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Correlates of Psychological Well-Being in Older Adults with Treatment-Resistant Depression

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Abstract

The purpose of this study was to examine the factors that are associated with psychological well-being in older adults with late-life depression and determine if social participation moderates and/or mediates these relationships. This dissertation study utilized secondary pre-treatment data collected from the "Optimum: Optimizing Depression Treatment in Older Adults" study (Cristancho et al. (2019). Community dwelling older adults (N = 369) were included if they currently met criteria for MDD, had failed at least two prior trials of MDD medication treatment, and were able to visit the study site to participate in cognitive and physical functioning assessments. Hierarchical multiple regressions were used to analyze the correlates of psychological well-being. Cognitive functioning and physical functioning measured by a 4-meter gait speed test were not significantly correlated with psychological well-being. Social participation ($B = .19$, $p < .001$) and levels of anxiety ($B = -.40$, $p < .001$) were found to be significant predictors of psychological well-being in the model ($F(9,359)$, $p < .001$, adjusted $R^2 = .228$). Results indicated that social participation was not a significant moderator ($\Delta R^2 = .002$, $p = .892$) of these relationships but was a significant partial mediator for the relationship between anxiety and psychological well-being [Indirect Effect = -.06, 95% C.I. (-.1022, -.0233)]. Exploratory analyses revealed that self-reported physical functioning and hand grip strength were additional significant predictors of psychological well-being in this sample. Overall, the findings from this study highlight the importance of social participation for psychological well-being in older adults with treatment resistant depression. Continued research is needed to gain a clearer understanding of factors that may promote psychological well-being in diverse populations of older adults with major depressive disorder.

Keywords: Aging, Late-life depression, Psychological well-being, Physical functioning

Predictors of Psychological Well-Being in Older Adults with Treatment-Resistant Depression

Mental health, physical health, and psychological well-being (PWB) are important throughout the lifespan, such that all age groups deserve an equal focus on research and treatment. With the projected increase in the United States' older adult population, 65 years or older, it will be important that research continues to capture information on the predictors of physical health, mental health, and PWB outcomes in late life (Colby & Ortman, 2015). A recent study surveying older adults with late-life depression found that assessing PWB is important for them (Lenze et al., 2016). A focus of research on older adults with late-life depression is important because of the disorder's impact on physical health, mental health, cognitive health, and PWB. Older age and depression have both been found to be associated with chronic physical illness (Atella et al., 2019; Grover et al., 2017). PWB has been found to share a bidirectional relationship with chronic physical illness (Steptoe et al., 2015). Increased PWB in older adults may help improve physical health, mental health, and also personal and social relationships (Steptoe, 2019). Older adults might see changes in their affective functioning, cognitive functioning, physical functioning, and social participation as they age. It will be important to examine how changes in these factors influence PWB in older adults with persistent depression.

Conceptualizing Psychological Well-Being

The literature shows that defining PWB has been challenging and that there is no universal definition. The lack of a universal definition has resulted in various theories, conceptualizations, and measurements of PWB in the literature. One conceptualization

of PWB centers on the hedonic approach that highlights the experience of positive affect and life satisfaction (Samman, 2007). Another conceptualization of PWB centers on the eudaimonic approach which highlights the perception of meaning or purpose in life (Ryff, 1989). In this study, PWB will constitute of the combination of both positive affect and life satisfaction.

Theories of Psychological Well-Being

Ryff's Model of Psychological Well-Being

Ryff (1989) was concerned that previous conceptualizations of PWB focused too heavily on positive affect and life satisfaction. The eudaimonic approach that Ryff (1989) supported excluded positive affect and life satisfaction and placed an emphasis on meaning and purpose in life. Ryff's six factor model of PWB includes domains on purpose in life (directedness in having goals in life and finding meaning in life), autonomy (independence from the beliefs and conventions of others), personal growth (self-actualization and optimal functioning), environmental mastery (ability to manipulate one's environment for physical and psychological needs), positive relationships (ability to empathize with others and develop friendships), and self-acceptance (having a positive attitude of one's self) (Ryff, 1989; Ryff, 2014). Ryff's eudaimonic approach adds to the literature by providing new information on human functioning, creating new research questions, and the development of new measures that center on meaning and purpose in life. However, a criticism of Ryff's six factor model of PWB focuses on the complete exclusion of positive affect and life satisfaction. This creates a challenge for researchers that want to study PWB and generate hypotheses and select measures for their research designs. Another criticism centers on parsimony because a previous study found high

factor correlations for the personal growth, purpose in life, self-acceptance, and environmental mastery domains (Springer et al., 2006).

PERMA Model of Psychological Well-Being

The PERMA model includes a combination of hedonic and eudaimonic components for PWB (Seligman, 2011). The model involves domains of positive emotion (experience of positive affectivity), engagement (focus on activities of interest), relationships (sense of belonging), meaning (purpose and direction in life), and accomplishment (mastery and competence in a skill). Unlike previous conceptualizations that focus on either the hedonic or eudaimonic approach, the PERMA model is unique because of its incorporation of both approaches in addition to other social components. Although the PERMA model brings novelty to the literature on PWB a main criticism of it is that it does not capture a unique concept of PWB (Goodman et al., 2017; Seligman, 2018). Goodman et al. (2017) found that the PERMA model had a .98 correlation with a subjective well-being (SWB) model. Therefore, even though new models of PWB might be created, PWB may just be one factor with several features (Goodman et al., 2017; Longo et al., 2016).

Measurement of Psychological Well-Being

Collecting data on PWB can be a challenge due to the lack of a universal definition of PWB. Researchers can choose from several self-report measures that have been created to measure well-being through the lens of PWB, physical well-being, spiritual well-being, and more (Linton et al., 2016). This can make measure selection a confusing task and result in researchers referring to their findings as PWB. The majority of the self-report PWB measures have relied on a hedonic or eudaimonic approach.

Araujo et al., (2017) found that research studies with older adults have heavily utilized measures based from a hedonic approach. The measurement of PWB are considered to be either experiential (positive affect) or cognitive evaluations (life satisfaction and meaning) (Salsman et al., 2014).

Positive Affect

Positive affect is a component of hedonic well-being and refers to a person's subjective experience of positive mood. A popular measure of positive affect is the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988). This measure consists of items that ask about both positive and negative emotions and has been found to have good internal reliability and external validity in the general population. A recent study also found the PANAS to have good reliability and validity for older adults above the age of 75 (Humboldt et al., 2017). Positive affect is also assessed in the PWB subdomain of the National Institute of Health Toolbox (NIH Toolbox) Emotion Battery (Salsman et al., 2013). The PWB subdomain incorporates items from the PANAS and other measures of positive affect.

Life Satisfaction

Life satisfaction is another component of hedonic well-being and has commonly been measured with the Satisfaction with Life Scale (SWLS; Diener et al., 1985). The scale captures global life satisfaction and does not include items specific to life experiences such as health or finances. The SWLS has been found to have good internal reliability and test-retest reliability in the general population and also good internal reliability and construct reliability in a sample of older adults above the age of 50 years in Mexico (Diener et al., 1985; Lopez-Ortega et al., 2016). A study including Malaysian

psychiatric and medical outpatients found that the SWLS had good internal reliability and concurrent validity (Aishvarya et al., 2014). The NIH Toolbox PWB subdomain also assesses for life satisfaction and draws multiple of its items from the SWLS (Salsman et al., 2013).

Methodological Concerns for Measuring of PWB

Due to the lack of a universal definition in the literature and a unified approach in conceptualizing PWB, selecting measures for PWB can be challenging. For example, a researcher may actually be measuring depressive symptoms and refer to it as PWB (Fuller-Iglesias et al., 2015). This can create confusion amongst readers and interfere with the advancement of the literature. The other challenge in selecting measures for PWB centers on using a unidimensional or multidimensional measure. A more comprehensive understanding of PWB is captured when multidimensional measures are used. Unidimensional measures that aim to capture positive affect, life satisfaction, or meaning may involve asking several items or having just one item that assesses PWB. Measure selection is also a challenging task because PWB measures originate from westernized beliefs and language and this may not generalize to non-western samples (Karasawa et al., 2011). Researchers will have to be careful about finding PWB measures that have been validated with different ages and cultures.

Psychological Well-Being in the Context of Depression

The literature lacks focus on examining predictors of PWB in the older adult population, especially for older adults who have late-life depression. Older adults might experience changes in their physical and cognitive functioning, number of chronic illnesses and medication usage, and social roles that their younger counterparts might not.

Socio-Demographic Predictors

A recent study examined potential risk factors of PWB in German community-dwelling older adults who were 65 years or older (Lukaschek et al., 2017). The researchers also examined these risk factors separately for women and for men. In regard to socio-demographic variables, the study found that low education and low income were significant risk factors for low PWB in men and that low income and living alone were significant risk factors for low PWB in women. Analysis also found that multi-morbidity was a significant risk factor for both men and women. Another study consisting of community-dwelling older adults examined the predictors of well-being using a composite score of positive affect and life satisfaction (Humboldt et al., 2014). The diverse study of older adults with Angolan, Brazilian, English, and Portuguese nationality found that spirituality (yes or no), living setting (rural or urban), household (living with others or alone), perceived health (good or poor), and medication (yes or no) were significant predictors of well-being. However, researchers did not find significant results for age, sex, or educational level as predictors of well-being.

