Depression and Loneliness as Mediators of Purpose in Life and Quality of Life in Older Adults

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Abstract

Objective: Worldwide populations are aging. This can potentially be a valuable resource to both the older individual and their communities or an ethical burden. A key factor in determining the potential opportunities that arise from these extra years of life is well-being. It is therefore important to understand determinants that foster healthy aging and well-being through maximising functional ability and enabling engagement in things that matter to them. This study utilises Quality of Life as a holistic measure of a well-being in older age. The existing literature has provided some support for Purpose in Life, Loneliness, and Depression as being associated with each other; it also suggests they are important pre-determinants of older adult Quality of Life. Based on previous literature it is possible the relationship between Purpose in Life and Quality of Life is partially mediated by Loneliness and Depression. **Method:** A structural equation model tested the longitudinal relationship between Purpose in Life and Quality of Life, and the potential parallel mediating effect of Loneliness and Depression, while controlling for Age, Gender, Marital Status, Social Support, Social Isolation and Socioeconomic Status. **Sample**: The analysis used observational survey-based secondary data obtained from three waves of the New Zealand Health, Work and Retirement Study. The participants represented older adults living in New Zealand, aged 55 years and over. **Results:** Correlational analysis found significant correlational relationships between the latent variables. Regression analysis found positive direct (B = .243) and indirect total effect (B = .227) relationships between Purpose in Life and Quality of Life. However, indirect effects were not significant when one mediator was controlled for. **Conclusion:** The current research supports prior findings that Purpose in Life predicts future Quality of Life in older adults and offers an important contribution towards future interventions aimed at older adult well-being. The mixed mediating results suggest

further research is needed to understand the role of Loneliness and Depression as potential pathways between Purpose in Life and Quality of Life.

Keywords: purpose in life, loneliness, depression, quality of life, mediation, longitudinal, older adults, structural equation modelling

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1.0. Introduction

World-wide, populations are aging at rates faster than previously seen, causing a significant increase in the number and proportion of older adults (WHO.a, 2023). For the first time in history, the older adult population (60 years and older) has outnumbered the child population (5 years and younger). By 2050, it is estimated that the number of persons aged over 80 years will triple to 426 million persons and a sizable 22% of the world's population will be over 60 years (UN, 2019). This demographic shift is even more salient in New Zealand; by 2038, it is estimated 25% of its population will be aged over 65 years (Koopman-Boyden, 2018). While an aging population can be seen as a success of humanity; this demographic shift will have a profound impact on many aspects of society including economic, political, and social processes. Furthermore, societies have an ethical obligation to provide environments that enable the well-being of older adults (WHO.d, 2023).

Older age is often associated with being a burden to society, largely due to negative stereotypes of fragility and dependency (Robertson, 2017). Unfortunately, the increased life expectancy in recent decades has in fact been accompanied by increases in chronic health conditions. Evidence suggests that while life expectancy has increased, the proportion of life spent in good health has remained broadly constant; additional years that extend life expectancy are dominated by declining physical and mental capacities. This has negative implications for both older adults and society (WHO.a, 2023). It also highlights an urgent need for society to facilitate pathways for older adults to achieve healthy aging. In other words, maintain one's well-being, despite capacity loses, so that additional years better facilitate opportunities for older adults to be valuable contributors to society. When we aid pathways for older adults to reach their full capacity; it impacts them, their families, and their

wider community. It is therefore within all of society's best interest to understand the modifiable determinants of well-being in older age.

However, older age presents a unique set of challenges to well-being. Biologically, aging is the gradual lifetime decline at a molecular and cellular level, which results in a gradual decreases in a person's capacity to maintain homeostasis in stress conditions, subsequently resulting in decreases in physical and mental capacity, which consequently, increases the risk of disease and mortality (Rodríguez-Rodero, 2011). However, even within the older adult population, healthy aging is a heterogenous experience, only loosely associated with biological age. Environmental, socio-demographic, and psychosocial factors contribute to healthy aging, resulting in the biological aging process being neither linear nor consistent (WHO.a, 2020). Therefore, research would suggest it is not older age itself that is associated with declining well-being, rather modifiable well-being variables that are frequently attached to older age.

With the rise of aging populations, there has been an increasing focus on the promotion of 'successful aging'. There is an extensive list of health and well-being outcomes that frequently conceptualise key gerontological models characterising a person's ability to age well. Common indicators include physical health, health behaviours, psychological and social well-being including psychological distress (Kim et al., 2022). Other models go further; conceptualising successful aging as remaining free of disability and disease and maintaining high levels cognitive and physical functioning; for example, the popular Rowe and Kahn's 'successful aging' framework, (Rowe and Kahn, 1987). These are all important indicators at any age. However, they may not realistically consider the aging body; nor the individuals lived experience over the course of their life that determines how they age. Older adult health is largely dependent on the individual's life-long social and physical

environments, their personal characteristics, including Gender and Socioeconomic Status (WHO.a, 2020), and to a smaller extend, genetics (Rodríguez-Rodero, 2011).

While this highlights the need for systematic changes that target societies at all stages of life, it also highlights the unobtainability of 'successful aging' as conceptualised by restrictive models such as Rowe and Kahn. It also ignores the subjectivity of aging, and what successful aging means to different people depending on their own social and cultural contexts (Yeung and Breheny, 2016). Therefore, a more inclusive criteria for healthy aging could be achieved through a capability's lens. This recognises the diverse and subjective determinants that facilitate the maintenance of an individual's capabilities and enable achievement of important functions (Stevens, 2017). It is important to consider the fact that these functions will change as a person ages. Aging is suggested to be a time when priorities shift from the development of oneself, to the maintenance of a relatively active lifestyle, their independence and a capability for self-expression and accomplishment. Therefore, well-being for older adults depends on a complex interplay between preferences, life satisfaction judgments (cognitive wellbeing), emotions and experiences (Klausen, 2020).

Given the above, an appropriate measure of well-being and indicator of successful aging is the subjective and multidimensional construct of Quality of Life which provides a more holistic measure of healthy aging. In fact, enjoying older age with Quality of Life is a fundamental indicator of the WHOs 'active aging' framework introduced in 2002, that became a leading conceptualisation of well-being in older age. The WHO focus on 'active aging' has since been replaced with 'healthy aging' that also places a strong emphasis on developing and maintaining functional ability, that enables well-being in older age (WHO.a, 2020). In fact, prior research has identified 'active aging' as being positively associated with Quality of Life and even found Quality of Life to be a proxy measure of 'active aging' (Marzo et al., 2023). Given the research in this field has found that older age tends to be

associated with a reduction in Quality of Life, understanding the modifiable determinants of Quality of Life is therefore fundamental (Ahadi & Hassani, 2021).

There is also growing evidence that Purpose in Life is an important and modifiable component of healthy aging; directly affecting psychological well-being predictors including Depression, Loneliness, and Quality of Life. Purpose in Life is a psychosocial resource that is suggested to, among its many benefits, protect against Loneliness, associated with less perceived stress, promote higher daily positive affect, and encourage health behaviours (Hill et al., 2018; Kang et al., 2021). Older adults are at risk of declining Purpose in Life due to loss of multiple roles associated with aging or environmental changes, for example retirement or bereavement (Pinquart, 2002). While employment provides opportunity for social integration; retirement has been shown to be negatively correlated with Purpose in Life (AshaRani et al., 2022).

Similarly, there is also emerging research that identifies Loneliness as a predictor of Quality of Life. Loneliness is a common concern throughout the lifespan. However, as suggested above, older age is often accompanied with changes in life circumstances such as retirement, loss of partners or friends, financial insecurity, health declines, and/or reduced mobility, all which may challenge the integrity of even the strongest social networks; an important protective construct against Loneliness (Pinquart & Sörensen, 2001; Kaye & Singer, 2018). The breakdown of social networks subsequently increases an older adult's vulnerability to Loneliness (Czaja et al., 2021).

Loneliness of older adults has been identified as a serious public health concern that has become even more salient in response to the COVID-19 pandemic (Groarke et al., 2020). It is widespread, with some countries reporting up to one in three older people feeling lonely (WHO.c, 2023). Loneliness has been linked to a range of mental health issues including

Depression, Anxiety, and suicidal ideation (Cacioppo et al., 2006; Donovan & Blazer, 2020; Beutel et al., 2017). Additionally, it has been linked to negative health behaviours including smoking and poor sleep quality (Shankar et al., 2011); increased doctor visits and inpatient care (Gerst-Emerson & Jayawardhana, 2015; Beutel et al., 2017), and physiological changes (e.g., increased stress reactivity, and both diastolic and systolic blood pressure). These findings suggest Loneliness is a significant and negative contributor to the overall well-being of older adults via physiological, psychosocial, and psychological pathways. Like Purpose in Life, Loneliness is fortunately a modifiable risk factor of Quality of Life (Czaja et al., 2021). Reducing or preventing Loneliness amongst older adults however requires understanding and identifying factors that both protect against it and give rise to it.

Lastly, Depression has been recognised as a serious mental health disorder in older adults. Furthermore, there is a growing body of research that recognises older adult Depression as a potential predictor of Quality of Life. (Klompstra et al. 2019). While some older adults maintain the mental capacities of a person much younger than themselves; in general, with increasing age, the prevalence of mental disability becomes higher. Worldwide, mental disability affects an estimated 20% of adults aged over 60 (WHO.b, 2020). In New Zealand, one of the most common mental disabilities is Depression that affects approximately 7% of older adults. As people live longer, the number of people living with mental disability, including Depression, increases (Brunton, 2022).

Overall, Purpose in Life, Loneliness, Depression and Quality of Life are all recognised as being associated, but distinct constructs. What is less understood is the directional relationships between these variables and the potential role of Loneliness and Depression as facilitating mediating pathways between Purpose of Life and Quality of Life. By using longitudinal data, this research is better positioned to capture both within person and between person differences over time. Longitudinal data will also better allow for

examination of the temporal order of changes and more accurate conclusions about Depression and Loneliness as mediators (Gunzler et al., 2013). This better positions Purpose in Life, Loneliness and Depression to be effectively utilised in policy and interventions, that are aimed at improving the Quality of Life, of older adults. Covariates to consider in the current study include Social Isolation, Marital Status, Socio-Economic Status (SES), perceived Social Support, Gender, and Age.

2.0. Literature Review

2.1. Conceptualising Quality of Life

2.1.1. Quality of Life as a Measure of Healthy Aging

As discussed earlier, ideally, 'healthy aging' should be conceptualised in terms of the capability to live well in older age. As defined by the WHO (WHO.a, 2020), Healthy ageing is developing and maintaining the functional ability that enables well-being in older age. This is not to undermine the importance of preventing disease and maintaining physical and mental health, however it is also important to consider the diverse experiences that will contribute to an older person's well-being rather than simply framing decline as personal failure. Therefore, measurements of well-being in older age needs to balance a realistic understanding of 'successful aging' with an awareness of a vulnerable aging body (Martin et al., 2007). It needs to extend beyond the presence or absence of physical health to also consider satisfaction of social and psychological needs (Yeung & Breheny, 2021). This suggests a more holistic measure of a person's well-being like Quality of Life is more appropriate.

2.1.2. Definition of Quality of Life

It is claimed that there were as many definitions of Quality of Life as there are researchers studying it. Quality of Life is a broad ranging, subjective and multidimensional construct. It is a measure of how an individual perceives their position in life based on both their psychological and physical well-being, their cultural position, value system, expectations and aims, their independence and capacity to form relationships. This is all within the context of environment and personal ambitions at that time in place (WHO, 1998). According to the World Health Organisation (WHO), Quality of Life has four dimensions: (a) physical health (including capability to work); (b) psychological (including how an individual perceives their situation in the context of cultural expectations); (c) social relationships; and (d) environment (including accessibility to quality health care and ability to partake in recreational and leisure occasions) (WHO, 1998).

The current research uses a similar definition of Quality of Life, that Quality of Life is a subjective experience that is encompasses the positive and negative factors spanning four domains of a person's life including control, autonomy, self-realisation, and pleasure (Wiggins et al., 2008). Theoretically, Wiggins draws from Doyal and Goughs (1984) Theory of Human Need, that gives equal importance to biological and social needs. While recognising the importance of basic human needs such as food and shelter; it is important to recognise the importance of 'being human' and the active and reflective process this represents. Overall, recognition of the four domains recognises the human need for satisfaction. Control and autonomy are natural pre-requisites to the feelings associated with being able to participate in society. The extent to which these feelings of freedom can be realised is captured by the domains 'self-realisation' and 'pleasure'. By conceptualising Quality of Life as the coming together of these four domains, the measure facilitates the complexities of feelings about life (Wiggins et al., 2008).

In the context of older adults, measures of Quality of Life are becoming increasingly more important in research. However, as people age, measures of Quality of Life need to give less consideration to the absence of disease and disability and more consideration to the satisfaction of social and psychological needs and the individuals ability to maintain autonomy and independence (WHO, 1998). This aligns with shifts in aging models, as we move from expectations of healthy aging as being absent of disease or disability, to well-being encompassing a person's capability (WHO.a, 2020). This suggests that how an individual perceives their own Quality of Life will adjust in line with their stage of life. Therefore, identifying the factors that protect Quality of Life as people age is essential, as is identifying the factors that have negative impact on Quality of Life (Ahadi and Hassani, 2021). Purpose in Life has been identified as a potential protective factor against declining Quality of Life. Likewise, Depression and Loneliness have been identified as potential risk factors of declining Quality of Life.

2.2. Conceptualising Purpose in Life

2.2.1. Definition of Purpose in Life

In recent years there has been a surge in literature exploring Purpose in Life, however a lack of consensus on how to conceptualise the construct has made it difficult to consolidate the findings. Conceptualisations of Purpose in Life include spirituality and religiousness, balance, social connections, mattering to others and inner strength. However, much of the literature conceptualises it as a psychological construct that facilitates meaningful aims and goals that they find satisfaction in. It is not binary construct; rather a fluid cognitive component of a person's identity that develops and changes over time (Hill & Weston, 2019; Pfund & Lewis, 2020). This conceptualisation aligns with the philosophical work of Frankl (1958), who recognised people's ability to form a sense of purpose in their lives, even in the

presence of significant adversity. Historically there has been a lack of distinguishment between Purpose in Life and Meaning in Life. However emerging research suggests there is a clear distinction between the two constructs that potentially share a bi-directional relationship (AshaRani et al., 2022; McKnight & Kashdan, 2009). To have Meaning in Life is to have a clear understanding of one's life and events encountered. To have Purpose in Life means an individual is future orientated through a broadly motivational understanding of their future direction and goals for which they can strive towards (AshaRani et al., 2022; Martela & Steger, 2016). Therefore, older adults may not have meaning (i.e., understanding) about their life situation after a recent bereavement, but they may have broader motivational purpose in their role as a grandparent or volunteer. In other words, meaning serves as a representation of the present life state, while purpose reflects valued life goals and provides the motivation for individuals to pursue them (AshaRani et al., 2022).

2.2.2. Purpose in Life in Older Age

Purpose in Life has been described as the 'cornerstone of successful aging' (AshaRani et al., 2022) and potential driver of optimal well-being for older adults (Musich et al., 2018). Subsequently it is of increasing interest for its potential to promote well-being in older adults (Kim et al., 2013). There is a small and growing body of research demonstrating Purpose in Life as being associated with better physical health, behavioural health, psychosocial health (Kim et al., 2022), and living longer (Cohen et al., 2016). That it protects against psychopathology (Kashdan et al., 2023) and linked to an improved ability to cope with both health and social stressors (Chun et al., 2016). Overall, this suggests the benefits gained from purpose may be accumulative through multiple biological, psychological, behavioural, and social pathways (Kim et al., 2013). Unlike goals and intentions, a Purpose in Life is a long-term commitment that is unlikely to be achieved in a short time frame. A sense of purpose directs the person to have a central aim and allocate their resources to progress towards their

overarching goals. This helps a person to remain emotionally engaged in their world. Subsequently it provides an intrinsic motivation to adopt healthy behaviours, which as we age are more important for achieving positive health outcomes and well-being (AshaRani et al., 2022; McKnight & Kashdan, 2009).

However, maintaining a sense of purpose in older age is dependent on several factors including the individual's sense of direction, goals, cognitive decline, general intelligence, feeling in control, supportive neighbourhoods, social support, and resilience (Musich et al., 2018; Pinquart et al., 2002). Older age is often associated with the loss of quality social roles and relationships and declines in both cognitive and physical functioning (McKenna et al., 2007; Ryff & Singer, 2008). Individual differences including general intelligence are important components of developing a sense of purpose. For example, purpose formation requires an ability to grasp abstract concepts including insight, introspection, and planning. However, age associated declines in cognitive ability due to disease (e.g., dementia) can hinder a sense of purpose. Without Purpose in Life, it is difficult for individuals to motivate themselves or maintain the self-confidence to engage socially. Likewise, a lack of self-esteem and restricted social contact can reinforce a lack of Purpose in Life. It is therefore not surprising that research suggests older adults may have difficulty maintaining Purpose in Life (Kashdan & Goodman, 2023).

The Evolutionary Theory (Cichon, 2001) may explain this relationship between purpose and social engagement. According to the Evolutionary Theory, humans thrive when able to adapt to their changing environment. Resource allocation is a potential mechanism to aid an individual in adapting to their changing environmental conditions. Purpose is an important construct in this relationship. It potentially provides a causal force for efficient resource allocation and people motivated by purpose should be more efficient resource allocators. Therefore, individuals with purpose are better equipped to avoid environmental

conditions that inhibit purpose due to more motivated behaviour (McKnight & Kashdan, 2009).

2.2.3. Determinants of Purpose in Life in Older Adults

There is limited research related to pre-determinants of Purpose of Life. However, the literature has identified several determinants of Purpose in Life: including Age, Gender, SES, Social Support, religious service attendance, Marital Status, and psychological distress including Depression.

The Role of Social Support.

Theoretically, the perception of quality engagement with others is a core aspect of Purpose in Life. It provides a sense of identity and promotes positive feelings of being respected and wanted. Furthermore, social integration including social relationships and participation with family and friends are consistently recognised as an important determinants of Purpose in Life (AshaRani et al., 2022; Martela & Steger, 2016). Low rates of Purpose in Life amongst older adults have been attributed to decreased opportunities for purposeful engagement or diminished purposeful roles in society (Pinquart, 2002). This suggests that by providing older adults opportunities to contribute to society in meaningful ways and therefore sustain their social value and relevance, also facilitates a sense of purpose.

Prior research has found older adults who believe significant others stand ready to help in the future, are more likely to have a deeper sense of Purpose in Life than older adults who are less sure about the availability of assistance in the future (Irving et al., 2017). Furthermore, literature also suggests the availability of emotional support from the likes of family members and friends results in a greater sense of Purpose in Life. In contrast, tangible support is associated with a lower sense of purpose (Krause, 2007; Hedberg et al., 2010).

In addition to being an important determinant of Purpose in Life, Social Support has also been identified as an important determinant of well-being in older adults. The availability of Social Support and quality relationships has been identified as important for human functioning and psychological well-being. Actual or perceived social support works as a buffer to stress, facilitates better resilience and ability to cope with changes associated with aging, and increases the individual's self-perceptions of their own value (Musich et al., 2018). This suggests social support is an important direct determinant of Purpose in Life, and direct and indirect determinant of well-being.

The Role of Religion and Spirituality.

Prior literature has supported theories that a sense of purpose can be the outcome of religiosity, spirituality, or faith. Acting in accordance with religious or spiritual beliefs may lead to desired outcomes (McKnight & Kashdan, 2009). However, the proposed pathways between religion and Purpose in Life appear to lack consensus. It has been proposed that religious beliefs provide an important source of purpose in the absence of social connection. Chan et al., (2018) found socially disconnected participants; those who lacked positive social relationships, reported higher Purpose in Life when they were higher in religiosity, compared to those low in religiosity. Whereas individuals who are socially connected relied less on religious beliefs to provide a sense of purpose, as their need for belonging is meet through social connection with family or friends. Other research suggests it is the quality of the religiosity that determines religion's ability to provide Purpose in Life. Ardelt (2008) found intrinsic, but not extrinsic religious orientations were associated with a sense of Purpose in Life. While an extrinsic religious orientation will likely improve the quantity of social interactions, it appears the quality of the relationship with God is of fundamental importance in the relationship between religion and Purpose in Life. This finding may explain longitudinal research findings by Chen et al. (2020) who found little support for religious

attendance affecting Purpose in Life. However, in contrast to these findings, other research has found greater church attendance is associated with a closer relationship with God. Which is associated with increased likelihood of the person providing emotional support to their social network members (Krause & Hayward, 2012). Overall, prior research suggests in the absence of other quality relationships, religion provides a source of Purpose in Life, but its ability to provide a sense of purpose is dependent on the reasons for the religious orientation.

