School of Population Health

Exploring Factors Associated with Depression among Older Community-dwelling Adults

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This thesis is presented in fulfilment of the requirements for the degree of Doctor of Philosophy, and in partial fulfilment of the requirements for the degree of Master of Psychology (Clinical), of Curtin University

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Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

The research presented and reported in this thesis was conducted in accordance with the National Health and Medical Research Council National Statement on Ethical Conduct in Human Research (2007) – updated March 2014. The proposed research study received human research ethics approval from the Curtin University Human Research Ethics Committee (EC00262), Approval Number # HR21/2014

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Abstract

Depression is a leading cause of disability worldwide and is a common health issue in later life with a 12-month prevalence rate of 6.1% among older adults. With a rapidly ageing population and the adverse effects of depressive symptoms on older adults' functioning, identifying factors that could be the focus of prevention or amelioration strategies is becoming increasingly important. Existing research has identified various factors found to be protective against later life depressive symptoms, yet studies have typically examined variables in isolation or in restricted combinations, and there is limited research on how changes in these factors might be associated with change in depressive symptoms over time. In addition, previous reviews examining factors associated with depressive symptoms among older adults have primarily focused on non-modifiable factors, and thus have limited value in terms of the development of community-based programs designed to prevent depression.

The aim of this thesis was to address these gaps in the literature by exploring various modifiable psychological and lifestyle protective factors associated with depressive symptoms among older adults. The four empirical chapters of this thesis provide information about which modifiable factors are likely to be most critical, and thus should be the focus of prevention or amelioration strategies for depressive symptoms in later life. Study 1 (Chapter 2) systematically reviewed relevant studies in the literature, Studies 2 and 3 (Chapters 4 and 5) cross-sectionally and prospectively investigated comprehensive models of a broad range of factors associated with depressive symptoms, and Study 4 (Chapter 6) used a qualitative methodology to explore the determinants of social engagement among people with and without clinically relevant depressive symptoms.

In the first study of this thesis (Chapter 2), a systematic search of Google Scholar, EBSCO, Medline, PubMed, ProQuest, PsychInfo, Science Direct, SCOPUS, Web of Science, and Wiley Online was conducted to identify factors, particularly those amenable to change, which are likely to be important protective or risk factors associated with depressive symptoms among older community-dwelling adults. In total, 75 studies were included in the review. All but one were considered to be of high quality. Twenty-one factors were identified as potential protective or risk factors for depressive symptoms. Good social and/or family support, better self-rated

health, engagement in physical activity, and participation in social activities were identified as key protective factors, and sleep disturbance was identified as an important risk factor.

The second study (Chapter 4) cross-sectionally investigated the relative importance of various factors found to be found to be protective against depressive symptoms in older adults and assessed the potential moderating effect of sociodemographic characteristics for each factor. Eligible participants were aged 60 years or older, lived in a community setting, and were fully retired. The sample consisted of 801 adults ranging in age from 60 to 95 years (61% female). The tested model explained a large proportion of the variance in depressive symptoms, with life satisfaction, self-esteem, and purpose in life found to have the strongest (negative) associations with depressive symptoms. In addition, age moderated the relationship between life satisfaction and depressive symptoms for all age groups, but the moderation effect was strongest for participants below the average age of this sample.

Study 3 examined the relationships between changes in psychological and lifestyle factors and change in depressive symptoms over time among older community-dwelling adults. Adults (N = 217) aged 60 years and older recruited by convenience sampling across the metropolitan area of Perth, Western Australia completed a self-administered survey at baseline and six-months later. On average, depressive symptoms across participants reduced over the six-month study period. The results illustrated that greater increases in life satisfaction, social support, and self-esteem were associated with greater decreases in depressive symptoms over time.

The findings from Studies 1, 2, and 3 indicated that strategies for the prevention or amelioration of depressive symptoms among older adults could potentially focus on enhancing social support, which was found to be a critical protective factor of depressive symptoms in all three studies. Forms of social engagement that facilitate social support therefore have the potential to prevent or reduce depressive symptoms among community-dwelling older people. To understand how to encourage social engagement to enhance social support, Study 4 explored the barriers, facilitators, and motivators of social engagement among older adults and identified differences between participants with and without depressive symptoms. The results from this study provided a typology of factors for social

engagement in later life, highlighting the importance of pre-existing social networks and significant age-related events (e.g., retirement and loss) among participants, especially those with depressive symptoms.

Together, the four empirical studies provide insight into critical factors that could be the focus of intervention strategies, which in turn may have the potential to prevent or reduce depressive symptoms among community-dwelling older people. The theoretical and practical implications of the results from this thesis highlight areas for future research and recommendations for policy makers, health professionals, and other relevant entities.

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Firstly, I would like to thank Professor Simone Pettigrew and Dr Michelle Jongenelis, for their advice and encouragement over the past six years. I would have never dreamed that this thesis nor the career opportunities I have now were even possible if it were not for your guidance and support. I would also like to thank Professor Peter McEvoy, for your insightful contributions and support. To all my supervisors, I will be forever grateful for all the opportunities you have given me. Thank you for believing in me, I would not be where I am today without you.

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Publications Arising from This Thesis

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Copyright Statement

Contributions

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Attributions of Empirical Work

Chapter 2 – Modifiable Protective and Risk Factors for Depressive Symptoms among Older Community-dwelling Adults: A Systematic Review

	Concept & Design	Data Acquisition	Data Analysis	Interpretation	First Draft	Revision	Final Approval
C. Worrall	✓	✓	✓	✓	✓	✓	✓
I acknowledge that these represent my contribution to the above research output Signed:							
M. I. Jongeneli s				✓	✓	✓	✓
I acknowledge that these represent my contribution to the above research output Signed:							
S. Pettigrew			✓	✓	✓	✓	✓
I acknowledge that these represent my contribution to the above research output Signed:							

Chapter 4 – An Exploratory Study of the Relative Effects of Various Protective Factors on Depressive Symptoms among Older People

	Concept & Design	Data Acquisition	Data Analysis	Interpretation	First Draft	Revision	Final Approval
C. Worrall	✓	✓	✓	✓	✓	✓	✓
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M. I. Jongenelis	✓	✓		✓	✓	✓	✓
I acknowledge that these represent my contribution to the above research output Signed:							
P. M. McEvoy				✓	✓	✓	✓
I acknowledge that these represent my contribution to the above research output Signed:							
B. Jackson						✓	✓
I acknowledge that these represent my contribution to the above research output Signed:							
R. U. Newton						✓	✓
I acknowledge that these represent my contribution to the above research output Signed:							
S. Pettigrew	✓	✓		✓	✓	✓	✓
I acknowledge that these represent my contribution to the above research output Signed:							

Chapter 5 – Changes in Protective Factors and Depressive Symptoms Over Time: A Latent Change Score Approach

	Concept & Design	Data Acquisition	Data Analysis	Interpretation	First Draft	Revision	Final Approval
C. Worrall	✓	✓	✓	✓	✓	✓	✓
I acknowledge that these represent my contribution to the above research output Signed:							
P. M. McEvoy	✓		✓	✓	✓	✓	✓
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M. I. Jongenelis	✓	✓		✓		✓	✓
I acknowledge that these represent my contribution to the above research output Signed:							
A. R. Johnson			✓	✓	✓	✓	✓
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B. Jackson						✓	✓
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R. U. Newton						✓	✓
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S. Pettigrew	✓	✓		✓		✓	✓
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CHAPTER 1. GENERAL INTRODUCTION

1.1. Ageing Population

The world's population is ageing. The number of people over the age of 60 years constitutes 13% of the population worldwide and 21.6% of the Australian population (United Nations, 2019). It is projected that by 2050 29% (9 million) of Australians will be aged 60 years and over (United Nations, 2019). Population ageing is forecast to result in an increase in disorders, diseases, and illnesses common in later life, which in turn will lead to higher indirect and direct costs to the health system (Cheruvu & Chiyaka, 2019; Donohue & Pincus, 2007). To mitigate health, social, and economic costs, there is a need for research investigating methods of preventing or reducing the impact of disorders that are prevalent among older adults.

1.2. Depression and Depressive Symptoms

Depression is considered one of the main causes of disability worldwide and is a leading contributor to the overall global burden of disease by 2030 (Mathers & Loncar, 2006; World Health Organization [WHO], 2018). It has been estimated to affect approximately 264 million people worldwide (GBD 2017 Disease and Injury Incidence and Prevalence Collaborators, 2018). With the high prevalence and the personal costs of lower quality of life and increased mortality (Correll et al., 2017; Donohue & Pincus, 2007; E. Walker et al., 2015), depression is considered a public health priority (Cuijpers et al., 2012; McLaughlin, 2011; WHO, 2013). Therefore, early intervention strategies are required to prevent and mitigate the impact of depressive symptoms.

The Diagnostic Statistical Manual of Mental Disorders fifth edition (DSM-5) and International Classification of Diseases 11 (ICD-11) are two frameworks used to diagnose individuals with depression (APA, 2013; WHO, 2018). Both frameworks state that a depressive episode or major depressive disorder, respectively, is characterised by a period of almost daily depressed mood or markedly diminished interest or pleasure in activities lasting at least two weeks, accompanied by at least five or more other symptoms including psychomotor agitation or retardation; fatigue or loss of energy; feelings of worthlessness, or excessive or inappropriate guilt; diminished ability to think or concentrate, or indecisiveness; and recurrent thoughts

of death [not just fear of dying] or suicide (APA, 2013; WHO, 2018). The DSM-5 also requires that symptoms cause the individual significant distress or impairment in their life (APA, 2013). In this thesis, depression is used to refer specifically to symptoms that merit a diagnosis such as major depressive disorder, whereas the term depressive symptoms refers to the continuum of symptoms of any severity that may or may not merit a diagnosis.

1.3. Depressive Symptoms among Older Adults

Depressive symptoms can have adverse effects on people's overall well-being (Allen, 2008), especially older people for whom the symptoms can be particularly intransigent (Thielke et al., 2010). Depressive symptoms can also complicate the treatment of chronic diseases (Chapman & Perry, 2008), which are disproportionately prevalent among older adults (Cheruvu & Chiyaka, 2019). Further, depressive symptoms such as difficulty concentrating, sleeping, somatic/psychomotor problems, and loss of interest in activities previously considered enjoyable in older adults are often misdiagnosed as manifestations of age-related deterioration and/or dementia (Alexopoulos, 2005; Elderkin-Thompson et al., 2003; Fiske et al., 2009; Rodda et al., 2011; Schoevers & Duursma, 2015).

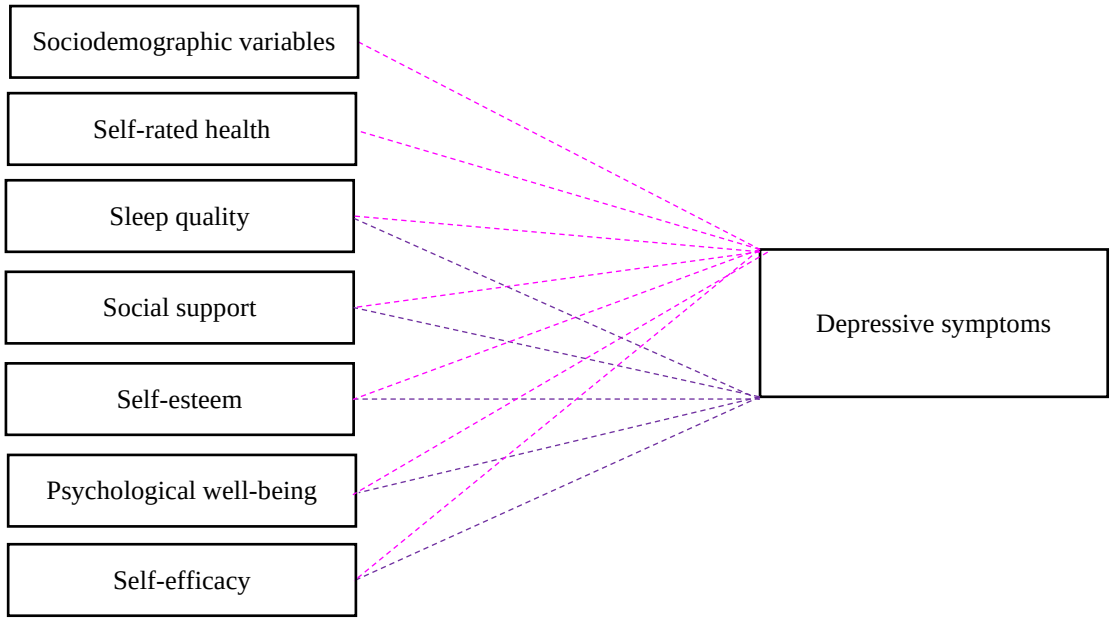
Despite older adults being disproportionally high users of health services in general, they are often hesitant to seek appropriate treatment for depressive symptoms due to (i) the shame associated with seeking mental health help generally or for symptoms that are perceived to be age-related, (ii) an assumption that mental health declines in older age, and/or (iii) uncertainty about what constitutes depression (Alexopoulos, 2005; Chapman & Perry, 2008; Chew-Graham et al., 2012; Rodda et al., 2011; Thomas & Shute, 2006). As such, the number of older people in community settings experiencing depressive symptoms could be higher than estimated. Community-based interventions that focus on enhancing protective factors and minimising risk factors have been identified as important elements of comprehensive approaches to the prevention of depressive symptoms among older people (WHO, 2012, 2018). Investigating factors associated with depressive symptoms in later life could therefore assist in informing developers of community-based programs about critical protective or risk factors for depressive symptoms among older community-dwelling adults (Fiske et al., 2009; A. Singh & Okereke, 2015).

1.4. Factors Associated with Depressive Symptoms in Older People

To date there has only been one systematic review focusing specifically on risk factors for depressive symptoms among older community-dwelling adults (Cole & Dendukuri, 2003), and two others that included a community sample in combination with older people residing in institutions (Djernes, 2006; Vink et al., 2008), all of which are now dated. While these reviews identified a range of biological, psychological, and lifestyle risk factors for depressive symptoms among older adults in community settings, the studies included in these reviews focused primarily on biological factors such as physical disability or physical illness (e.g., the presence and number of chronic diseases; Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008), with less attention paid to modifiable psychological and lifestyle risk factors. Further, research has also examined a number of different sociodemographic factors. For example, lower educational attainment, older age, lower socioeconomic status, and living alone have been identified as risk factors for depressive symptoms (Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008). Among studies that have examined modifiable factors, variables as lack of social support, sleep disturbance, and poor self-rated health were typically found to be associated with depressive symptoms (Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008). Many of the protective factors associated with depressive symptoms in community-dwelling older adults have been identified as the converse of the risk factors. For example, higher levels of social support, self-efficacy, self-rated health, self-esteem, and psychological well-being have been associated with fewer depressive symptoms (Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008; von Bonsdorff & Rantanen, 2011; Yoshida et al., 2015). These factors have been suggested to be protective against the risk of depressive symptoms for a variety of direct and indirect reasons including, buffering against the effects of stress, enhancing biological mechanisms (e.g., neuroplasticity), and improving psychological or lifestyle factors themselves (Cohen & Wills, 1985; Kandola et al., 2019; Lakey & Cronin, 2008). The evidence for these factors has been primarily identified in empirical research with only a small number grounded in theory (see Figure 1).

Figure 1

Model of Potentially Important Psychological and Lifestyle Factors Associated with Depressive Symptoms among Older Community-dwelling Adults Based on Previous Reviews and Psychological Theories and Empirical Evidence



Key

Empirically-validated relationship

Theoretically-validated relationship

1.4.1. Self-rated physical health. Self-rated physical health has been identified in the literature as a useful indicator of individuals overall health, mortality, and psychosocial status (Colman & Ataullahjan, 2010; R. Ferguson et al., 2002; Idler & Benyamini 1997; Mavaddat et al., 2011; Verbrugge & Jette 1994). In particular, self-rated physical health has been found to be negatively associated with depressive symptoms, including among the older population (Colman & Ataullahjan, 2010; Sun et al., 2012; Thielke et al., 2010; Worrall et al., 2020a; Yilmazel & Balci, 2014).

1.4.2. Sleep quality. The link between sleep and depressive symptoms has been grounded in theory that suggests that typical patterns of circadian shifts in physiological functions such as temperature and hormonal patterns are altered in individuals with depression. Each person's circadian rhythm, including the patterns of hormones levels such as melatonin and cortisol, will influence their biological and behavioural processes, and is often dysregulated in depression (Berk, 2009). For example, depressive symptoms may be linked to delayed melatonin release that can cause a phase delay in circadian rhythms (Berk, 2009). Additionally, lower levels of melatonin has been associated with depression and found to be suggestive of a phase advance with delayed sleep and waking times (Berk, 2009; Bunney & Potkin, 2008).

The relationship between sleep quality and depressive symptoms has been well understood in the literature and is a key diagnostic criterion for a diagnosis of depression (APA, 2013). Research suggests that there is a bi-directional link between sleep disturbances and depression, with poor sleep being a symptom of depression and sleep disturbances (especially insomnia) being an independent risk factor for depression (Franzen & Buysse, 2008; Riemann, Berger, & Voderholzer, 2001; Perlis et al., 2006). For example, prospective studies have found insomnia to be a key risk factor in the development and persistence of depressive symptoms among older adults (Fiske et al., 2010; Franzen & Buysse, 2008). Additionally, research has suggested that insomnia may be maintained by a person's maladaptive compensatory behaviours and unhelpful beliefs about sleep, as such there is evidence to suggest that concurrent treatment for comorbid insomnia may enhance effects of depression treatment (Manber et al., 2008; Yang et al., 2014).

1.4.3. Social support. Theoretical evidence suggests that social support is considered to have a direct and/or buffering effect on mental health (Taylor, 2011). One theory (the direct effect) suggests that social support has positive impacts on an individual's mental health during stressful and non-stressful times. Perceived social support is when individuals believe they have support available from friends, family, significant others, or any individual who would help them when needed (Gottlieb and Bergen, 2010). Research has found that individuals who perceive a higher level of received support from friends, family, or wider community members seem to be healthier and better at coping with stress (Bolger & Amarel, 2007). Another theory (the buffering effect) states that social support acts to moderate between stressful experiences and mental health outcomes (Cohen & McKay, 1984; Cohen & Wills, 1985). For example, research has suggested that social support may have moderating effects on genetic and environmental vulnerabilities and increase resilience to stress (Ozbay et al., 2007). While there is strong evidence for both theories, effective social support may depend more on the needs of the recipient and the type of support given by those in the recipient's social network (Cohen & McKay, 1984; Cohen & Wills, 1985; Horowitz et al., 2001; Thoits, 1986).

Social factors such as higher perceived social support have been linked to fewer depressive symptoms in multiple cross-sectional and prospective studies (Barnett & Gotlib, 1988; Santini et al., 2015; Worrall, Jongenelis, & Pettigrew, 2020a). Empirical evidence distinguishes between emotional, informational, and instrumental support (Antonucci, 1985; Barrera, 2000; Hogan et al., 2002; House & Kahn,1985; Tracy & Whittaker, 1990; Wills & Shinar, 2000). Emotional support reflects verbal and nonverbal communication of caring and comfort, instrumental support involves providing assistance through services or resources such as financial or physical aid, and informational support reflects giving someone advice (Hogan et al., 2002; Schulz & Schwazer, 2004; Taylor, 2011). Further, research has distinguished between perceived and received social support (Nurullah, 2012). There appears to be a general consensus in the literature that perceived support may be more important than received support, with perceived emotional support consistently shown to play a greater protective role compared to received support against depressive symptoms across general populations, including older adults (Djernes, 2006; Santini et al., 2015).

1.4.4. Self-esteem. Research has demonstrated support for the vulnerability model of self-esteem and depressive symptoms, which suggests that low levels of self-esteem predict the onset of depressive symptoms (Abramson et al., 1978; Beck, 1967; Metalsky et al., 1993; Orth & Robins, 2013; Roberts & Monroe, 1992; Sowislo & Orth, 2013; Zeigler-Hill, 2011). In particular, Beck's (1967) cognitive theory of depression hypothesises that negative beliefs about the self are not just a symptom of depression but rather play a critical causal role in its aetiology. There is strong evidence for this model across a wide range of samples and study designs (Sowislo & Orth, 2013). Previous findings have demonstrated that the vulnerability model holds for both men and women (Orth, Robins, & Roberts, 2008; Orth, Robins, Trzesniewski, Maes, & Schmitt, 2009; Sowislo & Orth, 2013), for all age groups from childhood to old age (Orth et al., 2009; Sowislo & Orth, 2013), and in clinical and non-clinical samples (Sowislo & Orth, 2013). The vulnerability model, in combination with existing research, suggests that there are likely to be practical implications of enhancing self-esteem for preventing or reducing depressive symptoms among older adults, through either direct or non-direct pathways. For example, evidence suggests that increases in self-esteem are associated with decreases in depression (i.e., a direct link; Orth & Robins, 2013) and that factors such as age, gender, and/or education may explain any variability in the relationship by functioning as moderators between low self-esteem and depression, thus (Sowislo & Orth, 2013).

1.4.5. Psychological well-being and life satisfaction. Psychology research has increasingly focused on the concept of well-being or the presence of positive psychological resources (referred to as 'positive psychology') and how these resources can be incorporated into psychological interventions in both clinical and non-clinical settings (Fava & Sonino, 2000; Fava & Tomba, 2009; Seligman & Csikszentmihalyi, 2000; Sin & Lyubomirsky, 2009). Aspects of well-being include those relating to subjective (or "hedonic") well-being (e.g., life satisfaction; Diener, 1984) and psychological (or "eudemonic") well-being (e.g., personal growth and purpose in life: Ryan & Deci, 2001; Ryff, 1989). These aspects of well-being have been found to be negatively associated with depressive symptoms (Duckworth et al., 2005; Lue et al., 2010; Pinquart, 2002; Seligman et al., 2006; Wood & Joseph, 2010; Yoo et al., 2016), highlighting the potential protective role that life satisfaction,

personal growth, and purpose in life have in preventing the risk of depressive symptoms or reducing the intensity or frequency of symptoms over time.

1.4.6. Self-efficacy. The concept of self-efficacy was proposed by Bandura (1977, 1982, 1994), who described it as the belief individuals hold about their capability to perform tasks. Bandura (1994) noted that an individual's sense of self-efficacy can impact on their engagement in adaptive behaviours and thus influence other aspects of their life. For example, a strong sense of self-efficacy is associated with adaptive coping strategies and has been found to be a protective factor for stress and depressive symptoms, whereas a low sense of self-efficacy may result in maladaptive coping behaviours and lead to a decline in psychological functioning (Bandura, 1994). Adaptive strategies may include relaxation, breathing exercises, reframing cognitions, whereas maladaptive strategies include recreational drug use, and excessive alcohol consumption. Self-efficacy concerns among older adults often focus on their physical and cognitive capabilities and their ability to engage in activities (Bandura, 1994).

1.5. Gaps in Current Research

Research on depressive symptoms in later life has begun to focus more on these modifiable factors discussed above, as they represent targets for intervention strategies that aim to enhance or minimise these factors (A. Singh & Okereke, 2015). However, despite this increase in studies examining various modifiable psychological and lifestyle protective factors, often theses variables are analysed in separate or restricted models and therefore they have not been considered within an overarching theoretical framework. Additionally, there appears to be a lack of research investigating how changes in these factors might be coupled with change in depressive symptoms and the relative importance of the various factors. Understanding how change impacts the relationships between protective factors and depressive symptoms is important for informing a theoretical understanding of factors that uniquely contribute to depressive symptoms, and to ensure prevention or amelioration strategies target these factors to prevent and/or reduce depressive symptoms among older adults.

1.6. Thesis Overview

With a rapidly ageing population and the negative impacts of depressive symptoms on the individual and the health system, it is critical to identify factors associated with depressive symptoms and change in depressive symptoms among older adults. There is growing research examining the various factors associated with depressive symptoms among older people, especially those factors amenable to change. There is a need to synthesise these recent studies to ensure that existing and future intervention strategies for depressive symptoms are targeting key variables based on contemporary evidence. In addition, many of these previous studies have examined variables in isolation or in limited combinations, so it is important for future research to comprehensively investigate which variables uniquely and most strongly contribute to predicting depressive symptoms cross-sectionally and prospectively to guide the development of an overarching theoretical framework that can then inform prevention and intervention efforts.

The overall aim of this thesis was to investigate modifiable psychological and lifestyle factors associated with depressive symptoms among older adults, thus adding to the growing area of research on late-life depressive symptoms and contributing to our theoretical understanding of factors that uniquely contribute to depression and how to develop and target interventions to prevent or mitigate the impact of depressive symptoms among older community-dwelling adults. This was achieved through four studies: a systematic review (Chapter 2), a cross-sectional quantitative study (Chapter 4), a longitudinal quantitative study (Chapter 5), and a qualitative study (Chapter 6).

This chapter outlines the importance of focusing on factors associated with depressive symptoms among the older adult population, as well as the gaps and rationale for the present thesis. Chapter 2 presents Study 1, a published systematic review that synthesised research on factors associated with depressive symptoms among older community-dwelling adults, with a particular focus on modifiable factors. Chapter 3 provides an overview of the rationale and methods used in Studies 2, 3, and 4, and an outline of each study's contribution to the overall thesis. Chapter 4 presents Study 2, which used a cross-sectional design to investigate the relative importance of various psychological and lifestyle factors found to be negatively associated with depressive symptoms in older adults and assessed the potential

moderating effect of sociodemographic characteristics for each factor (published). Chapter 5 presents Study 3, which used a prospective design to examine the relationships between change in psychological and lifestyle protective factors and change in depressive symptoms over time among older community-dwelling adults (unpublished). Chapter 6 presents Study 4, which used a qualitative approach to explore the factors influencing older adults' social engagement, with the specific objectives of identifying the barriers, facilitators, and motivators to social engagement. In addition, differences in the determinants of social engagement between older adult participants with clinically relevant depressive symptoms and those without depressive symptoms were explored (unpublished). These chapters are followed by a general discussion (Chapter 7, unpublished), which synthesises the major findings and implications of each study, provides an overarching theoretical model of predictors of depression in older adults, discusses overall limitations and strengths, offers recommendations for future research, and provides a general conclusion.

1.6.1. Summary of aims, method, and contribution of each study included in this thesis

1.6.1.1. Study 1 (Chapter 2). The first study was a systematic review of the literature with the objective of identifying the primary risk and protective factors that are associated with depressive symptoms among community-dwelling older adults. The systematic review provided an up-to-date account of the literature and a more specific focus on modifiable factors associated with depressive symptoms. This systematic review built upon previous systematic reviews investigating depressive symptoms among community-dwelling older adults (Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008). Articles included were dated from January 2006 as the most recent systematic review covered articles published up until December 2005 (Vink et al., 2008). The search strategy and process of selecting articles that were included in the final review was informed by the Preferred Reporting of Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher, Liberati, Tetzlaff & Altman, 2009). Articles that were included had at least one psychosocial, lifestyle behaviour, or socio-demographic factor that was associated with depressive symptoms. Articles that only examined medical, genetic, or biological factors were

excluded as these factors are not amenable to psychological intervention. To enhance the quality of the resulting review, 10% of the articles were reviewed by another researcher, with all discrepancies discussed to achieve resolution. The level of bias and quality of articles was assessed using the QualSyst assessment tool (Kmet, Robert, & Cook, 2004), as it allowed for various methodological designs (e.g., cross-sectional and longitudinal studies). This tool provided an overall score that indicated whether the quality of each article was low, medium, or high.

A descriptive, narrative review of the data and presentation of the characteristics and main findings was conducted instead of a formal statistical pooling of results. The chosen approached was deemed appropriate as there was substantial heterogeneity across the articles in terms of the age of the sample, the statistical methods used, and the independent and confounding variables included in analyses. As such, the various factors found across the articles to be significantly associated with depressive symptoms were categorised as either psychosocial, behavioural, or socio-demographic factors and presented in three corresponding tables. Consistent with previous reviews in this area (Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008), a plus sign indicated a risk factor, a minus sign indicated a protective factor, zero indicated that the factor had no effect of either type, and blank cells indicated that the factor was not studied. The findings from this systematic review were used to inform studies two and three (outlined below). Specifically, the factors found to be predictors of depressive symptoms in conjunction with previous research on ageing and/or depressive symptoms guided which variables were included in the model specifications in studies 2 and 3.

1.6.1.2. Study 2 (Chapter 4). The aim of Study 2 (presented in Chapter 4) was to investigate the relative importance of various factors associated with depressive symptoms in older adults identified in relevant ageing and depression literature including the systematic review (Study1/Chapter 2). Additionally, to assist in identifying specific sub-groups of older adults who may benefit more than others from interventions targeting each of these factors, the potential moderating effect of sociodemographic characteristics for each factor was assessed. Data from 801 older adult participants were available to examine the relationships between each of the factors described in Section 3.3 and depressive symptoms. Multivariate linear regression analysis was used to identify the most important factors associated with

depressive symptoms, as this analysis allowed for multiple variables to be entered into a single model to assess the relative importance of the factors. Moderation analyses were employed to identify any moderating effects of sociodemographic factors and therefore whether it would be beneficial for intervention programs to specifically target certain older adult population sub-groups.

This study made a unique contribution to the literature by incorporating a large number of modifiable factors in one cross-sectional model to identify the most influential factors that could be the focus of prevention and amelioration strategies targeting depressive symptoms among older people. Previous studies have only incorporated a limited number of factors in a single model or investigated a particular variable in isolation.

While the results from Study 2 identified several factors that could be beneficial for preventing depressive symptoms among older adults, these associations were only measured at one point in time. Longitudinal data were thus needed to assess whether the identified relationships hold over time. Study 3 was designed to address this limitation.

1.6.1.3. Study 3 (Chapter 5). Previous research has identified various factors negatively associated with later life depressive symptoms (Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008; Worrall et al., 2020a; Worrall, Jongenelis, McEvoy, Jackson, Newton, & Pettigrew, 2020b), yet there is limited research examining how changes in these factors might be predictive of changes in depressive symptoms. The aim of Study 3 (presented in Chapter 5) was to examine the relationships between changes in psychological and lifestyle protective factors and changes in depressive symptoms over time among older community-dwelling adults (i.e., to examine whether any changes that do occur are related to depressive symptoms). The total sample comprised of 217 participants. Data were collected from participants at baseline (T1) and follow-up six-months later (T2).

A latent change score approach was used to investigate the relationships between any changes in personal growth, purpose in life, self-esteem, self-efficacy, social support, self-rated health, life satisfaction, and physical activity and changes in depressive symptoms from baseline to follow-up. The latent change score approach used to analyse the longitudinal data in Study 3 has become an increasingly common method used for investigating change over time and can account for measurement

error within the models, leading to more accurate parameter estimates (Ferrer & McArdle, 2010; McArdle, 2009; McArdle & Hamagami, 2001; Wu et al., 2013), but no identified studies in the field of older adult depression have previously adopted this approach. This analysis method allowed general trajectories of change over time to be modelled simultaneously, along with relationships between changes in variables over time (McArdle, 2009; McArdle & Hamagami, 2001). Similar to Study 2, this study also contributed to the literature by including a large number of modifiable factors identified in prior work as being protective of depressive symptoms in a single model to identify which factors were uniquely and most strongly associated with changes in depressive symptoms over time. An important advantage of latent change models is that they can account for measurement error within the models, leading to more accurate parameter estimates (McArdle, 2009; McArdle & Hamagami, 2001).

1.6.1.4. Study 4 (Chapter 6). Studies 1, 2, and 3 highlighted the importance of social support for reducing the risk of depressive symptoms. Study 4 expands these studies, by examining the determinants of social engagement (which has been found to promote social support: Adams et al., 2011; Fiori et al., 2006; Global Council on Brain Health, 2017; Litwin, 2012). Taking a qualitative approach to identify the barriers, facilitators, and motivators to older people engaging socially with others, could provide insights into potentially effective strategies to encourage social engagement among this older population. Additionally, investigating whether there were any differences in the factors relating to engagement between participants (who were or were not experiencing clinically relevant depressive symptoms) using a qualitative approach could assist with identifying how best to encourage social engagement among older people who may benefit most from engagement with others (e.g., those with or at risk of experiencing clinically relevant depressive symptoms).

Semi-structured interviews were conducted with older adult participants as part of the larger project. It is recommended that data collection in qualitative research can cease when data saturation has occurred (Guest et al., 2006), which is the point at which ideas are well formed and patterns in the data are repetitive (Glaser & Strauss, 1967). The final sample consisted of 40 participants. Data collected until themes were stable and no novel themes emerged (Guest et al., 2006; Koch, 1994). Further details about sampling are provided in Chapter 6.

The analysis was data-driven, reflecting an inductive approach to analysis (Braun & Clarke, 2006; Patton, 1990), and thus allowed for data to be constructed into a typology of factors. The findings from this study provided context and understanding surrounding older adults' engagement in social activities in relation to depressive symptoms. Further, the findings from this qualitative study contributed to the overall thesis by expanding on the quantitative results and providing insights into the experiences of older adults. The findings thus have theoretical and practical implications, which are explicated in the final general discussion chapter. This study generated a typology of factors at various ecological levels, which could inform future research and policy, for health practitioners, policy makers, and other relevant agencies areas to potentially address in order to enhance factors like social support.

Note: The following chapter has been published in the Journal of Affective Disorders

Worrall, C., Jongenelis, M., & Pettigrew, S. (2020). Modifiable protective and risk factors for depressive symptoms among older community-dwelling adults: A systematic review. *Journal of Affective Disorders, 272*, 305-317. https://doi.org/10.1016/j.jad.2020.03.119

Minor edits have been made to present chapter to ensure consistency with the present thesis (e.g., Australian spelling). Supplementary Material have been presented as part of the results of this chapter. An additional paragraph has been included at the end of this chapter to assist with cohesion among chapters in this thesis. The published article is presented in Appendix A.