Motor Function Predictors

A common belief is that motor functioning decreases with increasing age. One study aimed to examine evaluative (life satisfaction) and experienced well-being (feelings of happiness) in community-dwelling older adults above the age of 60 (Freedman et al., 2017). The researchers analyzed data from 1,606 older adults from the 2013 Panel Study of Income Dynamics (PSID) study and found that having worse physical impairment, such as limited mobility and strength, was significantly associated with lower life satisfaction and less happiness. Another recent study examined the association between

hand grip strength and gait speed with life satisfaction (Soares et al., 2019). The researchers found that older adults with better gait speed performance scored better on the life satisfaction measure. No significant results were found for hand grip strength and life satisfaction in older adults.

Cognitive Function Predictors

A limited number of studies have examined cognitive impairment as a predictor of PWB. One study examined the influence of cognitive impairment on positive affect and life satisfaction from community-dwelling participants in Phase I and Phase II of the Georgia Centenarian Study (Bishop et al., 2011). The results suggested that an increase in cognitive impairment was associated with a decrease in positive affect in centenarians. The increase in cognitive impairment also had a detrimental influence on life satisfaction. The findings also highlighted that the negative association between increased cognitive impairment and lower life satisfaction could be influenced by the positive affect experienced by the centenarian. Another study wanted to examine the bidirectional relationship of cognition and PWB in a sample of community-dwelling older adults (Allerhand et al., 2014). This study analyzed a sample of 10,985 participants over the age of 50 from the English Longitudinal Study of Ageing (ELSA) data. The researchers found a positive association between cognition and PWB such that when someone's cognition increased so did their level of PWB. Unlike previous research studies that mainly used measures with a hedonistic approach, this study utilized 13 questions from the CASP-19 that assessed for hedonistic and eudaimonic approaches to well-being. One study examined the effects of cognition on eudaimonic well-being (Wilson et al., 2013). Data was used from the Rush Memory and Aging Project and a total of 1,049

community-dwelling participants with the mean age of 80.3 were used for the analysis. The findings suggest that an increase in cognitive decline results in a decline in eudaimonic well-being. In particular, the strongest association was for purpose in life compared to other factors of eudaimonic well-being. One potential reason that cognitive impairment may be a risk factor for decreased well-being is that increased cognitive impairment may make it more difficult for older adults to remember or evaluate purpose in life or aspects of life to feel satisfaction for (Wilson et al., 2013).

Affective Predictors

Lukaschek et al. (2017) also examined psychological variables that included anxiety, depression, and sleeping problems as risk factors of low PWB. The study found all three of the variables to be significant risk factors for low PWB in both men and women. Adams et al. (2016) examined the associations of depression, anxiety, and perceived stress on PWB using a non-depressed, community-dwelling older adult sample. The researchers found that depression and perceived stress were significant predictors of life satisfaction, but anxiety was not. The findings also showed that social support buffered the association between depression and PWB but did not buffer the association between perceived stress and PWB. There is a lack of studies on PWB that solely recruit clinical samples of older adults with depression. There has been some focus of this in the adult population. Wersebe et al. (2018) recruited adults with MDD, social phobia, and healthy controls. The study found that individuals with MDD had lower PWB than the healthy controls. This was also observed for individuals with social phobia which suggests that the presence of MDD and social phobia might be influencing an individual's social engagement and limits their experience of positive emotions. A study

examining genetic and environmental factors for MDD and life satisfaction in adult Norwegian twins found that MDD was associated with decreased life satisfaction (Nes et al., 2013). It may be possible that the personality trait neuroticism influences both MDD and life satisfaction.

Social Predictors

Most of the literature on predictors of PWB in older adults has focused on social contact and social participation. This might be due to the continuing social changes that occur in aging because of retirement or loss of friends and family. The loss of social contact in aging may result in feelings of loneliness amongst older adults. Lim & Kua (2011) examined the association between loneliness and PWB in a sample of 555 Singaporean community-dwelling older adults over the age of 55 years. The researchers found that regardless of living alone or with someone else, participants who reported feeling lonely had higher depressive symptom scores. In addition, a previous study examining the relationship between social contact with neighbors and PWB incorporated measures that included both hedonistic and eudaimonic components (Greenfield & Reyes, 2015). This study analyzed longitudinal data of ten years from 1,071 community-dwelling adults ranging from the ages of 40 to 70 years. The findings suggested that maintaining a low level of social contact or having a loss of social contact over a 10-year span did not result in a significant difference of positive affect or negative affect compared to the participants who maintained a high level of social contact. However, participants who maintained low levels of social contact or reported a loss of social contact scored significantly poorer on the eudaimonic measures of PWB compared to those who maintained a high level of social connections.

It is important to differentiate between the studies that focus on the relationship with social contact and PWB and the ones that focus on the relationship with social participation and PWB. Although these terms have been used interchangeably in the literature, they measure different aspects of an individual's social experiences (Levasseur et al., 2010). For example, the spectrum of social activities can include watching the news and remaining alert about what is going on in society, going on walks and seeing other people on the street, interacting with others but not having a specific role, collaborating with others, helping others, or contributing to society. A previous study examining the influence of volunteer work on PWB in 250 older adults in Taiwan found that there was a positive relationship between the two variables (Ho, 2015). Therefore, older adults engaging in volunteer work scored higher on an eudaimonic based measure of PWB than those who did not volunteer. The results suggest that volunteering may provide older adults with a greater sense of personal growth and purpose in life, which adds more meaning to their lives. One study utilized data from three waves of the Wisconsin Longitudinal Study (WLS) to examine the trajectory of PWB in aging and how social participation or social support may influence the trajectory (Sharifian & Gruhn, 2018). The findings suggested that PWB declined slightly from the mid-50's to the mid-70's year of age. The researchers also found a buffering effect for social participation and PWB but did not find a significant buffering effect for social support and PWB. Another research study examined the role of social participation on life satisfaction and depression among 696 Chinese older adults (Li et al, 2018). The researchers found that older adults with higher levels of social participation reported higher levels of life satisfaction than older adults who participated in less social activities. The findings also suggested that

higher engagement with social activities was associated with a lower level of depression in older adults. A few variables, such as marital status and perceived health status, were controlled for in the study and also had an influence on life satisfaction and depression. Older adults who reported being divorced or widowed had lower life satisfaction and higher levels of depression. Older adults who reported that their health status was good had higher levels of life satisfaction and lower levels of depression.

Major Depressive Disorder in Older Adults

Prevalence

Major Depressive Disorder (MDD) affects approximately 1% to 4% of community dwelling older adults in the United States (Glover & Srinivasan, 2017). Women are also at a greater risk for depression than men. These statistics suggest that the prevalence rate of meeting criteria for depression is low, but it is important to note that the prevalence of depressive symptoms in older adults is as high as 25%. MDD is broadly characterized by the experience of a depressed mood or loss of interest in activities nearly every day for at least two weeks (American Psychiatric Association, 2013). In order to meet DSM 5 criteria, there must also be changes in at least four symptoms such as appetite, sleep, concentration, thoughts of suicide, self-critical thoughts, and motivation. More research is needed to understand how older adults experience depressive symptoms compared to younger adults and how that might affect assessment and treatment.

Clinical Presentation

A recent review on this topic of research found insufficient evidence as to whether older adults endorse different patterns of depressive symptoms than adults at younger ages (Haigh et al., 2018). This same review found that prevalence of MDD is

lower for older adults than it is for younger adults. Older adults tend to have a worse trajectory and higher rate of recurrence than younger adults and this may be mediated by severity of depression and medical comorbidity. No differences were found in the effectiveness of psychotherapy treatments between older adults and those who are younger. However, antidepressants may have a reduced response in older adults than younger adults. Similar to younger age, depression in late life is influenced by psychological, social, and biological factors. Depression in later life also shows the same gender differences as earlier in life, with women experiencing higher rates of depression symptoms and MDD than men (Blazer & Steffens, 2015). Psychological factors, increased well-being and reduced negative affectivity, may be protective in late life.

In addition to examining the differences between clinical presentation of MDD based on age differences it is also important to examine the origin and duration of MDD for the older adult. Early-onset (EOD) and late-onset (LOD) depression in older adults have different clinical presentation in depressive symptoms and depressive episodes (Sachs-Ericsson et al., 2013). EOD is associated with more suicidal thoughts, poorer social support and more cognitive decline. Because the phrase "older adults" can refer to anyone above the age of 65 it is important to examine the time period when someone was born and how historical experiences can also affect the trajectory of depression. A cohort effect suggests that the decade when an individual was born in affects the trajectory of depressive symptoms (Blazer, 2017). A previous study of four successive decade-long cohorts found that there was a significant cohort effect for depressive symptoms and feelings of hopelessness (Sullivan et al., 2020). This finding provides evidence that those

born in the most recent cohort had lower rates of depressive symptoms than those born in the earliest cohort.