The Role of Age and Gender.

Age and Gender have both been associated with declines in Purpose in Life, however the findings are conflicting. A meta-analysis found evidence of Purpose in Life declining with Age; but it was not Age per se that was responsible for this decline, rather Age-related events as discussed earlier (Pinquart, 2002). Contrasting research findings suggest that the relationship between Age and Purpose in Life is complicated and likely has many contributing variables. For example, studies have found a higher Purpose in Life among the oldest old compared with a young old group (Bondevik & Skogstad, 2000). While other studies have reported lower Purpose in Life scores amongst the oldest old (over 85 years) compared to younger older adults (75-79 years) (Sarvimäki & Stenbock-Hult, 2000).

The relationship between Purpose in Life and Gender is also unclear. Females are proposed to have lower Purpose in Life compared to males (Hedberg et al., 2010; Pinquart, 2002). However, differences in Purpose in Life between Genders are generally considered to be small (Pinquart & Sorensen, 2001). The risk factors for low Purpose in Life appear to differ between male and female, with females appearing to be at greater risk. Women are more likely to be widowed, tend to have low psychological well-being due to low SES, a higher chance of being widowed and suffer from chronic conditions which inhibit their ability to perform daily functions (Pinquart & Sorensen, 2001; Pinquart, 2002). Whereas

historically older men were more prevalent in the workforce and therefore more likely to be more affected by the loss of purpose associated with retirement (Pinquart, 2002). Potentially these risk factors interact with Age, which could explain the inconclusive finding between Age and Purpose in Life. However, indirectly, Gender and Age both appear to be important determinants of Purpose in Life.

The Role of Socio-Economic Status.

Higher Socioeconomic Status (SES) is associated with higher levels of income, education, and higher professional status, all of which have been directly and indirectly associated with Purpose in Life (Pinquart, 2002). Higher income increases access to resources, including activities that provide opportunities to achieve Purpose in Life. Likewise, the availability of financial resources better enables older adults to help those in their community. This provides a pathway to feeling a sense of mattering, an important construct of Purpose in Life. Likewise, education provides knowledge regarding life goals and how to achieve them successfully (AshaRani et al., 2022). Therefore, having low SES reduces the availability of readily obtainable resources, which disrupts pathways to obtaining Purpose in Life. Overcoming this disadvantage requires sufficiently high levels of motivation. Recent research by Shiba et al. (2021) found in general, purpose slightly decreases with declining SES along a gradient. However, they also found some people within lower SES groups maintained high purpose. Suggesting high purpose is obtainable for those of lower SES, however, higher levels of motivation may be required to overcome the additional obstacles they encounter, compared to those from higher SES groups.

The Role of Marital Status.

Marital Status is another variable potentially associated with Purpose in Life. Married individuals have consistently reported higher levels of Purpose in Life than unmarried adults,

including widowed, divorced, and single individuals (Pinquart, 2002; Koren & Lowenstein, 2008). In fact, marital status was found to explain 2.6% of the variance of Purpose in Life in research by Pinquart (2002). However recent longitudinal research by Chen et al. (2020) found little support for marital status affecting an older person's Purpose in Life.

2.2.4. The Relationship Between Purpose in Life and Quality of Life

Theoretically, purpose builds resilience that enables the individual to better deal with difficult situations and consequently protects against decreases in Quality of Life (Blazek et al., 2015). There is limited research explicitly exploring the relationship between Purpose in Life and Quality of Life. However, available research does suggest a positive association. Research by Yeung and Breheny (2021), found Purpose in Life mediated the relationship between health status and Quality of Life, amongst older adults with disabilities. The research suggested Purpose in Life was an important buffer against stressors associated with disability; aiding the individual to deal with disability associated stressors in a more efficient manner. Given the high rates of disability amongst older adults (in 2013, 49% of older adults suffered physical disability and 6% suffered psychological disability) (FigureNZ.a, 2023), this is an important finding for a large proportion of older adults. Furthermore, other research has found the relationship between Purpose in Life and Quality of Life is significantly stronger when a medium to high level of Purpose of Life is reported, compared to low levels. This suggests a reasonable level of Purpose in Life is necessary before it benefits Quality of Life (Musich et al., 2018). Additionally, research has found Purpose in Life has a stronger relationship with the mental components of Quality of Life compared to physical components (Kim et al., 2022).

2.3. Loneliness

2.3.1. Definition of Loneliness

According to the attributional-discrepancy approach, Loneliness is a negative and painful subjective feeling, generally viewed as a discrepancy between desired and achieved levels of social connection (Perlman & Peplau, 1981). It is important to distinguish Loneliness from being alone or in solitude, which is an objective state. Being alone or in solitude is not a pre-requisite for the experience of Loneliness because not everyone feels lonely when they're alone. Loneliness can also be experienced in the presence of other people. For example, a New Zealand study by Jamison et al. (2018) found Loneliness highest amongst older Asian adults who lived with others. Overall, qualitative, or subjective appraisals of social relations, and friendships are more important predictors of Loneliness than the quantitative aspects of social relations (Spithoven et al., 2019).

Loneliness is commonly assessed using either unidimensional or multidimensional approaches. Researchers who claim Loneliness is unidimensional believe it is a single state varying in intensity and reached through a variety of contexts and relationship deficits (Russell, 1982). In contrast researchers who claim Loneliness is multidimensional distinguish between two different types of Loneliness. Weiss (1973) constructs Loneliness as having social and emotional dimensions. Emotional Loneliness can be conceptualised as the absence of a close confidant or emotional attachment, while social Loneliness refers to the feeling of missing a wider social network that provides a sense of belonging and companionship. This suggests that different types of relationships protect against different dimensions of Loneliness. For example, being married or living with a partner is considered protective against emotional Loneliness (Dahlberg & McKee, 2014; Diehl et al., 2018; Hoffman et al., 2022).

2.3.2. Theories of Loneliness

Three major theoretical approaches to Loneliness include the Social Needs Perspective, the Cognitive Discrepancy Model, and the Evolutionary Theory of Loneliness (Hawkley & Cacioppo, 2013; Perlman & Paplau, 1981; Spithoven et al., 2019). The Cognitive Discrepancy Model and Social Needs Theory both focus heavily on the social environment, and the direct relationship between an objective social deficit and subjective experience of Loneliness. They assume Loneliness is a negative emotion associated with negative social environments (Spithoven et al., 2019). Alternatively, the Evolutionary Theory of Loneliness states both social environment and genetics play an important part of the Loneliness experience. Additionally, the theory considers positive and negative sides of Loneliness (Hawkley & Cacioppo, 2013).

Discrepancy Approach

Drawing from an attributional-discrepancy approach, the popular definition offered by Perlman and Paplau (1981, pg. 31) defines Loneliness as "the unpleasant experience that occurs when a person's network or social relations are deficient in some important way, either quantitatively or qualitatively". This definition makes three main points, that are commonly shared with other definitions. First, that Loneliness is linked to an insufficient quantity of social connection; secondly, that Loneliness is subjective, therefore not always attributed to Social Isolation, and lastly, that Loneliness is an unpleasant and distressing feeling. Perlman and Paplau's attributional-discrepancy approach to defining Loneliness also accounts for cognitive factors that operate between the deficiency in relationships and how the individual responds to this deficiency. This affects how the experience is subjectively perceived. The two cognitive processes feeding into the Loneliness experience are firstly, predisposing factors including personality, cultural values and norms including stereotypes, and secondly,

cognitive processes related to how their situation is understood and their ability to improve their emotional state. Therefore, it looks at Loneliness beyond simply a discrepancy between desired and achieved social relations (Perlman & Peplau, 1981).

Social Needs Theory

Unlike the Cognitive Discrepancy Model, the social needs perspective suggests a direct relationship between objective social deficits and the subjective experience of Loneliness. The social needs perspective states that specific types of Loneliness arise when a relationship does not satisfy its underlying set of social needs. It is believed that social needs change over the life course and therefore Loneliness is expected to fluctuate accordingly (Weiss, 1973; Spithoven et al., 2019).

Evolutionary Theory of Loneliness

Lastly the Evolutionary Theory of Loneliness is built on the basis that establishing and maintaining social relationships is essential for reproduction and survival of social species i.e., social groups can acquire food together, protect against predators and care for infants. This behaviour ensures the individual acts in ways that increases their survival (Cacioppo et al., 2014). Therefore, Social Isolation, even in the presence of others, serves as a biological warning system, signalling that social relations are in danger. The feeling of Loneliness acts as a motivation to relieve the deficit in social relations, which consequently is rewarding. Furthermore, the Evolutionary Theory of Loneliness suggests Loneliness is influenced by both environmental factors and genetic inheritance. Genetically it is suggested multiple genes contribute to Loneliness. It is their interaction with the environment that leaves some more at risk of Loneliness than others. Those that are genetically at risk are more sensitive to their environment and consequently more at risk in adverse environments, and positive outcomes in beneficial environments (Hawkley & Cacioppo, 2013).

2.3.3. Determinants of Loneliness

Based on discrepancy theories of Loneliness, it develops from a perceived discrepancy between desired and actual social relationships (Peplau & Perlman, 1982). Subsequently it is poor quality social relationships that are more highly correlated to Loneliness rather than more objective measures such as network size (Pinquart & Sörensen, 2001). However, the path to Loneliness appears to be a complex interaction of genetic risk, cognitive processes, socioeconomic, structural, and functional characteristics (Hawkley et al., 2008).

Referring again to the Cognitive Discrepancy Model of Loneliness by Perlman and Peplau (1984), there are two cognitive processes mediating the circumstances and responses that determine the Loneliness outcome. There are both predisposing and cognitive responses that determine how the individual reacts and perceives their situation and ability to improve it. This could include personality traits, for example neuroticism has been linked to increased Loneliness (Wang & Dong, 2018), cultural values, for example ageist stereotypes, and precipitating events, for example retirement or relocation. However, how the individual attributes the causes of their situation or their locus of control, will determine their Loneliness risk. Bereavement for example is an external precipitating event that is less likely to create emotional disturbance related to Loneliness. Whereas attributing the event to internal or personal attributes is more likely to affect self-esteem, create thoughts of inadequacy, self-blame, and lowered self-worth. Furthermore, how a precipitating event or major life event is perceived can impact an individual's identity, capabilities, and sense of purpose (Robertson, 2019). For example, Newall et al., (2014) found those who felt a loss of control were more likely to transition into Loneliness over a 5-year period.

Furthermore, Hawkley and Kocherginsky (2018) identify socioeconomic characteristics and several structural and functional determinants of Loneliness. Structural characteristics pertain to relatively objective aspects of individuals' living arrangements, social roles, network structure, and social activity. It is important to note that the same structural factors will be experienced differently by different people. Whereas functional characteristics refer to an individuals' ability to engage in social opportunities within their environment and their subjective perceptions of relationship quality (Hawkley & Kocherginsky, 2018). Loneliness is often attributed to structural factors associated with loss of function; however, research is increasingly demonstrating the resiliency of older adults who often successfully navigate their social lives and relationships despite losses. In fact, a 5-year longitudinal study of older adults by Hawkley & Kocherginsky, (2018), found functional factors to be more robust predictors of Loneliness in older age. This could be explained by research by Carstensen et al. (2003) that found older adults are more selective about their social networks, choosing to focus on more meaningful relationships which is proving to be a powerful protection against loneliness.

Interestingly, the research that explores ethnicity as a determinant of Loneliness is scarce. A US study did not find a significant difference in rates of Loneliness between Whites and non-Whites (Hawkley & Kocherginsky, 2018; Shiovitz-Ezra & Leitsch, 2010). Research in New Zealand however found a significant difference in rates of Loneliness based on ethnicity. Pacifica were found to be the least lonely, while Asian people were found to be the loneliest (Jamieson et al., 2018).

Overall, prior research has identified a range of factors associated with changes in perceived loneliness experienced in older age. Several of these are discussed in further detail.

The Role of Social Isolation.

Social Isolation and Loneliness are both widespread and both are suggested to have serious effects on older adult mental health and Quality of Life (WHO.c, 2022). However, while Social Isolation and Loneliness are related, they are distinctly different constructs. As discussed earlier, Social Isolation is an objective state whereby the individual has limited social interaction with others. Whereas Loneliness is a subjective feeling that one does not have sufficient human interaction (Perissinotto et al., 2012).

Social Isolation and Loneliness are considered to have a weak, yet significant association, but some literature suggests Social Isolation potentially underpins Loneliness (Shankar et al., 2017; Tanskanen & Anttila, 2016; Czaja et al., 2021). Furthermore, Social Isolation is thought to be predicted by social network size, an important determinant of the level of Social Support a person receives which consequently affects a person's perceived level of Loneliness. This therefore suggests Social Isolation is both an important direct and indirect determinant of Loneliness.

The Role of Social Support.

Social Support is considered a functional factor. It is generally defined as the existence or availability of people on whom one can rely on, experience care from, value, and love. Social Support can be measured as the perception that one has assistance available, receives actual assistance, or is integrated in a social network (Liu et al., 2016). It is an important concept that is closely related to Loneliness, as the availability of Social Support is generally associated with lower levels of Loneliness. Prior research using older adult samples has found higher baseline Social Support is an important contributing factor to long-term recovery from Loneliness (Cohen-Mansfield, et al., 2009). Whereas less family support and greater friend strain was linked to transitioning into Loneliness five years into the future

(Hawkley & Kocherginsky, 2018). Furthermore, functional characteristics of having a larger social network is also generally related to being less socially isolated, greater perceived Social Support and subsequently less perceived Loneliness. This is particularly the case for older adults; however, older adults are an heterogenous group and subsequently, Social Support is assumed to vary among people in their later lives (Liu et al., 2016).

While there is a lack of consensus on which sources of Social Support are important protectors against Loneliness, there are suggestions that differentiating the source is important. Using a sample of adults aged 57–85 years, Shiovitz-Ezra and Leitsch (2010), reported that Social Support from family was a negative predictor of Loneliness, while Social Support from friends was not a predictor of future Loneliness. This is supported by longitudinal analyses that demonstrated those with higher levels of family support were less likely to become lonely. In fact, small increments of family support were found to be significantly important in reducing the likelihood of future Loneliness. Furthermore, participants with less family strain were more likely to recover from Loneliness (Hawkley & Kocherginsky, 2018). This is however challenged by Stevens and Westerhof (2006) who found among a sample of adults aged 40–85 years, only Social Support from partner and friends was significantly related to lower levels of Loneliness, whereas Social Support from family members was unrelated. To further complicate the findings, De Jong-Gierveld et al. (2006) found heterogeneous networks over primary kin networks are more important in staving off Loneliness. Clearly there is a lack of agreement regarding the association between Loneliness and relationship source. However, an important consideration may be that friendships and relationships with partners, to an extent, are more voluntary. It is easier for an individual to move away from an unsatisfactory friendship, or even from relationships with extended family (Lawton et al., 1994). Therefore, relationships with friends and extended family are less likely to exhibit conflict which could explain their lack of association with

Loneliness (Chen & Feeley, 2014). Overall, Social Support appears to be an important determinant of Loneliness.

The Role of Age.

The literature appears to lack consent on the relationship between Age and Loneliness. Some studies report Loneliness as increasing with Age, with it particularly prevalent amongst those of advanced age (Dykstra et al., 2005; Dykstra, 2009). While Kang et al. (2021) found older adults reported lower levels of Loneliness compared to younger adults. Other studies show Loneliness as remaining stable over the life course (Hawkley & Cacioppo, 2007), or report a U-shaped trend, i.e. Loneliness is higher for youth, appearing to decrease in mid-age and increase again in older age (Beutal, 2017; Pinquart & Sorensen, 2001). While globally, Loneliness is reported across the lifespan, in New Zealand rates of Loneliness have been reported to sharply increase for those over 75 years (HPA, 2016). Suggesting older Age is a strong contributor to Loneliness in New Zealand.

However. it has been suggested that Loneliness in older age is not attributable to Age per se; there are a few theories that explain Loneliness over the life course and into older Age. For example, Loneliness in younger adults has been attributed to personality attributes (De Jong-Gierveld, 1998). In general, younger adults prefer large, diverse networks with a higher proportion of relatively new social partners. It is reasonable to assume personality is important in obtaining this goal. Whereas, for older adults, the quality of their social network is more important than quantity. Increases in the quantity of their social network, can feel superficial to older adults (Carstensen et al., 1999). This can be explained by the Socioemotional Selectivity Theory (Carstensen et al., 1999), that states older adults prefer a reduced social network size, with emotionally close social relationships being preferred. However, as individuals age, they can become more vulnerable to variables that limit social

activity with those they are emotionally attached to. Aging is associated with spousal loss, mobility limitations that can limit their social network and subsequently increase their risk of Loneliness (Tijhuis et al., 1999; Donovan & Blazer, 2020). Alternatively, consistent with a cognitive perspective to Loneliness (Hees et al., 2019); subjective Age may be a greater determinant of Loneliness than chronological age. Research has found older subjective Age to be associated with an increase in Loneliness (Pikhartova et al., 2016). This is also consistent with Age stereotyping which influences the individual's expectations of aging that have been internalised over the course of their lives (Levy, 2003). Overall, the pathways between Age and Loneliness are complex with many mediating and moderating factors directing the relationship.

The Role of Gender.

The research suggests women are at a higher risk of becoming lonely, however these findings need to be taken into consideration of other contributing factors. In a meta-analysis of 149 studies from multiple countries, women between the ages of 60 and 80 reported a higher incidence of feeling Loneliness than men (Pinquart & Sorensen, 2001). However, these findings are based on the results from direct measures. In fact, gender differences in Loneliness are significantly larger when using single item measures compared to multi-item measures. This could be explained by men's reluctance to disclose socially undesirable feelings like Loneliness (McKenzie et al., 2018). Likewise, Dahlberg et al. (2014) did not find a significant difference in Loneliness between Gender per se, rather factors that are more related to Gender. Suggesting Gender has an indirect effect on Loneliness and the pathways between Gender and Loneliness differ between male and female. For example, women are more likely to be widowed, a strong predictor of Loneliness in both men and women (Nicolaisen & Thorsen, 2014). On average women live longer than men and historically, have tended to marry men who are older than themselves, meaning that women are more likely to

enter widowhood and at a younger age than men (Fors et al., 2008). Likewise, higher rates of Loneliness amongst women have also been attributed to higher rates of morbidity, which may restrict their overall ability to build social networks, creating a pathway to Loneliness (WHO.c, 2023). However, older men as a group typically have a more fragile or sparse social support network and are less likely to engage with formal support networks (WHO.c, 2023). Therefore, suggesting older men are at greater risk of Loneliness. Overall, there does not appear to be conclusive evidence of either gender being lonelier than the other. However, pathways to Loneliness appear to differ between males and females. Suggesting gender remains an important determinant of Loneliness.

The Role of Socioeconomic Status.

Sociodemographic variables attached to Socioeconomic Status (SES) including education, income and wealth have consistently been associated with Loneliness (Pinquart & Sörensen, 2001; Hawkley et al., 2008). However, income has been found to have a more significant relationship with Loneliness compared to education (Pinquart & Sörensen, 2001). Reduced income can contribute to low participation due to a lack of financial resources to engage in participation or low self-esteem and related feelings of marginalisation (Robertson, 2019). This suggests a social gradient exists between SES and Loneliness (Robertson, 2019), that is moderated by aspects of participation and psychosocial resources (Niedzwiedz et al., 2016; Tough et al., 2021). Furthermore, having the financial means to support participation can ease the burden on informal caregivers, subsequently aiding the maintenance of quality relationships.

The relationship between SES and Loneliness has been supported by longitudinal research that has found that particularly women of low SES are less likely to recover from Loneliness (Cohen-Mansfield, 2009). Likewise, those with fewer assets and a lower income-

needs ratio are more likely to become lonely five years into the future (Hawkley & Kocherginsky, 2018).

2.3.4. The Relationship Between Purpose in Life and Loneliness

Loneliness and a reduced sense of purpose are both associated with declines in functional capacity (Perissinotto et al., 2012), dementia onset and mortality in later life (Boyle et al., 2009; Holt-Lunstad et al., 2015). Overall, both are predictors of successful aging and there is strong evidence to suggest an association exists between Purpose in Life and Loneliness in older adults. Recent research and theory both suggest Purpose in Life promotes social engagement which in turn reduces perceived levels of Loneliness (Stillman et al., 2009). However, a scarcity of longitudinal research has limited the literature's ability to understand the directional relationship. Alternatively, a small amount of literature suggests Loneliness determines a person's sense of purpose. Loneliness arises from a deficiency in the quality of social ties and absence in social connection which in turn reduces the individuals Purpose in Life. (Martela and Steger, 2016).

