ABSTRACT

LOTHARY, ALLURA F. Changes in Views of Aging in Older Adulthood: The Importance of Activity Engagement. (Under the direction of Dr. Thomas M. Hess).

A growing body of literature has shown the importance of views of aging in older adulthood. Views of aging are broadly defined as beliefs a person has about old age, the aging process, or their own aging (Wurm et al., 2017). This project explored how changes in health influences changes in views of aging across older adulthood. Additionally, in two studies, this project explored different categories of activities as potential mediators explaining the association between changes in health and views of aging.

In Study 1, a nationally-representative sample of adults over the age of 50 (n =1923) was used to assess how changes in physical, mental, and cognitive health were associated with changes in views of aging, mediated by different categories of activities. In Study 2, a smaller longitudinal sample of older adults over age 65 (n =150) was also used to explore the domain-specific nature of these constructs. Domain-specificity was assessed by analyzing how changes in three types of health (physical, mental, cognitive) were associated with changes in views of aging within those same domains (physical health, mental health, and cognitive health) and if activities associated with those domains were the strongest mediators.

In Study 1, results found that changes in all types of health were associated with changes in views of aging. More specifically, experiencing declines in all types of health was associated with progressively more negative views of aging. Additionally, aligned with hypotheses, changes in activity engagement was a small but significant mediator for these associations. In contrast, Study 2 only found an association between changes in physical and mental health and views of aging within those domains. There were limited mediation effects found in Study 2 and support was not found for the domain-specific expectations of the mediation strengths.

In conclusion, this study found support for a linkage between changes in physical, mental, and cognitive health and views of aging. Some support was also found in the larger, nationally-representative sample that changes in activity engagement were a partial mediating mechanism between changes in health and views of aging. There was mixed evidence as to the strength of the mediation and the domain-specificity. These findings suggest changes in activity engagement may be one important mechanism fueling the association between changes in health and views of aging, but future research is needed to address limitations of this project and to better understand the longitudinal within-person trajectory of views of aging.

Changes in Views of Aging in Older Adulthood: The Importance of Activity Engagement

by
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DEDICATION

I dedicate this work to my grandmother, Sandra Johnson, and grandfather, Earl Johnson, who have always provided me with unconditional love and support. Thank you for always believing in me even when I did not believe in myself.

BIOGRAPHY

Allura Lothary graduated with a B.A. in Psychology and Anthropology from Luther College in 2016. She continued her education by joining the Lifespan Developmental Psychology program at North Carolina State University in the Fall of 2016 under the mentorship of Dr. Thomas M. Hess. Allura's research has focused on daily factors associated with health and wellbeing in older adulthood. She is particularly interested in how psychosocial, motivational, cognitive, and behavioral factors change and are associated with one another across the older adult lifespan. Allura hopes to use her graduate education to help improve older adult's quality of life and plans to transition into applied research on healthy aging after finishing her degree.

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Introduction

A substantial body of literature has shown the extensive implications of holding negative views of aging in older adulthood. Both cross-sectional and longitudinal studies have demonstrated that having more negative views of aging is associated with many different negative health outcomes in older adulthood, such as worse physical health, lower levels of cognitive functioning, and higher rates of mortality (Cheng, 2017; Kotter-Grühn et al., 2009; Levy et al., 2002; Sargent-Cox et al., 2014). Although this growing body of literature has identified linkages between one's earlier views of aging and their future or concurrent health, more recent research has turned to understanding factors which influence longitudinal changes in views of aging across older adulthood. Experiencing negative health events, such as a heart attack or other cardiovascular event, has been shown to be associated with negative changes in views of aging (Wurm et al., 2019). In contrast, other studies have found negative health-related events to be positively associated with the psychological growth domain of views of aging, indicating potential resilience (Bryant et al., 2012). Collectively, this research suggests health and views of aging are associated with one another, while the directional effects may be dependent upon the domain studied (Bryant et al., 2012; Schafer & Shippe, 2010; Wurm et al., 2008). Additionally, another missing link within this literature relates to the underlying mechanisms associated with changes in health and views of aging. Changes in engagement in everyday activities has been shown to be associated with health and well-being outcomes in older adulthood, but it has not yet been explored as a mediating mechanism associated with health and views of aging (Palgi et al., 2016; Ihle et al., 2017). Understanding the mechanisms behind how health influences our views of aging is particularly important for understanding how views of aging change over time and to help inform future long-term interventions focused on

altering views of aging. The proposed study aims to fill the gaps within this body of research by examining a potential mechanism driving the association between health and views of aging and exploring the specific contexts in which these associations are most evident. More specifically, this study examines the role of activity engagement as a mediator between changes in health and views of aging.

Views of Aging

Views of aging are defined as any perceptions, attitudes, or expectations a person has about older people, old age, or the aging process, and can also include perceptions about your own aging experience (Wurm et al., 2017). Views of aging have been conceptualized and measured in many different ways, such as age-related stereotypes, subjective age, and aging satisfaction, but more broadly include views of one's own aging and views of aging in general (for a review of different conceptualizations see Diehl et al., 2014). Previous research has suggested that views of aging are influenced by a myriad of factors including biological-evolutionary, psychological, and societal-contextual factors (Kornadt et al., 2019). Views of aging are formed throughout the lifespan and are influenced by representations of older adults in the media, personal experiences with older adults, and continual experiences with age-related stereotypes, along with experiences of our own aging process (Kornadt & Rothermund, 2015). Views of aging are also multifaceted, meaning individuals can hold both positive and negative views of aging across a variety of life domains, such as physical, mental, and cognitive health, which influence their decisions and behaviors within those domains. Holding negative views of aging has been shown to be particularly problematic for health in older adulthood. In a sample of adults over the age of 60, Bryant et al. (2012) found that individuals with more positive views of aging had higher levels of life satisfaction, better self-rated mental and physical health, and lower

levels of anxiety and depression diagnoses in comparison to individuals with more negative views of aging. However, this study was only cross-sectional which limits the ability to determine directionality or the association between health and views of aging over time.

