine in Sport*, *24*(4), 320-326. https://doi.org/10.1016%2Fj.jsams.2020.11.016

Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.). Sage.

Finlay-Jones, R., & Brown, G. W. (1981). Types of stressful life event and the onset of anxiety and depressive disorders. *Psychological Medicine, 11*(4), 803-815. https://doi.org/10.1017/s0033291700041301

Fiorillo, A., & Gorwood, P. (2020). The consequences of the COVID-19 pandemic on mental health and implications for clinical practice. *European Psychiatry: The Journal of the Association of European Psychiatrists, 63*(1), e32-e32. https://doi.org/10.1192/j.eurpsy.2020.35

Fiske, A., Wetherell, J. L., & Gatz, M. (2009). Depression in older adults. *Annual Review of Clinical Psychology, 5*, 363-389. https://doi.org/10.1146/annurev.clinpsy.032408.153621

Fletcher, G. F., Landolfo, C., Niebauer, J., Ozemek, C., Arena, R., & Lavie, C. J. (2018). Promoting physical activity and exercise. *Journal of the American College of Cardiology, 72*(14), 1622-1639. https://doi.org/10.1016/j.jacc.2018.08.2141

Foo, P. K., Perez, B., Gupta, N., Lorenzo, G. J., Misa, N.-Y., Gutierrez, B. S., Madison, O., B. Swift, U. M., & Anderson, E. S. (2021). High rates of COVID-19 infection among Indigenous Maya at a US safety-net health system in California. *Public Health*

Reports, 136(3), 295-300. https://doi.org/10.1177/0033354921990370

Galea, S., Ahern, J., Resnick, H., Kilpatrick, D., Bucuvalas, M., Gold, J., & Vlahov, D. (2002). Psychological sequelae of the September 11 terrorist attacks in New York City. *New England Journal of Medicine, 346*(13), 982-987. https://doi.org/10.1056/NEJMsa013404

Galea, S., Merchant, R. M., & Lurie, N. (2020). The mental health consequences of COVID-19 and physical distancing: The need for prevention and early intervention. *JAMA Internal Medicine, 180*(6), 817-818. https://doi.org/10.1001/jamainternmed.2020.1562

Garcia, M. A., Homan, P. A., García, C., & Brown, T. H. (2020). The color of COVID-19: structural racism and the pandemic's disproportionate impact on older racial and ethnic minorities. *The Journals of Gerontology: Series B*, *76*(3), e75-e80. https://doi.org/10.1001/jamainternmed.2020.1562

García-Fernández, L., Romero-Ferreiro, V., López-Roldán, P. D., Padilla, S., & Rodriguez-Jimenez, R. (2020). Mental health in elderly Spanish people in times of COVID-19 outbreak. *The American Journal of Geriatric Psychiatry, 28*(10), 1040-1045. https://doi.org/10.1016/j.jagp.2020.06.027

García-Portilla, P., de la Fuente Tomás, L., Bobes-Bascarán, T., Jiménez Treviño, L., Zurrón Madera, P., Suárez Álvarez, M., Menéndez Miranda, I., García Álvarez, L., Sáiz Martínez, P. A., & Bobes, J. (2020). Are older adults also at higher psychological risk from COVID-19? *Aging & Mental Health*, 25(7), 1297-1304. https://doi.org/10.1080/13607863.2020.1805723

Gasteiger, N., Vedhara, K., Massey, A., Jia, R., Ayling, K., Chalder, T., Coupland, C., & Broadbent, E. (2021). Depression, anxiety and stress during the COVID-19 pandemic: Results from a New Zealand cohort study on mental well-being. *BMJ Open, 11*(5),

e045325. https://doi.org/10.1136/bmjopen-2020-045325

Gelman, A., & Hill, J. (2006). *Data analysis using regression and multilevel/hierarchical models*. Cambridge University Press.

Glass, D. C., Kelsall, H. L., Slegers, C., Forbes, A. B., Loff, B., Zion, D., & Fritschi, L. (2015). A telephone survey of factors affecting willingness to participate in health research surveys. *BMC Public Health, 15*(1), 1017. https://doi.org/10.1186/s12889-015-2350-9

Global Observatory for Physical Activity. (2021). *Physical Activity Almanac*. https://new.globalphysicalactivityobservatory.com/New%20Country%20cards/New%20Zealand.pdf

Goldmann, E., & Galea, S. (2014). Mental health consequences of disasters. *Annual Review of Public Health, 35,* 169-183. https://doi.org/10.1146/annurev-publhealth-032013-182435

González-Sanguino, C., Ausín, B., Castellanos, M. Á., Saiz, J., López-Gómez, A., Ugidos, C., & Muñoz, M. (2020). Mental health consequences during the initial stage of the 2020 Coronavirus pandemic (COVID-19) in Spain. *Brain, Behavior, and Immunity, 87*, 172-176. https://doi.org/https://doi.org/10.1016/j.bbi.2020.05.040

Gooding, P., Hurst, A., Johnson, J., & Tarrier, N. (2012). Psychological resilience in young and older adults. *International Journal of Geriatric Psychiatry, 27*(3), 262-270. https://doi.org/10.1002/gps.2712

Gracey, M., & King, M. (2009). Indigenous health part 1: Determinants and disease patterns. *The Lancet, 374*(9683), 65-75. https://doi.org/10.1016/S0140-6736(09)60914-4

Grossmann, I., Na, J., Varnum, M. E. W., Park, D. C., Kitayama, S., & Nisbett, R. E. (2010). Reasoning about social conflicts improves into old age. *Proceedings of the National Academy of Sciences, 107*(16), 7246-7250. https://doi.org/10.1073/pnas.1001715107

Grosz, M. P., Rohrer, J. M., & Thoemmes, F. (2020). The taboo against explicit causal

inference in nonexperimental psychology. *Perspectives on Psychological Science, 15*(5), 1243-1255. https://doi.org/10.1177%2F1745691620921521

Gunnell, D., Appleby, L., Arensman, E., Hawton, K., John, A., Kapur, N., Khan, M., O'Connor, R. C., Pirkis, J., & Caine, E. D. (2020). Suicide risk and prevention during the COVID-19 pandemic. *The Lancet Psychiatry, 7*(6), 468-471. https://doi.org/10.1016/S2215-0366(20)30171-1

Hager, N. M., Judah, M. R., & Milam, A. L. (2020). Loneliness and depression in college students during the COVID-19 pandemic: Boredom and repetitive negative thinking as mediators (Preprint]. *Research Square*. https://doi.org/10.21203/rs.3.rs-101533/v2

Hall, G., Laddu, D. R., Phillips, S. A., Lavie, C. J., & Arena, R. (2021). A tale of two pandemics: How will COVID-19 and global trends in physical inactivity and sedentary behavior affect one another? *Progress in Cardiovascular Diseases, 64*, 108-110. https://doi.org/10.1016/j.pcad.2020.04.005

Hamer, M., Lavoie, K. L., & Bacon, S. L. (2014). Taking up physical activity in later life and healthy ageing: The English Longitudinal Study of Ageing. *British Journal of Sports Medicine, 48*(3), 239-243. https://doi.org/10.1136/bjsports-2013-092993

Hamm, M. E., Brown, P. J., Karp, J. F., Lenard, E., Cameron, F., Dawdani, A., Lavretsky, H., Miller, J. P., Mulsant, B. H., Pham, V. T., Reynolds, C. F., Roose, S. P., & Lenze, E. J. (2020). Experiences of American older adults with pre-existing depression during the beginnings of the COVID-19 pandemic: A multicity, mixed-methods study. *The American Journal of Geriatric Psychiatry, 28*(9), 924-932. https://doi.org/10.1016/j.jagp.2020.06.013

Hammen, C., & Watkins, E. (2018). *Depression* (3rd ed.). Routledge.

Hargreaves, E. A., Lee, C., Jenkins, M., Calverley, J. R., Hodge, K., & Houge Mackenzie, S. (2021). Changes in physical activity pre-, during and post-lockdown COVID-19

restrictions in New Zealand and the explanatory role of daily hassles. *Frontiers in Psychology, 12*(410). https://doi.org/10.3389/fpsyg.2021.642954

Harrison, V., Moulds, M. L., & Jones, K. (2021). Perceived social support and prenatal wellbeing; The mediating effects of loneliness and repetitive negative thinking on anxiety and depression during the COVID-19 pandemic. *Women and Birth*. https://doi.org/10.1016/j.wombi.2020.12.014

Hasin, D. S., Goodwin, R. D., Stinson, F. S., & Grant, B. F. (2005). Epidemiology of major depressive disorder: Results from the National Epidemiologic Survey on Alcoholism and Related Conditions. *Archives of General Psychiatry, 62*(10), 1097-1106. https://doi.org/10.1001/archpsyc.62.10.1097

Hasin, D. S., Sarvet, A. L., Meyers, J. L., Saha, T. D., Ruan, W. J., Stohl, M., & Grant, B. F. (2018). Epidemiology of adult DSM-5 major depressive disorder and its specifiers in the United States. *JAMA Psychiatry, 75*(4), 336-346. https://doi.org/10.1001/jamapsychiatry.2017.4602

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. Guilford Press.

Hayes, A. F., & Rockwood, N. J. (2020). Conditional process analysis: Concepts, computation, and advances in the modeling of the contingencies of mechanisms. *American Behavioral Scientist, 64*(1), 19-54. https://doi.org/10.1177%2F0002764219859633

Health Promotion Agency. (2020a). *The impact of lockdown on health risk behaviours.* https://www.hpa.org.nz/research-library/research-publications/the-impact-of-lockdown-on-health-risk-behaviours

Health Promotion Agency. (2020b). *Post-lockdown survey: The impact on health risk behaviours.* https://www.hpa.org.nz/research-library/research-publications/post-

lockdown-survey-the-impact-on-health-risk-behaviours

Hebert, E. A., & Dugas, M. J. (2019). Behavioral experiments for intolerance of uncertainty: Challenging the unknown in the treatment of generalized anxiety disorder. *Cognitive and Behavioral Practice, 26*(2), 421-436. https://doi.org/10.1016/j.cbpra.2018.07.007

Henderson, A. S., Jorm, A. F., Korten, A. E., Jacomb, P., Christensen, H., & Rodgers, B. (1998). Symptoms of depression and anxiety during adult life: evidence for a decline in prevalence with age. *Psychological Medicine, 28*(6), 1321-1328. https://doi.org/10.1017/S0033291798007570

Heuberger, R. A. (2009). Alcohol and the older adult: A comprehensive review. *Journal of Nutrition for the Elderly, 28*(3), 203-235. https://doi.org/10.1080/01639360903140106

Hodges, I., & Maskill, C. (2014). *Alcohol and older adults in New Zealand: A literature review*. Health Promotion Agency. https://www.hpa.org.nz/sites/default/files/Alcohol%20%20older%20adults%20in%20NZ%20-%20A%20literature%20review.pdf

Holmes, E. A., O'Connor, R. C., Perry, V. H., Tracey, I., Wessely, S., Arseneault, L., Ballard, C., Christensen, H., Silver, R. C., & Everall, I. (2020). Multidisciplinary research priorities for the COVID-19 pandemic: A call for action for mental health science. *The Lancet Psychiatry*, *7*(6), 547-560. https://doi.org/10.1016/S2215-0366(20)30168-1

Houkamau, C., Dell, K., Newth, J., Mika, J., Sibley, C., Keelan, T., & Dunn, T. (2021). *The wellbeing of Māori pre and post Covid-19 lockdown in Aotearoa/New Zealand.* https://cdn.auckland.ac.nz/assets/psych/about/our-research/MIFAS/Tech-Docs/MIFAS-Covid-19-2021-Report.pdf

Huckle, T., Parker, K., Romeo, J. S., & Casswell, S. (2020). Online alcohol delivery is associated with heavier drinking during the first New Zealand COVID-19 pandemic restrictions. *Drug and Alcohol Review*, *40*(5), 826-834. https://doi.org/10.1111/

dar.13222

Hyland, P., Shevlin, M., Murphy, J., McBride, O., Fox, R., Bondjers, K., Karatzias, T., Bentall, R. P., Martinez, A., & Vallières, F. (2021). A longitudinal assessment of depression and anxiety in the Republic of Ireland before and during the COVID-19 pandemic. *Psychiatry Research, 300*, 113905. https://doi.org/10.1016/j.psychres.2021.113905

Irwin, M., Artin, K. H., & Oxman, M. N. (1999). Screening for depression in the older adult: Criterion validity of the 10-Item Center for Epidemiological Studies Depression Scale (CES-D). *Archives of Internal Medicine, 159*(15), 1701-1704. https://doi.org/10.1001/archinte.159.15.1701

Jacob, L., Smith, L., Armstrong, N. C., Yakkundi, A., Barnett, Y., Butler, L., McDermott, D. T., Koyanagi, A., Shin, J. I., Meyer, J., Firth, J., Remes, O., López-Sánchez, G. F., & Tully, M. A. (2021). Alcohol use and mental health during COVID-19 lockdown: A cross-sectional study in a sample of UK adults. *Drug and Alcohol Dependence, 219*, 108488. https://doi.org/10.1016/j.drugalcdep.2020.108488

Jacob, L., Tully, M. A., Barnett, Y., Lopez-Sanchez, G. F., Butler, L., Schuch, F., López-Bueno, R., McDermott, D., Firth, J., & Grabovac, I. (2020). The relationship between physical activity and mental health in a sample of the UK public: A cross-sectional study during the implementation of COVID-19 social distancing measures. *Mental Health and Physical Activity, 19*, 100345. https://doi.org/10.1016%2Fj.mhpa.2020.100345