An important cross-section contribution to the literature includes work by Neville et al. (2018). Using a sample of 614 New Zealand males aged 60 years and older, a significant negative association was found between Purpose in Life and Loneliness. Older males who reported negative levels of Purpose in Life had higher rates of Loneliness compared to participants who reported neutral or positive levels of Purpose in Life. Additionally, the recent Covid-19 pandemic led to an uptake of research seeking to understand the relationship between Purpose in Life and Loneliness. It is believed that Purpose in Life potentially provided robust protection against Loneliness during Covid-19 social distancing safety measures. While overall there is little evidence of Loneliness increasing in response to the pandemic (Luchetti et al., 2020), it is likely some individuals felt lonelier during the

pandemic, while others felt less lonely, resulting in balancing of Loneliness levels. Differences in Loneliness responses however may be explained by perceived Purpose in Life.

A recent longitudinal and cross-sectional study provides support for the relationship and potential protective function of Purpose in Life. Using a sample of 135,227 participants from 36 cohorts, the study reported sense of purpose as consistently been associated with Loneliness (Sutin et al., 2022). The cross-sectional study reports a moderate effect size between Purpose in Life and Loneliness. Furthermore, they report a sense of purpose as being protective against developing Loneliness up to 15 years in the future. Notably the sample was aged 19 - 109 years; however, no evidence was found for age moderating the effect. Severe mental distress was however found to moderate the effect. The study followed up with two of the cohorts during the acute phase of the Covid-19 pandemic. The findings related to the pandemic found those with a greater sense of purpose prior to the pandemic had greater protection against Loneliness during the pandemic. Based on the findings, Sutin et al. (2022) suggest purpose may have a robust protective effect against Loneliness that is independent of context. Similar findings are reported by Kang et al. (2021) who found a strong relationship between Purpose in Life and Loneliness during the pandemic and pre-pandemic. However, their research did suggest medium to high levels of perceived levels of Purpose in Life is needed before the psychological resource is protective against Loneliness.

There are a few theoretical explanations for Purpose in Life's potential protective function against Loneliness. When one's life is lived with a sense of purpose, they are more likely to feel goal orientated and have a sense of satisfaction in their activities. This is motivating and can regulate behaviour. Likewise, higher levels of Purpose in Life have been linked to increased behavioural, affective, and cognitive engagement, compared to individuals with less perceived purpose. This engagement may motivate the individuals to meet their needs to connect with others (McKnight & Kashdan, 2009). Furthermore, many

activities connected to Purpose in Life are of a social nature, for example volunteering, family connection, community involvement or active religious congregation membership. Therefore, maintaining a sense of purpose is generally attached to meaningful engagement with other individuals. It has been suggested that this increased engagement, that supports Purpose in Life, provides the individual with increased physical and mental endurance to cope with adversity. Likewise increased Purpose in Life has been suggested to support positive coping skills that may protect individuals against adversity that may lead to Loneliness (McKnight & Kashdan, 2009).

Additionally, findings that older adults who reported less Loneliness than younger adults during the pandemic suggests the resilience of older adults have previously been underestimated, likely due to ageist stereotypes (Groake et al., 2020). However, this also suggests the association between Purpose in Life and Loneliness is possibly mediated by resilience. Therefore, Purpose in Life provides the individual with resilience against stress that subsequently aids prevention against the development of Loneliness.

4.3.5. The Relationship Between Loneliness and Depression

The relationship between Loneliness and Depression is well documented (Cacioppo et al., 2010; Liu et al., 2016; Ahadi & Hassani, 2021). Loneliness has been strongly associated with Depression, with multiple studies finding a positive corelation between the two constructs. For example, Beutal et al. (2017) found more than half of the loneliest participants were also depressed compared to only 5% whose Loneliness symptoms were only mild. Likewise, Van Beljouw et al., (2014) found older adults who were severely lonely, reported more severe depressive symptoms, compared to those who were mildly lonely. Also, using a sample of older adults with mild cognitive impairment, Zafar et al. (2021) found severe Depression and moderate to high Loneliness to be significantly associated. What is

less conclusive is whether the relationship has a causal direction. If a causal relationship exits, consensus is on the direction is yet to be reached. Some research suggests it is bi-directional. Using a nationally representative sample of over 50-year-olds living in the United States, Luo et al. (2012) found longitudinal evidence of a reciprocal relationship between Depression and Loneliness. Other theories suggest Depression causes Loneliness, through cognitive processes. Depressed people judge their social interactions as inadequate and socially withdraw, which leads to them becoming socially isolated and subsequently lonely. This creates a self-fulfilling prophecy in which lonely people actively distance themselves from would-be social partners (Robertson, 2019). This directional relationship is partially supported by Zafar et al. (2021) who found Loneliness mediated the relationship between Depression and Quality of Life. Other research argues Loneliness is a major precursor to Depression in older adults (Beljouw et al., 2014; Beutal et al., 2017; Cacioppo et al., 2006). Loneliness is believed to affect older adult vulnerability to psychological distress, causing issues such as Depression, suicide, social isolation, and anxiety. This theory is also supported by cross-lagged longitudinal research by Cacioppo et al. (2010) that concluded Loneliness predicts depressive symptoms. Furthermore, research suggests Loneliness mediates the relationship between decreasing social network size and depressive symptoms. For example, longitudinal research using older adults has found inadequate social relationships including social rejection, and a lack of social competence, as being linked to Loneliness, that may result in increased depressive symptoms, (Beutel et al., 2017; Domènech-Abella et al., 2021).

2.3.6. The Relationship Between Loneliness and Quality of Life

Relatively few studies have focused on the impact Loneliness has on the Quality of Life amongst older adults. However, the available research suggests a negative correlational relationship exists. Ahadi & Hassani (2021) found Loneliness had a direct negative affect on Quality of Life, but they also found Depression to be a significant mediator of the

relationship, suggesting if Loneliness did not lead to Depression, the effect of Loneliness on Quality of Life would be less diminished.

Likewise, Musich et al. (2015) also found Loneliness significantly reduced an individual's Quality of Life. Their study looked at the mental and physical components of Quality of Life separately, with Loneliness having a greater impact on the mental component of Quality of Life than physical components. For example, severe Loneliness reduced the physical component of Quality of Life by 9%, whereas the same level of Loneliness reduced the mental component of Quality of Life by 24%. Furthermore, Musich et al. (2015) found the magnitude of reduction in Quality of Life was negatively correlated to the level of Loneliness. For example, moderate Loneliness reduced the mental component of Quality of Life by 9% but severe Loneliness reduced it by 24%. Similar findings were found by Boehlen et al. (2022). Using a sample of 2,171 older German adults, Loneliness was found to cause lower levels of mental components of Quality of Life three years in the future, in both male and females. However, Loneliness only caused lower levels of physical components of Quality of Life for females. Not only does this suggest Loneliness is more detrimental to mental components of Quality of Life than physical components, but it also supports prior research related to Loneliness and Gender.

In addition to a significant direct relationship between Loneliness and Quality of Life, Loneliness is also potentially an important mediator. The literature also suggests Loneliness is an important mediator between Age, Gender, Marital Status and Social Support, and dependent variable Quality of Life (Kang et al., 2018). Females, widows, and the oldest aged adults have overall been found to have higher levels of Loneliness and lower levels of Quality of Life; suggesting Loneliness potentially plays both a direct and mediating role in the relationships.

2.4. Depression

2.4.1. Definition of Depression

Depressive disorders comprise several disorders sharing a common trait of sadness, emptiness, or irritable mood. These emotions are accompanied by somatic and cognitive changes that negatively affect the individual's capacity to function. The disorders differ in duration, timing, or presumed etiology. Major depressive disorder is the classic condition attached to depressive disorders. It is characterised by episodes of obvious changes in affect, cognition, neurovegetative functions and remission (APA, 2013).

The symptoms of moderate to severe Depression in older adults are like those seen in persons in the midlife, when no comorbid conditions are present. However subtle differences can be present. For example, onset of melancholia (symptoms of agitation or psychomotor retardation or agitation and non-interactive) is more likely in later age than non-melancholic Depression. Generally, older adult Depression is more likely to present with psychomotor disturbances (Ribeiro et al., 2020).

2.4.2. Prevalence of Depression

Depression is highly prevalent amongst older adults, with rates dramatically fluctuating between gender and ethnic groups. It is one of the most common mental disorders to affect older adults; it is reported to effect on average, 20% of people aged over 65 years. Rates in New Zealand are even higher, with it disproportionately affecting women. Recent figures suggest 21.8% of women aged between 65-74 years have been diagnosed with Depression compared to 11% of males. Figures also suggest age is important, with rates of diagnosis dropping to 12.8% for females and 10% for males, amongst the over 75-year age group (*FigureNZ.a*, 2022). Higher prevalence rates amongst women are consistent across all four broad categories of ethnicity (Asian, European/other, Māori and Pacific Island), however

Depression is most prevalent in Māori (27.6%) and European/other (23.6%) female ethnic groups (*FigureNZ.b*, 2022). The high rates of Depression in New Zealand and beyond suggest Depression is a major health concern and cause of disability in older age (Robertson, 2019; Helvik et al., 2016).

2.4.3. Theory of Depression in Older Age

The etiology of Depression in older adults is explained through biological, social, and psychological determinants. Biologically, Depression has been widely associated with medical illness including dementia disorders, cardiovascular disease, pain, and urinary incontinence (Blazer, 2003). Likewise, psychological theories attribute later life Depression to behaviour, including learnt helplessness that is resultant of adverse events, continued stressors, and daily hassles. Cognitive theories are however more popular, whereby the individual interprets events and achievements more negatively. Cognitive theories of Depression are consistent with the Diathesis-Stress model, whereby specific negative experiences affect a personal vulnerability and consequently are predictive of Depression (Blazer, 2003).

2.4.4. The Relationship Between Purpose in Life and Depression

The relationship between Purpose in Life and Depression is supported by both theory and empirical research that suggests purpose may reduce the effects or likelihood of Depression for older adults (Pinquart, 2002). According to Frankl's theory (1958, 1959, 1966), a high degree of Purpose in Life could serve as a protection for Depression. It has been suggested that Purpose in Life aids an individual's ability to efficiently allocate available resources towards opportunities that are important and attainable. This efficiency of action could over time produce cumulative benefits to emotional well-being, including avoidance of Depression (McKnight & Kashdan, 2009). Furthermore, a sense of purpose is

associated with better strategies to deal with difficult experiences, which can protect against depressive symptoms (Blazek et al., 2015).

Additionally, cross-sectional research has consistently found a strong negative association between Purpose of Life and Depression. For example, Pinquart (2002) found 73% of participants with below average levels of Depression also show above average levels of Purpose in Life. Likewise, research has found those with Depression had significantly lower Purpose in Life scores compared to those without Depression (Pinquart, 2002; Hedberg et al., 2010). However longitudinal research suggests a high degree of Purpose in Life does not prevent the development of Depression. Research by Hedberg et al. (2010) found 27% of women and 26% of men with high Purpose in Life, and without Depression at baseline had developed Depression after five years. Overall, prior research would suggest current levels of Purpose in Life are associated with current levels of Depression, but the limited longitudinal research would suggest current Purpose in Life is not indicative of future levels of Depression.

2.4.5. Relationship Between Depression and Quality of Life

Depression and Quality of Life have both been recognised as significant concerns for older aged adults. The WHO has identified mental health as one of the most important factors of old adult Quality of Life. It is estimated that Depression affects between 10-20% of older adults world-wide, making Depression one of the most common forms of mental distress followed by Anxiety, amongst older adults (WHO.b, 2020). Measures of Quality of Life is suggested to be an effective method of evaluating the detrimental effects of Depression amongst older adults (Cao et al., 2016).

While older age has consistently been associated with declines in Quality of Life, particularly amongst the oldest old adults (over 80 years) who report the lowest Quality of

Life scores (Ribeiro et al., 2020). However, it is suggested that Age itself does not explain the decline in Quality of Life, rather the health-related factors associated with aging including poor physical health, functional impairment, and Depression. Depression is recognised as obstructing a person's capacity to function, therefore significantly impacting psychological and social domains of the individual's Quality of Life (Zafar et al., 2021).

A recent study in Sweden using secondary data from 238 participants, with a mean age of 82, found higher Depression was related to lower Health Related Quality of Life (*r* =.651). They also found higher baseline Depression was related to lower health related Quality of Life two years in the future (Klompstra et al., 2019). Similar findings were found by Sivertsen et al. (2015), whose longitudinal research concluded higher levels of baseline Depression was associated with lower Quality of Life and Health Related Quality of Life scores at follow-up. However, compared to those with persistent depressive symptoms, Quality of Life did however improve when depressive symptoms lessen.

3.0. The Current Study

Quality of Life is consistently recognised by the WHO as an issue of importance (WHO.d, 2023). Maintaining Quality of Life in older age is an important component of facilitating an ability to age well. It is therefore increasingly recognised as an important subjective measure of older adult well-being. Quality of Life is a dynamic construct that comprises diverse domains that appear to be intertwined and interdependent. As an individual moves through older adulthood, they can face unique challenges associated with loss of social support networks, perceptions of physical challenges and financial inhibitors, that can reduce the individual's self-perceived Quality of Life. Improving older adult Quality of Life ensures the well-being of older adults, which in turn improves the ability of older adults to maintain the capacity to be contributing members of their families and communities. It is therefore

important that the pathways to maintaining and increasing Quality of Life of older adults are understood. Three potential determinants of Quality of Life in older adults are Purpose in Life, Loneliness, and Depression. Furthermore, these are modifiable factors, suggesting understanding their role in determining future Quality of Life offers greater insight to future interventions.

The literature suggests that the relationship between Purpose in Life, Loneliness, and Depression is complex with many different interactions. One of the main aims of this study is to further understand the longitudinal relationship between Purpose in Life and Quality of Life of older adults, and the potential role of Depression and Loneliness as parallel mediators of the relationship.

A recent systematic review of the literature identified promising relationships between each of the four main variables. Sufficient literature has found correlational relationships between the variables, however a lack causal longitudinal research leaves a gap in the literature as to the directional relationships. Furthermore, the direction of relationships found in the existing literature is inconsistent, suggesting a need for further research.

3.1. Hypothesis

The following hypotheses aim to analyse both correlational associations and causal relationships between the four main variables in clear falsifiable terms. The hypotheses aim to analyse the extent to which Purpose in Life effects Quality of Life, 4 years into the future, and the extent that this relationship is mediated by Loneliness and Depression. Therefore, the hypothesis aims to analysis the causal relationship between Purpose in Life and both Depression and Loneliness. Then subsequently the causal relationship between Depression and Loneliness on Quality of Life. All causal relationships will be analysed while controlling

for autoregressive effects and confounding variables, Age, Gender, Socioeconomic Status, Social Connection, Social Isolation and Marital Status.

H.1. There is a positive bivariate relationship between *Purpose in Life in 2016 and Quality of Life in 2020.*

H.2. There is a negative bivariate relationship between *Purpose in Life in 2016 and Loneliness in 2018.*

H.3. There is a negative bivariate relationship between *Purpose in Life in 2016 and Depression in 2018.*

H.4. There is a negative bivariate relationship between *Loneliness in 2018 and Quality of Life in 2020.*

H.5. There is a negative bivariate relationship between *Depression in 2018 and Quality of Life in 2020.*

H.6. When controlling for the effect of Depression in 2018, there is a positive indirect effect of Purpose in Life in 2016 on Quality of Life in 2020 (via an effect of Purpose in Life in 2016 on Loneliness in 2018).

H.7. When controlling for the effect of Loneliness in 2018, there is a positive indirect effect of Purpose in Life in 2016 on Quality of Life in 2020 (via an effect of Purpose in Life in 2016 on Depression in 2018).

H.8. When controlling for the effect of Loneliness and Depression in 2018, there is a direct positive effect of Purpose in Life in 2016 on Quality of Life in 2020 (i.e., the relationship between Purpose in Life is not completely mediated by Depression and Loneliness in 2018).

H.9. There is a positive total effect of Purpose in Life in 2016 on Quality of Life in 2020 (i.e., the sum of the direct and indirect effects through Depression 2018 and Loneliness in 2018).

4.0. Methods

4.1. Introduction

The current research seeks to draw causal inferences about the parallel mediating roles of Loneliness and Depression in the relationship between Purpose in Life and Quality of Life in older adults. The research uses secondary observational data collected by the longitudinal Health, Work, and Retirement (HWR) study; an initiative of the Health and Aging Research Team (HART) at Massey University. It is a large study of older adults in New Zealand that fundamentally surveys the experience of aging amongst New Zealanders, in New Zealand. To date, the study has provided over 16 years of longitudinal data on the aging experience, using several older adult cohorts (Stephens et al., 2018; Phillips, 2021). The longitudinal nature of the HWR study provides an important source of data to facilitate an ongoing understanding of how aging is changing and how positive aging can be facilitated. By following several cohorts over multiple years, researchers have a better understanding of the casual relationships between a lifetime of aging, environment, and well-being through temporal order of the cause (Wunsch et al., 2010).

The first wave of the study was commenced in 2006. This has been followed by biennial surveying of existing cohorts and refresh cohorts. The ongoing recruitment of refresh cohorts enables the study to remain sensitive to the aging experience that may differ between different age cohorts depending on events and policies during their lifetime. The 2006 and 2008 waves were primarily focused on the lives and retirement expectations of New Zealanders aged between 55-70 years of age. The study has since grown; participants are now age 55 and above and its focus has expanded to also include issues of health, work, retirement, and housing (Allen, 2017; Phillips, 2021). Overall, the HWR surveys have three

consistent and broad focuses (health and well-being, social participation, and economic participation) plus a section focused on current points of interest in New Zealand.

4.2. Participants

All participants in the HWR surveys have been selected from a random sample of people on the New Zealand electoral role. Approximately 97.6% of people aged over 50 years are listed on the New Zealand electoral role (Allen, 2017). The original cohort of HWR participants were recruited in 2006 with all persons aged between 55-70 at time of sampling assessed for inclusion in the sample. From this sample of eligible persons, two samples were randomly selected. One representing those who identified as of 'Māori descent' and another representing the 'general' population. The population samples for those who identified on the electoral role as being of Māori descent were over-sampled; to adequately represent this section of the older New Zealand community (Thompson et al., 2021). At selected waves of the study, additional cohorts have been recruited according to the same inclusion criteria. This maintains the studies ability to be sensitive to the life experiences of older adults in New Zealand and accounts for cohort differences and the subsequent effect this has on aging. All cohort recruits from 2006, 2009, 2014, 2016 and 2018 have been re-approached every two years to complete the survey unless excluded due to the being deceased, residing, or relocated overseas, withdrawn from the study, loss of contact, or previously participated in an HWR survey, but not responded to the previous three waves of surveys.

4.2.1. Participants for Current Study

The sample for the present study was drawn from the sixth (2016), seventh (2018) and eighth (2020) waves of the HWR study which were selected for two reasons. Firstly, these were the most recent waves with available data at the time of analysis. Secondly, to estimate a true indirect pathway across two time points in full longitudinal mediation analysis as

employed by this study, at least three waves of data were needed (Little, 2013). All participants were recruited in wave six (2016) or prior. Therefore no 'refresh' participants from waves seven (2018) or eight (2020) were included. Only participants in all three waves were included. After exclusion criteria were applied, the final sample size was 2,445.

4.2.2. Participant Descriptive Statistics

As described in Table 1, the final sample consisted of a relatively even spilt between male (1078) and female (1367) (55.91%). No participants identified as gender neutral. Married/Partnered participants made up 75.83% (*n*=1,854) of the sample with the remaining 24.17% identifying as not Married or Partnered. The current samples gender ratios were similar to the 2018 New Zealand Census data which reported 53.45% of the population aged over 55 years as being female. However, the 2018 New Zealand Census data reported only 66.26% of those aged over 55 years as married or in civil partnership. The current sample was predominately aged below 75 years (87.93%), This is very similar to the 2018 NZ census data which reported 85% of over 55-year-old population as aged under 75 years (StatsNZ, 2020).

As described in Table 2, Social Isolation was overall quite low, 22.29% engaged in none of the participation activities, with only 30.10% participating in one activity. In contrast, the level of perceived Social Support was reasonably high. The mean social provisions score was 79.67 (SD = 9.51). The SES of participants was predominately above 'fairly comfortable' with 2,263 (92.56%) participants rated 'fairly good' or better for SES. Of the 182 (7.44%) categorised as of low SES, 1.72% (42) were of severe hardship, 2.09% (51) significant hardship and 3.64% (89) of some hardship. These figures are like those reported in a 2001 older adult living report that found 5-10% of older adults experienced 'fairly low' to 'low' overall living standards (Ministry of Social Development, 2007).