MDD and Health Outcomes

Physical Health Outcomes

MDD in older adults is of high public health concern because of the possible associations that MDD has with physical health consequences. An area of great concern is the association between depression and increased risk of death (Gallo et al., 2013). Older adults with depression who are in usual care had a higher chance of dying than older adults without depression (hazard ratio 1.90). However, older adults with depression who were receiving interventions did not have a significantly higher risk of death than older adults without depression (hazard ratio 1.09). Older adults with depression who received intervention were significantly less likely to die than older adults with depression in usual care (hazard ratio 0.76). The presence of depressive symptoms and formal diagnosis of depression in older adults above the age of 65 has been found to be associated with an increase in disability, even after controlling for demographic characteristics, physical morbidity, and dementia (Da Silva et al., 2012). MDD has complex interrelationships with cognitive impairment (Wang & Blazer, 2015). Depression severity in older adults has been found to be a predictor of impairment in processing speed, language processing, working memory, episodic memory, and executive function (Sheline et al., 2006). Depressed older adults may also have significantly lower performance on receptive speech, writing, reading, arithmetic, and memory compared to non-depressed older adults (Ranjan et al, 2017). Cognitive impairment and neurocognitive disorders are also predictors of later-onset depression in

older adults. A recent meta-analysis supports the bidirectional relationship between sleep disturbance and depression in older adults (Bao et al., 2017). Older adults who report persistent sleep disturbances have a higher risk of developing depression and the reoccurring of depressive episodes than older adults who do not have sleep disturbances. Having depression also increases the risk of the development of sleep disturbances in older adults.

Mental Health Outcomes

In addition to negative physical health outcomes, MDD may also influence mental health outcomes in older adults. Diagnosis of late-life depression and the monitoring of depressive symptoms is also important because MDD is present in 54-87% of completed suicides in older adults (Conwell et al., 2011). A previous study of community-dwelling older adults, 65 years of age and older, found a moderate negative correlation ($r = -.41$, $p < .001$) between depression and psychological well-being (Rao et al., 2016). Low levels of psychological well-being have also been found to be a risk factor for depression in older adults (Wood & Joseph, 2010). These findings highlight the bidirectional relationship between psychological well-being and depression and highlight the importance of assessing psychological well-being when treating depression in older adults.

Theoretical Models of MDD

Tripartite Model of Anxiety and Depression

Many theories of MDD have been developed and studied but for the purpose of this review we will center on theories focusing on older adults. Similar to younger adults, the tripartite model of the constellation of depressive symptoms is confirmed in older

adults (Teachman et al., 2007). The tripartite model suggests that anxiety and depression share a commonality in negative affect and differ on the endorsement of either positive affect of physiological hyperarousal (Clark & Watson, 1991). Therefore, it is believed that depression is associated with the combination of negative affect and low positive affect. Low levels of positive affect may influence depressive symptoms like loss of interest, hopelessness, and apathy.

Biopsychosocial Model

The biopsychosocial model can also be applied for examining the cause of MDD in older adults (Aziz & Steffens, 2013; Engel, 1980). The biopsychosocial model adopts a multidimensional approach in understanding mental health disorders and considers the interaction of biological, psychological, and social factors. Previous literature suggests that a biological risk factor of depression is cardiovascular injury (Aziz & Steffens, 2013; Choi et al., 2014). Choi et al. (2014) found a bidirectional relationship between depression and cardiovascular disease in older adults above the age of 65. This finding implies that worsening cardiovascular health may influence the severity of depression and vice versa. Poor overall health may also contribute to depression (Aziz & Steffens, 2013). For example, individuals with Parkinson's disease, diabetes, or obesity may be at higher risk of developing depression. A study of community dwelling older adults also found that reduced quality of sleep and the presence of insomnia symptoms were risk factors for depressive symptoms in older adults (Jaussent et al., 2011). The biopsychosocial model also suggests that personality attributes and cognition are psychological factors for MDD in older adults (Aziz & Steffens, 2013). Neuroticism, the acceptance of negative affect, has been found to have a positive relationship with

depression in older adults (Chen et al., 2017). Rumination, the preoccupation of negative life events, was also found to have a positive relationship with depression. Rumination was found to have a mediating role in the relationship between neuroticism and depression. This suggests that older adults with maladaptive thought patterns are more prone to MDD. Social factors from the perspective of the biopsychosocial model may include life stressors such as chronic illness or socioeconomic status and social stressors like perceived social support or loneliness (Aziz & Steffens, 2013; Laird et al., 2019). These factors are pertinent to older age because of higher susceptibility to chronic illness, financial changes, shifting social roles, and loss of friends and family. Life stressors may also contribute to depression because they may stimulate negative affect and provide events for the older adult to ruminate over.

Behavioral Model

Behavioral models have also been proposed and center on the reduction of positive reinforcement leading to depressed mood (Lewinsohn, 1974). Fiske et al. (2009) added to this model to help describe MDD in late life. The behavioral model poses that older adults are engaging in activities less than before and are not having as much positive experiences in their day to day life. The model also suggests that negative self-critical cognitions work via a negative feedback loop and limit the number of activities that an older adult engages in. Functional and cognitive decline, role changes after the death of a partner, and ageist stereotypes may impact an older adult's participation in activities and self-critical cognitions.

Social Participation in the Context of Depression. The behavioral model previously mentioned suggests that social participation may be important for influencing

mood. Solomonov et al. (2019) tested a behavioral activation-based intervention termed "Engage" in a group of older adults who were 60 years or older. The goal of "Engage" is for the older adult to engage more in meaningful activities that provide rewards. Alexopoulos et al. (2016) found that a change in behavioral activation significantly predicted depression in older adults who participated in "Engage". Solomonov et al. (2019) found that older adults who engaged in interpersonal activities had higher involvement with behavioral activation and also had significant reduction in depressive symptoms. This finding highlights the enhanced benefit of behavioral activation when interpersonal activities are engaged. Future studies examining the effectiveness of CBT for depression in older adults should also incorporate PWB measures in their research design in order to examine how engagement in interpersonal relationships influences PWB.

Current Study Rationale and Aims

Positive mental health variables are important outcomes for depression treatment studies. PWB, including positive affect and life satisfaction, reflects more than the absence of depression. Little is known about the factors that are associated with PWB in older adults, especially for those who are battling persistent depression. A number of variables have been linked to lower levels of PWB, including lower SES, living alone, history of depression, as well as decline in cognition and physical functioning. Strong level of social participation may play a particularly important role in PWB, serving as a buffer for other risk factors.

Research Aim 1

There is currently no research study that has examined the possible correlates of PWB in older adults with persistent depression. The aim of this current study was to examine the factors that correlate with PWB among older adults with persistent depression. Based on the review of previous literature the focus will be on affective, cognitive, physical, social, and sociodemographic predictors of PWB. Because the behavioral model of depression suggests that older adults with depression are engaging in less social activities and because physical and cognitive decline may also impact an older adult's ability to participate in social roles and activities, this current study aimed to examine how social participation moderates the relationship between motor functioning, cognitive, and affective and PWB.

Hypothesis 1a

Lower motor functioning, lower cognitive functioning, greater length of current depressive episode (i.e., length of time because start of current episode), higher levels of anxiety, and lower social participation will be associated with lower levels of PWB in older adults with persistent depression.

Hypothesis 1b

Social participation moderates the relationships between these other predictors and PWB. These associations are weaker for individuals reporting higher levels of social participation.

Research Aim 2

There is currently no conceptual model that hypothesizes a causal order of the predictors of PWB in older adults with persistent depression. Decline in physical

functioning, cognitive decline, depression, and anxiety have all been linked to lower social participation. The second aim of this study was to explore the causal order of the predictors of PWB and examine if physical and cognitive functioning, length of current depressive episode, and level of anxiety impact PWB due to reductions in social participation.

Hypothesis 2a

Social participation mediates the relationship between motor functioning and PWB. The effect of motor functioning on PWB will be partially explained by motor functioning's association with social participation.

Hypothesis 2b

Social participation mediates the relationship between cognitive functioning and PWB. The effect of cognitive functioning on PWB will be partially explained by cognitive functioning's association with social participation.

Hypothesis 2c

Social participation mediates the relationship between length of current depressive episode and PWB. The effect of length of current depressive episode on PWB will be partially explained by length of current depressive episode's association with social participation.

Hypothesis 2d

Social participation mediates the relationship between anxiety and PWB. The effect of anxiety on PWB will be partially explained by anxiety's association with social participation.

Methods

Rationale for the use of Secondary Data

This dissertation study utilized secondary pre-treatment data collected from the "Optimum: Optimizing Depression Treatment in Older Adults" study (Cristancho et al. (2019). Similar to the use of primary data, the decision to use secondary data also possesses advantages and disadvantages (Cheng & Phillips, 2014). One of the benefits of using secondary data was that it is cost effective and allows for more time to be invested in the preparation, cleaning, and analyses of data because there is not a heavy time burden on the collection of data. The greatest disadvantage of using secondary data was that there was no control in the materials and procedures used to collect the data. Therefore, the use of secondary data from the Optimum study allowed for a "data-driven" approach for analyzing the data (Cheng & Phillips, 2014). The Optimum study is a rich dataset that consists of the collection of items that assess psychological well-being, severity of depression, cognitive impairment, physical impairment, and level of social participation in older adults with persistent depression. It is rare for a study to focus solely on older adults with persistent depression and include affective, cognitive, physical, and social variables. In addition, it was rewarding to use secondary data from the Optimum study because participants were recruited from a wide range of geographical locations, including urban and rural settings in both the United States and Canada.