Jacobson, N. C., & Newman, M. G. (2017). Anxiety and depression as bidirectional risk factors for one another: A meta-analysis of longitudinal studies. *Psychological Bulletin, 143*(11), 1155-1200. https://doi.org/10.1037/bul0000111

Jamieson, H. A., Gibson, H. M., Abey-Nesbit, R., Ahuriri-Driscoll, A., Keeling, S., &

Schluter, P. J. (2018). Profile of ethnicity, living arrangements and loneliness amongst older adults in Aotearoa New Zealand: A national cross-sectional study. *Australasian Journal on Ageing, 37*(1), 68-73. https://doi.org/10.1111/ajag.12496

Jansen, F. M., Prins, R. G., Etman, A., van der Ploeg, H. P., de Vries, S. I., van Lenthe, F. J., & Pierik, F. H. (2015). Physical activity in non-frail and frail older adults. *PLOS ONE, 10*(4), e0123168. https://doi.org/10.1371/journal.pone.0123168

Jansson-Fröjmark, M., & Lindblom, K. (2008). A bidirectional relationship between anxiety and depression, and insomnia? A prospective study in the general population. *Journal of Psychosomatic Research, 64*(4), 443-449. https://doi.org/10.1016/j.jpsychores.2007.10.016

Jenkins, M., Houge Mackenzie, S., Hodge, K., Hargreaves, E. A., Calverley, J. R., & Lee, C. (2021). Physical activity and psychological well-being during the COVID-19 lockdown: Relationships with motivational quality and nature contexts. *Frontiers in Sports and Active Living, 3*(43), 637576. https://doi.org/10.3389/fspor.2021.637576

Jensen, J., Spittal, M., Crichton, S., Sathiyandra, S., & Krishnan, V. (2002). *Direct measurement of living standards: The New Zealand ELSI scale.* Ministry of Social Development. https://www.msd.govt.nz/documents/about-msd-and-our-work/publications-resources/monitoring/direct-measurement-of-living-standards-ch1.pdf

Jensen, J., Spittal, M., & Krishnan, V. (2005). *ELSI short form: User manual for a direct measure of living standards*. Ministry of Social Development.

Jeong, H. S., Park, S., Lim, S. M., Ma, J., Kang, I., Kim, J., Kim, E.-J., Choi, Y. J., Lim, J. H., & Chung, Y. A. (2017). Psychometric properties of the Alcohol Use Disorders Identification Test-Consumption (AUDIT-C) in public first responders. *Substance Use & Misuse, 52*(8), 1069-1075. https://doi.org/10.1080/10826084.2016.1271986

Johnco, C., Knight, A., Tadic, D., & Wuthrich, V. M. (2015). Psychometric properties of the

Geriatric Anxiety Inventory (GAI) and its short-form (GAI-SF) in a clinical and non-clinical sample of older adults. *International Psychogeriatrics, 27*(7), 1089-1097. https://doi.org/10.1017%2FS1041610214001586

Jones, C. P. (2001). Invited commentary: "Race," racism, and the practice of epidemiology. *American Journal of Epidemiology, 154*(4), 299-304. https://doi.org/10.1093/aje/154.4.299

Joyce, L. R., Richardson, S. K., McCombie, A., Hamilton, G. J., & Ardagh, M. W. (2021). Mental health presentations to Christchurch Hospital emergency department during COVID-19 lockdown. *Emergency Medicine Australasia, 33*(2), 324-330. https://doi.org/10.1111/1742-6723.13667

Karim, S. S. A., & Karim, Q. A. (2021). Omicron SARS-CoV-2 variant: A new chapter in the COVID-19 pandemic. *The Lancet, 398*(10317), 2126-2128. https://doi.org/10.1016/S0140-6736(21)02758-6

Kaushal, N., Rhodes, R. E., Meldrum, J. T., & Spence, J. C. (2017). The role of habit in different phases of exercise. *British Journal of Health Psychology, 22*(3), 429-448. https://doi.org/10.1111/bjhp.12237

Keeley, G. (2020, March 24). Corpses of the elderly found abandoned in Spanish care homes. *Al Jezeera*. https://www.aljazeera.com/news/2020/3/24/corpses-of-the-elderly-found-abandoned-in-spanish-care-homes

Kessler, E. M., Kruse, A., & Wahl, H. W. (2014). *Clinical geropsychology: A lifespan perspective*. Oxford University Press.

Kilian, C., Rehm, J., Allebeck, P., Braddick, F., Gual, A., Barták, M., Bloomfield, K., Gil, A., Neufeld, M., & O'Donnell, A. (2021). Alcohol consumption during the COVID-19 pandemic in Europe: A large-scale cross-sectional study in 21 countries. *Addiction, 116*(12), 3369-3380. https://doi.org/10.1111/add.15530

Kim, H. H., & Jung, J. H. (2021). Social isolation and psychological distress during the COVID-19 pandemic: A cross-national analysis. *Gerontologist, 61*(1), 103-113. https://doi.org/10.1093/geront/gnaa168

Klaiber, P., Wen, J. H., DeLongis, A., & Sin, N. L. (2020). The ups and downs of daily life during COVID-19: Age differences in affect, stress, and positive events. *The Journals of Gerontology: Series B*, *76*(2), e30-e37. https://doi.org/10.1093/geronb/gbaa096

Knell, G., Robertson, M. C., Dooley, E. E., Burford, K., & Mendez, K. S. (2020). Health behavior changes during COVID-19 pandemic and subsequent "stay-at-home" orders. *International Journal of Environmental Research and Public Health, 17*(17), 6268. https://doi.org/10.3390/ijerph17176268

Koopman-Boyden, P., & Moosa, S. (2014). Living alone as a lifestyle of older people in New Zealand: Policy implications. *Policy Quarterly, 10*(3). https://doi.org/10.26686/pq.v10i3.4499

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine, 16*(9), 606-613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x

Kushner, M. G., Abrams, K., & Borchardt, C. (2000). The relationship between anxiety disorders and alcohol use disorders: A review of major perspectives and findings. *Clinical Psychology Review, 20*(2), 149-171. https://doi.org/10.1016/s0272-7358(99)00027-6

Kwan, R. Y. C., Salihu, D., Lee, P. H., Tse, M., Cheung, D. S. K., Roopsawang, I., & Choi, K. S. (2020). The effect of e-health interventions promoting physical activity in older people: A systematic review and meta-analysis. *European Review of Aging and Physical Activity, 17*(1), 7. https://doi.org/10.1186/s11556-020-00239-5

Kwong, A. S. F., Pearson, R. M., Adams, M. J., Northstone, K., Tilling, K., Smith, D.,

Fawns-Ritchie, C., Bould, H., Warne, N., Zammit, S., Gunnell, D. J., Moran, P. A., Micali, N., Reichenberg, A., Hickman, M., Rai, D., Haworth, S., Campbell, A., Altschul, D., … Timpson, N. J. (2020). Mental health before and during the COVID-19 pandemic in two longitudinal UK population cohorts. *The British Journal of Psychiatry*, *218*(6), 334–343. https://doi.org/10.1192/bjp.2020.242

Lam, K., Lu, A. D., Shi, Y., & Covinsky, K. E. (2020). Assessing telemedicine unreadiness among older adults in the United States during the COVID-19 pandemic. *JAMA Internal Medicine, 180*(10), 1389-1391. https://doi.org/10.1001/jamainternmed. 2020.2671

Lau, J. T., Yang, X., Tsui, H., Pang, E., & Wing, Y. K. (2006). Positive mental health-related impacts of the SARS epidemic on the general public in Hong Kong and their associations with other negative impacts. *Journal of Infection, 53*(2), 114-124. https://doi.org/10.1016/j.jinf.2005.10.019

Lee, E. E., Depp, C., Palmer, B. W., Glorioso, D., Daly, R., Liu, J., Tu, X. M., Kim, H.-C., Tarr, P., Yamada, Y., & Jeste, D. V. (2019). High prevalence and adverse health effects of loneliness in community-dwelling adults across the lifespan: Role of wisdom as a protective factor. *International Psychogeriatrics*, *31*(10), 1447-1462. https://doi.org/10.1017/S1041610218002120

Lee, E. P. X., Man, R. E. K., Gan, T. L. A., Fenwick, E. K., Aravindhan, A., Ho, K. C., Sung, S. C., Wong, T. Y., Ho, C. S. H., Gupta, P., & Lamoureux, E. L. (2021). The longitudinal psychological, physical activity, and financial impact of a COVID-19 lockdown on older adults in Singapore: The PIONEER-COVID population-based study. *International Journal of Geriatric Psychiatry*. *37*(1), 1-10. https://doi.org/ 10.1002/gps.5645

Levy, B. (2009). Stereotype embodiment: A psychosocial approach to aging. *Current*

Directions in Psychological Science, 18(6), 332-336. https://doi.org/1111%2Fj.1467-8721.2009.01662.x

Levy, B. R., Ferrucci, L., Zonderman, A. B., Slade, M. D., Troncoso, J., & Resnick, S. M. (2016). A culture–brain link: Negative age stereotypes predict Alzheimer's disease biomarkers. *Psychology and Aging, 31*(1), 82-88. https://doi.org/10.1037/pag0000062

Lewinsohn, P. M., Zinbarg, R., Seeley, J. R., Lewinsohn, M., & Sack, W. H. (1997). Lifetime comorbidity among anxiety disorders and between anxiety disorders and other mental disorders in adolescents. *Journal of Anxiety Disorders, 11*(4), 377-394. https://doi.org/10.1016/s0887-6185(97)00017-0

Li, J., Li, X., Jiang, J., Xu, X., Wu, J., Xu, Y., Lin, X., Hall, J., Xu, H., Xu, J., & Xu, X. (2020). The effect of cognitive behavioral therapy on depression, anxiety, and stress in patients with COVID-19: A randomized controlled trial. *Frontiers in Psychiatry, 11*, 580827. https://doi.org/10.3389/fpsyt.2020.580827

Lim, G. Y., Tam, W. W., Lu, Y., Ho, C. S., Zhang, M. W., & Ho, R. C. (2018). Prevalence of depression in the community from 30 countries between 1994 and 2014. *Scientific Reports, 8*(1), 2861. https://doi.org/10.1038/s41598-018-21243-x

Loeys, T., Moerkerke, B., & Vansteelandt, S. (2015). A cautionary note on the power of the test for the indirect effect in mediation analysis. *Frontiers in Psychology, 5*(1549). https://doi.org/10.3389/fpsyg.2014.01549

López-Bueno, R., Calatayud, J., Andersen, L. L., Balsalobre-Fernández, C., Casaña, J., Casajús, J. A., Smith, L., & López-Sánchez, G. F. (2020). Immediate impact of the COVID-19 confinement on physical activity levels in Spanish adults. *Sustainability, 12*(14), 5708. https://doi.org/10.3390/su12145708

Lorem, G. F., Schirmer, H., Wang, C. E. A., & Emaus, N. (2017). Ageing and mental health: Changes in self-reported health due to physical illness and mental health status with

consecutive cross-sectional analyses. *BMJ Open, 7*(1), e013629. https://doi.org/10.1136/bmjopen-2016-013629

Löwe, B., Wahl, I., Rose, M., Spitzer, C., Glaesmer, H., Wingenfeld, K., Schneider, A., & Brähler, E. (2010). A 4-item measure of depression and anxiety: Validation and standardization of the Patient Health Questionnaire-4 (PHQ-4) in the general population. *Journal of Affective Disorders, 122*(1-2), 86-95. https://doi.org/10.1016/j.jad.2009.06.019

Luo, M., Guo, L., Yu, M., & Wang, H. (2020). The psychological and mental impact of coronavirus disease 2019 (COVID-19) on medical staff and general public: A systematic review and meta-analysis. *Psychiatry Research*, *291*, 113190. https://doi.org/10.1016/j.psychres.2020.113190

Luppa, M., Sikorski, C., Luck, T., Ehreke, L., Konnopka, A., Wiese, B., Weyerer, S., König, H. H., & Riedel-Heller, S. G. (2012). Age- and gender-specific prevalence of depression in latest-life: Systematic review and meta-analysis. *Journal of Affective Disorders, 136*(3), 212-221. https://doi.org/10.1016/j.jad.2010.11.033

Lutz, R. S., Stults-Kolehmainen, M. A., & Bartholomew, J. B. (2010). Exercise caution when stressed: Stages of change and the stress–exercise participation relationship. *Psychology of Sport and Exercise, 11*(6), 560-567. https://doi.org/10.1016/j.psychsport.2010.06.005

Martínez-de-Quel, Ó., Suárez-Iglesias, D., López-Flores, M., & Pérez, C. A. (2021). Physical activity, dietary habits and sleep quality before and during COVID-19 lockdown: A longitudinal study. *Appetite, 158*, 105019. https://doi.org/10.1016/j.appet.2020.105019

Massey University. (2018). *2018 Health, Work & Retirement Survey content inventory*. https://www.massey.ac.nz/massey/fms/Colleges/College%20of%20Humanities%20an

d%20Social%20Sciences/Psychology/HART/surveys/HWR_2018_content_inventory.pdf?9FFEE461F619AFC7E9556AB0FA3D560F

Massey University. (2021). *Health, Work and Retirement Study surveys*. https://www.massey.ac.nz/massey/learning/departments/school-of-psychology/research/hart/new-zealand-health-work-and-retirement-study/health-work-and-retirement-questionnaires.cfm