Table 1.

Table of Quantity of Demographic Variables

Variable	***N***	**%**
Total Sample	2445	100
Gender		
Male	1,078	44.09
Female	1,367	55.91
Unspecified/Gender Neutral	0	0
Age		
55 – 64	1,100	44.99
65 – 74	1,050	42.94
75 – 84	293	11.98
85 – 94	2	0.08
Marital Status		
Married	1,854	75.83
Not Married/De Facto	591	24.17
Living Standards		
Severe Hardship	42	1.72
Significant Hardship	51	2.09
Some Hardship	89	3.64
Fairly Comfortable	177	7.24
Comfortable	388	15.87
Good	957	39.14
Very Good	741	30.31

Table 2.

Table of Descriptive Statistics for Control Variables

Measure	M_{MEAN}	M_{MEDIAN}	*SD*	Range	Raw α	Std α
SI (2016)	1.61	1.00	1.33	0.00-7.00		
SS (2016)	79.67	80.00	9.51	37.00 - 96.00	.92	.92
SES (2016)	25.36	27.00	5.32	0.00 – 31.10	.88	.89
AGE (2016)	65.84	65.00	6.28	55.00 – 88.00		

Note. SI = Social Isolation, SS = Social Support, SES = Socioeconomic Status.

4.2.3. Participant Descriptive Statistics of Measures for Main Constructs

As outlined in Table 3, the mean values for PIL remained stable and relatively high over the 4 years (25.88 – 26.14). The mean Loneliness score decreased slightly between wave 2016 – 2020 (1.01 – 1.17) suggesting on average, participants were not lonely. However, in 2016, 871 (35.62%) participants scored 2 or above, suggesting the presence of Loneliness. This decreased to 756 (30.92%) in 2018 and 734 (30.02%) in 2020. Using the standard cut off score of 13 for Depression, as discussed in measures, 8.26% (202) of the participants screened as likely to receive a clinical diagnosis of Depression in 2016, 9.45 % (231) in 2018 and 9.45 % (231) in 2020. Lastly, participants mean Quality of Life scores remained consistent and reasonably high over all three waves (29.12 (2016), 28.77 (2018) and 28.87 (2020)).

Table 3.

Descriptive Statistics for Main Variables

Measure	*M*	Median	*SD*	Range	Skew	Std α	Raw α
PIL (2016)	25.88	26.00	3.42	9.00 – 30.00	-1	.84	.83
PIL (2018)	26.14	27.00	3.56	10.00 – 30.77	-1	.83	.84
PIL (2020)	25.95	26.00	3.59	6.00 – 30.89	-1	.85	.84
LONE (2016)	1.20	1.00	1.29	-0.58 - 6.00	1	.59	.63
LONE (2018)	1.09	1.00	1.28	0.62 - 6.00	1	.62	.64
LONE (2020)	1.05	1.00	1.24	-1.75 – 6.00	1	.59	.62
DEPR (2016)	5.54	5.00	4.47	0.00 - 28.52	1	.82	.82
DEPR (2018)	5.93	5.00	4.67	0.00 - 29.00	1	.84	.83
DEPR (2020)	6.00	5.00	4.55	0.00 - 29.00	1	.83	.82
QOL (2016)	28.92	30.00	5.16	4.23 - 36.43	-1	.87	.85
QOL (2018)	28.56	30.00	5.32	2.00 - 36.30	-1	.87	.86
QOL (2020)	28.68	30.00	5.14	0.00 - 36.20	-1	.87	.85

Note. Possible ranges for each scale: PIL, 6 – 30; LONE, 0 – 3; DEPR, 0-30; QOL, 0-36.

4.2.4. Exclusion Criteria for Current Study

1. Participants who missed more than 20% (seven or more) of the total item responses from the four main study measures; Purpose in Life, Loneliness, Depression, and Quality of Life, at any one wave.

2. Participants who missed any items from demographic control variables: Gender, Age, and Marital Status. Missing data has been managed using the Ameila package. Which assumes a multivariate normal distribution, so all information about the relations in the data can be summarized by just means and covariances. Given responses to these variables are collected using 1-item responses, estimation of the missing data would be inappropriate (Honaker et al., 2011).

3. Participants who missed more than 20% (ten or more) of the total item responses from control measures; Socioeconomic Status and Social Support.

4. Participant whose responding was overly consistent for main variables with the same answer given for each item in a measure including reverse coded items.

5. Participants who did not participate in one of more of the surveys between 2016, 2018 and 2020.

4.3. Materials

4.3.1. Measures

The HWR survey utilises many measures to collect data on a broad spectrum of aging related issues. To answer the current research hypotheses, ten HWR questionnaire survey measures were required. The measures or scales used to measure the main study constructs (Purpose in Life, Loneliness, Depression, and Quality of Life) and control variables (Age, Gender, Marital Status, Social Support, Social Isolation and Socioeconomic Status) are

detailed in Table 4. The following section contains a brief outline and summary of these selected measures.

Table 4.

Table of Selected Measures used to Capture Study Constructs.

Construct	Measure
Purpose in Life	The Life Engagement Test
Loneliness	The 6-item De Jong Gierveld Loneliness Scale
Depression	Center for Epidemiological Studies Depression Scale (CESD10)
Quality of Life	The Evaluation of a Self-enumerated Scale of Quality of Life (CASP-19)
Socioeconomic Status (SES)	Economic Living Standards Index Short Form (ELSI-SF)
Social Isolation	Social Participation
Social Support	Social Provisions Scale
Gender	Male/ Female or Gender Neutral
Age	Date of Birth
Marital Status	Married; Civil Union/De facto/Partnered Relationship; Divorced or Permanently Separated; Widow or Widower; Single

4.3.2. Dependent Variable Measures

Quality of Life (QOL). Quality of Life was evaluated using the self-enumerated (CASP-12) (Wiggins et al., 2008). It is a subjective measure of well-being based on the theory that human need comprises four life domains: control, autonomy, self-realisation, and pleasure. The 12-item CASP-12 scale combines life domains 'control and autonomy', therefore reflecting a three-factor model of Quality of Life. The 12-item scale includes four negatively framed statements, for example 'I feel left out of things' and eight positively framed statements, for example 'I look forward to each day'. The participant indicates how often the specific statements applies to them using a 4-point Likert scale ranging from

'often', to 'never'. Item scores are rescaled using a 0-3 marking schedule and negative items are reversed. Item scores are summed giving a possible score range of between 0 -30. A higher overall score reflected a greater self-perception of Quality of Life. (Wiggins et al., 1994). Reported subscale internal reliability coefficients for the scale ranged widely between unreliable α = .45 and acceptable α= .8 (Towers et al., 2015). The current study reported an alpha coefficient between .86 - .87, suggesting acceptable scale reliability.

4.3.3. Independent Variable Measures

Purpose in Life (PIL). Purpose in Life was assessed using the 'Life Engagement Test' (LET) (Scheier et al., 2006). The test was developed based on theories of behavioural self-regulation; defining Purpose in Life as the extent a person considers his or her activities to be valuable and important to them. The six-item test comprises of three positively framed questions, for example, "to me, the things I do are all worthwhile", and three negatively framed questions, for example, "there is not enough purpose in my life". Each item is measured using a 5-point Likert scale ranging with 1, indicating 'strongly disagree', through to 5, indicating 'strongly agree'. Negatively framed items 1, 3, and 5 are reverse coded for scoring. Item scores are summed to give a total score ranging between 6 – 30, with a higher score on the scale indicating a higher Purpose in Life.

According to Scheier, et al. (2006), the test is psychometrically sound and retains a 1-factor item structure across a wide spectrum of ethnicities, age groups above eighteen years of age and genders, making it appropriate across a wide group. Using a sample of breast cancer patients and undergraduate students, the test authors report good internal consistency (.72 and .87) and moderate test-retest reliability (.61 to .76). Convergent validity has been supported with significant positive associations found between the LET and optimism, life satisfaction, general health, and self-esteem. Furthermore, significant negative correlations

have been reported between the LET and perceived stress, hostile attitudes, and depression. The alpha coefficient for the current sample was acceptable ranging from .83 - .84.

4.3.4. Mediating Variable Measures

Loneliness (LONE). Loneliness was measured using the self-administered 6-item De Jong Gierveld Loneliness Scale (De Jong-Gierveld & Tilburg, 2006), a short-form version of the original 11-item De Jong Gierveld Loneliness Scale. The 6-item scale is considered appropriate for large scale studies like the HWR as it offers a measure of overall loneliness and a measure of the two components of Loneliness; emotional and social Loneliness, as distinguished by Weiss (1973). The scale has three negatively framed items that measure emotional Loneliness (e.g., "I often feel rejected") and three positively framed items to assess social Loneliness (e.g., "There are many people I can trust completely"). Participants rate their agreeance to each statement using a 3-point scale ("no", "more or less" and "yes"). A dichotomous scoring system is used, where "more or less" indicated loneliness. Before scoring, items 1,5 and 6 require reverse coding. Total scores subscales emotional and social loneliness, range between 0-3. Combining the two subscales, gives a total overall Loneliness score ranging between 0-6.

The scale is considered an empirically valid and reliable measure of emotional, social, and overall Loneliness (De Jong-Gierveld & Tilburg, 2010). Using a sample representative of the general adult population, the scale report's acceptable reliability (.70 and .76) (De Jong-Gierveld & Tilburg, 2006). Emotional Loneliness reported lower α coefficients (.67 to .74) compared to social Loneliness (.70 and .73). Factor analysis supports a 2-factor structure of the scale (De Jong-Gierveld & Tilburg, 2006). The current study reported alpha coefficients between .63 - .65, indicating questionable scale reliability.

Depression (DEPR). Depression was measured using the short form version of the Centre for Epidemiological Studies Depression Scale (CES-D-10) (Andresen et al., 1994). The CESD-10 assesses depressive symptoms from the past week. The scale is designed for screening rather than diagnostic purposes, and therefore appropriate for detecting Depression in large scale studies (Andresen et al., 1994). The 10-item questionnaire has three negative affect statements, five somatic symptom statements and two positive affect statements. Participants score each statement using a 4-point Likert scale "rarely or none of the time" (score of 0) through to "all of the time" (score of 3). The two positive affect statements are reverse scored. Total scores can range from 0 – 30 with higher scores suggesting greater severity of depressive symptoms. Scores of 13 and above indicate the presence of Depression. The CES-D-10 has well-established validity and reliability. A large study using participants from Australia and USA, report a reliability coefficient of $\alpha = 0.70$ (Mohebbi et al., 2018). Other large-scale studies of older adults report good validity including a positive correlation with poorer health status scores ($r = .37$), strong negative correlations with positive affect ($r = -.63$), and retest correlations ($r = .71$). The CES-D-10 has shown good predictive accuracy when compared to the CES-D-20 item version ($\alpha = .97$) (Andresen et al., 1994). Factor structure have been reported as both 2-factor (positive and negative effect) and 3-factor (5-items, somatic symptoms; 2-items, positive effect and 3-items, negative effect). (Lee, 2007; James et al, 2020). The current study reported alpha coefficients between .82 - .84, indicating acceptable reliability.

4.3.5. Control Variable Measures

Sociodemographic Characteristics. Age and sex were included as personal characteristics. Age was considered a continuous variable ranging from 55 to 88 years (M = 65 years, SD = 6.28). Sex was treated as an ordinal variable (0 = male; 1= female, 2= gender diverse).

Marital Status. Marital status was measured through a 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. For analysis purposes response categories were reduced to either Married/Partnered or not Married/Partnered.

Social Isolation (SI). Social Isolation was measured using 'The Social Participation and Belonging Scale'. Participants were asked to indicate which of the following they belonged to: 'sports clubs'; 'community or service organisations that help people'; 'political party, trade union, professional association, or business organisation'; 'religious, church, or other spiritual organisation'; 'hobby, leisure time, or arts association/group'; 'group that supports cultural traditions, knowledge or arts'; and 'any other, club, lodge or similar organisation'. Scoring is 1 point for each organisation they respond 'yes' to and 0 points for each 'no' or missing response. The possible score range is 0 to 8.

Social Support (SS). Social Support was measured using the 'Social Provisions Scale' (Cutrona & Russell, 1987), a 24-item scale designed to assess six relational provisions as identified by Weiss (1974). These are the degree to which the persons social relationships currently supply guidance, reliable alliance, reassurance of worth, social integration, attachment, and opportunity to provide nurturance. Each provision is assessed using four items; two of these assess the presence of the provision while two assess its absence. A study using a sample of college students, schoolteachers, and nurses has reported excellent total support reliability (.92) and item subscale reliabilities ranging between .65 and .76 (Cutrona & Russell, 1987). Previous confirmatory factor analysis indicates a six-factor structure matching the six provisions measured. The discriminant validity of the scale has been demonstrated against relevant measures of mood (e.g., Depression), personality (e.g.,

neuroticism, introversion-extroversion), and social desirability (Cutrona & Russell, 1987). The current study reported a reliable alpha coefficient of $\alpha = .92$.

Socioeconomic Status (SES). Socioeconomic Status was measured using the Economic Living Standards Index Short Form (ELSI-SF) (Jensen et al., 2005). This 25-item survey is a measure of a person's economic standard of living based on their consumption and personal possessions. The measure uses a range of domains to evaluate the persons standard of living. The first domain; ownership restrictions is assessed by 8-items whereby a person indicates the degree to which they are financially restricted or free from restriction of ownership of possessions. The second domain; social participation restriction is assessed by 6-items, whereby the degree to which cost restricts a person's social participation. Third, the degree of economising on key areas including clothing, medical care, and home-heating is assessed using 8-items. The last domain is a self-rated assessment of the persons subjective perception of their financial situation, using 3-items. Participants score each response using either a 3, 4 or 5-point Likert scale. The scale is scored using a total score of all items. To truncate outliers, any score below 10 is set at 10. All total scores are then deducted by 10 to give a score range of 0 to 30. Scores are divided into 7 levels from severe hardship to very good. Previous studies have reported high correlation between the ELSI-SF and full ELSI scale and excellent internal reliability with a coefficient alpha of .88 (Jensen et al., 2005). The current study reported a standard alpha coefficient of .89.

4.4. Procedure

The following outlines the HWR data collection procedures and sample response rates for data relevant to the current study. For further information, see (Allen, 2017; Phillips, 2019; Phillips, 2021).

HWR - Wave 6 (2016).

Wave 6 (2016) of the HWR survey was funded by the Ministry of Business, Innovation and Employment. It had a focus on housing tenure and quality among the older New Zealand population, and how this facilitates social connections among the older New Zealand population.

Participants – Wave 6. The survey was sent to the existing cohort recruited between 2006 – 2014 and a 2016 refresh cohort. All persons on the electoral roll who were born between 05/03/1951 and 04/03/1961 (aged 55- 65 years) were considered for the refresh sample. A survey size for the refresh cohort was determined based on the Dillman et al. (2014) sample size calculation for population surveys. The calculation employs a finite population correction to calculate the target responding sample size. Based on the 2013 census, a non-Māori sample of n = 1,066 respondents and a Māori sample of n = 1,044 respondents, was required to adequately represent the populations of interest. As per the 2006 sampling protocol (Towers et al., 2015), there was an oversampling of persons who indicated of Māori descent in the New Zealand electoral roll as of 4th March 2016, this was to ensure adequate observations from the indigenous Māori population (Phillips, 2017). The final response to the 2016 survey (wave 6) was n = 4,028 (51.5%) responses.

On the 23 June 2016, a survey package was sent to all participants (existing cohort and refresh cohort) consisting of an introduction sheet, pen, a 24-page postal survey, consent form (if applicable) and reply-paid return envelope. Only 'refresh' participants were asked to consent to both the longitudinal survey and the health data-linkage study (Allen, 2017). Two reminders were sent to participants. The first was sent to all participants on 8 July, 2 weeks after initial contact, and a second reminder was sent 9 weeks after initial contact, on the 28 August. The second reminder that included a final reminder letter, information sheet, survey

booklet, and a reply-paid return envelope was sent to only those who without reason had not returned their survey.

Response Rate of Existing Cohort. Of the existing participant sample (n = 3,525), 2,757 (78.2 %) returned a completed survey. The response rate for men, n = 1,217, (77.1%) was similar to women, n = 1,540, (78.0%) (Phillips, 2019).

Response Rate of Refresh Cohort. Of the existing participant sample (*n = 4,298)*, 1,272 (29.6%) returned a completed survey. The response rate for men (28.2%) was again similar to women (31.1%) (Phillips, 2019).

HWR - Wave 7 (2018).

Wave 7 (2018) of the HWR study was funded by the Ministry of Business, Innovation and Employment. The postal survey focused on employment, workability, and workplace discrimination among the older New Zealand population (Phillips, 2019).

Participants – Wave 7. The 2018 survey was sent to the existing cohort participants recruited between 2006 – 2016 who meet criteria, and an additional 2018 refresh cohort. As the refresh cohort for 2018 were not included in this study, no further details are given here. For further details on the 2018 refresh cohort, please see (Phillips, 2019).

On the 1 August 2018, a survey package consisting of an introduction sheet, pen, a 32-page postal survey, consent form and reply-paid return envelope was sent to the existing participant cohort. Two follow-up reminders were sent to participants. The first was sent to all participants, 3 weeks after initial contact, and a second 12 weeks after initial contact. The second reminder was sent to only those who without reason had not returned their survey and included a final reminder letter, information sheet, survey booklet, and a reply-paid return envelope.

Response Rate of Existing Cohort. Of the existing participant sample (*n* = 4,369), *n* = 3,366 (77.0%) returned a completed survey. The response rate for persons not indicated as being of non-Māori descent (*n* = 2,186, 81.4%) was higher than the response rate for persons indicated as being of Māori descent (*n* = 1,175, 69.9%). The response rate for men (n = 1,478, 76.0%) was like women (*n* = 1,886, 78.0%) (Phillips, 2019). See Table 5.

HWR - Wave 8 (2020)

Wave 8 of the HWR study was funded by the Ministry of Business, Innovation and Employment. This survey focused on employment, workability, and workplace discrimination among the older New Zealand population.

Participants – Wave 8. Persons from cohorts recruited in 2006, 2009, 2014, 2016 and 2018 were surveyed in 2020 if they were not excluded (deceased, relocated overseas, withdrawn from the study) or lost to contact. As the refresh cohort for 2020 were not included in this study, no further details are given here. For further details on the 2020 refresh cohort, please see (Phillips, 2021).

On the 11th of June, 2020, existing cohorts recruited between 2006 – 2018 and a refresh cohort who were being invited to participate in the survey for the first time, were sent a survey pack consisting of an introductory letter, information sheet, pen, a 36-page postal survey, consent form and reply-paid return envelope. Two follow-up reminders were sent to participants. The first follow-up was sent to all participants on the 7 July, 2020, three weeks after initial contact and a second follow-up was sent on the 17 September, 12 weeks after initial contact. The second reminder was only sent to those who without reason had not returned their survey. The second reminder included a final reminder letter, information sheet, survey booklet, consent form and a reply-paid return envelope (Phillips, 2021).

Response Rates. From the existing cohort (recruited prior to 2020) (n = 4,614), *n* = 3,480 (75.4%) returned a completed survey. The response rate for persons not indicated as being of Māori descent (*n* = 2,251, 80.8%) was higher than the response rate for persons indicated as being of Māori descent (n = 1,224, 67.1%). There was little difference in the response rate for men (*n* = 1,510, 74.8%) and women (*n* = 1,968, 76.0%). Participants from the 2020 existing cohort who were recruited in the 2018 refresh cohort were later removed. See Table 5.

Table 5.

Table of Response Rates

Sample				Response					
Year	Existing (N)	Refresh (N)	Total (%)	Existing (%)	Refresh (%)	Existing		Refresh	
						Male (%)	Female (%)	Male (%)	Female (%)
2016	3,525	4,298	51.50	78.20	29.60	77.10	79.10	28.20	31.10
2018	4369			77.00		76.00	78.00		
2020	4,614			75.40		76.00	74.80		

4.5. Procedure

4.5.1. Data Preparation

Within Excel, identifying column, 'participant ID number' was deleted. Likewise, columns containing data that were superfluous to the present study were deleted for cleanliness. Loneliness, Depression, and SES scores were rescored according to measure criteria outlined above. In line with the study's longitudinal design, participants who did not participate in all three waves of study were deleted (*n*= 173). Participants with excessive consistent responding for a main variable were removed (*n*= 270). Lastly, a summed score for social participation was added in a separate column. The remaining data set was saved as a deidentified file and loaded into RStudio for the remainder of the analyses and data preparation.