Changes in Views of Aging

As negative views of aging are potentially detrimental for older adults' health and well-being, it is imperative to understand if and how our views of aging change across the lifespan. Several studies have, in fact, demonstrated that views of aging are malleable within experimental and intervention settings (Beyer et al., 2016; Brothers & Diehl, 2017; Kotter-Grühn & Hess, 2012; Stephan et al., 2013). On the negative side, priming older adults with age-related stereotypes (positive or negative) within a laboratory setting has been shown to increase how old someone felt (Kotter-Grühn & Hess, 2012). On the other hand, providing positive feedback about performance on tasks such as those assessing handgrip strength or cognition has been shown to improve self-perceptions of aging (Stephan et al., 2013; Miche & Wahl, 2013). Within an intervention context, the AgingPlus program has had some success modifying views of aging by combining workshops combating negative aging stereotypes with physical activity tracking and coaching (Brothers & Diehl, 2017). While there was evidence of positive growth in views of aging over a 12-week period, the sample was very selective with the older adults already demonstrating high levels of physical activity engagement and more positive views of aging than the general population of adults over 65 before starting the intervention. Additionally, due to lack of a randomized control trial, it is difficult to determine if reducing age-related stereotypes altered physical activity engagement or if increasing engagement in physical activities altered views of aging.

While research has demonstrated the potential malleability of views of aging, much less research has focused on the longitudinal changes occurring in such views. Kleinspehn-Ammerlahn et al. (2008) found that, over six years, older adults' aging satisfaction substantially decreased. In general, their study found that higher mean level social isolation, numbers of illnesses, and lower cognitive functioning were associated with worse aging satisfaction. However, only age, gender, and socioeconomic status at the first time point were significant predictors of changes in aging satisfaction over time. Together, this body of literature suggests that views of aging do change over time and are malleable within both laboratory and intervention settings. However, the specific mechanisms behind these changes—along with potential interventions based on such mechanisms—have not yet been explored in the literature.

Stereotype embodiment theory (Levy, 2009) also provides guidance as to the expectations and influential factors associated with views of aging over time. This theory posits that individuals internalize stereotypes about a group they are a part of over time. When stereotypes are increasingly self-relevant, they become more salient. While this theory mainly touches on the ways that aging stereotypes are damaging over time, it may also help us to understand the pathways through which older adults experience changes in their views of aging. For example, holding negative aging stereotypes may adversely impact older adults' beliefs and expectations about their health. Expanding upon this, it may be expected that, as people get older and internalize age-related stereotypes, they may associate changes in health with normative aging rather than attribute them to a cultural stereotype. As a result, they may engage in fewer health-promoting behavior which creates a feedback loop of declining health and more negative views of aging over time (see Figure 1).

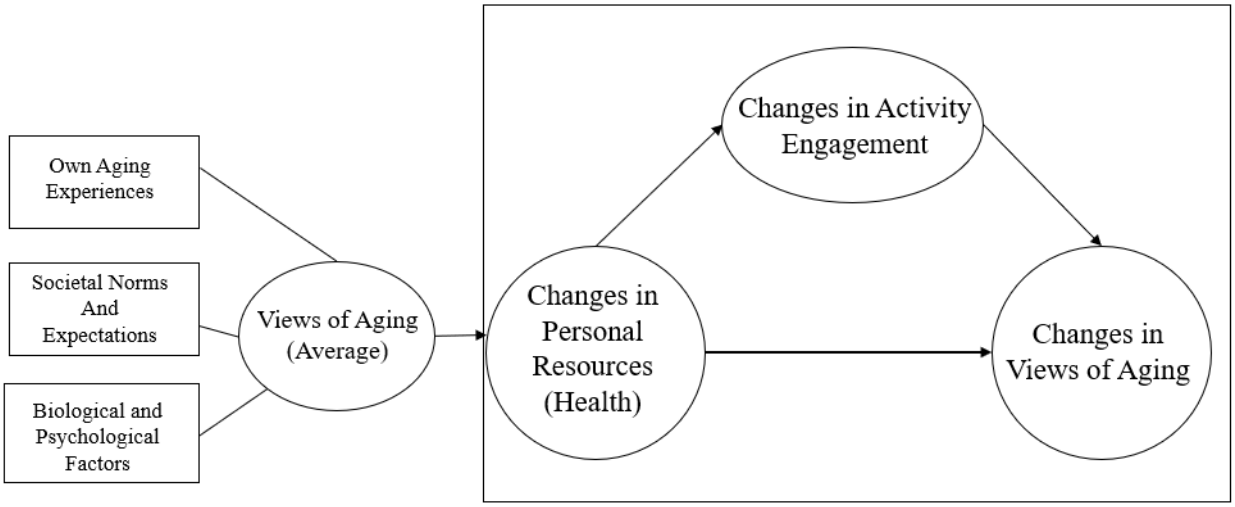

Figure 1. Conceptual model of views of aging, model within box being examined in this project.

