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Factors Influencing Purpose in Life in Middle-Aged and Older Adults

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Abstract

Purpose in life is an important dimension of psychological well-being with associated health benefits. The current study used a path analysis model to examine how perceived cognitive control, health locus of control- self, engagement in physical activity, and engagement in challenging cognitive activities relate to purpose in life longitudinally. Multimorbidity status was also examined as a potential moderator of paths in the model. Participants were middle-aged and older adults who participated in the Midlife in the United States (MIDUS) longitudinal national study (n = 2,481). After controlling for relevant covariates, engagement in physical activity, engagement in challenging cognitive activities, and health locus of control-self were all directly related to future purpose in life. Control beliefs appeared to be related to domain-specific behaviors. That is, health locus of control-self was positively related to engagement in physical activity and perceived cognitive control was positively related to engagement in challenging cognitive activities. Perceived cognitive control was also indirectly related to future purpose in life through challenging cognitive activities. Lastly, several pathways were hypothesized to be moderated by multimorbidity status. The only pathway found to be moderated was that between engagement in challenging cognitive activities and future purpose in life, such that engagement in challenging cognitive activities was significantly (positively) related to future purpose in life only for those without multimorbidities. Intervention targets such as beliefs related to internalized ageism, self-efficacy beliefs related to cognition, and behavioral activation may influence purpose in life, leading to benefits for psychological well-being and physical health.

Factors Influencing Purpose in Life for Middle-Aged and Older Adults

Psychological Well-Being

Psychological well-being is a construct that is also referred to as *eudaimonic well-being* (Ryff, 1989). *Eudaimonic well-being* is a multi-dimensional construct that involves living a purposeful and virtuous life that is in line with one's true potential (Proctor & Tweed, 2016). It is related to, but distinct from *hedonic well-being*. Hedonic well-being is mainly concerned with emotional experiences and involves achieving pleasure while avoiding pain (Kahneman et al., 1999).

Ryff's six-factor model of psychological well-being (Ryff, 1989) is one of the most common models in the well-being literature. Aspects of psychological well-being in Ryff's model include knowledge and acceptance of oneself (*self-acceptance*), the depth of connection with close others (*positive relations with others*), control over one's course of action in life (*autonomy*), level of management of life situations (*environmental mastery*), the extent to which an individual believes their life has meaning, purpose, or direction (*purpose in life*), and the extent to which an individual believes they are living up to their potential (*personal growth*; Ryff, 1989).

Purpose in Life

Purpose in life is one aspect of Ryff's psychological well-being model, and, as stated, indicates that one has goals and a sense of directedness (Ryff, 1989). Kashdan and McKnight (2009) define purpose in life in a similar way, as a self-organizing life aim that directs life goals and daily decisions. Research on purpose in life is not generally concerned about *what* each person's purpose is, only that they have a purpose that guides

their decisions. Purpose can come from a variety of sources such as one's career, close relationships, faith, or hobbies.

Although similar to other constructs such as values and meaning in life, purpose in life is also distinct. Although values can drive purpose, purpose requires a central, self-organizing life aim related to one or more values and thus, having values does not always indicate the presence of a strong purpose (Kashdan et al., 2023). Additionally, purpose is not the same as meaning in life. Many current scales of meaning in life consider purpose or goal-directedness to be one dimension of meaning in life, with the other dimensions considered to be mattering or comprehension (George & Park, 2017), or significance and coherence (Martela & Steger, 2023).

Why Study Purpose?

Purpose in life is a meaningful variable to examine in middle-aged and older adults because it tends to change with age, often being stable or higher in middle adulthood (Ko et al., 2016; Mann et al., 2019) and declining in older adulthood and with more limited future time perspective (Ko et al., 2016; Pfund, Ratner, et al., 2022), defined as one's perception of how much time they have left to live (Carstensen & Lang, 1996). Purpose in life variability can also occur with changes in life roles, such as retirement (Irving et al., 2017; Springer et al., 2011). The potential to experience purpose remains throughout life, however, and maintaining a sense of purpose is associated with several benefits for mental, cognitive, and physical health (McKnight & Kashdan, 2009).

Health Benefits. Those who remain higher in purpose in later life tend to report higher self-rated health (Hill et al., 2015), even when managing chronic conditions (Weston et al, 2023). Other health benefits of maintaining higher purpose in life

throughout the lifespan include decreased risk for stroke (Kim, Sun et al., 2013b), decreased risk of mortality over the course of several years (Boyle et al., 2009; Cohen et al., 2016; Hill et al., 2014; Shiba et al., 2021), and lower allostatic load (Zilioli et al., 2015). Higher purpose in life is even linked to spending fewer nights in the hospital for older adults (Kim et al., 2014).

In those with coronary heart disease, higher purpose in life appears to be related to a lower risk of myocardial infarction over the course of two years (Kim, Sun et al., 2013a). Not all chronic conditions appear to be related to purpose in life, however. Recent longitudinal findings have indicated that experiencing an adverse health event or diagnosis of some common conditions (i.e., arthritis, cancer, diabetes, heart problems, high blood pressure, lung disease, and stroke) generally does not cause people to experience a change in purpose in life relative to people who do not experience an adverse health event (P. Hill et al., 2021). Purpose in life appears to be relatively unaffected by increasing multimorbidities (Friedman & Ryff, 2012).

In addition to health outcomes, purpose in life may affect preventative health behaviors. Those with higher purpose in life tend to engage in more meaningful activities (Lewis & Hill, 2020), including physical activity (Pfund, DeLongis, et al., 2022). Those in the lowest quartile of purpose in life have a higher likelihood of becoming physically inactive, developing sleep problems, and developing an unhealthy body mass index (Kim et al., 2019). Additionally, some health behaviors appear to mediate the relationship between purpose in life and self-rated health (Hill et al., 2019). Purpose in life is also related to attending primary care visits, getting cholesterol tests and cancer screenings (Kim et al., 2014).

High purpose in life is also associated with cognitive benefits. Higher purpose in life in middle aged and older adults is associated with better cognitive performance (Lewis et al., 2016). Maintaining high purpose in life during older adulthood is also related to decreased risk of dementia and mild cognitive impairment (Boyle et al., 2009; Sutin et al., 2021a). The relationship between cognitive impairment and purpose in life is bidirectional, which has been demonstrated longitudinally (Wilson et al., 2013). Potential extraneous variables, such as socioeconomic status (SES) should be considered in the relationship between purpose in life and cognitive benefits, however. Lower SES (e.g., lower education level) is related to both lower purpose in life (Ryff & Singer, 2008), and cognitive decline in late life (Livingston et al., 2020). Additionally, those with medium or high purpose in life report higher health literacy than those with lower purpose in life (Musich et al., 2018).

Factors that Affect Purpose in Life

Because purpose in life has many health benefits, it is important to understand how to maintain a sense of purpose in life. There are both longitudinal and cross-sectional studies that examine factors that contribute to one's sense of purpose in life. Some of these factors include early life experiences and identity variables. Experiencing early life adversity, for example, has been found to be negatively predictive of purpose in life during adulthood (Hill et al., 2018; Homan & Kong, 2020). Parental bereavement, or having lost a child, is also negatively predictive of purpose in life (Kim & Hicks, 2015). Certain characteristics of one's work can also affect future purpose in life, including coworker support and skill variety (i.e., the degree to which one's job involves varied and high-level skills; Weston et al., 2021).

Just as purpose can drive behaviors, behaviors can also influence purpose. The earlier mentioned finding that purpose in life affects physical activity (Pfund, DeLongis, et al., 2022, appears to be bidirectional, as engagement in physical activity can also contribute to increased purpose in life (Pfund, DeLongis et al., 2022; Yemiscigil & Vlaev, 2021). Activity engagement, which is more broad than physical activity, appears to be an effective way to promote a sense of purpose, particularly in retired older adults (Greenfield & Marks, 2004; Lewis & Hill, 2020). Activity engagement includes participating in many types of activities, including cognitive activities (e.g., reading; card games), physical activities (e.g., gardening; walking), social activities (e.g., attending club meetings; attending a social event), and supportive activities (e.g., doing volunteer work; caring for a sick or disabled adult).

Previous research demonstrates that not only does purpose in life predict many health outcomes, but many health-related factors also predict future purpose in life. The current study will examine several factors that may affect future purpose in life, including control beliefs related to one's perceived ability to maintain physical and cognitive health, and purposeful engagement in behaviors that promote physical and cognitive health over time. The current study is interested in whether these factors will affect future purpose in life 7-10 years later. The goal of studying this is to examine potential factors that might promote future purpose in life regardless of current purpose in life. In other words, to some extent, this study examines whether living purposefully predicts future purpose. However, these purposeful behaviors and related beliefs are not directly examined in relation to one's specific purpose and are broader. More specifically, the focus of this study is examining whether beliefs in one's perceived cognitive control and

perceived control over their own health and subsequent engagement in health behaviors predict future purpose in life.

Factors Influencing Behavior

Because the current study examines the influence on engagement in health behaviors and their influence on future purpose in life, it is helpful to also consider factors that may affect the likelihood that someone will engage in specific behaviors. The current study will also consider perceived control, or *locus of control*, and its relationship with engagement in health behaviors.

Locus of control is a construct that was originally proposed as one element of Rotter's (1954; 1966) social learning theory which posits that individuals engage in specific behaviors based on observations of similar others. Social learning theory includes the elements of *expectancy* (which includes both locus of control and self-efficacy), and *reinforcement value*, or the degree to which one desires the specific outcome that is expected to result from a specific behavior. For example, if someone desires to increase their biceps muscles by performing curls with dumbbells, expectancy would be high if the person believes they have control over doing curls (e.g., they have access to dumbbells) and the physical ability and skills to perform the curls. In this scenario, reinforcement value would be high if the person highly desires increased tone in their biceps muscles (which would be expected to result from regular performance of the curls).

The elements of expectancy and reinforcement value are used to predict a behavioral outcome within social learning theory. Locus of control is an example of an expectancy belief within social learning theory, or whether one thinks that a given

behavior will result in a particular outcome. In other words, locus of control reflects the degree to which people believe that reinforcements (rewards and punishments) are contingent on their own behavior or personal characteristics (internal locus of control), or on external forces, such as luck, fate, or powerful others (external locus of control; Rotter, 1990).

The Theory of Planned Behavior

One's locus of control can often affect their likelihood of engaging in a specific behavior. This relationship can be explained somewhat by the theory of planned behavior. The theory of planned behavior (Ajzen, 1985; 1991) essentially states that one's intention to engage in a particular behavior is affected by attitudes toward the behavior, or how one appraises the behavior with regard to: 1) positive values; 2) subjective norms related to the behavior (i.e., one's perceived social pressure to perform or not perform the behavior); and 3) perceived control beliefs (i.e., whether one believes they can competently engage in the behavior; Ajzen, 1985, 1991).

Perceived control beliefs include beliefs about *self-efficacy*, or the perceived ease or difficulty one believes they will have in performing the behavior; and *controllability*, or that the performance or nonperformance of a behavior is up to them (Ajzen, 2002). In other words, if one feels capable and confident in their ability to engage in a particular behavior, their intention to engage in that behavior increases. The current study will examine two types of perceived control beliefs- perceived cognitive control and health locus of control.

Perceived Cognitive Control

Perceived cognitive control is the extent to which one believes that they can maintain cognitive abilities as they age and/or there are steps they can take to remain cognitively healthy as they age. This domain is important to study because there is a pervasive societal belief that competence declines with age, which is a stereotype that is easily internalized. Indeed, perceived cognitive control, regardless of objective cognitive performance, is likely to vary with age (Schafer & Shippee, 2010). Those with high perceived cognitive control may experience less age-related cognitive decline (Raldiris et al., 2021).

There is a lack of research on factors that contribute to perceived cognitive control specifically. Those who are women, non-white, older, and have lower education levels tend to have lower levels of general perceived control (Lachman et al., 2011; Zahodne et al., 2015), but it is not clear whether these relate to perceived cognitive control specifically.

Health Locus of Control

Social learning theory has been applied to engagement in health behaviors (e.g., Wallston 1992). In this case, the reinforcement value of a desired health outcome is considered, along with one's *health locus of control*, or the perceived level of control one has over their health (Wallston et al., 1976). The early days of health locus of control research emphasized a dichotomized model. Researchers originally categorized individuals as "health-externals" (i.e., those who believe that their health is determined by external factors, such as "luck, fate, chance, or powerful others") or as "health-internals" (i.e., those who believe that they become healthy or sick due to their own

behavior; Wallston et al., 1976). The construct of health locus of control, however, was later found to be better encompassed by a three-factor model, which replaced "externals" with *powerful others* (i.e., believing that one's doctor largely controls one's health) and *chance* (i.e., believing that luck largely controls one's health; Wallston et al., 1978). In the past two decades, researchers have shifted to dimensional approaches which examine how individuals vary along a continuum of control beliefs. Also, the internal dimension of health locus of control is now often referred to as health locus of control-self. Thus, the three dimensions of health locus of control studied in research are self, chance, and powerful others.