As per the exclusion criteria listed above, 46 participants who missed more than 20% of the total item responses for main variables or control variables in a wave were deleted. Relevant items were reverse coded, as specified in the measures section and redundant non-reversed columns were deleted. Indices were then created to establish mean scores and totals for all variables. Items were scored according to guidelines outlined in the measures section. To simplify data analysis and syntax, groups (greps) were established for each individual variable and vectors were established to combine main and control variables. The data was now ready for missing data analysis and imputation of missing data.

4.5.2. Missing Data

A missing data analysis was carried out on variables in the final sample. Overall, .46% of data was missing from variables used in the main analyses across all three waves. All four of the main variables maintained very low levels of missing data. Purpose in Life had the lowest rate of missing data (.08% - .44%). The remaining main variables had slightly higher rates of missing data but remained relatively low for Loneliness (.13% - .53%), Depression (.44% - .72%) and Quality of Life (.34% - .63%). Full details of missing data for each measure can be found in Table 6. Control variables - Age and Gender, had no missing data, however 23 participants had missing data for Marital Status. Missing data for the remaining control variables was relatively low for Social Support (.68%) and SES (1.44%). There was no missing data for Social Isolation.

A Little's MCAR test for the missing data was significant, suggesting the data was not missing completely at random (MCAR) (Little, 1998). It was assumed that the data was missing at random (MAR) and single expectation-maximisation imputation with no bootstrapping was used to implement missing data using the Amelia package in RStudio (Kline, 2016). This two-step process firstly imputed missing data with a predicted score through a series of regressions. The whole imputed data set is then entered for maximum

likelihood estimation. When auxiliary variables such as age and gender are anticipated in the MAR pattern, they can help predict the missingness of other variables and decrease potential bias that can occur due to lack of strength in the missingness pattern prediction (Kline, 2016).

Table 6.

Table of Missing Data from Main Variables and Control Variables

Measure	N	%
Total Missing Data	2525	.62
Main Variables		
Total Missing Data from Main Variables	1187	.46
PIL (2016)	12	.08
PIL (2018)	66	.44
PIL (2020)	38	.25
LONE (2016)	20	.13
LONE (2018)	80	.53
LONE (2020)	64	.42
DEPR (2016)	110	.44
DEPR (2018)	171	.68
DEPR (2020)	182	.72
QOL (2016)	101	.34
QOL (2018)	190	.63
QOL (2020)	153	.51
Control Variables		
Total Missing Data from Main Variables	1315	1.07
Age	0	0
Gender	0	0
Marital Status	23	.16
Social Support (SS)	408	.68
Social Isolation (SI)	0	0
SES	907	1.44

Note. PIL: Purpose in Life, LONE: Loneliness, DEPR: Depression, QOL: Quality of Life, SES: Socio-economic Status.

4.5.3. Data Analysis

All analysis was conducted using RStudio and the R programming language (Poist, 2023). Data preparation was run in both Excel and R Studio. Data for the requested measures was received from the HART research team at Massey University on the condition of agreeance with their data sharing policy. Data was received as a secure SPSS data file and converted to a EXCEL.csv file.

R programming language (Poist, 2023) and five packages were used to run the analysis. The Lavaan package was used for structural equation modelling (Rosseel et al., 2023). The Amelia package was used for missing data (Honaker et al., 2022). For correlations, reliability and descriptive statistics, the psych package was used (Revelle, 2021). The moments package was used for descriptive statistics to find the skewness of the three main measures (Komsta & Novomestky, 2015) and the Plyr package was used for splitting, applying, and combining data (Wickham, 2011). Lastly, figures were produced using the diagrams.drawio app. ("*diagrams"*, n.d.).

Item Parcelling. Item parcelling was used to aggregate the 10-items from Depression measure (CESD-10), and 12-items from Quality-of-Life measure (CASP12) into parcels instead of items, as indicators of the latent construct (Matsunaga, 2008). To deal with the multidimensional nature of these item sets, items were parcelled based on the measures three factor structures. Factor structures are as determined by previous literature and detailed in the 'measures' section. Furthermore, this ensured each parcel was unidimensional, a prerequisite of item parcelling (Little et al. 2002). Indicator items of latent variable Purpose in Life was not parcelled due to the measures 1-factor structure, nor was Loneliness due to concerns a two-item parcel would not be identified (Little et al., 2002). Using item parcelling allowed for a more parsimonious specification of a large and complex model.

Ordering. After rescaling of scores according to the measure's guidelines, latent variable, Loneliness was treated as an ordinal endogenous variable. Therefore, items used as indicators of latent variable Loneliness were directed as ordered factors to ensure RStudio package, Lavaan treated the variables as ordinal (Rosseel et al., 2023). Loneliness items were 'ordered' when the model fit was commanded in RStudio (ResearchGate, 2019).

4.6. Descriptive Analyses

Descriptive statistics for the four main scales and six control variables, included:

- The mean, median, standard deviation, skewness, minimum and maximum scores,
- The Cronbach's alpha reliability for main variables; Purpose in Life, Loneliness, Depression, and Quality of Life, at each of the three waves, and control variables; Social Support and SES. Determining internal reliability was not considered necessary for Social Isolation, Gender, Age, and Marital Status. Cronbach's alpha is most useful when the measure uses multiple Likert questions to form a scale, which these four didn't (Laerd, 2018).
- A Pearson's correlation matrix for all eighteen variables.

The data was now ready to use in the structural equation model.

4.7. Structural Equation Modelling (SEM)

SEM was the primary analysis used to answer the proposed hypotheses that Depression and Loneliness mediate the relationship between Purpose in Life and Quality of Life. The full R-Studio Syntax used for analysis can be found in Appendix A. The full-longitudinal mediation, cross-lagged panel model specifies the prediction that Purpose in Life has a causal effect of increased Quality of Life 4 years into the future directly and when mediated by Depression and Loneliness, after controlling for autoregressive effects of each latent variable and confounding variables in 2016. This combines a powerful statistical

technique that accounts for measurement error and longitudinal data that is modelled to examine change over three time points. Therefore, improving our understanding of how causal effects unfold over time, while also controlling for confounding variables and multiple pathways (Little, 2013).

SEM has been chosen because fundamentally it is a statistical technique that tests causal relationships of variables as specified by a model that is based on a theory or empirical literature. The current model has been specified based on previous literature and theories as outlined in the literature review, of Purpose in Life, Depression, Loneliness and Quality of Life (Kline, 2016). This is an important consideration, as the quality of the output received from SEM analysis is determined by the quality of theory and empirical research that is used to specify the model. While there remains some variation in findings related to the relationships between these variables, the current model is based on previous findings from similar populations. Also, important is that use of reliable observed variables, that are good indicators of the latent variables. All observed variables except Loneliness are supported by good to strong reliability in the current samples and as demonstrated by previous literature (Kline, 2016).

Central to SEM is the distinction between latent variables, that are hypothetical constructs which cannot be measured directly, and observed variables which act as indicators to the latent variables. In the current study, Purpose in Life, Loneliness, Depression, and Quality of Life all act as latent variables, and item scores acted as observed variables. Additionally, SEM models include both endogenous and exogenous variables. An endogenous variable, acts as a dependent variable, owever, can become an independent variable in another SEM equation. An exogenous variable is always an independent variable in the SEM equation. This is beneficial to the current study where endogenous mediating variables become independent variables to determine directional relationships between

mediating and dependent variable, Quality of Life. A SEM equation can model both causal relationships between exogenous and endogenous variables and between endogenous variables (Gunzler et al. 2013). In SEM, the dependent variable in one model can become the independent variable in other components of the SEM system. It is this flexibility of variables in SEM that enables SEM to infer causal relationships (Gunzler, 2013). This is beneficial to the current study where endogenous mediating variables become independent variables to determine directional relationships between mediating and dependent variable, Quality of Life. Likewise, ensuring the accuracy of the measured variables is also important in making causal inferences. The validity of causal inferences can be biased by measurement errors in the predicting variables and confounding variables. However, modelling the main variables as latent variables explicitly accounts for measurement error (Rohrer, 2018). Overall, the use of SEM in the current research provides flexibility and an ability to account for measurement error which strengthens causal inference.

The CLPM model is a popular choice for longitudinal mediation models because it incorporates repeated measures of latent variables, in other words, cause, mediator, and outcome. Therefore, estimating and accounting for auto-aggressive parameters and allowing for many different indirect effects to be accounted for. This partly accounts for unobserved confounders, for example unobserved confounders which have temporal effects are not problematic as the confounding goes through prior measurements of the factor included in the model and are thus statistically accounted for. The inclusion of autoregressive effects is believed to reflect the stability of individual differences in a variable over the two-year time lapse between waves (Preacher, 2015; Goldsmith et al., 2018). However stable time invariant confounding variables can be more problematic, potentially resulting in bias estimates if not accounted for (Rohrer & Murayama, 2023). Therefore, time invariant control variables; Age, Gender, Marital-Status, Socioeconomic Status, Social Isolation, and Social Support, are

controlled for in exogenous latent variables in 2016. Open 'back-door' paths of control variables are blocked from transmitting a noncausal association, in other words, the transmission of the effects of these variables is statistically controlled for in 2016 (Rohrer, 2018). Overall, the control of time invariant confounding variables strengthens justification of causal inference.

Further to CLPMs ability to control for confounders, other benefits include its ability strengthen causal mediation inference, by providing at least three time points, that when optimal time periods (lag) between points are used, can estimate a true indirect effect (Little, 2013). The HWR survey data is collected every two years, therefore lag between time points was set at 2 years for this study. International studies of ageing, including the US Health and Retirement Study and the English Longitudinal Study of Ageing, in which the HWR is modelled, use a two-year interval between waves (Massey, 2018). This further strengthens the assumption that two years is the optimal lag time between waves to detect the effects of Purpose in Life on loneliness and Depression, and Loneliness and Depression on Quality of Life (Little, 2013). Furthermore, the use of multiple lags compensates for any variation in effects due to duration between waves, therefore strengthening the findings (Selig et al., 2012).

However, important considerations that need to be noted in relation to interpretation and generalisability of indirect effects from a CLPM, is its assumption that stability, stationarity, and equilibrium remain stable. Stability refers to the degree to which the individual differences in the variable are maintained over time, stationarity refers to the assumption that the causal structure remains stable, and equilibrium assumes that cross-sectional variances and covariances remain stable (Hamaker et al., 2015). Descriptive statistics and a correlational matrix of the main variables, suggest these assumptions have been meet.

Lastly, of consideration is the model's multiple mediators. The proposed model has two mediators (Depression and Loneliness) that are believed to be correlated and meditate the causal relationship between Purpose in Life and Quality of Life. Therefore, parallel mediation was considered the most appropriate to test the hypothesis as the two mediators; Loneliness and Depression, are allowed to correlate with one another, but not to influence each other in causality (Hayes, 2013). A parallel mediation with two mediators allows for two indirect effects defined as a1b1 and a2b2 that go through M1 (Loneliness) and M2 (Depression) respectively (Kane & Ashbaugh, 2017). Loneliness and Depression are distinct forms of psychological distresses that may play different roles in the relationship between Purpose in Life and Quality of Life. By using parallel mediation, we can test the mediating effects of two dimensions of psychological distress and understand if one has a larger effect than the other.

Hypotheses 6 to 9 were tested via a latent variable, cross-lagged, full longitudinal parallel mediation model using structural equation model (SEM). Purpose in Life, Loneliness, Depression, and Quality of Life were all treated as latent variables. The control variables Gender, Age, Marital Status, Social Isolation, and Social Support were also treated as observed variables. See Figure 1. Regressions between control variables and exogenous variables and autoregressive effects were defined in the Lavaan command. Additionally, covariances between control variables were defined in the Lavaan command. The proposed model contains both direct and indirect effects. To express this structural model with Lavaan, the model specification command defines the latent variables in terms of their observed indicators. The direct effect from PIL (2016) and QOL (2020) was then defined and labelled (c). The parallel mediator effects were defined by first linking Purpose in Life with Loneliness (coefficient a1), and Loneliness with Quality of Life (coefficient b1). Next Purpose in Life was linked with Depression (coefficient a2), and Depression with Quality of Life (coefficient b2). The indirect effect of Purpose in Life on Quality of Life is product of

the mediator coefficients (a1*b1 + a2*b2). Finally, the total effect was estimated for Purpose in Life on Quality of Life by adding the direct effect (c) to the indirect effects (a1*b1 + a2*b2) (Finch & French, 2015).

4.8. Model Fit and Estimation

Diagonally weighted least squares, with robust standard errors (WLSMV) from the Lavaan package was the estimation method selected. This was chosen over default estimator maximum likelihood (ML) as unlike maximum likelihood, diagonally weighted least squares is specifically designed for ordinal observation data. While DWLS makes no distributional assumptions about the observed variables, a normal latent distribution underlying each observed categorical variable is instead assumed (Li, 2016).

Previous literature empirically supports the factor structures of the measures; therefore, a confirmatory factor analysis (CFA) was not fitted to each latent variable.

The following DWLS estimation method fit statistics were reported:

• The root-mean square error of approximation (RMSEA) and associated 90% confidence intervals.

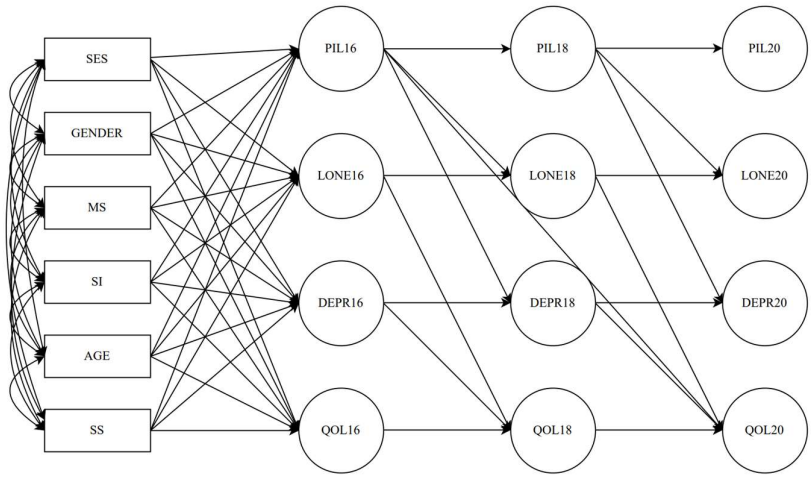
• The standardised root-mean square residual (SRMR)

• The comparative fit index (CFI)

• Chi-squared test and its associated *p*-value

Figure 1.

Structural Model Depicting Longitudinal, Mediational Pathways



Note. Following standard SEM practice, the circles depict each latent variable: Purpose in Life (PIL), Loneliness (LONE), Depression (DEPR) and Quality of Life (QOL). Rectangles are used to depict the six control variables, which are treated as observed variables. Double-headed arrows indicate correlations, and single-headed arrows indicate causal paths. For brevity, the observed variables which are the items of each latent variable, and error terms are not displayed.

4.9. Ethics

These procedures have received ethical approval. The HWR wave 6 (2016), wave 7 (2018) and wave 8 (2020) were granted ethics approval by the Massey University Human Ethics Committee (Southern A application 15/73; Health, Work and Retirement survey 2016-2018 (Allen, 2017); HEC: Southern A Application – 18/34; Health, Work and Retirement Study 2018 (Phillips, 2019); Southern A application 20/07; Health, Work and Retirement Study 2020, respectively (Phillips, 2021).

5.0. Results

5.1. Correlations Analysis

Pearson's Correlation was performed to analyse the relationship between main study variables at each wave and control variables at wave six. As expected, each of the main variables were strongly correlated with the same construct at different waves. Purpose in Life (PIL) was weakly correlated to Loneliness (LONE), weakly to moderately ($.50 < r < .75$) correlated to Depression (DEPR) and moderately correlated to Quality of Life (QOL). LONE was only weakly correlated to both DEPR and QOL, whereas DEPR was moderately to strongly correlated to QOL (See Table R1). Control variables, Age, Gender, and Marital Status (MS) were not correlated ($r < .25$) to any of the main study variables. However, SES and Social Support (SS) were weakly correlated to the main study variables (See Table 7).

Hypotheses 1-5. Pearson Coefficient correlations showed that the Hypotheses 1-5 were supported (see Table 7). PIL (2016) was significantly positively related to QOL (2020) and negatively related to LONE (2018) and DEPR (2018), LONE (2018) and DEPR (2018) were negatively related to QOL (2020).

5.2. Structural Equation Model Analysis

A statistical diagram of the hypothesized parallel multiple mediator CLPM model is shown in Figure 2, Structural equation modelling (SEM) was used to test hypotheses 6 to 9, where PIL, DEPR, LONE and QOL were all treated as latent variables. Four global fit statistics of the model were tested using model test statistic: Chi-square statistic and three approximate fit indexes; the root mean square error of approximation (RMSEA), the Bentler Comparative Fit Index (CFI) (Bentler, 1990), and Standardized Root Mean Square Residual (SRMR) (Kline, 2016).

Table 7.

Pearson's Correlations Among the Study Variables

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. PIL (2016)	1.00																	
2. PIL (2018)	.65	1.00																
3. PIL (2020)	.61	.66	1.00															
4. LONE (2016)	-.43	-.36	-.34	1.00														
5. LONE (2018)	-.39	-.41	-.37	.58	1.00													
6. LONE (2020)	-.38	-.38	-.45	.57	.62	1.00												
7. DPR (2016)	-.54	-.49	-.48	.35	.34	.32	1.00											
8. DPR (2018)	-.48	-.61	-.52	.33	.41	.37	.68	1.00										
9. DPR (2020)	-.43	-.50	-.63	.32	.36	.42	.62	.70	1.00									
10. QOL (2016)	.64	.57	.55	-.45	-.41	-.39	-.73	-.64	-.59	1.00								
11. QOL (2018)	.54	.65	.57	-.39	-.45	-.40	-.61	-.76	-.64	.76	1.00							
12. QOL (2020)	.52	.58	.68	-.36	-.40	-.45	-.58	-.66	-.77	.73	.78	1.00						
13. Age (2016)	-.01*	-.04*	-.07	-.07	-.07	-.07	-.01*	.00*	.03*	.00*	-.01*	-.07	1.00					
14. Gender (2016)	-.10	-.06	-.05**	.10	.06*	.08	-.04**	-.04*	-.04*	-.04*	-.02*	.02*	.06	1.00				
15. MS (2016)	-.09	-.09	-.09	.07	-.09	.06*	.16	.12	.11	-.12	-.13	-.11	.08	-.17	1.00			
16. SS (2016)	.58	.48	.48	-.55	-.47	-.46	-.42	-.39	-.36	.50	.45	.44	-.04*	-.10	-.19	1.00		
17. SI (2016)	.17	.12	.13	-.09	-.07	-.05	-.07	-.06	-.06	.13	.10	.10	.17	-.04	.00	.13	1.00	
18. SES (2016)	.34	.32	.30	-.29	-.30	-.28	-.45	-.45	-.39	.55	.52	.48	.05	.07	-.25	.35	.05**	1.00

Note. $p < .001$, *$p > .05$, **$p < .05$

The Chi-square statistic was significant, $p = .000$, indicating the null hypothesis of the exact fit in the model to the population can be rejected. However, given the large sample size of the current study, the chi-square test is not a suitable measure of fit as it usually significant when the sample size is large (Kenny, 2020). A RMESEA score of zero indicates a perfect fit, the current model gave .033 [.032, .034] suggesting a good fit (Kline, 2016). The SRMR which measures the difference between the observed correlation and the predicted correlation, reached the acceptable threshold with a standardised SRMR estimate of .052. A score of 0 indicates a perfect model, a score of .08 or less is recommended for a good fit (Hu & Bentler, 1999) with scores greater than .10 indicating a poor fit. Lastly, a standard CFI of 0.981 indicated a good model fit where 1.0 is a perfect fit (Kline, 2016). Overall, three of the four measures of fit were good.