Mata, J., Wenz, A., Rettig, T., Reifenscheid, M., Moehring, K., Krieger, U., Friedel, S., Fikel, M., Cornesse, C., Blom, A., & Naumann, E. (2021). Health behaviors and mental health during the COVID-19 pandemic: A longitudinal population-based survey in Germany. *Social Science & Medicine*, *287*, 114333. https://doi.org/10.1016/j.socscimed.2021.114333

Matsuzaki, S., Hashimoto, M., Yuki, S., Koyama, A., Hirata, Y., & Ikeda, M. (2015). The relationship between post-stroke depression and physical recovery. *Journal of Affective Disorders, 176*, 56-60. https://doi.org/https://doi.org/10.1016/j.jad.2015.01.020

Maugeri, G., Castrogiovanni, P., Battaglia, G., Pippi, R., D'Agata, V., Palma, A., Di Rosa, M., & Musumeci, G. (2020). The impact of physical activity on psychological health during Covid-19 pandemic in Italy. *Heliyon, 6*(6), e04315. https://doi.org/10.1016/j.heliyon.2020.e04315

Mazza, C., Ricci, E., Biondi, S., Colasanti, M., Ferracuti, S., Napoli, C., & Roma, P. (2020). A nationwide survey of psychological distress among Italian people during the COVID-19 pandemic: Immediate psychological responses and associated factors. *International Journal of Environmental Research and Public Health, 17*(9), 3165. https://doi.org/10.3390/ijerph17093165

McCarthy, H., Potts, H. W. W., & Fisher, A. (2021). Physical activity behavior before, during, and after COVID-19 restrictions: Longitudinal smartphone-tracking study of

adults in the United Kingdom. *Journal of Medical Internet Research, 23*(2), e23701. https://doi.org/10.2196/23701

McGarrah, R. W., Slentz, C. A., & Kraus, W. E. (2016). The effect of vigorous-versus moderate-intensity aerobic exercise on insulin action. *Current Cardiology Reports, 18*(12), 117. https://doi.org/10.1007/s11886-016-0797-7

McLeod, M., Gurney, J., Harris, R., Cormack, D., & King, P. (2020). COVID-19: We must not forget about Indigenous health and equity. *Australian and New Zealand Journal of Public Health, 44*(4), 253-256. https://doi.org/10.1111/1753-6405.13015

Meyer, J., McDowell, C., Lansing, J., Brower, C., Smith, L., Tully, M., & Herring, M. (2020). Changes in physical activity and sedentary behavior in response to COVID-19 and their associations with mental health in 3052 US adults. *International Journal of Environmental Research and Public Health, 17*(18), 6469. https://doi.org/10.3390/ijerph17186469

Millalen, P., Nahuelpan, H., Hofflinger, A., & Martinez, E. (2020). COVID-19 and Indigenous peoples in Chile: Vulnerability to contagion and mortality. *AlterNative: An International Journal of Indigenous Peoples, 16*(4), 399-402. https://doi.org/10.1177%2F1177180120967958

Miller, W., Anton, H., & Townson, A. (2008). Measurement properties of the CESD scale among individuals with spinal cord injury. *Spinal Cord, 46*(4), 287-292. https://doi.org/10.1038/sj.sc.3102127

Millett, G. A., Jones, A. T., Benkeser, D., Baral, S., Mercer, L., Beyrer, C., Honermann, B., Lankiewicz, E., Mena, L., & Crowley, J. S. (2020). Assessing differential impacts of COVID-19 on black communities. *Annals of Epidemiology, 47*, 37-44. https://doi.org/10.1016/j.annepidem.2020.05.003

Ministry of Health. (2013). *Guidelines on physical activity for older people* [Fact sheet].

https://www.health.govt.nz/system/files/documents/publications/guidelines-on-physical-activity-older-people-jan13-v3.pdf

Ministry of Health. (2018). *Mental health* [Fact sheet]. https://www.health.govt.nz/our-work/populations/maori-health/tatau-kahukura-maori-health-statistics/nga-mana-hauora-tutohu-health-status-indicators/mental-health

Ministry of Health. (2020). *New Zealand Health Survey*. https://www.health.govt.nz/nz-health-statistics/national-collections-and-surveys/surveys/new-zealand-health-survey

Ministry of Health. (2021). *How much activity is recommended?* [Fact sheet]. https://www.health.govt.nz/your-health/healthy-living/food-activity-and-sleep/physical-activity/how-much-activity-recommended

Moehring, A., Rumpf, H. J., Hapke, U., Bischof, G., John, U., & Meyer, C. (2019). Diagnostic performance of the Alcohol Use Disorders Identification Test (AUDIT) in detecting DSM-5 alcohol use disorders in the general population. *Drug & Alcohol Dependence, 204*, 107530. https://doi.org/10.1016/j.drugalcdep.2019.06.032

Moore, R. C., & Hancock, J. T. (2020). Older adults, social technologies, and the coronavirus pandemic: Challenges, strengths, and strategies for support. *Social Media + Society, 6*(3), https://doi.org/10.1177/2056305120948162

Mueller, A. L., McNamara, M. S., & Sinclair, D. A. (2020). Why does COVID-19 disproportionately affect older people? *Aging, 12*(10), 9959-9981. https://doi.org/10.18632/aging.103344

Mutz, M., & Gerke, M. (2021). Sport and exercise in times of self-quarantine: How Germans changed their behaviour at the beginning of the Covid-19 pandemic. *International Review for the Sociology of Sport, 56*(3), 305-316. https://doi.org/10.1177%2F1012690220934335

Neria, Y., Nandi, A., & Galea, S. (2008). Post-traumatic stress disorder following disasters: A

systematic review. *Psychological Medicine, 38*(4), 467-480. https://doi.org/10.1017/S0033291707001353

New Zealand Alcohol Beverages Council. (2020). *Alcohol industry calls for calm as bottle stores targeted by panic buying* [Media release]. https://nzabc.org.nz/alcohol-industry-calls-for-calm-as-bottle-stores-targeted-by-panic-buying/

New Zealand Government. (2021). *History of the COVID-19 alert system* [Fact sheet]. https://covid19.govt.nz/about-our-covid-19-response/history-of-the-covid-19-alert-system/#about-the-covid-19-alert-system.

Newby, J. M., O'Moore, K., Tang, S., Christensen, H., & Faasse, K. (2020). Acute mental health responses during the COVID-19 pandemic in Australia. *PLOS ONE, 15*(7), e0236562. https://doi.org/10.1371/journal.pone.0236562

Niedzwiedz, C. L., Green, M. J., Benzeval, M., Campbell, D., Craig, P., Demou, E., Leyland, A., Pearce, A., Thomson, R., Whitley, E., & Katikireddi, S. V. (2021). Mental health and health behaviours before and during the initial phase of the COVID-19 lockdown: Longitudinal analyses of the UK Household Longitudinal Study. *Journal of Epidemiology and Community Health, 75*(3), 224-231. https://doi.org/10.1136/jech-2020-215060

Nieman, D. C., & Wentz, L. M. (2019). The compelling link between physical activity and the body's defense system. *Journal of Sport and Health Science, 8*(3), 201-217. https://doi.org/10.1016/j.jshs.2018.09.009

Norris, F. H., Friedman, M. J., & Watson, P. J. (2002). 60,000 disaster victims speak: Part II. Summary and implications of the disaster mental health research. *Psychiatry, 65*(3), 240-260. https://doi.org/10.1521/psyc.65.3.240.20169

Nyström, M. B. T., Hassmén, P., Sörman, D. E., Wigforss, T., Andersson, G., & Carlbring, P. (2019). Are physical activity and sedentary behavior related to depression? *Cogent*

Psychology, 6(1), 1633810. https://doi.org/10.1080/23311908.2019.1633810

O'Rourke, H. P., & MacKinnon, D. P. (2015). When the test of mediation is more powerful than the test of the total effect. *Behavior Research Methods, 47*(2), 424-442. https://doi.org/10.3758/s13428-014-0481-z

Özdin, S., & Bayrak Özdin, Ş. (2020). Levels and predictors of anxiety, depression and health anxiety during COVID-19 pandemic in Turkish society: The importance of gender. *International Journal of Social Psychiatry, 66*(5), 504-511. https://doi.org/10.1177/0020764020927051

Pachana, N. A., Byrne, G. J., Siddle, H., Koloski, N., Harley, E., & Arnold, E. (2007). Development and validation of the Geriatric Anxiety Inventory. *International Psychogeriatrics, 19*(1), 103-114. https://doi.org/10.1017/s1041610206003504

Palamim, C. V. C., Ortega, M. M., & Marson, F. A. L. (2020). COVID-19 in the indigenous population of Brazil. *Journal of Racial and Ethnic Health Disparities, 7*(6), 1053-1058. https://link.springer.com/article/10.1007/s40615-020-00885-6

Palgi, Y., Shrira, A., Ring, L., Bodner, E., Avidor, S., Bergman, Y., Cohen-Fridel, S., Keisari, S., & Hoffman, Y. (2020). The loneliness pandemic: Loneliness and other concomitants of depression, anxiety and their comorbidity during the COVID-19 outbreak. *Journal of Affective Disorders, 275*, 109-111. https://doi.org/10.1016/j.jad.2020.06.036

Pallant, J. (2020). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS*. Routledge.

Pan, K. Y., Kok, A. A. L., Eikelenboom, M., Horsfall, M., Jörg, F., Luteijn, R. A., Rhebergen, D., Oppen, P. v., Giltay, E. J., & Penninx, B. W. J. H. (2021). The mental health impact of the COVID-19 pandemic on people with and without depressive, anxiety, or obsessive-compulsive disorders: A longitudinal study of three Dutch case-

control cohorts. *The Lancet Psychiatry, 8*(2), 121-129. https://doi.org/10.1016/S2215-0366(20)30491-0

Parr-Brownlie, L. C., Waters, D. L., Neville, S., Neha, T., & Muramatsu, N. (2020). Aging in New Zealand: Ka haere ki te ao pakeketanga. *The Gerontologist, 60*(5), 812-820. https://doi.org/10.1093/geront/gnaa032

Patten, S. B., Williams, J. V. A., Lavorato, D. H., & Eliasziw, M. (2009). A longitudinal community study of major depression and physical activity. *General Hospital Psychiatry, 31*(6), 571-575. https://doi.org/10.1016/j.genhosppsych.2009.08.001

Pearman, A., Hughes, M. L., Smith, E. L., & Neupert, S. D. (2021). Age differences in risk and resilience factors in COVID-19-related stress. *Journals of Gerontology Series B: Psychological Sciences & Social Sciences, 76*(2), e38-e44. https://doi.org/10.1093/geronb/gbaa120

Perri, R. L., Castelli, P., La Rosa, C., Zucchi, T., & Onofri, A. (2021). COVID-19, isolation, quarantine: On the efficacy of internet-based eye movement desensitization and reprocessing (EMDR) and cognitive-behavioral therapy (CBT) for ongoing trauma. *Brain Sciences, 11*(5), 579. https://doi.org/10.3390/brainsci11050579

Pfefferbaum, B., & North, C. S. (2020). Mental health and the COVID-19 pandemic. *New England Journal of Medicine, 383*(6), 510-512. https://doi.org/10.1056/NEJMp2008017

Phillips, C. (2017). Brain-derived neurotrophic factor, depression, and physical activity: Making the neuroplastic connection. *Neural Plasticity*, 7260130. https://doi.org/10.1155/2017/7260130

Phillips, H. (2019). *2018 Health, Work and Retirement (HWR) Survey. Technical report for the Health, Work and Retirement Study*. Massey University. https://www.massey.ac.nz/massey/fms/Colleges/College%20of%20Humanities%20and%20Social%20Scie

nces/Psychology/HART/publications/reports/Technical_Report_HWR_survey_2018v1_0.pdf?72550067F99368C80E5F84EE2976EE71

Phillips, H. (2021). *2020 Health, Work and Retirement (HWR) Survey. Technical report for the Health, Work and Retirement Study*. Massey University. https://www.massey.ac.nz/massey/fms/Colleges/College%20of%20Humanities%20and%20Social%20Sciences/Psychology/HART/publications/reports/Technical_Report_HWR_survey_2020.pdf?B37C0F8409B476CE11D7198DBF99EDC7

Pierce, M., Hope, H., Ford, T., Hatch, S., Hotopf, M., John, A., Kontopantelis, E., Webb, R., Wessely, S., & McManus, S. (2020). Mental health before and during the COVID-19 pandemic: A longitudinal probability sample survey of the UK population. *The Lancet Psychiatry, 7*(10), 883-892. https://doi.org/10.1016/S2215-0366(20)30308-4

Pollard, M. S., Tucker, J. S., & Green, H. D. (2020). Changes in adult alcohol use and consequences during the COVID-19 pandemic in the US. *JAMA Network Open, 3*(9), e2022942-e2022942. https://doi.org/10.1001/jamanetworkopen.2020.22942

Prati, G., & Mancini, A. D. (2021). The psychological impact of COVID-19 pandemic lockdowns: A review and meta-analysis of longitudinal studies and natural experiments. *Psychological Medicine*, *51*(2), 201-211. https://doi.org/10.1017/S0033291721000015

Qiu, J., Shen, B., Zhao, M., Wang, Z., Xie, B., & Xu, Y. (2020). A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: Implications and policy recommendations. *General Psychiatry, 33*(2), e100213. https://doi.org/10.1136/gpsych-2020-100213

Rabinowitz, L. G., & Rabinowitz, D. G. (2021). Women on the frontline: A changed workforce and the fight against COVID-19. *Academic medicine: Journal of the Association of American Medical Colleges, 96*(6), 808-812. https://doi.org/10.1097/