Health Locus of Control and Health Behaviors

Health locus of control is related to a person's likelihood of engaging in health-promoting behaviors, as well as avoiding risky health behaviors. In patients with cardiovascular disease, having a higher health locus of control-self is associated with engaging in more leisure time physical activity (Mercer et al., 2018). Beginning to engage in health-promoting behaviors can also change health locus of control over time. Completing a six-week behaviorally oriented pain management program, for example, was shown to increase health locus of control-self (Wallston, 2005)..

Other Factors Affecting Health Locus of Control

Many individual factors appear to play in a role in health locus of control, including SES, gender, age, and beliefs about aging. Individuals with more years of education appear to have higher health locus of control-self (Assari & Najand, 2023; Lachman & Prenda Firth, 2004), but income appears to be unrelated to health locus of control-self (Assari & Najand, 2023). Other researchers found that lower SES (using a

Winkler index) was related to *higher* scores on all health locus of control variables, including health locus of control-self (Grotz et al., 2011), as well as with worse health outcomes (Chen & Miller, 2013) than those from higher SES backgrounds.

There may also be some trends related to gender. Some researchers have reported that women more strongly believed that their health was in their doctor's hands (i.e., high health locus of control- powerful others), (Lachman & Prenda Firth, 2004), and others reported that women were more likely to have higher health locus of control-self, (Pudrovska, 2015). It is important to note that because health locus of control is a multidimensional construct, the two outcomes (i.e., high health locus of control-self and high health locus of control-powerful others) can co-exist.

A Note on the Internalization of Negative Age Stereotypes

Although the current study will not directly measure the internalization of negative age stereotypes, it is difficult to separate some constructs in the current study (e.g., cognitive control beliefs) from the effect of internalized age stereotypes. Thus, a brief discussion is warranted. *Stereotype embodiment* (Swift et al., 2017) refers to the internalization of age-based stereotypes. Notably, in the case of age-based stereotypes, these are stereotypes that were once applied to the "other" but become more self-relevant as one approaches older adulthood. This leads to embodiment of a stereotype that one has believed since a young age (Levy, 2009). Embodiment of stereotypes has the potential to affect many aspects of life, including behaviors and personal characteristics (Swift et al., 2017).

Negative views of older adults in society tend to relate to competence (Cary et al., 2016; Fiske et al., 2002), and there is an assumption that all aspects of physical and

cognitive functioning decline with age (Lamont et al., 2015). Internalizing age stereotypes influences expectations related to aging and thus, is likely to affect our behaviors (Levy & Leifheit-Limson, 2009). Many internalize the belief that age-related health declines are unavoidable and that it is too late to do anything to positively impact one's health. This can, of course, affect one's engagement in health behaviors. Having a more positive self-perception of aging has been linked to a higher frequency of engagement in preventative health behaviors (Beyer et al., 2015; Beyer et al., 2019; Levy & Myers, 2004; Massie & Meisner, 2019; Menkin et al., 2022; Wurm et al., 2010). Middle-aged and older adults with a positive view of aging tend to engage in more physical activity than those with less positive views on aging. This pattern was found to be the case even when comparing those with poorer health (Wurm et al., 2010).

Increasing age and internalization of age-related stereotypes may be related in complex ways to lower health locus of control-self. Sargent-Cox and Anstey (2015) found significant interactions between health locus of control-self and age, gender, and beliefs in age stereotypes. Older adult women (median age of 74) in their study, for example, showed lower health locus of control-self than women with a median age of 58 or a median age of 39, and this trend was not the case for men.

Relationships Between Control Beliefs, Activity Engagement, and Purpose in Life

Research on the relationship between health locus of control and any dimension of psychological well-being is limited, including purpose in life. One study demonstrates a positive relationship between purpose in life and health locus of control-self, as well as a negative relationship between purpose in life and health locus of control-powerful

others (Zilioli et al., 2015). More research is needed on the relationship between these two variables, and the ways in which they influence health outcomes.

Perceived cognitive control is likely to affect aspects of well-being, such as purpose in life. This relationship has not been directly studied; however, many of the benefits seen in those with positive views of aging are also seen in those with higher purpose in life. Those with higher purpose in life, for example, also tend to experience a decreased risk of dementia later in life (Boyle et al., 2009; Wilson et al., 2013). There are likely pathways that contribute to the relationship between perceived cognitive control and purpose in life. As described above, the embodiment of negative age stereotypes, including perceived cognitive control, affect the activities that one engages in, including physical and cognitive activities. Perceived cognitive control may be related to other control beliefs, such as perceived control over one's health, which also affect engagement in health-related activities. In turn, these variables (i.e., engagement in health-related activities and health locus of control) are likely related to purpose in life. As an example, retirement tends to be a time when purpose in life declines due to the purpose previously assigned to one's career. Among retired individuals, however, leisure activity participation and purpose in life has been found to have a bidirectional positive relationship, according to data from the Health and Retirement Study (Lewis & Hill, 2020). Engagement in cognitive activities specifically was found to predict change in purpose in life over time (Lewis & Hill, 2020).

Adults with Multimorbidities

In addition to the relationships between control beliefs, health behaviors, and future purpose in life, the current study also examined multimorbidity status as a potential

moderator of these relationships. *Multimorbidities* generally refers to two or more chronic health conditions existing simultaneously. There is, however, some discrepancy in the literature, as some definitions of multimorbidity consider one chronic condition plus one risk factor (e.g., hypertension), or one chronic condition plus one symptom (e.g., chronic pain), to constitute multimorbidity (Griffith et al., 2019; Willadsen et al., 2016).

In the United States, about 60 percent of adults have at least one chronic health condition, and about 42 percent have multimorbidities (Buttorff et al., 2017). The number of adults with multimorbidities increases with age, with about 50 percent of adults over 50, and 60-82 percent of adults 65 or older reporting multiple chronic conditions (AARP, n.d.; Buttorff et al., 2017; Ward et al., 2014). In addition to age, low socioeconomic status (SES) — as measured by indices such as income, education level, and area deprivation index — is associated with a higher risk of developing multimorbidities (Kivimäki et al, 2020; Marengoni et al., 2020; Pathirana & Jackson, 2018).

Psychosocial Functioning and Multimorbidities

The relationship between physical and mental health is well-established, and aspects of well-being are often affected in individuals with chronic conditions. Adults with chronic conditions, for example, often experience decreases in life satisfaction, self-rated quality of life, and positive affect, along with increases in negative affect and depressive symptoms (Friedman & Ryff, 2012; Mroczek & Spiro, 2005; Williams & Egede, 2016). Research indicated that experiencing negative health events and diagnoses, including multimorbidities, may not change purpose in life, however (P. Hill et al., 2021; Friedman & Ryff, 2012). This is surprising, given that those with multimorbidities are

more likely to have functional impairment, and role changes are often related to changes in purpose in life.

The evidence on chronic conditions and purpose in life suggests that the narrative of successful aging may overvalue avoiding chronic conditions altogether. When looking at a model of successful aging put forth by Rowe and Kahn (1997), the major components of successful aging are avoiding disease and disability, maintaining high cognitive and physical functioning, and continuing engagement with life. By definition, for those with multimorbidities, one of these three components of successful aging (i.e., avoiding disease or disability) has not been met. Because most older adults have at least one chronic condition, in a given year, only about 12 percent of older adults fit Rowe and Kahn's criteria of having aged successfully (McLaughlin et al., 2010). Thus, it may be worthwhile to expand the criteria for successful aging. Resilience in the presence of chronic conditions, for example, may be a more useful criterion than absence of disease. Furthermore, because avoiding disease entirely is rare as we age, there may be more value in focusing on how we can maximize other aspects of the Successful Aging model, such as engagement with life. It is psychologically beneficial that "successful aging" is not a term reserved for a rare few. In fact, older adults who perceive themselves as having aged successfully generally have better self-rated subjective well-being even when they have multiple chronic health conditions (Weir et al., 2010).

There appears to be a relationship between multimorbidities and subjective cognitive difficulties. One twin study found that the presence of chronic disease and multimorbidity were related to both subjective cognitive impairment and objective cognitive impairment initially, but after controlling for genetic factors by using co-twin

control analyses, only subjective cognitive impairment remained significant (Caracciolo et al., 2013). The results of several other studies have indicated that those with multimorbidities compared to those with one or no chronic conditions, are more likely to self-report subjective memory difficulties (Franco et al., 2022; Pedro et al., 2016; Yap et al., 2020). In addition to subjective memory complaints, those with multimorbidities may report subjective difficulty in other cognitive domains, such as concentration (Jacob et al., 2019). It is worth noting however that many chronic conditions are associated with subjective cognitive complaints (N. Hill et al., 2021).

Current Study Rationale

Dimensions of psychological well-being have been found to be related to general self-efficacy (i.e., how much people believe they can deal with difficult situations and achieve their goals (Krok & Zarzycka, 2020). Purpose in life specifically is related to engagement in cognitive activities (Lewis & Hill, 2020), and engagement in preventative health behaviors (Kim et al., 2020; Yemiscigil & Vlaev, 2021). There is also a positive relationship between purpose in life and health locus of control-self (Zilioli et al., 2015). Additionally, perceived control over health is related to engagement in preventative health behaviors, such as physical activity (Mercer et al., 2018). Perceived cognitive control would also be expected to lead to increased engagement in challenging cognitive activities, though this relationship has not been examined directly.

Despite a lack of previous evidence on the relationship between chronic conditions and purpose in life specifically, the examination of multimorbidities as a moderator of the relationships in the current study is meaningful. First, the presence of multimorbidities is likely to be related to control beliefs, such as perceived cognitive

control and health locus of control. Previous research indicated that individuals with one chronic condition or no chronic conditions were more likely to have an internal health locus of control than those with multimorbidities (van der Linden et al., 2001). Part of the relationship between multimorbidities and perceived cognitive control may be related to objective cognitive performance, however. Longitudinal data has found that examining increasing multimorbidity has been linked to decline in performance in certain cognitive domains, such as verbal fluency tests (Fabbri et al., 2016), global cognition, immediate and delayed recall, and working memory (Wei et al., 2018). It is not clear, however, whether these findings extend to purpose in life as a specific psychological resource.

The current study examined relationships between these variables using a path analysis. This study did this by examining several paths individually. First, this study examined the relationship between one's perceived cognitive control and their health locus of control-self (i.e., their perceived control over their own health). Second, the study examined the relationship between control beliefs (i.e., perceived cognitive control and health locus of control) and engagement in health-related behaviors (both cognitive and physical). Third, the study examined how the control variables (i.e., age beliefs and health locus of control-self), and the behavioral variables (i.e., engagement in physical activity and engagement in challenging cognitive activities) are related to purpose in life. Next, this study examined all potential indirect paths. Lastly, the study looked at the presence or absence of multimorbidities (i.e., having two or more or chronic conditions, or fewer than two chronic conditions) as a potential moderator for the relationships explored in the analyses.

A population of individuals with physical multimorbidities presents a unique group in which to examine the variables in the current study because having multimorbidities may lend itself to variance in control beliefs, health behaviors, or purpose in life. Individuals with multimorbidities have likely had many role changes, which can affect purpose in life. Also, recent MIDUS evidence indicates that greater psychological resources (measured as a single factor but including many domains) are negatively associated with number of chronic conditions, and positively associated with health behaviors (Woo et al., 2020).

The relationships between all other variables and purpose in life in the proposed model were examined longitudinally. The rationale for examining the relationship between behavioral and control beliefs with purpose in life longitudinally was to establish temporal precedence of the control beliefs and health behaviors. This allowed consideration of whether these factors lead to higher purpose in life 7-10 years later versus just establishing a correlational relationship. Additionally, the longitudinal analyses allowed for the examination in change in purpose of life over time, so that future research may look to replicate the current study or compare purpose in life over time to other variables.

The present study hypothesized that:

1. Respondents with higher perceived cognitive control (measured during MIDUS II) will endorse higher levels of health locus of control-self (measured during MIDUS II). This hypothesis is depicted in path 1 of Figure 1.
2. Respondents with higher perceived cognitive control (measured during MIDUS II) will report a) a higher frequency of engagement in physical activity (measured

during MIDUS II); and b) a higher frequency of engagement in challenging cognitive activities (measured during MIDUS II). This hypothesis is depicted in paths 2a and 2b of Figure 1.

3. Respondents endorsing higher levels of health locus of control- self (measured during MIDUS II) will report a) a higher frequency of engagement in physical activity (measured during MIDUS II); and b) a higher frequency of engagement in challenging cognitive activities (measured during MIDUS II). This hypothesis is depicted in paths 3a and 3b of Figure 1.
4. Respondents endorsing higher levels of health locus of control- self (measured during MIDUS II) will endorse higher levels of purpose in life during MIDUS III (i.e., 7-10 years later). This hypothesis is depicted in path 4 of Figure 1.
5. Engagement in physical health behaviors will be related to purpose in life, such that a higher frequency of engagement in physical activity during MIDUS II will be related to higher purpose in life during MIDUS III (i.e., 7-10 years later). This hypothesis is depicted in path 5 of Figure 1.
6. Engagement in cognitive activities will be related to purpose in life, such that a higher frequency of engagement in challenging cognitive activities during MIDUS II will be related to higher purpose in life during MIDUS III (i.e., 7-10 years later). This hypothesis is depicted in path 6 of Figure 1.
7. Having multimorbidities (measured during MIDUS II) will moderate the relationships observed in hypotheses 1, 4, 5, and 6. Due to the limited available research in this area, no direction of effects was hypothesized.