CHAPTER 2. (Study 1) - Modifiable Protective and Risk Factors for Depressive Symptoms among Older Community-dwelling Adults: A Systematic Review

2.1. Introduction

Depression is a leading cause of disability worldwide and constitutes a primary contributor to the overall global burden of disease (WHO, 2020). Depression is more common in later life, with an estimated prevalence among those aged 60 years and older of 7% for females and 5% for males, compared to 4% for females and 3% for males in the broader adult population (WHO, 2017). Many more people (including older adults) experience depressive symptoms that are not severe or persistent enough to merit a diagnosis, but are still associated with significant distress or impairment in important domains of daily functioning (Hjarsbech et al., 2011; Rowe & Rapaport, 2006; Strine et al., 2009). Furthermore, depressive symptoms often go undetected (Fiske et al., 2009), and this is especially the case among older adults due to the uncertainty about what constitutes depression in this cohort (Alexopoulos, 2005; Chapman & Perry, 2008; Chew-Graham et al., 2012; Rodda et al., 2011; Thomas & Shute, 2006). As the proportion of people aged 60 years and older is projected to increase from 13% in 2017 to 21% in 2050 (United Nations, 2017), it is likely that the number of older adults experiencing depressive symptoms will also increase substantially unless appropriate prevention strategies are developed and implemented.

Depressive symptoms can be especially debilitating for older adults. Compared to younger cohorts, older adults tend to have more limited social networks and suboptimal coping strategies (Fiske et al., 2009; Vink et al., 2008; von Faber et al., 2016). In addition, the impact of depressive symptoms on daily functioning and well-being is greater among older adults, and can often result in direct medical costs and indirect economic costs due to reduced mobility (Bock et al., 2014; Donohue & Pincus, 2007). Preventing depressive symptoms in later life therefore has the potential to reduce the impact of these symptoms on both individuals and society.

Community-based interventions that focus on enhancing protective factors and minimizing risk factors have been identified as an important element of comprehensive approaches to the prevention of depressive symptoms among older people (WHO, 2012, 2020). Identifying the factors associated with depressive symptoms among older adults can assist in informing effective community-based

programs aimed at preventing these symptoms. Three systematic reviews examining potential factors could be located (Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008), of which only one focused specifically on community-dwelling older adults (Cole & Dendukuri, 2003). The reviews had a degree of overlap, with 15 studies included in at least two reviews and three studies included in all three reviews. The majority of studies included in the reviews had longitudinal study designs and were primarily focused on non-modifiable factors, of which gender, functional impairment, and history of depression were typically found to be the most important (Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008). The most relevant modifiable factors were found to be low levels of social support, poor self-rated health, and sleep disturbance (Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008).

With the existence of cohort effects between different groups of seniors across time (Fozard & Wahl, 2012), current research on relevant protective and risk factors for depressive symptoms is needed to ensure intervention developers have access to up-to-date evidence to inform their efforts. It is particularly important to include modifiable factors in analyses to provide the information inputs required to develop interventions that can effectively target those variables that have the greatest potential to produce favourable change (A. Singh & Okereke, 2015). The present systematic review addressed these needs by synthesizing recent research on factors associated with depressive symptoms among older community-dwelling adults, with a particular focus on modifiable factors. Sociodemographic variables were also examined to enable the identification of specific groups of individuals within the broader older community-dwelling population who are most in need of intervention.

2.2. Method

2.2.1. Search strategy. This review was conducted in accordance with the Preferred Reporting of Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). As the most recent systematic review that could be located included studies up to December 2005 (Vink et al., 2008), a comprehensive search of the following databases was conducted for articles published from January 2006, with an end date of June 2018: Google Scholar, EBSCO, Medline, PubMed, ProQuest, PsychInfo, Science Direct, SCOPUS, Web of Science, and Wiley Online.

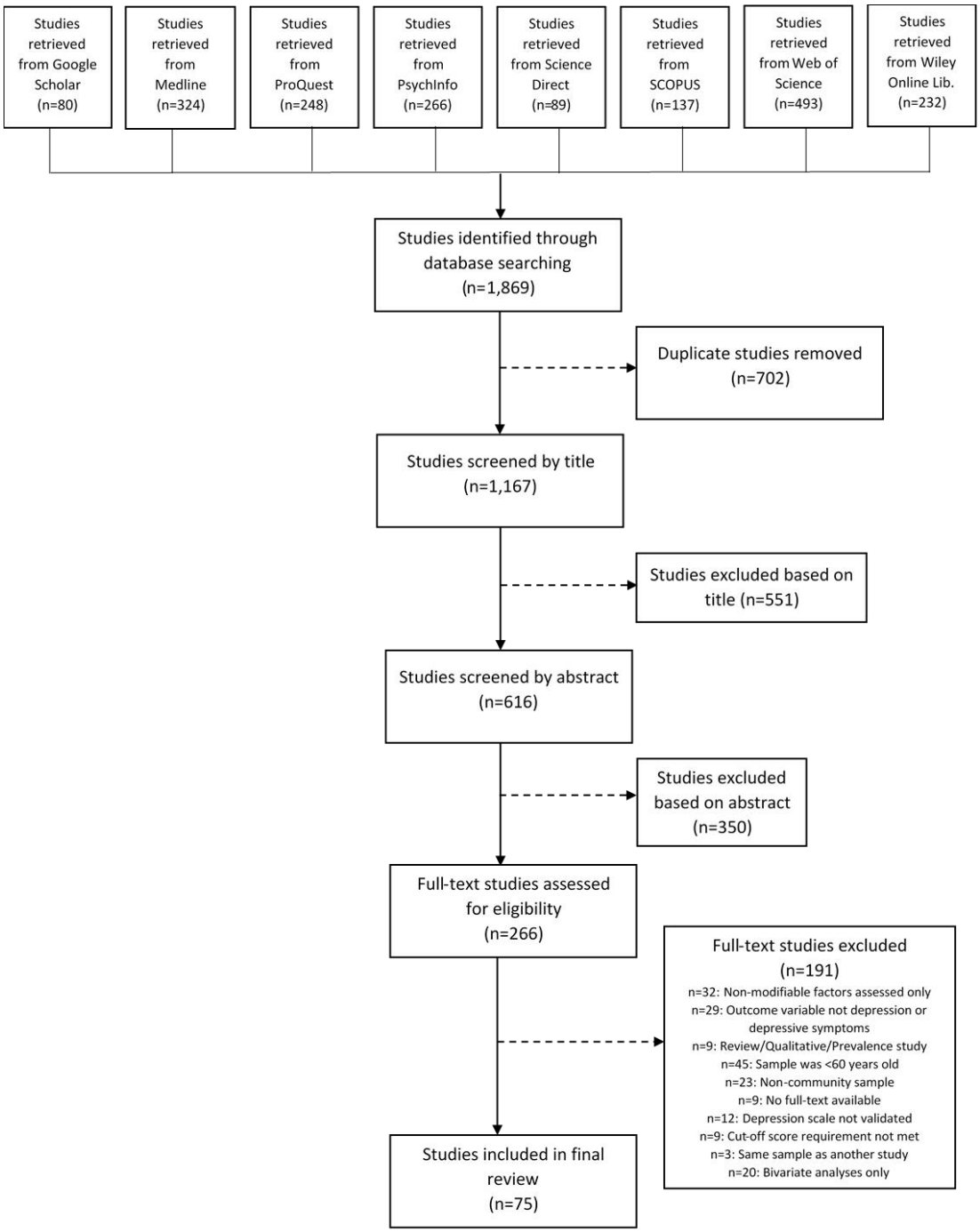
The search terms were (risk factors OR protective factors OR predictors OR correlates OR association) AND (depressi* OR senile depression OR late*-life depression) AND (older people OR older adult OR elderly people OR late* life OR geriatric OR senior*) AND (community OR community-dwelling OR community population OR community sample OR independently living).

2.2.2. Selection criteria. Inclusion criteria for the studies were as follows: available in full-text; published in English; published between January 2006 and June 2018; methodology was either quantitative or mixed-method; participants were aged 60 years or older; participants were living in the community; the range of constructs examined as potential protective or risk factors for depression included at least one psychosocial, behavioural, or socio-demographic factor; multivariate analysis methods were employed; depressive symptoms were an outcome variable; and cut-off scores (if used) were equal to or above the validated cut-off score for clinically relevant depressive symptoms. For studies that were longitudinal in design, only those that controlled for pre-existing depressive symptoms in analyses or excluded participants who were identified as being depressed at baseline were reviewed.

2.2.3. Search process. The PRISMA flow diagram shown in Figure 2 summarises the step-by-step process of selecting studies. The search initially returned 1,869 studies, with 1,167 remaining after the removal of duplicates. All study titles, abstracts, and full-texts were screened for relevance by the first author, and 10% of the studies at each step were reviewed by the third author. Disagreements about which studies should be included were discussed and resolved before moving on to the next step. This process resulted in 75 studies that were eligible to be included in the final review.

Figure 2

PRISMA Flow Diagram: Selection of Studies



2.2.4. Quality assessment. The methodological quality of each included study was determined using the QualSyst assessment tool (Kmet et al, 2004). Quality was assessed against 14 criteria by the first and third authors, with discrepancies discussed until consensus was reached. Each study was given a score for each criterion (0 = no, 1 = partial, 2 = yes), with a 'not applicable' (N/A) option also available. An overall quality assessment score was calculated by summing all scores given for each criterion (excluding N/A scores), with higher scores indicating greater methodological rigor (adjusting for number of applicable criteria). The overall score is presented as a percentage, which indicates quality grade: <50% low; ≥50 and <70% medium; and ≥70% high (Kmet et al., 2004).

2.2.5. Data extraction. Across studies, there was considerable heterogeneity in terms of the age of the sample, the statistical methods used, and the independent and confounding variables included in analyses. As such, a formal statistical pooling of results was not attempted. Instead, a descriptive, narrative review of the data and tabulation of the study characteristics and main findings were undertaken. Factors were identified as risk or protective factors where there was a clear majority of studies supporting the finding.

2.3. Results

2.3.1. Study and participant characteristics. The characteristics of the 75 studies included in the review are described in Table 1. Across the studies there were 205,590 participants (baseline age ranged from 60 to 105 years), with sample sizes ranging from 108 to 37,193 (mean = 2,741; median = 1,253). The majority of studies included both females and males, with four studies comprising only males. The studies varied in terms of cultural setting: 23% (N = 17) were conducted in the United States, 16% (N = 12) in China, 15% (N = 11) in Japan, and 11% (N = 8) in Europe. The remaining studies were set in various other countries around the world (e.g., Australia and Thailand).

2.3.2. Methodological quality. The quality assessment criteria were applied to each of the 75 studies (scores shown in Table 1). Almost all reviewed studies were assessed to be of high quality, with 74 studies meeting ≥70% of the eligible criteria. The remaining study was identified as medium quality, meeting between ≥50% and <70% of the eligible criteria. Methodological strengths of studies included study objectives described sufficiently, appropriate variance estimates provided, and results described in sufficient detail. Methodological weaknesses of studies included method of participant selection not described sufficiently, participant characteristics not described in sufficient detail, and confounding variables not controlled for in analyses.

Two-thirds (64%) of the studies were cross-sectional and the remainder were longitudinal. The majority of studies (93%) used self-report measures to assess depressive symptoms, of which approximately half (57%) used the Geriatric Depression Scale (GDS) and one-fifth (21%) used the Center for Epidemiological Studies Depression scale (CESD).

Table 1

Assessed studies investigating protective and risk factors for depressive symptoms among community-dwelling older adults

			Sample Size			Age (years)		Criteria for depression				
Studies	**Country**	**Methodology**	**Baseline**	**Follow-up**	**% Female**	**Range**	**Mean**	**Measure**	**Cut-off score**	**Depressed participants N (%)**	**Factors studied**	**Quality assessment total (%)**
Abe et al., 2012	Japan	Cross-sectional	2,152	-	46	65+	76.7	GDS-15	≥6	570 (26)	Psychosocial Behavioral Sociodemographic	82
Aihara et al., 2011	Japan	Cross-sectional	887	-	53	65+	75.4	GDS-5	≥2	114 (13)	Behavioral	64
Alexandrino-Silva et al., 2011	Brazil	Cross-sectional	367	-	65	60+	70.1	CIDI	Meets diagnostic criteria	69 (19)	Psychosocial	73
Almeida et al., 2011	Australia	Longitudinal	12,203	5,127	-	65-85	-	ICD-9 & ICD-10	Meets diagnostic criteria	128	Behavioral	91
Almeida et al., 2014	Australia	Longitudinal	3,873	-	-	65-83	-	GDS-15	≥7	610	Behavioral Sociodemographic	95
Ang & Malhotra, 2016	Singapore	Cross-sectional	2,766	-	53	-	-	CESD-11	-	-	Psychosocial	91
Baiyewu et al., 2015	Africa (Nigeria)	Cross-sectional	458	-	57	-	73.7	GDS-30	≥11	59 (13)	Psychosocial Behavioral	77
Brinda et al., 2016	Multiple Countries	Cross-sectional	14,877	-	55	65+	-	ICD-10	Meets diagnostic criteria	700 (5)	Psychosocial Sociodemographic	95
Cao et al., 2016	China	Cross-sectional	1,168	-	52	60-94	70.7	GDS-30	≥11	305 (26)	Psychosocial	100
Carayanni et al., 2012	Europe (Greece)	Cross-sectional	360	-	61	60+	-	GDS-15	≥6	109 (30)	Behavioral Sociodemographic	95
Carriere et al., 2017	Europe (France)	Longitudinal	1,253	-	59	68-76	-	CESD-20	≥16	342	Sociodemographic	100

Castro-Costa et al., 2008	Africa (Cameroon)	Cross-sectional	1,510	-	61	-	-	GHQ-12	≥5	582 (39)	Psychosocial Behavioral Sociodemographic	91
Chan, M & Zeng, 2009	China	Cross-sectional	1,042	-	100	60+	71.4±7.4	GDS-15	≥8	124 (12)	Psychosocial	86
Chan, A et al., 2011	Singapore	Cross-sectional	4,489	-	54	60-97	69.3±7.2	CESD-11	-	-	Psychosocial Behavioral Sociodemographic	100
Chan, D et al., 2012	China	Longitudinal	4,000	2,630	40	65+	71.7±4.7	GDS-15	≥8	192 (baseline) 105 (follow-up)	Psychosocial Behavioral Sociodemographic	100
Chan, R et al., 2014	China	Cross-sectional & Longitudinal	2,902	2,211	40	65+	71.8±4.8	GDS-15	≥8	218	Behavioral	95
Chang, Y et al., 2017	China (Taiwan)	Longitudinal	2,673	1,361	45	65+	74.2±5.7	CESD-10	≥10	624	Psychosocial Behavioral	100
Chao et al., 2018	USA	Cross-sectional	3,157	-	59	60-105	72.8±8.3	PHQ-9	≥10	256	Psychosocial Sociodemographic	95
Cho et al., 2018	South Korea	Cross-sectional	10,197	-	57	60+	70.2±6.6	GDS-15	≥8	2,391 (23)	Behavioral Sociodemographic	91
Choi, N & McDougall, 2009	USA	Cross-sectional	211	-	81	60-96	-	GDS-15	≥5	51 (24)	Psychosocial Sociodemographic	100
Choi, K et al., 2013	Europe	Cross-sectional	7,238	-	48	60-99	68.7±6.8	EUROD-12	≥4	765 (11)	Sociodemographic	95
Elliot et al., 2014	USA	Cross-sectional	6,483	-	57	65+	-	PHQ-9	-	-	Behavioral Sociodemographic	100
Fukunaga et al., 2012	Japan	Cross-sectional	964	-	62	65+	-	GDS-15	≥6	199 (21)	Psychosocial Behavioral Sociodemographic	82
Garcia-Pena et al., 2013	Mexico	Longitudinal	2,949	2,352	61	60+	70.9	GDS-30	≥11	-	Psychosocial Behavioral Sociodemographic	95
Giltay et al., 2006	Europe (Netherlands)	Longitudinal	464	135	-	64-84	70.8	Zung SDS	≥50	202	Psychosocial	91

Glass et al., 2006	USA	Cross-sectional & Longitudinal	2,812	1,970	61	65+	-	CESD-20	≥16	-	Behavioral Sociodemographic	100
Gomes et al., 2018	Brazil	Cross-sectional	1,378	-	63	60+	-	GDS-10	≥5	(15)	Behavioral	95
Gong et al., 2018	China	Cross-sectional	3,182	-	59	60-95	70.7±6.9	GDS-15	≥6	640 (21)	Psychosocial Behavioral Sociodemographic	86
Han et al., 2007	South Korea	Cross-sectional	205	-	63	60+	-	KDSKA-25	-	-	Psychosocial Sociodemographic	95
Hua et al., 2015	China	Cross-sectional	954	-	63	60+	70.9±7.2	GDS-30	≥11	151 (16)	Behavioral	77
Isaac et al., 2009	Europe (France)	Longitudinal	1,849	463	58	65+	73.2	CESD-20	≥15/16	564 (31)	Behavioral	100
Jaussent et al., 2011	Europe (France)	Longitudinal	9,077	3,824	56	65+	-	Modified CESD-20	≥16	618 (16)	Behavioral	95
Jeon & Dunkle, 2009	USA	Longitudinal	193	155	80	85+	87.7	SCL-90 Depression Scale	-	-	Psychosocial	86
Kaneko et al., 2007	Japan	Cross-sectional	1,925	-	57	60+	70.7±7.0	Zung SDS	≥50	201 (10)	Psychosocial Sociodemographic	77
Khaltar et al., 2017	Sri Lanka	Cross-sectional	778	-	61	60+	-	GDS-15	≥6	236 (30)	Psychosocial Sociodemographic	95
Ku et al., 2018	China (Taiwan)	Longitudinal	285	274	54	65+	74.5±6 .1	GDS-15	≥5	274 (100)	Behavioral	91
Kuchibhatla et al., 2012	USA	Longitudinal	3,973	1,516	65	65-105	-	CESD-20	≥16	930	Psychosocial Sociodemographic	100
Kuroda et al., 2015	Japan	Cross-sectional	1,856	-	50	65-94	72.9±5.5	GDS-15	≥6	272 (15)	Psychosocial Behavioral Sociodemographic	95
Lee, C et al., 2012	China (Taiwan)	Longitudinal	2,432	1,481	46	65+	73.4	CESD-10	≥10	312 (21)	Psychosocial Behavioral Sociodemographic	100
Lee, L et al., 2012	Malaysia	Cross-sectional	318	-	59	60+	-	GDS-15	≥5	96 (30)	Behavioral Sociodemographic	100

Lee, E et al., 2013	USA	Longitudinal	419	382	55	60-95	68.5	SCID & HAMD-24	Meets diagnostic criteria	68 (16)	Behavioral Sociodemographic	95
Lee, H et al., 2014	USA	Cross-sectional	810	-	55	60+	70.4	PHQ-9	≥10	32 (4)	Behavioral Sociodemographic	100
Li, N et al., 2011	China	Cross-sectional	2,002	-	49	60+	-	GDS-15	≥8	250 (13)	Psychosocial Behavioral	95
Li, J et al., 2015	Singapore	Cross-sectional	162	-	76	65+	72.2±6.2	GDS-15	≥5	56 (35)	Psychosocial Sociodemographic	86
Lin et al., 2014	USA	Cross-sectional	108	-	56	60-94	70.6±7.7	GDS-15	≥5	? (11)	Psychosocial Sociodemographic	95
Lue et al., 2010	China (Taiwan)	Longitudinal	1,868	1,487	42	65+	-	CESD-10	≥10	293	Psychosocial Sociodemographic	100
Maglione et al., 2014a	USA	Longitudinal	1,966	952	100	70-100	84.2	GDS-15	≥6	46 (5)	Behavioral	100
Maglione et al., 2014b	USA	Cross-sectional	3,020	-	100	70-100	-	GDS-15	≥6	355 (12)	Behavioral	100
Morikawa et al., 2013	Japan	Cross-sectional	3,796	-	50	65-93	72.2±5.1	GDS-15	≥6	561 (15)	Psychosocial Behavioral Sociodemographic	100
Murata et al., 2008	Japan	Cross-sectional	29,860	-	54	65+	-	GDS-15	≥5	9,834 (33)	Psychosocial Sociodemographic	95
Nakulan et al., 2015	India	Cross-sectional	220	-	58	65+	-	ICD-10	Meets diagnostic criteria	86 (39)	Psychosocial Sociodemographic	86
Nicolosi et al., 2011	Brazil	Cross-sectional	303	-	65	65+	71.8±5.4	GDS-15	≥5	63 (21)	Psychosocial Sociodemographic	100
Park, J. et al., 2015	South Korea	Longitudinal	701	340	48	65+	71.3±4.9	GDS-15	≥8	104	Behavioral	100
Park, M, 2017	South Korea	Longitudinal	2,435	-	100	65-104	-	CESD-11	-	-	Psychosocial Behavioral	100
Park, Y. et al., 2017	South Korea	Cross-sectional	258	-	52	65+	74.7	GDS-30	≥10	44 (17)	Psychosocial Sociodemographic	100
Piboon et al., 2012	Thailand	Cross-sectional	317	-	60	60-97	70.4±7.66	GDS-30	-	-	Psychosocial Sociodemographic	95

Pilania et al., 2017	India	Cross-sectional	500	-	54	60+	68.5±7.7	GDS-30	≥22	72 (14)	Behavioral Sociodemographic	95
Richardson et al., 2012	USA	Cross-sectional	378	-	69	-	-	SCID & PHQ-9	Meets diagnostic criteria / ≥10	101 (27)	Psychosocial	100
Russell & Taylor, 2009	USA	Cross-sectional	947	-	55	-	-	CESD-20	-	-	Psychosocial Sociodemographic	86
Sachs-Ericsson et al., 2007	USA	Longitudinal	4,162	2,406	63	65+	72±5.7	CESD-20	-	-	Psychosocial Sociodemographic	95
Schwarzbach et al., 2013	Europe (Germany)	Cross-sectional	1,028	-	67	75+	-	GDS-15	≥6	99 (10)	Behavioral Sociodemographic	100
Shin et al., 2008	South Korea	Longitudinal	1,000	787	53	65+	75.4	DSM-IV	Meets diagnostic criteria	65 (16)	Psychosocial	95
Smagula et al., 2015	USA	Cross-sectional & Longitudinal	2,892	2,124	-	65+	76.2±5.5	GDS-15	≥6	177	Behavioral	91
St John et al., 2006	Canada	Cross-sectional	1,382	-	60	65+	75.3	CESD-20	≥16	159 (12)	Psychosocial Sociodemographic	95
Sun et al., 2012	USA	Longitudinal	1,000	624	53	60+	74.9±5.9	GDS-15	≥6	(7)	Psychosocial Sociodemographic	91
Tani et al., 2015	Japan	Longitudinal	77,714	37,193	53	65+	-	GDS-15	≥5	4373	Psychosocial Behavioral Sociodemographic	91
Tanner et al., 2014	USA	Cross-sectional	533	-	76	60-100	78.5±8.8	GDS-15	>5	186 (35)	Psychosocial Sociodemographic	91
Thirthahalli et al., 2014	India	Cross-sectional	473	-	71	60+	68.7±6.7	CESD-20	≥16	179 (38)	Behavioral Sociodemographic	95
Uemura et al., 2018	Japan	Longitudinal	5,104	3,106	49	65+	71.5±5.2	GDS-15	≥6	239	Behavioral	91
Vanoh et al., 2016	Malaysia	Cross-sectional	2,264	-	52	60+	-	GDS-15	≥5	373 (17)	Psychosocial Behavioral Sociodemographic	95

van't Veer-Tazelaar et al., 2008	Europe (Netherlands)	Cross-sectional	2,850	-	62	75-99	-	CESD-20	≥16	887 (31)	Sociodemographic	100
Woo et al., 2006	China	Cross-sectional	3,394	-	44	65+	72 ±4.9	GDS-15	≥8	280 (8)	Behavioral	100
Yoo et al., 2016	South Korea	Cross-sectional	648	-	70	65+	75.4 ±5.9	GDS-15	-	-	Psychosocial Sociodemographic	100
Yoshida et al., 2015	Japan	Longitudinal	1,327	680	57	65+	72.7±5.4	GDS-15	≥6	115	Behavioral	91
Yoshimura et al., 2013	Japan	Cross-sectional	274	-	68	65+	74.3±4.7	GDS-15	≥5	59 (22)	Sociodemographic	100

Note: CESD = Center for Epidemiological Studies Depression scale; CIDI = Composite International Diagnostic Interview; DSM = Diagnostic and Statistical Manual of Mental Disorders; GDS = Geriatric Depression Scale; GHQ = General Health Questionnaire; HADS = Hospital Anxiety and Depression Scale; HAMD = Hamilton Depression Rating Scale; ICD = International Classification of Diseases; KDSKA = Kim Depression Scale for Korean Americans; PHQ = Patient Health Questionnaire; SCID = Structured Clinical Interview for DSM; SCL = Symptom Checklist; Zung SDS = Zung Self-Rating Depression Scale.

2.3.3. Identified protective and risk factors. Modifiable and non-modifiable variables assessed in the eligible studies were categorised as potential risk or protective factors for depressive symptoms. Only factors that were reported in at least three studies are discussed and presented in Tables 2 to 4. This threshold was selected to enable comparisons among results. Factors examined by fewer than three studies are listed in Table 5.

In total, 21 potential protective and risk factors were identified. These were categorised as psychosocial (social/family support, self-rated health, social network size, loneliness, sense of personal mastery), behavioural (physical activity, social participation, engagement in hobbies, use of modern devices, sleep disturbance, diet quality, smoking status, alcohol use), or sociodemographic (age, gender, education level, marital status, living situation, body mass index [BMI], socioeconomic status [SES], employment status).

Tables 2, 3, and 4 present findings from multivariate analyses relating to each of these factors. The majority of studies reported at least one significant association between a protective (60 studies) or risk (39 studies) factor and depressive symptoms among older community-dwelling adults. Very few studies assessed interaction effects, of which the majority examined potential moderating effects of sociodemographic variables. The results of these interactions are presented in Table 6 in the supplementary materials, along with the relevant independent and confounding variables for each included study.

2.3.3.1. Psychosocial factors. The relationships between psychosocial factors and depressive symptoms were explored in 45 studies (see Table 2). There was substantial evidence for the protective role of good social and/or family support and better self-rated health, with findings consistent across cross-sectional and longitudinal studies. Fewer studies examined sense of personal mastery as a potential protective factor, however the available evidence indicated a protective effect across both cross-sectional and longitudinal studies. Loneliness was only examined in cross-sectional studies, all but one of which found it to be an important risk factor for depressive symptoms. There were varied results within and between cross-sectional and longitudinal studies on the effect of larger social networks.

Table 2

Relationships between Psychosocial Factors and Depressive Symptoms among Community-dwelling Older Adults

Study	Good social/family support N=36	Better self-rated health N=16	Loneliness N=5	Large social network N=5	Sense of personal mastery N=3
Abe et al., 2012	-				
Alexandrino-Silva et al., 2011	-				
Ang & Malhotra, 2016	-				-
Baiyewu et al., 2015		-			
Brinda et al., 2016	0				
Cao et al., 2016	0	-			
Castro-Costa et al., 2008		-			
Chan, A et al., 2011	-				
Chan, D et al., 2012	0				
Chan, M & Zeng, 2009	-	-			
Chang, Y et al., 2017	-	-			
Chao et al., 2018	-				
Choi, N & McDougall, 2009	-				
Fukunaga et al., 2012	-				
Garcia-Pena et al., 2013	0			0	
Giltay et al., 2006		-			
Gong et al., 2018	-				
Han et al., 2007	-	-		0	
Jeon & Dunkle, 2009	-				-
Kaneko et al., 2007	-	-	+		
Khaltar et al., 2017	-				
Kuchibhatla et al., 2012	-	-		-	
Kuroda et al., 2015	-			-	
Lee, C et al., 2012	0				
Li, N et al., 2011		-			
Li, J et al., 2015	-		+		
Lin et al., 2014				0	-
Lue et al., 2010	0				
Morikawa et al., 2013	-				
Murata et al., 2008		-			
Nakulan et al., 2015	-				
Nicolosi et al., 2011		-			
Park, M, 2017	-				
Park Y. et al., 2017	-				
Piboon et al., 2012	-		+		
Richardson et al., 2012	-				
Russell & Taylor, 2009	-				
Sachs-Ericsson et al., 2007		-			
Shin et al., 2008	-				
St John et al., 2006		-			
Sun et al., 2012	-	-			
Tani et al., 2015	-				
Tanner et al., 2014	-		+		
Vanoh et al., 2016	0		0		
Yoo et al., 2016	-	-			

Note. N = number of studies examining this factor. A plus sign (+) indicates a risk factor, a minus sign (-) indicates a protective factor, zero (0) indicates a non-significant association, and a blank cell indicates the factor was not examined. *Italics* indicates longitudinal studies. Studies that did not examine psychosocial factors are not included in this table.

2.3.3.2. Behavioural factors. The relationships between behavioral factors and depressive symptoms were explored in 42 studies (see Table 3). Strong support across cross-sectional and longitudinal studies was found for physical activity, greater social participation, engagement in hobbies, and good diet quality being significant protective factors, and sleep disturbance being a significant risk factor. The majority of studies examining past/current smoking and alcohol use did not find these behaviors to be significant risk factors for depressive symptoms. Research examining the use of modern devices was limited and results were varied.

Table 3

Relationships between Behavioural Factors and Depressive Symptoms among Community-dwelling Older Adults

Study	Physical activity N=15	Greater social participation N=12	Sleep disturbance N=11	Alcohol use N=10	Past or current smoker N=8	Good diet quality N=6	Engaged in hobbies N=5	Use of modern devices N=2
Abe et al., 2012			+					
Aihara et al., 2011	-	0		0	0	-	-	
Almeida et al., 2014				+	+			
Almeida et al., 2011			+					
Baiyewu et al., 2015		-						
Carayanni et al., 2012		-						
Castro-Costa et al., 2008			+					
Chan, A et al., 2011		-						
Chan, D et al., 2012				0			-	
Chan, R et al., 2014						-		
Chang, Y et al., 2017	-							
Cho et al., 2018	-							
Elliot et al., 2014		-						0
Fukunaga et al., 2012			+	0	0	-		
Garcia-Pena et al., 2013	0			0	0			
Glass et al., 2006	-	-						
Gomes et al., 2018						-		

Gong et al., 2018			+					
Hua et al., 2015	-					-		
Isaac et al., 2009		-						
Jaussent et al., 2011			+					
Ku et al., 2018	-							
Kuroda et al., 2015		-						
Lee, C et al., 2012				0			-	
Lee, L et al., 2012	-	0						
Lee, E et al., 2013			+					
Lee, H et al., 2014	-							
Li, N et al., 2011				+				
Maglione et al., 2014a			0					
Maglione et al., 2014b			+					
Morikawa et al., 2013	-		+	+	0			
Park J et al., 2015	-			0	0			
Park M, 2017							-	
Pilania et al., 2017							-	
Smagula et al., 2015			+					
Schwarzbach et al., 2013		-						
Tani et al., 2015		-						
Thirthahalli et al., 2014					0			
Uemura et al., 2018	-	-						-
Vanoh et al., 2016	0							
Woo et al., 2006	0			0	+	-		
Yoshida et al., 2015	-							

Note. N = number of studies examining factor. A plus sign (+) indicates a risk factor, a minus sign (-) indicates a protective factor, a zero (0) indicates a non-significant association, and blank cell indicates the factor was not examined. *Italics* indicates longitudinal studies. Studies that did not examine behavioural factors are not included in this table.

2.3.3.3. Sociodemographic factors. The relationships between sociodemographic factors and depressive symptoms were explored in 48 studies (see Table 4). The majority of studies examining age, gender, marital status, living arrangement, employment status, and weight status did not find a significant relationship between these factors and depressive symptoms. This was the case among both cross-sectional and longitudinal studies. Results relating to lower education level and SES were mixed, which appeared to be potentially attributable to differing methodologies. Out of the 28 studies that included education level, the 21 cross-sectional studies found a non-significant relationship between lower education level and depressive symptoms, while most of the seven longitudinal studies found lower education level to be a significant risk factor. Only four cross-sectional studies examined the relationship between SES and depressive symptoms, of which half found it to be risk factor and half did not find a significant relationship.

Table 4

Relationships between Sociodemographic Factors and Depressive Symptoms among Community-dwelling Older Adults

Study	Older N=35	Female N=30	Lower level of education N=28	Not married N=16	Living alone N=11	Unemployed N=5	Overweight/ obese N=4	Low SES N=4
Abe et al., 2012	0	0			0	+		
Almeida et al., 2014	+							
Brinda et al., 2016	0	+	+					
Carayanni et al., 2012				+				+
Carriere et al., 2017	0						0	
Castro-Costa et al., 2008	+	+	+	+				
Chan, A et al., 2011	0		+		+			
Chan, D et al., 2012	0			0				
Chao et al., 2018	+	+	0	+	0			
Cho et al., 2018							0	
Choi, K et al., 2013						0		
Choi, N & McDougall, 2009	0	0	0		0			

Elliot et al., 2014	-							0
Fukunaga et al., 2012	+	0			0			
Garcia-Pena et al., 2013	+	0	+	0	0			
Gong et al., 2018	+		+					
Glass et al., 2006	0	+		+				
Han et al., 2007	0	0	+					
Kaneko et al., 2007	+							
Khaltar et al., 2017	0	0	0	0	0			+
Kuchibhatla et al., 2012	0	+	+					
Kuroda et al., 2015	+		0		+			
Lee, C et al., 2012			0			0		
Lee, L et al., 2012	0			0				
Lee, E et al., 2013	-	0	+	+				
Lee, H et al., 2014	+							
Li, J et al., 2015	0	0	0		0			
Lin et al., 2014	0	0	0	0				
Lue et al., 2010	0	+	0	0				
Morikawa et al., 2013	0	0	+					
Murata et al., 2008	-	0	0	+				
Nakulan et al., 2015		+						
Nicolosi et al., 2011			+					
Park, J et al., 2017			0					
Piboon et al., 2012		+						
Pilania et al., 2017		+						
Russell &Taylor, 2009	0	0		0	+			0
Sachs-Ericsson et al., 2007	0	0	+				+	
Schwarzbach et al., 2013	0	0	0					
St John et al., 2006	0	0	0		0			
Sun et al., 2012	0	0	+	0				

Tani et al., 2015				0		0		
Tanner et al., 2014		0						
Thirthahalli et al., 2014		+	0			0		
Vanoh et al., 2016			+					
van't Veer-Tazelaar et al., 2008	0	0	+	0				
Yoo et al., 2016	0	0	0					
Yoshimura et al., 2013	0	0					0	

Note. N = number of studies examining factor. A plus sign (+) indicates a risk factor, a minus sign (-) indicates a protective factor, a zero (0) indicates a non-significant association, and blank cell indicates the factor was not examined. *Italics* indicates longitudinal studies. Studies that did not examine sociodemographic factors are not included in this table.