Procedures of Obtaining Permission to use Data

The list of principal investigators for the Optimum study includes Dr. Eric Lenze, M.D., Wallace & Lucille Renard Professor of Psychiatry and the Director of the Healthy

Mind Lab at Washington University School of Medicine in St. Louis, Missouri; Dr. Jordan Karp, M.D., Professor of Psychiatry, Anesthesiology, and Clinical and Translational Science at the University of Pittsburgh School of Medicine; Dr. Benoit Mulstant, M.D., Professor and the Labatt Family Chair of the Department of Psychiatry at the University of Toronto; Dr. Helen Lavretsky, M.D., Professor In-Residence in the Department of Psychiatry at the University of California-Los Angeles; and Dr. Steven Roose, M.D., Professor of Clinical Psychiatry at the College of Physicians &Surgeons, Columbia University. A data analysis plan form was completed and was approved by the publications committee for the Optimum study. The proposed study was reviewed and approved for analysis by the University of Missouri – St. Louis' Institutional Review Board.

Participants

Participants for the Optimum study were recruited from Los Angeles city and county; St. Louis and rural Missouri; Western Pennsylvania; New York City; and Toronto and rural Ontario. All participants in the study provided informed consent. Participants were screened for depression symptoms, cognitive impairment, and adequate anti-depressant trials. To be eligible for the Optimum study, individuals needed to be community dwelling older adults at or above the age of 60 years, (i.e., both men and women) who met criteria for a current major depressive disorder (MDD). Participants were also required to have attempted at least two or more antidepressant treatments, at a recommended dose and for a recommended length, and failed to respond. Eligible participants also had a score of 10 or higher on the Patient Health Questionnaire – 9 (PHQ – 9; Kroenke et al., 2001).

A baseline visit was required to confirm study eligibility and randomize participants into three separate medication strategies. Participants were randomized in either an augmentation with aripiprazole, augmentation with bupropion, or current medication switch to bupropion medication strategy. Failure to remit to any of these medication strategies after 10 weeks resulted in the randomization of either a lithium augmentation or switch to nortriptyline medication strategy. For more detailed information on randomization and treatment procedures please refer to Cristancho et al. (2019).

Participants for the current dissertation study (N = 369; M = 68.9, SD = 6.8) were individuals randomized into Step 1 and who completed the intake assessment for the Optimum Study, including physical visit to a study site for the completion of cognitive and motor functioning assessment. 621 older adults were randomized at baseline, however, due to the nature of data collection and cognitive and motor functioning needing to be tested in person, 369 participants completed on-site assessments and were eligible for the current study (n=252 did not attend the in-person cognitive and motor testing and were not considered eligible for the current study).

Measures

All data used for this proposed study were collected during pre-treatment assessments.

Demographic background and participant health status: Demographic information included age, gender, race, ethnicity, education in years, and marital status. Race was re-coded so that 0 represented White participants and 1 represented the collection of participants from other race options. Female was re-coded as 0 and male

was re-coded as 1. Married was re-coded as 0 and other marital status options were re-coded as 1. Health status was measured by the Cumulative Illness Rating Scale - Geriatric(CIRS-G) as this provided a comprehensive assessment of comorbid medical and psychiatric illness. This information was collected during the phone screening to determine eligibility and was also verified during the in-person or phone version of the baseline study time point.

Psychological Well-Being: PWB was measured using the NIH Toolbox for Assessment of Neurological and Behavioral Function (NIH Toolbox) Emotion Battery (NIHTB-EB). Measures reflecting positive affect and life satisfaction were used from the Psychological Well-Being subdomain (Salsman et al., 2013). The positive affect measure consisted of items from the Positive and negative Affect Schedule – Expanded Form (PANAS-X), Mental Health Inventory (MHI), Functional Assessment of Chronic Illness Therapy – Spiritual Well-being (FACIT-Sp), and the Brief Mood Introspection Scale (BMIS). The positive affect measure included both high (e.g., happiness) and low (e.g., peace) activated positive affect. The life satisfaction measure consisted of items from the Satisfaction with Life Scale (SWLS) and the Students' Life Satisfaction Scale (Salsman et al., 2013). General and domain specific items were measured in the life satisfaction measure. Both the positive affect and life satisfaction measure are computer adaptive tests and the number of items completed were dependent on the participant's responses. A single composite PWB score was computed by averaging the scores for positive affect and life satisfaction.

Motor functioning: Motor functioning was measured with the NIH Toolbox Motor Battery (NIHTB-MB; Reuben et al., 2013). For this study, four of the five

possible tests were used to measure dexterity, strength, balance, and locomotion. Dexterity involves the ability to manipulate objects with the coordination of one's fingers, strength involves the ability to control one's movements through force and power of muscle, balance involves the ability to orient one's body during static and dynamic decisions, and locomotion involves one's ability to move from one location to another (Reuben et al., 2013). The individual tests included the 9-Hole Pegboard Dexterity Test, Grip Strength Test, Standing Balance Test, and 4-Meter Walk Gait Speed Test. For our analysis, the 4-meter Walk Gait Speed Test was used as the primary variable to define motor functioning.

Cognitive functioning: Cognitive functioning was measured with the NIH Toolbox Cognition Battery (NIHTB-CB; Weintraub et al., 2013). This study utilized multiple test instruments of the NIHTB-CB that measure domains of executive function, attention, episodic memory, language, processing speed, and working memory. The individual tests consist of the Dimensional Change Card Sort Test (cognitive flexibility), Flanker Inhibitory Control and Attention Test (attention and inhibitory control), Picture Sequence Memory Test (episodic memory), List Sorting Working Memory Test (sequence different visually and orally presented stimuli), Pattern Comparison Processing Speed Test (processing speed). A fluid cognition composite score was calculated for the NIHTB-CB that included all of the previously mentioned tests. The use of composite scores for the NIHTB-CB has shown an adequate internal consistency ($\alpha = .77$), excellent test-retest reliability ($\alpha = .90$), and good convergent validity with other standard cognitive measures ($\alpha = .89$) in adult populations (Heaton et al., 2014; Weintraub et al., 2014).

Length of current depressive episode: This item was obtained by summing the number of weeks from the start of the current episode of depression at baseline.

Severity of anxiety: The severity of anxiety was measured by the Patient Reported Outcomes Measurement Information System (PROMIS) anxiety computer adaptive test (CAT) (Pilkonis et al., 2011). The PROMIS anxiety is a self-reported measure that centers on the past seven days and assesses fearfulness, worry, nervousness, and somatic symptoms such as racing heart. The participant must complete a minimum of four items on the CAT in order to generate an anxiety score. The response options are based on a five-point scale where 1 represents never and 5 represents always. Total raw scores were converted to T-scores that have a mean of 50 and a standard deviation of 10.

Social participation: Social participation was measured by the PROMIS ability to participate in social roles and activities computer adaptive test (Hahn et al., 2014). The items are self-reported and assess the participants ability to perform in various social roles and activities. Items have a negative wording and the scores for the responses are reverse coded such that higher scores suggest greater ability to participate in social activities. Four items must be completed during the CAT in order to generate a valid score. The total raw score was translated into a T-score.

Self – reported physical functioning: The PROMIS physical function measured computer adaptive test captures a self-report on mobility, dexterity, central (neck and back functioning), and daily living activities (Rose et al., 2008). Mobility items may center on the ability to stand from a seated position or being able to walk, run, or jump. Dexterity items may center on activities that include arm, shoulder, or hand (upper

extremity) such as writing or opening jars. The total raw score of responses was translated into a T-score.

Data Analysis Plan

Planned Analyses

All analyses for this dissertation were conducted with SPSS version 28. Initially, the data were screened by analyzing the descriptives for any missing responses. Data in randomized clinical trials may be missing completely at random (MCAR), at random (MAR), or not at random (MNAR) (Jakobsen et al., 2017). Multiple imputation (MI) was used for data missing at random (Manly & Wells, 2014). Following this, data were checked for outliers, skewness, and kurtosis, as well as the central tendency and dispersion of all variables to be included in the analyses. The next step involved checking for a number of issues (i.e., linear relationships between the independent variables and dependent variable, multivariate normality, that residuals were normally distributed, multicollinearity, and homoscedasticity). Lastly, the following variables were examined as potential covariates: medical comorbidity and illness severity collected from the Cumulative Illness Rating Scale – Geriatric (CIRS-G) score, chronicity of depression (current age subtracted by age at first depressive episode), ratio of current age divided by chronicity of depression, gender, marital status, years of education, ethnicity, and race. Categorical variables were split and coded into either 0 or 1. For gender, female was coded as 0 and male was coded as 1. For race, White was coded as 0 and all other race options were coded as 1. For marital status, married was coded as 0 and all other marital status options were coded as 1. Potential covariates that were significant were included in the first step of the regression.