Method

Source of the Data

MIDUS is an ongoing longitudinal study on health and wellbeing that includes English-speaking, non-institutionalized adults in the United States. MIDUS data were chosen for these research questions because MIDUS contains a large sample of middle-aged and older adults and includes a diverse range of individuals from across the United States. Because MIDUS researchers have thus far collected three waves of data, these data allow for longitudinal analysis. The MIDUS sample also contains a large sample of adults with multimorbidities, which helps to address the seventh hypothesis of this study.

The current study used data from MIDUS II and MIDUS III. MIDUS II data were collected between 2004 and 2006. MIDUS III data were collected between 2013 and 2014. MIDUS II and MIDUS III were chosen not only because they provide more recent samples, but also because they coincide with MIDUS researchers beginning to collect objective cognitive data via neuropsychological test administration. Although this study did not aim to analyze cognitive data specifically, many of the variables in the current study are adjacent to cognitive data and assessing data from these collection points leaves opportunity for future research using cognitive data.

Procedures of Obtaining the Original Dataset

MIDUS data and documentation are available to the public at the Inter-university Consortium for Political and Social Research (ICPSR) website. All data and codebooks can be downloaded from the ICPSR homepage. This author received approval from the University of Missouri – St. Louis' Institutional Review Board to use MIDUS II and MIDUS III data.

Procedures of Data Collection in the Original Dataset

Researchers originally recruited over 7,000 participants from across the U.S. to participate in MIDUS via random digit dialing (RDD). Specific metropolitan areas were oversampled to ensure racial and geographic representativeness (Radler, 2014). Eligibility requirements included being an adult between the ages of 25 and 74, and being non-institutionalized, English-speaking, having a working telephone, and being located in the contiguous United States. Respondents were told that researchers were using the survey to study health and wellbeing during midlife (Ryff et al., 2017).

The full MIDUS dataset involves around 20,000 variables spanning a number of demographic, psychosocial, and health-related domains. All participants completed two self-administered questionnaires and a 30-minute phone interview at each wave. Additionally, a subset of these participants also completed an 8-day daily diary of stress. Beginning in the second MIDUS wave (i.e., MIDUS II), some participants also completed cognitive assessments, biomarker testing, and brain imaging (Radler, 2014). There are minimal differences between MIDUS II and MIDUS III in the variables that are included within the datasets.

Data from MIDUS I were collected between 1995-1996. Data from MIDUS II were collected between 2004 and 2006, and data from MIDUS III were collected between 2013-2014. Each wave re-sampled those who were included in MIDUS I (minus those lost to attrition), and also recruited new samples of participants. The total number of participants included in the MIDUS I sample was 7,108 (51.1% female, mean age = 46.4). In MIDUS-II, 4,963 individuals participated, 69.8% of whom were from MIDUS I. The MIDUS III sample is comprised of 3,294 individuals, 46.3% of whom were

originally sampled in MIDUS I. Attrition in the MIDUS study, much like with prior longitudinal research, was somewhat influenced by sociodemographic factors. Less attrition was found, for example, in individuals who were white, female, and married (Radler & Ryff, 2010). These types of attrition patterns, however, were anticipated and compensated for in MIDUS in several ways, such as by oversampling populations in each wave with known higher attrition rates and by assigning more experienced research staff to participants from populations known for high attrition (to successfully complete more interviews).

Participants

This study examined 2,481 middle-aged and older adults using existing data from MIDUS II and MIDUS III. To be included in the analyses of the current study, adults had to be 40 years of age or older at the time they participated in MIDUS II and had to have participated in both MIDUS II and MIDUS III. Demographic information provided is based on how participants responded when they completed MIDUS II. The average age of participants analyzed was 56.82 (*SD* = 10.23). About 56 percent of this sample identified as female, and 44 percent identified as male. The majority were married (73%), and over 92 percent of the sample identified their race as White. The majority (94%) of the sample had received a high school diploma or GED and about half had completed an associate's degree or above. Over half the sample (53.8%) was employed either full-time or part-time, and about 23 percent of the sample was retired. The mean annual household income for the sample was $75,081.87 (*SD* = $61,126.11). On average, participants were managing 2.16 physical health conditions (*SD* = 2.23), with about 55 percent of the sample identified as having multimorbidities (i.e., two or more physical health

conditions). The average self-rated health score for participants analyzed was 3.75 (*SD* = 0.91) out of 5. A full list of demographic data can be found in Table 1.

Materials

Participants completed all measures as part of the self-administered questionnaire and phone interview portions of MIDUS data collection.

Measures

Perceived Cognitive Control. Perceived Cognitive Control was measured using items from the Personality in Intellectual Aging Contexts (PIC) Scale (Lachman et al., 1982). The original scale consists of 72 items with six subscales; MIDUS II and III used nine items, which came from four of the six subscales- *internal, chance, powerful others*, and *attitude toward intellectual aging (morale)*. MIDUS researchers used a nine-item version of the scale. The nine items were administered in MIDUS via self-administered questionnaire and were each rated on a 7- point scale from 1 (*Agree Strongly*) to 7 (*Disagree Strongly*), which were intended to create a single score, rather than subscales.

This scale was scored by calculating the mean of all items. A higher score on this measure indicates higher perceived cognitive control, or a belief that one can maintain cognitive acuity as they age. MIDUS researchers have demonstrated that the nine-item version of this scale has good internal consistency (Cronbach's alpha = .73; Ryff et al., 2007). For the specific participants assessed in the current study, internal consistency was acceptable (Cronbach's alpha = .69).

Health Locus of Control- Self. Health locus of control is generally measured as a multidimensional construct, with the subscales being *self (i.e., internal)*, *chance*, and *powerful others* (Wallston et al., 1978). It is not uncommon, however, for researchers to

examine only one of the three dimensions of health locus of control, which is also reported as either the total score on that dimension (e.g., Zhang & Jang, 2017), or the average score on the dimension (e.g., Pudrovska, 2015). The current study examined only the *self* subscale. In the MIDUS dataset, this subscale consists of 4 items, which are rated on a 7-point scale from 1 (*Agree Strongly*) to 7 (*Disagree Strongly*).

For ease of interpretation in the current study, items were recoded and a mean from these items was calculated such that a higher score indicated a higher health locus of control-self, and a lower score on these items indicated a lower health locus of control-self. The four-item version of health locus of control-self has been found to have good internal consistency (Cronbach's alpha = .74; Ryff et al., 2007). For the specific participants assessed in the current study, internal consistency was also good (Cronbach's alpha = .75).

Engagement in Physical Activity. In the current study, engagement in physical activity was examined using the mean of moderate and light activity that each individual reported participating in throughout the year. The items on this scale are measured on 6-point scale, ranging from 1 (*Several Times a Week*) to 6 (*Never*). For ease of interpretation in the current study, all items were recoded and a mean was calculated so that higher scores indicated more frequent engagement in physical activity.

Engagement in Challenging Cognitive Activities. In the current study, engagement in challenging cognitive activities was measured by averaging the self-reported frequencies of six cognitive activities, including reading books, magazines or newspapers; doing word games such as crossword, puzzles, or scrabble; playing cards or other games such as Bridge or Chess; attending educational lectures or courses; writing

(e.g., letters, journal entries, or stories); and using a computer (e.g., sending email or searching the internet). These items were rated on a 6-point scale ranging from 1 (*Daily*) to 6 (*Never*). For ease of interpretation in the current study, all items were recoded and a mean was calculated so that higher scores indicated more frequent engagement in challenging cognitive activities.

Purpose in Life. Purpose in life during the MIDUS III wave was measured using the average of seven items measured on a 7-point scale, which ranges from 1 (*Agree Strongly*) to 7 (*Disagree Strongly*). Some items on this scale are reversed scored. Higher scores on this measure indicate higher levels of purpose in life and lower scores indicate lower levels of purpose in life. The seven items on this scale are pulled from the 42-item version of Ryff's Psychological Well-Being scale. This 7-item version of purpose in life has been found to have good internal consistency (Cronbach's alpha = .70; Ryff et al., 2007). For the specific participants assessed in the current study, internal consistency was also good (Cronbach's alpha = .74).

Demographics/Potential Covariates

Information was collected on several demographic features of participants. Demographic variables were either recollected or verified for accuracy at each data collection point, depending on whether they were variables that would be expected to change over time. Date of birth, for example, was collected originally at the time participants entered the MIDUS study and was verified for accuracy during any subsequent waves in which the individual participated. Any discrepancies were noted, and errors were corrected.

The current study examined the following demographic factors as potential covariates: participants' age, sex, marital status, racial background, education, employment status, annual household income, sum of chronic physical health conditions, self-reported health, and purpose in life during MIDUS II wave. All demographic variables were from MIDUS II. The final column in Table 1 displays the way in which all potential demographic variables were coded in this study.

Age. Age of each participant was determined by subtracting participants' reported birth year (given during the phone interview) from the date of respondent data entry.

Sex. Participants were asked their sex during a phone interview upon joining the MIDUS study. Participants were given "male" or "female" as options. (These were coded as 0 = male; 1 = female).

Marital Status. Participants were asked the following question over the phone each time they participated in MIDUS: "Are you married, separated, divorced, widowed, or never married?" Note that in the final model of the current study, marital status was dichotomized as "unmarried" and "married", as will be discussed below. (These were coded as 0 = unmarried; 1 = married).

Racial Background. Racial background was self-reported by participants by asking them their main racial background and giving them the following options: White; Black and/or African American; Native American or Alaska Native, Aleutian Islander/Eskimo; Asian; Native Hawaiian or Pacific Islander; multiracial; and other. Ethnicity was asked separately from racial background. In the current study, race was dichotomized in to black, indigenous, and other people of color (BIPOC) and non-BIPOC. (These were coded as 0 = non-BIPOC; 1 = BIPOC).

Education. MIDUS asked participants to self-report the highest level of education that they had completed from the following options: No school/Some grade School; Eighth grade/Junior High; Some High school (9-12, No Diploma/No GED); GED; Graduated from High School; 1 to 2 Years of College, No Degree Yet; 3 or More Years of College, No Degree Yet; Graduated from 2-Year College, Vocational School, or Associate's Degree; Graduated from 4- or 5-Year College, or Bachelor's Degree; Some Graduate School; Master's Degree; and Ph.D., E.D., MD, DDS, LLB, LLD, JD, or Other Professional Degree.

Employment Status. Participants were asked the following question over the phone each time they participated in MIDUS "What [is] your current employment situation – are you working now for pay, self-employed, looking for work, laid off, retired, a homemaker, a full-time or part-time student, or something else?". Note that in the final model of the current study, employment status was dichotomized as "not working" and "working", as will be discussed below. (These were coded as 0 = not working; 1 = working).

Annual Household Income. Annual household income was self-reported on the self-administered questionnaire which asked about Household Total Income from Wage, Pension, Social Security, and Other Sources. Respondents were given 42 options which included "Less than $0 (Loss)", "$0 (None)", and then ranged from "$1-$1,999" to "$250,000 or More". For analyses in this study, annual income was condensed into $25,000 increments to create 10 income categories, as shown in Table 1. Respondents total household income was also recorded as a whole number, which was used to calculate a mean annual household income for those analyzed in the current study.

However, due to restrictions for variance allowed within a variable in Mplus, income categories were used in the study analyses and income was treated as an ordinal variable.

Chronic Physical Health Conditions. The following question was asked on the self-administered questionnaire to assess for the presence of chronic conditions: "In the past twelve months, how often have you experienced or been treated for any of the following?" There were up to 29 conditions to choose from, most of which can be seen in Appendix A. In addition to the items in Appendix A, the item "anxiety, depression, or some other emotional disorder" was included in the self-administered questionnaire. This item is excluded from the current study due to the question's focus on mental health disorders rather than on physical conditions. Also, 10 additional items not listed in Appendix A were included in MIDUS III but not in MIDUS II, and thus were excluded from the current study. These items were: itch; dry and sore skin; scaly skin; hand rash; pimples, acne; face rash; warts; sweating; hair loss; and none of the above.

Self-rated Health. Self-rated health was assessed using the following item from MIDUS II: "Compared to other people your age, how would you rate your overall health?" Responses were in a 5-point scale from 1 (*Excellent*) to 5 (*Poor*). For ease of interpretation in the current study, this variable was recoded so that higher scores equated to higher self-rated health.

Purpose in Life during MIDUS II. This scale was assessed as a covariate to allow the opportunity to control for the effects of current purpose in life when predicting future purpose in life. This scale included the same items and was measured the same way as purpose in life during the MIDUS III wave, using the average of seven items measured on a 7-point scale, which ranges from 1 (*Agree Strongly*) to 7 (*Disagree*

Strongly). Some items on this scale are reversed scored. Higher scores on this measure indicate higher levels of purpose in life and lower scores indicate lower levels of purpose in life.

Multimorbidities. The current study examined multimorbidities as a potential moderator and thus, calculated a separate dichotomous variable that classified the presence or absence of multimorbidities. This variable was created by summing the total number of "yes" responses to the 29 questions, as described above, that asked about the presence or absence of different chronic conditions in the self-administered questionnaire in MIDUS. Multimorbidities was defined as endorsing two or more physical health conditions over the past 12 months. Thus, a final variable was calculated that dichotomized the sample into those with and without multimorbidities. (This final variable was coded as 0 = no multimorbidities; 1 = multimorbidities).