5.2.1. Parallel Multiple Mediator Model for QOL Amongst Older Adults

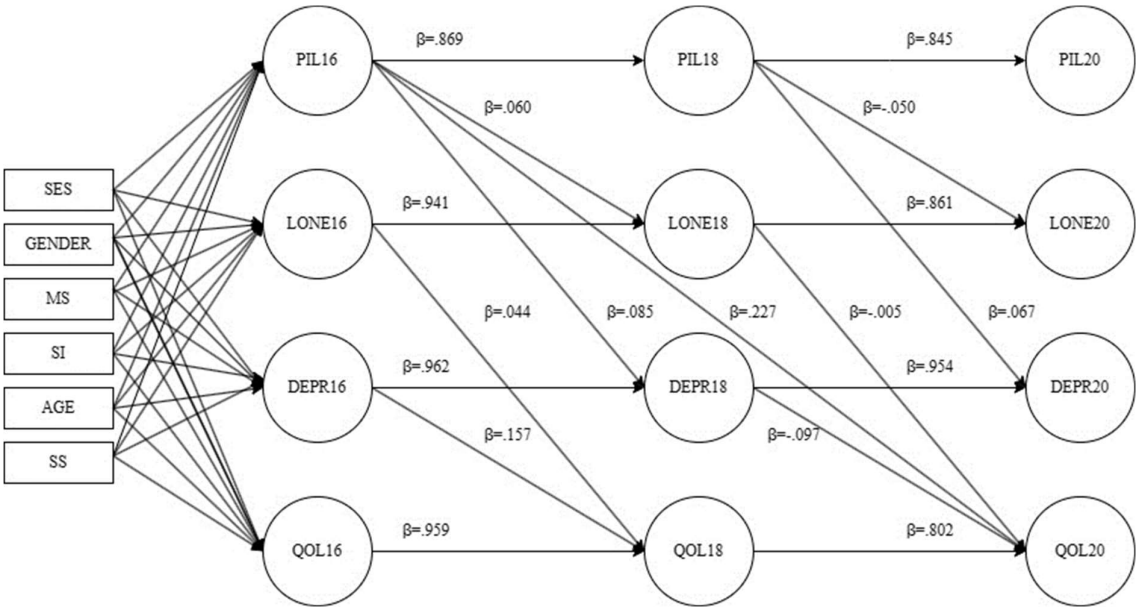
The effect of PIL through DEPR and LONE to QOL (path a_1b_1; path a_2b_2) was examined. Table 10 shows that a significant total effect ($a_1b_1 + a_2b_2 + c$) and direct effect were found. However, the indirect effects were not statistically significant. As shown in Table 8 and Table 9, only one single path was significant (PIL to DEPR), however its positive direction was not expected. All other single paths were not significant.

The hypothesised findings controlled for prior levels of each variable which was achieved by using a cross-lagged-panel-model. To better understand the effect prior levels had on each variable, a SEM latent variable analysis was run to determine the effect of each variable on itself two years into the future. This was in addition to the hypothesized mediation relationship from PIL (2016) through LONE (2018) and DEPR (2018) to QOL (2020). The SEM analysis found prior levels of each variable to be a strong and positive indicator of future levels (See Table 9). The lowest effect was found between QOL (2018) to

QOL (2020) (β = .802), while the strongest effect was found between DEPR (2016) to DEPR (2018) (β =.962).

Figure 2.

Structural Equation Model Depicting Pathway Regressions



Note. This structural equation model predicts that Purpose in Life (2016) predicts Loneliness (2018) (a1) and Depression (2018) (a2), in turn Loneliness (2018) (b1) and Depression (2018) (b2) predicts Quality of Life (2020). Autoregressive effects for each of the main variables is accounted for. Statistics are standardised regression coefficients.

Hypothesis 6

The regression paths between PIL and QOL when mediated by LONE and controlling for DEPR needed to be positive and statistically significant for the hypotheses to be supported. Hypothesis 6 was not supported: The effect of PIL (2016) on QOL (2020) when mediated by LONE, after controlling for DEPR, Age, Gender, MS, SES, SI, and SS was not significant (estimated regression path *a1b1* = -.001, 95% CI [-.000, -.000], p = .771). See Table 10.

Hypothesis 7

The regression paths between Purpose in Life and Quality of Life when mediated by DEPR and controlling for LONE needed to be positive and statistically significant for the hypotheses to be supported. Hypothesis 7 was not supported: The effect of PIL (2016) on QOL (2020) when mediated by DEPR after controlling for LONE, Age, Gender, MS, SES, SI, and SS, was not statistically significant (*a2b2* = -.015, 95% CI [-.051, -.032], p = .644). See Table 10.

Hypothesis 8

The regression paths between PIL and QOL when controlling for DEPR and LONE needed to be positive and statistically significant for the hypotheses to be supported. Hypothesis 8 was supported: The direct effect of PIL (2016) on QOL (2020) when controlling for DEPR and LONE was positive (estimated regression path *c* = 0.243, 95% CI [0.128, 0.357], p < 0.001). See Table 10.

Hypothesis 9

The regression paths between PIL and QOL when mediated by DEPR and LONE needed to be positive and statistically significant for the hypotheses to be supported. Hypothesis 9 was supported: The Total Effect (sum of the direct and indirect effects) of PIL (2016) on QOL (2020) when mediated by DEPR and LONE in 2018, was positive and statistically significant (estimated regression = 0.227, 95% CI [0.115, 0.339], p < 0.001). See Table 10.

Table 8.

Structural Model Assessment

Regression	B	β	SE	*p*-value	95% CI	
					LL	UL
PIL(2016) → PIL (2018)	.906	.869	.030	.000	.841	.970
PIL (2016) → LONE (2018)	.056	.060	.031	.068	-.004	.116
PIL (2016) → DEPR (2018)	.135	.085	.054	.013	.028	.241
PIL (2018) → PIL (2020)	.883	.845	.030	.000	.824	.942
PIL (2018) → LONE (2020)	-.062	-.050	.028	.025	-.116	-.008
PIL (2018) → DEPR (2020)	.099	.067	.038	.008	.026	.173
LONE (2016) → LONE (2018)	.665	.941	.051	.000	.566	.764
LONE (2016) → QOL (2018)	.116	.044	.054	.032	.010	.221
LONE (2018) → LONE (2020)	1.177	.861	.075	.000	1.030	1.324
LONE (2018) → QOL (2020)	-.019	-.005	.064	.768	-.144	.106
DEPR (2016) → DEPR (2018)	1.021	.962	.046	.000	.931	1.110
DEPR (2016) → QOL (2018)	.157	.067	.144	.276	-.125	.439
DEPR (2018) → DEPR (2020)	.933	.954	.034	.000	.866	1.00
QOL (2016) → QOL (2018)	.976	.959	.066	.000	.846	1.106
QOL (2018) → QOL (2020)	.758	.802	.049	.000	.662	.855

Note. β – standardised coefficient; B = estimated coefficient; SE = standard error; LL = lower level 95% confidence interval; UL = upper level 95% confidence interval; PIL = Purpose in Life; LONE = Loneliness; DEPR = Depression; QOL = Quality of Life.

Table 9.

Model Summaries for Main Variables in Parallel Mediator Model Depicted in Figure 1.

Variables	M_1 (LONE)				M2 (DEPR)				Y(QOL)			
	Path	β	SE	*p-value*	Path	β	SE	*p-value*	Path	β	SE	*p-value*
X (PIL)	a_1	.060	.031	<.068	a_2	.085	.054	<.013	*c'*	.074	.059	<.000
$M_{1(LONE)}$									b_1	-.005	.064	<.768
$M_{2(DEPR)}$									b_2	-.052	.097	<.266

Note. $M_{1(LONE)}$ = mediating variable Loneliness, $M_{2(DEPR)}$ = mediating variable Depression, Y(QOL) = dependent variable Quality of Life, X (PIL) = independent variable Purpose in Life, SE = standard error, β = standardised coefficient.

Table 10.

Total Direct and Indirect Effects for Parallel Multiple Mediator Model

Measure	B	β	*p*	95% CI	
				LL	UL
Model without mediators	.243	.074	.000	.128	.357
Direct effect (*c*)					
PIL (2016) → QOL (2020)					
Model with mediators	.227	.069	.000	.115	.339
Total effect (*c'*)					
PIL (2016) → QOL (2020)					
Indirect effect (a_1b_1)	-.001	-.000	.771	-.008	.006
PIL (2016) → $LONE_{M1}$ (2018)					
→ QOL (2020)					
Indirect effect (a_2b_2)	-.015	-.004	.306	-.042	.013
PIL (2016) → $DEPR_{M2}$ (2018)					
→ QOL (2020)					
Contrast	-.028	-.113	.804	-.249	.193

Note. B = unstandardised coefficient; β = standardised coefficient; CI = confidence interval; PIL = purpose in life, DEPR = depressive symptoms; QOL = quality of life; LONE = loneliness; LL – lower level 95% confidence interval, UL – upper level 95% confidence interval; X = independent variable; Y = dependent variable, → = affect; total effects (*c*) = direct effect (*c*') + indirect effects ($a_1 b_1 + a_2b_2$).

6.0. Discussion

6.1. Introduction

The current study primarily aimed to investigate the mediating effects of Loneliness and Depression in the directional relationship between Purpose in Life and Quality of Life. Additionally, it was hypothesised that negative bivariate correlational relationships exist between Purpose in Life and both Depression and Loneliness, and Loneliness and Depression with Quality of Life. In other words, greater perceived Purpose in Life plays a protective role against developing Loneliness and Depression, which results in higher levels of future Quality of Life in older adults.

6.2. Purpose in Life's Relationship with Quality in Life

Consistent with the existing literature, the current research found a strong bivariate relationship between Purpose in Life (2016) and Quality in Life (2020). This suggests maintaining higher perceived Purpose in Life is associated with a higher level of self-perceived Quality of Life. These findings contribute to the growing cross-sectional research that increasingly recognises the protective role of Purpose in Life. Additionally, structural equation modelling (SEM) analysis was used to determine the directional relationship. When potential confounding variables (Marital Status, Social Isolation, Social Support, Age, Gender, SES, and prior levels Quality of Life) were controlled for, Purpose in Life significantly predicted Quality or Life four years into the future. This suggests Purpose in Life protects against future declines in Quality of Life. Longitudinal research looking specifically at the relationship between Purpose in Life and Quality in Life remains scarce; this finding contributes an important addition to the literature and provides further evidence of a directional relationship between Purpose in Life and Quality of Life.

These findings support key theories that explain higher Purpose in Life as aiding a better appreciation of why challenges are worth enduring (Frankl, 2006). Furthermore, empirical evidence suggests Purpose in Life fosters resilience against short-term challenges, stressors, and daily hassles (Hill et al., 2018; Kim et al., 2019; McKnight & Kashdan, 2009; Musich et al., 2018). Additionally, people with a higher sense of purpose have been found to display a heightened ability to curb impulsivity (Burrow and Spreng, 2016), and report higher self-efficacy (Rush et al., 2020). This suggests Purpose in Life disrupts stress-unhealthy behaviour pathways. Consequently, they are less likely to make impulsive decisions related to unhealthy behaviours and instead engage in healthier behaviours like exercise or pursue interests, even if they are not immediately appealing. There is also evidence of purpose been associated with greater long term physiological health based on metabolism, inflammation, and nervous system functioning (Zilioli et al., 2015). This subsequently can provide potential support and promote better psychological and physical health in older age; a time often associated with changes in personal resources, and physical and mental decline (Kashdan & McKnight, 2009; Kim et al., 2013).

6.3. Purpose in Life and Changes in Loneliness and Depression

Consistent with the existing literature, we found Purpose in Life to have a moderate to strong negative correlational relationship with Depression (Nkyi & Ninnoni, 2020) and Loneliness (Bondevik & Skogstad, 2000; Neville et al., 2019; Sutin et al., 2022). This suggests a greater sense of Purpose in Life is associated with lower levels of Depression and Loneliness.

Empirically and theoretically, individuals with a greater sense of purpose tend to have better mental health and less psychological distress. Theoretically two possible explanations for the relationship are that a greater sense of purpose creates more psychological flexibility

and promotes flexible responding to disruption, that may lead to psychological distress (Laird et al., 2019; McKnight & Kashdan, 2009). Additionally, a small but growing body of research suggests Purpose in Life provides a protective function against Depression via increased resilience (Musich et al., 2022). This is supported by prior research using clinical samples, that found higher Purpose in Life was associated with lower depressive symptoms (Smith & Zautra., 2004; Heisel & Flett., 2004).

Structural equation modelling was used to understand potential directional effects of Purpose in Life on Depression two years into the future. A significant and positive coefficient was reported. The results are in partial agreeance with prior findings by Hedberg et al. (2010) found approximately a quarter of participants with high Purpose in Life, and without Depression at baseline had developed Depression after five years. However, given the theory and prior empirical cross-sectional findings supporting an overall negative effect, these findings are unusual. There are a few possible explanations; the most likely is that the effect is spurious. Alternatively, the relationship may be the effect of other unidentified time-variant confounding variables operating between 2016 and 2018 (Rohl et al., 2018). Another important consideration that is discussed in more detail below is the problem of multicollinearity. Multicollinearity can lead to SEM estimates that are inaccurate. There are some assurances that multicollinearity is not operating; only moderate correlations were found between Purpose in Life and Depression at all waves including exogenous variables from wave six (2016).

The current research also used SEM to understand potential directional effects of Purpose in Life on Loneliness two years into the future. The results did not show any significant directional relationships between Purpose in life (2016) and Loneliness (2018) while controlling for Age, Gender, Martial-Status, Social Isolation, Social Support and SES. There is some existing support for these findings. A recent review of longitudinal risk factors

for Loneliness, did not identify low Purpose of Life as a potential risk factor for Loneliness, but rather identified many of the current study's control variables as potential longitudinal risk factors including, Marital Status, limited Social Support, perceived poor health and those with depressed mood (Dahlberg et al., 2022). Additionally, Maciá et al., (2021) found the association between Purpose in Life and Loneliness was drastically reduced when other risk factors were accounted for, including general health and social connectedness. Therefore, it is plausible that the controlled variables fully account for the relationship.

In general, the research related to Purpose in Life is still limited and there remains a lack of consensus on how it is conceptualised. This is further complicated by limited theory related to the relationship between the study's main constructs. Furthermore, existing research has produced mixed results in relation to the direction of the causal relationship between the three constructs. While Purpose in Life has been identified as protecting against Loneliness by Kang et al., (2021) and Depression by Nkyi and Ninnoni (2020) and Pinquart, (2002) it should also be noted that Sutin (2022) has found Loneliness causes a decrease in Purpose in Life. Given the lack of consensus, it is also possible that Loneliness and Depression are predeterminants of Purpose in Life.

6.4. Quality of Life and Changes in Loneliness and Depression

A moderate negative bivariate correlation was found between Loneliness (2018) and Quality of Life (2020). This is in agreeance with previous cross-sectional studies using older adult participants that has found significant correlations between Loneliness and Quality of Life (Ahadi & Hassani., 2021; Musich et al., 2015). However, the relationship is not straightforward. For example, Fan et al. (2021) did not find a significant correlational relationship between Loneliness and Health Related Quality of Life after controlling for demographic variables but did find Loneliness was a significant predictor of lower Quality of Life 9-months into the future.

Using SEM, the current research failed to find a significant directional relationship between Loneliness and Quality of Life when controlling for Gender, Age, Marital Status, Social Isolation, Social Support, SES, and baseline effects of Loneliness. There are a few plausible explanations for the current findings. Firstly, on average, the sample self-reported lower levels of Loneliness. Several prior studies have found only moderate to severe levels of Loneliness significantly predicted future levels of both physical and mental dimensions of Quality of Life in longitudinal research (Brett., 2019; Fan et al., 2021; Rumas et al., 2021). Therefore, the average level of loneliness may not have been high enough to significantly affect future Quality of Life. Secondly, the current results may, like other studies, suggest other factors interacting with Loneliness are contributing to a person's Quality of Life. It is suggested that perceived lack of social interaction and Social Isolation; characteristic of Loneliness, might persist over time and independently contribute to longitudinal decreases in Quality of Life. Therefore, by controlling for these characteristics as separate factors, the impact of Loneliness has been reduced leading to an insignificant effect. Thirdly, prior research has found older adults expect and even accept Loneliness in older age and subsequently achieve Quality of Life in other forms (Donovan & Blazer, 2020). Likewise, it has been suggested that many older adults have experienced transient Loneliness, implying most have experience coping with the feeling of Loneliness, subsequently reducing the effect it has on their perceived Quality of Life (Marsillas & Schoenmakers., 2021). However, it is widely accepted that Loneliness is associated with a range of detrimental health outcomes. Declines in physical health and mental capacity due to Loneliness may require a longer time frame than two years before significant effects to the Quality of Life are detected. Lastly, the current study reported low Loneliness alpha coefficients of between .63 - .65, suggesting unacceptable internal reliability for measures of Loneliness.

Regarding the relationship between Depression and Quality of Life, the current findings were consistent with previous literature. A moderate bivariate correlation was found between Depression (2018) and Quality of Life (2020). Using SEM, the current research failed to find a significant directional relationship between Depression and Quality of Life when controlling for Gender, Age, Marital Status, Social Isolation, Social Support, SES, and baseline effects of Depression. Prior longitudinal research using participants aged between 79-90 years, found Depression to only be significantly associated with physical components of Quality of Life, but not other factors of Quality of Life (Brett et al., 2019). The current research looked at Quality of Life from a needs-satisfaction theory perspective, it is therefore difficult to know what domains of Quality of Life were affected in the current study.

While the previous findings are mixed, a literature review by Sivertsen et al., (2015) did conclude that Quality of Life declines with increasing severity of Depression in both cross-sectional and longitudinal studies. Given Depression has been found to have a considerable influence on how an individual approaches and responses to life circumstances, which may have an important role in influencing Quality of Life (Brett et al., 2012), it is possible other time variant confounding variables need to be further considered.

It is worth noting that previous research has found prior levels of Quality of Life to be the most important determinant of future Quality of Life in older adults, with baseline Quality of Life explaining between 20.3% and 35.6% of the variance in the equivalent current Quality of Life measures (Brett et al., 2019). The current research has controlled for baseline Quality of Life, and this may have also been an important contributor to insignificant effects between Loneliness and Depression, and Quality of Life.

Overall, neither Loneliness nor Depression were found to be risk factors for predicting future declines in Quality of Life. There is literature to support these findings,

however theory would suggest further research is required to better understand the relationships.

6.5. Loneliness and Depression as mediators of the relationship between Quality of Life and Purpose in Life

This study estimated the parallel mediating effects of both Depression and Loneliness in the relationship between Purpose in Life and Quality of Life in older adults in New Zealand, while controlling for plausible confounding variables (Socioeconomic Status, Social Isolation, Social Support, Marital Status, Age, and Gender) and prior levels of each of the main variables. Mediation was tested using three waves from the longitudinal HWR study. This is the first study to my knowledge that has tested Loneliness and Depression as possible parallel mediators in the relationship between Purpose in Life and Quality of Life.

The results of this study found a significant direct effect with mediators and a significant total effect without mediators. However, no indirect effects were found when either Loneliness (2018) or Depression (2018) mediated the relationship. While no significant indirect effect was found, the results remain an important contribution to the literature. As this research has demonstrated, the pathways and mechanisms contributing to older adult Quality of Life is complex. The insignificant indirect effects when only Loneliness or Depression was a mediator between Purpose in Life and Quality of Life, suggests further work is needed to understand how these important factors interact and contribute to the Quality of Life of older adults. Prior research and theory would suggest they are both important predeterminants of Quality of Life, however the current research would suggest they do only act alone as mediators in the relationship.

6.6. Strengths of the Research

The strengths of this study included a large, diverse, and national sample of New Zealand adults aged over 55 years. The sample closely represented the Age demographics of the population based on comparisons made with New Zealand Statistics, which strengthens the generalisability of the data to the wider population. Furthermore, the data utilised for the current study was taken from three waves of the HWR longitudinal study, that has been collecting data for over 16 years, with a two-year lag between each wave. This strengthened the study's ability to make causal inferences about the relationships between the variables and provided sufficient time between waves for effects to develop. Also, the prospective nature of the data mitigates concerns about retrospective reporting bias.

The current research analysis used structural equation modelling which means measurement error is accounted for within the model. Additionally, using a cross-lagged path model allowed for the model to account for prior levels for the variable (auto-regressive effects). Additionally, unlike much of the prior research, the current research controlled for a range of confounding variables that have been identified as potential predeterminants of Purpose in Life, Depression and Loneliness. Therefore, improving the internal validity of the analysis and confidence in drawing conclusions about directional relationship from the results of the study. Likewise, the observed variables used to identify the latent variables were measured using reliable and validated measures, further strengthening the reliability of the results.

6.7. Limitations

While the present study has many strengths, there are however limitations that should be considered alongside the results.

6.7.1. Potential Multicollinearity

Analysis using SEM has allowed this research to both account for measurement error and manage multiple endogenous constructs. However, it also makes it difficult to assess the impact of multicollinearity on parameter estimates (Grewal et al., 2004). Multicollinearity can lead to inaccurate SEM estimates and large standard errors; and may explain the unusual effect found between Purpose in Life (2016) and Depression (2018) and lack of statistically significant results between other latent variables. Precautions have been taken to avoid this potential problem. The current study uses a large sample with a sample observation greater than 6:1, and measures for main variables (Purpose in Life and Depression) each reported high reliability (above 0.8), which has been suggested to offset the effects of multicollinearity (Mason & Perreault, 1991). However, Loneliness reports a weaker reliability (below .7) at each wave, which could have contributed to potential problems.