Table 5

Factors Associated with Depressive Symptoms among Community-dwelling Older Adults in Multivariate Analyses

	Under weight	Good quality of life	Good life satisfaction	Low self-estimate of happiness	Good relationships with neighbours	Chair stand	Chair reach	Care for grandkids	Living with others but eating alone	Occasional alcohol use	Vitamin deficiency	High vitamin intake	High fat intake	High calorie intake	Avoids excess fat/salt	Alternative diet	Consume fish in diet
Abe et al., 2012				+													
Aihara et al., 2011					-					-					-		0
Cao et al., 2016		-															
Carayanni et al., 2012								-									
Chan, D et al., 2012																	
Cho et al., 2018	+																
Choi, K et al., 2013								0									
Gougeon et al., 2015														+		0	
Ivey et al., 2015					-												
Kuroda et al., 2015									+								
Li J et al., 2015		0															
Lue et al., 2010			-	+													
Morikawa et al., 2013										-							

Niu et al., 2013															0	
Oishi et al., 2009											+	0				
Park, M et al., 2017										0						
Santos et al., 2012						-	-									
Tani et al., 2015									+							
Vanoh et al., 2016						0	0						0			
Woo et al., 2006										0	0	0		-		0
Yoo et al., 2016			-													

Note. Factors listed were examined in ≤ 2 studies. A plus sign (+) indicates a risk factor, a minus sign (-) indicates a protective factor, a zero (0) indicates a non-significant association, and a blank cell indicates the factor was not examined.

Table 6

Confounding Variables, Effects of Independent Variables, and Interactions from Studies Included in Review

Studies	Confounding variables	Independent variables of interest to this review	Effect size		Significant interactions
			OR | RR | HR	β	
Abe et al., 2012	None specified	Female Age Living alone Sleep disturbance Poor social support Unemployed	0.91 – 0.94 1.01 – 1.03 0.81 – 1.22 1.19 – 1.48* 1.10 – 1.28* 2.41 – 3.25*		None tested
Aihara et al., 2011	Age Illness Cognitive difficulties	Physical exercise Good diet quality No smoking Engaged in hobbies Participation in community activity No alcohol	3.40 – 3.46* 2.37 – 2.54* 1.82 – 2.00 2.60 – 4.32* 0.46 – 2.59 0.75 – 7.70		None tested
Alexandrino-Silva et al., 2011	Gender Anxiety Life events Bereavement Living alone SES Cognitive impairment Chronic somatic illness	Perceived lack of social support	0.70 – 3.50*		Social support X Male: OR = 3.50 (95% CI:2.20 – 12.40)
Almeida et al., 2011	Age Education level Migrant status Living alone Low social support Smoking BMI Chronic illnesses	Difficulty falling asleep	1.83*		None tested

Almeida et al., 2014	Age Smoking history Cardiovascular diseases BMI	Age 75-79 Past smoking Risky alcohol	1.33* 1.29* 0.58*		None tested
Ang & Malhotra, 2016	Race Housing type Education level Age Living arrangement Employment status # of children ADL and IADL difficulties # of chronic illnesses Vision and hearing difficulties	Received social support Personal mastery		-0.01 – -0.29* -0.36 – -0.42*	None tested
Baiyewu et al., 2015	None specified	Poor social engagement Poor self-perceived health	0.05* 0.08*		None tested
Brinda et al., 2016	Age Gender	Social isolation Lack of formal education Years after 65 years of age Female	1.70 1.98* 0.99 1.42*		None tested
Cao et al., 2016	Age Education level Monthly income Self-reported insomnia	Social relationships Self-rated physical health	1.01 0.93**		None tested
Carayanni et al., 2012	Age Children's existence Economic situation Marital status Multimorbidity Meetings with friends Caring for invalid persons Care of grandchildren Outings and excursions Education level	Not currently married Meeting with friends in free Low economic status	3.5 – 6.63* 4.21 – 4.26* 1.23 – 2.26*		None tested

Carriere et al., 2017	Baseline age	Age Overweight or obese	1.00 – 1.07 0.87 – 1.37		None tested
Castro-Costa et al., 2008	Age Gender Marital status Education level ADL difficulties Sleep complaints	Female Age 80+ Not married Lower # of schooling years Poor self-rated health Sleep complaints	1.15* 1.22* 1.25 – 1.30* 1.42* 1.84 – 2.44* 1.77*		None tested
Chan, M & Zeng, 2009	Referenced previous research	Poor self-rated health Poor social support	4.15* 3.63*		None tested
Chan, A et al., 2011	Age Ethnic group Education level Housing type # of chronic diseases ADL and IADL difficulties	Living alone Weak social support Age No social activity Secondary education		0.60 – 1.70* 0.20 – 1.30* -0.00 – -0.02 0.20 – 0.70* -0.80 – 0.01*	Males: Living alone X Weak social support: $\beta = 0.10$ (*SE* = 0.50)
Chan, D et al., 2012	Follow-up GDS score	Age Not married Frequent contact with family/friends Risky alcohol consumption Loss of hobby	0.97 – 1.01 0.90 – 1.62 0.50 – 0.58 0.83 – 1.83 2.13 – 2.77*		None tested
Chan, R et al., 2014	Baseline age Gender Daily energy intake BMI Physical activity # of IADL difficulties Smoking habit Alcohol use Education level Marital status Baseline self-reported history of diabetes	Good diet quality	0.55*		None tested

	Hypertension Heart disease or stroke CSI-D score				
Chang, Y et al., 2017	Present age Gender Education level Marital status Smoking Social participation Chronic conditions	Exercise Good self-rated health Social support	0.56 – 0.67* 0.28* 0.86*		None tested
Chao et al., 2018	Age Gender Education level Annual income Marital status Years in the United States Living arrangement # of children Years in the community Country of origin Medical comorbidities	Age Gender Education level Marital status Living arrangement Positive perceived social support	1.03* 1.81* 1.00 0.82* 1.00 0.82*		None tested
Cho et al., 2018	Age BMI Comorbidity Drinking Education level Income Living status Marital status Mild cognitive impairment Nutritional status Self-reported health status Gender Smoking	Inactive Overweight	1.73* 0.98		Inactive X Normal weight: OR = 1.73 (95% CI:1.29 – 2.31) Inactive X Underweight: OR = 2.04 (95% CI:1.36 – 3.04) Inactive X Overweight/obese: OR = 1.72 (95% CI:1.29 – 2.30)

Choi, N & McDougall, 2009	Age Race/ethnicity Gender Living alone Education level Financial situation/worries # of medical conditions # of ADL and IADL difficulties Homebound Previous mental health treatment # of stressful life events Sum of current unmet needs	Age Female Living alone Education level Social support		-0.03 -0.18 0.01 0.02 -0.09*	None tested
Choi, K et al., 2013	Age Gender Marital status Educational level SES	Paid work yes vs.no	0.71		None tested
Elliot et al., 2014	Age Education level	Age SES Computer use Social integration		-0.09* -0.10 0.02 -0.02*	Ill-health X High computer users: $\beta = 0.38$ (*SE* = ?) ADL limitations X High computer users: $\beta = 0.47$ (*SE* = ?)
Fukunaga et al., 2012	None specified	Age Gender Drinking alcohol Smoking Sleep Appetite Living alone Social support		0.17* 0.00 -0.00 -0.03 0.15* 0.20* -0.03 0.12*	None tested
Garcia-Pena et al., 2013	None specified	Age Gender Married Living alone	1.04* 0.89 0.93 0.81		None tested

		Education level # of friends Social support Exercises regularly Alcohol drinking Smoking	0.92* 0.99 0.99 1.01 1.08 1.06		
Giltay et al., 2006	Age Cardiovascular disease Education level Physical activity	Self-rated health	No value specified		None tested
Glass et al., 2006	Age Gender Time Education level Marital status Fitness activities Health and functional status	Social engagement Age Female Marital status Physical exercise		-0.31* -0.02 0.93* -0.92* -0.36*	No significant interactions
Gomes et al., 2018	Gender Age Marital status Education level Economic class Leisure activity Current smoking Alcohol intake	Low diet quality	2.43*		None tested
Gong et al., 2018	SES Health and functional variables	Age 80+ Education level Satisfied sleep quality Social support	0.67* 2.19* 0.41* 1.09*		Worse sleep quality among empty nesters living alone or with spouse increases depressive symptoms Better social support among empty nesters living alone decreases depressive symptoms
Han et al., 2007	Age Gender Educational level Perceived health status Years in the United States	Age Gender Educational level Perceived health status Network size Perceived social support		0.08 0.12 -0.16* 0.23* -0.03 -0.15*	None tested

Hua et al., 2015	None specified	Nutrition Physical activity	1.12* 1.11*		None tested
Isaac et al., 2009	Gender Age Marital status	Higher social activity	1.60*		Social activity X Gender: OR = 1.55 (95% CI:1.16 – 2.08) Social activity X Age: OR = 1.54 (95% CI:1.15 – 2.06) Social activity X Marital status: OR = 1.55 (95% CI:1.15 – 2.07) Social activity X Education: OR = 1.60 (95% CI:1.19 – 2.16) Social activity X Alcohol: OR = 1.59 (95% CI:1.18 – 2.14)
Jaussent et al., 2011	CESD baseline Gender Age Education level Living alone Coffee consumption Alcohol consumption Smoking Chronic disease Past major depression Disability Prescribed sleep medication intake Homeopathic and non-prescription treatments for sleep	Poor sleep quality	1.71*		None tested
Jeon & Dunkle, 2009	Attrition Gender Race Education level Functional health	Personal mastery Social support		0.04* 6.77*	None tested
Kaneko et al., 2007	Age Gender	Poor self-rated health Loneliness Poor family support Age 80+	6.01* 4.16* 2.78* 2.79*		None tested
Khaltar et al., 2017	Gender Age	Female Age 75+	1.97 0.85		None tested

	Ethnicity Education level Marital status Economic status Living arrangement # self-reported diseases Occupation before aged 60 years	Not married Low SES Living alone Low perceived social support Low education level	1.72 1.97* 1.44 2.94* 1.88		
Ku et al., 2018	Gender Age Educational level Marital status Main source of income Smoker status Alcohol consumption BMI # of chronic diseases	Light physical activity	0.67*		None tested
Kuchibhatla et al., 2012	Age Race Gender Education level Self-rated health Functional status Cognitive status Stressful life events Social network Social interaction	Female Age Education level Poor self-rated health Larger social network Higher social interaction	1.91* 0.90 0.95* 2.69* 0.96* 0.98*		None tested
Kuroda et al., 2015	None specified	Social ties with family/friends Low reciprocal social support Fewer frequency of going out Low income Education level Age Living alone	0.90 – 0.97* 1.66 – 1.73* 2.21 – 2.79* 1.65 – 1.72* 1.03 – 1.05 0.95 – 0.99* 0.37 – 0.78*		None tested

Lee, C et al., 2012	Age Gender CESD score	Fewer leisure activities Moderate & high social support vs. low social support Education vs. no education Alcohol drinking yes vs. no Employed vs. unemployed	0.56* 0.83 – 0.87 0.85 – 1.15 0.89 0.67		None tested
Lee, L et al., 2012	Age Gender Ethnicity Education level	Older age Married No social engagement No habitual exercise	1.69 0.68 1.51 1.24*		None tested
Lee, E et al., 2013	Age Gender Marital status Education level Chronic disease Depression score Antidepressant and sedative-hypnotic use Baseline depression	Sleep disturbance Age Gender Marital status Education level	16.05* 0.84* 0.70 12.24* 0.55*		None tested
Lee, H et al., 2014	Age Chronic conditions Annual household income	Physical activity Age	0.28* 0.68*		None tested
Li, N et al., 2011	Gender Poor self-rated health Cognitive impairment Poor income	Poor self-rated health Drinking	7.70* 0.39*		None tested
Li, J et al., 2015	None specified	Social support Loneliness Age Gender Education level Living arrangement		-0.23* 0.42* -0.01 -0.06 -0.03 -0.05	None tested
Lin et al., 2014	None specified	Age Female Not married		-0.12 -.013 0.07	None tested

		Education (< college) Sense of mastery Social network		-0.13 -0.29* -0.15	
Lue et al., 2010	Gender Age Education level Marital status Ethnicity Occurrence of new diseases Perceived health stress Perceived financial stress Life satisfaction Functional condition	Female Older 75+ Lower education Not married Social support Poor life satisfaction	1.58* 0.82 -0.24 – -0.14 0.22 – 0.41 0.11 – 0.23 0.65*		None tested
Maglione et al., 2014a	Age Race Site Smoking status BMI Education level Exercise # of reported medical conditions ADL difficulties Cognitive impairment Use of medications	Sleep disturbance	1.64		None tested
Maglione et al., 2014b	Age Race Site Smoking status BMI Education level Exercise # of reported medical conditions ADL difficulties	Decreased mean of the modelled activity curve (i.e., lowest quartile)	1.60*		None tested

	Cognitive impairment Use of medications				
Morikawa et al., 2013	Age Gender Metabolic syndrome Sleep status Smoking Alcohol use Social supports Visual, hearing Walking Cognitive function Life events	Older age Female ≥10 years of education Sleep disturbance Smoking Risky alcohol use? Social support Physical activity	0.94 0.95 0.78* 2.22* 2.66 0.61* 0.44 – 0.56* 0.53*		None tested
Murata et al., 2008	Age Illness Higher level of ADL Gender Marital status Self-rated health	Female Age Poor self-rated health Not married 6-9 years of education	1.01 0.99* 3.41* 1.27* 1.18*		None tested
Nakulan et al., 2015	None specified	Good social support Female	0.27*		None tested
Nicolosi et al., 2011	None specified	Poor self-reported health Education level	0.64* -0.14*		None tested
Park, J et al., 2015	Age Gender Education level Marital status Living arrangement Medical insurance Employment	Alcohol Smoking Physical activity	0.23 10.55 0.17*		None tested
Park, Y et al., 2017		Higher education Lower social support	0.94 1.08 – 1.14*		None tested
Park, M, 2017	None specified	Supportive family Participation in leisure activities		-0.35* -1.22*	None tested

Piboon et al., 2012	None specified	Social support Loneliness Gender		-0.21* 0.23* 0.21*	None tested
Pilania et al., 2017	Marital status Education level Present occupation SES Economic dependency Physical activity Sleep problems	Female No hobbies	2.68* 3.84*		None tested
Richardson et al., 2012	Age Gender Race Marital status Income Education level # of IADL difficulties # of medical conditions Social Network Scale Stressful life events Self-related health Religion Pain Social network Social support	Social support	0.96*		None tested
Russell & Taylor, 2009	Social characteristics Exposure to recent life events	Living alone Female Good social support Age SES Not married	5.04* 1.87 -6.86* -0.06 -1.24 -0.28 – -0.29		Support X Living alone: β = 1.92 (*SE* = 0.916)
Sachs-Ericsson et al., 2007	T1 depression T1 & T2 health status T2 BMI	Age Gender Education level Smoking		-0.00 0.24 -0.04* -0.13	Race X BMI T1: β = 0.14 (*SE* = 0.06) Race X BMI X Education: β =-0.37 (*SE* = 0.19)

		Physical activity Self-rated health		0.18 0.34*	
Schwarzbach et al., 2013	Gender Age Education level Assisted living Care level Functional limitations Mobility impairment Vision impairment Hearing impairment Functional impairment Cognitive impairment Utilization of formal nursing care	Female Education level Social integration Age	2.00 0.90 – 1.10 3.00 – 8.90* 0.50 – 0.60		None tested
Shin et al., 2008	Age Gender Education level	Poor social support	3.05*		None tested
Smagula et al., 2015	Age Alcohol consumption IADL difficulties Apnea-hypopnea index Baseline anxiety BMI Caffeine consumption Cognitive performance Education level # of medical conditions # of medications Physical activity Poor subjective sleep Race Smoking status Study site	Lowest quartile Low circadian activity rhythm robustness	2.04* 2.58*		None tested

St John et al., 2006	None specified	Female Age (years) Education level Lives alone Poor self-rated health	1.14 0.98 0.97 1.43 3.09*		None tested
Sun et al., 2012	Age Gender Ethnicity Marital status Education level Health, and resources available to an individual at baseline ADL and IADL difficulties	Age Female Married Education level Good self-rated health Good social support		0.01 0.19 -0.08 0.06* -0.32* -0.11*	None tested
Tani et al., 2015	Equivalised household income Education level Age History of disease(s)/symptom(s) Higher level of functional ability Frequency of vegetable or fruit intake BMI Social participation Frequency of meet friends Employment status Marital status.	Poor social support No social participation Not employed Not married	0.95 – 1.31* 1.09 – 1.34* 0.96 – 1.24 0.68 – 1.15		Male Eating X Cohabitation status: RR = 2.54 (95% CI:1.25 – 5.18)
Tanner et al., 2014	None specified	Social support Gender Loneliness	0.69	-0.22* 0.20 1.05*	None tested
Thirthahalli et al., 2014	None specified	Female Not literate Unemployed Tobacco consumption	1.90* - - -		None tested

Uemura et al., 2018	Age Gender Education level Current smoking status Alcohol consumption Living status Self-rated health Mini-Mental State Examination Short Physical Performance Battery Medications Geriatric Depression Scale at baseline.	Light physical exercise Using technology Social activity	0.74* 0.68* 0.54 – 0.69*		None tested
Vanoh et al., 2016	Age Gender Monthly income Alcohol intake Living arrangement	Education level Loneliness Exercise Social support	0.91* 1.00 1.19 1.00		None tested
van't Veer-Tazelaar et al., 2008	Gender	Age Not married Low education Female	- - 1.45* -		No significant interactions
Woo et al., 2006	GDS score Age Gender Education level SES History of stroke Myocardial infarction Angina Congested heart failure Diabetes mellitus	Past current smoking Drinking 1+ alcoholic beverage a week Physical activity Vegetables	1.02 – 1.64* 1.01 0.77 – 0.95 0.63 – 0.73*		None tested
Yoo et al., 2016	None specified	Poor social support Good self-rated health Education level		-0.11 – 0.07* -0.14 – 0.02* -0.01 – -0.12	None tested

		Age Female		0.02 – 0.09 -0.05 – -0.17	
Yoshida et al., 2015	Gender Age Educational level Smoking status Alcohol consumption Outpatient visits ADL difficulties	Physical activity	0.50*		None tested
Yoshimura et al., 2013	None specified	Age Gender BMI	- - -		None tested

Note. OR = odds ratio. HR = hazard ratio. RR = risk ratio. SES = socioeconomic status. BMI = body mass index. ADL = activities of daily living. IADL = instrumental activities of daily living. GDS = Geriatric Depression Scale. CESD = Center for Epidemiologic Studies Depression Scale. CSI-D = Community Screening Instrument for Dementia. None specified = study did not explicitly state confounding factors. Where effect sizes are presented as a range, this indicates that the study did not provide an effect size for the total sample and instead provided effect sizes for multiple sub-groups among the sample. * $p < .05$ for at least one of the effects presented. - indicates a non-significant association and no value is specified. None tested = no interactions were tested.

2.4. Discussion

This systematic review assessed 75 studies examining various modifiable and non-modifiable factors associated with depressive symptoms among older community-dwelling adults. All but one of the studies were deemed to be of high quality, and the mean quality score was 0.94. Of the 21 factors identified in this review, good social/family support, better self-rated health, engagement in physical activity, and participation in social activities were identified as key protective factors, while sleep disturbance was identified as an important risk factor (see Table 7). These results are consistent with those of previous reviews (Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008), indicating that these factors should be focal issues in efforts to improve the well-being of older people.

Table 7

Systematic Review Outcome Summary

Protective Factors	**Risk Factors**	**Inconclusive Factors**	**Unrelated Factors**
Good social/family support^{+++}	Sleep disturbance^{+++}	Level of education^{+++}	Age^{+++}
Better self-rated health^{+++}	Loneliness^{+}	Alcohol use^{+++}	Gender^{+++}
Physical activity^{+}		Smoking status^{++}	Marital status^{+++}
Greater social participation+		Social network size^{+}	Living arrangement^{+++}
<u>Good diet quality</u>		SES^{+++}	<u>Employment status</u>
<u>Engagement in hobbies</u>		<u>Use of modern devices</u>	Weight status^{+}
Sense of personal mastery^{+}			

Note. Factors identified in this review are listed in descending order of importance in each column; <u>Underline</u> indicates factors that have not been examined by previous reviews; + indicates how many out of the three previous systematic reviews examined this factor.

In contrast with previous reviews (Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008), the majority of studies examining sociodemographic factors did not find an association with depressive symptoms. This variation in outcomes may be at least partially due to the relative importance of the other factors included in the multivariate analyses conducted in more recent studies. The lack of effect of these sociodemographic factors in the present review suggests that it may not be necessary to tailor mental well-being interventions according to characteristics such as age, gender, marital situation, and living arrangement, which potentially simplifies the task of intervention design and implementation by permitting a more broad-based approach.

Overall, the review results highlight the importance of interventions and prevention programs designed to achieve (i) increased social and/or family support, (ii) higher self-rated health, (iii) greater participation in physical and social activities, and (iv) improved sleep patterns. Evidence indicates that interventions focused on increasing social and/or physical activity are particularly effective in reducing depressive symptoms among older adults (Catalan-Matamoros et al., 2016; Forsman et al., 2011a, 2011b). This may be due to the ability of such interventions to address all four of the factors identified as being predictive of depressive symptoms in this review. For example, physical activity has been found to improve sleep quality (Reid et al., 2010; N. A. Singh et al., 2005), social activity has been linked with greater social support (C. Li et al., 2018), and both physical and social activities have been linked with positive changes in older adults' self-rated health (Fiorillo & Nappo, 2017; Ichida et al., 2013; Wanderley et al., 2011). Facilitating older adults' participation in such activities is therefore important to prevention efforts. This could be achieved by tailoring programs and activities to seniors' capabilities (e.g., access to transport, fitness levels) and preferences (e.g., activities the individual finds meaningful/interesting or that involve peers and family members) (Catalan-Matamoros et al., 2016; Forsman et al., 2011a, 2011b; Liljas et al., 2019). It is also important to ensure that such activities are affordable (Liljas et al., 2019).

Several new modifiable variables were included in this review: engagement in hobbies, diet quality, employment status, and use of modern devices. Of these, engagement in hobbies and good diet quality were found to be protective against depressive symptoms, while no significant relationship was found for employment status. The results for use of modern devices were inconclusive across studies. Given the recency of work in these areas, further research could assist in clarifying the role of these factors in influencing older people's likelihood of experiencing depressive symptoms.

2.4.1. Limitations. The present review had several limitations that should be considered. First, it was confined to studies published in English. However, the included studies were undertaken in a wide range of countries, including those where other languages are dominant. Second, the factors addressed in the results represent variables examined by three or more studies, thus emerging and novel factors assessed by a smaller number of studies were not reviewed (but are listed in Table 5).

Third, the included studies used a range of depression scales (e.g., GDS, CESD) and measurement approaches (e.g., cut-off vs continuous scores), limiting the comparability of results. Fourth, the included studies using multivariate analyses may not be directly comparable because varying adjustments were made for different variables, and it is possible that discrepancies relating to individual factors may be due to the nature and quantity of other variables included in the analyses.

2.4.2. Conclusion. Results of this and previous reviews highlight the complex nature of the aetiology of depressive symptoms and the likely interrelationships between various psychosocial, behavioral, and sociodemographic factors. The important roles of social support and participation, better self-rated health, physical activity, and sleep quality in protecting against depressive symptoms among community-dwelling older adults were confirmed. This suggests that interventions that encourage social support, enhance self-rated health, include physical activity components, and/or improve sleep hygiene may have the potential to prevent or reduce depressive symptoms among community-dwelling older people.

2.5. Future Studies

This chapter provides an overview of the primary protective factors associated with depressive symptoms evident in the existing literature. The relative order of importance of these factors based on this systematic review is as follows: social support, self-rated health, sleep quality, social participation, and physical activity. While these factors are important to include in future research, factors grounded in theory such as self-esteem, self-efficacy, and psychological well-being were not examined by three or more studies and thus were not analysed in this systematic review, but may still be potentially important. Further, despite many factors being identified as potentially important, no studies have investigated the predictive utility of these variables in the same model, instead focusing on a single or limited number of variables. As such, the aims of Studies 2 and 3 of this thesis are to address this gap by examining the relative importance and unique contribution of each of these factors in a single model. These findings will guide the development of an overarching theoretical framework in the final chapter of the thesis.

CHAPTER 3. GENERAL METHOD

This chapter provides an overview of the overall method for recruiting participants, ethical considerations, and discussion about each of the measures used to assess factors associated with depressive symptoms in older people that were assessed in studies 2, 3, and 4.

3.1. Older Community-dwelling Adult Participants

Studies 2, 3, and 4, presented in Chapters 4, 5, and 6 respectively, were part of a larger project funded by an ARC Discovery Grant (DP140100365) exploring healthy ageing among older adults (Pettigrew et al., 2015). In the larger project, over 800 community-dwelling older adults (aged 60 years and older) were recruited using convenience sampling into various phases of the project, which involved different combinations of psychological and physical testing. Eligible participants were aged 60 years or older, lived in a community setting, and were fully retired. Participants were recruited via a range of methods including notices in community newspapers, radio announcements, and flyers placed at seniors' events and retirement villages across the Perth metropolitan area. Participants were allocated into two sub-samples, with half completing a questionnaire that included a wide range of demographic, lifestyle, and psychological measures either online or via post, and the other half completing the same questionnaire and further assessments conducted at University campuses at two time points, six months apart. These further assessments consisted of an in-person interview, physical assessment that included height and weight measurements, and provided with an accelerometer to wear for seven consecutive days at the start and end of the six months to track their physical activity levels. Specific details pertaining to each study are provided in the relevant chapters.

While this thesis represents an extension of the ARC Discovery project, the contribution is unique in that the primary focus was on depressive symptoms compared to the broader project aim of exploring diverse aspects of healthy ageing. Separate from the larger project, this thesis produced outcomes with specific relevance for informing prevention or amelioration strategies for depressive symptoms among older adults at a community level.

3.1.1 Ethical Considerations

Participants were informed that their participation was completely voluntary and that they had the right to withdraw from the study at any time, without prejudice. Ethics approval was obtained from Curtin University Human Research Ethics Committee, and written informed consent was obtained from all participants prior to their participation.

3.2. Depressive Symptoms

The 20-item Center for Epidemiologic Studies Depression Scale (CESD) was used to assess participants' current symptoms of depression (Radloff, 1977; Radloff & Teri, 1986). The CESD is a widely used measure of depressive symptoms among various community samples, including older adults (Beekman et al., 1995; Blank et al., 2004; Lewinsohn et al., 1997; Radloff & Teri 1986; Vilagut et al., 2016). A main advantage of the CESD is the ease of administration (Radloff & Teri, 1986), which was an important consideration as participants completed a broad range of measures as part of the larger project.

Participants rated the frequency with which they experienced a range of depressive symptoms over the past week on a scale ranging from 0 (rarely or none of the time) to 3 (most or all of the time), resulting in potential total scores ranging from 0 to 60. Higher scores indicate greater frequency of depressive symptoms (Radloff, 1977; Radloff & Teri, 1986). The CESD has been validated in older community-dwelling adults (Beekman et al., 1995; Kennedy et al., 1991; Lewinsohn et al., 1997; Radloff, 1986), with internal consistency and test-retest reliability of CESD responses estimated at $\alpha = .82$ and $r = .52$, respectively (Lewinsohn et al., 1997). Although the CESD scale was designed for research purposes rather than clinical or diagnostic assessment, an established cut-off score of 16 is often used to indicate clinically relevant depressive symptoms (Radloff, 1977). Having clinically relevant depressive symptoms is suggestive of the individual experiencing symptoms that may reflect a diagnosis of major depressive disorder. However, while some researchers have found support for the validity of this cut-off point (Beekman et al., 1997; Radloff, 1977; Radloff & Teri, 1986; Wada et al., 2007), others suggest it is too low and leads to high false-positive rates (Depression Guideline Panel, 1993; Radloff & Teri, 1986; Vilagut et al., 2016). A cut-off point of 20 has therefore also been suggested, with evidence suggesting it provides a more adequate trade-off

between sensitivity and specificity (Radloff & Teri, 1986; Vilagut et al., 2016). Given (i) this disagreement among researchers, (ii) statistical evidence suggesting that cut-off scores can result in loss of information, loss of power, misleading parameter estimates, and difficulties in interpretation compared to continuous scores (Cumsille et al., 2000; MacCallum et al., 2002), and (iii) evidence suggesting that the latent structure of the scale is dimensional, thus the construct is not indicative of a valid cut-off point (Guo et al., 2014), the CESD was treated as a continuous variable in Studies 2 and 3.

3.3. Description and Measures of Independent Variables Selected for Studies 2 and 3

The independent variables selected for inclusion in Studies 2 and 3 (Chapters 4 and 5) were informed by an exhausted search of the literature including the systematic review (Study 1/Chapter 2). Descriptions of the measures used to assess the independent variables are discussed below (Section 3.3.1 to 3.3.7).

3.3.1. Social support. Among the most commonly used measures of perceived social support is the Social Provision Scale (Cutrona & Russell, 1987). The 24-item Social Provisions Scale (SPS) was used to measure the degree to which participants' social relationships provide various dimensions of social support (Cutrona & Russell, 1987). The six subscales reflect the relational provisions identified by Weiss (1974): attachment, social integration, reassurance of worth, reliable alliance, guidance, and opportunity for nurturance. Participants responded on a scale ranging from 1 (strongly disagree) to 4 (strongly agree), resulting in a total score ranging from 24 to 96, with higher scores indicative of higher levels of perceived social support (Cutrona & Russell, 1987). The SPS scale has been validated in older community-dwelling adults, with internal consistency of SPS responses estimated at $\alpha = .71$ (Russell & Cutrona, 1991).

3.3.2. Physical activity. Participation in physical activity has been found to be negatively correlated with depressive symptoms in older adults (Blake, 2012; H. Lee et al., 2014; Worrall et al., 2020a). Physical exercise programs have demonstrated positive outcomes in decreasing depressive symptoms among older people, and continued exercise may prevent recurrence of depressive symptoms

(Blake et al., 2009). Similarly, regular physical activity in older people aged 60 years and above may provide protection against the risk of developing depressive symptoms and other mental health disorders (Pasco et al., 2010). Additional psychological benefits of physical exercise may include improvement in older adults' responses to stress, sense of self-efficacy, and self-esteem (Carek et al., 2011).

In Study 2, self-reported physical activity was assessed by asking participants how many hours of moderate to vigorous activity they do in an average week. The Australian Department of Health's Physical Activity and Sedentary Behaviour Guidelines definition of moderate to vigorous physical activity (i.e., physical activity that involves breathing harder or puffing and panting: Australian Government Department of Health, 2019) was provided for clarity. Response options were as follows: 0 hours, less than 1 hour, between 1 and 2 hours, between 2 and 3 hours, between 3 and 4 hours, between 4 and 5 hours, and 5 or more hours a week.

In Study 3, physical activity was assessed objectively using waist accelerometers (GT3X ActiGraph, Pensacola, FL) for a period of seven days at baseline and follow-up. Established vector magnitude cut points for older adults were used to calculate average minutes of engagement in moderate to vigorous physical activity per week (≥ 2,752 counts per minute: Santos-Lozano et al., 2013).

3.3.3. Self-rated physical health. Self-rated physical health was assessed by asking participants to describe their physical health on a scale from 1 (very good) to 5 (very bad) in line with previous research (Idler & Benyamini, 1997).

3.3.4. Self-esteem. The 10-item Rosenberg Self-Esteem Scale (RSES) was used to measure participants' level of self-esteem (Rosenberg, 1965, 1989). Item response options ranged from 1 (strongly disagree) to 4 (strongly agree), resulting in a total score ranging from 10 to 40, with higher scores indicative of a higher sense of self-esteem (Rosenberg, 1965, 1989). The RSES has been validated in older community-dwelling adults, with internal consistency and test-retest reliability of RSES responses estimated at $\alpha = .71$ and $r = .79$, respectively (Lawton et al., 1984).

3.3.5. Self-efficacy. The 10-item General Self-Efficacy Scale (GSES) by Schwarzer and Jerusalem (1995) was used to measure participants' general sense of perceived self-efficacy. The GSES was designed to assess individuals' ability to

adapt after experiencing stressful life events and cope with daily hassles (Schwarzer & Jerusalem, 1995). Participants responded on a scale ranging from 1 (not true at all) to 4 (exactly true), resulting in a total score ranging from 10 to 40, with higher scores indicative of a higher sense of perceived self-efficacy (Schwarzer & Jerusalem, 1995). The GSES has been used to assess perceived self-efficacy among an older adult sample, with internal consistency of GSES responses estimated at $\alpha = .90$ (Brown et al., 2012).