Health and Views of Aging

While previous research has found support for the idea that views of aging change over time, there has been much less focus on what mechanisms are behind these changes. Wurm et al. (2019) have tried to address this gap in the literature by exploring how experiencing a cardiovascular event alters future views of aging. Over a three-year period, individuals who had experienced a cardiovascular event had significant negative changes in three different indicators of views of aging (gains, losses, subjective age), suggesting that experiencing changes in health predicts declines in future views of aging. Beyond this, Sargent-Cox et al. (2012) also found that declines in health over a 16-year period predicted poorer views of aging. Both declines in physical functioning and increases in number of medical conditions were associated with poorer views of aging. This study also explored control beliefs as a mediator, finding evidence for partial mediation at the within-person level associated with physical functioning and views of aging. Control beliefs, in this case, are reflective of the sense of control someone believes they

have over the aging process. These findings suggest control beliefs may be one attitudinal mechanism informing how changes in one's health impact their views of aging. While not longitudinal, Bryant et al. (2012) also found evidence that worse physical health was associated with more negative views of aging within the domains of physical and psychosocial loss. Interestingly, they worse physical health to be associated with more positive views of aging in the psychological growth domain. Collectively, this research suggests that changes in health are associated with changes in views of aging, but the specific behavioral and psychological mechanisms behind these changes are still unclear.

Health and Activity Engagement

Given that research has shown the importance of understanding the link between health and views of aging, it is then important to look at previous research within the health and well-being literature in older adulthood to identify potential mechanisms fueling these relationships. Maintaining and increasing engagement in a wide variety of activities has been shown to be particularly important for health and well-being in older adulthood. Many studies have shown that engaging in many different types of activities (e.g., physical, social, and intellectually challenging) is associated with higher levels of well-being, functional health, and life satisfaction (Cohen-Mansfield et al., 2013; Huxhold et al., 2013). While it has been shown to be beneficial to engage in a wide variety of daily activities, older adults tend to perform fewer of these activities over time (Jopp & Hertzog, 2007). Within this body of literature, the consequences of declines in physical health on changes in well-being in older adulthood have been shown to be mediated through engagement in both physical and general leisure activities (Ihle et al., 2017; Palgi et al., 2016). These findings suggest that psychological well-being may not be solely a reflection of physical health but may also reflect the consequences of declines in physical health on our ability

to stay engaged in activities of daily living. Being able to use adaptive strategies or make adjustments in the face of health limitations to continue engaging in daily activities has been shown to serve as a positive coping mechanism, such that an individual's well-being is less affected by declines in health when they can find ways to maintain engagement in the activities they typically do (Ihle et al., 2017).

Activity Engagement and Views of Aging

In a similar vein, activity engagement may be an important mechanism for understanding changes in views of aging in older adulthood. When weighing one's experience of aging, declines in activity engagement may be a salient way to perceive changes in health. In this way, behavior (activity engagement) can be used as information informing the individual how changes in their health limits daily life. One way in which researchers have tried to understand how behavior may be associated with subjective experiences of aging has been through the lens of a self-fulfilling prophecy. Work by Wurm et al. (2013) suggests that having negative self-perceptions of aging may result in use of less adaptive selection, optimization, and compensation strategies (SOC; Baltes & Baltes, 1990) for older adults, which can then create a self-fulfilling prophecy. Baltes' (1997) SOC theory states that as we age, we engage in a series of processes to select and achieve our goals, as well as compensate for losses in resources to maintain levels of functioning. These processes are collectively referred to as SOC strategies, and being able to appropriately and effectively use SOC strategies over time has been shown to be associated with more positive age-related outcomes (Baltes, 1997; Freund & Baltes, 2002; Wiese et al., 2002). For example, having more negative views of aging at the onset of a serious disease diagnosis has been shown to result in lower utilization of SOC strategies related to leading a healthy lifestyle (such as engaging in health-promoting behaviors). This, in turn, can result in worse health

outcomes and lower well-being as a result of reduction in health-promoting behaviors. In the domain of driving, research has shown older adults may experience an identity shift as a result of driving cessation, reinforcing their beliefs about activities an older adult engages in (Pachana et al., 2017). In a similar way, experiencing negative changes in health may influence views of aging by shifting activity engagement and influencing older adults' beliefs about their own identities as well as beliefs about the capabilities of other older adults.

One cross-sectional study using a small sample of Korean older adults found that engagement in health-promoting behaviors partially mediated the relationship between views of aging and both physical and mental health (Kim et al.,2009). However, due to the cross-sectional nature of the study, they were unable to make conclusions about the direction of the effects. This suggests that health-promoting behaviors may be an important and salient factor associated with views of aging and health. Research by Klusmann et al. (2012) furthered this idea by conducting an intervention focused on improving physical activity. Over two hundred women aged 70-93 participated in a physical activity intervention and a six-month follow-up. Mediation analyses suggested that participating in the activity intervention reduced aging dissatisfaction through increases in direct approach motivation. By engaging in more physical activities, the participants experienced changes in their feelings towards exercise and their exercise identity. These changes served as important and motivational information, ultimately improving views of aging. Cumulatively, although limited. this literature provides evidence suggesting engagement in daily activities may serve as important information for older adults' views of aging.

Domain Specificity

In terms of the associations between health, activity engagement, and views of aging, another area that is also under-investigated is the domain-specific nature of these changes.