Hypothesis 1 Analyses

Hypothesis 1a aimed to examine the strongest correlates of PWB among older adults with persistent depression. Hypothesis 1b aimed to examine how social participation moderates the relationship between the predictors and PWB. Hierarchical multiple regression was conducted to examine the effects of motor functioning (NIHTB-MB), cognitive functioning (NIHTB-CB), length of current depressive episode (weeks from start of current episode of depression), severity of anxiety (PROMIS anxiety), and social participation (PROMIS ability to participate in social roles and activities) on PWB (composite score of positive affect and life satisfaction from the NIHTB-EB PWB subdomain). Block 1 consisted of motor and cognitive impairment variables. Block 2 consisted of the social participation variable, block 3 consisted of the length of current depressive episode and anxiety variables. Block 4 consisted of interactions of social participation with : motor functioning, cognitive functioning, length of current depressive episode, and anxiety. In order to perform a moderation analysis in block 4, product terms were created for each of the four interactions listed. This included computing four new variables with the multiplication of social participation to motor functioning, cognitive functioning, length of current depressive episode, and anxiety. In order to analyze social participation as a moderator it was important to evaluate if there was a significant change in the variance explained (ΔR^2). If there was support for a moderation effect of social participation, a dichotomous variable would be created by splitting social participation into high and low groups based on the median. This would allow an examination of separate correlation matrices for these high and low social participation groups. It would also allow for a visual representation of study findings.

Hypothesis 2 Analyses

The secondary research question aimed to examine how social participation mediated the relationship between motor functioning, cognitive functioning, length of current depressive episode, and severity of anxiety with PWB. A path analysis was conducted to explore a theorized causal order among the variables of interest. A path analysis involves a combination of many paths between endogenous (dependent variable) and exogenous (independent variable) variables. The PROCESS macro plug-in for SPSS was used for the mediation analysis (Hayes & Little, 2018). Model number four was used to conduct a basic mediation analysis. PWB was placed in the outcome variable slot (Y) and either motor functioning, cognitive functioning, length of current depressive episode, or severity of anxiety were placed in the independent variable slot (X). Social participation was entered into the mediator variable slot (M). Running this program individually for each hypothesized exogenous variable produced an output that provides statistics on the total, direct, and indirect effects. A regression analysis was needed for all the endogenous variables in the conceptual model. For example, the PROCESS macro regression analysis examines if motor functioning predicts PWB, if motor functioning predicts social participation, and if motor functioning and social participation together predict PWB. When conducting the regression analysis with motor functioning and social participation together, it will be important to examine if social participation also predicts PWB. It will also be important to examine if motor functioning no longer predicts or is a lessened predictor of PWB. The model summary and path coefficients for each regression analysis were examined for significance. A Sobel test was also conducted to determine if there is a significance between the path of motor functioning

predicting PWB and the path of motor functioning and social participation together predicting PWB. Kappa-squared will be used to determine the effect size of the mediation (Preacher & Kelley, 2011). This pattern of regression analysis was also conducted for the other exogenous variables (cognitive functioning, length of current depressive episode, and severity of anxiety) with social participation as the mediator and PWB as the endogenous variable.

Power Analysis

A power analysis was conducted to examine the sample size needed for a medium effect size at .80 power, alpha = .05, for hypothesis 1 and 2. The G*power 3.1 software was used to perform the power analysis for multiple linear regression. For the hierarchical multiple regression for hypothesis 1a and 1b, that includes nine predictor variables, a sample size of 114 was preferred. The separate multiple regressions that were required for the secondary research question involved either one or two predictors in the regression model. The total number of paths in the model will be 12 and a reasonable assumption was that 10 participants were required per path, suggesting that a sample size of 120 or higher was preferred. Thus, this study is considered sufficiently powered to address aims and hypotheses.

Results

Demographic Characteristics

Participants ranged in age from 60 years old to 91 years old and 65% of the participants identified as female. The sample predominately consisted of white (85.1%) and non-Hispanic (90.2%) participants. Older adults in the study had an above average level of completed education (M = 14.82, SD = 2.96) and 37.4% of the sample were

married. In regard to medical health, results from the CIRS-G indicated that this was a sample with comorbid health concerns (M = 8.38, SD = 4.61) and mean BMI indicated that the average participant's score was in the obese range (M = 30.47, SD = 6.46). Depression measures assessed at baseline highlight that older adults were experiencing moderate levels of depression (M_{MADRS} = 22.31, SD = 7.26; $M_{PHQ\text{-}9}$ = 15.40, SD = 4.29). Participants also experienced chronic depression and reported an average of 833.17 (SD = 937.98) weeks for the duration of their current depression. The sample was also shown to have moderately high levels of anxiety (M = 64.18, SD = 6.66). Older adults in the study reported mild levels of social participation (M = 41.87, SD = 6.98). Positive affect (M = 31.69 , SD = 7.16) and life satisfaction (M = 38.33 , SD = 6.04) were both nearly two standard deviations below the T score of 50. As mentioned above, a total score for PWB (M = 35.02, SD = 5.71) was computed to combine both positive affect and life satisfaction. Demographic characteristics can be observed in Table 1.

Table 1

Descriptive Statistics of Participants and Study Measures (N = 369)

Variable	N (%)	Range	Mean (SD)
Age		**60-91**	**69.00 (6.71)**
Race			
White	**314 (85.1%)**		
Black/African	**28 (7.6 %)**		
Asian	**5 (1.4%)**		
Multi-race	**8 (2.2%)**		
Other	**14 (3.8%)**		
Ethnicity			
Hispanic	**36 (9.8%)**		
Non-Hispanic	**333 (90.2%)**		
Gender			
Female	**240 (65.0%)**		

Male	**129 (35.0%)**		
Years of Education			**14.82 (8.77)**
CIRS-G			**8.38 (4.61)**
Fluid Cognition (Standard Score)			**86.72 (10.85)**
4 Meter Gait Speed			**4.56 (1.23)**
Duration of Depressive Episode (Weeks)			**833.17 (937.98)**
Age of Onset Depression			**31.90 (19.56(**
MADRS			**22.31 (7.26)**
PROMIS Anxiety (T Score)			**64.18 (6.66)**
PROMIS Physical Function			**41.58 (7.29)**
PROMIS Social Participation			**41.87 (6.98)**
Psychological Well-Being (Average T-Score)			**35.02 (5.71)**
Positive Affect (T-Score)			**31.69 (7.12)**
Life Satisfaction (T-Score)			**38.34 (6.05)**

Missing Data: Study Variables

369 participants met eligibility criteria for this study. Out of the 21 study variables that were needed for analyses, 14 variables contained missing data and 7 variables had completed data. 39.8% of the data were missing for standing balance, 6% for gait speed, 4.1% for grip strength, 2.2% for dexterity, 11.9% for length of depressive episode, and roughly 6% for levels of anxiety, social participation, life satisfaction, positive affect, and self-reported physical functioning. Multiple imputation was used to substitute missing data and the Mersenne Twister option was utilized as a random number generator to create five iterations of the data. These five iterations were averaged, and this created one dataset that was used for all the analyses.

Hypothesis Testing

Hypothesis 1a: Lower motor functioning, lower cognitive functioning, greater length of current depressive episode (i.e., length of time from start of current episode), higher

levels of anxiety, and lower social participation will be associated with lower levels of PWB in older adults with persistent depression.

Table 2 displays the correlations of PWB. Depressive symptoms had a moderate negative relationship with PWB. Variables that were examined as covariates did not have a significant correlation with PWB. Table 3 provides a full list of the correlations of central variables in analyses. Variables were analyzed using Pearson correlations. Motor functioning ($r = .03$, $p = .31$) and cognitive functioning ($r = .004$, $p = .47$) did not have a significant correlation with PWB. Current length of depressive episode ($r = .07$, $p = .07$) also did not have a significant correlation with PWB. Social participation had a significant positive relationship with PWB ($r = .31$, $p < .001$) and anxiety levels had a significant negative relationship with PWB ($r = -.45$, $p < .001$). Hypothesis 1a is partially supported. These findings highlight that levels of anxiety and social participation are correlates of PWB, although other study variables are not. Both measures of depression, the PHQ-9 ($r = -.41$, $p < .001$) and MADRS ($r = -.50$, $p < .001$) had a significant correlation with PWB.

Table 2

Correlations of PWB

Measure	1	2	3	4	5	6	7	8	9	10	11	12
1 PWB	1											
2 Age	.05	1										
3 Gender	-.09	-.06	1									
4 Ethnicity	-.05	.04	-.05	1								
5 Years of Education	.04	-.08	-.19***	.26***	1							
6 CIRS-G	-.09	.10	.03	.08	-.14**	1						
7 Age of Depression Onset	.06	.20***	-.11*	-.15**	.12*	.03	1					
8 Depression symptoms severity (MADRS)	-.50***	-.17**	.17***	-.01	-.09	.09	-.09	1				
9 Cognition	.004	-.39***	.12*	-.02	.24***	-.17**	-.09	-.02	1			
10 Motor	.03	.28***	.11*	-.13**	-.18***	.19** *	.17***	-.03	-.26***	1		
11 Social Participation	.31***	.08	-.04	-.06	.08	-.13*	.01	-.29***	.07	.01	1	
12 Anxiety	-.45***	-.09	.07	-.11*	-.10	-.03	-.03	.46***	-.09	-.07	-.31***	1

*p < .05, **p < .01, ***p<.001

Table 3

Correlations of Central Variables in Analyses

Measure	1	2	3	4	5	6	7	8
1 PWB	1							
2 Cognition	.004	1						
3 Motor	.03	-.26***	1					
4 Social Participation	.31***	.07	.01	1				
5 Anxiety	-.45***	-.09*	-.07	-.31***	1			
6 Length of Depressive Episode	-.08	.04	.02	.02	.01	1		
7 Self-reported physical functioning	.12*	.20***	-.40***	.35***	-.06	-.02	1	
8 Grip Strength	.11*	.16**	-.13**	.003	-.08	.02	.12*	1

*p < .05, **p < .01, ***p<.001

Hypothesis 1b: Social participation moderates the relationships between these other predictors and PWB. These associations are weaker for individuals reporting higher levels of social participation.