3.3.6. Life satisfaction. Life satisfaction was assessed by asking participants to rate how satisfied they are with their life on a scale of 1 (very satisfied) to 5 (very dissatisfied). This measure was adapted from the World Values Survey, which assesses a range of social, political, economic, religious, and cultural attitudes; beliefs; and values as part of an international research program (Inglehart et al., 2014). The response options on the measure of life satisfaction was reduced from 10 (in the World Values Survey) to 5 in this thesis to reflect the response options for the other questions about satisfaction with health in the larger project survey.

3.3.7. Purpose in life. The 14-item Purpose in Life subscale from the Psychological Well-Being Scale (Ryff, 1989) was used to measure participants' belief/feeling that there is purpose and meaning to life. Participants responded on a scale ranging from 1 (strongly disagree) to 6 (strongly agree), resulting in a total score ranging from 14 to 84, with higher scores indicative of individuals having a sense of direction and belief that there is meaning in life (Ryff & Essex, 1992; van Dierendonck, 2004). This subscale has been used to measure older adults' perceived purpose in life, with internal consistency of the responses estimated at $\alpha = .85$ (S. Ferguson & Goodwin, 2010).

3.3.8. Personal growth. The 14-item Personal Growth subscale from the Psychological Well-Being Scale (Ryff, 1989) was used to measure participants' personal development and willingness to grow as a person. Participants responded on a scale ranging from 1 (strongly disagree) to 6 (strongly agree), resulting in a total score ranging from 14 to 84. Higher scores indicated participants viewed themselves as being open to new experiences, while lower scores indicated participants lacked a sense of personal improvement and were unwilling to develop new attitudes or

behaviours (Ryff & Essex, 1992; van Dierendonck, 2004). This subscale has been used to measure older adults' perceived personal growth, with internal consistency of the responses estimated at $\alpha = .87$ (Heidrich, 1993).

3.3.9. Demographic information. Sociodemographic variables included in the thesis to identify whether interventions should be tailored according to characteristics such as age, gender, living arrangements, and highest level of education attained.

Note: The following chapter has been published in Frontiers in Public Health

Worrall, C., Jongenelis, M., McEvoy, P., Jackson, B., Newton, R. U., & Pettigrew, S. (2020). An exploratory study of the relative effects of various protective factors on depressive symptoms among older people. *Frontiers in Public Health, 8*, 579304. https://doi.org/10.3389/fpubh.2020.579304

Minor edits have been made to present chapter to ensure consistency with the present thesis (e.g., Australian spelling). Supplementary Material have been presented as part of the results of this chapter. The published article is presented in Appendix B.

CHAPTER 4. (STUDY 2) – An Exploratory Study of the Relative Effects of Various Protective Factors on Depressive Symptoms among Older People

4.1. Introduction

Depression is a leading cause of burden of disease worldwide (WHO, 2020). With the proportion of people aged 60+ years worldwide projected to increase from 13% in 2017 to approximately 21% in 2050 (United Nations, 2017), the prevention and amelioration of depressive symptoms among older adults is recognised as a public health priority to ensure increasing life expectancy is accompanied by positive psychological well-being (WHO, 2015). Depressive symptoms can be especially debilitating for older adults because they (i) are particularly intransigent among members of this population segment (Thielke et al., 2010); (ii) complicate the treatment of chronic diseases (Chapman & Perry, 2008), which are disproportionately prevalent among older adults (Cheruvu & Chiyaka, 2019); and (iii) often go undetected due to uncertainty about what constitutes depressive symptoms in this cohort (Chew-Graham et al., 2012; Rodda et al., 2011). In addition, older adults tend to have more limited social networks and suboptimal coping strategies compared to younger cohorts, which can make them more vulnerable to depressive symptoms (Bruine de Bruin et al, 2019; Fiske et al., 2009; von Faber et al., 2016). The development of effective strategies to prevent and ameliorate depressive symptoms is critical to optimise older people's well-being and reduce health system costs (Rodda et al., 2011, Allen, 2008).

Identifying factors that can protect against later life depressive symptoms is important for informing the development of appropriate prevention and amelioration strategies. Previous research suggests that relevant modifiable factors that could be the focus of such strategies include social support, self-rated health, and physical activity (Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008; Worrall et al., 2020a). There is strong evidence for the protective effects of each of these factors, individually and in various combinations, across both cross-sectional and longitudinal studies (Aihara et al., 2011; Y. Chang et al., 2017; Cho et al., 2018; Han et al., 2007; Ku et al., 2018; H. Lee et al., 2014; J. Park et al., 2015; Strawbridge et al., 2002; Sun et al., 2012; Yoo et al., 2016). Overall, research investigating the trajectory of depressive symptoms in older people has found higher levels of social support, self-rated health, and physical activity to be associated with (i) fewer

depressive symptoms at baseline and (ii) a lower likelihood of depressive symptoms emerging over time (Strawbridge et al., 2002; Sun et al., 2012). In addition to these well-established protective factors, there is growing evidence that life satisfaction, purpose in life, personal growth, self-efficacy, and self-esteem are protective against depressive symptoms (Bisschop et al., 2004; Hedberg et al., 2010; Horowitz et al., 2005; Lue et al., 2010; Orth et al., 2009; Sowislo & Orth, 2013; Vink et al., 2008; Windsor et al., 2015; Wood & Joseph, 2010; Yoo et al., 2016).

While previous work supports the importance of each of these protective factors, to date there does not appear to be research incorporating them all to provide an understanding of their relative effects to enable appropriate prioritization in intervention design. To address this deficit, the present study adopted an exploratory approach to investigate the relative importance of modifiable factors that have been found to be protective against depressive symptoms (as outlined above). A second aim was to investigate whether sociodemographic characteristics (gender, age, living arrangement, and educational attainment) moderate the relationships between these protective factors and depressive symptoms to assist in identifying specific sub-segments of older adults who are likely to benefit most from interventions. The results provide insights into which factors are likely to be important to consider in the development of population-level depressive symptom prevention and amelioration strategies for older people, and also suggest key variables to incorporate in future longitudinal research designed to further extend this field of research.

4.2. Method

4.2.1. Design, recruitment, and procedure. The data used in this cross-sectional study were collected between 2014 and 2016 as part of a larger project exploring healthy aging among older adults (Pettigrew et al., 2015). Ethical approval was received from Curtin University's Human Research Ethics Committee. Eligibility criteria were being aged 60 years or older, living in a community setting, and being fully retired. Participants were recruited via a range of methods including notices in community newspapers, radio announcements, and flyers placed at seniors' events and retirement villages across the metropolitan area of Perth, Western Australia.

In total, 801 adults met the above eligibility criteria and provided written informed consent. Participation involved completing a self-administered survey that included psychological, social, and physical health measures validated for use in older adults. These measures are described in detail below. Unless otherwise stated, the items forming each of the scales included in the survey were summed for analysis purposes.

4.2.2. Sample characteristics. The final sample consisted of older adults ranging in age from 60 to 95 years (M = 71.93 years, SD = 6.68), 61% of whom were female. Characteristics of the present sample alongside those of the Australian older adult population are presented in Table 8. Pearson chi-square tests indicated the sample was representative in terms of gender, age, and education but not living arrangement: the present sample had a significantly higher proportion of older adults living alone compared to the Australian older adult population.

Table 8

Sample Characteristics

Characteristics (%)	Sample (N = 801)	Australian 60+ population[a] (N = 4,976,160)	*p*
Gender			.317
Female	61	53	
Male	39	47	
Age			.085
60-69	41	50	
70-79	46	31	
80+	13	19	
Education			.120
Non-tertiary	43	55	
Tertiary	57	45	
Living arrangement			.040
Not living alone	65	79	
Living alone	35	21	

Note. Education = highest level of education attained.

[a]Percentages based on data for all women and men aged 60 years and older from the 2016 Australian Census (Australian Bureau of Statistics, 2019).

4.2.3. Outcome variable. Depressive symptoms were assessed using the 20-item Centre for Epidemiological Studies Depression Scale (CES-D: Radloff, 1977). Participants responded to each item (e.g., "I felt that everything I did was an effort") on a 4-point scale that ranged from 0 (rarely or none of the time) to 3 (most or all of the time). Cronbach's alpha in the present study was .87, indicating good reliability.

4.2.4. Independent variables.

4.2.4.1. Psychological well-being. The 14-item Personal Growth and Purpose in Life subscales of Ryff's (1989) Psychological Well-Being Scale were used to measure personal growth and purpose in life, respectively. Responses to items (e.g., "I have the sense that I have developed a lot as a person over time"; "I have a sense of direction and purpose in life") were made on a scale of 1 (strongly disagree) to 5 (strongly agree). Cronbach's alpha in the present study indicated good reliability for scores on both the Personal Growth ($\alpha = .86$) and Purpose in Life ($\alpha = .88$) subscales.

4.2.4.2. Self-esteem. Self-esteem was measured using the 10-item Rosenberg Self-Esteem Scale (Rosenberg, 1965). Respondents answered each item (e.g., "I feel that I'm a person of worth, at least on an equal plane with others") on a 4-point scale that ranged from 0 (strongly disagree) to 3 (strongly agree). Cronbach's alpha for scores on this scale was .88, indicating good reliability.

4.2.4.3. Social support. The 24-item Social Provision Scale (Cutrona & Russell, 1987) was used to assess social support. Each item (e.g., "There is someone I could talk to about important decisions in my life") was measured on a 4-point scale that ranged from 1 (strongly disagree) to 4 (strongly agree). The scores on this scale were found to have excellent reliability ($\alpha = .92$).

4.2.4.4. Self-efficacy. Self-efficacy was assessed using the 10-item General Self-Efficacy Scale (Schwarzer & Jerusalem, 1995). Participants responded to each item (e.g., "I can solve most problems if I invest the necessary effort") on a 4-point scale that ranged from 1 (not at all true) to 4 (exactly true). Cronbach's alpha was .90, indicating excellent reliability.

4.2.4.5. Life satisfaction. Life satisfaction was assessed by asking participants to rate how satisfied they are with their life on a scale of 1 (very satisfied) to 5 (very dissatisfied) (adapted from the World Values Survey: Inglehart et al., 2014). For analysis purposes, this variable was reverse scored.

4.2.4.6. Physical activity. Level of physical activity was measured by asking participants: How many hours of moderate to vigorous activity (that is, physical activity that makes you breathe harder or puff and pant) would you do in an average week? The definition provided for moderate to vigorous activity was based on the Australian Department of Health's Physical Activity and Sedentary Behaviour Guidelines (www.health.gov.au). Response options were: 0 hours, less than 1 hour, between 1-2 hours, between 2-3 hours, between 3-4 hours, between 4-5 hours, and 5 or more hours.

4.2.4.7. Self-rated health. Consistent with previous research (Idler & Benyamini, 1997), self-rated health was assessed by asking participants to describe their physical health on a scale from 1 (very good) to 5 (very bad). For analysis purposes, this variable was reverse scored.

4.2.4.8. Demographic variables. Sociodemographic variables included age (treated as continuous), gender (1 = male, 2 = female; treated as dichotomous), living arrangement (1 = lives alone, 2 = does not live alone; treated as dichotomous), and highest level of education attained (no formal school/primary school, high school, technical/trade certificate, undergraduate, postgraduate; treated as continuous).

4.2.5. Statistical analysis. Descriptive statistics for each modifiable protective factor are presented in Table 9. Univariate linear regression analyses were conducted to assess the relationships between each of the independent variables and the outcome variable of depressive symptoms (treated as continuous). Independent variables found to be significantly associated with depressive symptoms were then simultaneously entered into a linear multivariate regression model using SPSS 26. The Variance Inflation Factor (VIF) was used to assess via an observation of bivariate correlations among variables for multicollinearity (see Table 10).

Moderation analyses were conducted using the PROCESS macro in SPSS to determine if the sociodemographic variables of gender, age, level of education, or living alone moderated the relationship between each of the significant independent variables and the outcome variable of depressive symptoms (Hayes, 2017). Each of the independent variables found to be significant in univariate analyses and each of the sociodemographic variables were entered in analyses separately. Bootstrapping was performed (N = 5000 samples), and a Bonferroni-adjusted alpha level of < .005 was used to control for the family-wise error rate. Missing data were treated listwise.

Table 9

Descriptive Statistics for Tested Protective Factors (IVs) and Depressive Symptoms

IVs	*M* (*SD*)	Sample Range	Scale Range	Skewness	Kurtosis
Life satisfaction	4.07 (0.82)	1 – 5	1 – 5	-0.99	1.19
Self-esteem	23.48 (4.96)	1 – 30	0 – 30	-0.68	0.43
Purpose in life	66.57 (11.72)	18 – 84	14 – 84	-0.76	0.43
Social support	79.00 (10.41)	33 – 96	24 – 96	-0.58	0.49
Self-rated health	4.00 (0.77)	1 – 5	1 – 5	-0.99	1.20
Self-efficacy	32.19 (4.38)	12 – 40	10 – 40	-0.37	0.77
Physical activity	3.77 (1.82)	1 – 7	1 – 7	0.39	-0.94
Personal growth	69.48 (10.06)	29 – 84	14 – 84	-0.73	0.27
Depressive symptoms	9.02 (8.14)	0 – 54	0 – 60	1.68	3.59

Note. IVs = independent variables; M = mean; SD = standard deviation.

Table 10

Correlations Among Variables

	LS	SS	SEst	PiL	SRH	PA	PG	SEff	DS
Life Satisfaction (LS)	–								
Social Support (SS)	.49**	–							
Self-esteem (SEst)	.54**	.57**	–						
Purpose in Life (PiL)	.57**	.58**	.68**	–					
Self-rated Health (SRH)	.42**	.28**	.35**	.37**	–				
Physical Activity (PA	.20**	.13**	.13**	.18**	.31**	–			
Personal Growth (PG)	.35**	.41**	.51**	.66**	.27**	.16**	–		
Self-efficacy (SEff)	.40**	.37**	.54**	.50**	.26**	.15**	.44**	–	
Depressive symptoms (DS)	-.62**	-.52**	-.64**	-.62**	-.38**	-.14**	-.42**	-.45**	–

Note. ** = correlation is significant at the 0.01 level, * = correlation is significant at the 0.05 level.

4.3. Results

4.3.1. Regression analyses. Univariate regression analyses showed that life satisfaction, purpose in life, personal growth, self-esteem, social support, self-efficacy, physical activity, self-rated health, educational attainment, and living arrangement were all negatively associated with depressive symptoms (see Table 11 for results of univariate regressions). A multivariate regression analysis combining these variables into a single model was used to explore the relative importance of these factors. VIF was less than 10 and bivariate correlations were less than .70 indicating that multicollinearity was not an issue. The model explained 55.6% of the variance in depressive symptoms ($F(10,734) = 91.93$, $p < .001$). The variables in the model that remained significantly and negatively associated with depressive symptoms at the Bonferroni-adjusted alpha level of < .005 in descending order of effect were: life satisfaction, self-esteem, and purpose in life (see Table 12).

Table 11

Univariate Regression Analyses between Independent Variables (IVs) and Depressive Symptoms

IVs	B	*SE*	β	*p*	95% CI for B
Life-satisfaction	-6.11	0.28	-0.62	.000	-6.66, -5.58
Self-esteem	-1.04	0.05	-0.64	.000	-1.13, -0.95
Purpose in life	-0.44	0.02	-0.62	.000	-0.47, -0.40
Social support	-0.40	0.02	-0.52	.000	-0.452, -0.36
Self-rated health	-4.04	0.35	-0.38	.000	-4.73, -3.35
Self-efficacy	-0.84	0.06	-0.45	.000	-0.96, -0.72
Personal growth	-0.34	0.03	-0.42	.000	-0.40, -0.29
Physical activity	-0.63	0.16	-0.14	.000	-0.95, -0.32
Living alone	-2.44	0.61	-0.14	.000	-3.63, -1.25
Education	-0.96	0.27	-0.13	.000	-1.49, -0.43
Gender	1.09	0.60	0.07	.068	-0.08, 2.26
Age	-0.04	0.05	-0.03	.354	-0.13, 0.05

Note. IVs = independent variables; B = unstandardised estimates; SE = standard error of B; β = standardised estimate; p = significance value; CI = confidence interval. Results significant at $p < .05$ included in multivariate analyses.

Table 12

Unstandardised Parameter Estimates, Standardised Parameter Estimates, and Standard Errors for the Multivariate Model (in descending order of Part r^2)

IVs	B	*SE*	β	*p*	95% CI for B	*Part* r^2
Life satisfaction	**-2.76**	**0.33**	**-0.28**	**<.001**	**-3.40, -2.12**	**-.21**
Self-esteem	**-0.42**	**0.06**	**-0.26**	**<.001**	**-0.54, -0.30**	**-.17**
Purpose in life	**-0.13**	**0.03**	**-0.19**	**<.001**	**-0.19, -0.07**	**-.11**
Social support	-0.07	0.03	-0.08	.012	-0.12, -0.02	-.06
Self-rated health	-0.77	0.30	-0.07	.011	-1.37, -0.18	-.06
Self-efficacy	-0.13	0.06	-0.07	.018	-0.25, -0.02	-.06
Living alone	-0.82	0.45	-0.05	.066	-1.70, 0.06	-.05
Physical activity	0.11	0.12	0.03	.338	-0.12, 0.35	.02
Personal growth	0.01	0.03	0.01	.758	-0.05, 0.06	.01
Education	-0.00	0.19	0.00	.997	-0.38, 0.38	.00

Note. IVs = independent variables; B = unstandardised estimates; SE = standard error of B; β = standardised estimate; *p* = significance value; CI = confidence interval; Part r^2 = proportion of unique variance accounted for. Results significant at $p < .005$ are presented in bold.

4.3.2. Moderating effects. At the Bonferroni-adjusted alpha level of < .005, a significant moderating effect of age was observed for life satisfaction (B = 0.13, SE = 0.04, p < .002, 95% CI for B [0.05, 0.21]). See Table 13 for results of moderation analyses. Post-hoc investigation of this effect showed that life satisfaction was negatively associated with depressive symptoms for all age groups, but the strength of the association was stronger for those participants below the average age of this sample compared to those of mean age or older (see Table 14 and Figure 3 for significant results). Age did not moderate the relationships between any of the other independent variables and depressive symptoms, nor were there significant moderating effects observed for gender, living arrangement, or educational attainment (see Table 13).

Table 13

Moderating Interactions between the Significant Independent Variables (IVs) and Depressive Symptoms

Moderators	Interactions											
	Age			Gender (1 = male, 2 = female)			Living Arrangement (1 = lives alone, 2 = does not live alone)			Education		
IVs	B (*SE*)	*p*	95% CI for B	B (*SE*)	*p*	95% CI for B	B (*SE*)	*p*	95% CI for B	B (*SE*)	*p*	95% CI for B
Life satisfaction	0.13 (0.04)	<.002	0.05, 0.21	-0.54 (0.57)	.346	-1.67, 0.59	0.86 (0.57)	.123	-0.25, 1.97	-0.26 (0.26)	.318	-0.78, 0.26
Self-esteem	0.01 (0.07)	.355	-0.01, -0.02	0.06 (0.10)	.525	-0.13, 0.23	0.09 (0.04)	.032	0.01, 0.17	0.03 (0.04)	.434	-0.05, 0.12
Purpose in life	0.01 (0.00)	.012	0.00, 0.01	-0.06 (0.04)	.135	-0.14, 0.02	0.14 (0.09)	.139	-0.04, 0.32	0.01 (0.02)	.690	-0.03, 0.04
Social support	0.01 (0.00)	.007	0.00, 0.02	-0.11 (0.05)	.030	-0.20, -0.01	0.03 (0.05)	.531	-0.07, 0.13	-0.00 (0.02)	.946	-0.05, 0.04
Self-rated health	0.14 (0.06)	.015	0.03, 0.25	0.57 (0.72)	.425	-0.84, 1.98	-0.63 (0.71)	.373	-2.03, 0.76	-0.15 (0.33)	.651	-0.79, 0.50
Self-efficacy	0.02 (0.01)	.030	0.00, 0.04	-0.12 (0.13)	.339	-0.37, 0.13	0.11 (0.12)	.359	-0.13, 0.35	-0.04 (0.05)	.433	-0.15, 0.06
Physical activity	0.03 (0.02)	.217	-0.12, 0.08	-0.03 (0.32)	.917	-0.66, 0.60	0.42 (0.33)	.202	-0.23, 1.07	0.09 (0.15)	.580	-0.22, 0.39
Personal growth	-0.01 (0.00)	.014	0.00, 0.02	-0.04 (0.05)	.417	-0.15, 0.06	0.06 (0.06)	.283	-0.05, 0.17	-0.04 (0.03)	.118	-0.09, 0.01
Living arrangement	0.00 (0.09)	.975	-0.18, 0.18	1.83 (1.35)	.176	-0.82, 4.48	-	-	-	0.36 (0.56)	.522	-0.75, 1.47
Education	0.00 (0.04)	.914	-0.08, 0.09	-0.06 (0.57)	.923	-1.17, 1.06	0.36 (0.56)	.522	-0.75, 1.47	-	-	-

Note. IVs = independent variables; B = unstandardised estimates; SE = standard error of B; *p* = significance value; CI = confidence interval. Bonferroni-adjusted alpha level of < .005.

Table 14

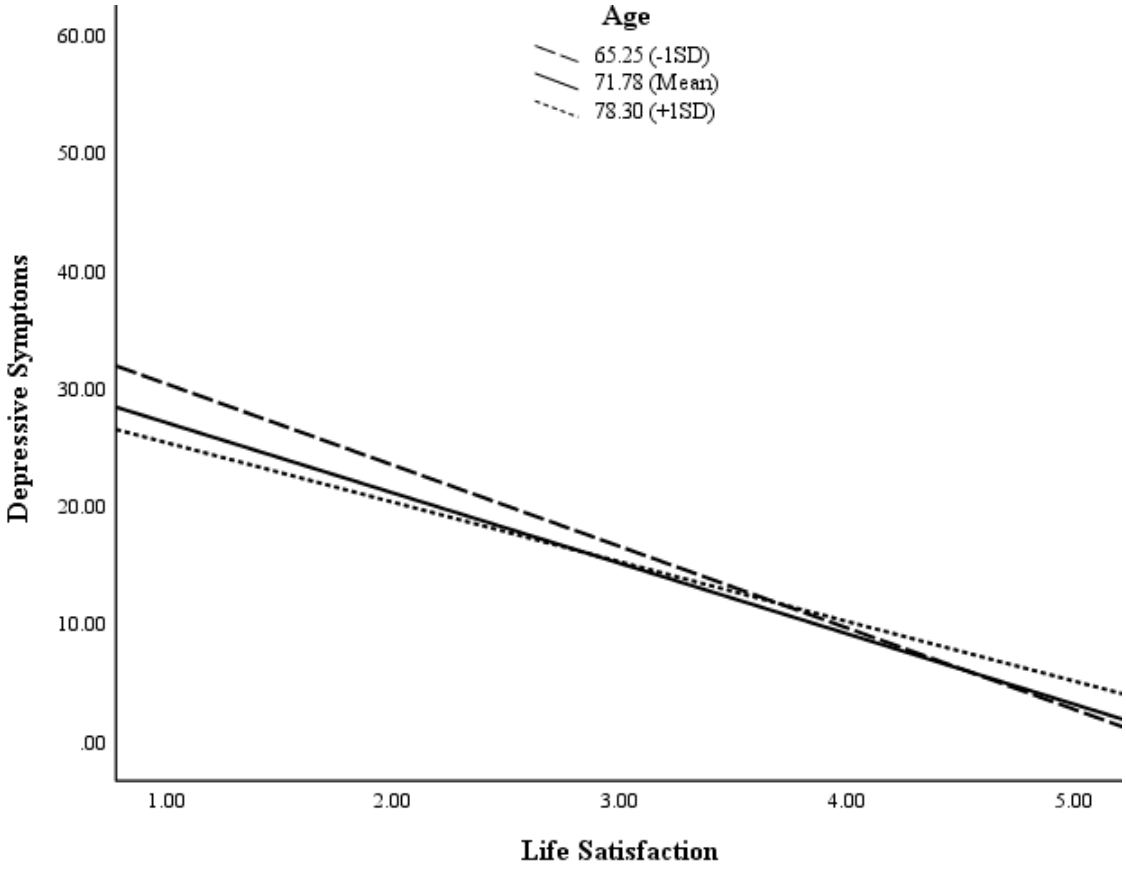
Significant Moderating Effect of Age between Life Satisfaction and Depressive Symptoms

Age	B	*SE*	*p*	95% CI for B
65.25 (-1SD)	-6.82	0.35	< .001	-5.98, -4.35
71.78 (Mean)	-5.99	0.28	< .001	-6.54, -5.45
78.30 (+1SD)	-5.16	0.41	< .001	-5.98, -4.35

Note. B = unstandardised estimates; *SE* = standard error of B; *p* = significance value; CI for B = confidence interval. Bonferroni-adjusted alpha level of < .005.

Figure 3

Significant Moderating Effect of Age on the Relationship between Life Satisfaction and Depressive Symptoms



4.4. Discussion

To better understand the nature of the relationships between factors that are particularly important in protecting against depressive symptoms among older adults, the present study combined a broad range of factors that have been identified in previous research as being potentially relevant. To assess whether interventions should be targeted at specific sub-groups of the wider older adult population, a second aim of this study was to investigate whether sociodemographic characteristics moderated any of the relationships between each protective factor and depressive symptoms.

The tested model explained a large proportion (55.6%) of the variance in depressive symptoms. Life satisfaction, self-esteem, and purpose in life were found to have the strongest (negative) association with depressive symptoms, which is consistent with previous longitudinal research (Lue et al., 2010; Orth et al., 2009; Sowislo & Orth, 2013; Windsor et al., Yoo et al., 2016). However, this past work examined each of these variables in isolation or in models including a limited number of factors. The results of the present study indicate that even when considering a larger number of potential variables, life satisfaction, self-esteem, and purpose in life may be especially important in preventing and ameliorating depressive symptoms among older people.

The results of the present study in relation to physical activity are in contrast with the conclusions of a recent systematic review that found a negative relationship between extent of participation in physical activity and the experience of depressive symptoms among older people (Worrall et al., 2020a). The non-significant relationship found here may reflect the range of other psychological variables included in the study and their relative importance in protecting against depressive symptoms. Measurement limitations may also have played a role, such as the reliance on self-report (Mammen & Faulkner, 2013; Teychenne et al., 2008) and the assessment of only moderate to vigorous activity, which may not adequately capture all forms of protective activity relevant to older people (Y. Chang et al., 2017; Ku et al., 2018; H. Lee et al., 2014; J. Park et al., 2015).

In terms of the moderation analyses used to assess whether interventions should target particular groups of older adults, just one moderating effect (age) was found, whereby a stronger relationship was found between life satisfaction and depressive symptoms among those participants below the average age of this sample, thus suggesting that interventions to improve life satisfaction could be particularly

beneficial for those who are in this younger category (and likely to be newly retired). There is little prior work with which to compare these moderation outcomes. Some studies have examined the moderating effects of age, gender, education level, and living arrangement on the relationship between social support and depressive symptoms (Alexandrino-Silva et al., 2011; A. Chan et al., 2011; Gong et al., 2018; Isaac et al., 2009; Russel & Taylor, 2009). This work has produced inconsistent results, which in combination with the general lack of effects found in the present study suggests that there may be little need to tailor intervention efforts to demographic sub-groups within the broader cohort of older people.

4.4.1. Implications. The results from this study highlight the importance of life satisfaction, self-esteem, and purpose in life as focus areas for interventions aimed at preventing and ameliorating depressive symptoms among older people. While self-esteem exhibits trait-like stability (Orth, 2017), and is thus better suited to individual therapeutic intervention, life satisfaction and purpose in life have the potential to be modifiable through population-level interventions. As such, interventions that focus on ways of enhancing life satisfaction and purpose in life are likely to hold most potential for scalable prevention and amelioration strategies. Previous research suggests that encouraging people to participate in meaningful tasks such as hobbies, leisure activities, or volunteering can increase their life satisfaction and purpose in life (Greenfield & Mark, 2004; Irving et al., 2017; Y. Li, 2007; Morrow-Howell, 2010). These activities have been suggested to provide older adults with opportunities that promote purpose in life and life satisfaction from (i) the relationships formed, (ii) the pursuit of goals, (iii) maintenance of independence, and (iv) engagement with the community (Boyle et al., 2009; Morrow-Howell, 2010). These types of activities have also been found to be associated with social support, self-efficacy, and self-rated health (Fiorillo & Nappo, 2017; Musick & Wilson, 2003; Van Willigen, 2000). Further, participation in meaningful tasks appears to be beneficial in helping individuals adjust to age-related losses such as retirement (i.e., loss of work role) and bereavement (Greenfield & Mark, 2004; Y. Li, 2007; Van Willigen, 2000). Encouraging older adults to engage in meaningful activities and facilitating relevant opportunities for them to do so may thus constitute means of preventing and ameliorating depressive symptoms in later life.

4.4.2. Limitations, future directions, and strengths. The main limitation of the present study was its cross-sectional design. Further research is needed to test the results longitudinally to assess whether the identified relationships hold over time. Another potential limitation was the use of convenience sampling, although the resulting sample was largely similar in profile to the population of older Australians, with the exception of living arrangement (see Table 8). Future studies should seek to access representative samples to test whether these results are generalisable. Similar research could also be conducted in other countries to assess the extent to which the identified relationships are relevant to other cultures. Given the inclusion of a broad range of psychological constructs in this study, a further potential limitation was the risk of social desirability bias in responses. To minimise this risk, an 'arms-length' data collection method was used in the form of self-administered surveys. This approach has been found to result in more truthful responses to sensitive questions compared to when an interviewer is present (Krumpal, 2013).

The primary strength of this study was the large number of potential protective factors incorporated into a model that was tested on a substantial sample of community-dwelling older people. However, despite the wide range of factors included in this study, some potentially relevant variables were not assessed and could be incorporated into future research. In particular, including a measure of objective health could provide additional important data and overcome the limitations associated with relying solely on self-rated health as an indicator of physical well-being. Further, recent research suggests that sleep and diet quality may influence older people's experience of depressive symptoms (Worrall et al., 2020a), making these potentially important variables to include in future studies.

4.4.3. Conclusion. This study assessed the relative importance of a large number of factors that have been established in prior work as being protective against depressive symptoms in older adults. Life satisfaction and purpose in life were found to be the most influential factors, and could therefore be the focus of prevention and amelioration strategies targeting depressive symptoms in later life. Previous research has shown that engaging in activities perceived to be meaningful can increase older adults' life satisfaction and purpose in life. As such, it is likely that programs that focus on enhancing these protective factors could decrease the risk of depressive symptoms and improve overall well-being among older adults.

CHAPTER 5. (STUDY 3) – Changes in Protective Factors and Depressive Symptoms Over Time: A Latent Change Score Approach

5.1. Introduction

The population worldwide is aging rapidly, and the number of people aged 60 years and older is expected to double by 2050 (United Nations, 2017). Depressive symptoms are more common among older adults compared to the general adult population, with 12-month prevalence rates of approximately 6.1% and 4.5%, respectively (WHO, 2017). Depressive symptoms in later life have been linked to increased use of health services and treatment complications from chronic diseases, which in turn can negatively impact on daily functioning and lead to significant indirect and direct costs on the health system (Bock et al., 2014; Chapman & Perry, 2008; Donohue & Pincus, 2007; WHO, 2017). As such, promoting psychological well-being among older adults has been nominated as a public health priority (WHO, 2015).

Systematic reviews have identified modifiable protective factors associated with the prevention and amelioration of depressive symptoms among older adults, with social support, self-rated health, self-esteem, life satisfaction, self-efficacy, and physical activity found to be potentially important (Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008; Worrall et al., 2020a). Specifically, higher levels of each of these protective factors have been found to be associated with fewer depressive symptoms cross-sectionally, and a lower likelihood of depressive symptoms emerging over time.

Additionally, previous research has found that favourable psychological well-being is strongly related to lower depressive symptoms (Ryff, 1989; Ryff et al., 1994; Ryff & Keyes, 1995), and that low psychological well-being is a risk factor for later life depressive symptoms (Wood & Joseph, 2010). Key components of psychological well-being include purpose in life (i.e., having goals and direction in life) and personal growth (i.e., views self as growing or improving over time: Ryff, 1995; Ryff & Singer, 1998) Both of these psychological resources have been found to be protective against depressive symptoms among older adults (Pinquart, 2002; Wood & Joseph, 2010).

These psychological and lifestyle protective factors mentioned above are often examined in isolation, and in limited combinations. Further, there is limited research investigating how change in these factors might be coupled with change in

depressive symptoms. Identifying independent predictors of change in depressive symptoms, specifically, whether change in only some or all of these factors is uniquely associated with change in depressive symptoms over time is critical for prioritizing prevention and intervention targets for older people.

Using longitudinal data from a large cohort of Australian older adults, the aim of this study was to examine the associations between changes in psychological and lifestyle protective factors and change in depressive symptoms across two time points. Latent change score (LCS) analysis has been increasingly identified as a useful method for investigating change over time (Ferrer & McArdle, 2010; McArdle, 2009; McArdle & Hamagami, 2001; Wu et al., 2013). Additionally, a LCS approach to modelling longitudinal data incorporates the strengths (while compensating for the limitations) of autoregressive and growth curve models (McArdle, 2009; McArdle & Hamagami, 2001). This approach simultaneously includes general trajectories of change over time and the extent to which prior levels of the construct are related to future change, therefore, allowing change between multiple time points to be assessed and determinants of this change to be directly modelled (McArdle, 2009; McArdle & Hamagami, 2001). The aim of this study was to examine the relationships between changes in psychological and lifestyle protective factors and changes in depressive symptoms over time among older community-dwelling adults (i.e., to examine whether any changes that do occur are related to depressive symptoms). Accordingly, it was hypothesised that over a six-month period, greater increases in protective factors would be associated with greater reductions in depressive symptoms, and greater decreases in protective factors would be associated with greater increases in depressive symptoms.