Research has demonstrated that views of aging are domain-specific, such that having a certain view in one area (such as physical health) will not necessarily relate to activities outside of that domain (e.g., Kornadt & Rothermund, 2015; Kuhlmann et al., 2015; Voss et al., 2017). Research by Meisner et al. (2013) examined how physical health and physical activity were associated with different subscales of the expectations regarding aging scale, a measurement assessing aging attitudes (ERA; Sarkisian et al., 2002). Cross-sectionally, they found an association between physical health, physical activity engagement, and the physical health subscale of the ERA, but no association was observed for the mental health or cognitive health subscales. So far, there has been no longitudinal research assessing the domain-specific nature of changes in health and views of aging, which is necessary for understanding the domain-specificity of mediators and outcomes. For example, changes in physical health may not necessarily have an impact on cognitive or social activities or changes in views of aging within the cognitive or social domains. For these reasons, it is important to understand the domain-specific longitudinal trajectory of changes in health, activity engagement, and views of aging so that future interventions can target the correct, or multiple, domains to effect the most change.

Beyond domains of changes, it is also important to expand the conceptualization of health within this framework. Previous research by Hess, Growney, O'Brien, Neupert, and Sherwood (2018) has expanded the view of health to include a broader array of resources including physical, mental, and cognitive health. Each of these processes reflect different underlying resources and are important predictors of engagement in everyday activities. Exploring a multidimensional conceptualization of health changes such as this may give us a better understanding of the types of health that impact our views of aging. Beyond this, longitudinal research has not yet explored how different types of activities may be influenced by changes in

different types of health. Much of the research looking at views of aging and activity engagement has focused on physical activity engagement (Beyer et al., 2016; Brothers & Diehl, 2017; Klusmann et al., 2012; Kuhlmann et al., 2015). While physical activity engagement is linked with a variety of types of health, there are consistently higher correlations between physical activities, such as exercising and outdoor activities, and dimensions of physical health in contrast to other domains of health (Jopp & Hertzog, 2010). Engagement in cognitively demanding activities such as using technology, engaging in novel activities, and writing have also been shown to be highly correlated with cognitive health in older adulthood. More specifically, engagement in developmental and experiential activities has been shown to be positively related to cognitive health. Developmental activities in this case include activities such as writing and word games, and experiential activities include things such as reading and hobbies. On the other hand, TV watching has generally shown negative correlations with cognitive health (Jopp & Hertzog, 2010). Queen and Hess (2018) also found within a cross-sectional framework that having better physical and cognitive health was associated with more engagement in cognitively demanding activities.

With regards to the association between mental health and activity engagement in older adulthood, previous research has shown that mental health is positively associated with engagement in a wide variety of activities across domains. Both social and physical activities have been shown to be associated with mental health. Even engagement in relatively solitary activities, such as hand-working hobbies, has been shown to be correlated with mental health in older adulthood (Menec, 2003). In contrast to physical and cognitive health, which seems to be linked with similar domain activities, mental health may be associated with more global activity engagement. Experiencing declines in mental health in older adulthood may then be associated

with declines in engagement in a wide variety of activities. Supporting this idea, Silvia et al. (2016) found that individuals with higher levels of depressive symptoms show higher rates of disengagement sooner when they perceive a task to be difficult, a phenomenon known as depressive blunting. A similar effect was identified in older adults by Hess and Knight (2020) in a study examining the affective aspects of chronic mental fatigue. Similarly, experiencing declines in mental health may reduce engagement in many types of activities as engagement may be perceived as more difficult across the board. For these reasons, understanding how different types of health are associated with specific activities is important for understanding the causal pathways associated with changes in views of aging across the older adult lifespan.

In sum, a growing body of research suggests that changes in health are predictive of longitudinal changes in our views of aging. As engagement in daily activities has been shown to be an important mediating mechanism between health and well-being, and has been shown to be associated with views of aging, it is necessary to better understand the associations between changes in health, activity engagement, and views of aging across the older adult lifespan. Furthermore, addressing a gap in the literature, this study seeks to better understand the role of domain-specificity in these relationships. More specifically, this study will also assess how changes in physical, mental, and cognitive health are associated with changes in same-domain activities and views of aging.

The Present Study

The present study aims to examine the longitudinal associations between changes in health, activity engagement, and views of aging in older adulthood in two different samples. While previous research has explored the factors that are associated with mean-level views of aging and how views of aging impact long-term health, there has been less research exploring

how views of aging change over time. The first study, using a nationally representative and open-source dataset, examines associations between changes in health, different types of activity engagement, and general views of aging. The second study examines the domain-specific nature of these changes in a smaller sample. Measures available in Study 2 allow for within-domain analyses across health, activity category, and views of aging, such that it will be possible to examine how changes in three specific domains of health (i.e., physical, mental, cognitive) are associated with changes in activities and views of aging both within and across different domains. The particularly novel contribution of these two studies is the exploration of different types of activities as mediating the changes in views of aging within two different samples, which has not previously been explored in the literature.

Aim 1: Health and Views of Aging

The first goal of both Study 1 and Study 2 is to explore how changes in different types of health (physical, mental, cognitive) are associated with changes in views of aging. In Study 1, I will explore how changes in each type of health are associated with changes in general views of aging. It is expected that negative changes in all types of health will be associated with negative changes in general views of aging based on the research by Wurm et al. (2019). Building upon this in Study 2, it will be possible to explore how changes in the different types of health are associated with changes in views of aging within those same domains. For example, it is expected that changes in physical health will be more strongly associated with changes in views of aging within the physical health domain in contrast to views of aging within the mental health or cognitive health domains (Sargent-Cox et al., 2012). The first aim of this project will extend the previous literature by expanding the types of health changes and their associations with views of aging. Additionally, in Study 2, the domain-specific nature of these changes will be examined

by assessing how changes in health are associated with changes in views of aging within the physical health, mental health, and cognitive health domains.