Data Analysis

Initial Analyses

Initial analyses were conducted in SPSS to ensure that the data met assumptions of path analysis, including data normality as well as variable linearity and multicollinearity. Data were screened for missing data and outliers, and relevant descriptive statistics were examined. Table 2 lists the percentage of each missing variable. Missing data were handled by using a Full Information Maximum Likelihood (FIML) estimation within Mplus. Table 1 lists the sample demographics and Table 3 lists descriptive statistics for the variables in the main analyses.

Covariates were also examined, and significant covariates were included in the main analyses. Covariates assessed included: age, sex, marital status, racial background,

education level, employment status, annual household income, number of chronic conditions, self-rated health, and purpose in life during the MIDUS II wave. Data were also assessed to determine whether they met assumptions of path analysis, including data normality, variable linearity, and absence of multicollinearity.

Path analyses were conducted in using Mplus Version 8 (Muthén & Muthén, 2019) to test all hypotheses.

Power Analysis

In order to have adequate statistical power for path analysis in SEM, there should be between 10-20 cases for every estimated parameter (Kline, 2015). The hypothesized model had 5 observed variables, and 8 regression coefficients, totaling to 13 parameters. The final model adds 6 covariates and an additional covariance (between physical activity and challenging cognitive activities), and adds 18 total regression coefficients, totaling to 37 parameters. To be on the high end of Kline's (2015) requirements, this model requires 740 participants. There are 2,481 participants in the dataset who completed questionnaires and interviews for both MIDUS II and MIDUS III. Thus, this analysis is considered sufficiently powered.

Results

Missing Data

In general, the amount of missing data for the variables included in the main analysis was low, with the five main variables having less than one percent of data missing for the targeted sample. For the targeted covariates, the amount of missing data was also relatively low. The highest percentage of missing data was annual household income, which had 3.4 percent of data missing, followed by employment status, which

had 2.2 percent of data missing. All other covariates had less than one percent of data missing. Complete information on missing data is presented in Table 2. Missing data in the current study were managed using full information maximum likelihood (FIML) in Mplus.

Initial Analyses

Assumptions

The descriptive statistics for perception of cognitive aging, health locus of control-self, physical health behaviors, cognitive health behaviors, and purpose in life can be found in Table 1. Mahalanobis Distances and Cook's Distances were used to assess for multivariate outliers. Using the five main variables in the analysis, a cut off of 20.52 (using the chi-square distribution; Tabachnick & Fidell, 2007) was used when assessing Mahalanobis distance values. There were 41 observations that exceeded this value, which indicated that scores deviated from the centroid. For these observations with high Mahalanobis distance values, Cook's distances were examined, using a cutoff of 1 to determine influence of observations (Tabachnick & Fidell, 2007). None of these values had a Cook's distance value of 1 or greater. As such, all participants were retained.

Mahalanobis Distances were also assessed for the five main variables plus the eight covariates, using a cut-off of 34.52. There were 39 observations that exceeded this cutoff. For these observations with high Mahalanobis distance values, Cook's distances were examined, using a cutoff of 1 to determine influence of observations. None of these values had a Cook's distance value of 1 or greater. All participants were retained.

The assumption of linearity was also assessed. Tests of linearity indicated that purpose in life demonstrated linearity with all variables, including perceived cognitive

control, $F(1,57) = 324.68.10$, $p < .001$; health locus of control-self $F(1,27) = 146.06$, $p < .001$; physical activity, $F(1,54) = 118.24$, $p < .001$; and challenging cognitive activity $F(1,39) = 108.85$, $p < .001$.

To test the assumption of data normality, skewness and kurtosis were examined. Table 3 depicts the skewness and kurtosis of each main variable in the model. As can be seen in Table 3, health locus of control-self has a slight positive skew, with a skewness value of -2.29, which is above the cut-off of ±2 and a high kurtosis of 8.16, which is above the cut-off of ±7 (George & Mallery, 2010). The residuals were also assessed for normality, and a Shapiro-Wilk test indicated nonnormality of residuals, $W(2443) = 0.98$, $p < .001$. Large sample sizes such as that in the current study, however, are often robust to non-normality (Schmidt & Finan, 2018). Thus, the data were left as is in the model (i.e., not transformed). As a precaution, when running analyses in Mplus, all main effects were tested a second time using an mlr estimator, which is robust to nonnormal data. All effects that were significant initially (i.e., using ml estimator) were all significant using the mlr estimator, and all effects that were non-significant using the ml estimator remained non-significant using the mlr estimator. The fit of the model also did not change using the mlr estimator.

The assumption of absence of multicollinearity was also examined. Table 4 shows the correlations among the main variables and the continuous covariates. (Note: this table was also used to test for potential covariates. As such, there are some variables included that were not used in the final model.) The values demonstrate that multicollinearity is not present among these variables. As an additional assessment of multicollinearity, Purpose in Life in MIDUS III was regressed on all other variables and potential

covariates, and variance inflation factor (VIF) values were examined. No VIF values exceeded even a conservative cut-off of 2.5 (Johnston et al., 2018), and no tolerance values were lower than 0.1 (Tabachnick & Fidell, 2018). All VIF and Tolerance values can be seen in Table 5.

Potential Covariates

Ten variables were analyzed as potential covariates-age, sex, marital status, racial background, education level, employment status, annual household income, number of chronic conditions, self-rated health, and purpose in life during the MIDUS II wave. The correlations in Table 4 were also used to identify significant covariates. Age was found to be significantly negatively related to purpose in life (MIDUS III), $r = -0.10$, $p < .001$, making it a relevant covariate, and it was also negatively related to perceived cognitive control, $r = -0.06$, $p < .01$, and engagement in physical activity $r = -0.11$, $p < .001$, and was positively related to health locus of control-self $r = 0.06$, $p < .01$.

Number of physical health conditions was significantly negatively related to purpose in life, $r = -0.19$, $p < .001$, making it a relevant covariate. Number of physical health conditions was also negatively related to perceived cognitive control, $r = -0.19$, $p < .001$ health locus of control-self $r = -0.14$, $p < .001$, and engagement in physical activity $r = -0.07$, $p < .001$.

Self-rated health was significantly positively related to purpose in life (MIDUS III), $r = 0.26$, $p < .001$, making it a relevant covariate, and was positively related to all other main variables.

Education level was significantly positively related to purpose in life (MIDUS III), $\rho = 0.22$, $p < .001$, making it a relevant covariate, and was positively related to all

other main variables. Because education level is considered an ordinal variable, it was left as it was coded (see Table 1) in Mplus and treated as continuous within the main analyses. This is considered acceptable for covariates within Mplus (Muthén & Muthén, 2019, p. 19).

Annual household income was also treated as an ordinal variable in the current study. Annual household income was significantly related to purpose in life (MIDUS III), $\rho = 0.25$, $p < .001$, making it a relevant covariate. Annual household income was also positively related to perceived cognitive control, $\rho = 0.11$, $p < .001$, engagement in physical activity, $\rho = 0.14$, $p < .001$, and engagement in challenging cognitive activities, $\rho = 0.16$, $p < .001$.

Purpose in life during the MIDUS II waves was also significantly related to purpose in life (MIDUS III), $r = 0.64$, $p < .001$, and was positively related to all other main variables.

Nominal covariates in Mplus need to be dichotomized to use as covariates (Muthén & Muthén, 2019, p. 19), and thus, marital status was recoded to dichotomize it into the following two categories: 1) never married, widowed, separated, or divorced (henceforth referred to as "unmarried"); and 2) married. (These were coded as 0 = unmarried; 1 = married). A series of independent samples t-tests were then run to test whether marital status was a significant covariate. When comparing married and unmarried individuals on purpose in life (MIDUS III) scores, Levene's test for equality of variances was significant ($F(2475, 1095.18) = 14.33$, $p < .001$), and thus, equal variances were not assumed for this analysis. Marital status was considered a relevant covariate, as it was significantly related to purpose in life (MIDUS III), $t(1095.18) = -7.41$, $p < .001$,

such that unmarried individuals reported lower purpose in life (M = 5.20, SD = 1.07) than did married individuals (M = 5.55, SD = 0.96). Additionally, marital status was significantly related to engagement physical activity, $t(2458) = -2.00$, $p < .05$. (Equal variances were assumed for this analysis due to a non-significant Levene's test, $F(2458, 1143.52) = 1.06$, $p = .30$). Unmarried individuals reported engaging in less frequent physical activity (M = 4.46, SD = 1.26) than did married individuals (M = 4.58, SD = 1.23).

Sex was also tested as potential covariate. (This variable was coded as 0 = male; 1 = female). A series of independent samples t-tests were then run to test whether marital status was a significant covariate. Sex was not found to be a relevant covariate, $t(2476) = 0.56$, $p = .57$. (Equal variances were assumed for this analysis due to a non-significant Levene's test, $F(2476, 2347.23) = 0.01$, $p = .94$).

Racial background was coded to dichotomize it into the following two categories: 1) non-BIPOC, and 2) BIPOC. (These were coded as 0 = non-BIPOC; 1 = BIPOC.) A series of independent samples t-tests were then run to test whether racial background was a significant covariate. Racial background was not found to be a relevant covariate, $t(2468) = 0.29$, $p = .78$. (Equal variances were assumed for this analysis due to a non-significant Levene's test, $F(2468, 196.74) = 0.01$, $p = .41$).

Employment status was recoded to dichotomize it into the following two categories- unemployed, retired, or disabled/sick leave (henceforth referred to as "not working"); or employed, self-employed, homemaker, or student (henceforth referred to as "working"). (This variable was coded as 0 = not working; 1 = working.) A series of independent samples t-tests were then run to determine whether employment status was a

significant covariate. Employment status was considered a relevant covariate, as it was significantly related to purpose in life, $t(2421) = -7.63$, $p < .001$ (Equal variances were assumed for this analysis due to a non-significant Levene's test, $F(2421, 1178.95) = 0.00$, $p = .99$). Individuals who were working ($M = 5.55$, $SD = 0.99$) reported higher purpose in life than those who were not working ($M = 5.21$, $SD = 0.98$). Employment status was also significantly related to perceived cognitive control, $t(2419) = -6.03$, $p < .001$, (Equal variances were assumed for this analysis due to a non-significant Levene's test, $F(2419, 1120.87) = 1.24$, $p = .27$). Individuals who were working reported higher perceived cognitive control ($M = 5.05$, $SD = 0.92$) than those who were not working ($M = 4.79$, $SD = 0.97$). Employment status was also significantly related to physical activity, $t(1047.71) = -2.16$, $p = .03$ (Equal variances were not assumed for this analysis due to a significant Levene's test, $F(2404, 1047.71) = 15.14$, $p < .001$). Individuals who were working reported engaging in a higher frequency of physical activity ($M = 4.59$, $SD = 1.19$) than did those who were not working ($M = 4.45$, $SD = 1.33$).

Table 1

Participant Demographics at Time of MIDUS II (*N* = 2,481)

Demographic Characteristic	n	Valid %	Code Assigned (Nominal and Ordinal Only)
Age	*M* = 56.82	*SD* = 10.23	N/A
Sex/Gender			
Male	1095	44.1	0
Female	1386	55.9	1
Marital Status			
Married	1810	73	1
Separated	39	1.6	2
Divorced	301	12.1	3
Widowed	162	6.5	4
Never Married	168	6.8	5
Marital Status (Dichotomized)			
Never Married, Separated, Divorced, or Widowed	670	27.0	0
Currently Married	1810	73.0	1
Racial Background			
White/Caucasian	2300	93	1
Black/African American	77	3.1	2
Native American or Alaska Native	35	1.4	3
Asian	10	0.4	4
Other	51	2.1	5
Dichotomized Race			
Non-BIPOC	2300	93	0
BIPOC	173	7	1
Education			
No High School Diploma	114	4.6	1
High School Diploma or GED	630	25.4	2
Some College; No Degree	517	20.8	3
Associate's Degree/Two-Year Degree	184	7.4	4
Bachelor's Degree/Four-Year Degree	519	20.9	5
Some Graduate School	85	3.4	6
Master's Degree	296	11.9	7
Ph.D., Ed.D., MD, DDS, LLB, LLD, JD, or Other Professional Degree	134	5.4	8
Employment Status			
Employed (Full-Time or Part-Time)	1334	53.8	1
Self-Employed	300	12.1	2
Unemployed or Laid Off	52	2.1	3
Retired	575	23.3	4
Homemaker	129	5.2	5