5.2. Method

5.2.1. Sample and recruitment. The data used in this study were generated as part of a larger healthy ageing project involving retired older community-dwelling adults aged 60 years or older (Pettigrew et al., 2015). Participants were recruited by convenience sampling across the metropolitan area of Perth, Western Australia via a range of strategies including notices at seniors' events and retirement villages, radio announcements, and articles in community newspapers. Ethical approval was received from Curtin University's Human Research Ethics Committee (#HR21/2014) and all participants provided written informed consent.

5.2.2. Measures. Protective factors, depressive symptoms, and sociodemographic characteristics (outlined below) were assessed at baseline (T1) and again six-months later (T2). Participants completed a self-administered survey that included a range of health measures validated for use among the older adult population (described below). Correlations between variables are presented in Table 15.

Table 15

Correlations Among Variables for Baseline (Above Diagonal) and Follow-up (Below Diagonal)

	LS	SS	SEst	PiL	SRH	PA	PG	SEff	DS
Life Satisfaction (LS)	–	.51**	.61**	.55**	.52**	.20**	.30**	.37**	-.67**
Social Support (SS)	.49**	–	.61**	.64**	.24**	-.01	.48**	.38**	-.59**
Self-esteem (SE)	.54**	.58**	–	.68**	.28**	.10	.47**	.50**	-.71**
Purpose in Life (PiL)	.56**	.62**	.68**	–	.33**	.12	.69**	.44**	-.69**
Self-rated Health (SRH)	.34**	.36**	.46**	.44**	–	.27**	.31**	.26**	-.44**
Physical Activity (PA)	.16*	-.02	.16*	.10	.22**	–	.06	.07	-.16*
Personal Growth (PG)	.35**	.53**	.50**	.66**	.20**	.10	–	.42**	-.44**
Self-efficacy (SEff)	.42**	.48**	.64**	.56**	.20**	.02	.50**	–	-.53**
Depressive Symptoms (DS)	-.58**	-.48**	-.68**	-.72**	-.32**	-.23**	-.46**	-.45**	–

Note. ** = correlation is significant at the 0.01 level, * = correlation is significant at the 0.05 level.

5.2.2.1. Dependent variable. The 20-item Center for Epidemiologic Studies Depression Scale (CESD; Radloff, 1977) was used to assess the extent to which participants experienced depressive symptoms. Responses to items (e.g., “I felt depressed”) were made on a scale of 0 (rarely or none of the time) to 3 (most of the time). Cronbach’s alpha in the present study at T1 was .89, indicating good reliability.

5.2.2.2. Independent variables. The psychological and lifestyle protective factors measured at T1 and T2 are as follows.

5.2.2.2.1. Social support. The 24-item Social Provision Scale (Cutrona & Russell, 1987) was used to measure social support. Participants responded to each item (e.g., "I feel part of a group of people who share my attitudes and beliefs") on a 4-point scale that ranged from 1 (strongly disagree) to 4 (strongly agree). In the present study, Cronbach's alpha at T1 was .92, indicating excellent reliability for the scores on this scale.

5.2.2.2.2. Self-esteem. The 10-item Rosenberg Self-Esteem Scale (Rosenberg, 1965) was used to assess self-esteem. Each item (e.g., "I feel that I have a number of good qualities") was measured on a 4-point scale that ranged from 0 (strongly disagree) to 3 (strongly agree). The scores on this scale were found to have excellent reliability in the present study (T1 $\alpha = .91$).

5.2.2.2.3. Self-efficacy. The 10-item General Self-Efficacy Scale (Schwarzer & Jerusalem, 1995) was used to measure self-efficacy. Respondents answered each item (e.g., "If I am in a bind, I can usually think of something to do") on a 4-point scale that ranged from 1 (not at all true) to 4 (exactly true). In the present study, Cronbach's alpha at T1 was .89, indicating good reliability for the scores on this scale.

5.2.2.2.4. Life satisfaction. Participants were asked to rate how satisfied they are with their life on a scale of 1 (very satisfied) to 5 (very dissatisfied; adapted from the World Values Survey; Inglehart et al., 2014). For analysis purposes, this variable was reverse scored so that higher scores indicated higher levels of the protective factor.

5.2.2.2.5. Psychological well-being. Personal growth and purpose in life were assessed using the 14-item subscales of Ryff's (1989) Psychological Well-Being Scales. Responses to items (e.g., "I am the kind of person who likes to give new things a try"; "I have a sense of direction and purpose in life") were made on a scale of 1 (strongly disagree) to 5 (strongly agree). Cronbach's alpha in the present

study indicated good reliability for scores on both the Personal Growth subscale (T1 α = .86) and the Purpose in Life subscale (T1 α = .90).

5.2.2.2.6. Self-rated health. Based on previous research (Idler & Benyamini, 1997), self-rated health was measured by asking participants to rate their physical health on a scale from 1 (very good) to 5 (very bad). For analysis purposes, this variable was reverse scored.

5.2.2.2.7. Physical activity. To measure their physical activity level, participants wore waist accelerometers (GT3X ActiGraph, Pensacola, FL) for a period of seven days at T1 and T2. Established vector magnitude cut points for older adults were used to calculate the average minutes of moderate to vigorous physical activity per week (≥ 2,752 counts per minute: Santos-Lozano et al., 2013). Because these accelerometer-derived parameters were strongly positively-skewed (i.e., some individuals exercised markedly more than the majority of the sample), they were log-transformed before conducting analyses (Kline, 2011).

5.2.2.3. Demographic variables. Participants were asked to report their age, gender, highest level of education attained, and living arrangement. The present sample consisted of 217 adults ranging in age from 60 to 95 years (M = 70.00 years, SD = 6.15). Characteristics of the present sample alongside those of the Australian older adult population are presented in Table 16. Pearson chi-square tests indicated the sample was representative in terms of gender, education, and living arrangement, but was significantly younger compared to the Australian population of older adults.

Table 16

Baseline Sample Characteristics

Characteristics (%)	Sample (N = 217)	Australian 60+ population[a] (N = 4,976,160)	*p*
Gender			.671
Female	49	53	
Male	51	47	
Age			< .001
60-69	51	50	
70-79	42	31	
80+	7	19	
Education			.066
Non-tertiary	41	55	
Tertiary	59	45	
Living arrangement			.253
Not living alone	71	79	
Living alone	29	21	

Note. Education = highest level of education attained.
[a]Percentages based on data for all women and men aged 60 years and older from the 2016 Australian Census (Australian Bureau of Statistics, 2019).

5.2.3. Statistical analysis. To test the hypothesis that changes in protective factors would be inversely associated with change in depressive symptoms between baseline and follow-up, latent change score (LCS) analyses were conducted. LCS analyses are a type of structural equation modelling that combines the beneficial concepts of autoregressive and growth curve models to assess longitudinal data (McArdle, 2009; McArdle & Hamagami, 2001). LCS modelling specifies the amount of change between assessments as a latent variable, allowing this change to be used as a predictor or an outcome. Additionally, LCS can account for measurement error when used in combination with single-indicator latent variables, which use an estimate of a scale's reliability to adjust the observed scores for measurement error. Further, this method can account for missingness at a single time-point (i.e., when a participant missed the first session, or the follow-up) through the use of full-information maximum-likelihood. For the present study, this approach enabled change in protective factors to be assessed as predictors of change in depressive symptoms.

As a single analysis comprising LCS models for all protective factors and depressive symptoms would require a sample size larger than was available, separate LCS models were estimated for each protective construct and the factor scores for

the latent change (i.e., slope) variables from these models were saved. There were significant variance in change scores between individuals on each of the protective factors (all *p* values < .001), and that correlations between the slopes of variables were small to medium suggestive that multicollinearity was not a problem (see Table 17). Therefore, all predictors were suitable for examination in the final model. In this model, the factor scores for each of the protective factors were entered into an analysis with the LCS model of depressive symptoms, with the latent change variables of each of the protective factors specified as predicting the latent change in depressive symptoms. In this way, change in depressive symptoms across the study period and associations between changes in protective factors and change in depressive symptoms could be examined with the present sample size.

Table 17

Correlations Among Slopes of Each Variable

	LS	SS	SEst	PiL	PA	PG	SEff
Life satisfaction (LS)	–						
Social support (SS)	0.16	–					
Self-esteem (SEst)	0.28	0.39	–				
Purpose in life (PiL)	0.24	0.35	0.38	–			
Physical activity (PA)	0.08	0.03	-0.01	0.03	–		
Personal growth (PG)	0.16	0.23	0.16	0.50	-0.01	–	
Self-efficacy (SEff)	0.16	0.18	0.22	0.27	0.03	0.24	–

The models were analysed using Mplus version 8.4, with the robust maximum likelihood (MLR) estimator used to account for any non-normality or missingness (McArdle, 2009; Muthén & Muthén, 1998-2017). The fit of the LCS model was assessed using model chi-square, the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the Standardised Root Mean Square Residual (SRMR), and the Root Mean Square Error of Approximation (RMSEA). A non-significant model chi-square, CFI and TLI values ≥ .95, SRMR values < .08, and RMSEA value ≤ .06 are indicative of good model fit.

5.3. Results

The model provided an excellent fit to the data, $\chi2(8) = 7.58$, p = .475 CFI = 1.00, TLI = 1.00, SRMR = 0.05, RMSEA 0.00, 95% CI = [0.00, 0.08]. Descriptive statistics for depressive symptoms and each of the protective factors at T1 and T2 and the average amount of change in each variable over the six-month study period are presented in Table 18.

On average, change in depressive symptoms was negative and significant, with the correlation between baseline depressive symptoms and this change was negative and significant (unstandardised: B = -0.29 [-0.42, -0.15], p < .001; standardised β = -0.42 [-0.60, -0.24], p < .001) These findings indicate that depressive symptoms decreased on average, and that individuals with higher baseline levels showed greater decreases in depressive symptoms over the study period.

Table 18

Average Amount of Observed Change for Protective Factors and Depressive Symptoms

Protective Factors	Baseline *M* (*SD*)	Follow-up *M* (*SD*)	Scale Range	*M* Δ(*SD*)	*p*	95% CI
Life satisfaction	4.01 (0.85)	4.00 (0.91)	1 – 5	-0.02 (0.79)	.730	[-0.12, 0.09]
Social support	77.93 (10.21)	79.92 (10.55)	24 – 96	1.96 (6.46)	<.001	[0.93, 2.99]
Self-esteem	23.11 (5.44)	24.50 (5.20)	0 – 30	1.42 (3.19)	<.001	[0.89, 1.96]
Purpose in life	65.30 (12.29)	66.45 (11.97)	14 – 28	1.14 (6.41)	.046	[0.02, 2.26]
Self-rated health	3.83 (0.76)	3.86 (0.83)	1 – 5	0.03 (0.66)	.536	[-0.06, 0.12]
Physical activity	5.04 (1.04)	4.89 (1.12)	NA	-0.15 (0.64)	.001	[-0.24, -0.06]
Personal growth	68.32 (9.65)	68.65 (10.06)	14 – 28	0.34 (5.26)	.499	[-0.65, 1.33]
Self-efficacy	31.84 (4.36)	32.64 (4.48)	10 – 40	0.81 (2.32)	<.001	[0.40, 1.22]
Depressive symptoms	9.13 (8.71)	8.25 (7.91)	0 – 60	-0.89 (5.34)	.049	[-1.77, -0.00]

Note. *M* = mean (higher scores denote more positive perceptions or greater engagement in the behaviour); *SD* = standard deviation; *M* Δ = mean amount of change; *SD* = standard deviation; *p* = significance value; CI = confidence interval; scores for physical activity are log transformed.

As shown in Table 19, increases in life satisfaction, social support, and self-esteem were significantly associated with reductions in depressive symptoms from baseline to follow-up. These results suggest that (i) as life satisfaction increased by one additional point, depressive symptoms decreased by an additional 1.90 points; (ii) as social support increased by one additional point, depressive symptoms decreased by an additional 0.25 points; and (iii) as self-esteem increased by one additional point, depressive symptoms decreased by an additional 0.32 points. None of the other changes in protective factors were found to be significantly associated with change in depressive symptoms over the six-month period.

Table 19

Unstandardised and Standardised Parameter Estimates and Standard Errors for the Latent Change Score Model (in descending order of β)

IVs	B	*SE*	95% CI	*p*	*β*
Δ Life satisfaction	**-1.90**	**0.48**	**-2.84, -0.96**	**< .001**	**-0.28**
Δ Social support	**-0.25**	**0.08**	**-0.41, -0.09**	**.003**	**-0.25**
Δ Self-esteem	**-0.32**	**0.15**	**-0.61, -0.03**	**.029**	**-0.16**
Δ Purpose in life	-0.12	0.09	-0.29, 0.06	.200	-0.11
Δ Self-rated health	-0.90	0.52	-1.92, 0.43	.083	-0.11
Δ Physical activity	-0.68	0.61	-1.88, 0.12	.270	-0.08
Δ Personal growth	-0.12	0.11	-0.32, 0.12	.322	-0.07
Δ Self-efficacy	0.07	0.26	-0.44, 0.57	.270	-0.02

Note. IVs = independent variables; B = unstandardised estimates; *SE* = standard error of B; *β* = standardised estimates; *p* = significance value; CI = confidence interval for B. Results significant at *p* < .05 are presented in bold.

5.4. Discussion

To identify factors that are likely important for inclusion in interventions designed to prevent or ameliorate depressive symptoms in later life, this study examined the relationships between changes in protective factors and change in depressive symptoms over a six-month period. Overall, depressive symptoms significantly decreased in this sample across time. Further, participants who had higher depressive symptom scores at baseline reported greater decreases in symptoms over the six-months compared to those with lower scores at baseline. This may be due to floor effects for people with already low levels of depressive symptoms at baseline.

The hypothesis that changes in protective factors would be inversely associated with change in depressive symptoms between baseline and follow-up was partially supported. Findings indicated that although depressive symptoms decreased on average among the present sample, increases in life satisfaction, social support, and self-esteem were uniquely associated with even greater reductions in depressive symptoms. This outcome is consistent with the results of prior research that has found these factors to be protective against depressive symptoms (Y. Chang et al., 2017; Glass et al., 2006; Lue et al., 2010; Orth et al., 2009; M. Park, 2017; Sowislo & Orth, 2013; Sun et al., 2012). The present study extends this prior work by demonstrating that change in these variables is negatively associated with change in

depressive symptoms even when incorporated into a comprehensive model that includes a large number of protective factors and accounts for measurement error.

In contrast with previous research (Y. Chang et al., 2017; Giltay et al., 2006; Horowitz et al., 2005; J. Park et al., 2015; Sachs-Ericsson et al., 2007; Wood & Joseph, 2010), the present study did not find increases in purpose in life, self-rated health, personal growth, or self-efficacy to be significantly predictive of reductions in depressive symptoms, nor were decreases in physical activity found to be significantly predictive of an increase in symptoms. Differences between the present study and previous work are likely due to this past work examining protective factors in isolation or in models containing a limited number of factors. Additionally, many of the protective factors included in the present study are likely to be inter-related in complex ways, and therefore non-significant results could be due to mediations and/or interactions between these factors. For example, physical activity may enhance perceived life satisfaction (Koivumaa-Honkanen et al., 2000; Maher et al., 2015; Strine et al., 2008), which was found in the present study to be associated with depressive symptoms. Future longitudinal studies using several time points could investigate these temporal relationships between the predictors, as well as whether these protective factors can moderate the influence of known risk factors for poor mental health.

5.4.1. Implications. The results highlight the potential roles that life satisfaction, social support, and self-esteem may play in preventing and reducing depressive symptoms among older people. As such, interventions that focus on ways of enhancing these protective factors are likely to hold potential for addressing depressive symptoms. Previous research suggests that older adults should be encouraged to engage in activities that they find meaningful and/or involve connecting with others to increase social relationships (Anderson et al., 2014; Forsman et al., 2011a; Van Willigen, 2000). Specific recommended activities include volunteering, hobbies, or joining social groups (Anderson et al., 2014; Catalan-Matamoros et al., 2016; P. Chang et al., 2014; Chiao et al., 2011; Forsman et al., 2011a; Fried et al., 2004; Haski-Leventhal, 2009; Heo et al., 2018; Joshi et al., 2016; C. Li et al., 2018; Morrow-Howell, 2010; Musick & Wilson 2003; Taylor, 2011; Van Willigen, 2000).

These types of activities have been found to be associated with favourable outcomes on a range of psychosocial, physical, and cognitive health factors,

including depressive symptoms. For example, volunteering can provide older adults with meaningful roles, social connectedness, and opportunities to learn and develop skills, thus facilitating social support, increasing life satisfaction, and enhancing self-esteem (Krause & Shaw 2000; Y. Li & Ferraro, 2005; Musick & Wilson 2003; Pillemer & Glasgow 2000; Van Willigen 2000). Other favourable outcomes of these activities can include greater self-rated health, physical activity, purpose in life, self-efficacy, and personal growth (Anderson et al., 2014; Fried et al., 2004; Haski-Leventhal, 2009; Heo et al., 2017; Y. Li, 2007; Musick & Wilson 2003; Van Willigen, 2000). The impact that meaningful leisure and/or social activities have on a variety of factors, specifically life satisfaction, social support, and self-esteem, highlights a means of possibly addressing depressive symptoms in later life. As such, encouraging older adults to engage in these types of activities and facilitating relevant opportunities for them to do so could constitute effective strategies for preventing and ameliorating depressive symptoms in the older population.

5.4.2. Strengths, limitations, and future directions. The primary strengths of this study were its longitudinal design, which allowed an investigation of relationships between changes in protective factors and change in depressive symptoms over time, and the large number of potential protective factors incorporated into a comprehensive model. Additionally, using LCS analysis to examine the relationships between changes in protective factors and change in depressive symptoms across time meant that measurement error could be controlled for, thus increasing the reliability of the present results.

A limitation of this study was that data were only collected at two time points, and therefore relationships could not be examined over several time points. Having several time points is required to examine more complex relationships (e.g., mediation, Maxwell & Cole, 2007), make stronger causal inferences (Maxwell et al., 2011), and increase reliability of LCS results (Klopack & Wickrama, 2020). For example, future prospective studies could explore changes in, and temporal coupling between, protective factors and depressive symptoms. Another limitation was the use of convenience sampling, although the sample was mostly representative of the population of older Australians, with the exception of age. In the context of these limitations, future studies should aim to use more than two time points and include larger and more representative samples to assess the reliability and generalizability of

these results. Additionally, studies could be conducted in other countries to test whether the identified relationships replicate in other cultures.

5.4.3. Conclusion. This study assessed changes in a large number of psychological and lifestyle protective factors in older adults over six-months to identify relationships between changes in these factors and change in depressive symptoms over time. Changes in life satisfaction, social support, and self-esteem were found to be significantly and uniquely associated with change in depressive symptoms and could therefore be the focus of interventions addressing depressive symptoms among older adults. Previous research has shown that increases in these protective factors may be achieved through engagement in meaningful activities such as volunteering, hobbies, or joining social groups that encourage social participation, promote life satisfaction, and foster development of self-esteem. Therefore, it is likely that programs that focus on enhancing these protective factors could decrease depressive symptoms.

CHAPTER 6. Study 4 – A typology of factors associated with older adults' engagement in social activities with and without clinically relevant depressive symptoms

6.1. Introduction

There is extensive research highlighting various factors that are protective of later life depressive symptoms (Cole & Dendukuri, 2003; Djernes, 2006; Pinquart, 2002; Vink et al., 2008; Wood & Joseph, 2010; Worrall et al., 2020a). The studies outlined in the previous chapters explored the nature of the relationships between a broad range protective factors and depressive symptoms in older people. The aims of these studies were to identify factors that are likely to be important targets for interventions designed to prevent or reduce later life depressive symptoms. Across all three studies, the results indicated that social support may be particularly important in protecting against depressive symptoms, as it was consistently found to be significantly (negatively) associated with depressive symptoms among the samples used in this thesis and those in previous research (see Chapters 2, 4, and 5). Enhancing social support thus constitutes a potential means of preventing and/or reducing depressive symptoms among older adults.

As noted in Chapter 1, the term social support refers to the emotional, instrumental, or informational support individuals perceive they experience from social networks such as family, friends, and community members (Hogan et al., 2002; Schulz & Schwazer, 2004; Taylor, 2011). An important distinction to make is between the constructs of social network, social engagement/participation, and social support. While social support arises from engagement/participation with members of an individual's social network, having a network of people to connect with does not necessarily guarantee receiving support (Nurullah, 2012). As such, identifying potential barriers and facilitators to social engagement/participation and the impact this may have on connecting with members of a social network can contribute to our understanding of how to enhance social support, thus preventing and/or ameliorating depressive symptoms among older adults.

Existing research has highlighted that certain activities can provide older adults with opportunities that promote social support from social engagement and a sense of connectedness (Adams et al., 2011; Fiori et al., 2006; Global Council on Brain Health, 2017; Litwin, 2012). The term social engagement refers to interacting with friends, family, and neighbours and attending social functions or organised

community groups (Adams et al., 2011; Berkman et al. 2000; Olesen & Berry, 2011). Activities such as leisure hobbies, volunteering, and/or social groups, which encourage social engagement have been associated with positive psychosocial, physical, and cognitive health outcomes (Anderson et al., 2014; Catalan-Matamoros et al., 2016; Chiao et al., 2011; Fiori et al., 2006; Forsman et al., 2011a; Greenfield & Mark, 2004; Heo et al., 2018; Joshi et al., 2016; Y. Li, 2007; C. Li et al., 2018; Taylor, 2011). Specifically, social engagement has been shown to positively influence older adults' social support (Fiori et al., 2006), and other factors identified as potentially important such as self-esteem, life satisfaction, and purpose in life (Adams et al., 2011; Gallagher, 2012; Santini, et al., 2017). Further, these activities appear to be beneficial in helping individuals adjust to age-related losses such as retirement and bereavement (Adams et al., 2011; Greenfield & Mark, 2004; Y. Li, 2007; Olesen & Berry, 2011; Van Willigen, 2000). However, despite these known positive impacts, previous research has suggested that many older adults who could benefit from social supports (e.g., older adults at risk for experiencing depressive symptoms) are not engaging in activities that encourage social engagement (Dury et al., 2015; Goll et al., 2015; Ramos & Wilmoth, 2003). Therefore, it is critical that developers of programs designed to prevent and/or ameliorate depressive symptoms are aware of the barriers, facilitators, and motivators relevant to social engagement (Hao et al., 2017).

While there is a growing number of studies investigating the potential determinants of social engagement in later life (Dare et al., 2018; Gilmour, 2012; Goll et al., 2015; Hao et al., 2017; Raymond et al., 2013; J. Walker et al., 2013), previous research has largely focused on understanding volunteering and leisure activities more broadly (Costello et al., 2011; Crombie et al., 2004; Dury et al., 2015; Hong & Morrow-Howell, 2013; Kerr et al., 2012; Kosteli et al., 2016; Newson & Kemps, 2007; A. Patel et al., 2013; D. B. Smith, 2004; J. D. Smith & Gay, 2005; Tang et at al., 2009; Warburton et al., 2007; Windsor et al., 2008). Additionally, much of the research on social engagement has been analysed quantitatively, thus providing limited insights into older adults' experiences of being either encouraged or discouraged to engage socially with others (Gilmour, 2012; Hao et al., 2017; Raymond et al., 2013).

The overall aim of this study was to understand older adults' participation in activities that involve social interaction, with specific objectives being to identify and explore the barriers, facilitators, and motivators relevant to social engagement.

Additionally, this study explored possible differences between participants with and without clinically relevant depressive symptoms in relation to factors influencing their social engagement. Differences between these two groups could help to inform relevant agencies on how best to encourage socialisation among older people who could benefit from engagement with others. A qualitative approach was adopted which allows for a rich description of participants' experiences to be generated (Braun & Clarke, 2013). The results of this study will add to the literature investigating the determinants of engaging in activities that improve protective factors of later life depressive symptoms. Understanding the potential barriers, facilitators, and motivators to social engagement in later life could help health practitioners, policy makers, and relevant agencies understand how to encourage the uptake or continuation of social engagement, which is likely to enhance social support (as well as other potentially important factors), thus preventing and/or ameliorating depressive symptoms among older adults.

6.2. Method

6.2.1. Recruitment, design, and sample. A convenience sample of retired older adults aged 60 years or older living in community settings were recruited via advertisements placed at retirement villages and seniors' events, in community newspapers, and on a local radio station in the metropolitan area of Perth, Western Australia. As described in Chapter 3 (Section 3.1.) a sub-sample of participants were asked to attend university campuses for in-person interviews and further physical assessments.

Qualitative research aims to understand lived experiences and thus seeks to purposively select individuals who are able to provide rich descriptions and accounts of particular topics (Hodges, 2011). Given that the aim of this study was to understand the participation in activities that involve social interaction and how this may have differed due to levels of depressive symptoms, two sub-samples of participants were created from those who completed interviews at university campuses. One sample comprised of participants with clinically relevant depressive symptoms while the other sample comprised participants without. As noted in Section 3.2, higher scores on the CESD are likely to be reflective of clinically relevant depressive. Having clinically relevant depressive symptoms is suggestive of

the individual experiencing symptoms that may reflect a diagnosis of major depressive disorder.

The overall sample comprised of 40 participants (see Table 20). It was important to ensure that equal representation in terms of gender (i.e., male and female) and depressive symptoms (i.e., participants with and without clinically relevant depressive symptoms). Data analysis continued until code frequency and themes were stable across the data and no novel themes emerged (Guest et al., 2006).

Table 20

Participant Demographic Information, Stratified by Depressive Symptoms

	Present study sample *(N = 40)*	Participants with clinically relevant depressive symptoms *(N = 20)*	Participants with no depressive symptoms *(N = 20)*
Demographics	%	%	%
Gender			
Female	50.0	50.0	50.0
Male	50.0	50.0	50.0
Age			
60-64	22.5	44.4	55.6
65-69	37.5	40.0	60.0
70-74	20.0	50.0	50.0
75-79	12.5	80.0	20.0
80+	7.5	66.7	33.3
Education			
Non-tertiary	45.0	72.2	27.8
Tertiary	55.0	31.8	68.2
Living arrangement			
Alone	20.0	50.0	50.0
Not alone	80.0	50.0	50.0
Sociodemographic status			
Low	20.0	50.0	50.0
Medium	30.0	50.0	50.0
High	50.0	50.0	50.0

6.2.2. Procedure. Participants completed a self-administered survey that included a range of health measures and demographic questions (see Section 3.3.) and were asked to sign a consent form prior to the interview. Interviews were conducted by two researchers involved in larger healthy ageing study at local university campuses and on average were 17 minutes in duration. After the interview, participants completed a series of walking and strength tests as part of the larger project.

The interviews were semi-structured in format to allow coverage of specific issues relating to their health and engagement in activities while allowing participants to introduce any other topics they felt were relevant (see Appendix C). Participants were broadly asked about the typical activities they engaged in day-to-day. Prompts about their social engagements with family, friends, neighbours, and others in their environment, as well as engagement in social activities over their lifetime, were used to explore possible factors associated with significant changes (e.g., retirement, parenting, illness). The interviews were transcribed verbatim from audio recordings, with the transcripts then imported into NVivo 12 (QSR International) for inductive coding and analysis.

6.2.3. Data analysis. The inductive coding process involved transcripts being read in their entirety, followed by line-by-line coding, with the coding hierarchy being inductively updated with emergent codes as data analysis progressed (Bradley et al., 2007; Thomas, 2006). As new codes emerged, earlier data were re-coded to ensure coverage of all relevant data. This exploratory approach allowed for the topics that emerged from the data to be synthesised into a typology of factors influencing older adults' social engagement and for these topics to be considered in relation to concepts in the literature (Huberman & Miles, 1994; Thomas, 2006). Given the inductive nature of the coding process, coding was undertaken by a single coder. However, the credibility of the interpretation was enhanced by discussions with other members of the research team (Fram, 2013; Krefting, 1991).

6.3. Findings

The data seemed to reflect topics that were relevant to an ecological systems model. This theoretical framework takes into consideration both the individual and the environment in which they are embedded, suggesting that individuals exist within and are influenced by system levels. The topics discussed by participants in this

study appeared to fit within the system levels outlined in McLeroy et al. (1988) ecological model to health promotion: intrapersonal, interpersonal, community/organisations, and policy. This model was found to offer a useful typology of the factors that may potentially deter (i.e., barriers) or promote (i.e., facilitators or motivators) social engagement among older adults. Table 21 illustrates this typology, with the findings below outlining the main barriers, motivators, and facilitators that emerged from the data as functioning at each ecological level. Illustrative quotes are presented with participant descriptors: randomly allocated participant number (P#1 to P#40), gender (M = male, F = female), age, and depressive symptoms (DS = clinically relevant depressive symptoms, N-DS = no depressive symptoms). For example, P#1, F, 60, DS is a 60-year-old female with clinically relevant depressive symptoms.

Table 21

Factors Influencing Social Engagement among Older Community-dwelling Adults

Ecological level	Factors
Intrapersonal	Self-confidence
Interpersonal	Family
	Friends
	Neighbours
	Community groups
	Workplace
Community/Organisations	Neighbourhood environment
	Proximity to family
	Incidental interactions with neighbours
	Helping neighbours
	Parks
	Transportation
Policy	Relocation
	Retirement
	Loss

6.3.1. Intrapersonal. The themes that emerged relevant to individuals' personal characteristics were discussed primarily among participants with clinically relevant depressive symptoms (hereafter referred to simply as 'depressive

symptoms'). Several participants reported a lack of self-confidence, which tended to function as a barrier to social engagement. Participants' typically noted how they were quite reserved and had been shy for most of their life, which in turn meant that they did not often engage socially with others, especially in novel situations.

I suppose I was fairly withdrawn. … I did have friends but they were old friends. I didn't tend to make new friends very much. … I get stressed more now than I ever did, which is odd, because I thought when you get older you wouldn't care, you know … but I'm not like that, I get anxious (P#30, M, 75, DS).

I don't consider myself to be overly exuberant or outlandish or gregarious. I think I consider myself to be reserved (P#29, M, 61, DS).

Participants depressive symptoms also discussed how their outlook on life had changed, especially since retiring. They often discussed feeling a lack of motivation, social engagement declining and just general sense of dissatisfaction with their life now.

Participant 3: My life has changed. Everything's changed.
Interviewer: So it's all become less than it used to be?
Participant 3: Very much so… Everything has changed since I retired and I unfortunately had to (P#3, F, 68, DS).

I am at a low point in my life and that means I do a minimum activities, and that is showing everywhere (P#21, F, 71, DS).

6.3.2. Interpersonal. Types of social engagement within participants' social environments were commonly discussed among participants with and without depressive symptoms. Participants commented on being motivated to socially engage with formal and informal social network systems, including family, friends, neighbours, community groups, and colleagues from work. While participants experiencing depressive symptoms tended to have limited social engagement and often only saw their family occasionally, they were more motivated to spend time with family members compared to those from other social network systems.

The only ones we mainly interact with are family and kids (P#8, M, 78, DS).

Not really, just going out with family occasionally and stuff like that, just for meals or something like that. That's about it (P#9, M, 62, DS).

For participants with depressive symptoms, relationships with family members were typically motivated through wanting to support them by babysitting grandchildren or caring for elderly parents. However, for female participants, they noted how supporting family meant that they had little time available to socialise with friends or other social network systems. Participants without depressive symptoms tended to have more informal activities with family members and often engaged in various activities together.

I am involved quite a lot with my grandchildren who are teenagers, but my daughter has a few problems so we're there helping her. [I attend] a few of them [social outings] but I probably wouldn't go to as many activities as some of the others (P#25, F, 71, DS).

I go from time to time with my sister and brother-in-law bushwalking … when [it is] this type of weather. I don't do it in the summer … I mainly interact with my children and their families, and my sister plays a large part in my life. We'll go to concerts together or to the movies, that sort of things weekly (P#36, F, 74, N-DS).

For participants without depressive symptoms, they typically had larger established social networks including friends and neighbours and would catch up on a regular basis compared to those without.

I've got a couple of other friends, male friends that I speak with almost every day, that type of thing. We might just go out to the movies, or something, or just go shopping or something, just interacting with other people. I'm not short of people … I've got them all around me (P#40, M, 80, N-DS)

I've got quite a few friends that are retired and yes. I go out to far too many lunches probably … coffees and dinners. Probably at least four times a week (P#36, F, 64, N-DS).

Social, sporting, outdoor physical activities, and religious groups were common ways for participants, especially those without depressive symptoms to develop and maintain social connections with people who had similar interests. Overall, community groups were framed as a facilitator for social engagement, by these participants who typically discussed being involved in various groups in the community for several years and would socialise with members of these groups regularly.

I belong to the Red Hat Society. It's a social club where you wear red and purple. I have belonged to that for 12 years. We go, might go and visit somewhere like the WA Newspapers, go out to lunch and then we go away, quite a few trips. It's been very good for a lot of people that stayed at home and didn't have much contact (P#13, F, 63, N-DS).

While participants who experienced depressive symptoms often commented on not being part of a group. For some participants though, they were aware of the benefits and were looking to join a group, but other factors such as shyness or access seemed to function as barriers. Further, for those participants who had recently started attending groups reported on the benefits they were receiving from social engagement such as a lift in their mood, thus highlighting these groups as a facilitating factor.

It [social activity] sort of started to get some boost, again, now with the lawn bowls. I'm playing twice a week and I practice on a Wednesday. The social activity is getting better than what it has been since I retired (P#24, M, 68, DS).

I know what I have to do for myself, like joining a group like Probus or anything like that where you talk about things and you learn things and you do things (P#21, F, 71, DS).