Aim 2: Activity Engagement

The second goal of this project is to explore activity engagement as a mediating mechanism between changes in health and views of aging. For both studies, it is expected that changes in activity engagement will partially mediate the association between changes in health and views of aging. Previous research by Growney and Hess (2020) has demonstrated associations between changes in personal resources (health) and changes in activity engagement in activities such as reading, writing, and technical skills. However, the associations between health and activity engagement varied based upon the type of health and category of activity. For example, emotional health (encapsulating mental health and affect) was shown to be associated with a myriad of activities (technical, social, developmental, experiential), whereas sensory functioning (encapsulating hearing and eyesight) was only shown to be associated with technical and developmental activities. In a cross-sectional study, health was found to be associated with all types of activities except for passive or tv-watching (Hess & Queen, 2018). Similarly, Jopp and Herzog (2010) have also reported low or negative correlations between cognitive ability and passive activity engagement (such as TV watching). For these reasons, changes in all types of activity engagement, except for passive activity engagement or tv watching, are expected to be significant mediators in both studies.

Aim 3: Domain-Specificity of Model

The last aim of this project focuses on the expected domain-specific nature of these effects. The first hypothesis pertaining to domain-specificity is that mediation effects are expected to be stronger when looking within domains across health, activity category, and views

of aging in contrast to models looking across domains. This will be examined by comparing activity domains within the model, with expectations that the activity associated with the domain will demonstrate stronger mediation effects in comparison to activities not associated with those domains. For example, it is expected that changes in physical activity engagement will demonstrate stronger mediation effects associated with changes in physical health and views of aging in the physical health domain in comparison to other types of activities. Additionally, cognitively demanding activities, such as developmental and experiential activities, are expected to demonstrate stronger mediations effects associated with changes in cognitive health and views of aging in the cognitive health domain in comparison to more passive activities. With regards to mental health, a more domain-general affect is expected such that overall activity level is expected to have the strongest mediation effect. In Study 1, within-domain matching will be examined by matching the health type and activity category. In Study 2, this will be expanded further so that the health type, activity category, and domain of the views of aging measure will be matching. Table 1 further outlines the expected domain-specific effects for each study.

Table 1
Domain-specific expectations for each study

Predictor	Mediator	Outcome
Study 1		
Physical Health	Physical Activity	General VoA
Mental Health	Overall Activity	General VoA
Cognitive Health	Developmental Activity	General VoA
Cognitive Health	Experiential Activity	General VoA
Study 2		
Physical Health	Physical Activity	VoA Physical Health
Mental Health	Overall Activity	VoA Mental Health
Cognitive Health	Developmental Activity	VoA Cognitive Health
Cognitive Health	Experiential Activity	VoA Cognitive Health

Note. VoA indicates Views of Aging measure. For the mental health domain, no specific category of activity is expected to match the domain as the strongest mediation effect, so it is expected for general or overall activities to be the strongest mediator.

Methods

Study 1

Participants

Participants were part of the Health and Retirement Study (HRS), a nationally representative survey of adults over age 50 years old and their spouses (hrs.isr.umich.edu). The current study includes three waves of data collected as part of the psychosocial questionnaire (2008, 2012, and 2016), a leave-behind paper survey designed to assess six different psychosocial content areas (well-being, lifestyle, social relationships, personality, work, and self-related beliefs). Half of the sample were given the opportunity to complete the leave-behind survey every two years, creating four-year intervals between collections starting in 2006. However, relevant measures for the current study were collected starting in 2008. In 2008, approximately 5000 individuals were eligible to complete the leave-behind psychosocial questionnaire on paper. Health information was pulled from the corresponding physical health and cognition core interviews. These interviews were conducted over the phone every two years for the majority of the sample; however, this study used the core sample data corresponding to the psychosocial questionnaire years. Demographic information for the sample was pulled from the most recent (2016) cross-wave tracker file and can be seen in Table 4.

The present study uses individuals who (a) were 50 and older in 2008, (b) completed 3 waves of the psychosocial questionnaire without a proxy, and (c) specifically provided information about their self-perceptions of aging and activity engagement (N = 1923). Individuals who had a proxy fill out the questionnaire were not included due to the potential for severe health issues or cognitive impairment, which may have limited their ability and agency to engage in the daily activities listed in the questionnaire.

Measures

Health

Three indicators of physical health were used. Self-rated health measured how the participants health was from “excellent (1), very good, good, fair, to poor (5)”. Self-rated health was coded so that higher scores indicate worse health. Second, the number of chronic conditions were collected from a list of eight illnesses (high blood pressure, diabetes, cancer, lung disease, heart condition, stroke, psychiatric problems, or arthritis). A sum was computed for the total number of conditions and then recoded into an ordinal scale, due to limited variability above four conditions, the scale was from zero to four or more conditions. The last indicator of physical health was a sum of functional limitations. Participants reported if they experienced difficulties with 23 different tasks because of health problems. Higher scores indicate worse physical health.