Student (Full-Time or Part-Time)	7	0.3	6
Permanently Disabled or Sick Leave	29	1.2	7
Employment Status (Dichotomized)			
Unemployed, Retired, or Disabled/Sick	656	27	0
Employed, Self-Employed, Homemaker, or Student	1770	73	1
Annual Household Income (All Sources)	*M* = 75,081.87	*SD* = 61,126.11	
$0-$24,999	436	18.2	1
$25,000-$49,999	518	21.6	2
$50,000-$74,999	482	20.1	3
$75,000-$99,999	354	14.8	4
$100,000-$124,999	230	9.6	5
$125,000-$149,999	144	6.0	6
$150,000-$174,999	66	2.8	7
$175,000-$199,999	53	2.2	8
$200,000-249,999	49	2.0	9
$250,000 or Higher	65	2.7	10
Number of Physical Health Conditions	*M* = 2.17	*SD* = 2.23	N/A
Multimorbidity Status (2+ Chronic Conditions)			
No Multimorbidities (0 or 1 Physical Health Conditions)	1126	45.4	0
Multimorbidities (2+ Physical Health Conditions)	1355	54.6	1
Purpose in Life during MIDUS II	*M* = 5.58	*SD* = 0.97	N/A
Self-Rated Health	*M* = 3.75	*SD* = 0.91	N/A

Table 2

Percentage of Missing Data

Variable	Total: Missing n (%) 2,481 total participants
Age (MIDUS II)	0(0)
Sex/Gender (MIDUS II)	0(0)
Marital Status (MIDUS II)	1(<0.1)
Racial Background (MIDUS II)	8(0.3)
Education (MIDUS II)	2(0.1)
Employment Status (MIDUS II)	55(2.2)
Annual Household Income (MIDUS II)	84(3.4)
Number of Chronic Physical Health Conditions (MIDUS II)	0(0)
Self-Rated Health (MIDUS II)	1(<0.1)
Perceived Cognitive Control (MIDUS II)	5(0.2)
Health Locus of Control-Self (MIDUS II)	14(0.6)
Frequency of Engagement in Physical Activities (MIDUS II)	20(0.8)
Frequency of Engagement Challenging Cognitive Activities (MIDUS II)	14(0.6)
Purpose in Life (MIDUS III)	1(0.1)
Purpose in Life (MIDUS II)	6(0.2)

Table 3

Descriptive Statistics for Main Analysis Variables

Characteristic	*M* (Range)	*SD*	Skewness	Kurtosis
Perceived Cognitive Control (MIDUS-II)	4.97 (1-7)	0.94	-0.08	-0.19
Health Locus of Control (MIDUS-II)	6.10 (1-7)	0.87	-2.29	8.16
Frequency of Engagement in Physical Activities (MIDUS-II)	4.55 (1-6)	1.24	-0.93	0.40
Frequency of Engagement Challenging Cognitive Activities (MIDUS II)	3.13 (1-6)	0.82	0.12	-0.27
Purpose in Life (MIDUS III)	5.46 (1-7)	1.00	-0.55	-0.20

Table 4

Correlations Between Main Variables and Potential Covariates

	1	2	3	4	5	6	7	8	9	10
1. Perceived Cognitive Control (MIDUS II)	--									
2. Health Locus of Control-Self (MIDUS II)	0.17**	--								
3. Engagement in Physical Activity (MIDUS II)	0.14**	0.16**	--							
4. Engagement in Challenging Cognitive Activity (MIDUS II)	0.25**	0.09**	0.19**	--						
5. Purpose in Life (MIDUS III)	0.34**	0.23**	0.21**	0.21**	--					

6. Age	-0.06*	0.06*	-0.11**	-0.01	-0.10**	--				
7. Number of Chronic Physical Health Conditions	-0.19**	-0.14**	-0.07**	-0.05	-0.19**	0.18**	--			
8. Self-rated Health	0.26**	0.32**	0.19**	0.15**	0.26**	0.06*	-0.36**			
9. Education	[a]0.24**	[a]0.07**	[a]0.20**	[a]0.34**	[a]0.22**	[a] -0.11**	[a]-0.13**	[a]0.23**		
10. Total household income	[a]0.11**	[a]0.02	[a]0.14**	[a]0.16**	[a]0.25**	[a]-0.31**	[a]-0.18**	[a] 0.15**	[a]0.36**	
11. Purpose in Life during MIDUS II	0.36**	0.27**	0.17**	0.18**	0.64**	0.01	-0.20**	0.29**	[a]0.16**	[a]0.18**

*p<.01
**p<.001

Note. Items with superscript [a] contain an ordinal variable and thus, statistic reported is Spearman's rho. All other reported correlations are Pearson's *r*.

Table 5

VIF and Tolerance Values When Regressing Purpose in Life (MIDUS III) on Variables

	VIF	Tolerance
Perceived Cognitive Control (MIDUS II)	0.79	1.26
Health Locus of Control-Self (MIDUS II)	0.84	1.19
Engagement in Physical Activity (MIDUS II)	0.88	1.14
Engagement in Challenging Cognitive Activities (MIDUS II)	0.82	1.22
Age	0.65	1.53
Sex	0.89	1.12
Marital Status	0.87	1.15
Racial Background	0.97	1.03
Education Level	0.75	1.34
Employment Status	0.67	1.48
Annual Household Income	0.71	1.40
Number of Chronic Conditions	0.79	1.26
Self-Rated Health	0.72	1.38
Purpose in Life during MIDUS II	0.77	1.29

Main Analyses

Path analysis was conducted using Mplus Version 8 (Muthén & Muthén, 2019) for all hypotheses. The single model (as depicted in Figure 1, with relevant covariates) was initially run. The initial model included the following covariates (which appeared to be related to purpose in life in preliminary analyses): age, marital status, education level, employment status, annual household income, number of chronic conditions, self-rated health, and purpose in life during the MIDUS II wave. Fit of this model was assessed using values of Root Mean Square Error of Approximation (RMSEA), where .06 or less was considered an acceptable fit (Hu & Bentler, 1999), and Comparative Fit Index (CFI), where 0.90 or higher was considered acceptable fit (Hu & Bentler, 1999). Fit of this model was adequate, CFI = .98, RMSEA = .05, SRMR = .01, $X^2(9) = 64.83$, $p < .001$.

Despite model fit appearing adequate, some adjustments were made to the model after examining the model results and modification indices. The following covariates were not significantly related to purpose in life in the initial model results and were removed from subsequent analyses: marital status (ß = 0.02, $p = .15$) and sum of chronic conditions (ß = -0.01, $p = .43$). Modification indices also recommended correlating frequency of engagement in physical activity and frequency of engagement in challenging cognitive activities. Because active adults may be likely to engage in a variety of leisure activities, this made theoretical sense and, thus, these two variables were correlated in the final model. Additionally, the initial version of the model indicated that income is not significantly related to engagement in physical activity (ß = 0.02, $p = .41$), that self-rated health is not significantly related to engagement in challenging cognitive activities, (ß = 0.02, $p = .35$) and that income is also not significantly related to

challenging cognitive activities, (ß = 0.03, p = .12). These relationships were thus removed in the final version of the path analysis.

The final model fit was acceptable and is described in more detail below. As such, the following parameter estimates were examined for the hypotheses of this study.

H1: The first hypothesis examining the relationship between perceived cognitive control and health locus of control-self was assessed by testing path 1 in Figure 1.

H2: The second hypothesis examining the relationship between perceived cognitive control and engagement in health-related behaviors was assessed by testing paths 2a and 2b in Figure 1.

H3: The third hypothesis examining the relationship between health locus of control-self and engagement in health-related behaviors was assessed by testing paths 3a and 3b in Figure 1.

H4: The fourth hypothesis examining the relationship between health locus of control-self and purpose in life was assessed by testing path 4 in Figure 1.

H5: The fifth hypothesis examining the relationship between physical activity and purpose in life was assessed by testing path 5 in Figure 1.

H6: The sixth hypothesis examining the relationship between engagement in challenging cognitive activities and purpose in life was assessed by testing path 6 in Figure 1.

H7: The seventh hypothesis examining the possible moderating role of multimorbidities was assessed by running moderation regression models on paths 1, 4, 5, and 6 in Figure 1.

Full information maximum likelihood was used to address missing data, which was less than 1% for all main variables (i.e., 0.2% for purpose in life, 0.6% for perceived cognitive control, 0.6% for health locus of control-self, 0.8% for engagement in physical activity, and 0.6% for engagement in challenging cognitive activity). Missing data were less than 5% for all covariates (i.e., 2.2% for employment status, 0.1% for education, 0% for age, and <.01% for marital status).

The fit indices for the final overall model indicated adequate fit, CFI = .990, RMSEA = .036, SRMR = .010, $X^2(8) = 33.801$, $p < .001$. According to the R^2, the final model predicted 45% of the variance for purpose in life, 14% for health locus of control-self, 11% for engagement in physical activity, and 15% for engagement in challenging cognitive activity. Figure 2 presents a visual representation with all standardized values of all main analyses and covariate relationships among variables. Table 6 presents all unstandardized and standardized estimates for all main analyses, correlations, and covariates in the final model.

Figure 1

Model of hypothesized relations between view of aging, health locus of control, physical health behavior, cognitive engagement, and purpose in life.

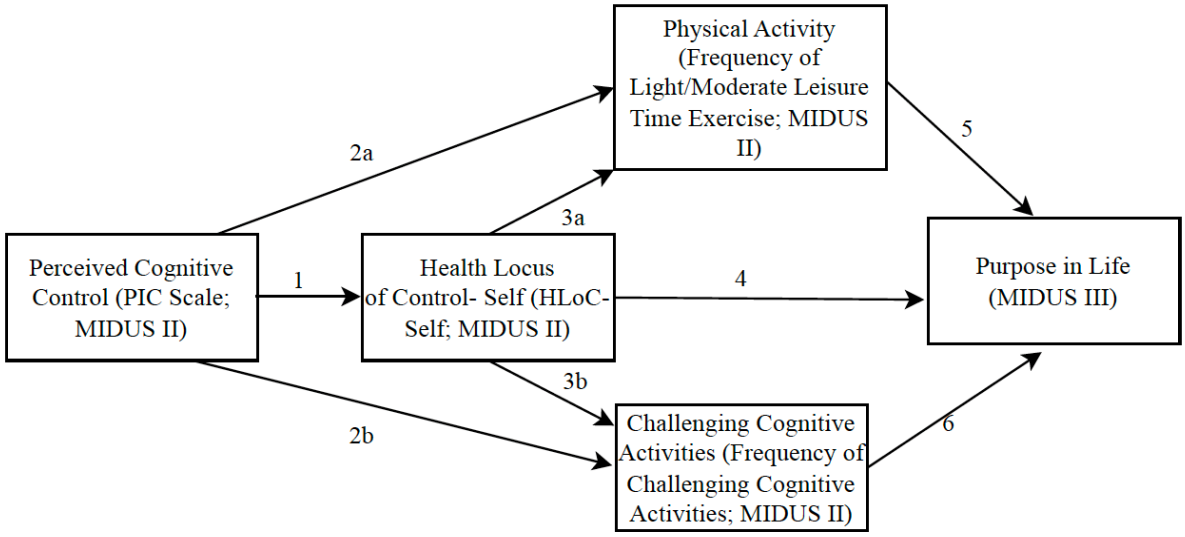
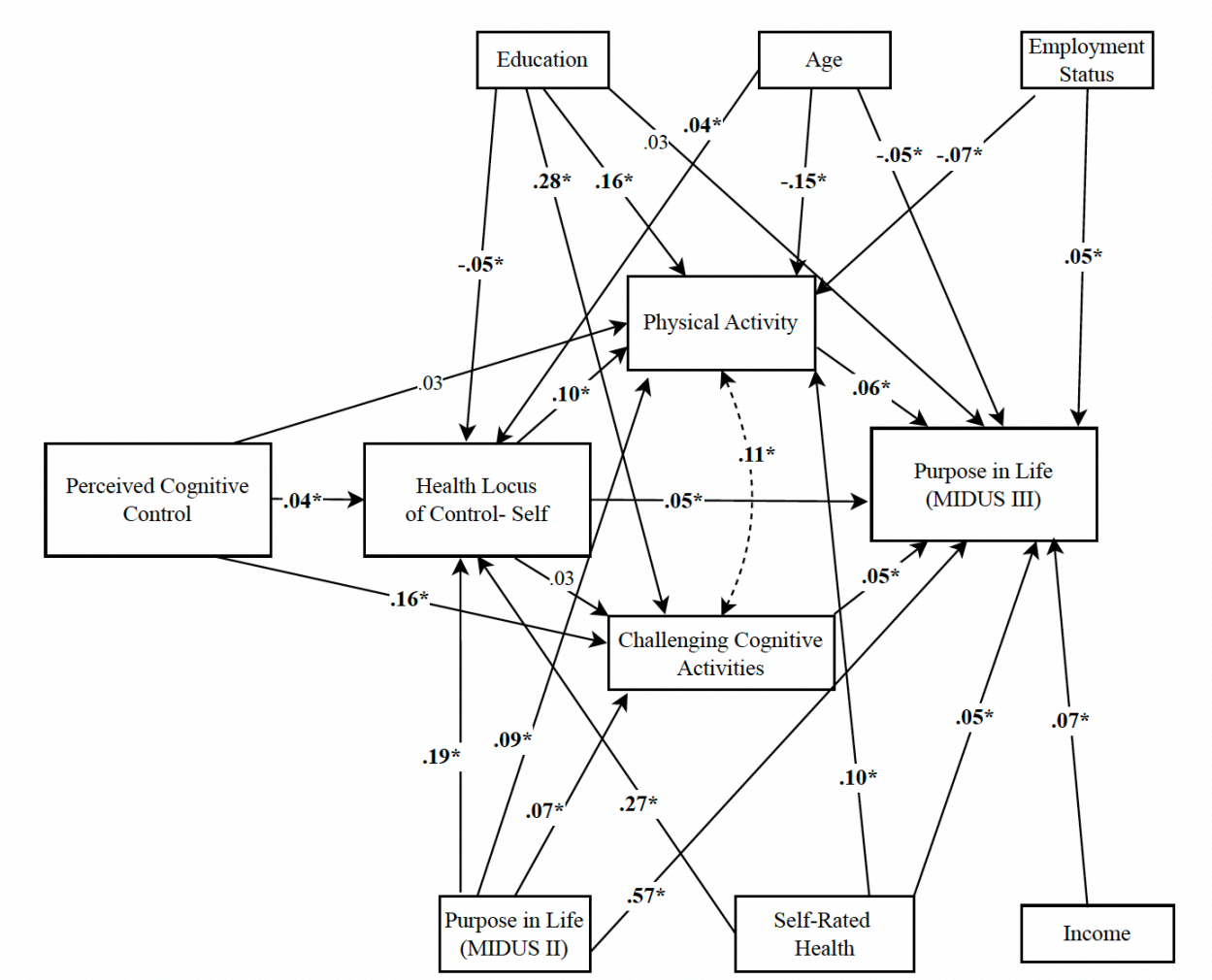