ACM.0000000000004011

Radio New Zealand. (2020, April 6). Health watchdog worried alcohol retailers given 'almost free rein' during lockdown. https://www.rnz.co.nz/news/national/413509/health-watchdog-worried-alcohol-retailers-given-almost-free-rein-during-lockdown

Radloff, L. S. (1977). The CES-D scale:A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*(3), 385-401. https://doi.org/10.1177/014662167700100306

Rajkumar, R. P. (2020). COVID-19 and mental health: A review of the existing literature. *Asian Journal of Psychiatry, 52*, 102066. https://doi.org/10.1016/j.ajp.2020.102066

Ramalho, R. (2020). Alcohol consumption and alcohol-related problems during the COVID-19 pandemic: A narrative review. *Australasian Psychiatry, 28*(5), 524-526. https://doi.org/10.1177/1039856220943024

Rebar, A. L., Stanton, R., Geard, D., Short, C., Duncan, M. J., & Vandelanotte, C. (2015). A meta-meta-analysis of the effect of physical activity on depression and anxiety in non-clinical adult populations. *Health Psychology Review, 9*(3), 366-378. https://doi.org/10.1080/17437199.2015.1022901

Reppas-Rindlisbacher, C., Finlay, J. M., Mahar, A. L., Siddhpuria, S., Hallet, J., Rochon, P. A., & Kobayashi, L. C. (2021). Worries, attitudes, and mental health of older adults during the COVID-19 pandemic: Canadian and US perspectives. *Journal of the American Geriatrics Society*, *69*(5), 1147-1154. https://doi.org/10.1111/jgs.17105

Rettie, H., & Daniels, J. (2021). Coping and tolerance of uncertainty: Predictors and mediators of mental health during the COVID-19 pandemic. *American Psychologist*, *76*(3), 427-437. https://doi.org/10.1037/amp0000710

Ribeiro, W. S., Bauer, A., Andrade, M. C. R., York-Smith, M., Pan, P. M., Pingani, L., Knapp, M., Coutinho, E. S. F., & Evans-Lacko, S. (2017). Income inequality and

mental illness-related morbidity and resilience: A systematic review and meta-analysis. *The Lancet Psychiatry, 4*(7), 554-562. https://doi.org/10.1016/S2215-0366(17)30159-1

Robb, C. E., de Jager, C. A., Ahmadi-Abhari, S., Giannakopoulou, P., Udeh-Momoh, C., McKeand, J., Price, G., Car, J., Majeed, A., Ward, H., & Middleton, L. (2020). Associations of social isolation with anxiety and depression during the early COVID-19 pandemic: A survey of older adults in London, UK. *Frontiers in Psychiatry, 11*, 591120. https://doi.org/10.3389/fpsyt.2020.591120

Robichaud, M. (2013). Cognitive behavior therapy targeting intolerance of uncertainty: Application to a clinical case of generalized anxiety disorder. *Cognitive and Behavioral Practice, 20*(3), 251-263. https://doi.org/10.1016/j.cbpra.2012.09.001

Robichaud, M., Koerner, N., & Dugas, M. J. (2019). *Cognitive behavioral treatment for generalized anxiety disorder: From science to practice*. Routledge.

Robinson, E., Sutin, A. R., Daly, M., & Jones, A. (2022). A systematic review and meta-analysis of longitudinal cohort studies comparing mental health before versus during the COVID-19 pandemic in 2020. *Journal of Affective Disorders*, *296*, 567-576. https://doi.org/10.1016/j.jad.2021.09.098

Rodda, J., Walker, Z., & Carter, J. (2011). Depression in older adults. *BMJ, 343*, d5219. https://doi.org/10.1136/bmj.d5219

Rodriguez-Diaz, C. E., Guilamo-Ramos, V., Mena, L., Hall, E., Honermann, B., Crowley, J. S., Baral, S., Prado, G. J., Marzan-Rodriguez, M., & Beyrer, C. (2020). Risk for COVID-19 infection and death among Latinos in the United States: Examining heterogeneity in transmission dynamics. *Annals of Epidemiology, 52*, 46-53. https://doi.org/10.1016%2Fj.annepidem.2020.07.007

Rogers, J. P., Watson, C. J., Badenoch, J., Cross, B., Butler, M., Song, J., Hafeez, D., Morrin,

H., Rengasamy, E. R., Thomas, L., Ralovska, S., Smakowski, A., Sundaram, R. D., Hunt, C. K., Lim, M. F., Aniwattanapong, D., Singh, V., Hussain, Z., Chakraborty, S., … Rooney, A. G. (2021). Neurology and neuropsychiatry of COVID-19: A systematic review and meta-analysis of the early literature reveals frequent CNS manifestations and key emerging narratives. *Journal of Neurology*, *92*(9), 932-941. jnnp-2021-326405. https://doi.org/10.1136/jnnp-2021-326405

Roschel, H., Artioli, G. G., & Gualano, B. (2020). Risk of increased physical inactivity during COVID-19 outbreak in older people: A call for actions. *Journal of the American Geriatrics Society, 68*(6), 1126-1128. https://doi.org/10.1111/jgs.16550

Saha, S. (2006). Improving literacy as a means to reducing health disparities. *Journal of General Internal Medicine, 21*(8), 893-895. https://doi.org/10.1111%2Fj.1525-1497.2006.00546.x

Salari, N., Hosseinian-Far, A., Jalali, R., Vaisi-Raygani, A., Rasoulpoor, S., Mohammadi, M., Rasoulpoor, S., & Khaledi-Paveh, B. (2020). Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: A systematic review and meta-analysis. *Globalization and Health, 16*(1), 57. https://doi.org/10.1186/s12992-020-00589-w

Saltiel, F. (2020). Who can work from home in developing countries? *Covid Economics, 7*, 104-118.

Sama, S. R., Quinn, M. M., Galligan, C. J., Karlsson, N. D., Gore, R. J., Kriebel, D., Prentice, J. C., Osei-Poku, G., Carter, C. N., & Markkanen, P. K. (2021). Impacts of the COVID-19 pandemic on home health and home care agency managers, clients, and aides: A cross-sectional survey, March to June, 2020. *Home Health Care Management & Practice, 33*(2), 125-129. 10.1177%2F1084822320980415

Santomauro, D. F., Mantilla Herrera, A. M., Shadid, J., Zheng, P., Ashbaugh, C., Pigott, D.

M., Abbafati, C., Adolph, C., Amlag, J. O., Aravkin, A. Y., Bang-Jensen, B. L., Bertolacci, G. J., Bloom, S. S., Castellano, R., Castro, E., Chakrabarti, S., Chattopadhyay, J., Cogen, R. M., Collins, J. K., … Ferrari, A. J. (2021). Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. *The Lancet, 398*(10312), 1700-1712. https://doi.org/10.1016/S0140-6736(21)02143-7

Sasaki, S., Sato, A., Tanabe, Y., Matsuoka, S., Adachi, A., Kayano, T., Yamazaki, H., Matsuno, Y., Miyake, A., & Watanabe, T. (2021). Associations between socioeconomic status, social participation, and physical activity in older people during the COVID-19 pandemic: A cross-sectional study in a northern Japanese city. *International Journal of Environmental Research and Public Health, 18*(4), 1477. https://doi.org/10.3390/ijerph18041477

Satre, D. D., Hirschtritt, M. E., Silverberg, M. J., & Sterling, S. A. (2020). Addressing problems with alcohol and other substances among older adults during the COVID-19 pandemic. *The American Journal of Geriatric Psychiatry, 28*(7), 780-783. https://doi.org/10.1016/j.jagp.2020.04.012

Saunders, J. B., Aasland, O. G., Babor, T. F., de la Fuente, J. R., & Grant, M. (1993). Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption--II. *Addiction, 88*(6), 791-804. https://doi.org/10.1111/j.1360-0443.1993.tb02093.x

Sepúlveda-Loyola, W., Rodríguez-Sánchez, I., Pérez-Rodríguez, P., Ganz, F., Torralba, R., Oliveira, D. V., & Rodríguez-Mañas, L. (2020). Impact of social isolation due to COVID-19 on health in older people: Mental and physical effects and recommendations. *Journal of Nutrition, Health & Aging, 24*(9), 938-947. https://doi.org/10.1007/s12603-020-1500-7

Sibley, C. G., Greaves, L. M., Satherley, N., Wilson, M. S., Overall, N. C., Lee, C. H., Milojev, P., Bulbulia, J., Osborne, D., & Milfont, T. L. (2020). Effects of the COVID-19 pandemic and nationwide lockdown on trust, attitudes toward government, and well-being. *American Psychologist, 75*(5), 618-630. https://doi.org/10.1037/amp0000662

Siebert, J. S., Braun, T., & Wahl, H.-W. (2020). Change in attitudes toward aging: Cognitive complaints matter more than objective performance. *Psychology and Aging, 35*(3), 357-368. https://doi.org/10.1037/pag0000451

Small, B. J., Dixon, R. A., McArdle, J. J., & Grimm, K. J. (2012). Do changes in lifestyle engagement moderate cognitive decline in normal aging? Evidence from the Victoria Longitudinal Study. *Neuropsychology, 26*(2), 144-155. https://doi.org/10.1037/a0026579

Smith, J. P., & Randall, C. L. (2012). Anxiety and alcohol use disorders: Comorbidity and treatment considerations. *Alcohol Research: Current Reviews, 34*(4), 414–431. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3860396/

Smith, L., Jacob, L., Butler, L., Schuch, F., Barnett, Y., Grabovac, I., Veronese, N., Caperchione, C., Lopez-Sanchez, G. F., Meyer, J., Abufaraj, M., Yakkundi, A., Armstrong, N., & Tully, M. A. (2020). Prevalence and correlates of physical activity in a sample of UK adults observing social distancing during the COVID-19 pandemic. *BMJ Open Sport & Exercise Medicine, 6*(1), e000850. https://doi.org/10.1136/bmjsem-2020-000850

Snowdon, J. (2001). Is depression more prevalent in old age? *Australian & New Zealand Journal of Psychiatry, 35*(6), 782-787. https://doi.org/10.1046/j.1440-1614.2001.00968.x

Son, J. S., Nimrod, G., West, S. T., Janke, M. C., Liechty, T., & Naar, J. J. (2021). Promoting

older adults' physical activity and social well-being during COVID-19. *Leisure Sciences, 43*(1-2), 287-294. https://doi.org/10.1080/01490400.2020.1774015

Sousa, R. D. d., Rodrigues, A. M., Gregório, M. J., Branco, J. D. C., Gouveia, M. J., Canhão, H., & Dias, S. S. (2017). Anxiety and depression in the Portuguese older adults: Prevalence and associated factors. *Frontiers in Medicine, 4*, 196. https://doi.org/10.3389/fmed.2017.00196

Sparks, H. (2020, March 19). Morbid 'boomer remover' coronavirus meme only makes millennials seem more awful. *The New York Post*. https://nypost.com/2020/03/19/morbid-boomer-remover-coronavirus-meme-only-makes-millennials-seem-more-awful/

Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine, 166*(10), 1092-1097. https://doi.org/10.1001/archinte.166.10.1092

Stanton, R., To, Q. G., Khalesi, S., Williams, S. L., Alley, S. J., Thwaite, T. L., Fenning, A. S., & Vandelanotte, C. (2020). Depression, anxiety and stress during COVID-19: Associations with changes in physical activity, sleep, tobacco and alcohol use in Australian adults. *International Journal of Environmental Research and Public Health, 17*(11), 4065. https://doi.org/10.3390/ijerph17114065

Stephens, C., & Alpass, F. (2018). *The New Zealand Health, Work and Retirement Longitudinal Study 2006-2016*. https://www.massey.ac.nz/massey/fms/Colleges/College%20of%20Humanities%20and%20Social%20Sciences/Psychology/HART/publications/reports/NZHWR_10YearReport_2006-2016_LR.pdf

Stephens, C., Alpass, F., & Towers, A. (2010). Economic hardship among older people in New Zealand: The effects of low living standards on social support loneliness and mental health. *New Zealand Journal of Psychology, 39*(2), 49-55. https://mro.

massey.ac.nz/handle/10179/9489

Stephens, C., & Breheny, M. (2021). Diverse experiences among older adults in Aotearoa/New Zealand during COVID-19 lockdown: A qualitative study. *Australasian Journal on Ageing*. Advance online publication. https://doi.org/10.1111/ajag.12995

Stewart, D., Hewitt, C., & McCambridge, J. (2021). Exploratory validation study of the individual AUDIT-C items among older people. *Alcohol & Alcoholism, 56*(3), 258-265. https://doi.org/10.1093/alcalc/agaa080

Steyn, N., Binny, R. N., Hannah, K., Hendy, S., James, A., Lustig, A., Ridings, K., Plank, M. J., & Sporle, A. (2021). Māori and Pacific people in New Zealand have higher risk of hospitalisation for COVID-19. *medRxiv*. https://doi.org/10.1101/2020.12.25.20248427

Stockwell, S., Trott, M., Tully, M., Shin, J., Barnett, Y., Butler, L., McDermott, D., Schuch, F., & Smith, L. (2021). Changes in physical activity and sedentary behaviours from before to during the COVID-19 pandemic lockdown: A systematic review. *BMJ Open Sport & Exercise Medicine, 7*(1), e000960. https://doi.org/10.1136/bmjsem-2020-000960

Streiner, D. L. (2001). Regression toward the mean: Its etiology, diagnosis, and treatment. *The Canadian Journal of Psychiatry, 46*(1), 72-76. https://doi.org/10.1177/070674370104600111

Ströhle, A. (2008). Physical activity, exercise, depression and anxiety disorders. *Journal of Neural Transmission, 116*(6), 777-784. https://doi.org/10.1007/s00702-008-0092-x

Sutin, A. R., Robinson, E., Daly, M., Gerend, M. A., Stephan, Y., Luchetti, M., Aschwanden, D., Strickhouser, J. E., Lee, J. H., & Sesker, A. A. (2020). BMI, weight discrimination, and psychological, behavioral, and interpersonal responses to the

coronavirus pandemic. *Obesity, 28*(9), 1590-1594. https://doi.org/10.1002/oby.22914

Swartz, H. A. (2020). The role of psychotherapy during the COVID-19 pandemic. *American Journal of Psychotherapy 73*(2), 41-42. https://doi.org/10.1176/appi.psychotherapy.20200015

Tabachnick, B. G., Fidell, L. S., & Ullman, J. B. (2007). *Using multivariate statistics* (5th ed.). Pearson.