6.7.2. Effect of Covid-19 Pandemic

When interpreting the data collected in wave eight (2020), it is important to consider the impact caused by the unprecedented Covid-19 pandemic. In early 2020, most of the world including New Zealand was affected by the spread of the newly emerging coronavirus 'Severe Acute Respiratory Syndrome Coronavirus 2' (SARS-CoV-2). To reduce the spread of the virus, New Zealand entered a nationwide lockdown between 25 March – 27 April 2020, whereby physical contact was restricted to only those in a person's 'bubble'. However, various infection control measures that restricted a person's ability to socialise were enforced at different levels throughout New Zealand until September 2021. Early in the outbreak, the World Health Organisation (WHO) issued a statement recognising the negative mental and psychosocial health considerations related to the virus and mass quarantines. Additionally, early in the pandemic, older adults and those with chronic illnesses were identified as being at higher risk of severe infection of Covid-19 and subsequent mortality due to compromised

immune systems. The resultant fear was expected to increase the mental health impact on older individuals. How this has affected the data in the current study is unclear. Longitudinal studies using European and United States populations suggest the pandemic had no significant impact on overall psychological distress of older adults (Webb & Chen, 2022). Furthermore, a study reported New Zealand adults as maintaining better mental health and well-being during the initial lockdowns than their counterparts in the United Kingdom and Australia (Faulkner et al., 2021). The data from the current study suggests little change in the average reported levels of Loneliness, Depression, Purpose in Life or Quality of Life. However, Every-Palmer et al. (2020) found significantly higher levels of psychological distress in adults aged over 55 years were significantly higher during the Covid-19 lockdown when compared to levels reported in a New Zealand Health Survey 2018/19. Overall, the HWR data shows little evidence that Covid-19 had a significant effect on psychological distress or Quality of Life, and prior research would suggest older adults in New Zealand fared better. However, it is possible the pandemic introduced other time-variant confounding factors that have not been controlled for.

6.7.3. Secondary Data

The current study utilised existing data made available through the HWR study. Fortunately, the HWR study caters to the broader aims of a longitudinal study of health and ageing, which suited the aims of the current study, however decisions regarding which constructs, measures, and variables to use in the current study were restricted to those used in the HWR study. The study does not include a specific measure of Social Isolation; therefore, the variable was constructed from the Social Participation measure, consequently Social Isolation as a construct had uncertain validity and reliability. Ideally future work in this area would employ a validated measure of Social Isolation to ensure validity and reliability.

6.7.4. Sample

As mentioned above, the current research utilised secondary data from the longitudinal HWR project. Overall, the data provided a good demographic representation of the population. The response rate was high from the existing cohort, who were exclusively used in the wave seven (2018) and wave eight (2020). However, wave six (2016) used in the current research included both an existing and refresh cohort. The refresh cohort consistently demonstrated low response rates, including the refresh cohort included in the 2016 wave. This could raise concerns that response bias is influencing participation. It is possible participants who were less depressed, of higher education and SES, and more mobile were more likely to respond. Likewise, this will affect participant attribution and who remains in the study. Furthermore, previous research has demonstrated higher Purpose in Life is associated with lower rates of cognitive decline and dementia. Likewise, Loneliness has been associated with worse cognitive functioning and greater risk of cognitive decline. While response rates from the existing cohort were high, this is a possible reason for people dropping out of the study. Which would therefore bias rates of Depression and Purpose in Life in later waves (Pluim, 2023). Furthermore, while the response rate in wave eight (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.

In terms of generalisability, the current sample was largely aged below 75 years, with only three participants aged over 85 years. While the older adult population in New Zealand is predominately under 75 years. Using only 3 participants over the age of 85 years potentially restricts the generalisability of the current research to the oldest of the old age groups. Also, the HWR study surveyed those living independently in private homes, but not those living in retirement homes, hospitalised, or in government facilities. Therefore, the findings may not be generalisable to these important at-risk contexts.

6.8. Future Research

The current research has demonstrated the complexity of the pathways between Purpose in Life and Quality of Life and the role Loneliness and Depression play in the relationship. Therefore, there are many opportunities for future research to build on the current research.

While the current research did not report a significant regression between the independent variable and mediators, or mediators and dependent variable, nor indirect effects via single mediators, there remains theory and prior research to support the model. Furthermore, if replicated, it is suggested that anxiety be included as a third mediator in the relationship. Anxiety is the second most common mental disability affecting older adults. Data related to anxiety was not available from the HWR data until 2018. Therefore, not included in the current research model as autoregressive effects of Anxiety in 2016 could not be controlled for. Recent reports claim anxiety is the most prevalent mental health disorder amongst community dwelling older adults in Europe. Yet, in comparison to Depression, a dearth of research exists on the relationship between Anxiety and Quality of Life. This raises awareness of the need to further study the relationships of psychosocial problems like Anxiety and potential correlates like Purpose in Life and Quality of Life in older adults (Ribeiro, 2020). Likewise, another important protective psychosocial parameter that has lacked scientific attention and should be of consideration for future research is psychological resilience. Psychological resilience is believed to protect against psychological distress including Depression and Stress. Furthermore, Purpose in Life has been found to be protective of resilience in older adults. Overall, therefore it is possible resilience is an important mediator in the relationship between Purpose in Life, Depression, and Quality of Life (Musich et al., 2022).

Also of consideration is additional confounding variables. Retirement has not been controlled for in this study despite been strongly associated with Purpose in Life and depressive symptoms. Again, this relationship is complex with retirement from low-stress jobs increasing depressive symptoms compared to not retiring, whereas retiring from high-stress job resulted in large reductions in depressive symptoms (Larid et al., 2019). Traditionally retirement age was 65 years and predominantly affected males. Suggesting that retirement could be controlled through Age and Gender, however retirement age is becoming more blurred, and affecting all genders. Additionally, physical health is widely cited as a predeterminant of Loneliness, Depression and Quality of Life. Future research should therefore control for the construct.

The current research could also be strengthened with the inclusion of ethnicity. Previous research from the United States of America has suggested differences in rates of Purpose in Life and Loneliness based on race. Therefore, controlling for ethnicity is recommended. Alternatively, considering the affect ethnicity has on pathways between Purpose in Life and Quality of Life would provide a more in depth understanding of the relationship. Understanding how ethnicity affects the predeterminants of well-being is a pressing issue world-wide; New Zealand is no exception. In New Zealand, the indigenous Māori population that accounts for 17% of the population, experience the worst health and well-being with greater disability compared with other ethnicities (MoH, 2019). Furthermore, their life expectancy is 7 years shorter than non-Māori. Therefore, how ethnicity affects the predeterminants of Quality of Life is a very relevant and important issue.

The current research looked at Loneliness as an overall measure of Loneliness, which has suited the overall aims of the current research. However, the De Jong Gierveld Loneliness Scale used in the current research is bidimensional, measuring both emotional and social Loneliness. Future research using the De Jong Gierveld Loneliness Scale should distinguish

different types of Loneliness as this would be an important consideration for interventions for Loneliness. While older adults typically report higher rates of social Loneliness, they are a heterogenous group, so social Loneliness should not be assumed (Luanaigh & Lawlor, 2008).

Lastly, research related to Purpose in Life is still limited and lacks consensus on how it is conceptualised. This is further complicated by limited theory related to the relationship between the study's main constructs. This study has used causal arrows within the SEM model to predict that higher perceived Purpose in Life will decrease levels of Depression and Loneliness, which will in turn increase Quality of Life. However major assumptions are made that Purpose in Life precedes Loneliness and Depression, also that the relationship between Loneliness and Depression is correlational, not directional. Therefore, it is recommended that further work is needed to understand the directions of these relationships using longitudinal data to increase confidence in causal effects. The use of a parallel mediation model assumes the two mediators, Loneliness and Depression are correlational with no causal relationship between them. Again, the direction of the relationship differs depending on the theory and findings from the existing literature is mixed. Future research should focus on better understanding these relationships before deciding on serial or parallel mediation.

6.9. Practical and Clinical Implications

The present study adds valuable support to prior research that suggests Purpose in Life is an important component of Quality of Life. This study goes further to suggest higher Purpose in Life benefits a person's future Quality of Life. This suggests screening older adults for purposefulness is a viable strategy to help identify individuals at risk of lower levels of healthy aging. Emerging research suggests Purpose in Life can be modified through intervention (Kim et al., 2020). Therefore, targeted interventions to increase purposefulness may promote healthy aging. However, while the current research offers promise for Purpose in Life being a valuable focus for interventions to target older adult Quality of Life, it is

important to consider the differences in how Purpose in Life continues to be conceptualised. Any interventions need to consider carefully what the chosen measure conceptualises.

7.0. Conclusion

Worldwide, the size and proportion of older adults in the population is increasing. This can either present new opportunities for the older adult, their family and society, or a large economical and ethical burden. The success of an aging population is largely dependent on the older adult populations ability to age well. It is therefore imperative that the pathways to older adult Quality of Life is understood to facilitate effective policy and interventions.

The current research has attempted to further understand the longitudinal relationship between Purpose in Life and Quality of Life and potential pathways mediating the relationship, while controlling for potential confounding variables. This study has contributed to the current literature that Purpose in Life positively contributes to the long-term Quality of Life of older adults both directly and indirectly through parallel mediators, Depression and Loneliness. This supports previous findings that Purpose in Life directly contributes to future Quality of Life and adds a novel contribution to the literature that the relationship remains significant when mediated by both Loneliness and Depression. This relationship did not however remain significant when mediated by only either Depression or Loneliness.

The results suggest that policies and interventions aimed at enhancing purpose might be effective in enhancing the future Quality of Life of our rapidly aging population. Furthermore, that Loneliness and Depression as mediators should be important considerations. However, the fact the indirect relationship is only significant when mediated by both mediators suggests the relationship is complex. Likewise, the lack of significant relationships between predicting variable Purpose in Life and mediating variables suggests further work is needed to understand alternative directionality between the variables.

Nevertheless, the significant findings remain an important contribution. Later life can be a time of exemplified changes in roles due to significant life events such as retirement or bereavement. However, Purpose in Life is a modifiable psychological construct. Suggesting that interventions that target purpose in older adults, is potentially an effective approach to maintaining and improving older adult Quality of Life. It is also important to note that the older adult population is a heterogeneous population. The current research has provided valuable insight that is specific to the New Zealand population.

8.0. Conflict of Interest

The author declares no conflict of interest.