Three indicators of mental health were also used. The first was a shortened form of the Center for Epidemiologic Studies Depression scale (CES-D; Radloff, 1977). Participants answered 8 yes or no questions pertaining to the experience of depressive symptoms, and a sum score was computed. The Short Form Composite International Diagnostic Interview (CIDI-SF; Kessler et al., 1998) was also used to assess mental disorders. Participants answered two screening questions regarding if they felt sad, blue, or depressed for more than two weeks in the past 12 months, and if during the past 12 months there was ever a time lasting two or more weeks when they lost interest in activities that normally gave them pleasure. A symptom checklist was then provided for individuals who said yes to either screening question. Sum scores were made based on number of experienced symptoms, with a range from 0 to 7. Life Satisfaction, used to capture subjective well-being, was assessed using a 5-item satisfaction with life questionnaire (Diener et al., 1985). Participants rated how much they agreed with statements

associated with how satisfied they were with their life-as-a-whole from “strongly disagree (1) to strongly agree (7).” An average score was computed across the five items. Life satisfaction was reverse coded so that higher scores indicate lower satisfaction. Across mental health, higher scores indicate worse mental health.

As indicators of cognitive health, two assessments of fluid cognitive ability and a self-rated measure of memory were included. Total recall was assessed by having participants read a list of 10 words and recall as many as possible. This information was collected immediately after reading and again later in the interview to create a sum score of immediate and delayed recall. For the serial 7s task, participants were asked to subtract 7 from 100 and then were asked to subtract 7 from the next 4 cumulative responses. Correct responses were scored as 1 and incorrect were scored as 0, and the total sum was calculated. Lastly, self-rated memory was assessed by asking the participant to rate their memory at the present time from “excellent (1), very good, good, fair, to poor (5)”. Self-rated memory was reverse coded so that higher indicated better memory. In sum, higher scores indicate better cognitive health. Mean values for each wave can be seen in Table 2.

Views of Aging

The self-perceptions of aging measure was a composite of two different scales. This included five items from the Attitudes Towards Own Aging Subscale of the Philadelphia Geriatric Morale Scale (Lawton, 1975; Liang & Bollen, 1983), which had participants rate agreement with statements about aging on a 1 (strongly disagree) to 6 (strongly agree) scale. Additionally, there were three items rated on the same scale which particularly focused on aging satisfaction and were similar to those in the Berlin Aging Study. Based on guidance from the HRS, a unidimensional composite mean score was calculated by reverse-scoring the negatively

framed items. Higher scores indicate more positive views of aging. Reliability for each wave was quite high for the unidimensional scale (α = .81 to .83).

Activity Engagement

Engagement in each of 19 different leisure activities was assessed using a frequency scale from 0 (Never), 1 (Not in the last month), 2 (At least once a month), 3 (Several times a month), 4 (Once a week), 5 (Several times a week) to 6 (Daily). Activities were categorized into five groups based on those used in the Victoria Longitudinal Study Activities Questionnaire (VLSAQ; Jopp & Hertzog, 2010): developmental activities (educational activities, writing), experiential activities (reading, hobbies), physical activities (gardening, sports), social activities (volunteering, social clubs), and passive activities (watching tv, praying privately). An overall average activity engagement score was also calculated to assess an average of all types of activities at each wave. These groupings were used to be consistent with those identified by the psychometrically sound VLSAQ and to be comparable to those used in previous research using this same dataset (Queen & Hess, 2018).

Demographic Information

Demographic information was obtained using the 2016 cross-wave tracker file, which keeps an up-to-date record of changes in demographic information of each participant at each wave of collection. Demographic information included in this study were age, gender, race, years of education, and marital status (Table 4).

Procedure

Participants in the study answered questionnaires, surveys, and completed cognitive tasks in two ways. The first was an over the phone core interview, which collected demographic, health information, and the cognitive tasks. The second was a leave-behind paper questionnaire

containing the psychosocial questionnaire assessing activity engagement and views of aging. Participants were paid for each segment of the survey at each wave, including the baseline core interview, core panel interview, and the leave-behind questionnaire. Core interviews were conducted every two years and the leave-behind questionnaires were given every four years (see for more information; https://hrs.isr.umich.edu/documentation/survey-design).

Table 2
Study 1 Descriptive Statistics

Variable		*M*(SD) Wave 1	Wave 2	Wave 3
Physical Health	*(higher = worse)*			
	Self-Rated	3.40 (.99)	3.32 (.98)	3.14 (.99)
	Chronic Conditions	2.14 (1.28)	2.46 (1.33)	2.71 (1.36)
	Functional Limitations	3.53 (3.07)	3.94 (3.29)	4.72 (3.95)
Mental Health	*(higher = worse)*			
	CES-D	1.39 (1.91)	1.49 (1.89)	1.15 (1.69)
	CIDI-SF	.33 (1.31)	.31 (1.28)	.31 (1.26)
	Life Satisfaction*	4.09 (.77)	4.02 (.79)	3.99 (.83)
Cognitive Health	(*higher = better*)			
	Total Recall	10.52 (2.77)	9.74 (3.11)	8.94 (3.19)
	Serial 7s	4.18 (1.12)	4.10 (1.14)	4.00 (1.25)
	Self-Rated Memory*	2.95 (.87)	3.05 (.85)	3.16 (.88)
Views of Aging		4.12 (1.01)	3.91 (.98)	3.76 (1.03)
Overall Activity Engagement		3.08 (.75)	2.84 (.75)	2.72 (.77)

* indicates item was reverse-coded

Study 2

In order to explore the multidimensional nature of the constructs and to compare the strengths of domain-specific models, Study 2 used a dataset from a five-year, three-wave longitudinal study. This study includes measures specific to the physical, mental, and cognitive domains relating to health, mediating activities, and views of aging.