Lastly, several participants mentioned that they were still in regular contact with former colleagues. These comments highlighted the importance of sustaining social networks formed prior to retirement. The workplace seemed to function as a

facilitating factor to social engagement later in life, allowing participants to maintain already established friendships with work colleagues.

I get together with my work mates too … The girls get together and the whole lot of us get together for a meal (P#26, F, 70, N-DS).

6.3.3. Community/organisations. The physical environment of neighbourhoods was discussed as a determinant of social engagement among participants. Participants with or without depressive symptoms typically commented on how the amount and type of social engagement was influenced by the neighbourhood environment. Although participants experiencing depressive symptoms tended to keep to themselves (which acted as a barrier for social engagement), structures in their physical environment were identified as possible facilitating factors for socialising, and therefore could be utilised. The topics that emerged included: living close to family, incidental interactions with and helping neighbours, and access to parks and public transport.

Many participants discussed intentionally living close to family members. Given that participants with depressive symptoms often reported family being their only point of contact, it seems proximity may play a large part in facilitating these interactions.

My sister lives next door. My niece lives next door on the other side. My brother lives next door to my sister and my sister lives behind … There's boundaries, but we do see each other regularly. My wife will go next door quite often (P#1, M, 61, DS).

Among participants without depressive symptoms, it was common to engage socially with neighbours, though the type of interactions seemed to differ for men and women. Only male participants commented on how shared spaces such as lobbies, surrounding streets, or the front of their house functioned as a facilitator for social interactions, while mostly female participants reported that social engagement was typically facilitated by helping their neighbours in some way.

Well, I live in a unit which is in a complex. It's three-story. There are 46 people living there. I get to know quite a few of them, so we have regular dinner out and functions like that (P#40, M, 80, N-DS).

I help out the lady next door sometimes. She's got two small children, so I might help her out now and again … Babysitting or just taking one of them to school (P#16, F, 68, N-DS).

For participants with depressive symptoms the interactions with neighbours were typically incidental or informal interactions and did not appear to differ between genders. This may have reflected participants lack confidence to initiate conversations with others. It seemed that these participants would interact with neighbours if they stopped past and said hello but would typically not seek out social engagement with those in their neighbourhood.

Oh, sometimes. If I'm outside doing something and someone walks past and we get, we might get yakking (P#8, M, 78, DS).

Among participants who experienced depressive symptoms, the availability of spaces such as parks in the neighbourhood seemed to encourage social engagement and allowed for social gatherings, thus functioning as a facilitator. For many of these participants this interaction was often the only contact they had socially with others. In addition, having a dog seemed to motivate participants to utilise the parks on a regular basis and engage socially with others who also walked their dogs at the parks.

My socialising is meeting people in the park and walking our dogs together. I do that daily. That is a set routine every day from four until six … They're all seniors with dogs (P#3, F, 68, DS).

Talking to my mate when we walk round the oval in the morning … another guy and his dog (P#10, M, 79, DS).

The importance of transport was discussed as both a barrier and facilitator by participants. Having access to cars or public transport allowed participants to socially engage with friends, family, and attend groups, thus functioning as a facilitating factor. Travelling far distances or via car were reported as becoming more difficult

for some participants, especially among those with depressive symptoms, therefore highlighting a potential barrier for social engagement.

Yeah, social interaction. I go to most of the - we sometimes go out to dinner with Bentley Park. They take two or three buses to a venue, just have a meal, and you mix with the, mostly, old ladies (P#20, M, 71, N-DS).

Possibly maybe driving … I'm starting to find I try and stay out of the traffic. Possibly going from one place to another, that type of thing (P#22, F, 67, DS).

One [child] is further away and we go down to Harvey and see them down there, which we'll do this weekend … Try to catch them once a month (P#1, M, 61, DS).

I like somewhere near so I don't have to drive too far or able to catch the public transport … If there are no places then I give up and if it's too far away for me to drive or spend too much time on public transport then it's not good because I don't want to spend too much time (P#39, M, 66, N-DS).

6.3.4. Policy. The topics that emerged from the data reflected common transitions that participants had experienced and impacted on their social engagement included relocation, retirement, and loss. These transitional events were identified by participants with and without depressive symptoms as catalysts for them to either withdraw from social events or seek to join groups and participate in activities. The factors discussed at this ecological level highlight potential opportunities for primary care and health practitioners, policy makers, and other relevant agencies to intervene to ensure the development of new social networks and/or the maintenance of established relationships.

Moving to a new area was primarily discussed as a barrier to social engagement. Participants noted how their social activity had decreased since relocating, which was often because they were leaving behind well-established friendship groups. It appeared that when a move did happen, those with depressive symptoms did not manage as well and those without symptoms. For example, compared to participants with depressive symptoms, those without reported that their

social engagement had declined but seemed to have managed to develop new social networks (e.g., through the workplace or community group).

We sort of dropped out of that [social clubs] after we left New Zealand (P#8, M, 78, DS).

I grew up in Adelaide. My wife grew up in New South Wales. So all our growing up friends are over east. But we've got a small group of friends (P#29, M, 61, N-DS).

I have this year just moved from [East coast] to [West coast] to look after my mother and that in itself is a very interesting experience. I have acquaintances at the village but not friends. Most - this is really silly. My best friends are on the east coast because I lived over there for very many years before [moving] back here. I've just had occasion to go back there a couple of times … I know a lot of people and I have family here but I don't have soul mates and the ones that I have had, have gone east, would you believe it (P#27, F, 66, DS).

Many participants discussed their thoughts surrounding retirement and what they expected this transition to look like. Participants with depressive symptoms tended to express more negative views about retirement, seeing it as a loss or difficult transition, while those without viewed it as a chance to be more social. For some participants, much of their social engagement involved work colleagues and found retiring meant that their social activity level declined as it became more difficult to see these people outside of work.

I retired. It was a bit of a shock to the system and … It was brought on by some changes to the government rules. I had planned to retire at the end of last year however it was brought forward by 12 months … I lost track of people (P#24, M, 68, DS).

That social activity was obviously different than being retired. So it's not the same but I'm still active. I mean, I go out all the time. In fact, too much sometimes for dinners and stuff like that (P#40, M, 80, N-DS).

People say once you retire, what are you going to do? You'll be bored. I said no, you can never be bored because there's something else different that will come along (P#18, F, 69, N-DS).

The loss of a spouse, whether because of death (only had occurred among female participants) or divorce (only had occurred among male participants), was reflected by participants as a critical transition period. Participants often noted that they withdrew from friendship groups or activities that encouraged social engagement. For participants who experienced depressive symptoms, they tended to still be withdrawn from multiple sources of social engagement or had recently started socialising again, compared to those without symptoms who had support from other social networks such as family or were looking to join a group. Further, for a few participants with depressive symptoms who had a spouse pass away, their death often came after them being ill for several years, which contributed to their decline in social engagement. This was because for some it meant much of their time was prioritised to caring for their spouse, and for other participants they commented on their social group not understanding their situation.

Participant #11: I suppose I've become a bit of a recluse since [my husband] died. I don't want to go back with the same people. I don't know why. I just don't want to … I thought I might go and find another club, an old people's club or something to join (P#11, F, 82, N-DS).

… About 11 years ago my husband developed Alzheimer's and as he got worse everything came to a halt. He died four years ago and I've started to go dancing and swimming again (P#32, F, 82, DS).

It would be less socially active because you're - you know, once you're widowed, that makes a difference and you've just got less contact with people (P#35, F, 74, N-DS).

I'm divorced, kind of mucked me around a bit (P#15, M, 65, N-DS).

6.4. Discussion

The overall aim of this study was to present an overview of the factors that can impact on older adults' social engagement. Previous research has largely

investigated the determinants of social and leisure activities more broadly (e.g., Costello et al., 2011; Dury et al., 2015; Gilmour, 2012; Goll et al., 2015; Hao et al., 2019; Warburton et al., 2007), or have focused more narrowly on specific sub-populations (e.g., Dare et al., 2018; J. Walker et al., 2013). In contrast, this study explicitly sought the views of older adults with and without clinically relevant depressive symptoms about their lived experiences with social engagement. This study provides a typology that illustrates the barriers, facilitators, and motivators to engaging socially with others that could be addressed to help enhance protective factors like social support and therefore minimise the burden of depressive symptoms among older adults. Many of factors listed in Table 19 are consistent with previous research examining older adults' social engagement and/or isolation more broadly.

Unsurprisingly, the barriers to participants with depressive symptoms identified at the intrapersonal ecological level were a lack of satisfaction in life and difficulties like shyness that they had been experiencing for most of their life. This is consistent with research illustrating that a lack of participation in activities has been related to shyness and life satisfaction (Fernandez et al., 2001; Ghiglieri et al., 2020; Jang et al., 2004; Ziegler, 2012) as well as these factors related to depressive symptoms (Fiske et al., 2009; Howat et al., 2004; Santini et al., 2020). While the factors identified at this level help us to understand direct interactions of the individual's characteristics, and that these are likely key factors to address, an understanding from the larger ecological systems may provide a more comprehensive view.

Family, friends, and neighbours form crucial parts of older adults' social network (Antonucci, 2001; Cheng et al., 2009; Cornwell et al., 2008; Neville et al., 2018; Phillipson et al., 1999; R. Walker & Hiller, 2007). These relationships become particularly important as older adults face age-related challenges and transitions such as retirement or bereavement, as well as other non-age-related situations like moving to a new area (Adams et al., 2011; Neville et al., 2018; Olesen & Berry, 2011). For many older adults, including the present study participants, family interactions are the primary form of social engagement (Nocon & Pearson, 2000). Study participants with depressive symptoms appeared to have limited engagement with friends and tended to have more interactions with family members. Many of these participants were not part of community groups or found it difficult to socialise with others due to shyness, therefore their social networks were likely to remain small, which also may explain the lack of friendships and socialisation outside the family. Further, while

family interactions were typically phrased positively, for some study participants with depressive symptoms, time spent with family members (e.g., looking after grandchildren) meant they did not have time to visit friends. This is consistent with previous research that found family responsibilities to be a barrier to participating in social activities (Gilmour, 2012; Minkler, 1999; Pruchno, 1999). The findings from this study highlight that friendships and social engagement outside of family members may be just as, if not more, important to older people. However, it should be noted that these findings do not necessarily suggest that family engagement is unimportant, instead they indicate that perhaps it is the type of engagement and quality that is particularly crucial. For example, it was evident among study participants, especially those without depressive symptoms that they found enjoyment from engaging in leisure activities (e.g., walks or movies) with family members and therefore would regularly catch up.

Friendships for participants seemed to be developed and maintained in various ways and to different extents. Some participants had remained in regular contact with friends from their workplace, while others formed new friendships by joining community groups. The latter has been reported as an avenue for older adults to develop long-term and satisfying social networks (Neville et al., 2018). Similarly, participants differed in the extent to which they connected with and formed relationships with their neighbours and other people in their community (Boneham & Sixsmith, 2006; Kearns & Parkinson, 2001; Phillipson et al., 1999; C. Walker et al., 2007). Individuals with depressive symptoms typically lacked involvement with community groups and tended to keep to themselves rather than interacting with neighbours. This was especially noticeable among participants with depressive symptoms who had lost a significant person in their life (often a spouse), as these participants tended to remain withdrawn and found it difficult to re-engage with friends or groups. This finding is consistent with older adults reporting that their low level of social engagement is related to the death or absence of family, friends, and/or neighbours (Goll et al., 2015). Key life events identified in this study such as retirement, loss of family member, and residential shifts, are well recognised in the literature as likely risk factors for social disengagement (Findlay & Cartwright, 2002; Lang et al., 2008; Owen, 2007; C. Walker et al., 2007; Wenger & Burholt, 2004). The findings from this study suggest that perhaps for older adult at risk for depressive symptoms, these events could function as additional stressors. Among the

study participants when such a move did occur, those with depressive symptoms appeared to have more difficulty coping.

In line with previous research, neighbourhood environment seemed to play a crucial role in influencing the degree to which participants socialised with others in their community (Neville et al., 2018; O'Brien, 2014; Van Dijk et al., 2015). For example, places within the borders of a house/complex such as lobbies, front gardens, or driveways (referred to in the literature as thresholds: Gardner, 2011; Peace et al., 2005), provide easy and readily available opportunities for social interaction, most often with neighbours. In addition, it was common for participants to live close to family and have regular engagement with their neighbours, sometimes having communal dinners. Access to transport and availability of spaces like parks in the community are also examples of external factors that likely play a role in influencing older adults' social engagement, especially for those experiencing depressive symptoms. This is likely because not engaging socially with others may not be entirely a personal choice, instead it could be a result of a lack of awareness or access to resources that help them to participate (Gilmour, 2012; Neville et al., 2018). In addition, moving to a new area or community was a difficult transition for participants with depressive symptoms. Having to relocate to an unfamiliar area, especially if family is not living in the same community, is also likely to influence older adults' knowledge of available activities (Goll et al., 2015; Neville et al., 2018; Stockdale, 2011).

6.4.1. Implications. In conjunction with previous research, the typology produced in this study illustrates the importance of addressing the factors affecting social engagement across multiple domains. At the interpersonal level, the important role that friends, family, and neighbours play in older adults' social engagement was highlighted (Antonucci, 2001; Cheng et al., 2009; Cornwell et al., 2008; Neville et al., 2018; Phillipson et al., 1999; R. Walker & Hiller, 2007). Encouragement to develop and maintain a variety of social networks could play a crucial role in promoting further social engagement and other healthy behaviours (Kiecolt-Glaser & Newton, 2001; Seeman, 2000; Wu & Sheng, 2019), as well as ensuring that when certain networks are no longer available due to transitional events (identified at the policy level) other networks can meet support and friendship needs. Friendship has been shown to contribute to resilience in older people, especially when family do not live close by (Neville et al., 2018; Stockdale, 2011; Wells, 2009). It also seemed that

having a variety established networks may be particularly important during life events such as retirement, relocating, and/or illness/death of spouse in facilitating social engagement, and therefore impacting on the level social support during these transitions and in turn experiencing depressive symptoms. For example, many of the participants without depressive symptoms reported being a part of their respective groups for several years. Overall, the results from this study highlights the importance of a variety of pre-existing or established social networks in social engagement in later life, particularly for those at risk for depressive symptoms.

Engagement in local community groups can help older adults feel connected to their community (Neville et al., 2018) and promote social engagement. An example of the benefits of community groups is demonstrated in a study examining social engagement in Japan, where the majority of older residents are part of local senior citizen clubs (Minister of Health Labour and Welfare, 2017). These types of organisations coordinate a variety of activities (e.g., group physical activities, traveling, and cleaning and managing public spaces) that improve quality of life, encourage members to contribute to the local community, and develop relationships among local residents (Nemoto et al., 2018; Tomioka et al., 2017). While some participants with depressive symptoms who were just starting to engage in groups commented on their mood starting to lift, many of the participants with depressive symptoms typically discussed finding it difficult to engage in social activities even if they were aware and interested in joining. This highlights that among these participants, despite some level of motivation other factors are perhaps more prominent barriers such as intrapersonal factors. Many of the participants with depressive symptoms noted how shyness or a lack of self-confidence in social settings often affected their ability to socially engage with others, which could indicate an area that needs addressing. Interventions that target social skills, self-esteem, or social through psychological interventions could be a way of addressing these barriers to current and future social engagement, and in turn could help to mitigate the risk factors of developing depressive symptoms in later life.

Existing literature has demonstrated the importance of well-designed physical environments that allow access to resources such as transport, parks, and shops (Neville et al., 2016, 2018; O'Brien, 2014; Van Dijk et al., 2015). Although many of the participants with depressive symptoms in this study tended to keep to themselves, a few did use the infrastructure in their communities, highlighting these as potential facilitating factors. However, as these interactions were often their only form of

social engagement, it may not have been regular enough to warrant meaningful change, or the quality of social interaction may not have existed, which has been shown to be just as beneficial as the frequency (Werner-Seidler et al., 2017). Further, age-friendly communities are examples of potential infrastructures (physical and social) that can be changed to encourage older adults to participate in activities, allow them to uphold important relationships, engage meaningfully in the community, and find new sources of interest of purpose (Scharlach & Lehning, 2013). For example, some local governments have implemented free group exercise programs at local parks based on physical capability (rather than age) and offers opportunities for individuals to involve their dogs too (e.g., https://www.melvillecity.com.au/things-to-do/community-sport-and-recreation/active-in-the-park).

At broader community and policy levels, retirement and ageing in general do not necessarily need to be viewed as negative aspects of life. The results of this study illustrate potential areas for relevant entities to address such as older peoples' awareness of the multiple health benefits of social engagement and their ability to access opportunities to socialise such as community groups or activities in their local areas. Specific strategies could include public educational campaigns that highlight the benefits of social engagement in later life, primary care and health practitioners endorsing groups, and/or retirement plans that include recommendations to social activities, as well as volunteering or leisure activities. It may also be beneficial for organisations to circulate flyers about opportunities to socialise in the local community at places such as doctors' offices, libraries, local shops, community centres, or letter drops to promote awareness to older adults, especially those who may be new to the area, newly retired, or lost a spouse.

6.4.2. Limitations and future directions. The main limitations of this study relate to the sample size and the involvement of only Western Australian participants. Both of these characteristics limit the generalisability of the findings to the broader population of older people. Future quantitative studies with larger and more representative samples should investigate the determinants of social engagement identified in this study to evaluate whether these factors are replicable and generalisable. In addition, the data only represents the participants at one point in time. Although this study did not find stark differences between participants with and without depressive symptoms groups, does not necessarily mean that these factors are not important considerations to undertake when trying to enhance depressive

symptoms. For example, the barriers identified by participants without depressive symptoms could indicate the beginning effects of factors likely to impact on their mood, or for participants experiencing depressive symptoms but were motivated to join a group could just be starting to see their mood improve as their level of social support increases. Lastly, research is needed to investigate the impact of addressing individual's lack of confidence or anxiety in social settings on their social engagement in later life. Future prospective studies could indicate whether these changes are likely to exist.

Participants experiencing depressive symptoms in the sample were less likely to be tertiary educated than those without, which may have confounded the results. Participants with a non-tertiary educated, and therefore likely less financial, could have impacted on the resources they had to engage in multiple community activities. Although participants who with depressive symptoms were also more likely to be older than those without, participants included in the sample were relatively mobile and absent of significant functional impairments as they were asked to attend a face-to-face interview on the university campus.

Novel contributions of this study are the ecological framework in the context of social engagement and the comparison of participants with depressive symptoms to those without. Future prospective studies could deepen our understanding of these factors by examining patterns in social engagement from adulthood through later life.

6.4.3. Conclusion. This study explored the lived experiences of older adults with and without clinically relevant depressive symptoms in relation to their engagement in social activities. The typology generated in this study can inform local government, policy makers, and other relevant agencies about factors that could be the focus of intervention and prevention strategies designed to enhance social engagement. The findings highlight the importance of (i) older people having a variety of social networks that are established prior to reaching older age to ensure they are supported when certain social ties diminish, (ii) local organisations to promote the benefits of social engagement, (iii) neighbourhoods that are structured to encourage community interaction, and (iv) referrals and recommendations that can be made to older people when significant changes occur (e.g., retire, move, or loss) or are experiencing some level of social anxiety. Further, these results emphasise the need for efforts to optimise social engagement and the direct and indirect benefits

(i.e., preventing/reducing depressive symptoms) of enhancing factors like social support in older adults.

CHAPTER 7. GENERAL DISCUSSION

7.1. Overview

Depressive symptoms are associated with significant distress and they can impact negatively on older adults' daily functioning (Hjarsbech et al., 2011; Rowe & Rapaport, 2006; Strine et al., 2009). Therefore, identifying the most critical protective factors is crucial to guiding intervention strategies aimed at preventing or reducing depressive symptoms among older adults. The overall aim of this thesis was to identify factors that are important in protecting against later life depressive symptoms that could be targeted in prevention and amelioration efforts. The findings add to the growing body of research on late-life depressive symptoms and contribute to our understanding of how to develop and target interventions to prevent or mitigate the impact of depressive symptoms among older community-dwelling adults. To achieve these objectives, four separate studies were conducted. This chapter briefly summarises the results of these four studies before discussing the overall implications, strengths, and limitations of this thesis, followed by recommendations for future research.

7.2. Summary of Findings

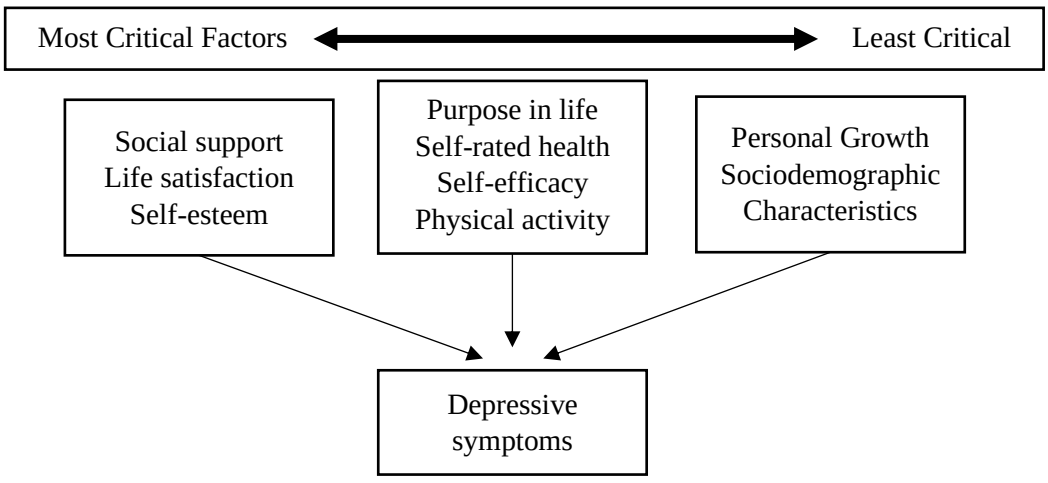
Studies 1, 2, and 3 of this thesis explored various modifiable factors associated with depressive symptoms, first in previous studies (Study 1), and then sought to identify the unique contribution of factors when examined in a comprehensive model with a broad range of variables cross-sectionally (Study 2) and prospectively (Study 3). Across all three studies, social support was consistently found to be significantly (negatively) associated with depressive symptoms and was found to the only common factor across these studies. This finding was unsurprising given that social support had been demonstrated to be negatively associated with depressive symptom across a large number of previous cross-sectional and longitudinal studies in the literature. The results of Study 2 indicated other significant protective factors associated with depressive symptoms such as life satisfaction, self-esteem, and purpose in life. Although previous studies have examined these protective factors in limited combinations with other factors, Study 2 provides novel contributions to the ageing literature by examining these factors in a comprehensive

model, thus highlighting the relative importance of these factors in preventing depressive symptoms among older adults.

Further, Study 3 expanded on Study 2 by investigating the relationships between changes in a range of protective factors and change in depressive symptoms over time. The findings indicated that although depressive symptoms decreased on average among the present sample, increases in social support, life satisfaction, and self-esteem were uniquely associated with larger reductions in depressive symptoms. The results from Study 3, in combination with those from Study 1 and 2, provide further evidence that social support, along with life satisfaction and self-esteem, are potentially critical protective factors. The relative weighting of these factors is depicted in Figure 4. Following this, factors that appear to be relatively less critical include purpose in life, self-rated health, and self-efficacy which were significant protective factors only in Study 2 (i.e., cross-sectionally), and physical activity which was found to be a consistent significant protective factor in previous research only. Personal growth does not appear to be an important factor given the limited evidence from previous studies and non-significant association with depressive symptoms in Studies 2 and 3. Sociodemographic characteristics also appeared to provide little unique predictive utility for depression symptoms once incorporated into comprehensive models.

Figure 4

Relationships between Depression Symptoms and Independent Factors Examined in this Thesis



Existing literature indicates that engagement in social activities is positively associated with the protective factor of social support, and could therefore decrease the risk of depressive symptoms among older adults. As such, Study 4 aimed to explore the determinants of social engagement to identify any factors that could assist in encouraging older people to engage in social activities. One of the main findings from this study was that having an already established range of social networks facilitated social engagement among these participants, and that these established networks are particularly during life events such as retirement, relocation, and illness or death of a spouse. For participants with depressive symptoms, a lack of confidence and social ties appeared to result in limited social engagement, contributing to a lack of perceived social support during transitions and in turn increasing the risk of depressive symptoms. The implications the findings from Studies 1 to 4 are discussed in more detail below.

7.3. Theoretical Implications

This thesis provides a comprehensive and in-depth overview of factors that are potentially important for preventing or ameliorating depressive symptoms among older community-dwelling adults. Overall, the findings from this thesis, in combination with previous literature demonstrate various direct and indirect relationships likely to be associated with depressive symptoms (see Figure 5). The most critical protective factors identified from this thesis are life satisfaction, social support, and self-esteem, which were illustrated to have a direct association with depressive symptoms. These direct effects were observed after controlling for a broad range of other factors, and may also explain the non-significant associations found between various factors and depressive symptoms in contrast with previous research. Figure 5 illustrates these relationships, with the identified critical protective factors represented by solid black lines and potential direct, mediating, and moderating relationships based on previous research represented by dashed lines. To reflect the direction of the associations between the protective factors and depressive symptoms are illustrated arrows are used in the proposed model, however it is likely that many of these relationships may be reciprocal.

Further, the results from demonstrated the moderating effect of age on the relationship between life satisfaction and depressive symptoms (see Study 2/Chapter 4). A stronger relationship was found between life satisfaction and depressive

symptoms among those participants below the average age of this sample, suggesting that interventions to improve life satisfaction could be particularly beneficial for those who are in this younger category (and likely to be newly retired). However, as there is little prior work with which to compare these moderation outcomes, and the cross-sectional nature of the data, further research is needed to replicate these results using prospective designs. Intervention research that compares the effectiveness of bolstering life satisfaction for younger and older individuals would also be informative.

Overall, there appears to be a lack of consistent results in the literature about the moderating effects of various sociodemographic characteristics on the relationships between protective factors and depressive symptoms in later life. This may suggest that there is potentially little need to tailor intervention efforts to demographic sub-groups within the broader cohort of older people. While previous studies have illustrated the moderating effects of gender and living arrangement on the relationship between social support and depressive symptoms (Alexandrino-Silva et al., 2011; A. Chan et al., 2011; Gong et al., 2018; Isaac et al., 2009; Russel & Taylor, 2009), these findings are in contrast with Study 2 and therefore are presented as proposed interactions in the model (see Figure 5). These findings, in combination with the general lack of moderation effects found in Study 2 and a lack of consistent results in previous studies examining the moderating effects of various sociodemographic characteristics, highlight the need for further research assessing the moderating effects (Alexandrino-Silva et al., 2011; A. Chan et al., 2011; Cho et al., 2018; Elliot et al., 2014; Glass et al., 2006; Gong et al., 2018; Isaac et al., 2009; Russell & Taylor, 2009; Sachs-Ericsson et al., 2007; Tani et al., 2015; van't Veer-Tazelaar et al., 2008).

Other suggested relationships in Figure 5 include cross-sectional associations between depressive symptoms and the three factors of purpose in life, self-rated health, and self-efficacy (see Study 2/Chapter 4), which are consistent with previous research (Cole & Dendukuri, 2003; Djernes, 2006; Horowitz et al., 2005; Vink et al., 2008; Wood & Joseph, 2010; Worrall et al., 2020a). While these findings suggest that purpose in life, self-rated health, and self-efficacy could potentially be important for protecting against depressive symptoms, theses associations appeared to be less important in relation to change in depressive symptoms compared to life satisfaction, social support. For example, unlike the *critical* protective factors, increases in

purpose in life, self-rated health, and self-efficacy were not associated with decreases in depressive symptoms over time (see Study 3/Chapter 5). Further prospective research examining multiple time points is needed to assess the generalisability and reliability of these results, and to test possible reciprocal relationships. Additionally, while sleep quality was not included in the models assessed in Study 2 and 3, sleep disturbance was identified as a significant risk factor for depressive symptoms among older adults in Study 1 (see Chapter 2), making it a potentially important variable to include in future studies, and therefore is presented as a proposed association in Figure 5.

There are several mediating relationships proposed in Figure 4 based on previous literature in combination with the findings from this thesis. First, the results of Studies 2 and 3 in relation to physical activity were in contrast with the conclusions of previous studies that found a negative relationship between extent of participation in physical activity and the experience of depressive symptoms among older people (see Study 1/Chapter 2). While the non-significant relationship between physical activity and depression symptoms found in Study 2 and 3 may be due to the range of other psychological variables included in the studies and their relative importance in protecting against depressive symptoms, it could also be due to possible mediating effects between these factors. Existing research has suggested that physical activity may enhance social support (Babiss & Gangwisch, 2009; Hallgren et al., 2017; Harvey et al., 2010; Jewett et al., 2014; Kandola et al., 2019; Sabiston et al., 2016), life satisfaction (Koivumaa-Honkanen et al., 2000; Maher et al., 2015; Strine et al., 2008), and self-esteem (Dishman et al., 2006; Kandola et al., 2019; Ryan, 2008), all of which were found to be critical protective factors in this thesis. Therefore, consistent with our findings, physical activity may not explain additional unique variance in depression symptoms after controlling for social support and self-esteem.

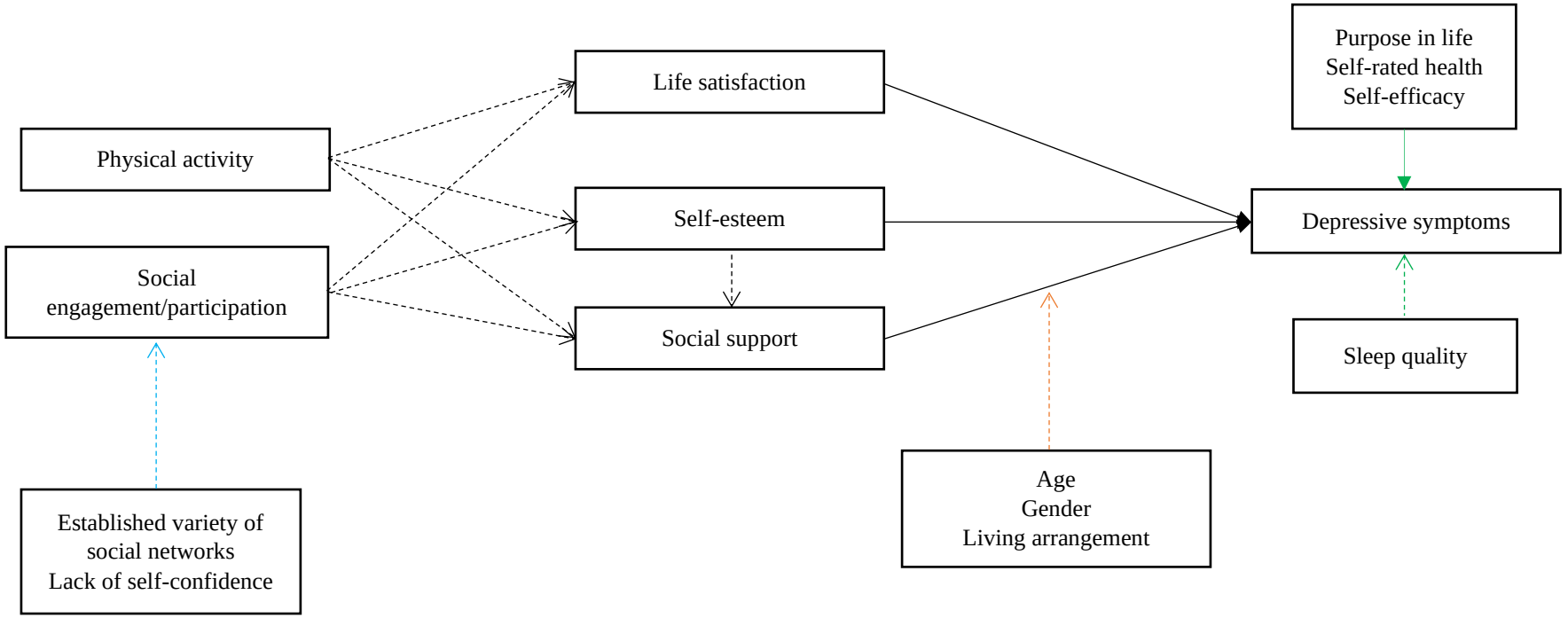
Previous research has also illustrated that low self-esteem can lead to social avoidance, which may contribute to the development of depressive symptoms through diminished social support (Ottenbreit & Dobson, 2004). Additionally, studies have suggested that social support may have mediating effects between participation and engagement in social activities and depressive symptoms (E. Choi et al., 2020). As such, both of these potential mediating effects of social support have been proposed in the model illustrated in Figure 5. Further, the results from Study 4

and a recent review (Townsend et al., 2021) highlight that having a variety of established social networks may be an important preventive measure, which could be promoted before significant age-related events occur. These networks likely help to foster social connections and support, and therefore have been included in the model. Lastly, possible mediating effects of life satisfaction and self-esteem between social engagement and depressive symptoms have also been in included in the model as previous research has illustrated the positive impact that involvement in activities that include opportunities for social interaction can have of life satisfaction and self-esteem (Chu & de Guzman, 2014; Jang et al., 2004).

Overall, the findings from this thesis and previous research suggest that the factors reviewed and examined in this thesis are likely to be inter-related in complex ways, offering a possible explanation for some of the non-significant results that arose (e.g., physical activity). While this thesis highlighted critical factors found to protect against depressive symptoms among older community-adults, the proposed relationships in Figure 5 could not be tested as participants were only assessed at two time points, making it inappropriate to generalise these findings prospectively. Future prospective studies including at least three time points are needed to assess these proposed relationships in Figure 5.