Figure 2

Path Analysis Model. Numbers indicate standardized path coefficients. Significant paths are bolded. Employment Status, Education, Age, Income, Self-Rated Health, and Purpose in Life during MIDUS II were controlled for as covariates in the model. All covariates were also correlated with one another, and with Perceived Cognitive Control. (N = 2,481)



Note. *Paths bolded and with an asterisk are considered significant, with confidence intervals not containing zero

Perceived cognitive control was positively related to health locus of control-self, supporting the first hypothesis. Higher perceived cognitive control was not related to frequency of engagement in physical activity but was related to higher frequency of engagement in challenging cognitive activities, and so the second hypothesis was partially supported. Higher health locus of control-self was related to higher frequency of engagement in physical activity but was unrelated to frequency of engagement in challenging cognitive activities. Thus, the third hypothesis was also partially supported. Higher health locus of control-self during MIDUS II was related to higher future purpose in life (i.e., during MIDUS III), and thus, the fourth hypothesis was supported. Higher frequency of engagement in physical activity during MIDUS II was associated with higher future purpose in life, supporting the fifth hypothesis. Higher frequency of engagement in challenging cognitive activities during MIDUS II was related to higher future purpose in life, supporting the sixth hypothesis. The correlation between frequency of engagement in physical activity and frequency of engagement in challenging cognitive activities was significantly positive.

Age was positively related to health locus of control-self and was negatively related to physical activity and future purpose in life. Education was significantly negatively related to health locus of control-self. Education was positively related to related to engagement in physical activity and engagement in challenging cognitive activities. Notably education was unrelated to future purpose in life in the final model. Self-rated health was positively related to health locus of control-self, engagement in physical activity, and future purpose in life. Employment status was significantly related to engagement in physical activity, such that those who were not employed reported

engaging in more physical activity. Employment status was significantly related to future purpose in life, such that those who were employed during MIDUS II reported higher purpose in life 7-10 years later (i.e., during MIDUS III) than those who were not employed during MIDUS II. Income was positively related to future purpose in life. Lastly, purpose in life during MIDUS II was positively related to health locus of control-self, engagement in physical activity, engagement in challenging cognitive activities, and future purpose in life.

Table 6

Parameter Estimates for Path Analysis Model

Parameter	*B(SE)*	ß	*p*	95% Confidence Interval
Main Effects				
Cognitive Control → HLoC- Self	**.04(.02)**	**.04**	**.05**	**[.001, .089]**
Cognitive Control → Physical Activity	.04(.03)	.03	.19	[-.016, .070]
Cognitive Control → Challenging Cognitive Activities	**.14(.02)**	**.16**	**<.001**	**[.119, .200]**
HLoC- Self → Physical Activity	**.15(.03)**	**.10**	**<.001**	**[.060, .144]**
HLoC- Self → Challenging Cognitive Activities	.04(.02)	.03	.14	[-.008, .066]
HLoC- Self → Purpose in Life	**.06(.02)**	**.05**	**.003**	**[.017, .080]**
Physical Activity → Purpose in Life	**.05(.01)**	**.06**	**<.001**	**[.031, .096]**
Challenging Cognitive Activities → Purpose in Life	**.06(.02)**	**.05**	**.001**	**[.019, .085]**
Correlations				
Physical Activity & Challenging Cognitive Activities	**.09(.02)**	**.11**	**<.001**	**[.061, .149]**
Covariates				
Age → HLoC- Self	**.003(.002)**	**.04**	**.04**	**[.001, .074]**
Age → Physical Activity	**-.02(.003)**	**-.15**	**<.001**	**[-.196, -.105]**
Age → Purpose in Life	**-.01(.002)**	**-.05**	**.02**	**[-.085, -.007]**
Education → HLoC- Self	**-.02(.01)**	**-.05**	**.02**	**[-.088, -.009]**
Education → Physical Activity	**.10(.01)**	**.16**	**<.001**	**[.128, .203]**

Education → Challenging Cognitive Activities	**.12(.01)**	**.28**	**<.001**	**[.243, .317]**
Education → Purpose in Life	.02(.01)	.03	.07	[-.005, .065]
Self-Rated Health → HLoC- Self	**.25(.02)**	**.27**	**<.001**	**[.222. .306]**
Self-Rated Health → Physical Activity	**.14(.03)**	**.10**	**<.001**	**[.054, .144]**
Self-Rated Health → Purpose in Life	**.06(.02)**	**.05**	**.003**	**[.016, .085]**
Employment Status → Physical Activity	**-.20(.07)**	**-.07**	**.003**	**[-.115, -.026]**
Employment Status → Purpose in Life	**.12(.04)**	**.05**	**.005**	**[.016, .092]**
Income → Purpose in Life	**.03(.01)**	**.07**	**<.001**	**[.031, .103]**
Purpose in Life MIDUS II → HLoC- Self	**.17(.02)**	**.19**	**<.001**	**[.146, .229]**
Purpose in Life MIDUS II → Physical Activity	**.11(.03)**	**.09**	**<.001**	**[.032, .114]**
Purpose in Life MIDUS II → Challenging Cognitive Activities	**.06(.02)**	**.07**	**<.001**	**[.146, .229]**
Purpose in Life MIDUS II → Purpose in Life	**.59(.02)**	**.57**	**<.001**	**[.542, .603]**

Note. Bolded numbers indicate significant finding, with confidence interval not containing 0. HLoC- Self = Health Locus of Control- Self

Indirect Paths

The indirect paths in this model were tested. First, the indirect effect of perceived cognitive control on physical activity through health locus of control- self was tested. This path was non-significant, *ab* = .004, *p* = .09, 95% CI [.000, .010]. Second, the indirect effect of perceived cognitive control on engagement in challenging cognitive activity through health locus of control- self was tested, which was found to be non-significant, *ab* = .001, *p* = .27, 95% CI [.000, .004]. Next, the indirect effect of perceived cognitive control on purpose in life (MIDUS III) through health locus of control- self was tested, and was found to be non-significant, *ab* = .002, *p* = .12, 95% CI [.000, .005]. The indirect effect of perceived cognitive control on purpose in life (MIDUS III) through physical activity was then tested, and was found to be non-significant, *ab* = .002, *p* = .26, 95% CI [-.001, .006].

Next, the indirect effect of perceived cognitive control on purpose in life (MIDUS III) through challenging cognitive activity was tested, and was found to be significant, *ab* = .008, p <.01, 95% CI [.003, .015]. Higher perceived cognitive control was associated with a higher frequency of engagement in challenging cognitive activities, which was associated with higher future purpose in life.

The indirect effect of health locus of control- self on purpose in life (MIDUS III), through physical activity was then tested, and was found to be significant, *ab* = .006, p <.01, 95% CI [.003, .011]. Higher health locus of control-self was associated with a higher frequency of engagement in physical activity, which was associated with higher future purpose in life.

Finally, the indirect path from health locus of control- self to purpose in life (MIDUS III), through challenging cognitive activity was then tested, and was found to be non-significant, *ab* = .001, p =.21, 95% CI [.000, .004].

Moderation Analyses

The final hypothesis in this paper was that some of the paths in this model would be moderated by multimorbidity status (i.e., whether a participant has two or more chronic health conditions). The hypothesis specifically stated that on paths 1, 4, 5, and 6 in Figure 1 would be moderated by multimorbidity status.

An initial model constrained all 26 paths (i.e., all hypothesized paths, the covariate paths, and the covariance between physical activity and challenging cognitive activities). The fit indices for this model indicated good fit, CFI = .990, RMSEA = .022, SRMR = .019, $X^2(42) = 68.329$, p = .006. Each of the four paths hypothesized to be moderated by multimorbidity status was unconstrained individually to check for

moderation of multimorbidity status on that particular path. Each unconstrained was compared to the fully constrained model using chi-square difference tests. A critical value for X^2 difference for any given model testing one unconstrained variable would be 3.84. All chi-square difference values are displayed in Table 7.

The following paths were assessed according to hypothesis 7:

1) Multimorbidity status did not affect the path between perceived cognitive control and health locus of control-self, X^2 difference = 0.39.
2) Multimorbidity status did not affect the path between health locus of control-self during MIDUS II and purpose in life during MIDUS III, X^2 difference = 0.52.
3) Multimorbidity status did not affect the path between engagement in physical activity during MIDUS II and purpose in life during MIDUS III, X^2 difference = 0.10.
4) Multimorbidity status moderated the path between engagement in challenging cognitive activities during MIDUS II and purpose in life during MIDUS III, X^2 difference = 5.87. For those with no multimorbidities, engagement in challenging cognitive activities was significantly positively related to future purpose in life, ß = .10, p <.001 and for those with multimorbidities, engagement in challenging cognitive activities was not significantly related to future purpose in life, ß = .02, p = .35.

Table 7

Analyses of Model Path Moderation by Multimorbidity Status

Parameter	*No Multimorbidities* ß*(SE)*	*Multimorbidities* ß *(SE)*	X^2 diff
Cognitive Control → HLoC- Self	.03(.03)	.05(.03)	0.39
HLoC- Self → Purpose in Life	.06(.02)*	.04(.02)	0.52
Physical Activity → Purpose in Life	.08(.02)***	.05(.02)*	1.03
Challenging Cognitive Activity → Purpose in Life	.10(.02)***	.02(.02)	5.87

*p< .05; **p<.01; ***p<.001

Note. HLoC- Self = Health Locus of Control- Self

Discussion

The current study used data from the MIDUS dataset to examine the relationships between future purpose in life, perceived cognitive control, health locus of control-self, engagement in physical activity, and engagement in challenging cognitive activities in a sample of middle-aged and older adults. This study added to extant MIDUS literature and was the first to examine this particular combination of variables regarding future purpose in life. Overall, this study found that health locus of control-self, engagement in physical activity and engagement in challenging cognitive activities directly relates to future purpose in life, that perceived cognitive control directly relates to engagement in challenging cognitive activities and that health locus of control-self directly relates to engagement in physical activity. Additionally, perceived cognitive control indirectly relates to future purpose in life via engagement in challenging cognitive activities. Health locus of control-self also showed an indirect path to future purpose in life through engagement in physical activity. Lastly the direct path from engagement in challenging cognitive activities to purpose in life was moderated by multimorbidity status, such engagement in challenging cognitive activities was related to future purpose in life only for those with no multimorbidities.

Sample Characteristics

It is difficult to compare purpose in life scores in the current study to those from datasets other than MIDUS, as many other datasets measured purpose in life on scales other than the 1-7 scale used in MIDUS. Overall, the sample of individuals in the present study reported moderately high levels of purpose in life during the MIDUS III wave, with an average of 5.45 on a scale from 1-7 (with 7 being the highest possible response).

This average is consistent with purpose in life for everyone in MIDUS III, which was 5.44 (Ryff et al., 2019), and for everyone in MIDUS II, which was 5.48 (Ryff et al., 2007). The participants in the current study differed from the general MIDUS population in that they had to be 40 or older during the MIDUS II wave and had to complete both the MIDUS II and MIDUS III self-administered questionnaires. It is well-documented that ratings of purpose in life tend to decline with age (e.g., Pfund, Ratner, et al., 2022). Average purpose in life decreased slightly among individuals in the current sample from MIDUS II to MIDUS III waves, as those in this sample reported an average purpose in life of 5.59 during MIDUS II.

Participants within the current study had a mean perceived cognitive control of 4.97 on a 1-7 scale, with 7 indicating the highest perceived cognitive control. The specific measure used in the current study, Personality in Intellectual Aging Contexts (PIC), is not widely used outside of MIDUS. Studies outside of MIDUS that have used it have used a 6-point Likert scale instead of a 7-point Likert scale (e.g., Zahodne et al., 2015), making it difficult to compare to the results of the current study. The sample analyzed in the current study, however, had very similar PIC scores with the entire sample of people who participated in MIDUS II (Ryff et al., 2007).