Hierarchical multiple regression was used to test Hypothesis 1b, which aimed to evaluate the role of social participation as a moderator in the study variables. The overall model was significant $F(9,359)$, $p < .001$, adjusted $R^2 = .228$, see Table 4. Motor functioning and cognitive functioning were entered into block 1 of the first model and did not account for a statistically significant amount of the variance in the model $F(2,366) = .149$, $p = .861$, adjusted $R^2 = -.005$. The addition of social participation in block 2 resulted in a significant increase in the amount of variance explained in the second model, $\Delta R^2 = .10$, $p < .001$. Length of current depressive episode and level of anxiety

were added in block 3 and resulted in a statistically significant increase in the amount of variance explained in the third model, $\Delta R^2 = .15$, $p < .001$. Block 4 was designed to test the moderation effect of social participation and included four interaction items of social participation multiplied with cognitive function, motor functioning, length of current depression, or levels of anxiety. The addition of block 4 did not result in a statistically significant change in the amount of variance explained, $\Delta R^2 = .002$, $p = .892$. Thus, hypothesis 1b was not supported. Social participation ($B = .19$, $p < .001$), and levels of anxiety ($B = -.40$, $p < .001$) were significant predictors of PWB.

Table 4

Hierarchical regression analyses for moderation effect of social participation (Hypothesis 1b)

Predictor Variable	*β*	*R*	*R^2/ Adj R^2*	*ΔR^2*	*F*	*ΔF*
Step 1		.03	.001/-.005	.001	.149	.149
Cognition	.01					
Motor Functioning	.03					
Step 2		.313	.10/.09	.10	13.17***	39.18***
Cognition	-.01					
Motor Functioning	.02					
Social Participation	.31***					
Step 3		.495	.25/.23	.15	23.53***	35.36***
Cognition	-.04					

Motor Functioning	-.01					
Social Participation	.19***					
Anxiety	-.40***					
Length of depressive episode	-.08					
Step 4		.497	.25/.23	.002	13.09***	.28
Cognition	-.05					
Motor Functioning	-.01					
Social Participation	.20***					
Anxiety	-.40***					
Length of depressive episode	-.08					
Social Participation and Cognition	-.02					
Social Participation and Motor Functioning	-.03					
Social participation and Anxiety	.03					
Social Participation and Length of depressive episode	-.03					

*p < .05, **p < .01, ***p<.001

Hypothesis 2a: Social participation mediates the relationship between motor functioning and PWB. The effect of motor functioning on PWB will be partially explained by motor functioning's association with social participation.

Analyses were not conducted because there was no relationship between motor functioning and PWB.

Hypothesis 2b: Social participation mediates the relationship between cognitive functioning and PWB. The effect of cognitive functioning on PWB will be partially explained by cognitive functioning's association with social participation.

Analysis was not conducted because there was no relationship between cognitive functioning and PWB.

Hypothesis 2c: Social participation mediates the relationship between length of current depressive episode and PWB. The effect of length of current depressive episode on

PWB will be partially explained by length of current depressive episode's association with social participation.

Analysis was not conducted because there was no relationship between length of current depressive episode and PWB.

Hypothesis 2d: Social participation mediates the relationship between anxiety and PWB. The effect of anxiety on PWB will be partially explained by anxiety's association with social participation.

To investigate hypothesis 2d a series of regression analyses were performed using PROCESS. The outcome variable for analysis was PWB. The predictor variable for the analysis was level of anxiety. The mediator variable for the analysis was social participation. The results show that level of anxiety negatively predicted PWB (Effect = -.39, $p < .001$). The indirect effect of anxiety on PWB was found to be statistically significant [Effect = -.06, 95% C.I. (-.1022, -.0233)]. This finding supports the hypothesis that social participation at least partially mediated the relationship between anxiety and PWB. Anxiety negatively affected social participation (Effect = -.33, $p < .001$) and social participation positively affected PWB (Effect = .15, $p < .001$). A Sobel test ($Z = -3.23$, $p < .001$) was conducted and indicated that the mediator variable significantly carried the influence of an independent variable on the dependent carriable. See Table 5; Figure 1.

Table 5

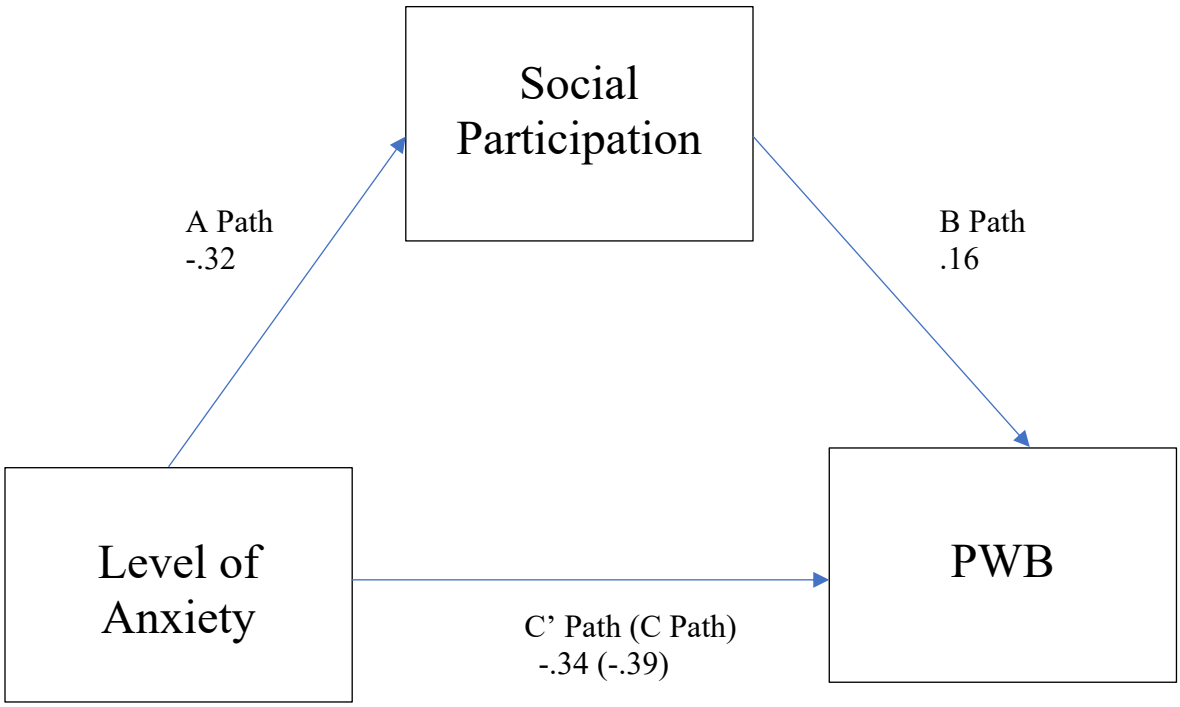
Mediation analysis output: social participation and level of anxiety

	Coefficient	SE	t	LLCI	ULCI
Path a (anxiety to social participation)	-.32	.05	-6.24***	-.4272	-.2226
Path b (social participation to PWB)	.16	.04	3.95***	.0778	.2323
Path c (anxiety to PWB) (total effect)	-.39	.04	-9.71***	-.4662	-.3092
Path c' (anxiety to PWB) (direct effect)	-.34	.04	-8.19***	-.4182	-.2563
Indirect effect (anxiety to social participation to PWB)	-.06	.02	-	-.1022	-.0223

*p < .05, **p < .01, ***p<.001

Figure 1

Mediation analysis: evaluating social participation and level of anxiety



Secondary Analyses

Further analyses were conducted to explore the relationship among other variables in the dataset that assessed the constructs of interest in this study. A variable of interest was self-reported physical functioning because this captured the older adult's self-perceptions regarding their motor functioning. Analyses were replicated similar to hypotheses 1 and 2 but with the gait speed variable replaced by the self-reported physical functioning variable. Self-reported physical functioning had a significant positive relationship with PWB ($r = .12$, $p < .05$). Hierarchical multiple regression were used for this analysis. The overall model was significant $F(9,359)$, $p < .001$, adjusted $R^2 = .25$. Self-reported physical functioning, and cognitive functioning were entered into block 1 of

the first model and did not account for a statistically significant amount of the variance in the model $F(2,366) = 2.71$, $p = .07$, adjusted $R^2 = .01$. The addition of social participation in block 2 resulted in a significant increase in the amount of variance explained in the second model, $\Delta R^2 = .08$, $p < .001$. Length of current depressive episode and level of anxiety were added in block 3 and resulted in a statistically significant increase in the amount of variance explained in the third model, $\Delta R^2 = .15$, $p < .001$. Block 4 was designed to test the moderation effect of social participation and included four interaction items of social participation multiplied with cognitive function, self-reported physical functioning, length of current depression, or levels of anxiety. The addition of block 4 did not result in a statistically significant change in the amount of variance explained, $\Delta R^2 = .001$, $p = .958$. Thus, there was not a moderating relationship between social participation and self-reported physical functioning. Self-reported physical functioning ($B = .10$, $p < .05$), social participation ($B = .15$, $p < .001$), and levels of anxiety ($B = -.34$, $p < .001$) were significant predictors of PWB in this analysis.