Figure 5

Proposed Model of Protective Factors for Depressive Symptoms among Older Community-dwelling Adults



Key

Direct associations of *critical* protective factors with depressive symptoms observed in this thesis

Proposed mediations based on previous research

Proposed interactions based on previous research

Observed associations of *less critical* protective factors and depressive symptoms in this thesis

Proposed association of potentially important factor identified in systematic review

Proposed factors impacting on social engagement/participation identified in this thesis

Note. While the arrows reflect the direction of observed and proposed associations, it is likely that many of these relationships may be reciprocal.

7.4. Practical Implications

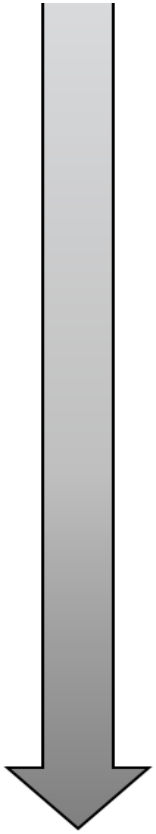
Community-based interventions that focus on enhancing protective factors and minimising risk factors have been identified as important elements of comprehensive approaches to the prevention of depressive symptoms among older people (WHO, 2012, 2018). This thesis identified a range of protective factors associated with depressive symptoms among older community-dwelling adults, with those identified as being most critical recommended to be the focus of comprehensive interventions. The practical implications of the overall findings from this thesis are illustrated in Table 22. This table provides an overview of various interventions aimed at preventing or ameliorating depressive symptoms among older adults, and was adapted from V. Patel et al.'s (2018) stage approach to addressing mental health disorders and Fries et al.'s (2011) reduction of morbidity using prevention strategies. The proposed interventions could be employed at different levels (or stages) depending on symptoms severity.

Age-related life events discussed in Study 4 also highlight potential key events that participants found to be difficult to cope with and that seemed to impact negatively on their social engagement. Taking a multi-level approach offers various opportunities for relevant entities to intervene at community, targeted group, and individual levels along a dimension from no symptoms to different stages of depression (V. Patel et al., 2018). Where symptoms are impacting negatively in the individual but may not merit a diagnosis, a multi-level approach can lead to appropriate support and engagement being implemented as a preventative measure, such as promoting self-care or simply increased monitoring (V. Patel et al., 2018). Each of the levels of intervention are discussed in more detail below.

Table 22

A Multi-level Intervention Model for Addressing Depressive Symptoms among Older Community-dwelling Adults

DEPRESSIVE SYMPTOMS SEVERITY	LEVELS OF INTERVENTION STRATEGIES	ENTITIES INVOLVED AT EACH INTERVENTION LEVEL
No depressive symptoms 	**Primordial Intervention:** Prevention of risk factors for depressive symptoms at a population/community level • Public awareness and education about depressive symptoms • Public awareness and education about risk and protective factors of depressive symptoms • Public promotion of engagement in activities that involve connecting with others (e.g., social or physical activities, volunteering) • Interventions to reduce stigma and promote help-seeking • Promotion of self-care interventions • Identify and establish social supports	Local and Federal Governments • Education campaigns • Education about protective factors (e.g., social support, life satisfaction, and self-esteem) • Activities that enhance protective factors available and accessible to older adults • Promotion of activities in general that enhance protective factors Organisational human resource department • Education pamphlets and online resources about depressive symptoms and retirement • Education about protective factors (e.g., social support, life satisfaction, and self-esteem) • Promotion of activities in general that enhance protective factors Superannuation funds • Education pamphlets and online resources about ageing and retirement • Education about protective factors (e.g., social support, life satisfaction, and self-esteem) • Promotion of activities in general that enhance protective factors Health professionals (e.g., GPs) • General education about ageing • Promotion of activities available in communities Family and friends • Education about the risk and protective factors of depressive symptoms • Education about who/where to refer to for assistance
	Primary Intervention: Reduction of risk factors before depressive symptoms develop • Use of screening tools to assess limited/lack of protective factors • Identification and monitoring of high-risk individuals	Local Governments • Promotion/advertising of activities that enhance protective factors available and accessible to older adults Organisational human resource department

 Severe depressive symptoms	• Target individuals before, during, and after life transitions (e.g., retirement, relocation, illness/loss of spouse) • Engagement activities that involve connecting with others (e.g., social or physical activities, volunteering) • Identify and establish social supports **Secondary Intervention:** Prevention of progression of depressive symptoms after onset • Continued use of screening and monitoring tools of high-risk individuals • Treatment of psychological barriers where necessary (e.g., lack of social confidence) • Address other barriers to engagement (e.g., access) • Engagement activities that involve connecting with others (e.g., social or physical activities, volunteering) • Engage with social supports	• Education pamphlets and online resources about risk and protective factors of depressive symptoms • Education about who/where to refer to for assistance • Referral made to health professionals (if necessary) • Promotion/encouragement to engage in activities that enhance protective factors available and accessible to older adults Health professionals (e.g., GPs, Mental health professionals) • Administration of screening tools • Monitoring of high-risk individuals • Provide psychoeducation about depression • Provide recommendations of activities in community • Referral made to mental health professional (if necessary) Family and friends • Education about risk and protective factors of depressive symptoms • Education of who/where to refer to for assistance • Provide support to individual with depressive symptoms where necessary
	Tertiary Intervention: Reduction of morbidity from depressive symptoms and complications that have developed • Psychological interventions (e.g., Cognitive Behavioural Therapy) • Rehabilitation and ongoing community engagement and support	Mental health professionals (e.g., Psychologists, Psychiatrists) • Provide psychological interventions • Provide medication interventions Family and friends • Provide ongoing support

Note. Adapted from Fries et al. (2011) and V. Patel et al.

7.4.1. Primordial intervention. At this level, the aims are to prevent the risk factors for depressive symptoms from developing and to establish or maintain protective factors. The results from this thesis highlight the critical factors of social support, life satisfaction, and self-esteem that could be deemed as protective or risk dependent on the level (i.e., high = protective, low = risk) as they are negatively associated with depressive symptoms. Additionally, Figure 5 illustrates proposed activities that may enhance these factors and prevent or reduce depressive symptoms through possible mediating effects. At this primordial stage, it may be useful to address these critical and relevant factors at a population or community level as they can benefit older adults with and without clinically relevant depressive symptoms (V. Patel et al., 2018), as well as capture individuals in middle-adulthood before they reach retirement and older age. It is important for primary care practitioners, policy makers, and other entities involved with older adults to be aware of the most critical protective factors associated depressive symptoms in later life (e.g., life satisfaction, social support, and self-esteem), as well as the activities that enhance these factors and protect against depressive symptoms. For example, Henning et al. (2020) suggest that engagement in leisure activities prior to retirement may be associated with benefits for retirees as their results showed that people who were more socially or physically active at baseline had larger decreases in depressive symptoms over time. These results, in combination with the findings of this thesis, highlight the importance of preventing/protecting against depressive symptoms, including sub-threshold symptoms, prior to retirement.

Further, approaches that educate, motivate, and assist older adults to overcome issues that prevent them from being willing or able to engage in leisure activities may be required. For example, Organisational human resource department or superannuation funds could provide their employees and customers with information about the risk and protective factors for depressive symptoms in later life, and promote engagement in activities to expand their social networks to enhance protective factors like social support, life satisfaction, and self-esteem (Anderson et al., 2014; Catalan-Matamoros et al., 2016; Chiao et al., 2011; Fiori et al., 2006; Forsman et al., 2011a; Greenfield & Mark, 2004; Heo et al., 2018; Joshi et al., 2016; Krause & Shaw 2000; Y. Li, 2007; C. Li et al., 2018; Taylor, 2011). Additionally, the results of this thesis identify critical factors that are likely to be indicative of whether an older person's experience with depressive symptoms will change. Specifically, the results suggest that it is important for primary care providers such as

General Practitioners to regularly check in about the patient's lifestyle, such as their social engagement and level of perceived social support, and any significant changes that may impact negatively on their support system, satisfaction, or self-esteem. Primary care providers are typically the first, and often only, point of contact older adults have with mental health services (Alexopoulos, 2005; McKay & Draper, 2012), and thus could play a vital role in implementing these intervention strategies outlined above. Further, the most critical factors identified in this thesis highlight protective and risk factors that could be important variables to include in the policies for assessment and prevention for depressive symptoms outlined in the Guidelines for preventive activities in general practice (www.racgp.org.au).

7.4.2. Primary and secondary intervention. At the primary intervention stage, the aim is to decrease the prevalence of risk factors whilst enhancing protective factors, with the secondary intervention stage aiming to prevent the progression of symptoms. These stages aim to capture older adults who experience depressive symptoms but not severe enough to merit a diagnosis (V. Patel et al., 2018). Often in primary care, older people tend to present with less severe and more mixed symptoms compared with those in mental health services. Screening and monitoring of risk and protective factors might help to provide strategies on how to proceed if there is no clear diagnosis, and to identify older people who are at high risk for developing severe symptoms and require referral to mental health professionals. For example, currently there are tools available such as Beyond Blue's *reflecting on your connections* questions (www.beyondblue.org.au), which may assist in exploring topics like social support and engagement. Additionally, other interventions such as psychoeducation about depressive symptoms might be particularly relevant in providing reasons behind encouraging engagement in social and meaningful leisure activities. These strategies may also be useful for friends, family, and neighbours of older adults to be aware of, especially given the crucial role that they can play in promoting healthy behaviours (Seeman, 2000; Wu & Sheng, 2019).

7.4.3. Tertiary intervention. The tertiary intervention stage aims to mitigate the impact of depressive symptoms. For older adults who progress to having more severe symptoms and diagnosable depression, it is essential that they can access appropriate care through more tailored interventions such as psychological or

psychiatric interventions (V. Patel et al., 2018). As noted in Study 4, some individuals who experience clinically relevant depressive symptoms may require interventions delivered by mental health specialists before they are able to engage in social activities and see any positive changes in relevant protective factors. Individuals with more severe symptoms may be stuck in a cycle where the symptoms and subsequent thoughts and behaviours function as barriers to engaging in activities. In these cases, there is strong evidence to suggest that psychological interventions such as Cognitive Behavioural Therapy and Behavioural Activation are effective in reducing depressive symptoms among community-dwelling older adults (Cox & D'Oyley, 2011; Kanter et al., 2011; Laidlaw et al., 2008; Pinquart et al., 2007; Serfaty et al., 2009).

7.5. Conclusion

Previous studies investigating the relationships between depressive symptoms and various factors have largely investigated variables in isolation or in limited combinations, and have primarily focused on non-modifiable factors. This thesis aimed to identify and understand key factors related to depressive symptoms among older adults that are amenable to change, and can therefore be feasibly targeted in early intervention efforts. Across four studies, various modifiable factors that are protective of depressive symptoms were comprehensively explored to identify and understand the relative importance and unique contribution of various factors in preventing or ameliorating depressive symptoms among older adults. A major strength of Studies 2 and 3 is the inclusion of substantial numbers of variables, thereby enabling the identification of those that are most critical. Overall, this thesis provides an extensive overview of the literature on depressive symptoms in later life, and identified several critical factors (life satisfaction, social support, and self-esteem) across different sub-groups of older people living in the community. The theoretical implications illustrated a proposed model highlighting areas for future research to explore, while the practical implications provided recommendations for varying levels of intervention strategies for policy makers, health professionals, and other relevant entities to implement to target varying levels of depressive symptoms among older adults at the community and individual level. It is hoped that the findings from this thesis can contribute to reducing the economic, societal, and personal costs of depressive symptoms in older age.

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APPENDIX A

Published article - Study 1

Worrall, C., Jongenelis, M., & Pettigrew, S. (2020). Modifiable protective and risk factors for depressive symptoms among older community-dwelling adults: A systematic review. *Journal of Affective Disorders, 272*, 305-317. https://doi.org/10.1016/j.jad.2020.03.119

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Review article

Modifiable Protective and Risk Factors for Depressive Symptoms among Older Community-dwelling Adults: A Systematic Review

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1. Introduction

Depression is a leading cause of disability worldwide and constitutes a primary contributor to the overall global burden of disease (World Health Organization [WHO], 2018). Depression is more common in later life, with an estimated prevalence among those aged 60 years and older of 7% for females and 5% for males, compared to 4% for females and 3% for males in the broader adult population (WHO, 2017). Many more people (including older adults) experience depressive symptoms that are not severe or persistent enough to merit a diagnosis, but are still associated with significant distress or impairment in important domains of daily functioning (Hjarsbech et al., 2011; Rowe & Rapaport, 2006; Strine et al., 2009). Furthermore, depressive symptoms often go undetected (Fiske, Wetherell, & Gatz, 2009), and this is especially the case among older adults due to the uncertainty about what constitutes depression in this cohort (Alexopoulos, 2005; Chapman & Perry, 2008; Chew-Graham et al., 2012; Rodda et al., 2011; Thomas & Shute, 2006). As the proportion of people aged 60 years and older is projected to increase from 13% in 2017 to 21% in 2050 (United Nations, 2017), it is likely that the number of older adults experiencing depressive symptoms will also increase substantially unless appropriate prevention strategies are developed and implemented.

Depressive symptoms can be especially debilitating for older adults. Compared to younger cohorts, older adults tend to have more limited social networks and suboptimal coping strategies (Fiske et al., 2009; Vink, Aartsen, & Schoevers, 2008; von Faber et al., 2016). In addition, the impact of depressive symptoms on daily functioning and well-being is greater among older adults, and can often result in direct medical costs and indirect economic costs due to reduced mobility (Bock et al., 2016; Donohue & Pincus, 2007). Preventing depressive symptoms in later life therefore has the potential to reduce the impact of these symptoms on both individuals and society.

Community-based interventions that focus on enhancing protective factors and minimizing risk factors have been identified as an important element of comprehensive approaches to the prevention of depressive symptoms among older people (WHO, 2012, 2018). Identifying the factors associated with depressive symptoms among older adults can assist in informing effective community-based programs aimed at preventing these symptoms. Three systematic reviews examining potential factors could be located (Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008), of which only one focused specifically on community-dwelling older adults (Cole & Dendukuri, 2003). The reviews had a degree of overlap, with 15 studies included in at least two reviews and three studies included in all three reviews. The majority of studies included in the reviews had longitudinal study designs and were primarily focused on non-modifiable factors, of which gender, functional impairment, and history of depression were typically found to be the most important (Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008). The most relevant modifiable factors were found to be low levels of social support, poor self-rated health, and sleep disturbance (Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008).

With the existence of cohort effects between different groups of seniors across time (Fozard & Wahl, 2012), current research on relevant protective and risk factors for depressive symptoms is needed to ensure intervention developers have access to up-to-date evidence to inform their efforts. It is particularly important to include modifiable factors in analyses to provide the information inputs required to develop interventions that can effectively target those variables that have the greatest potential to produce favorable change (Singh & Okereke, 2015). The present systematic review addressed these needs by synthesizing recent research on factors associated with depressive symptoms among older community-dwelling adults, with a particular focus on modifiable factors. Sociodemographic variables were also examined to enable the identification of specific groups of individuals within the broader older community-dwelling population who are most in need of intervention.

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2. Method

2.1. Search strategy

This review was conducted in accordance with the Preferred Reporting of Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher, Liberati, Tetzlaff & Altman, 2009). As the most recent systematic review that could be located included studies up to December 2005 (Vink et al., 2008), a comprehensive search of the following databases was conducted for articles published from January 2006, with an end date of June 2018: Google Scholar, EBSCO, Medline, PubMed, ProQuest, PsychInfo, Science Direct, SCOPUS, Web of Science, and Wiley Online. The search terms were (risk factors OR protective factors OR predictors OR correlates OR association) AND (depressi* OR senile depression OR late*-life depression) AND (older people OR older adult OR elderly people OR late* life OR geriatric OR senior*) AND (community OR community-dwelling OR community population OR community sample OR independently living).

2.2. Selection criteria

Inclusion criteria for the studies were as follows: available in full-text; published in English; published between January 2006 and June 2018; methodology was either quantitative or mixed-method; participants were aged 60 years or older; participants were living in the community; the range of constructs examined as potential protective or risk factors for depression included at least one psychosocial, behavioral, or socio-demographic factor; multivariate analysis methods were employed; depressive symptoms were an outcome variable; and cut-off scores (if used) were equal to or above the validated cut-off score for clinically relevant depressive symptoms. For studies that were longitudinal in design, only those that controlled for pre-existing depressive symptoms in analyses or excluded participants who were identified as being depressed at baseline were reviewed.

2.3. Search process

The PRISMA flow diagram shown in Figure 1 summarizes the step-by-step process of selecting studies. The search initially returned 1,869 studies, with 1,167 remaining after the removal of duplicates. All study titles, abstracts, and full-texts were screened for relevance by the first author, and 10% of the studies at each step were reviewed by the third author. Disagreements about which studies should be included were discussed and resolved before moving on to the next step. This process resulted in 75 studies that were eligible to be included in the final review (references presented in the appendix).

2.4. Quality assessment

The methodological quality of each included study was determined using the QualSyst assessment tool (Kmet, Robert, & Cook, 2004). Quality was assessed against 14 criteria by the first and third authors, with discrepancies discussed until consensus was reached. Each study was given a score for each criterion (0 = no, 1 = partial, 2 = yes), with a 'not applicable' (N/A) option also available. An overall quality assessment score was calculated by summing all scores given for each criterion (excluding N/A scores), with higher scores indicating greater methodological rigor (adjusting for number of applicable criteria). The overall score is presented as a percentage, which indicates quality grade: $<50\%$ low; ≥ 50 and $<70\%$ medium; and $\geq 70\%$ high (Kmet et al., 2004).

2.5. Data extraction

Across studies, there was considerable heterogeneity in terms of the age of the sample, the statistical methods used, and the independent and confounding variables included in analyses. As such, a formal statistical pooling of results was not attempted. Instead, a descriptive, narrative review of the data and tabulation of the study characteristics and main findings were undertaken. Factors were identified as risk or protective factors where there was a clear majority of studies supporting the finding.

3. Results

3.1. Study and participant characteristics

The characteristics of the 75 studies included in the review are described in Table 1. Across the studies there were 205,590 participants (baseline age ranged from 60 to 105 years), with sample sizes ranging from 108 to 37,193 (mean = 2,741; median = 1,253). The majority of studies included both females and males, with four studies comprising only males. The studies varied in terms of cultural setting: 23% (n = 17) were conducted in the United States, 16% (n = 12) in China, 15% (n = 11) in Japan, and 11% (n = 8) in Europe. The remaining studies were set in various other countries around the world (e.g., Australia and Thailand).

3.2. Methodological quality

The quality assessment criteria were applied to each of the 75 studies (scores shown in Table 1). Almost all reviewed studies were assessed to be of high quality, with 74 studies meeting $\geq 70\%$ of the eligible criteria. The remaining study was identified as medium quality, meeting between $\geq 50\%$ and $<70\%$ of the eligible criteria. Methodological strengths of studies included study objectives described sufficiently, appropriate variance estimates provided, and results described in sufficient detail. Methodological weaknesses of studies included method of participant selection not described sufficiently, participant characteristics not described in sufficient detail, and confounding variables not controlled for in analyses.

Two-thirds (64%) of the studies were cross-sectional and the remainder were longitudinal. The majority of studies (93%) used self-report measures to assess depressive symptoms, of which approximately half (57%) used the Geriatric Depression Scale (GDS) and one-fifth (21%) used the Center for Epidemiological Studies Depression scale (CESD).

3.3. Identified protective and risk factors

Modifiable and non-modifiable variables assessed in the eligible studies were categorized as potential risk or protective factors for depressive symptoms. Only factors that were reported in at least three studies are discussed and presented in Tables 2 to 4. This threshold was selected to enable comparisons among results. Factors examined by fewer than three studies are listed in Table S1 in the supplementary materials.

In total, 21 potential protective and risk factors were identified. These were categorized as psychosocial (social/family support, self-rated health, social network size, loneliness, sense of personal mastery), behavioral (physical activity, social participation, engagement in hobbies, use of modern devices, sleep disturbance, diet quality, smoking status, alcohol use), or sociodemographic (age, gender, education level, marital status, living situation, body mass index [BMI], socioeconomic status [SES], employment status).

Tables 2, 3, and 4 present findings from multivariate analyses relating to each of these factors. The majority of studies reported at least one significant association between a protective (60 studies) or risk (39 studies) factor and depressive symptoms among older community-dwelling adults. Very few studies assessed interaction effects, of which the majority examined potential moderating effects of socio-demographic variables. The results of these interactions are presented

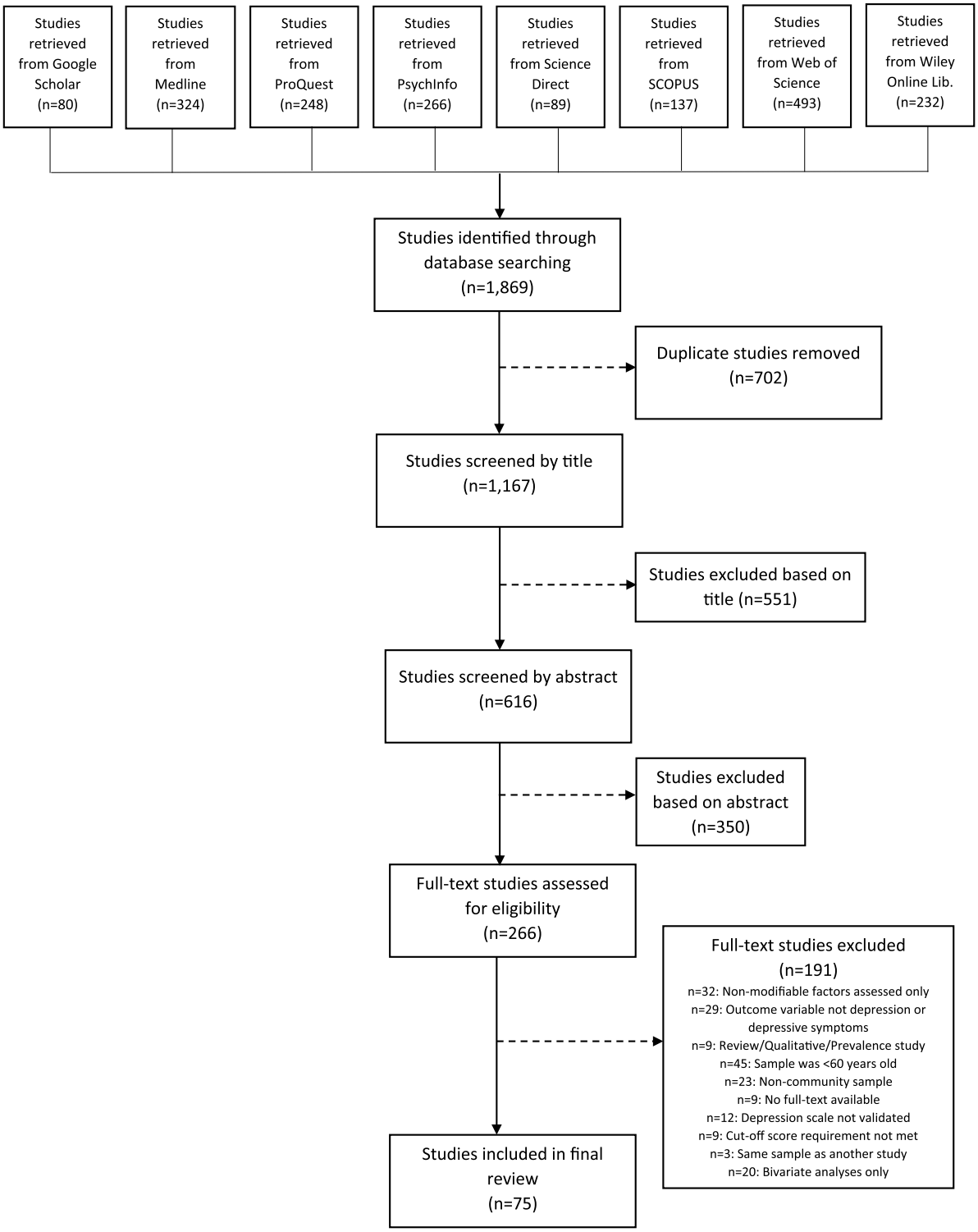

Figure 1. PRISMA flow diagram: Selection of studies

in Table S2 in the supplementary materials, along with the relevant independent and confounding variables for each included study.

3.3.1. *Psychosocial factors*

The relationships between psychosocial factors and depressive symptoms were explored in 45 studies (see Table 2). There was substantial evidence for the protective role of good social and/or family support and better self-rated health, with findings consistent across cross-sectional and longitudinal studies. Fewer studies examined sense of personal mastery as a potential protective factor, however the available evidence indicated a protective effect across both cross-sectional and longitudinal studies. Loneliness was only examined in cross-sectional studies, all but one of which found it to be an important risk factor for depressive symptoms. There were varied results within and between cross-sectional and longitudinal studies on the effect of larger social networks.

Table 1
Assessed studies investigating protective and risk factors for depressive symptoms among community-dwelling older adults.

Studies	Country	Methodology	Sample Size		% Female	Age (years)		Criteria for depression		Depressed participants N (%)	Factors studied	Quality assessment total (%)
			Baseline	Follow-up		Range	Mean	Measure	Cut-off score			
Abe et al., 2012	Japan	Cross-sectional	2,152	-	46	65+	76.7	GDS-15	≥6	570 (26)	Psychosocial Behavioral Sociodemographic	82
Aihara et al., 2011	Japan	Cross-sectional	887	-	53	65+	75.4	GDS-5	≥2	114 (13)	Behavioral	64
Alexandrino-Silva et al., 2011	Brazil	Cross-sectional	367	-	65	60+	70.1	CIDI	Meets diagnostic criteria	69 (19)	Psychosocial	73
Almeida et al., 2011	Australia	Longitudinal	12,203	5,127	-	65-85	-	ICD-9 & ICD-10	Meets diagnostic criteria	128	Behavioral	91
Almeida et al., 2014	Australia	Longitudinal	3,873	-	-	65-83	-	GDS-15	≥7	610	Behavioral Sociodemographic	95
Ang and Malhotra, 2016	Singapore	Cross-sectional	2,766	-	53	-	-	CESD-11	-	-	Psychosocial	91
Baiyewu et al., 2015	Africa (Nigeria)	Cross-sectional	458	-	57	-	73.7	GDS-30	≥11	59 (13)	Psychosocial Behavioral	77
Brinda et al., 2016	Multiple Countries	Cross-sectional	14,877	-	55	65+	-	ICD-10	Meets diagnostic criteria	700 (5)	Psychosocial Sociodemographic	95
Cao et al., 2016	China	Cross-sectional	1,168	-	52	60-94	70.7	GDS-30	≥11	305 (26)	Psychosocial	100
Carayanni et al., 2012	Europe (Greece)	Cross-sectional	360	-	61	60+	-	GDS-15	≥6	109 (30)	Behavioral Sociodemographic	95
Carriere et al., 2017	Europe (France)	Longitudinal	1,253	-	59	68-76	-	CESD-20	≥16	342	Sociodemographic	100
Castro-Costa et al., 2008	Africa (Cameroon)	Cross-sectional	1,510	-	61	-	-	GHQ-12	≥5	582 (39)	Psychosocial Behavioral Sociodemographic	91
Chan and Zeng, 2009	China	Cross-sectional	1,042	-	100	60+	71.4±7.4	GDS-15	≥8	124 (12)	Psychosocial	86
Chan et al., 2011	Singapore	Cross-sectional	4,489	-	54	60-97	69.3±7.2	CESD-11	-	-	Psychosocial Behavioral Sociodemographic	100
Chan et al., 2012	China	Longitudinal	4,000	2,630	40	65+	71.7±4.7	GDS-15	≥8	192 (baseline) 105 (follow-up)	Psychosocial Behavioral Sociodemographic	100
Chan et al., 2014	China	Cross-sectional & Longitudinal	2,902	2,211	40	65+	71.8±4.8	GDS-15	≥8	218	Behavioral	95
Chang et al., 2017	China (Taiwan)	Longitudinal	2,673	1,361	45	65+	74.2±5.7	CESD-10	≥10	624	Psychosocial Behavioral	100
Chao et al., 2018	USA	Cross-sectional	3,157	-	59	60-105	72.8±8.3	PHQ-9	≥10	256	Psychosocial Sociodemographic	95
Cho et al., 2018	South Korea	Cross-sectional	10,197	-	57	60+	70.2±6.6	GDS-15	≥8	2,391 (23)	Behavioral Sociodemographic	91
Choi and McDougall, 2009	USA	Cross-sectional	211	-	81	60-96	-	GDS-15	≥5	51 (24)	Psychosocial Sociodemographic	100
Choi et al., 2013	Europe	Cross-sectional	7,238	-	48	60-99	68.7±6.8	EUROD-12	≥4	765 (11)	Sociodemographic	95
Elliot et al., 2014	USA	Cross-sectional	6,483	-	57	65+	-	PHQ-9 item	-	-	Behavioral Sociodemographic	100
Fukunaga et al., 2012	Japan	Cross-sectional	964	-	62	65+	-	GDS-15 item	≥6	199 (21)	Psychosocial Behavioral Sociodemographic	82
Garcia-Pena et al., 2013	Mexico	Longitudinal	2,949	2,352	61	60+	70.9	GDS-30 item	≥11	-	Psychosocial Behavioral Sociodemographic	95
Giltay et al., 2006	Europe (Netherlands)	Longitudinal	464	135	-	64-84	70.8	Zung SDS	≥50	202	Psychosocial	91
Glass et al., 2006	USA	Cross-sectional & Longitudinal	2,812	1,970	61	65+	-	CESD-20	≥16	-	Behavioral Sociodemographic	100
Gomes et al., 2018	Brazil	Cross-sectional	1,378	-	63	60+	-	GDS-10	≥5	(15)	Behavioral	95
Gong et al., 2018	China	Cross-sectional	3,182	-	59	60-95	70.7±6.9	GDS-15	≥6	640 (21)	Psychosocial Behavioral Sociodemographic	86
Han et al., 2007	South Korea	Cross-sectional	205	-	63	60+	-	KDSKA-25	-	-	Psychosocial Sociodemographic	95
Hua et al., 2015	China	Cross-sectional	954	-	63	60+	70.9±7.2	GDS-30	≥11	151 (16)	Behavioral	77

(*continued on next page*)

Table 1 (*continued*)

Studies	Country	Methodology	Sample Size		% Female	Age (years)		Criteria for depression		Depressed participants N (%)	Factors studied	Quality assessment total (%)
			Baseline	Follow-up		Range	Mean	Measure	Cut-off score			
Isaac et al., 2009	Europe (France)	Longitudinal	1,849	463	58	65+	73.2	CESD-20	≥15/16	564 (31)	Behavioral	100
Jaussent et al., 2011	Europe (France)	Longitudinal	9,077	3,824	56	65+	-	Modified CESD-20	≥16	618 (16)	Behavioral	95
Jeon and Dunkle, 2009	USA	Longitudinal	193	155	80	85+	87.7	SCL-90 Depression Scale	-	-	Psychosocial	86
Kaneko et al., 2007	Japan	Cross-sectional	1,925	-	57	60+	70.7 ± 7.0	Zung SDS	≥50	201 (10)	Psychosocial Sociodemographic	77
Khaltar et al., 2017	Sri Lanka	Cross-sectional	778	-	61	60+	-	GDS-15	≥6	236 (30)	Psychosocial Sociodemographic	95
Ku et al., 2018	China (Taiwan)	Longitudinal	285	274	54	65+	74.5 ± 6 .1	GDS-15	≥5	274 (100)	Behavioral	91
Kuchibhatla et al., 2012	USA	Longitudinal	3,973	1,516	65	65-105	-	CESD-20	≥16	930	Psychosocial Sociodemographic	100
Kuroda et al., 2015	Japan	Cross-sectional	1,856	-	50	65-94	72.9 ± 5.5	GDS-15	≥6	272 (15)	Psychosocial Behavioral Sociodemographic	95
Lee, C et al., 2012	China (Taiwan)	Longitudinal	2,432	1,481	46	65+	73.4	CESD-10	≥10	312 (21)	Psychosocial Behavioral Sociodemographic	100
Lee, L et al., 2012	Malaysia	Cross-sectional	318	-	59	60+	-	GDS-15	≥5	96 (30)	Behavioral Sociodemographic	100
Lee et al., 2013	USA	Longitudinal	419	382	55	60-95	68.5	SCID & HAMD-24	Meets diagnostic criteria	68 (16)	Behavioral Sociodemographic	95
Lee et al., 2014	USA	Cross-sectional	810	-	55	60+	70.4	PHQ-9	≥10	32 (4)	Behavioral Sociodemographic	100
Li et al., 2011	China	Cross-sectional	2,002	-	49	60+	-	GDS-15	≥8	250 (13)	Psychosocial Behavioral	95
Li et al., 2015	Singapore	Cross-sectional	162	-	76	65+	72.2 ± 6.2	GDS-15	≥5	56 (35)	Psychosocial Sociodemographic	86
Lin et al., 2014	USA	Cross-sectional	108	-	56	60-94	70.6 ± 7.7	GDS-15	≥5	? (11)	Psychosocial Sociodemographic	95
Lue et al., 2010	China (Taiwan)	Longitudinal	1,868	1,487	42	65+	-	CESD-10	≥10	293	Psychosocial Sociodemographic	100
Maglione et al., 2014a	USA	Longitudinal	1,966	952	100	70-100	84.2	GDS-15	≥6	46 (5)	Behavioral	100
Maglione et al., 2014b	USA	Cross-sectional	3,020	-	100	70-100	-	GDS-15	≥6	355 (12)	Behavioral	100
Morikawa et al., 2013	Japan	Cross-sectional	3,796	-	50	65-93	72.2 ± 5.1	GDS-15	≥6	561 (15)	Psychosocial Behavioral Sociodemographic	100
Murata et al., 2008	Japan	Cross-sectional	29,860	-	54	65+	-	GDS-15	≥5	9,834 (33)	Psychosocial Sociodemographic	95
Nakulan et al., 2015	India	Cross-sectional	220	-	58	65+	-	ICD-10	Meets diagnostic criteria	86 (39)	Psychosocial Sociodemographic	86
Nicolosi et al., 2011	Brazil	Cross-sectional	303	-	65	65+	71.8 ± 5.4	GDS-15	≥5	63 (21)	Psychosocial Sociodemographic	100
Park et al., 2015	South Korea	Longitudinal	701	340	48	65+	71.3 ± 4.9	GDS-15	≥8	104	Behavioral	100
Park, 2017	South Korea	Longitudinal	2,435	-	100	65-104	-	CESD-11	-	-	Psychosocial Behavioral	100
Park et al., 2017	South Korea	Cross-sectional	258	-	52	65+	74.7	GDS-30	≥10	44 (17)	Psychosocial Sociodemographic	100
Piboon et al., 2012	Thailand	Cross-sectional	317	-	60	60-97	70.4 ± 7.66	GDS-30	-	-	Psychosocial Sociodemographic	95
Pilania et al., 2017	India	Cross-sectional	500	-	54	60+	68.5 ± 7.7	GDS-30	≥22	72 (14)	Behavioral Sociodemographic	95
Richardson et al., 2012	USA	Cross-sectional	378	-	69	-	-	SCID & PHQ-9	Meets diagnostic criteria / ≥10	101 (27)	Psychosocial	100
Russell and Taylor, 2009	USA	Cross-sectional	947	-	55	-	-	CESD-20	-	-	Psychosocial Sociodemographic	86

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Table 1 (*continued*)

Studies	Country	Methodology	Sample Size		% Female	Age (years)		Criteria for depression		Depressed participants N (%)	Factors studied	Quality assessment total (%)
			Baseline	Follow-up		Range	Mean	Measure	Cut-off score			
Sachs-Ericsson et al., 2007	USA	Longitudinal	4,162	2,406	63	65+	72±5.7	CESD-20	-	-	Psychosocial Sociodemographic	95
Schwarzbach et al., 2013	Europe (Germany)	Cross-sectional	1,028	-	67	75+	-	GDS-15	≥6	99 (10)	Behavioral Sociodemographic	100
Shin et al., 2008	South Korea	Longitudinal	1,000	787	53	65+	75.4	DSM-IV	Meets diagnostic criteria	65 (16)	Psychosocial	95
Smagula et al., 2015	USA	Cross-sectional & Longitudinal	2,892	2,124	-	65+	76.2±5.5	GDS-15	≥6	177	Behavioral	91
St John et al., 2006	Canada	Cross-sectional	1,382	-	60	65+	75.3	CESD-20	≥16	159 (12)	Psychosocial Sociodemographic	95
Sun et al., 2012	USA	Longitudinal	1,000	624	53	60+	74.9±5.9	GDS-15	≥6	(7)	Psychosocial Sociodemographic	91
Tani et al., 2015	Japan	Longitudinal	77,714	37,193	53	65+	-	GDS-15 item	≥5	4373	Psychosocial Behavioral Sociodemographic	91
Tanner et al., 2014	USA	Cross-sectional	533	-	76	60-100	78.5±8.8	GDS-15 item	>5	186 (35)	Psychosocial Sociodemographic	91
Thirthahalli et al., 2014	India	Cross-sectional	473	-	71	60+	68.7±6.7	CESD-20 item	≥16	179 (38)	Behavioral Sociodemographic	95
Uemura et al., 2017	Japan	Longitudinal	5,104	3,106	49	65+	71.5±5.2	GDS-15 item	≥6	239	Behavioral	91
Vanoh et al., 2016	Malaysia	Cross-sectional	2,264	-	52	60+	-	GDS-15 item	≥5	373 (17)	Psychosocial Behavioral Sociodemographic	95
van't Veer-Tazelaar et al., 2008	Europe (Netherlands)	Cross-sectional	2,850	-	62	75-99	-	CESD-20 item	≥16	887 (31)	Sociodemographic	100
Woo et al., 2006	China	Cross-sectional	3,394	-	44	65+	72 ±4.9	GDS-15 item	≥8	280 (8)	Behavioral	100
Yoo et al., 2016	South Korea	Cross-sectional	648	-	70	65+	75.4 ±5.9	GDS-15 item	-	-	Psychosocial Sociodemographic	100
Yoshida et al., 2015	Japan	Longitudinal	1,327	680	57	65+	72.7±5.4	GDS-15 item	≥6	115	Behavioral	91
Yoshimura et al., 2013	Japan	Cross-sectional	274	-	68	65+	74.3±4.7	GDS-15 item	≥5	59 (22)	Sociodemographic	100

Note: CESD = Center for Epidemiological Studies Depression scale; CIDI = Composite International Diagnostic Interview; DSM = Diagnostic and Statistical Manual of Mental Disorders; GDS = Geriatric Depression Scale; GHQ = General Health Questionnaire; HADS = Hospital Anxiety and Depression Scale; HAMD = Hamilton Depression Rating Scale; ICD = International Classification of Diseases; KDSKA = Kim Depression Scale for Korean Americans; PHQ = Patient Health Questionnaire; SCID = Structured Clinical Interview for DSM; SCL = Symptom Checklist; Zung SDS = Zung Self-Rating Depression Scale.