Health locus of control-self in the current study had a mean of 6.10 and is similar to the overall MIDUS II sample, which had a mean of 6.06 (Ryff et al., 2007). Interestingly, this was consistent across other MIDUS samples, such as MIDUS III, which had a mean of 6.05 (Ryff et al., 2019). Other studies have also found high health locus of control-self. A German study of adults 18 and older found mean health locus of control to be 4.1 on a 1-5 scale, with 5 indicating the highest health locus of control

(Grotz et al., 2011). It seems, in general, adults recognize that there are behavioral steps they can take to benefit their own health.

Participants in the current study had an average frequency of engagement in challenging cognitive activity of 3.03, which translates to engagement in challenging cognitive activity several times per month. This specific scale for measuring frequency of engagement in challenging cognitive activities is only used in the MIDUS study. The average frequency of engagement in challenging cognitive activity in the current study is consistent with another study that examined MIDUS II data in 3,343 adults ages 32-84, with only those with neurological conditions excluded. That study reported that the average frequency of engagement in challenging cognitive activity was 3.02 (Lachman et al., 2010). Thus, the results of this variable in the current study did not vary greatly from the general MIDUS population.

The current guidelines published by the U.S. Department of Health and Human Services (2018) is to get about 150 to 300 minutes per week of moderate intensity physical activity and thus, in general, it can be said the sample in this current study was falling below recommendation, with their mean score of 4.55 translating to engaging in physical activity between once a week to several times a month. A 2020 study indicated that less than half of American adult 18 and older meet recommendations for aerobic activity and about 31 percent meet the guidelines for muscle strengthening and only about 24 percent meet guidelines for both, and this percentage decreased with age (Elgaddal et al., 2022).

Findings Related to the Hypotheses of the Current Study

There were several hypotheses addressed by this study, which were both cross-sectional and longitudinal in nature. A quick reference to the outcomes of the hypotheses of the current study (i.e., whether each hypothesis was supported or not) can be found in Table 8. It is notable that although several pathways in the current study reached statistical significance, effect sizes for these relationships were all relatively small.

Table 8

Outcomes of Hypotheses of Current Study

Hypothesis	Was Hypothesis Supported?
1. Respondents with higher perceived cognitive control will endorse higher levels of health locus of control-self.	Yes
2. Respondents with higher perceived cognitive control will report a) a higher frequency of engagement in physical activity; and b) a higher frequency of engagement in challenging cognitive activities.	Partially (related to higher frequency of engagement in challenging cognitive activities only)
3. Respondents endorsing higher levels of health locus of control- self will report a) a higher frequency of engagement in physical activity; and b) a higher frequency of engagement in challenging cognitive activities.	Partially (related to higher frequency of engagement in physical activity only)
4. Respondents endorsing higher levels of health locus of control- self during MIDUS II will endorse higher levels of purpose in life during MIDUS III.	Yes
5. A higher frequency of engagement in physical activity during MIDUS II will be related to higher purpose in life during MIDUS III.	Yes
6. A higher frequency of engagement in challenging cognitive activities during MIDUS II will be related to higher purpose in life during MIDUS III.	Yes

7. Having multimorbidities will moderate the relationships observed in hypotheses 1, 4, 5, and 6.	Partially, path 6 only (Multimorbidity status moderated the path between engagement in challenging cognitive activities and future purpose in life)

Hypothesis 1- Perceived Cognitive Control and Health Locus of Control- Self

As predicted, higher perceived cognitive control was related to higher levels of health locus of control-self. Although the relationship between scores on these two measures has not been directly studied previously, the two constructs were expected to be related due to their similar nature of representing control beliefs. The PIC scale is considered to be a form of locus of control (Lachman, 1986) and the 36-item version has similar subscales to the multidimensional health locus of control scale. (Note that the version of PIC used in the current study was shorter and not considered multifactorial.) Both perceived cognitive control and health locus of control can be traced back to social learning theory (Rotter, 1954; 1966), or the degree to which people believe that outcomes are contingent on their own behavior or personal characteristics, or on external forces, such as luck, fate, or powerful others (Rotter, 1990). Thus, despite a lack of previous research on the relationship between these two variables, it makes theoretical sense that they were found to be related.

Hypothesis 2- Perceived Cognitive Control and Engagement in Health Behaviors

As predicted, higher perceived cognitive control was related to a higher frequency of engagement in challenging cognitive activities. Contrary to hypotheses however, perceived cognitive control was unrelated to engagement in physical activity. Previous research on perceived cognitive control, especially that using the PIC scale specifically, is quite limited. However, this finding is consistent with the Theory of Planned Behavior, as will be discussed in the next section, as the control belief translated to a domain-specific behavior.

Hypothesis 3- Health Locus of Control-Self and Engagement in Health Behaviors

As predicted, higher health locus of control-self was related to a higher frequency of engagement in physical activity. Contrary to hypotheses, however, health locus of control- self was unrelated to frequency of engagement in challenging cognitive activities. Higher health locus of control-self has previously been associated with more engagement in physical activity (e.g., Cheng et al., 2016; Mercer et al., 2018).

In general, the finding that control beliefs affect behavioral outcomes (i.e., hypotheses 2 and 3) is consistent with theory. One component of the theory of planned behavior (Ajzen, 1985; 1991) is perceived behavioral control. Essentially, this portion of the theory states that if one feels capable and confident in their ability to engage in a particular behavior (i.e., perceived behavioral control), their intention and likelihood of engaging in that behavior increases. In addition to capability, perceived control over outcomes is important. According to Rotter's locus of control theory, when one believes they have control over outcomes, they are more likely to engage in behaviors to achieve the desired outcome (Rotter, 1966). The findings of the current study appear to be consistent with this theory and domain-specific. That is, believing one has more control over their cognition leads them to pursue more challenging cognitive activities and believing one has more control over their own health leads them to pursue more physical activities.

Hypothesis 4- Health Locus of Control-Self and Purpose in Life

As predicted, higher health locus of control- self during MIDUS II was positively related to purpose in life during MIDUS III. Previous researchers using MIDUS data also found a relationship between health locus of control- self and purpose in life (Zilioli

et al., 2015), but with purpose in life predicting future health locus of control-self. As such, the relationship between purpose in life and health locus of control-self is bidirectional. As a caveat, however, these results should be interpreted cautiously given the high skew of health locus of control-self. In the current study, health locus of control-self was restricted, and generally high (mean of 6.10 out of 7).

Hypothesis 5- Engagement in Physical Activity and Purpose in Life

As expected, a higher frequency of engagement in physical activity during MIDUS II was related to higher purpose in life during MIDUS III. This finding is consistent with research demonstrating a relationship between physical activity and purpose in life both cross-sectionally (Hooker & Masters, 2016; Lewis & Hill, 2020) and longitudinally (Kim et al., 2020; Yemiscigil & Vlaev, 2021). This relationship between physical activity and purpose in life makes sense, as those with high purpose are, by definition, highly goal-oriented and likely to engage in activities that align with their values. Additionally, being physically active can help provide a sense of personal achievement for some older adults (Morgan et al., 2019). Being aware of one's sense of purpose during daily activities, or having high *meaning salience*, may be an important intermediate step in the relationship between purpose in life and health behaviors (Hooker et al., 2018).

A separate study found that engaging in frequent physical activity was unrelated to purpose in life (Chen et al., 2020). However, the 2020 study differed from the current study in a few key ways: 1) All participants were female nurses (or former nurses); 2) purpose in life was measured with a single item from Ryff's scale (i.e., "I have a sense of direction and purpose in life"); and 3) physical activity engagement was measured by a

single dichotomous variable (i.e., stating whether or not they engaged in frequent physical activity). Thus, it makes sense that the findings of the current study were seemingly inconsistent with the previous finding.

The relationship between physical activity and purpose in life may have benefits for perceived health. Purpose in life is related to self-rated health (Hill et al., 2015), and health behaviors such as moderate and strenuous physical activity also appear to be partially responsible for this relationship (Hill et al., 2019).

Hypothesis 6- Engagement in Challenging Cognitive Activities and Purpose in Life

As expected, a higher frequency of engagement in challenging cognitive activities during MIDUS II was related to higher purpose in life during MIDUS III. Engagement in cognitive activities has previously been found to predict initial purpose in life, as well as stability in purpose in life over time (Lewis & Hill, 2020). Broad activity engagement, including cognitive activities, is an effective way to promote a sense of purpose, particularly in retired older adults (Lewis & Hill, 2020). Additionally, both higher purpose and more engagement in cognitive activities is likely to result in healthier cognitive aging and less cognitive decline (Lee et al., 2020; Sutin et al., 2021b).

Hypothesis 7- Multimorbidity Status as a Moderator

The hypothesis in the current study stated that multimorbidities would moderate pathways 1 (i.e., the relationship between perceived cognitive control and health locus of control-self), 4 (i.e., the relationship between health locus of control-self and purpose in life), 5 (i.e., the relationship between engagement in physical activity and purpose in life), and 6 (i.e., the relationship between engagement in challenging cognitive activities and purpose in life). Multimorbidity status was found to moderate only pathway 6, such that

engagement in challenging cognitive activities was related to future purpose in life only for those with no multimorbidities. Several previous studies have indicated that increasing multimorbidities is unrelated to purpose in life (Chen et al., 2020; Friedman & Ryff, 2012; P. Hill et al., 2021). It was still worth examining, however, whether multimorbidity status affected relationships related to control beliefs as well as health behaviors in the current study.

It was somewhat surprising that the paths involving control beliefs were not moderated by multimorbidity status (i.e., pathways 1 and 4), as previous research has indicated that individuals with one chronic condition or no chronic conditions were more likely to have an internal health locus of control than those with multimorbidities (van der Linden et al., 2001). Additionally, although multimorbidity status has not been compared to perceived cognitive control as defined in the current study, those with multimorbidities compared are more likely to self-report memory complaints those with one or no chronic conditions (Franco et al., 2022; Pedro et al., 2016; Yap et al., 2020), and those with multimorbidities are also more likely to report difficulty with concentration (Jacob et al., 2019).

The finding that multimorbidity status moderated the relationship between challenging cognitive activities and purpose in life is consistent with research indicating that increasing multimorbidities is inversely related to social participation (which includes cognitive activities in addition to other activities), but high purpose in life can mitigate this relationship (Luster et al., 2022).

Indirect Pathways and Clinical Relevance

As discussed throughout the sections above, several direct and indirect pathways of influence were examined in the current study. These indirect paths may provide targets for intervention to improve purpose in life.

Higher perceived cognitive control showed significant indirect paths through engagement in challenging cognitive activities to future purpose in life. That is, middle-aged and older adults who endorsed higher perceived cognitive control also tended to endorse a higher frequency of engagement in challenging cognitive activities, which was then associated with higher purpose in life during MIDUS III. The current study also found a significant indirect path of health locus of control- self on purpose in life (MIDUS III), through physical activity, such that higher health locus of control-self was associated with a higher frequency of engagement in physical activity, which was associated with higher future purpose in life. This, combined with the above indirect path, provide evidence that not only to control beliefs affect domain-specific behaviors associated with those beliefs, but these relationships can also influence future purpose in life.

Covariates

Several variables were found to be covariates with purpose in life and were thus added to the current model. First, employment status, which was dichotomized into "working" and "not working", was significantly related purpose in life and engagement in physical activity. Those who were working during MIDUS II reported a higher purpose in life during MIDUS III than those who were not working during MIDUS II. Those who were not working during MIDUS II, however, reported engaging in more physical

activity. Notably, because the current study included only physical activity not performed in the context of paid employment, it is possible that those not working simply had more leisure time to engage in physical activity. The relationship between employment status and purpose in life has been seen in the literature, as retirement can lead to decreased purpose in life (Pinquart, 2002), but typically explains only a small amount of variance in purpose in life, with many adults maintaining high purpose in life after retirement (Lewis & Hill, 2020).

Second, education was significantly related to engagement in physical activity engagement in challenging cognitive activities, and health locus of control-self. Education level is a social determinant of health, and thus, can be related to one's ease of access to physical activity and challenging cognitive activities. Indeed, in the current study, engagement in health behaviors tended to increase with increasing education levels. Education has previously been found to be related to purpose in life (Ryff & Singer, 2008). Notably, however, although the initial analyses and the initial path model in the current study suggested a relationship between education and future purpose in life, the final model did not find a significant relationship between education and future purpose in life. The relationship between education level and engagement in challenging cognitive activities was also strong relative to other relationships in the current study. This makes theoretical sense, as those with higher education may be related to one feeling more competent in and enjoying cognitive activities such as attending lectures or writing for fun.

Third, age was related to future purpose in life, engagement in physical activity, and health locus of control-self. Age was negatively related to purpose in life and

engagement in physical activity and positively related to health locus of control-self. Previous research has indicated that purpose in life (Ko et al., 2016; Pfund, Ratner, et al., 2022), though certainly not an inevitability of getting older. The relationship between age and decreased purpose in life may be more a result of age-related losses than a result of chronological age (Irving et al., 2017). Internalizing negative age stereotypes may lead older adults to believe they are not capable of many forms of physical activity, particularly if they have chronic conditions (Levy et al., 2009).