Analyses were replicated similar to the hypothesis 2 to analyze if there was a mediating relationship between social participation and self-reported physical functioning. To investigate this, a series of regression analyses was performed using PROCESS. The outcome variable for analysis was PWB. The predictor variable for the analysis was self-reported physical functioning. The mediator variable for the analysis was social participation. The results show that self-reported physical functioning did not significantly predict PWB (Effect = .008, $p = .84$). The indirect effect of self-reported physical functioning on PWB was found to be statistically significant [Effect = .11, 95%

C.I. (.0543, .1753)]. This finding supported that social participation partially mediates the relationship between self-reported physical functioning and PWB.

Similarly, analyses were completed with grip strength replaced as a variable for motor functioning. Grip strength had a significant positive relationship with PWB ($r = .11$, $p < .05$). Hierarchical multiple regression was used for this analysis. The overall model was significant $F(6,362)$, $p < .001$, adjusted $R^2 = .24$. Grip strength and cognitive functioning were entered into block 1 of the first model and did not account for a statistically significant amount of the variance in the model $F(2,366) = 2.15$, $p = .12$, adjusted $R^2 = .01$. The addition of social participation in block 2 resulted in a significant increase in the amount of variance explained in the second model, $\Delta R^2 = .10$, $p < .001$. Length of current depressive episode and level of anxiety were added in block 3 and resulted in a statistically significant increase in the amount of variance explained in the third model, $\Delta R^2 = .14$, $p < .001$. Block 4 was designed to test the moderation effect of social participation and included one interaction items of social participation multiplied with grip strength. The addition of block 4 did not result in a statistically significant change in the amount of variance explained, $\Delta R^2 = .000$, $p = .793$. Thus, there was not a moderating relationship between social participation and grip strength. Grip strength ($B = .11$, $p < .05$), social participation ($B = .20$, $p < .001$), and levels of anxiety ($B = -.39$, $p < .001$) were significant predictors of PWB in this analysis.

To investigate if there was a mediating relationship between social participation and grip strength a series of regression analyses was performed using PROCESS. The outcome variable for analysis was PWB. The predictor variable for the analysis was grip strength. The mediator variable for the analysis was social participation. The results

show that grip-strength did significantly predict PWB (Effect = .06, $p < .05$). The indirect effect of self-reported physical functioning on PWB was found to not be statistically significant [Effect = .001, 95% C.I. (-.0325, .0362)]. This finding supported that social participation does not mediate the relationship between grip strength and PWB.

Table 5

Summary of Hypothesized Findings

	Hypothesis	Analysis	Result/Finding
1a	Lower motor functioning, lower cognitive functioning, greater length of current depressive episode (i.e., length of time because start of current episode), higher levels of anxiety, and lower social participation will be associated with lower levels of PWB in older adults with persistent depression.	Hierarchical Multiple Regression	Partially supported. Social participation and level of anxiety were found to be significant predictors of PWB.
1b	Social participation moderates the relationships between these other predictors and PWB. These associations are weaker for individuals reporting higher levels of social participation.	Hierarchical Multiple Regression	Not supported.
2a	Social participation mediates the relationship between motor functioning and PWB. The effect of	N/A – Analysis not conducted due to no	Not supported.

	motor functioning on PWB will be partially explained by motor functioning's association with social participation.	significant relationship between variables	
2b	Social participation mediates the relationship between cognitive functioning and PWB. The effect of cognitive functioning on PWB will be partially explained by cognitive functioning's association with social participation.	N/A - Analysis not conducted due to no significant relationship between variables	Not supported.
2c	Social participation mediates the relationship between length of current depressive episode and PWB. The effect of length of current depressive episode on PWB will be partially explained by length of current depressive episode's association with social participation.	N/A - Analysis not conducted due to no significant relationship between variables	Not supported.
2d	Social participation mediates the relationship between anxiety and PWB. The effect of anxiety on PWB will be partially explained by anxiety's association with social participation.	Linear regressions analyzed by PROCESS (Hayes & Little, 2018)	Supported.

Discussion

Older adults with treatment-resistant depression are an understudied group and it is important to gain a more comprehensive understanding of cognitive, physical, and psychological characteristics. This study investigated the correlates of PWB of older adults with treatment-resistant depression. Study variables focused on different domains such as cognition, motor functioning, anxiety, length of depressive symptoms, and social participation. Extra consideration was given to the role of social participation, so this variable was examined as a moderator and mediator for the significant correlates of PWB. Results showed that level of anxiety and social participation were significantly correlated with PWB and were retained as significant predictors of PWB. Social participation was not found to moderate the relationship between anxiety and PWB, but it was found to be a significant partial mediator for the relationship between anxiety and PWB. Secondary analyses were conducted that examined the relationship of self-reported physical functioning and PWB. Self-reported physical functioning was found to be significant, unlike the other objective motor functioning measure (4-meter gait speed test), which was non-significant. Because PWB was created from the average of life satisfaction and positive affect, analyses were re-run with both of these identified as individual dependent variables. These results did not differ from the original findings when examining the total score representing PWB.

PWB and Cognitive Functioning

There have been limited studies that have examined the relationship between PWB and cognitive functioning, especially in older adults. One takeaway from this sample of older adults is that the average fluid cognition score was in the below average

range (average uncorrected standard score of 86). These scores were similar to averages of fluid cognition NIH toolbox scores with a sample of community dwelling older adults experiencing symptoms of depression or anxiety (Brooks et al., 2021). Surprisingly, the average of the study was similar to a recent study that utilized the NIH toolbox cognitive battery to assess fluid cognition in a non-depressed and non-demented community sample of older adults (Snitz et al., 2020). Previous literature has implied increased risk of cognitive impairment for individuals with depression. Our analysis indicated a non-significant correlation between cognitive functioning and PWB, which differs from previous studies that have found a significant relationship (Gates et al., 2014; Wilson et al., 2013). Differing results might be due to the high variability in assessment measures used to capture cognitive functioning and different definitions and conceptualizations of PWB. For example, in this study, a composite score of fluid cognition related tasks was used, although other studies may not have used composite scores and only looked at associations with certain domains like processing speed, memory, or executive functioning. In this study, we also focused on positive affect and life satisfaction as components of PWB, although other studies may focus on purpose and meaning or other closely related concepts like autonomy, resilience, or negative affect. Previous research has highlighted that memory concerns and reduced cognitive functioning are associated with PWB, however this relationship is partially mediated by perceived quality of life (Gates et al., 2014). We did not assess for self-reported quality of life or how the participants perceived the consequences of their cognitive difficulties. In this sample, it may be possible that although the older adults on average scored in the below average

range, their level of cognitive functioning might not be impacting various domains in their life that lower their quality of life.

PWB and Motor Functioning

Aging affects older adults differently and is a main factor in physical impairment. It is important to keep in mind the importance of physical functioning and impairment because it can affect an older adult's participation in productive and leisure activities (Freedman et al., 2017). Participation or lack of participation in those activities may influence both life satisfaction and positive affect. In this study, results from the analyses assessing the relationship between motor functioning and PWB were mixed. On one hand, gait speed was not determined to be a correlate of PWB but grip strength was. Both measures are objective assessments but differ in the area of assessment between upper extremity and lower extremity. The average gait speed score was 4.56 seconds, which would narrow down to a rate of 0.88 meters per second. A 2019 study also utilized the NIH toolbox 4-meter gait speed test and created normative data for a static start similar to the procedure for this study (Bohannon and Wang, 2019). The mean scores for men aged 60 to 69 was 1.16, for men aged 70 to 79 was 1.07, and for men aged 80 to 85 was .97. The mean scores for women aged 60 to 69 was 1.05, for women aged 70 to 79 was 0.99, and for women aged 80 to 85 was 0.95. The average score from our study was lower than these scores, and this is aligned with previous studies that have suggested that increased depressive symptoms are associated with impaired gait velocity, stride, and swing time variability (Brandler et al., 2012). A self-reported measure of physical functioning that included components of both lower extremity and upper extremity functioning was found to significantly correlate with PWB. This measure may be the most accurate at describing

the link between motor functioning and PWB because it encompasses several motor domains and assesses if older adults are able to complete daily living activities. Previous research has shown that grip strength, balance, and self-rated mobility are correlated with life-satisfaction (Qazi et al., 2021). Hand grip strength is necessary to participate in activities of daily living, and decreased hand grip strength is associated with limitations in participating in activities of daily living and increasing dependency (Halaweh, 2020). Previous research demonstrates that increased handgrip strength was associated with decreased odds of experiencing anxiety, depression, and hopelessness in older adults (Ashdown-Franks et al., 2019; Gordon et al., 2019).