Taylor, S. (2019). *The psychology of pandemics: Preparing for the next global outbreak of infectious disease*. Cambridge Scholars Publishing.

Te Pou. (2019). *Working with older people: Mental health and addiction workforce development priorities*. Te Pou o te Whakaaro Nui. https://www.tepou.co.nz/resources/working-with-older-people-mental-health-and-addiction-workforce-development-priorities-report

Teychenne, M., Costigan, S. A., & Parker, K. (2015). The association between sedentary behaviour and risk of anxiety: A systematic review. *BMC Public Health, 15*, 513. https://doi.org/10.1186/s12889-015-1843-x

Thibaut, F., De La Barra, F., Gordon, H., Cosyns, P., & Bradford, J. M. (2010). The World Federation of Societies of Biological Psychiatry guidelines for the biological treatment of paraphilias. *World Journal of Biological Psychiatry, 11*(4), 604-655. https://doi.org/10.3109/15622971003671628

Thielke, S. M., Diehr, P., & Unutzer, J. (2010). Prevalence, incidence, and persistence of major depressive symptoms in the Cardiovascular Health Study. *Aging & Mental Health, 14*(2), 168-176. https://doi.org/10.1080/13607860903046537

Thomas, D. R., & Zumbo, B. D. (2011). Difference scores from the point of view of reliability and repeated-measures ANOVA: In defense of difference scores for data analysis. *Educational and Psychological Measurement, 72*(1), 37-43. https://doi.org/

10.1177/0013164411409929

Tomioka, K., Kurumatani, N., & Hosoi, H. (2017). Association between social participation and 3-year change in instrumental activities of daily living in community-dwelling elderly adults. *Journal of the American Geriatrics Society, 65*(1), 107-113. https://doi.org/10.1111/jgs.14447

Towers, A. (2006). *Health, Work and Retirement Study: Summary report for the 2006 data wave*. Massey University. https://www.massey.ac.nz/massey/fms/Colleges/College%20of%20Humanities%20and%20Social%20Sciences/Psychology/HART/surveys/methodology_towers.pdf?B0EC45CD5658D967B62E69202C5DAA94

Towers, A., Stevenson, B., Breheny, M., Allen, J., & Pahana, N. (2017). Health, Work, and Retirement Longitudinal Study. *Encyclopedia of Geropsychology,* 1025-1033

Tran, T. D., Hammarberg, K., Kirkman, M., Nguyen, H. T. M., & Fisher, J. (2020). Alcohol use and mental health status during the first months of COVID-19 pandemic in Australia. *Journal of Affective Disorders, 277*, 810-813. https://doi.org/10.1016%2Fj.jad.2020.09.012

Tull, M. T., Barbano, A. C., Scamaldo, K. M., Richmond, J. R., Edmonds, K. A., Rose, J. P., & Gratz, K. L. (2020). The prospective influence of COVID-19 affective risk assessments and intolerance of uncertainty on later dimensions of health anxiety. *Journal of Anxiety Disorders, 75*, 102290. https://doi.org/10.1016%2Fj.janxdis.2020.102290

United Nations. (2017). *World population ageing 2017: Highlights* [Fact sheet]. https://www.un.org/en/development/desa/population/publications/pdf/ageing/WPA2017_Highlights.pdf

United Nations. (2020). *Policy brief: The impact of COVID-19 on older persons*. https://unsdg.un.org/sites/default/files/2020-05/Policy-Brief-The-Impact-of-COVID-19-on-

Older-Persons.pdf

Vahia, I. V., Jeste, D. V., & Reynolds, C. F. (2020). Older adults and the mental health effects of COVID-19. *JAMA, 324*(22), 2253-2254. https://doi.org/10.1001/jama.2020.21753

van Kessel, G. (2013). The ability of older people to overcome adversity: A review of the resilience concept. *Geriatric Nursing, 34*(2), 122-127. https://doi.org/10.1016/j.gerinurse.2012.12.011

van Tilburg, T. G., Steinmetz, S., Stolte, E., van der Roest, H., & de Vries, D. H. (2020). Loneliness and mental health during the COVID-19 pandemic: A study among Dutch older adults. *The Journals of Gerontology: Series B*, *76*(7), e249-e255. https://doi.org/10.1093/geronb/gbaa111

Vazquez, C., Valiente, C., García, F. E., Contreras, A., Peinado, V., Trucharte, A., & Bentall, R. P. (2021). Post-traumatic growth and stress-related responses during the COVID-19 pandemic in a national representative sample: The role of positive core beliefs about the world and others. *Journal of Happiness Studies, 22*(7), 2915-2935. https://doi.org/10.1007/s10902-020-00352-3

Vindegaard, N., & Benros, M. E. (2020). COVID-19 pandemic and mental health consequences: Systematic review of the current evidence. *Brain, Behavior, and Immunity, 89*, 531-542. https://doi.org/10.1016/j.bbi.2020.05.048

Vink, D., Aartsen, M. J., & Schoevers, R. A. (2008). Risk factors for anxiety and depression in the elderly: A review. *Journal of Affective Disorders, 106*(1-2), 29-44. https://doi.org/10.1016/j.jad.2007.06.005

Vogel, E. A., Zhang, J. S., Peng, K., Heaney, C. A., Lu, Y., Lounsbury, D., Hsing, A. W., & Prochaska, J. J. (2021). Physical activity and stress management during COVID-19: A longitudinal survey study. *Psychology & Health*, 1-11. https://doi.org/10.1080/

08870446.2020.1869740

Vogel, T., Brechat, P. H., Leprêtre, P. M., Kaltenbach, G., Berthel, M., & Lonsdorfer, J. (2009). Health benefits of physical activity in older patients: A review. *International Journal of Clinical Practice, 63*(2), 303-320. https://doi.org/10.1111/j.1742-1241.2008.01957.x

Walsh, J. M. E., Pressman, A. R., Cauley, J. A., & Browner, W. S. (2001). Predictors of physical activity in community-dwelling elderly white women. *Journal of General Internal Medicine, 16*(11), 721-727. https://doi.org/10.1111/j.1525-1497.2001.00506.x

Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., McIntyre, R. S., Choo, F. N., Tran, B., Ho, R., Sharma, V. K., & Ho, C. (2020). A longitudinal study on the mental health of general population during the COVID-19 epidemic in China. *Brain, Behavior, and Immunity, 87*, 40-48. https://doi.org/10.1016/j.bbi.2020.04.028

Wang, Y., Kala, M., & Jafar, T. H. (2020). Factors associated with psychological distress during the coronavirus disease 2019 (COVID-19) pandemic on the predominantly general population: A systematic review and meta-analysis. *PLOS ONE, 15*(12), e0244630. https://doi.org/10.1371/journal.pone.0244630

Wang, Y. P., & Andrade, L. H. (2013). Epidemiology of alcohol and drug use in the elderly. *Current Opinion in Psychiatry, 26*(4), 343-348. https://doi.org/10.1097/YCO.0b013e328360eafd

Wetherell, J. L., Gatz, M., & Craske, M. G. (2003). Treatment of generalized anxiety disorder in older adults. *Journal of Consulting and Clinical Psychology, 71*(1), 31-40. https://doi.org/10.1037//0022-006x.71.1.31

Wild, B., Herzog, W., Schellberg, D., Lechner, S., Niehoff, D., Brenner, H., Rothenbacher, D., Stegmaier, C., & Raum, E. (2012). Association between the prevalence of

depression and age in a large representative German sample of people aged 53 to 80 years. *International Journal of Geriatric Psychiatry, 27*(4), 375-381. https://doi.org/10.1002/gps.2728

Williams, M. N., Grajales, C. A. G., & Kurkiewicz, D. (2013). Assumptions of multiple regression: Correcting two misconceptions. *Practical Assessment, Research, and Evaluation, 18*(11), 1-14. https://doi.org/10.7275/55hn-wk47

Wittchen, H. U., Kessler, R., Pfister, H., Höfler, M., & Lieb, R. (2000). Why do people with anxiety disorders become depressed? A prospective-longitudinal community study. *Acta Psychiatrica Scandinavica, 102*, 14-23. https://pubmed.ncbi.nlm.nih.gov/11131466/

Wolitzky-Taylor, K. B., Castriotta, N., Lenze, E. J., Stanley, M. A., & Craske, M. G. (2010). Anxiety disorders in older adults: A comprehensive review. *Depression and Anxiety, 27*(2), 190-211. https://doi.org/10.1002/da.20653

Wong, S. Y. S., Zhang, D., Sit, R. W. S., Yip, B. H. K., Chung, R. Y., Wong, C. K. M., Chan, D. C. C., Sun, W., Kwok, K. O., & Mercer, S. W. (2020). Impact of COVID-19 on loneliness, mental health, and health service utilisation: A prospective cohort study of older adults with multimorbidity in primary care. *British Journal of General Practice, 70*(700), e817-e824. https://doi.org/10.3399/bjgp20X713021

World Health Organization. (2017). *Mental health of older adults* [Fact sheet]. https://www.who.int/news-room/fact-sheets/detail/mental-health-of-older-adults

World Health Organization. (2018). *Ageing and health* [Fact sheet]. https://www.who.int/news-room/fact-sheets/detail/ageing-and-health

World Health Organization. (2020a). *Alcohol does not protect against COVID-19: Access should be restricted during lockdown* [Media release]. https://www.euro.who.int/en/health-topics/disease-prevention/alcohol-use/news/news/2020/04/alcohol-does-not-

protect-against-covid-19-access-should-be-restricted-during-lockdown

World Health Organization. (2020b). *Coronavirus disease (COVID-19) situation report-162* [Media release]. https://www.who.int/docs/default-source/coronaviruse/20200630-covid-19-sitrep-162.pdf?sfvrsn=e00a5466_2

World Health Organization. (2020c). *Mental health and psychosocial considerations during the COVID-19 outbreak, 18 March 2020*. https://www.who.int/docs/default-source/coronaviruse/mental-health-considerations.pdf

World Health Organization. (2020d). *WHO Director-General's opening remarks at the media briefing on COVID-19: 11 March 2020* [Speech]. https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020

World Health Organization. (2021). *WHO coronavirus (COVID-19) dashboard*. https://covid19.who.int

Wright, L., Steptoe, A., & Fancourt, D. (2020). Are we all in this together? Longitudinal assessment of cumulative adversities by socioeconomic position in the first 3 weeks of lockdown in the UK. *Journal of Epidemiology and Community Health, 74*(9), 683-688. https://doi.org/10.1136/jech-2020-214475

Xiong, J., Lipsitz, O., Nasri, F., Lui, L. M. W., Gill, H., Phan, L., Chen-Li, D., Iacobucci, M., Ho, R., Majeed, A., & McIntyre, R. S. (2020). Impact of COVID-19 pandemic on mental health in the general population: A systematic review. *Journal of Affective Disorders, 277*, 55-64. https://doi.org/10.1016/j.jad.2020.08.001

Yao, H., Chen, J. H., & Xu, Y. F. (2020). Patients with mental health disorders in the COVID-19 epidemic. *The Lancet Psychiatry, 7*(4), e21. https://doi.org/10.1016/S2215-0366(20)30090-0

Zach, S., Zeev, A., Ophir, M., & Eilat-Adar, S. (2021). Physical activity, resilience, emotions,

moods, and weight control of older adults during the COVID-19 global crisis. *European Review of Aging and Physical Activity, 18*(1), 5. https://doi.org/10.1186/s11556-021-00258-w

Zhang, S. X., Wang, Y., Jahanshahi, A. A., & Schmitt, V. G. H. (2020). Early evidence and predictors of mental distress of adults one month in the COVID-19 epidemic in Brazil [Preprint]. *medRxiv*. https://doi.org/10.1101/2020.04.18.20070896

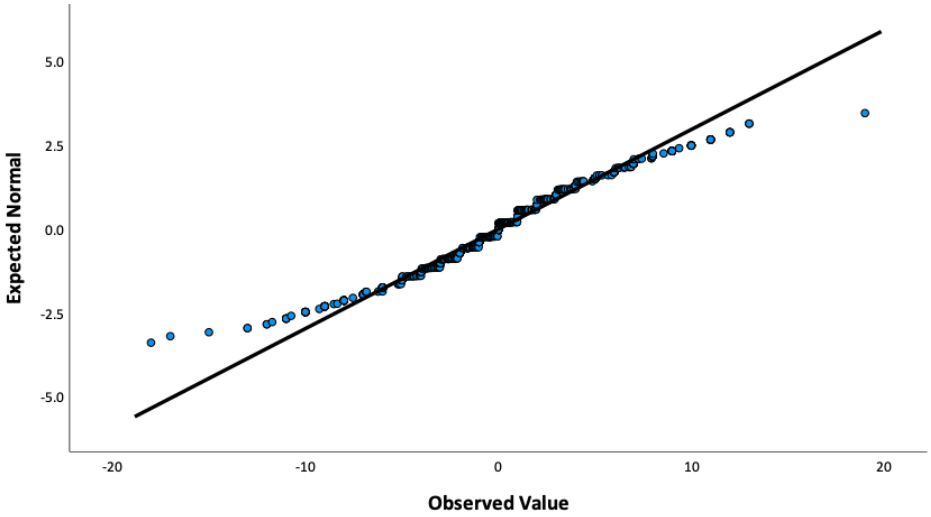
Appendix A: Plots for Assumption Testing

This appendix includes all the plots used to test assumptions in the current study. They are presented in order of appearance in the Results section, and are listed under the research question and analysis they pertain to.