Table 2
Relationships between psychosocial factors and depressive symptoms among community-dwelling older adults.

Study	Good social/family support n = 36	Better self-rated health n = 16	Loneliness n = 5	Large social network n = 5	Sense of personal mastery n = 3
Abe et al., 2012	-				
Alexandrino-Silva et al., 2011	-				
Ang and Malhotra, 2016	-				-
Baiyewu et al., 2015		-			
Brinda et al., 2016	0				
Cao et al., 2016	0	-			
Castro-Costa et al., 2008		-			
Chan et al., 2011	-				
Chan et al., 2012	0				
Chan and Zeng, 2009	-	-			
Chang et al., 2017	-	-			
Chao et al., 2018	-				
Choi and McDougall, 2009	-				
Fukunaga et al., 2012	-				
Garcia-Pena et al., 2013	0			0	
Giltay et al., 2006		-			
Gong et al., 2018	-				
Han et al., 2007	-	-		0	
Jeon and Dunkle, 2009	-				-
Kaneko et al., 2007	-	-	+		
Khaltar et al., 2017	-				
Kuchibhatla et al., 2012	-	-		-	
Kuroda et al., 2015	-			-	
Lee, C et al., 2012	0				
Li et al., 2011		-			
Li et al., 2015	-		+		
Lin et al., 2014				0	-
Lue et al., 2010	0				
Morikawa et al., 2013	-				
Murata et al., 2008		-			
Nakulan et al., 2015	-				
Nicolosi et al., 2011		-			
Park, 2017	-				
Park et al., 2017	-				
Piboon et al., 2012	-		+		
Richardson et al., 2012	-				
Russell and Taylor, 2009	-				
Sachs-Ericsson et al., 2007		-			
Shin et al., 2008	-				
St John et al., 2006		-			
Sun et al., 2012	-	-			
Tani et al., 2015	-				
Tanner et al., 2014	-		+		
Vanoh et al., 2016	0		0		
Yoo et al., 2016	-	-			

Note: n = number of studies examining this factor. A plus sign (+) indicates a risk factor, a minus sign (-) indicates a protective factor, zero (0) indicates a non-significant association, and a blank cell indicates the factor was not examined. *Italics* indicates longitudinal studies. Studies that did not examine psychosocial factors are not included in this table.

3.3.2. Behavioral factors

The relationships between behavioral factors and depressive symptoms were explored in 42 studies (see Table 3). Strong support across cross-sectional and longitudinal studies was found for physical activity, greater social participation, engagement in hobbies, and good diet quality being significant protective factors, and sleep disturbance being a significant risk factor. The majority of studies examining past/current smoking and alcohol use did not find these behaviors to be significant risk factors for depressive symptoms. Research examining the use of modern devices was limited and results were varied.

3.3.3. Sociodemographic factors

The relationships between sociodemographic factors and depressive symptoms were explored in 48 studies (see Table 4). The majority of studies examining age, gender, marital status, living arrangement, employment status, and weight status did not find a significant relationship between these factors and depressive symptoms. Results relating to lower education level and SES were mixed. Half of the studies examining these factors found them to be risk factors for depressive symptoms, while the other half did not find significant relationships.

4. Discussion

This systematic review assessed 75 studies examining various modifiable and non-modifiable factors associated with depressive symptoms among older community-dwelling adults. All but one of the studies were deemed to be of high quality, and the mean quality score was 0.94. Of the 21 factors identified in this review, good social/family support, better self-rated health, engagement in physical activity, and participation in social activities were identified as key protective factors, while sleep disturbance was identified as an important risk factor (see Table 5). These results are consistent with those of previous reviews (Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008), indicating that these factors should be focal issues in efforts to improve the well-being of older people.

In contrast with previous reviews (Cole & Dendukuri, 2003; Djernes, 2006; Vink et al., 2008), the majority of studies examining sociodemographic factors did not find an association with depressive

Table 3
Relationships between behavioral factors and depressive symptoms among community-dwelling older adults.

Study	Physical activity n = 15	Greater social participation n = 12	Sleep disturbance n = 11	Alcohol use n = 10	Past or current smoker n = 8	Good diet quality n = 6	Engaged in hobbies n = 5	Use of modern devices n = 2
Abe et al., 2012			+					
Aihara et al., 2011	-	0		0	0	-	-	
Almeida et al., 2014				+	+			
Almeida et al., 2011			+					
Baiyewu et al., 2015		-						
Carayanni et al., 2012		-						
Castro-Costa et al., 2008			+					
Chan et al., 2011		-						
Chan et al., 2012				0			-	
Chan et al., 2014						-		
Chang et al., 2017	-							
Cho et al., 2018	-							
Elliot et al., 2014		-						0
Fukunaga et al., 2012			+	0	0	-		
Garcia-Pena et al., 2013	0			0	0			
Glass et al., 2006	-	-						
Gomes et al., 2018						-		
Gong et al., 2018			+					
Hua et al., 2015	-					-		
Isaac et al., 2009		-						
Jaussent et al., 2011			+					
Ku et al., 2018	-							
Kuroda et al., 2015		-						
Lee, C et al., 2012				0			-	
Lee, L et al., 2012	-	0						
Lee et al., 2013			+					
Lee et al., 2014	-							
Li et al., 2011				+				
Maglione et al., 2014a			0					
Maglione et al., 2014b			+					
Morikawa et al., 2013	-		+	+	0			
Park et al., 2015	-			0	0			
Park, 2017							-	
Pilania et al., 2017							-	
Smagula et al., 2015			+					
Schwarzbach et al., 2013		-						
Tani et al., 2015		-						
Thirthahalli et al., 2014					0			
Uemura et al., 2017	-	-						-
Vanoh et al., 2016	0							
Woo et al., 2006	0			0	+	-		
Yoshida et al., 2015	-							

Note: n = number of studies examining factor. A plus sign (+) indicates a risk factor, a minus sign (-) indicates a protective factor, a zero (0) indicates a non-significant association, and blank cell indicates the factor was not examined. *Italics* indicates longitudinal studies. Studies that did not examine behavioral factors are not included in this table.

symptoms. This variation in outcomes may be at least partially due to the relative importance of the other factors included in the multivariate analyses conducted in more recent studies. The lack of effect of these sociodemographic factors in the present review suggests that it may not be necessary to tailor mental well-being interventions according to characteristics such as age, gender, marital situation, and living arrangement, which potentially simplifies the task of intervention design and implementation by permitting a more broad-based approach.

Overall, the review results highlight the importance of interventions and prevention programs designed to achieve (i) increased social and/or family support, (ii) higher self-rated health, (iii) greater participation in physical and social activities, and (iv) improved sleep patterns. Evidence indicates that interventions focused on increasing social and/or physical activity are particularly effective in reducing depressive symptoms among older adults (Catalan-Matamoros, Gomez-Conesa, Stubbs, & Vancampfort, 2016; Forsman, Nordmyr, & Wahlbeck, 2011a; Forsman, Schierenbeck, & Wahlbeck, 2011b). This may be due to the ability of such interventions to address all four of the factors identified as being predictive of depressive symptoms in this review. For example, physical activity has been found to improve sleep quality (Reid et al., 2010; Singh et al., 2005), social activity has been linked with greater social support (Li, Jiang, Li, & Zhang, 2018), and both physical and social activities have been linked with positive changes in older adults' self-rated health (Fiorillo & Nappo, 2017; Ichida et al., 2013; Wanderley et al., 2011). Facilitating older adults' participation in such activities is therefore important to prevention efforts. This could be achieved by tailoring programs and activities to seniors' capabilities (e.g., access to transport, fitness levels) and preferences (e.g., activities the individual finds meaningful/interesting or that involve peers and family members) (Catalan-Matamoros et al., 2016; Forsman et al., 2011a, 2011b; Liljas et al., 2019). It is also important to ensure that such activities are affordable (Liljas et al., 2019).

Several new modifiable variables were included in this review: engagement in hobbies, diet quality, employment status, and use of modern devices. Of these, engagement in hobbies and good diet quality were found to be protective against depressive symptoms, while no

Table 4
Relationships between sociodemographic factors and depressive symptoms among community-dwelling older adults.

Study	Older n = 35	Female n = 30	Lower level of education n = 28	Not married n = 16	Living alone n = 11	Unemployed n = 5	Overweight/obese n = 4	Low SES n = 4
Abe et al., 2012	0	0			0	+		
Almeida et al., 2014	+							
Brinda et al., 2016	0	+	+					
Carayanni et al., 2012				+				+
Carriere et al., 2017	0						0	
Castro-Costa et al., 2008	+	+	+	+				
Chan et al., 2011	0		+		+			
Chan et al., 2012	0			0				
Chao et al., 2018	+	+	0	+	0			
Cho et al., 2018							0	
Choi et al., 2013						0		
Choi and McDougall, 2009	0	0	0		0			
Elliot et al., 2014	-							0
Fukunaga et al., 2012	+	0			0			
Garcia-Pena et al., 2013	+	0	+	0	0			
Gong et al., 2018	+		+					
Glass et al., 2006	0	+		+				
Han et al., 2007	0	0	+					
Kaneko et al., 2007	+							
Khaltar et al., 2017	0	0	0	0	0			+
Kuchibhatla et al., 2012	0	+	+					
Kuroda et al., 2015	+		0		+			
Lee, C et al., 2012			0			0		
Lee, L et al., 2012	0			0				
Lee et al., 2013	-	0	+	+				
Lee et al., 2014	+							
Li et al., 2015	0	0	0		0			
Lin et al., 2014	0	0	0	0				
Lue et al., 2010	0	+	0	0				
Morikawa et al., 2013	0	0	+					
Murata et al., 2008	-	0	0	+				
Nakulan et al., 2015		+						
Nicolosi et al., 2011			+					
Park et al., 2017			0					
Piboon et al., 2012		+						
Pilania et al., 2017		+						
Russell and Taylor, 2009	0	0		0	+			0
Sachs-Ericsson et al., 2007	0	0	+				+	
Schwarzbach et al., 2013	0	0	0					
St John et al., 2006	0	0	0		0			
Sun et al., 2012	0	0	+	0				
Tani et al., 2015				0		0		
Tanner et al., 2014		0						
Thirthahalli et al., 2014		+	0			0		
Vanoh et al., 2016			+					
van't Veer-Tazelaar et al., 2008	0	0	+	0				
Yoo et al., 2016	0	0	0					
Yoshimura et al., 2013	0	0					0	

Note: n = number of studies examining factor. A plus sign (+) indicates a risk factor, a minus sign (-) indicates a protective factor, a zero (0) indicates a non-significant association, and blank cell indicates the factor was not examined. *Italics* indicates longitudinal studies. Studies that did not examine sociodemographic factors are not included in this table.

significant relationship was found for employment status. The results for use of modern devices were inconclusive across studies. Given the recency of work in these areas, further research could assist in clarifying the role of these factors in influencing older people's likelihood of experiencing depressive symptoms.

The present review had several limitations that should be considered. First, it was confined to studies published in English. However, the included studies were undertaken in a wide range of countries, including those where other languages are dominant. Second, the factors addressed in the results represent variables examined by three or more studies, thus emerging and novel factors assessed by a smaller number of studies were not reviewed (but are listed in Table S1). Third, the included studies used a range of depression scales (e.g., GDS, CESD) and measurement approaches (e.g., cut-off vs continuous scores), limiting the comparability of results. Fourth, the included studies using multivariate analyses may not be directly comparable because varying adjustments were made for different variables, and it is possible that discrepancies relating to individual factors may be due to the nature and quantity of other variables included in the analyses.

Table 5
Systematic review outcome summary.

Protective Factors	Risk Factors	Inconclusive Factors	Unrelated Factors
Good social/family support^{+++} Better self-rated health^{+++} Physical activity^{+} Greater social participation^{+} Good diet quality Engagement in hobbies Sense of personal mastery^{+}	Sleep disturbance^{+++} Loneliness^{+}	Level of education^{+++} Alcohol use^{+++} Smoking status^{++} Social network size^{+} SES^{+++} Use of modern devices	Age^{+++} Gender^{+++} Marital status^{+++} Living arrangement^{+++} Employment status Weight status^{+}

Note: Factors identified in this review are listed in descending order of importance in each column; Underline indicates factors that have not been examined by previous reviews; + indicates how many out of the three previous systematic reviews examined this factor.

5. Conclusion

Results of this and previous reviews highlight the complex nature of the etiology of depressive symptoms and the likely interrelationships between various psychosocial, behavioral, and sociodemographic factors. The important roles of social support and participation, better self-rated health, physical activity, and sleep quality in protecting against depressive symptoms among community-dwelling older adults were confirmed. This suggests that interventions that encourage social support, enhance self-rated health, include physical activity components, and/or improve sleep hygiene may have the potential to prevent or reduce depressive symptoms among community-dwelling older people.

Author Declaration Statement

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

We confirm that we have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including the timing of publication, with respect to intellectual property. In so doing we confirm that we have followed the regulations of our institutions concerning intellectual property.

Contributors

Author CW conceptualized the study and took primary responsibility for preparing the manuscript. Author SP assisted with the design of the study, reviewing potential studies to include, assessing the quality of studies included, and manuscript preparation. Author MJ provided conceptual input for the study design and contributed to the preparation of the manuscript. The funder played no role in the conducting of the research or the reporting of the results.

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Declaration of Competing Interest

None.

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None.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jad.2020.03.119.

Appendix

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APPENDIX B

Published article - Study 2

Worrall, C., Jongenelis, M., McEvoy, P., Jackson, B., Newton, R. U., & Pettigrew, S. (2020). An exploratory study of the relative effects of various protective factors on depressive symptoms among older people. *Frontiers in Public Health, 8*, 579304. https://doi.org/10.3389/fpubh.2020.579304

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BRIEF RESEARCH REPORT
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An Exploratory Study of the Relative Effects of Various Protective Factors on Depressive Symptoms Among Older People

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Objective: The present study investigated the relative importance of various factors found to be negatively associated with depressive symptoms in older adults and assessed the potential moderating effect of sociodemographic characteristics for each factor.

Method: Depressive symptoms were measured with the Center of Epidemiological Studies Depression Scale. Psychological, social, and physical health measures relating to the following factors were also administered: personal growth, purpose in life, self-esteem, self-efficacy, social support, self-rated health, life satisfaction, and physical activity. Multivariate linear regression analysis was used to investigate the most important factors associated with depressive symptoms, and moderation analyses were employed to identify any moderating effects of sociodemographic factors.

Results: Life satisfaction, self-esteem, and purpose in life were found to be negatively associated with depressive symptoms. Only one moderating effect was observed—the negative relationship between life satisfaction and depressive symptoms was significantly stronger among the younger respondents.

Conclusion: These findings suggest that strategies for the prevention or amelioration of depressive symptoms across subgroups of the senior population could be optimized by focusing on enhancing life satisfaction, self-esteem, and purpose in life.

Keywords: older adults, aging–old age–seniors, protective factors, comprehensive model, depressive symptoms

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INTRODUCTION

Depression is a leading cause of burden of disease worldwide (1). With the proportion of people aged 60+ years worldwide projected to increase from 13% in 2017 to ∼21% in 2050 (2), the prevention and amelioration of depressive symptoms among older adults is recognized as a public health priority to ensure increasing life expectancy is accompanied by positive psychological well-being (3). Depressive symptoms can be especially debilitating for older adults because they (i) are particularly intransigent among members of this population

items (e.g., "I have the sense that I have developed a lot as a person over time"; "I have a sense of direction and purpose in life") were made on a scale of 1 (*strongly disagree*) to 5 (*strongly agree*). Cronbach's alpha in the present study indicated good reliability for scores on both the Personal Growth ($\alpha = 0.86$) and Purpose in Life ($\alpha = 0.88$) subscales.

Self-esteem was measured using the 10-item Rosenberg Self-Esteem Scale (39). Respondents answered each item (e.g., "I feel that I'm a person of worth, at least on an equal plane with others") on a 4-point scale that ranged from 0 (*strongly disagree*) to 3 (*strongly agree*). Cronbach's alpha for scores on this scale was 0.88, indicating good reliability. The 24-item Social Provision Scale (40) was used to assess social support. Each item (e.g., "There is someone I could talk to about important decisions in my life") was measured on a 4-point scale that ranged from 1 (*strongly disagree*) to 4 (*strongly agree*). The scores on this scale were found to have excellent reliability ($\alpha = 0.92$).

Self-efficacy was assessed using the 10-item General Self-Efficacy Scale (41). Participants responded to each item (e.g., "I can solve most problems if I invest the necessary effort") on a 4-point scale that ranged from 1 (*not at all true*) to 4 (*exactly true*). Cronbach's alpha was 0.90, indicating excellent reliability. Life satisfaction was assessed by asking participants to rate how satisfied they are with their life on a scale of 1 (*very satisfied*) to 5 (*very dissatisfied*) [adapted from the World Values Survey: (42)]. For analysis purposes, this variable was reverse scored.

Level of physical activity was measured by asking participants: *How many hours of moderate to vigorous activity (that is, physical activity that makes you breathe harder or puff and pant) would you do in an average week?* The definition provided for moderate to vigorous activity was based on the Australian Department of Health's Physical Activity and Sedentary Behavior Guidelines (43). Response options were: 0 h, <1 h, between 1–2 h, between 2–3 h, between 3–4 h, between 4–5 h, and 5 or more h.

Consistent with previous research (44), self-rated health was assessed by asking participants to describe their physical health on a scale from 1 (*very good*) to 5 (*very bad*). For analysis purposes, this variable was reverse scored.

Sociodemographic variables included age (treated as continuous), gender (1 = male, 2 = female; treated as dichotomous), living arrangement (1 = lives alone, 2 = does not live alone; treated as dichotomous), and highest level of education attained (no formal school/primary school, high school, technical/trade certificate, undergraduate, postgraduate; treated as continuous).

Statistical Analysis

Descriptive statistics for each modifiable protective factor are presented in **Table 2**. Univariate linear regression analyses were conducted to assess the relationships between each of the independent variables and the outcome variable of depressive symptoms (treated as continuous). Independent variables found to be significantly associated with depressive symptoms were then simultaneously entered into a linear multivariate regression model using SPSS 26. The Variance Inflation Factor (VIF) was used to assess for multicollinearity.

Moderation analyses were conducted using the PROCESS macro in SPSS to determine if the sociodemographic variables of gender, age, level of education, or living alone moderated the relationship between each of the significant independent variables and the outcome variable of depressive symptoms (45). Each of the independent variables found to be significant in univariate analyses and each of the sociodemographic variables were entered in analyses separately. Bootstrapping was performed ($n = 5{,}000$ samples), and a Bonferroni-adjusted alpha level of <0.005 was used to control for the family-wise error rate. Missing data were treated listwise.

TABLE 2 | Descriptive statistics for tested protective factors (IVs) and depressive symptoms.

IVs	M (SD)	Sample range	Scale range	Skewness	Kurtosis
Life satisfaction	4.07 (0.82)	1–5	1–5	−0.99	1.19
Self-esteem	23.48 (4.96)	1–30	0–30	−0.68	0.43
Purpose in life	66.57 (11.72)	18–84	14–84	−0.76	0.43
Social support	79.00 (10.41)	33–96	24–96	−0.58	0.49
Self-rated health	4.00 (0.77)	1–5	1–5	−0.99	1.20
Self-efficacy	32.19 (4.38)	12–40	10–40	−0.37	0.77
Physical activity	3.77 (1.82)	1–7	1–7	0.39	−0.94
Personal growth	69.48 (10.06)	29–84	14–84	−0.73	0.27
Depressive symptoms	9.02 (8.14)	0–54	0–60	1.68	3.59

IVs = independent variables; M = mean; SD = standard deviation.

TABLE 3 | Unstandardized parameter estimates, standardized parameter estimates, and standard errors for the multivariate model (in descending order of part r^2).

IVs	B	*SE*	*β*	*p*	95% CI for B	Part r^2
Life satisfaction	**−2.76**	**0.33**	**−0.28**	**<0.001**	**−3.40, −2.12**	**−0.21**
Self-esteem	**−0.42**	**0.06**	**−0.26**	**<0.001**	**−0.54, −0.30**	**−0.17**
Purpose in life	**−0.13**	**0.03**	**−0.19**	**<0.001**	**−0.19, −0.07**	**−0.11**
Social support	−0.07	0.03	−0.08	0.012	−0.12, −0.02	−0.06
Self-rated health	−0.77	0.30	−0.07	0.011	−1.37, −0.18	−0.06
Self-efficacy	−0.13	0.06	−0.07	0.018	−0.25, −0.02	−0.06
Living alone	−0.82	0.45	−0.05	0.066	−1.70, 0.06	−0.05
Physical activity	0.11	0.12	0.03	0.338	−0.12, 0.35	0.02
Personal growth	0.01	0.03	0.01	0.758	−0.05, 0.06	0.01
Education	−0.00	0.19	0.00	0.997	−0.38, 0.38	0.00

IVs = independent variables; B = unstandardized estimates; SE = standard error of B; β = standardized estimate; p = significance value; CI = confidence interval; Part r^2 = proportion of unique variance accounted for. Results significant at p <0.005 are presented in bold.

RESULTS

Regression Analyses

Univariate regression analyses showed that life satisfaction, purpose in life, personal growth, self-esteem, social support,

TABLE 4 | Significant moderating effect of age between life satisfaction and depressive symptoms.

Age	B	*SE*	*p*	95% CI for B
65.25 (−1SD)	−6.82	0.35	<0.001	−5.98, −4.35
71.78 (Mean)	−5.99	0.28	<0.001	−6.54, −5.45
78.30 (+1SD)	−5.16	0.41	<0.001	−5.98, −4.35

B = unstandardized estimates; SE = standard error of B; p = significance value; CI for B = confidence interval. Bonferroni-adjusted alpha level of <0.005.

self-efficacy, physical activity, self-rated health, educational attainment, and living arrangement were all negatively associated with depressive symptoms (see **Supplementary Table 1** for results of univariate regressions). A multivariate regression analysis combining these variables into a single model was used to explore the relative importance of these factors. VIF was <10 indicating that multicollinearity was not an issue. The model explained 55.6% of the variance in depressive symptoms ($F_{(10,734)} = 91.93$, $p < 0.001$). The variables in the model that remained significantly and negatively associated with depressive symptoms at the Bonferroni-adjusted alpha level of <0.005 in descending order of effect were: life satisfaction, self-esteem, and purpose in life (see **Table 3**).

Moderating Effects

At the Bonferroni-adjusted alpha level of <0.005, a significant moderating effect of age was observed for life satisfaction (B = 0.13, SE = 0.04, $p < 0.002$, 95% CI for B [0.05, 0.21]). See **Supplementary Table 2** for results of moderation analyses. *Post-hoc* investigation of this effect showed that life satisfaction was negatively associated with depressive symptoms for all age groups, but the strength of the association was stronger for those participants below the average age of this sample compared to those of mean age or older (see **Table 4** and **Supplementary Figure 1** for significant results). Age did not moderate the relationships between any of the other independent variables and depressive symptoms, nor were there significant moderating effects observed for gender, living arrangement, or educational attainment (see **Supplementary Table 2**).

DISCUSSION

To better understand the nature of the relationships between factors that are particularly important in protecting against depressive symptoms among older adults, the present study combined a broad range of factors that have been identified in previous research as being potentially relevant. To assess whether interventions should be targeted at specific subgroups of the wider older adult population, a second aim of this study was to investigate whether sociodemographic characteristics moderated any of the relationships between each protective factor and depressive symptoms.

The tested model explained a large proportion (55.6%) of the variance in depressive symptoms. Life satisfaction, self-esteem, and purpose in life were found to have the strongest (negative) association with depressive symptoms, which is consistent with previous longitudinal research (26, 30–33). However, this past work examined each of these variables in isolation or in models including a limited number of factors. The results of the present study indicate that even when considering a larger number of potential variables, life satisfaction, self-esteem, and purpose in life may be especially important in preventing and ameliorating depressive symptoms among older people.

The results of the present study in relation to physical activity are in contrast with the conclusions of a recent systematic review that found a negative relationship between extent of participation in physical activity and the experience of depressive symptoms among older people (16). The non-significant relationship found here may reflect the range of other psychological variables included in the study and their relative importance in protecting against depressive symptoms. Measurement limitations may also have played a role, such as the reliance on self-report (46, 47) and the assessment of only moderate to vigorous activity, which may not adequately capture all forms of protective activity relevant to older people (18, 21–23).

In terms of the moderation analyses used to assess whether interventions should target particular groups of older adults, just one moderating effect (age) was found, whereby a stronger relationship was found between life satisfaction and depressive symptoms among those participants below the average age of this sample, thus suggesting that interventions to improve life satisfaction could be particularly beneficial for those who are in this younger category (and likely to be newly retired). There is little prior work with which to compare these moderation outcomes. Some studies have examined the moderating effects of age, gender, education level, and living arrangement on the relationship between social support and depressive symptoms (48–51). This work has produced inconsistent results, which in combination with the general lack of effects found in the present study suggests that there may be little need to tailor intervention efforts to demographic subgroups within the broader cohort of older people.

Implications

The results from this study highlight the importance of life satisfaction, self-esteem, and purpose in life as focus areas for interventions aimed at preventing and ameliorating depressive symptoms among older people. While self-esteem exhibits trait-like stability (52), and is thus better suited to individual therapeutic intervention, life satisfaction and purpose in life have the potential to be modifiable through population-level interventions. As such, interventions that focus on ways of enhancing life satisfaction and purpose in life are likely to hold most potential for scalable prevention and amelioration strategies. Previous research suggests that encouraging people to participate in meaningful tasks such as hobbies, leisure activities, and/or volunteering can increase their life satisfaction and purpose in life (53–56). These activities have been suggested to provide older adults with opportunities that promote purpose in life and life satisfaction from (i) the relationships formed, (ii) the pursuit of goals, (iii) maintenance of independence, and (iv) engagement with the community (56, 57). These types of activities have also been found to be associated with social

support, self-efficacy, and self-rated health (58–60). Further, participation in meaningful tasks appears to be beneficial in helping individuals adjust to age-related losses such as retirement (i.e., loss of work role) and bereavement (53, 55, 60). Encouraging older adults to engage in meaningful activities and facilitating relevant opportunities for them to do so may thus constitute means of preventing and ameliorating depressive symptoms in later life.

Limitations, Future Directions, and Strengths

The main limitation of the present study was its cross-sectional design. Further research is needed to test the results longitudinally to assess whether the identified relationships hold over time. Another potential limitation was the use of convenience sampling, although the resulting sample was largely similar in profile to the population of older Australians, with the exception of living arrangement (see **Table 1**). Future studies should seek to access representative samples to test whether these results are generalizable. Similar research could also be conducted in other countries to assess the extent to which the identified relationships are relevant to other cultures. Given the inclusion of a broad range of psychological constructs in this study, a further potential limitation was the risk of social desirability bias in responses. To minimize this risk, an "arms-length" data collection method was used in the form of self-administered surveys. This approach has been found to result in more truthful responses to sensitive questions compared to when an interviewer is present (61).

The primary strength of this study was the large number of potential protective factors incorporated into a model that was tested on a substantial sample of community-dwelling older people. However, despite the wide range of factors included in this study, some potentially relevant variables were not assessed and could be incorporated into future research. In particular, including a measure of objective health could provide additional important data and overcome the limitations associated with relying solely on self-rated health as an indicator of physical well-being. Further, recent research suggests that sleep and diet quality may influence older people's experience of depressive symptoms (16), making these potentially important variables to include in future studies.

CONCLUSION

This study assessed the relative importance of a large number of factors that have been established in prior work as being protective against depressive symptoms in older adults. Life satisfaction and purpose in life were found to be the most influential factors, and could therefore be the focus of prevention and amelioration strategies targeting depressive symptoms in later life. Previous research has shown that engaging in activities perceived to be meaningful can increase older adults' life satisfaction and purpose in life. As such, it is likely that programs that focus on enhancing these protective factors could decrease the risk of depressive symptoms and improve overall well-being among older adults.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because ethics clearance was received on the basis that information would be confidential. Requests to access the datasets should be directed to spettigrew@georgeinstitute.org.au.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Curtin University Human Research Ethics Committee. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

CW conducted the analyses and took primary responsibility for preparing the manuscript. MJ, SP, and CW collected the data. SP and MJ assisted with manuscript preparation. All authors contributed to study conceptualization, read and edited drafts of the manuscript, and approved the final manuscript. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2020.579304/full#supplementary-material

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APPENDIX C

Social Engagement Interview Questions

Thank you for coming in. As discussed, I would like to talk to you about the sorts of activities you usually do, and audio record our discussion today. Is that still okay with you? Do you have any questions before we begin?

What sorts of social activities do you usually do?

Is there anything that stops you from being as active as you would like?

Are there particular types of activities that you avoid?

Can you tell me more about that?

In terms of your social activity, can you tell me a bit about your engagement in social activity throughout your life?

How have your social activity levels changed over your lifetime? How so?