Participants and Data Collection

The participants in this study were community-based volunteers recruited via newspaper and online advertisements from the Raleigh, North Carolina area to participate in a five-year longitudinal study. Prior to the first experimental session, the Short Blessed Test (Katzman et al., 1983) was used as a cognitive screening measure, with individuals scoring over six being excluded from participation. Due to the overarching goals of the main study, individuals were also excluded before the first wave if they self-reported uncontrolled hypertension or had other medical conditions affecting cardiovascular responses. They were also excluded if their blood pressure met or exceeded 160/100 (N = 3). This resulted in 153 participants eligible in the first wave. Demographic information of the sample at the first wave is shown in Table 4.

Participants completed three in-lab test sessions in years 1, 3, and 5. (Participants were also invited to participate in additional online surveys during years 2 and 4, but these data will not be used here since all measures of interest to the current research were not included at these assessments.) At each of the three time points of collection, 134 to 153 participants provided data. Seventeen of the original respondents did not participate in year 3, resulting in a decision to add 10 new participants to the sample at year 3. Data for those participants were collected for years 3 and 5.

Measures

Health

The physical health and mental health subscales of the SF-36 (Ware, 1993) were used to assess physical and mental health, respectively. Additionally, a modified version of the chronic-conditions checklist used in the MIDUS study was used to collect information about the number of health issues at each timepoint. Chronic conditions were recoded due to the low number of

reported conditions such that any number of conditions above 4 were recoded as a 4, based on previous research using the MIDUS data (Piazza et al., 2007). This resulted in an ordinal scale from zero to four or more conditions. Chronic conditions were reverse coded, resulting in higher scores indicating a lower number of chronic conditions. Depressive symptoms were assessed using the Geriatric Depression Scale and were also reverse coded so that higher scores indicate a lower number of depressive symptoms (Sheikh & Yesavage, 1986). High scores for physical and mental health items indicate better health. Cognitive health was assessed using the Letter-Number Sequencing test and the Digit-Symbol Substitution Test from the Weschler Adult Intelligence Scale-III, as indicators of fluid ability (WAIS-III; Weschler, 1997). Additionally, Vocabulary Test 2 from the Kit of Factor-Referenced Cognitive Tests was used to assess verbal ability (Ekstrom et al., 1976). Higher scores on all cognitive tasks indicate better cognitive ability. See Table 3 for mean values of the health variables at each wave.

Views of aging

Aging expectations and attitudes were assessed using the 12-item Expectations Regarding Aging survey (ERA-12; Sarkisian et al., 2005). This included three subscales (physical health, mental health, and cognitive health) of four items each. Questions on this survey were rated using a four-point scale from (1) definitely true, (2) somewhat true, (3) somewhat false, to (4) definitely false. Higher scores indicate more positive expectations regarding aging.

Activity Engagement

Leisure activity engagement was measured using a modified version of the Victoria Longitudinal Study Activities Questionnaire (VLSAQ; Jopp & Hertzog, 2010) that included activities from each of seven different categories. Activities were assessed in two ways, a weekly measurement burst design and a retrospective questionnaire, however only the retrospective

activity questionnaire collected during the pretest survey in Years 1, 3, and 5 will be used for this study. This questionnaire used the standard VLSAQ format focused on retrospective reports over a 2-year period, with participants rating frequency on a scale of 1 to 9, with 1(Never), 2 (Less than once a year), 3 (About once a year), 4 (2 to 3 times a year), 5 (About once a month), 6 (2 to 3 times a month), 7 (About once a week), 8 (2 to 3 times a week), to 9 (Daily). This assessment included four activities with the highest factor loadings from Jopp and Hertzog within each of the seven categories (i.e., 28 items total). Mean scores for each activity category were calculated. The categories included developmental, experiential, physical, social activities aligned with those used in Study 1 along with three new activity categories: technical (using computer software, doing mathematical calculations), games (word, board, computer, etc.), and tv watching instead of passive. An overall average activity category was also calculated using the mean score of all activities at each wave.

Demographic Information

Demographic information was collected during a post-session survey online. This included age, gender, race, marital status, and education in years (Table 4).

Procedure

At each wave, surveys were sent via email to take online or were administered over the phone based on participant preferences. At all three times of assessment, participants completed a pre-session survey, in-lab experimental session, post-session survey, and 5-weekly surveys specifically pertaining to activity engagement. All data collected in this study were part of the pre-session and post-session surveys.

Table 3

Study 2 Descriptive Statistics

Variable	*higher= better*	*M*(SD) Wave 1	Wave 2	Wave 3
Physical Health				
	SF-36 physical	47.05 (4.49)	45.38 (4.92)	46.12 (4.96)
	Chronic Conditions*	2.24 (1.90)	2.11 (1.84)	2.34 (2.24)
Mental Health				
	SF-36 mental	56.78 (6.46)	58.26 (5.93)	56.76 (7.27)
	GDS*	1.12 (1.65)	1.03 (1.61)	1.05 (1.51)
Cognitive Health				
	LNS	9.97 (2.61)	10.54 (2.37)	10.11 (2.67)
	DSS	63.75 (14.38)	62.31 (14.11)	62.90 (14.70)
	Vocabulary	25.99 (5.56)	26.52 (5.50)	26.64 (5.18)
Views of Aging				
	Physical Health	2.41 (.61)	2.46 (.64)	2.44 (.64)
	Mental Health	3.26 (.52)	3.25 (.57)	3.27 (.55)
	Cognitive Health	2.42 (.58)	2.52 (.62)	2.53 (.66)
Overall Activity Engagement		4.55 (.74)	4.55 (.77)	4.44 (.81)

*indicates item was reverse-coded

Table 4

Participant Characteristics

Variable	Study 1 (*n*=1923) *M*(SD) or *n*%	Study 2 (*n*=150) *M*(SD) or *n*%
Age	69.70 (5.98)	71.82 (4.52)
Education (in years)	13.14 (1.02)	16.85 (2.45)
Marital Status	67.1% married	62.9% married
Race/Ethnicity	86.9% white	90.2% white

Analytic Plan

In order to address the aims and research questions of this paper, multilevel modeling was used for both studies. Multilevel modeling is an appropriate choice due to the nature of the data (years within people) and its ability to account for missing data. Prior to running the lower-level mediation models for each study, principal component analyses were run using the health variables to determine fit. After determining fit, factor scores were created using regression

weights for each of the health variables (physical health, mental health, cognitive health) for both datasets. Additionally, confirmatory factor analyses were conducted to confirm the subscales of the views of aging scale used in Study 2. Correlations of the variables can be seen in Tables A1 and A2 in the appendix.