Research Question 1: *T* Tests

Figure A1

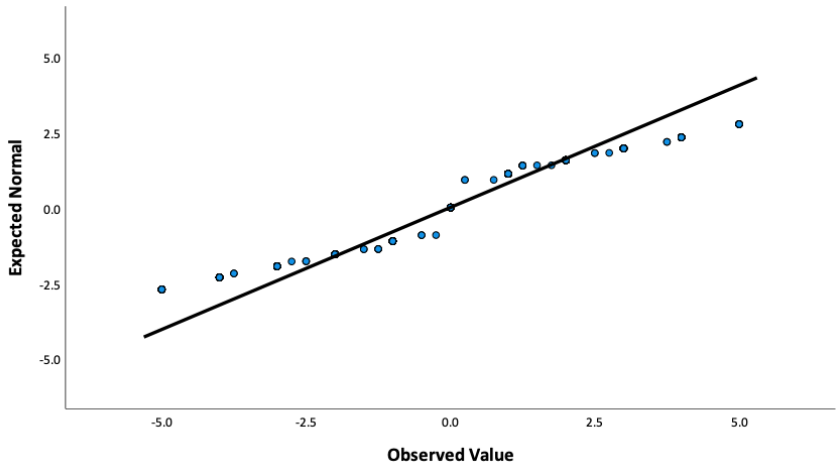
Normal Q-Q Plot of Depression Difference Scores



Note. This figure depicts a mild violation of normality.

Figure A2

Normal Q-Q Plot of Anxiety Difference Score

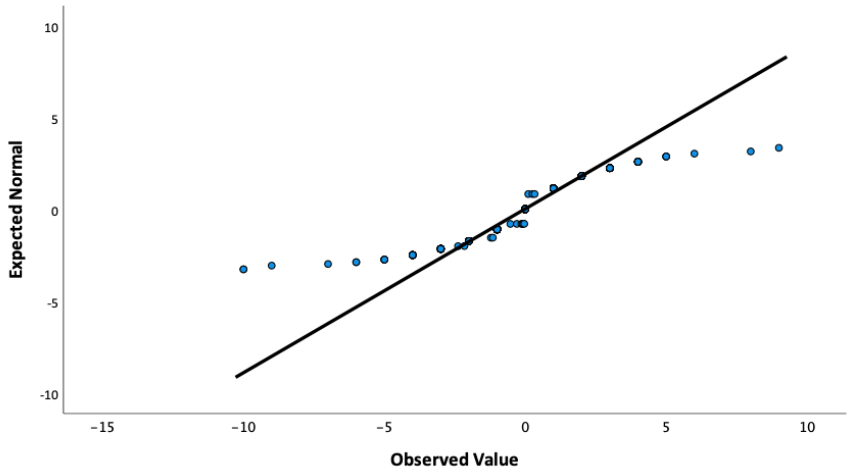


Note. This figure depicts a mild violation of normality.

Research Question 2: *T* Tests

Figure A3

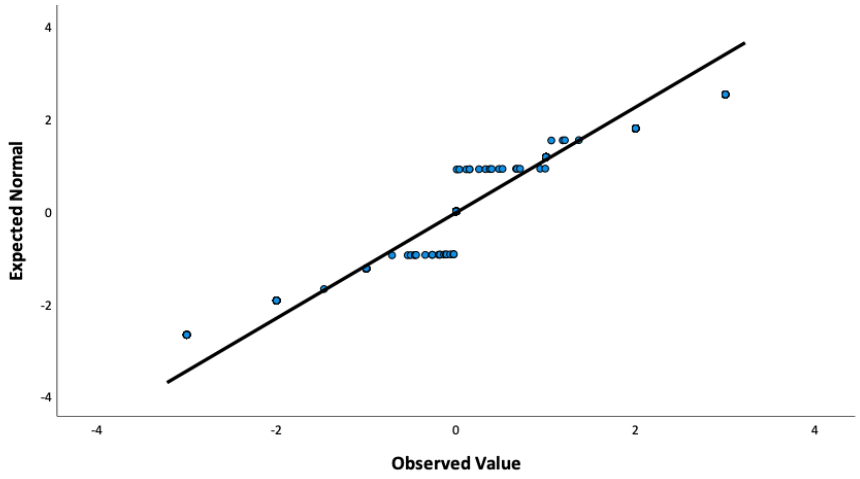
Normal Q-Q Plot of Alcohol Use Difference Score



Note. This figure depicts a moderate violation of normality.

Figure A4

Normal Q-Q Plot of Physical Activity Difference Score

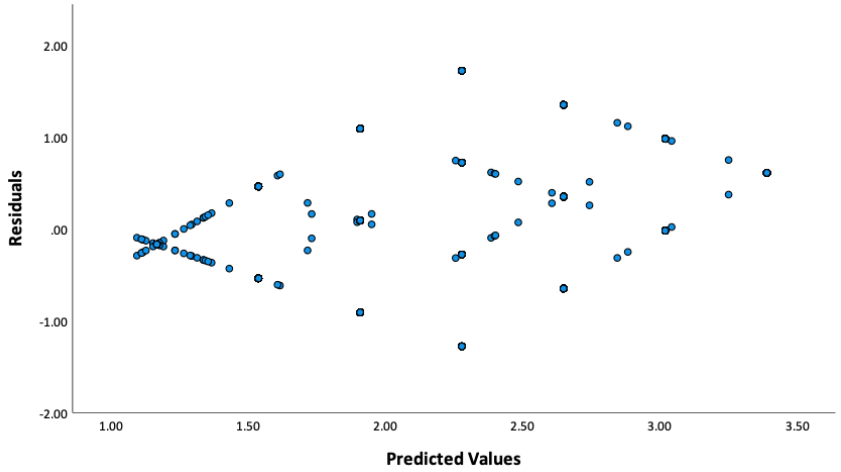


Note. This figure depicts a mild violation of normality.

Research Question 2: Multi Level Mediation

Figure A5

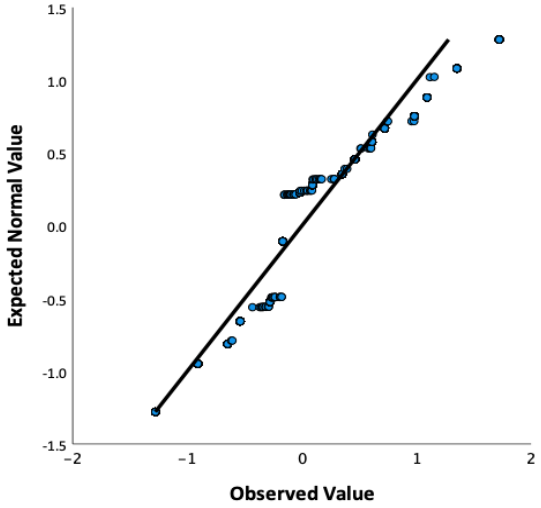
Scatter Plot of Residuals by Predicted Values for Physical Activity Regressed on Year



Note. Figures 5 and 6 are drawn from an SPSS Mixed model of depression with physical activity regressed on year. This figure shows the assumption of homoscedacity is met.

Figure A6

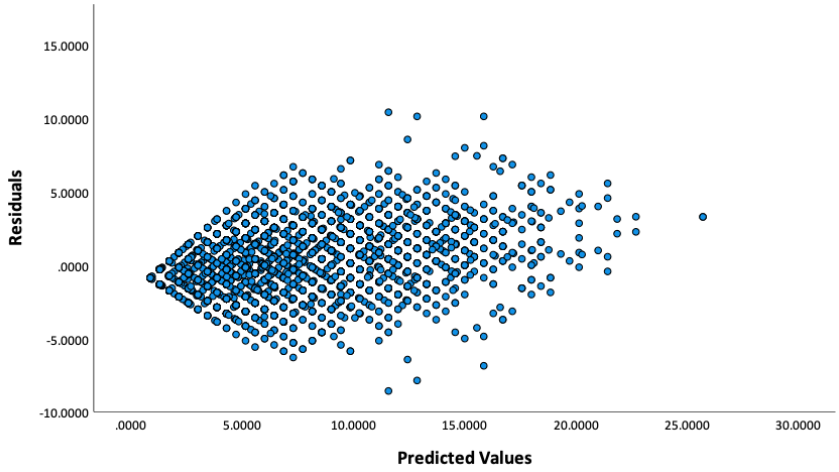
Normal Q-Q Plot of Residuals for Physical Activity Regressed on Year



Note. Figures 5 and 6 are drawn from an SPSS Mixed model of depression with physical activity regressed on year. This figure depicts a mild violation of normality.

Figure A7

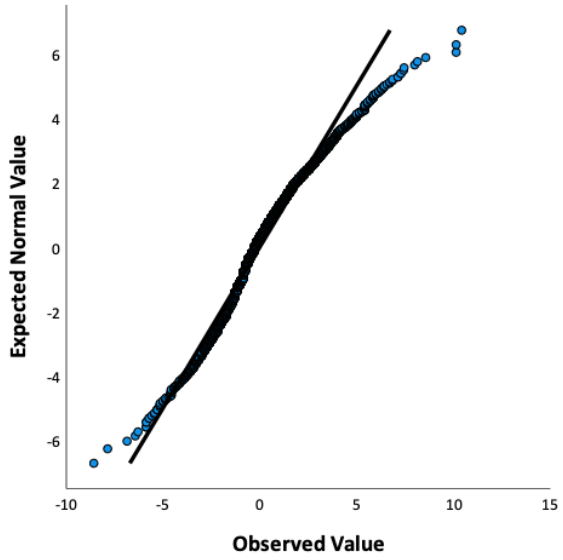
Scatter Plot of Residuals by Predicted Values for Depression Regressed on Year and Physical Activity



Note. Figures 7 and 8 are drawn from an SPSS Mixed model of depression with depression regressed on year and physical activity. This figure shows the assumption of homoscedacity is met.

Figure A8

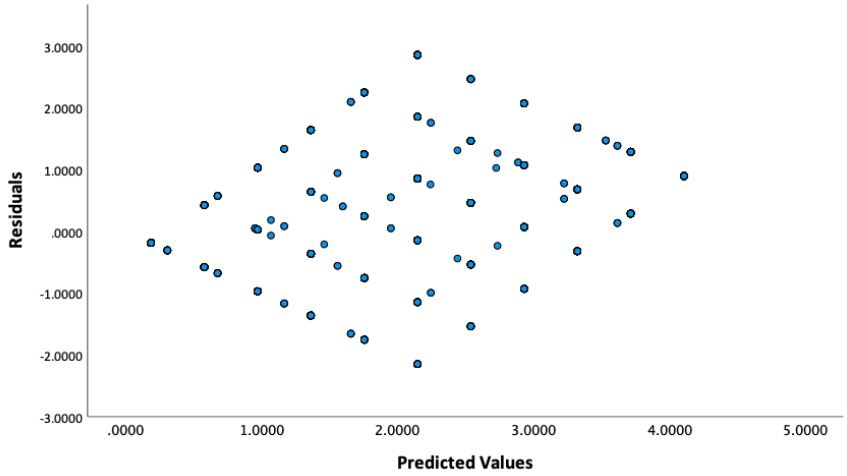
Normal Q-Q Plot of Residuals for Depression Regressed on Year and Physical Activity



Note. Figures 7 and 8 are drawn from an SPSS Mixed model of depression with depression regressed on year and physical activity. This figure depicts a mild violation of normality.

Figure A9

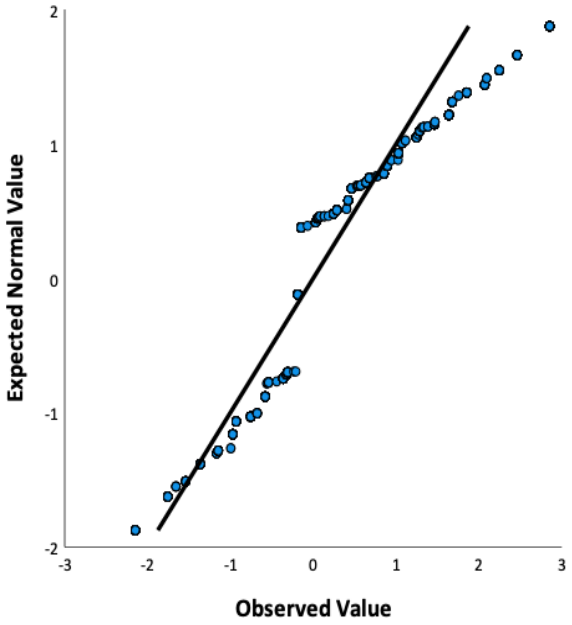
Scatter Plot of Residuals by Predicted Values for Anxiety Regressed on Year and Physical Activity



Note. Figures 9 and 10 are drawn from an SPSS Mixed model of anxiety regressed on year and physical activity. This figure shows the assumption of homoscedacity is met.