PWB and Mental Health

Previous research has made a link between the presence of depression and lower levels of PWB (Lukaschek et al., 2017; Adams et al; 2016). Although it is not a guarantee that someone who is depressed will not experience high or appropriate levels of PWB, it is understandable that there is a relationship between the PWB component of positive affect and depression because it represents negative affect. For example, in this study there was a significant negative correlation with endorsed depressive symptoms (MADRS scores) and PWB, life satisfaction, and positive affect. Because this finding has garnered much examination in previous literature and it is rare to conduct research with a sample of older adults with treatment-resistant depression, we examined the relationships between length of depressive episode and PWB, life satisfaction, and positive affect. Interestingly the length of the current depressive episode did not have a significant correlation with PWB or life satisfaction but it did have a significant negative correlation with positive affect. This finding suggests that as a depressive episode

lengthens, the level of positive affect decreases. The average length of the self-reported current depressive episode was quite high for this sample and implied that the average participant perceived being in the same depressive episode for the past 16 years. This was not, however, verified by collateral informants. The tripartite model of anxiety and depression highlights that individuals with depression have a comorbidity of high negative affect and low positive affect (Clark and Watson, 1991). Increased length of the depressive episode might amplify depressive symptoms like apathy, hopelessness, or loss of interest. Similarly, the tripartite model of anxiety highlights that anxiety can be explained by the combination of high negative affect and high physiological hyperarousal (Clark & Watson, 1991). The sample of older adults in this study reported elevated levels of anxiety during the week prior to assessment. Further analysis determined that level of anxiety had a significant negative relationship with PWB, similar to findings from previous studies (Iani et al., 2019; Lukaschek et al., 2017).

PWB and Social Participation

Advanced age is associated with a shift in social network size and density, and, for some older adults, increased barriers to socialization due to declines in cognitive or physical functioning. Social participation may be an avenue for older adults to maintain or even build social relationships with other people, along with a sense of support, belongingness, and community. There is a need to research characteristics of social participation in older adults with treatment-resistant depression because a majority of the current research is conducted with non-depressed community dwelling samples. On average, participants in this study scored below average on social participation. In this study, we found a positive correlation between social participation and PWB, such that

those who self-reported higher social participation also self-reported higher levels of PWB. This finding adds to already existing literature on the significant relationship between social participation and PWB (Chen & Zhang, 2022; Ho, 2015; Li et al., 2018).

Social participation was also examined as a moderator and mediator for the significant correlates of PWB. To date there are no studies that have examined the moderation and mediation effects of social participation on a sample of older adults with treatment resistant depression. Fiske et al (2009) highlighted that social participation can be affected by cognitive and physical impairment in older adults with depression. In this study there was not a significant relationship between cognitive functioning and PWB so social support was not analyzed as a moderator or mediator. Social participation was not found to be a significant moderator of the relationship between self-reported physical function and PWB; it was, however, found to be a significant partial mediator. Social participation was also found to be a significant partial mediator for the relationship between levels of anxiety and PWB. These findings suggest that levels of social participation may not influence the strength of the relationship between self-reported physical function or anxiety and PWB. What may be occurring, however, is that increased anxiety negatively impacts social participation – with this decrease in social participation influencing PWB. Similarly, someone who scores low on self-report of physical functioning might also be limited in social participation; this may help explain their reported levels of PWB.

Implications

One clear strength of this study is the availability of cognitive, physical, affective, and social variables for a sample of older adults with treatment-resistant depression. It

was observed that social participation was a correlate of PWB and a significant predictor in the regression models. It was also demonstrated that social participation was a significant partial mediator for the relationship between anxiety and PWB, and for self-reported physical function and PWB. This is one of the only studies that has been able to evaluate social participation and PWB in a sample of older adults with treatment-resistant depression, highlighting the importance of these relationships. In light of existing behavioral models of depression and theories of PWB, the finding from this study further supports the inclusion of social participation in these models (Fiske et al., 2009; Gates et al., 2014).

In the past, PWB has been considered primarily as the absence of psychopathology. Definitions have evolved with the growing movement of positive psychology; now, PWB is viewed through the lens of happiness, life satisfaction, and meaning in life. PWB and psychopathology, however, do share a bidirectional relationship, making them related to one another yet separate concepts (Lamers et al., 2015). This bidirectional relationship suggests that PWB should be measured in clinical trials and mental health treatment. In particular, it may be important to incorporate PWB within evidence-based treatments for late-life depression. A recent meta-analysis examined the benefits of positive psychology interventions (PPI's) in clinical settings and found that PPI's that center on gratitude, promoting positive relationships, and pursuing meaning were effective in improving well-being and also reducing depressive and anxiety symptoms in clinical settings (Chakssi et al., 2018).

Limitations

This is the first known research evaluating the correlates of PWB in a sample of older adults with treatment-resistant depression. A primary limitation of this dissertation study is the inability to examine causality due to reliance on cross-sectional data, and the lack of an intervention or manipulation of social participation as the target independent variable. Our study also focused on adults over the age of 60 and heavily relies on data collected from White participants. This is important to note because adults under 60 also experience treatment-resistant depression and we cannot report on how these relationships differ. In regard to racial diversity, although this study collected data from five major cities in North America that are racially diverse, it contained 85% White participants. A recent article has highlighted that Black and AI/AN older adults scored lower on life satisfaction than their White counterparts (Wyman et al., 2022).

Another limitation to the study centers on the selected measure to assess PWB and the self-report measure of length of current episode of depression Life satisfaction and positive affect concepts of the PWB measure were collected in this study but meaning and purpose were not. This provided us with rich information on experiential and evaluative components of PWB (Salsman et al., 2014), yet the inclusion of meaning and purpose would have been optimal, as they are different constructs. Salsman et al (2014) describes these constructs as life satisfaction centering on liking one's life and meaning and purpose focuses on believing that one's life matters. Inclusion of the meaning and purpose measure would have allowed for a greater understanding of the components of PWB. In assessing length of current depressive episode, a limitation is that participants were asked to list the number of weeks since the start of their depressive

episode. Dunlop et al (2019) concluded that participants in clinical trials can accurately recall depressive symptoms after two years but did note that the accuracy was higher at 12 months than 24 months. In this study, older adults may have been tasked with having to remember an episode that started many years prior. It is also possible that such retrospective reports are influenced by a number of factors related to the study variables.

Future Directions

Implementation of a longitudinal design may help with understanding which factors influence PWB and how PWB changes with age. Cross-sequential designs may help with separating age effects and cohort effects. The data might also not be an accurate representation of PWB because it is capturing PWB in a moment and not during a longer time period. For example, an older adult leaving his or her house to participate in a research study might be answering questions surrounding happiness, life satisfaction, or meaning in life differently than how they would normally feel if they had remained housebound. Because PWB measures and most depression measures rely on self-report it might be beneficial for future studies to adopt ecological momentary assessment (EMA) in the research design (Trull & Ebner-Premier, 2020). The benefit of EMA data collection is that it does not require the same degree of retrospection as self-report measures or semi-structured interviews (Mofsen et al., 2019). EMA would allow for the collection of data over time and would prevent older adult participants the challenge of having to remember their mood or thoughts over the past day, week, or longer. Self-report measures and semi-structured interviews are typically done in a lab setting and EMA would allow for the older adult to respond to the questions in a more natural setting (Trull & Ebner-Premier, 2020).

A future direction of research should include involving the oldest-old in research studies focusing on PWB. The oldest-old population is increasing, and individuals are living longer with chronic illnesses, functional decline, and cognitive impairment. These age factors that are specific to this group might alter the conceptualization and measurement of PWB in this oldest-old. The oldest-old have been underrepresented in PWB research and collecting information about predictors of PWB in this group can help with future policy making and bettering their day-to-day lives (Creswell-Smith et al., 2018). In addition to including older adults who vary in age, it is also important for future research studies to include older adults from various races and ethnicities. Future studies should examine how culture and race influence cognitive and experiential evaluation of life (Clauss-Ehlers et al., 2019). The conceptualization of PWB in western culture may adopt an individualistic orientation and PWB measures may neglect accurately assessing PWB in groups of individuals who more strongly value family and community (Cooke et al., 2016). Recruiting a sample of older adults who vary in age, race, ethnicity, socioeconomic status, and physical illness will allow for a better understanding of cross-culture validity for PWB.

Conclusion

This study found that anxiety, self-reported physical function, hand grip strength, and social participation were correlates of PWB in older adults with treatment-resistant depression. The existence of these relationships calls for the inclusion of PWB measures in future clinical trials for treatment-resistant depression. It will be important to evaluate the ways in which successful treatments for depression also lead to increases in PWB.

Implementing positive psychology interventions in combination with medication might be beneficial for increasing PWB and positive mood in older adults.

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