Fourth, income was a relevant covariate and was positively related to future purpose in life. This was consistent with literature using data from the MIDUS I and MIDUS II wave which indicates that higher purpose in life was related to current and future income and net worth (Hill et al., 2016).

Fifth, self-rated health was positively related to future purpose in life, physical activity, and health locus of control-self. Previous research has linked self-rated health to current purpose in life (e.g., Hill et al., 2019). It is also notable that in the current study, the relationship between self-rated health and health locus of control-self was a strong effect size relative to other effects. This is consistent with previous research specific to self-rated health and health locus of control (e.g., Berglund et al., 2014) and to more theoretical research linking a general sense of control to health (Lachman et al., 2011). In other words, autonomy is important to perceived health. It should be noted that some sense of autonomy, both generally and as it relates to health (e.g., having a choice of health care providers) is related to having economic resources. Thus, social determinants of health are relevant here and will be discussed in more detail below.

Lastly, purpose in life during MIDUS II (i.e., current purpose in life) was a relevant covariate. Current purpose in life is generally stable in middle age (Ko et al., 2016) with potential decline in older adulthood. Thus, it makes sense that current level of purpose in life would be highly predictive of purpose in life 7-10 years later. Controlling for current purpose in life in the current study was important to ensure that all of the relationships in future purpose in life could not be accounted for by baseline purpose in life.

Clinical Relevance

Purpose in life is an important variable measuring goal-directedness and sense of values. Purpose can decrease in older adulthood, but maintaining high purpose has important benefits for both mental and physical health (McKnight & Kashdan, 2009) and can even lead to decreased risk of mortality over several years (Boyle et al., 2009; Cohen et al., 2016; Hill et al., 2014; Shiba et al., 2021). Therefore, strategies aimed at improving or maintaining purpose in life are important.

Perceived cognitive control may be an important control belief target for intervention given its indirect relationship with future purpose in life. Targeting perceived cognitive control may involve deconstructing ageist stereotypes and increasing self-efficacy for cognitive tasks. This can be achieved by psychoeducation that directly addresses facts and misconceptions related to cognitive aging. Additionally, education related to age-based stereotypes at a younger age, as well as contact with older adults from a young age may help deter the societal pervasiveness of ageism in future generations, leading to less internalized ageism. Levy's (2018) Positive Education about Aging and Contact Experiences (PEACE) model, uses education and contact with older

adults as techniques for decreasing ageism. Most people have little to no education on aging, as this is not often something that is taught in school, and aging coursework is also uncommon in college (Cherry et al., 2014; Marshall, 2015). As a consequence of having less education on aging, people tend to cling to stereotypes about older adults, ignoring the fact that many older adults are cognitively and physically fit (Levy & Macdonald, 2016). When people do obtain knowledge on aging, their attitudes toward older adults become more positive (Wurtele & Maruyama, 2013). The contact component of the PEACE model uses the intergroup contact hypothesis (Williams, 1947; Allport, 1954), which asserts that increased contact between older adults and younger adults, termed *intergenerational contact*, may help decrease ageism.

The current study also demonstrated that in addition to control beliefs, which impact behaviors, targeting behaviors directly may also have an important impact on future purpose in life. Engagement in both physical activity and challenging cognitive activities predicted future purpose in life in the current study. This makes sense, as these activities are highly goal-direct and, for many people, values-consistent activities. As such, engaging in purposeful activities regularly is likely to lead someone to experience a higher sense of purpose in life. Much like behavioral activation is used to increase engagement in activities associated with pleasure and mastery and decrease activities that maintain depression (e.g., Dimidjian et al., 2011), encouraging engagement in values-consistent and goal-oriented activities has the potential to enhance one's sense of purpose in life.

Strengths and Limitations

The current study had several strengths and limitations. First, this study added to the literature on the relationship between control beliefs and health behaviors and the relationship between health behaviors and purpose in life. This integrated work on various theories related to control beliefs, health behaviors, and purpose in life.

The use of secondary data comes with both strengths and limitations. In terms of strengths, secondary data allows for efficiency of research. Additionally, data from existing national longitudinal datasets, such as MIDUS, have been collected and analyzed by experienced researchers and are often updated and maintained on a regular basis; these are important advantages when considering use of secondary data (Cheng & Phillips, 2014). MIDUS researchers took particular precautions, such as double data entry, programmatic data cleaning procedures, and the creation and use of codebooks to verify data quality (Radler, 2014). Short-form assessments of psychosocial constructs were validated in pilot studies prior to use in MIDUS (Radler, 2014).

In terms of limitations of using secondary data, secondary data allows less control over choice of measures and participant recruitment. As an example, the current study used the health locus of control-self subscale from form A of the multidimensional health locus of control scale (Wallston et al., 1978). Although this will give a decent measure of participants' health locus of control-self, it does not offer information about health locus of control related to chance or powerful others. (Although MIDUS attempted to collect data on the powerful others dimension, the two-item version used yielded an exceptionally low alpha value). Additionally, Form C of the multidimensional health locus of control scale (Wallston et al., 1994), which is intended for individuals managing

medical conditions, is not available in the MIDUS data and thus could not be used in the current study's moderation analyses, which specifically examined individuals with multimorbidities.

The diversity of participants in the current study was somewhat limited. The current study limited analyses to 1) participants who were 40 years of age or older at the time they participated in MIDUS II; and 2) participants who participated in both MIDUS II and MIDUS III. Considering the age restrictions, the average age was relatively young (about 57 years old). Also, the sample was about 92 percent White and 94 percent of individuals had a high school diploma, with about half the sample having an associate's degree or higher. The mean annual household income (at the time of MIDUS II, from 2004-2006) was over $75,000, which is much higher than the median household income of $46,242 in 2005 (Webster & Bishaw, 2010). In sum, participants in the current study were generally middle-aged, White, highly educated, and middle-class. This may be partially due to the use of random digit dialing as a recruitment method in MIDUS, which would have excluded individuals without consistent access to a phone at the time of recruitment.

Findings may look different in more racially and socially diverse samples. People with higher education, household income, and total wealth for example, tend to report higher purpose in life (Shiba et al., 2021). Furthermore, the concept of social determinants of health likely play a role here. Social determinants of health is a construct that models the ways in which governance, policies, culture, and societal values affect social hierarchy and socioeconomic position contribute to health inequities (Osmick & Wilson, 2020; WHO, 2010). In other words, socioeconomic variables are likely to

determine one's access to medical care, nutrient-dense food, exercise (e.g., a safe neighborhood to walk in or a gym), and health literacy.

Ryff's purpose in life subscale is not without criticisms. The purpose in life scale is one dimension of the overall psychological well-being scale, and other researchers have questioned whether Ryff's psychological well-being scale is best captured by six dimensions (e.g., Springer & Hauser, 2006). Purpose in life, for example, was found to be highly correlated with other dimensions of psychological well-being, such as self-acceptance, environmental mastery, and personal growth, leading to concerns that Ryff's scale lacked multidimensionality (Kashdan et al., 2023; Springer & Hauser, 2006). Findings from a more recent study that analyzed the factor structure of Ryff's model indicated that the scale had two distinct dimensions- one on which all positively-worded items loaded and one on which all negatively-worded items loaded (Henn et al., 2016). Ryff and Singer (2006), however, provided a rebuttal to the criticism (i.e., Springer & Hauser, 2006) and stated that the data were misinterpreted by the other researchers and did indeed fit into six factors.

Another criticism of Ryff's scale is that the sample originally used to empirically test Ryff's model was primarily composed of healthy, highly educated, and financially advantaged individuals (Ryff, 1989). This leaves the question of whether there are some individuals for whom Ryff's model does not fit well, such as individuals with multimorbidities, or those of lower SES. Dimensions of Ryff's model may also measure differently cross-culturally. In independent cultures, for example, well-being may be considered individual in scope, whereas in interdependent cultures, well-being may be more relational in scope (Ryff et al., 2020).

As stated previously, health locus of control-self was restricted in the current study, with most people noting a generally high health locus of control-self (average of 6.10 out of 7). This indicates that relationships in the current study between health locus of control-self and other variables may be an underestimate compared to the general population. Additionally, the other dimensions of health locus of control (i.e., chance and power full others) was not used in this study, limiting what could be found about health locus of control. It is important to reiterate that health locus of control is a multidimensional construct and thus, being high on one dimension of the scale does not necessary mean being low on other dimensions. For example, one can both believe there are ways in which they have high control their own health and believe their doctor plays a major role in health outcomes.

Although the current sample notably involved only individuals who were both middle-aged or older during MIDUS II and also participated in MIDUS III, the mean health locus of control-self value in the current study was close to the overall mean of health locus of control-self for MIDUS II (6.07 out of 7; standard deviation of 0.87). Health locus of control-self was also high when considering all people who participated in MIDUS III (6.07 out of 7; standard deviation of 0.75). As noted above, participants in the current study were generally middle-aged, White, highly-educated, and middle-class. A more diverse sample may have yielded more of a range in health locus of control-self.

Future Directions

Future research should continue to examine purpose in life in more racially and socially diverse contexts. As noted previously, social determinants of health can affect many outcomes, including physical, cognitive, and psychological functioning. Despite

positive attitudes toward health behaviors and high health locus of control-self, for example, one may face economic barriers to nutrient-rich foods, spaces for physical activity, health care, and necessary medications. It is important, therefore, to examine variables such as purpose in life, health locus of control, perceived cognitive control, and health behaviors in those with varying levels of socioeconomic resources. Such research could have vast implications for practice and policies.

Second, additional personal factors and behaviors are likely relevant to purpose in life, such as spirituality, social support, and social activity. Research has found, for example, that opportunities to stay mentally, physically, and socially active (such as in retirement communities) can promote purpose in life in older adulthood (Lewis et al., 2020). These factors would be expected to enhance purpose in life by providing opportunities for values-consistent activities. Thus, an examination of these potential predictors of future purpose in life could be considered.

Third, although the current study examined control beliefs and discussed internalized ageism as a factor that likely affects control beliefs, it did not use an actual measure of internalized ageism. Thus, using a scale of internalized ageism such as the Everyday Ageism Scale (Allen et al., 2021) to confirm the expected relationship between internalized ageism and control beliefs as they relate to purpose in life is a potential direction for future research.

Lastly, the current study did not have a measure of individuals' awareness of their purpose. It is important to look at people's sense of what makes their lives meaningful, or *meaning salience* (Hooker et al., 2018). The activities examined in the current study were expected to be values-consistent activities, but we do not know the extent to which

participants 1) perceived these activities to be meaningful; or 2) had a sense of what is meaningful to them. McKnight and Kashdan (2009) summed up the importance of awareness of purpose in life well: “When a person is not aware of a purpose but still influenced by that purpose, there exists greater cognitive load and less efficient resource allocation” (p. 244). Those with higher meaning salience would be expected to have higher engagement in health behaviors and in other meaningful activities. Thus, future research might include an examination between meaning salience (e.g., using the Thoughts of Meaning Scale; Hooker & Masters, 2018), activity engagement, and future purpose in life.

Conclusion

The potential to maintain high purpose in life exists throughout the lifespan, and maintaining high purpose has important health benefits. The current study established several important factors that precede purpose in life, which may be important targets for intervention. These factors include perceived cognitive control (via an indirect pathway), health locus of control- self, engagement in physical activity, and engagement in challenging cognitive activities. Thus, directly intervening at the level of health behaviors or targeting control beliefs that affect domain-specific behaviors may help enhance future purpose in life in the context of middle-aged and older adulthood.

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Appendix A

Chronic Conditions Included in MIDUS 2

Participants were asked: *In the past twelve months, how often have you experienced or been treated for any of the following? (Check all that apply.)*

Condition	Number Endorsed	Percentage of Sample
Asthma, bronchitis, or emphysema	252	10.2
Tuberculosis	2	0.1
Other lung problem	53	2.1
Arthritis, rheumatism, or other bone or joint disease	675	27.2
Sciatica, lumbago, or recurring backache	410	16.5
Persistent skin trouble (e.g., eczema)	206	8.3
Thyroid disease	217	8.7
Hay fever	277	11.2
Recurring stomach trouble, indigestion, or diarrhea	417	16.8
Urinary or bladder problems	310	12.5
Being constipated all or most of the time	123	5.0
Gall bladder trouble	55	2.2
Persistent foot trouble (e.g., bunions, ingrown toenails)	245	9.9
Trouble with varicose veins requiring medical treatment	24	1.0
AIDS or HIV infection	4	0.2
Lupus or autoimmune disorders	35	1.4
Persistent trouble with your gums or mouth	108	4.4
Persistent trouble with your teeth	144	5.8
High blood pressure or hypertension	726	29.3
Alcohol or drug problems	22	0.9
Migraine headaches	171	6.9
Chronic sleeping problems	260	10.5
Diabetes or high blood sugar	212	8.5
Multiple sclerosis, epilepsy, or other neurological disorders	59	2.4
Stroke	16	0.6
Ulcer	25	1.0
Hernia or rupture	38	1.5
Piles or hemorrhoids	220	8.9
Swallowing problems	95	3.8

Note. The following item from this scale was removed from use in the current study, as it did not fit with the current study's definition of physical multimorbidity: Anxiety, depression, or some other emotional disorder.