Figure A10

Normal Q-Q Plot of Residuals for Anxiety Regressed on Year and Physical Activity

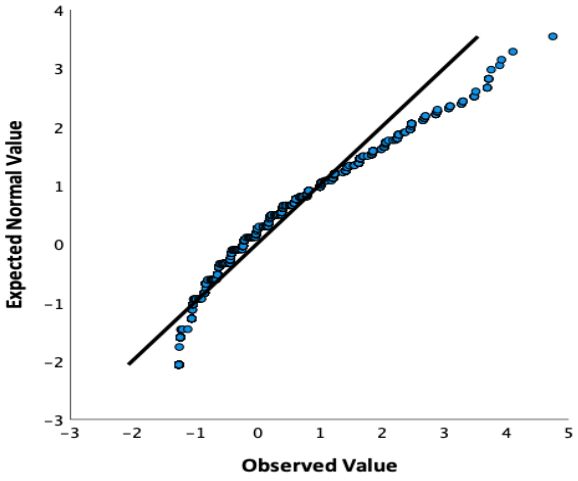


Note. Figures 9 and 10 are drawn from an SPSS Mixed model of anxiety regressed on year and physical activity. This figure depicts a moderate violation of normality.

Research Question 3: ANOVAs

Figure A11

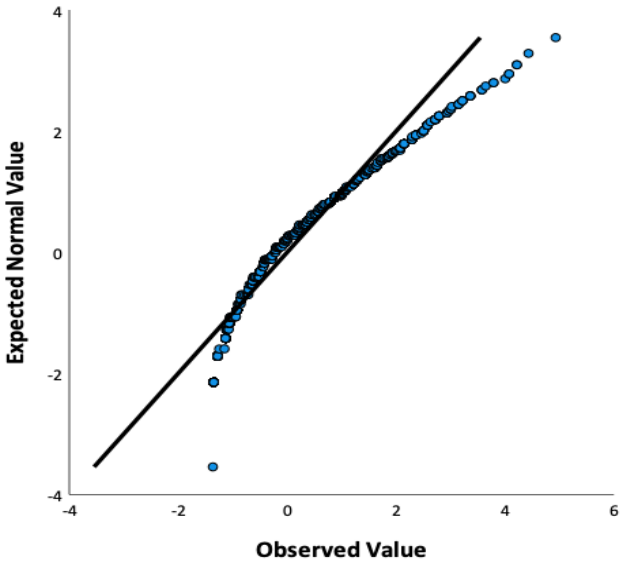
Normal Q-Q Plot of Residuals for Depression and Gender in 2018



Note. This figure depicts a mild violation of normality.

Figure A12

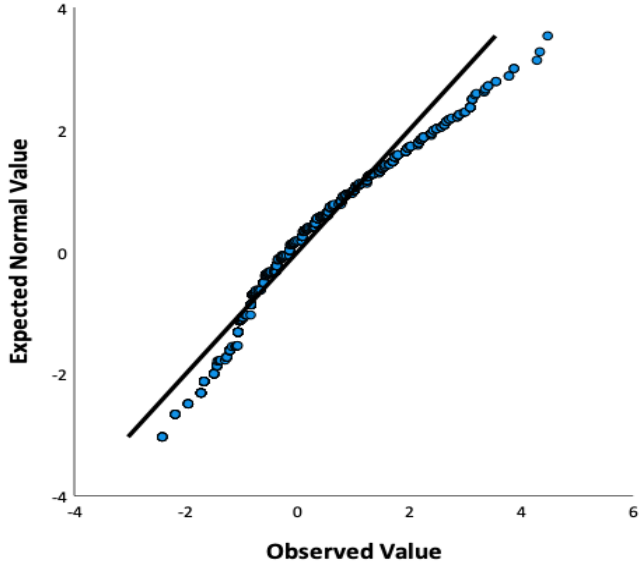
Normal Q-Q Plot of Residuals for Depression and Gender in 2020



Note. This figure depicts a mild violation of normality.

Figure A13

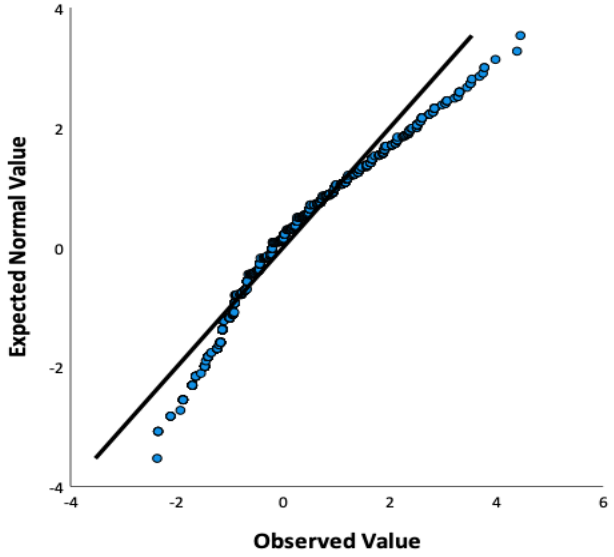
Normal Q-Q Plot of Residuals for Depression and SES in 2018



Note. This figure depicts a mild violation of normality.

Figure A14

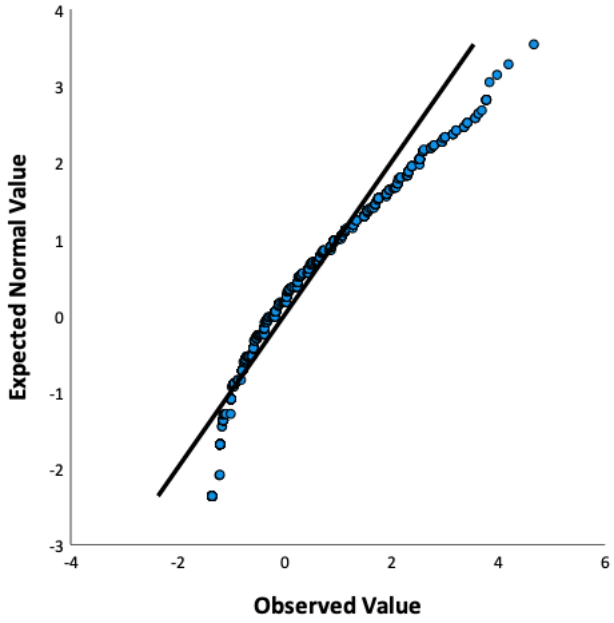
Normal Q-Q Plot of Residuals for Depression and SES in 2020



Note. This figure depicts a mild violation of normality.

Figure A15

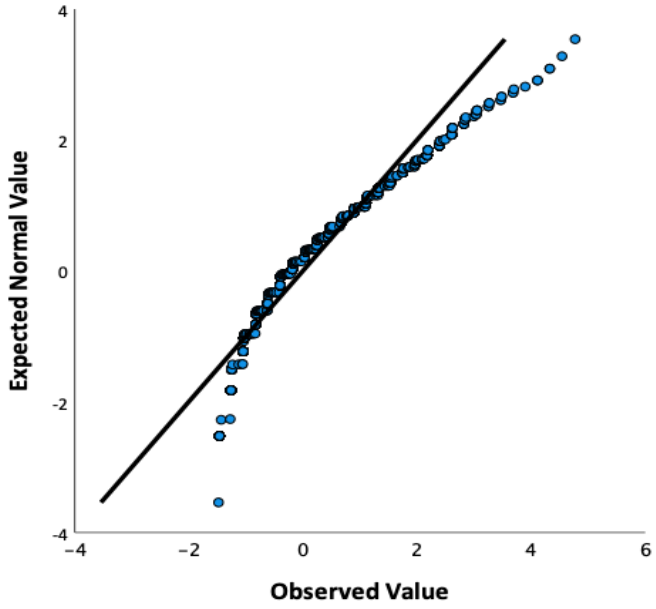
Normal Q-Q Plot of Residuals for Depression and Ethnicity in 2018



Note. This figure depicts a mild violation of normality.

Figure A16

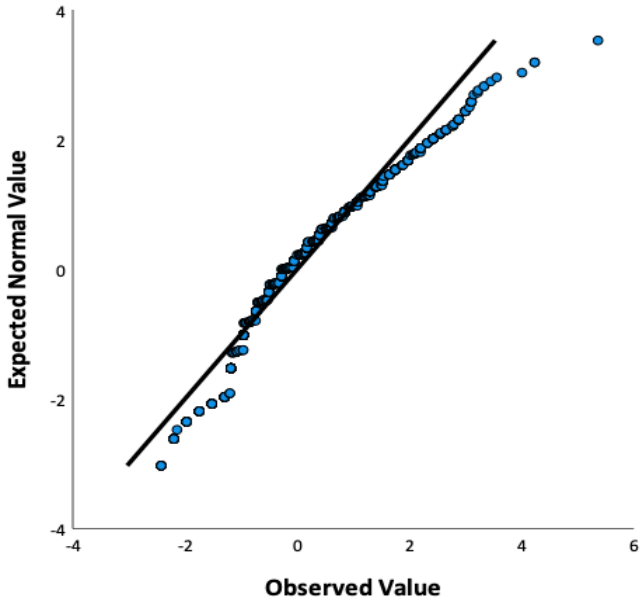
Normal Q-Q Plot of Residuals for Depression and Ethnicity in 2020



Note. This figure depicts a mild violation of normality.

Figure A17

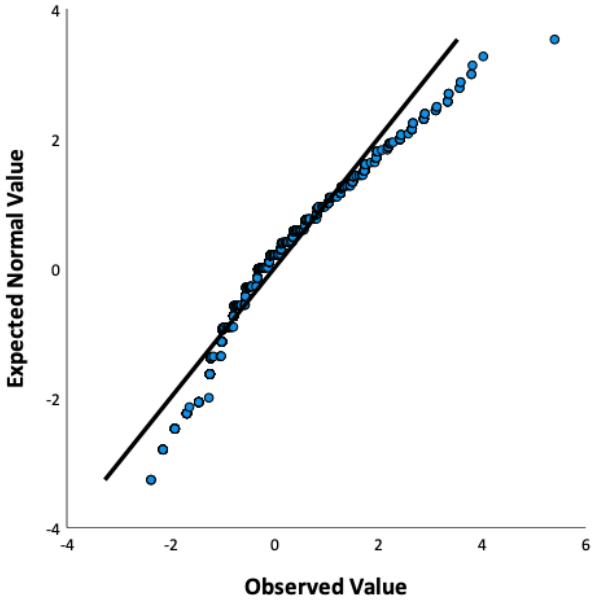
Normal Q-Q Plot of Residuals for Depression and Pre-Existing Mental Health Status in 2018



Note. This figure depicts a mild violation of normality.

Figure A18

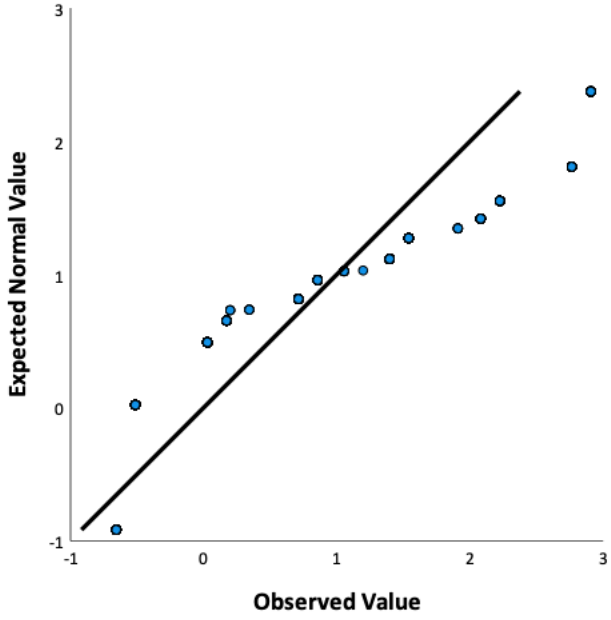
Normal Q-Q Plot of Residuals for Depression and Pre-Existing Mental Health Status in 2020



Note. This figure depicts a mild violation of normality.

Figure A19

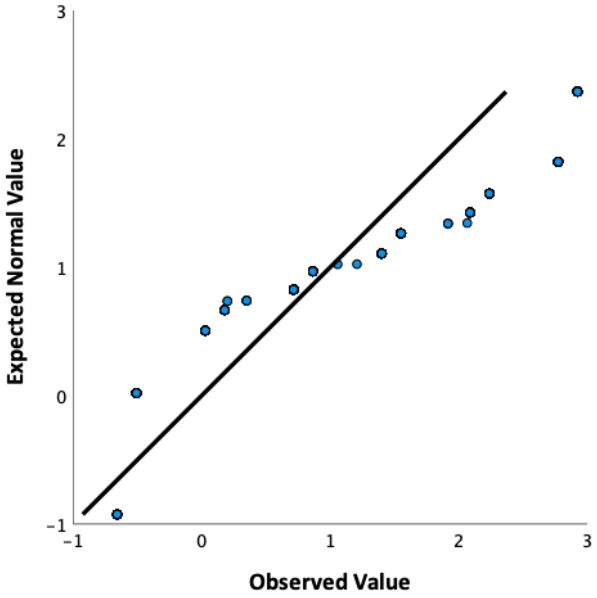
Normal Q-Q Plot of Residuals for Anxiety and Gender in 2018



Note. This figure depicts a moderate violation of normality.