9.0. References

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Appendix A

Syntax for RStudio Data Analysis

```
#upload data
data <- read.csv("HWRThesis_Data.LONE.dic.csv")
library(lavaan)
library(psych)
library(Amelia)
library(plyr)
library(dplyr)
library(moments)

#Delete identifying information
data <- subset(data, select =-c(AW_ID))

#view data
View(data)

##Exclusion Criteria
#Check sum of missing data for control variables.
sum(is.na(data["AGE_16"]))
#check % of missing "AGE_16" data
sum(is.na(data[, "AGE_16"]))/(nrow(data[, "AGE_16"])*ncol(data[, "AGE_16"]))*100
#check "Age_16" for participants below 55 years. Remove any participants below 55 years of age.
sum(data$AGE_16 > 54, na.rm = TRUE)
#Check GENDER_16 for missing data
sum(is.na(data[,"GENDER_16"]))
#check % of missing "MaritalStatus_16" data
sum(is.na(data["MaritalStatus_16"]))

#create groups (grep) for each of the main variables
PIL16_var = c(grep("PIL16_", colnames(data), value = TRUE))
PIL16_var
PIL18_var = c(grep("PIL18_", colnames(data), value = TRUE))
PIL18_var
PIL20_var = c(grep("PIL20_", colnames(data), value = TRUE))
PIL20_var
LONE16_var = c(grep("LONE16_", colnames(data), value = TRUE))
LONE16_var
LONE18_var = c(grep("LONE18_", colnames(data), value = TRUE))
LONE18_var
LONE20_var = c(grep("LONE20_", colnames(data), value = TRUE))
LONE20_var
CESD16_var = c(grep("CESD16_", colnames(data), value = TRUE))
CESD16_var
CESD18_var = c(grep("CESD18_", colnames(data), value = TRUE))
CESD18_var
CESD20_var = c(grep("CESD20_", colnames(data), value = TRUE))
CESD20_var
CASP16_var = c(grep("CASP16_", colnames(data), value = TRUE))
CASP16_var
CASP18_var = c(grep("CASP18_", colnames(data), value = TRUE))
CASP18_var
CASP20_var = c(grep("CASP20_", colnames(data), value = TRUE))
CASP20_var
SPS16_var = c(grep("SPS16_", colnames(data), value = TRUE))
SPS16_var
SP16_var= c(grep("SP16TOT", colnames(data), value = TRUE))
SP16_var
SES16_var= c(grep("SES16_", colnames(data), value = TRUE))
SES16_var

#Created vector that combine main variables
MAIN_VAR = c(PIL16_var, PIL18_var, PIL20_var, LONE16_var, LONE18_var, LONE20_var, CESD16_var, CESD18_var, CESD20_var,
CASP16_var, CASP18_var, CASP20_var)
MAIN_VAR16 = c(PIL16_var, LONE16_var, CESD16_var, CASP16_var)
MAIN_VAR18 = c(PIL18_var, LONE18_var, CESD18_var, CASP18_var)
MAIN_VAR20 = c(PIL20_var, LONE20_var, CESD20_var, CASP20_var)

MAIN.CTRL_VAR = c(PIL16_var, PIL18_var, PIL20_var, LONE16_var, LONE18_var, LONE20_var, CESD16_var, CESD18_var,
CESD20_var, CASP16_var, CASP18_var, CASP20_var, SPS16_var, SES16_var)

#CTRL_VAR1 = c(, SPS16_var, SES16_var)
CTRL_VAR = c(SPS16_var, SES16_var)

##Missing data
#sum of total missing data in dataset
sum(is.na(data))
sum(is.na(data))/(nrow(data)*ncol(data))*100
```

```
#Sum of missing data in main variables individually
sum(is.na(data[, PIL16_var]))
sum(is.na(data[, PIL18_var]))
sum(is.na(data[, PIL20_var]))
sum(is.na(data[, LONE16_var]))
sum(is.na(data[, LONE18_var]))
sum(is.na(data[, LONE20_var]))
sum(is.na(data[, CESD16_var]))
sum(is.na(data[, CESD18_var]))
sum(is.na(data[, CESD20_var]))
sum(is.na(data[, CASP16_var]))
sum(is.na(data[, CASP18_var]))
sum(is.na(data[, CASP20_var]))
#sum of miss control variables
sum(is.na(data[, SES16_var]))
sum(is.na(data[,SES16_var]))/(nrow(data[,SES16_var])*ncol(data[,SES16_var]))*100
sum(is.na(data[, SPS16_var]))
sum(is.na(data[,SPS16_var]))/(nrow(data[,SPS16_var])*ncol(data[,SPS16_var]))*100
sum(is.na(data[,"MaritalStatus_16"]))/(nrow(data[,"MaritalStatus_16"])*ncol(data[,"MaritalStatus_16"]))*100

sum(is.na(data[, CTRL_VAR]))
sum(is.na(data[,CTRL_VAR]))/(nrow(data[,CTRL_VAR])*ncol(data[,CTRL_VAR]))*100
sum(is.na(data[, MAIN_VAR]))
sum(is.na(data[,MAIN_VAR]))/(nrow(data[,MAIN_VAR])*ncol(data[,MAIN_VAR]))*100

View(data1)

#Work out percentage of missing data for main variables
sum(is.na(data[,PIL16_var]))/(nrow(data[,PIL16_var])*ncol(data[,PIL16_var]))*100
sum(is.na(data[,PIL18_var]))/(nrow(data[,PIL18_var])*ncol(data[,PIL18_var]))*100
sum(is.na(data[,PIL20_var]))/(nrow(data[,PIL20_var])*ncol(data[,PIL20_var]))*100
sum(is.na(data[,LONE16_var]))/(nrow(data[,LONE16_var])*ncol(data[,LONE16_var]))*100
sum(is.na(data[,LONE18_var]))/(nrow(data[,LONE18_var])*ncol(data[,LONE18_var]))*100
sum(is.na(data[,LONE20_var]))/(nrow(data[,LONE20_var])*ncol(data[,LONE20_var]))*100
sum(is.na(data[,CASP16_var]))/(nrow(data[,CASP16_var])*ncol(data[,CASP16_var]))*100
sum(is.na(data[,CASP18_var]))/(nrow(data[,CASP18_var])*ncol(data[,CASP18_var]))*100
sum(is.na(data[,CASP20_var]))/(nrow(data[,CASP20_var])*ncol(data[,CASP20_var]))*100
sum(is.na(data[,CESD16_var]))/(nrow(data[,CESD16_var])*ncol(data[,CESD16_var]))*100
sum(is.na(data[,CESD18_var]))/(nrow(data[,CESD18_var])*ncol(data[,CESD18_var]))*100
sum(is.na(data[,CESD20_var]))/(nrow(data[,CESD20_var])*ncol(data[,CESD20_var]))*100
sum(is.na(data[,MaritalStatus_16]))/(nrow(data1[,MaritalStatus_16])*ncol(data1[,MaritalStatus_16]))*100

##Exclude data that is missing more than 20%
#create function called count_missing
count_missing <- function(x){sum(is.na(x))}

#Create function called miss_fun
miss_fun = function(x){sum(is.na(x))}

#Exclude data that is missing more than 20%
data$nmiss = apply(X = data[ ,CTRL_VAR], MARGIN = 1, FUN = miss_fun)
sum(data$nmiss > 10)
data <- data[data$nmiss <= 10,]

data$nmiss = apply(X = data[ ,MAIN_VAR16], MARGIN = 1, FUN = miss_fun)
sum(data$nmiss > 7)
data <- data[data$nmiss <= 7,]

data$nmiss = apply(X = data[ ,MAIN_VAR18], MARGIN = 1, FUN = miss_fun)
sum(data$nmiss > 7)
data <- data[data$nmiss <= 7,]

data$nmiss = apply(X = data[ ,MAIN_VAR20], MARGIN = 1, FUN = miss_fun)
sum(data$nmiss > 7)
data <- data[data$nmiss <= 7,]

#remove 23 observations where MaritalStatus_16 was NA
data1 <- data[!is.na(data$MaritalStatus_16), ]
data1
```

```
#Missing Data Imputation - Use single expectation-maximisation (EM) imputation
set.seed(1234)
am_imp = amelia(x = data1[ ,c(SES16_var, SPS16_var, PIL16_var, PIL18_var, PIL20_var, LONE16_var, LONE18_var, LONE20_var,
CESD16_var, CESD18_var, CESD20_var, CASP16_var, CASP18_var, CASP20_var)], m = 1, boot.type = "none", digits = 2, format
= 'f')

#Display structure of R object
str(am_imp)
#View this data-frame of imputed values
View(am_imp$imputations$imp1)
#Combine 'old' data set with 'new' data set
data_old = data1[, -which(colnames(data1) %in% MAIN.CTRL_VAR)]
full_data = cbind(data_old, am_imp$imputations$imp1)
View(full_data)
data2 <- full_data

View(data2)

##Reverse code

#Define PIL to reverse code - 5 point scale
reverse_col5 = c("PIL16_1", "PIL16_3", "PIL16_5", "PIL18_1", "PIL18_3", "PIL18_5", "PIL20_1", "PIL20_3", "PIL20_5")
data2[ , reverse_col5] = 6 - data2[ , reverse_col5]
#Reverse Code LONE
data2$LONE16_1r <- 1- data2$LONE16_1
data2$LONE16_5r <- 1- data2$LONE16_5
data2$LONE16_6r <- 1- data2$LONE16_6
data2$LONE18_1r <- 1- data2$LONE18_1
data2$LONE18_5r <- 1- data2$LONE18_5
data2$LONE18_6r <- 1- data2$LONE18_6
data2$LONE20_1r <- 1- data2$LONE20_1
data2$LONE20_5r <- 1- data2$LONE20_5
data2$LONE20_6r <- 1- data2$LONE20_6
#Reverse code CESD
data2$CESD16_5r <- 3- data2$CESD16_5
data2$CESD16_8r <- 3- data2$CESD16_8
data2$CESD18_5r <- 3- data2$CESD18_5
data2$CESD18_8r <- 3- data2$CESD18_8
data2$CESD20_5r <- 3- data2$CESD20_5
data2$CESD20_8r <- 3- data2$CESD20_8
#Reverse code CASP
data2$CASP16_4r <- 3-data2$CASP16_4
data2$CASP16_5r <- 3-data2$CASP16_5
data2$CASP16_7r <- 3-data2$CASP16_7
data2$CASP16_8r <- 3-data2$CASP16_8
data2$CASP16_9r <- 3-data2$CASP16_9
data2$CASP16_10r <- 3-data2$CASP16_10
data2$CASP16_11r <- 3-data2$CASP16_11
data2$CASP16_12r <-3-data2$CASP16_12
data2$CASP18_4r <- 3-data2$CASP18_4
data2$CASP18_5r <- 3-data2$CASP18_5
data2$CASP18_7r <- 3-data2$CASP18_7
data2$CASP18_8r <- 3-data2$CASP18_8
data2$CASP18_9r <- 3-data2$CASP18_9
data2$CASP18_10r <- 3-data2$CASP18_10
data2$CASP18_11r <- 3-data2$CASP18_11
data2$CASP18_12r <- 3-data2$CASP18_12
data2$CASP20_4r <- 3-data2$CASP20_4
data2$CASP20_5r <- 3-data2$CASP20_5
data2$CASP20_7r <- 3-data2$CASP20_7
data2$CASP20_8r <- 3-data2$CASP20_8
data2$CASP20_9r <- 3-data2$CASP20_9
data2$CASP20_10r <- 3-data2$CASP20_10
data2$CASP20_11r <- 3-data2$CASP20_11
data2$CASP20_12r <- 3-data2$CASP20_12

#reverse code SPS
data2$SPS16_2r <- 5-data2$SPS16_2
data2$SPS16_3r <- 5-data2$SPS16_3
data2$SPS16_6r <- 5-data2$SPS16_6
data2$SPS16_9r <- 5-data2$SPS16_9
data2$SPS16_10r <- 5-data2$SPS16_10
data2$SPS16_14r <- 5-data2$SPS16_14
data2$SPS16_15r <- 5-data2$SPS16_15
data2$SPS16_18r <- 5-data2$SPS16_18
data2$SPS16_19r <- 5-data2$SPS16_19
data2$SPS16_21r <- 5-data2$SPS16_21
data2$SPS16_22r <- 5-data2$SPS16_22
data2$SPS16_24r <- 5-data2$SPS16_24
```

```
#Delete columns where variable has been reverse coded
data2[ , c("LONE16_1", "LONE16_5", "LONE16_6", "LONE18_1", "LONE18_5", "LONE18_6", "LONE20_1", "LONE20_5", "LONE20_6",
"CESD16_5", "CESD16_8", "CESD18_5", "CESD18_8", "CESD20_5", "CESD20_8", "CASP16_4", "CASP16_5", "CASP16_7", "CASP16_8",
"CASP16_9", "CASP16_10", "CASP16_11", "CASP16_12", "CASP18_4", "CASP18_5", "CASP18_7", "CASP18_8", "CASP18_9",
"CASP18_10", "CASP18_11", "CASP18_12", "CASP20_4", "CASP20_5", "CASP20_7", "CASP20_8", "CASP20_9", "CASP20_10",
"CASP20_11", "CASP20_12")] <- list(NULL)
data2[ , c("SPS16_2", "SPS16_3", "SPS16_6", "SPS16_9", "SPS16_10", "SPS16_14", "SPS16_15", "SPS16_18", "SPS16_19",
"SPS16_21", "SPS16_22", "SPS16_24")] <- list(NULL)

#create groups (grep) for each of the main variables
PIL16_var = c(grep("PIL16_", colnames(data2), value = TRUE))
PIL16_var
PIL18_var = c(grep("PIL18_", colnames(data2), value = TRUE))
PIL18_var
PIL20_var = c(grep("PIL20_", colnames(data2), value = TRUE))
PIL20_var
LONE16_var = c(grep("LONE16_", colnames(data2), value = TRUE))
LONE16_var
LONE18_var = c(grep("LONE18_", colnames(data2), value = TRUE))
LONE18_var
LONE20_var = c(grep("LONE20_", colnames(data2), value = TRUE))
LONE20_var
CESD16_var = c(grep("CESD16_", colnames(data2), value = TRUE))
CESD16_var
CESD18_var = c(grep("CESD18_", colnames(data2), value = TRUE))
CESD18_var
CESD20_var = c(grep("CESD20_", colnames(data2), value = TRUE))
CESD20_var
CASP16_var = c(grep("CASP16_", colnames(data2), value = TRUE))
CASP16_var
CASP18_var = c(grep("CASP18_", colnames(data2), value = TRUE))
CASP18_var
CASP20_var = c(grep("CASP20_", colnames(data2), value = TRUE))
CASP20_var
SPS16_var = c(grep("SPS16_", colnames(data2), value = TRUE))
SPS16_var
SP16_var= c(grep("SP16TOT", colnames(data2), value = TRUE))
SP16_var
SES16_var= c(grep("SES16_", colnames(data2), value = TRUE))
SES16_var

View(data2)

#sum SES - SORT
data2$SESTot <- rowSums(data2[ , c(SES16_var)])
data2$SPSTot <- rowSums(data2[ , c(SPS16_var)])
data2$SPTot <-data2$"SP16TOT"

#deduct 10 from SES Tot as per scoring guidelines
data2[ , "SESTot"] <- data2[ , "SESTot"] -10

#set min value of zero for all data
data2$SESTot[data2$SESTot < 0.0] <- 0.0

#Check reliability
psych::alpha(data2[, PIL16_var])
psych::alpha(data2[, PIL18_var])
psych::alpha(data2[, PIL20_var])
psych::alpha(data2[, LONE16_var])
psych::alpha(data2[, LONE18_var])
psych::alpha(data2[, LONE20_var])
psych::alpha(data2[, CESD16_var])
psych::alpha(data2[, CESD18_var])
psych::alpha(data2[, CESD20_var])
psych::alpha(data2[, CASP16_var])
psych::alpha(data2[, CASP18_var])
psych::alpha(data2[, CASP20_var])
psych::alpha(data2[, SES16_var])
psych::alpha(data2[, SPS16_var])
psych::alpha(data2[, SP16_var])
psych::alpha(data2)
cronbach.alpha(data2)
```

```
##Descriptive Statistics - Demographics

#Sum Main variables
data2$PIL16tot <- data2$"PIL16_1" + data2$"PIL16_2" + data2$"PIL16_3" + data2$"PIL16_4" + data2$"PIL16_5" +
data2$"PIL16_6"
data2$PIL18tot <- data2$"PIL18_1" + data2$"PIL18_2" + data2$"PIL18_3" + data2$"PIL18_4" + data2$"PIL18_5" +
data2$"PIL18_6"
data2$PIL20tot <- data2$"PIL20_1" + data2$"PIL20_2" + data2$"PIL20_3" + data2$"PIL20_4" + data2$"PIL20_5" +
data2$"PIL20_6"
data2$LONE16tot <- data2$"LONE16_1r" + data2$"LONE16_2" + data2$"LONE16_3" + data2$"LONE16_4" + data2$"LONE16_5r" +
data2$"LONE16_6r"
data2$LONE18tot <- data2$"LONE18_1r" + data2$"LONE18_2" + data2$"LONE18_3" + data2$"LONE18_4" + data2$"LONE18_5r" +
data2$"LONE18_6r"
data2$LONE20tot <- data2$"LONE20_1r" + data2$"LONE20_2" + data2$"LONE20_3" + data2$"LONE20_4" + data2$"LONE20_5r" +
data2$"LONE20_6r"
data2$CESD16tot <- data2$"CESD16_1" + data2$"CESD16_2" + data2$"CESD16_3" + data2$"CESD16_4" + data2$"CESD16_5r" +
data2$"CESD16_6"+ data2$"CESD16_7" + data2$"CESD16_8r" + data2$"CESD16_9"+ data2$"CESD16_10"
data2$CESD18tot <- data2$"CESD18_1" + data2$"CESD18_2" + data2$"CESD18_3" + data2$"CESD18_4" + data2$"CESD18_5r" +
data2$"CESD18_6"+ data2$"CESD18_7" + data2$"CESD18_8r" + data2$"CESD18_9"+ data2$"CESD18_10"
data2$CESD20tot <- data2$"CESD20_1" + data2$"CESD20_2" + data2$"CESD20_3" + data2$"CESD20_4" + data2$"CESD20_5r" +
data2$"CESD20_6"+ data2$"CESD20_7" + data2$"CESD20_8r" + data2$"CESD20_9"+ data2$"CESD20_10"
data2$CASP16tot <- data2$"CASP16_1" + data2$"CASP16_2" + data2$"CASP16_3" + data2$"CASP16_4r" + data2$"CASP16_5r" +
data2$"CASP16_6"+ data2$"CASP16_7r" + data2$"CASP16_8r" + data2$"CASP16_9r"+ data2$"CASP16_10r"+ data2$"CASP16_11r"+
data2$"CASP16_12r"
data2$CASP18tot <- data2$"CASP18_1" + data2$"CASP18_2" + data2$"CASP18_3" + data2$"CASP18_4r" + data2$"CASP18_5r" +
data2$"CASP18_6"+ data2$"CASP18_7r" + data2$"CASP18_8r" + data2$"CASP18_9r"+ data2$"CASP18_10r"+ data2$"CASP18_11r"+
data2$"CASP18_12r"
data2$CASP20tot <- data2$"CASP20_1" + data2$"CASP20_2" + data2$"CASP20_3" + data2$"CASP20_4r" + data2$"CASP20_5r" +
data2$"CASP20_6"+ data2$"CASP20_7r" + data2$"CASP20_8r" + data2$"CASP20_9r"+ data2$"CASP20_10r"+ data2$"CASP20_11r"+
data2$"CASP20_12r"

#Summary data for each variable including Mean, Median and range
summary(data2[, c("PIL16tot","PIL18tot","PIL20tot", "LONE16tot", "LONE18tot", "LONE20tot", "CESD16tot", "CESD18tot",
"CESD20tot", "CASP16tot", "CASP18tot", "CASP20tot")])
summary(data2[, c("SESTot")])
summary(data2[, c("SPTot")])
summary(data2[, c("SPSTot")])
summary(data2[, c("AGE_16")])

#skewness of main scales
round(skewness(data2$"PIL16tot"))
round(skewness(data2$"PIL18tot"))
round(skewness(data2$"PIL20tot"))
round(skewness(data2$"LONE16tot"))
round(skewness(data2$"LONE18tot"))
round(skewness(data2$"LONE20tot"))
round(skewness(data2$"CESD16tot"))
round(skewness(data2$"CESD18tot"))
round(skewness(data2$"CESD20tot"))
round(skewness(data2$"CASP16tot"))
round(skewness(data2$"CASP18tot"))
round(skewness(data2$"CASP20tot"))

#Standard Deviation
round(sapply(data2[, c("PIL16tot","PIL18tot","PIL20tot", "LONE16tot", "LONE18tot", "LONE20tot", "CESD16tot",
"CESD18tot", "CESD20tot", "CASP16tot", "CASP18tot", "CASP20tot")], sd), 2) #standard deviation rounded to 2dp
cor(data2[, MAIN_VAR])
sd(data2$"PIL16tot")
sd(data2$"PIL18tot")
sd(data2$"PIL20tot")
sd(data2$"LONE16tot")
sd(data2$"LONE18tot")
sd(data2$"LONE20tot")
sd(data2$"CESD16tot")
sd(data2$"CESD18tot")
sd(data2$"CESD20tot")
sd(data2$"CASP16tot")
sd(data2$"CASP18tot")
sd(data2$"CASP20tot")
sd(data2$AGE_16)
sd(data2$"SESTot")
sd(data2$"SPSTot")
sd(data2$"SP16TOT")
```

```
##calculate Pearson correlations with p values
corr.test(data2[, c(
  "PIL16tot",
  "PIL18tot",
  "PIL20tot",
  "LONE16tot",
  "LONE18tot",
  "LONE20tot",
  "CESD16tot",
  "CESD18tot",
  "CESD20tot",
  "CASP16tot",
  "CASP18tot",
  "CASP20tot",
  "AGE_16",
  "GENDER_16",
  "SPSTot",
  "SP16TOT",
  "SESTot",
  "MaritalStatus_16"
)])


#Create scale scores
data2$PIL16_tot = rowSums(data2[, PIL16_var])
data2$PIL18_tot = rowSums(data2[, PIL18_var])
data2$PIL20_tot = rowSums(data2[, PIL18_var])
data2$LONE16_tot = rowSums(data2[, LONE16_var])
data2$LONE18_tot = rowSums(data2[, LONE18_var])
data2$LONE20_tot = rowSums(data2[, LONE18_var])
data2$CESD16_tot = rowSums(data2[, CESD16_var])
data2$CESD18_tot = rowSums(data2[, CESD18_var])
data2$CESD20_tot = rowSums(data2[, CESD18_var])
data2$CASP16_tot = rowSums(data2[, CASP16_var])
data2$CASP18_tot = rowSums(data2[, CASP18_var])
data2$CASP20_tot = rowSums(data2[, CASP18_var])


#DESCRIPTIVE STATISTICS
nrow(data2) #sample size
table(data2$AGE_16)
table(data2$SESTot)
table(data2$GENDER_16)
table(data2$MaritalStatus_16)
table(data2$SPTot)
table(data2$SPSTot)
table(data2$CESD16tot)
table(data2$CESD18tot)
table(data2$CESD20tot)
table(data2$LONE16tot)
table(data2$LONE18tot)
table(data2$LONE20tot)
table(data2$CASP16tot)
table(data2$CASP18tot)
table(data2$CASP20tot)
table(data2$PIIL16tot)
table(data2$PIL18tot)
table(data2$PIL20tot)

##Item parcelling
#creation of item parcels for depression
data2$CESD_pos16 = data2$CESD16_5r + data2$CESD16_8r
data2$CESD_neg16 = data2$CESD16_3 + data2$CESD16_6 + data2$CESD16_9
data2$CESD_som16 = data2$CESD16_1 + data2$CESD16_2 + data2$CESD16_4 + data2$CESD16_7 + data2$CESD16_10
data2$CESD_pos18 = data2$CESD18_5r + data2$CESD18_8r
data2$CESD_neg18 = data2$CESD18_3 + data2$CESD18_6 + data2$CESD18_9
data2$CESD_som18 = data2$CESD18_1 + data2$CESD18_2 + data2$CESD18_4 + data2$CESD18_7 + data2$CESD18_10
data2$CESD_pos20 = data2$CESD20_5r + data2$CESD20_8r
data2$CESD_neg20 = data2$CESD20_3 + data2$CESD20_6 + data2$CESD20_9
data2$CESD_som20 = data2$CESD20_1 + data2$CESD20_2 + data2$CESD20_4 + data2$CESD20_7 + data2$CESD20_10

#creation of item parcels for quality of life
data2$CASP_C16 = data2$CASP16_1 + data2$CASP16_2 + data2$CASP16_3 + data2$CASP16_4r + data2$CASP16_5r + data2$CASP16_6
data2$CASP_P16 = data2$CASP16_7r + data2$CASP16_8r + data2$CASP16_9r
data2$CASP_S16 = data2$CASP16_10r + data2$CASP16_11r + data2$CASP16_12r
data2$CASP_C18 = data2$CASP18_1 + data2$CASP18_2 + data2$CASP18_3 + data2$CASP18_4r + data2$CASP18_5r + data2$CASP18_6
data2$CASP_P18 = data2$CASP18_7r + data2$CASP18_8r + data2$CASP18_9r
data2$CASP_S18 = data2$CASP18_10r + data2$CASP18_11r + data2$CASP18_12r
data2$CASP_C20 = data2$CASP20_1 + data2$CASP20_2 + data2$CASP20_3 + data2$CASP20_4r + data2$CASP20_5r + data2$CASP20_6
data2$CASP_P20 = data2$CASP20_7r + data2$CASP20_8r + data2$CASP20_9r
data2$CASP_S20 = data2$CASP20_10r + data2$CASP20_11r + data2$CASP20_12r
```

```
data2[,c("LONE16_1r", "LONE16_2", "LONE16_3", "LONE16_4", "LONE16_5r", "LONE16_6r", "LONE18_1r", "LONE18_2", "LONE18_3",
"LONE18_4", "LONE18_5r", "LONE18_6r", "LONE20_1r", "LONE20_2", "LONE20_3", "LONE20_4", "LONE20_5r", "LONE20_6r")] <-
lapply(data2[,c("LONE16_1r", "LONE16_2", "LONE16_3", "LONE16_4", "LONE16_5r", "LONE16_6r", "LONE18_1r", "LONE18_2",
"LONE18_3", "LONE18_4", "LONE18_5r", "LONE18_6r", "LONE20_1r", "LONE20_2", "LONE20_3", "LONE20_4", "LONE20_5r",
"LONE20_6r")], ordered)


##Mediation model
#Mediation Model – using item parcelling and parallel mediation

set.seed(1234)
PARALLELmed2.model<-
  'LONE16 =~ LONE16_1r+LONE16_2+LONE16_3+LONE16_4+LONE16_5r+LONE16_6r
LONE18 =~ LONE18_1r + LONE18_2 + LONE18_3 + LONE18_4 + LONE18_5r + LONE18_6r
LONE20 =~ LONE20_1r + LONE20_2 + LONE20_3 + LONE20_4 + LONE20_5r + LONE20_6r
PIL16 =~ PIL16_1 + PIL16_2 + PIL16_3 + PIL16_4 + PIL16_5 + PIL16_6
PIL18 =~ PIL18_1 + PIL18_2 + PIL18_3 + PIL18_4 + PIL18_5 + PIL18_6
PIL20 =~ PIL20_1 + PIL20_2 + PIL20_3 + PIL20_4 + PIL20_5 + PIL20_6
CESD16 =~ CESD_neg16 + CESD_som16 + CESD_pos16
CESD18 =~ CESD_neg18 + CESD_som18 + CESD_pos18
CESD20 =~ CESD_neg20 + CESD_som20 + CESD_pos20
CASP16 =~ CASP_C16  + CASP_P16 + CASP_S16
CASP18 =~ CASP_C18  + CASP_P18 + CASP_S18
CASP20 =~ CASP_C20  + CASP_P20 + CASP_S20

#Covariance between control variables and exogenous variables

AGE_16 ~~ SP16TOT + SPSTot + SESTot + MaritalStatus_16 + GENDER_16
SP16TOT ~~ SPSTot + SESTot + MaritalStatus_16 + GENDER_16
SPSTot ~~ SESTot + MaritalStatus_16 + GENDER_16
SESTot ~~ MaritalStatus_16 + GENDER_16
MaritalStatus_16 ~~ GENDER_16
PIL16 ~~ LONE16 + CESD16 + CASP16
LONE16 ~~ CESD16 + CASP16
CESD16 ~~ CASP16
PIL18 ~~ LONE18 + CESD18 + CASP18
LONE18 ~~ CESD18 + CASP18
CESD18 ~~ CASP18

#Regressions
PIL16 + LONE16 + CESD16 + CASP16 ~ AGE_16 + SP16TOT + SPSTot + SESTot + MaritalStatus_16 + GENDER_16
PIL18 ~ PIL16
PIL20 ~ PIL18
LONE18 ~ LONE16
CESD18 ~ CESD16
CASP18 ~ CASP16 + LONE16 + CESD16
LONE20 ~ LONE18 + PIL18
CESD20 ~ CESD18 + PIL18
CASP20 ~ CASP18

#Direct effect
CASP20 ~ c*PIL16
#CASP20 ~ c*LONE16

#Mediator effect
LONE18 ~ a1*PIL16
CASP20 ~ b1*LONE18
CESD18 ~ a2*PIL16
CASP20 ~ b2*CESD18

#PIL18 ~ a1*LONE16
#CASP20 ~ b1*PIL18
#CESD18 ~ a2*LONE16
#CASP20 ~ b2*CESD18

#indirect effect
a1b1 :=a1*b1
a2b2 :=a2*b2
#total effect
total:= c + (a1*b1) + (a2*b2)
contrast := a1b1 - a2-b2'

PARALLELmed2.model.fit <-sem(PARALLELmed2.model, data=data2, estimator="WLSMV", ordered = c("LONE16_1r", "LONE16_2",
"LONE16_3", "LONE16_4", "LONE16_5r", "LONE16_6r", "LONE18_1r", "LONE18_2", "LONE18_3", "LONE18_4", "LONE18_5r",
"LONE18_6r", "LONE20_1r", "LONE20_2", "LONE20_3", "LONE20_4", "LONE20_5r", "LONE20_6r"), test = "Satorra-Bentler")
summary(PARALLELmed2.model.fit, fit.measures=T, ci = TRUE, standardized=T) #SUMMARY'
standardizedSolution(fit, type = "std.all". level = 0.95)
```