Figure A20

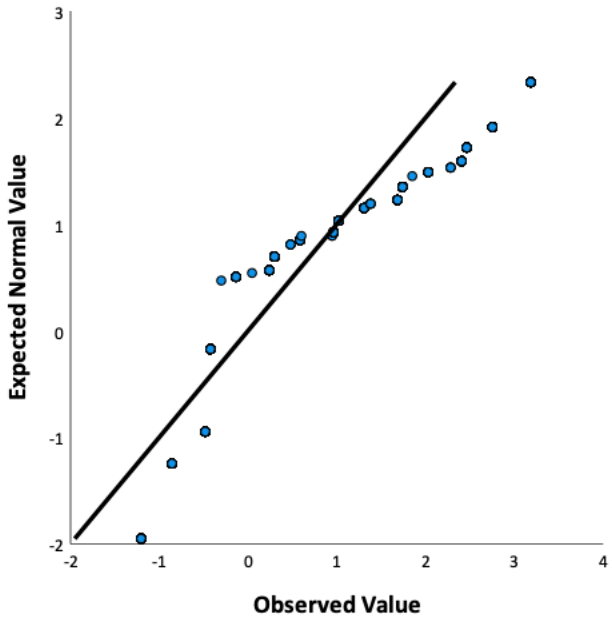
Normal Q-Q Plot of Residuals for Anxiety and Gender in 2020



Note. This figure depicts a moderate violation of normality.

Figure B21

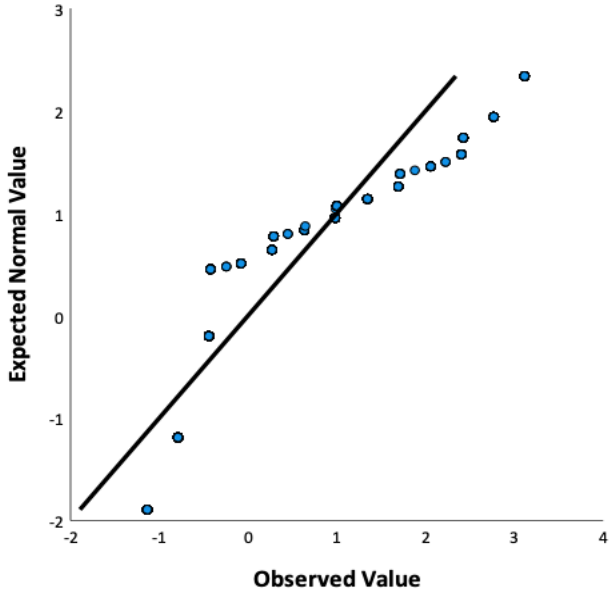
Normal Q-Q Plot of Residuals for Anxiety and SES in 2018



Note. This figure depicts a moderate violation of normality.

Figure A22

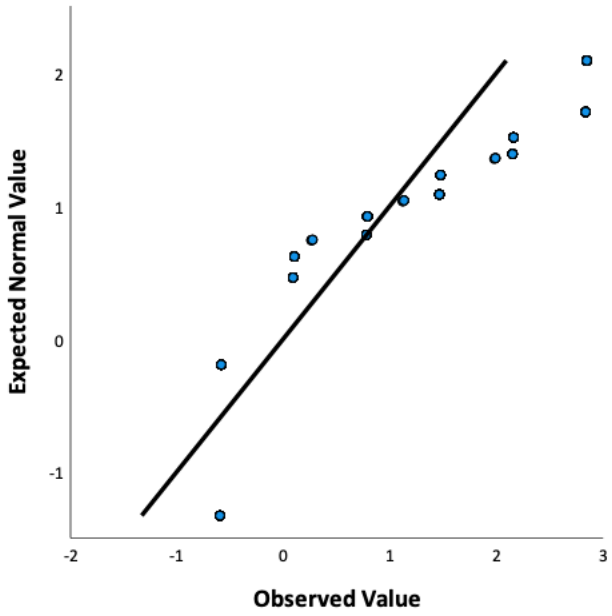
Normal Q-Q Plot of Residuals for Anxiety and SES in 2020



Note. This figure depicts a moderate violation of normality.

Figure A23

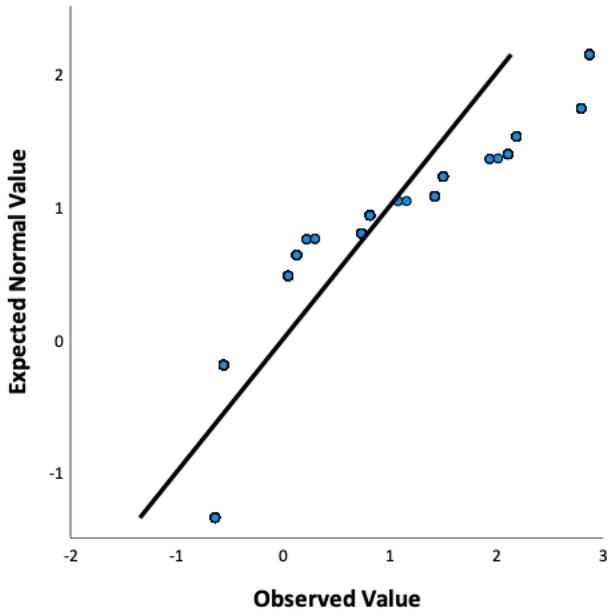
Normal Q-Q Plot of Residuals for Anxiety and Ethnicity in 2018



Note. This figure depicts a moderate violation of normality.

Figure A24

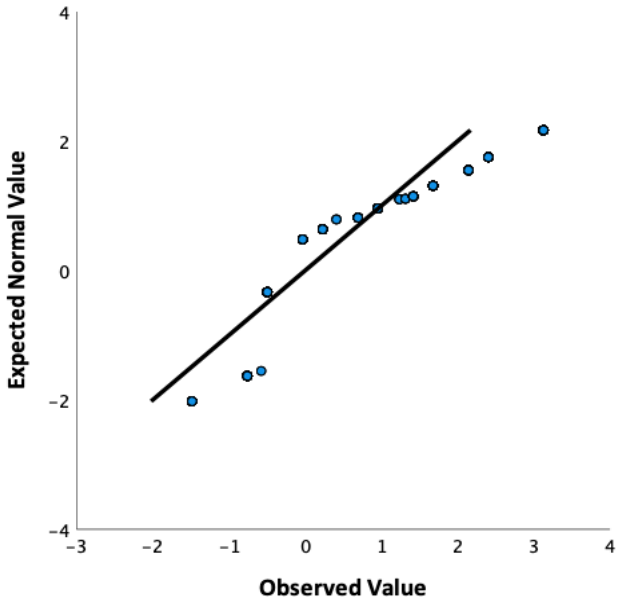
Normal Q-Q Plot of Residuals for Anxiety and Ethnicity in 2020



Note. This figure depicts a moderate violation of normality.

Figure A25

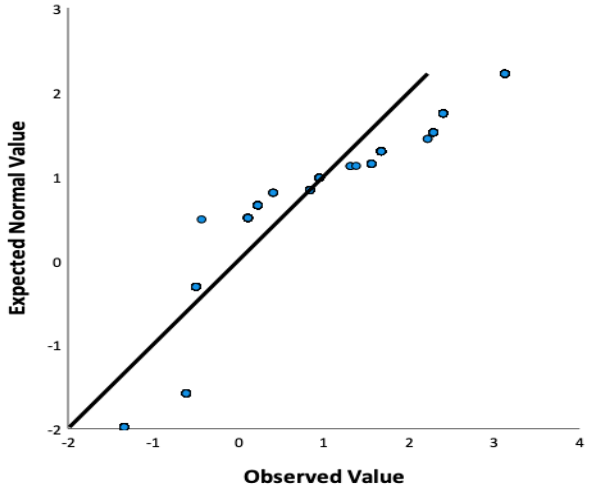
Normal Q-Q Plot of Residuals for Anxiety and Pre-Existing Mental Health Status in 2018



Note. This figure depicts a moderate violation of normality.

Figure A26

Normal Q-Q Plot of Residuals for Anxiety and Pre-Existing Mental Health Status in 2020

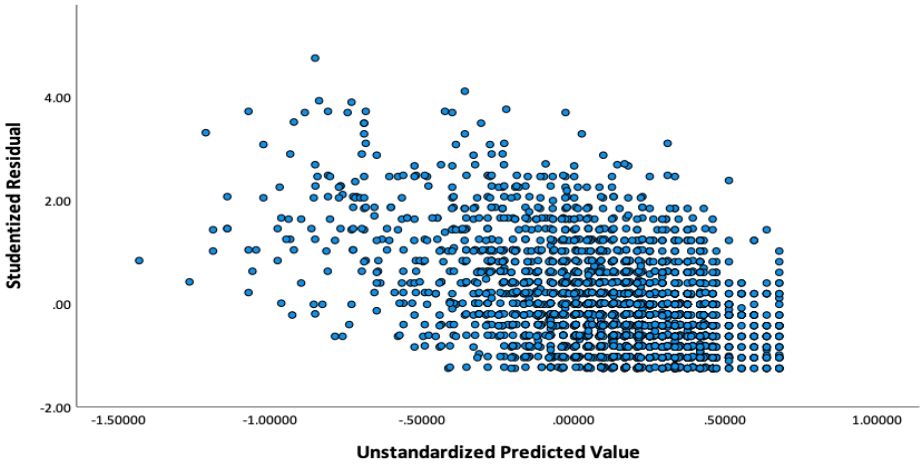


Note. This figure depicts a moderate violation of normality.

Research Question 3: Multiple Linear Regressions

Figure A27

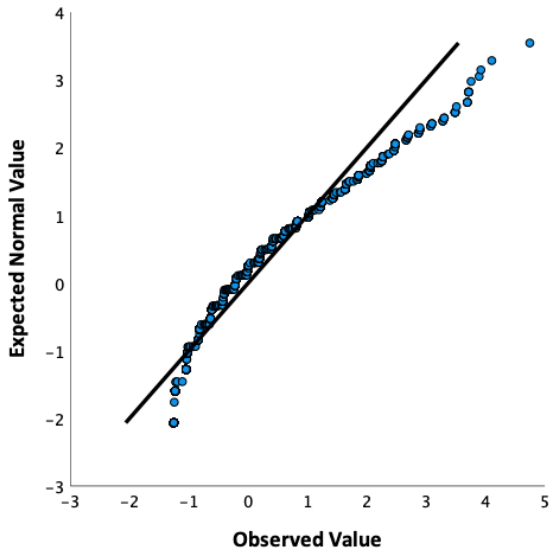
Scatter Plot of Studentized Residuals by Unstandardized Predicted Value for the Depression Multiple Linear Regression



Note. This figure shows no evidence against the assumption of linearity. The assumption of homoscedacity is violated as there is less variance in the residuals for higher predicted values.

Figure A28

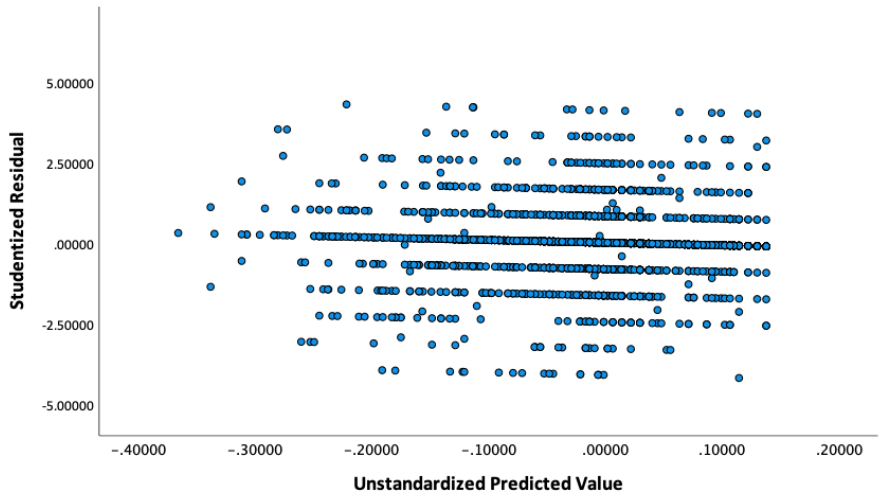
Normal Q-Q Plot of Residuals for the Depression Multiple Linear Regression



Note. This figure depicts a mild violation of normality.

Figure A29

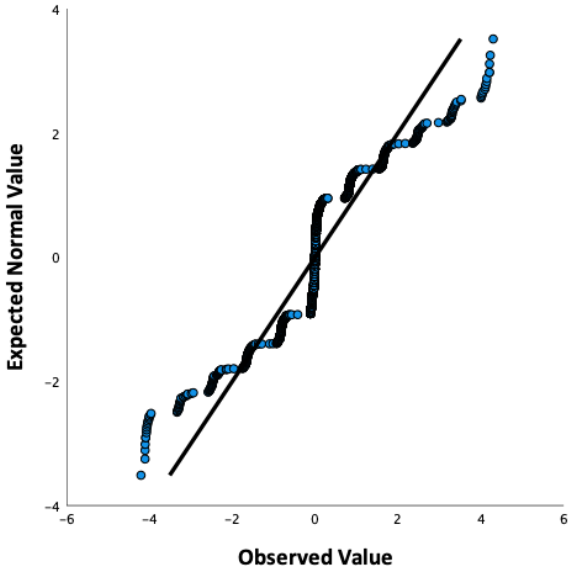
Scatter Plot of Studentized Residuals by Unstandardized Predicted Value for the Anxiety Multiple Linear Regression



Note. This figure shows that assumptions of homoscedacity and linearity are met.

Figure A30

Normal Q-Q Plot of Residuals for the Anxiety Multiple Linear Regression



Note. This figure depicts a moderate violation of normality.