After confirming and computing factor scores and subscales, lower-level mediation analyses were run using the Monte Carlo Method (Bauer, Preacher, & Gil, 2006). There were years (Level 2) within person (Level 1), with each of the constructs of interest being assessed at level 1 (see main example of formula below).

Level 1: Views of Aging $_{it} = \beta_{0it} + \beta_{1it}(\text{Health}) + \beta_{2it}(\text{Activity Engagement}) + r_{it}$

Level 2: $\beta_{0i} = \gamma_{00} + u_{0i}$

$\beta_{1i} = \gamma_{10} + u_{1i}$

$\beta_{2i} = \gamma_{20} + u_{2i}$

Age, gender, and education of the participant were controlled for within each analysis. The Monte Carlo method was chosen for several reasons to be the most appropriate for both studies. Namely, it does not require assumptions of normality to estimate the indirect and total effects and it is able to utilize parametric bootstrapping which has been shown to be a more efficient method in contrast to other bootstrapping methods (Bauer, Preacher, & Gil, 2006; Preacher & Selig, 2012). Additionally, as recommendations by Rucker et al. (2011) have suggested it is not necessary to establish a significant IV-DV pathway prior to running mediation, direct and indirect effects will be reported only from within the mediation models. The Monte Carlo mediation models were run using SAS 9.4 with 95% Confidence intervals reported based on 20,000 Monte Carlo replications, with the guidance from Bauer et al. (2006). Additionally, the independence test macro was used to calculate the indirect effects and

confidence intervals using the Monte Carlo method (Bauer et al., 2006). Guidelines from Hayes (2018) were followed to determine significant mediation, which states that the test of indirect effects ultimately provides guidance regarding the significance of the mediation regardless of the direct pathway significance levels. Lastly, for significant mediation models, adjusted upsilon (υ) effect sizes were calculated using the MBESS package in R (Lachowicz, Preacher, & Kelly, 2018). Lachowicz, Preacher, and Kelly (2018) created a novel method to calculate effect sizes specific to mediation analyses. These analyses were conducted to reduce bias and address some of the issues pertaining to calculating effect size within large samples.

Results

Study 1

Health Factor Scores

A principal component analysis (PCA) was performed using SPSS to create factor scores based on regression weights for each of the three health factors. The physical health principal component analysis met fit criteria for a 1-factor solution. Guidelines from Hervé and Williams (2010) as well as Jollife (2002) were used to determine fit. These criteria included Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) values at least .50, a significant Bartlett's Test of Sphericity, and component matrix values greater than .50. The PCA for mental health and cognitive health also met criteria for a 1-factor solution (see Table A3 in appendix). Factor scores were then computed for each type of health at each wave using the Bartlett approach which produces factor scores using maximum likelihood estimates. This methodology was chosen as it produces unbiased estimates of the true factor scores in comparison to other methodologies (Hershberger, 2005; DiStefano et al., 2009). As a result, factor scores are also centered.

Unconditional Models

I next ran a fully unconditional MLM with no predictors or control variables to determine between and within person variability in views of aging. I found significant variance at both Level 1 (within-person) and Level 2 (between-person) for the unidimensional score of views of aging ($p < .001$). I then calculated an intraclass correlation coefficient (ICC) to determine the amount of between and within person variability (Raudenbush & Byrk, 2002). These calculations determined that 60.13% of the variability was found at Level 2 (between person) whereas 39.87% of the variability was found at Level 1 (within person). As both values were significant, these results serve as support for the next steps of the model that sought to determine predictors for the within-person changes. Null models were also run for the independent variables and mediators, with significant between and within person variability observed for all types of health and activities (Table 5).

Table 5

Study 1 Null Model and Intraclass Correlations (ICC)

Measure	Estimates: τ_{00}	S.E.	Estimates: σ^2	S.E.	*p*	ICC (% within)
Views of Aging	.63	.02	.41	.01	<.001	39.87%
Physical Health	.79	.03	.21	.00	<.001	21.22%
Mental Health	.51	.02	.50	.01	<.001	49.46%
Cognitive Health	.67	.03	.35	.01	<.001	34.46%
Overall Activity	.31	.01	.28	.01	<.001	47.67%

After running the fully unconditional MLM, I ran a model with wave as a predictor, to determine how much of the within-person variance could be accounted for by changes in time. I controlled for age, gender, and education at the first wave. Results indicated that wave was a significant predictor of changes in views of aging ($b = -.18$, $SE = .01$, $p < .001$), with views of aging becoming more negative over time. Calculating the R^2_{within} value by subtracting the σ^2

from the conditional model from the σ^2 from the unconditional model, divided by the σ^2 from the unconditional model, revealed that 20.4% of the within-person variance in views of aging were accounted for by change over time ($\sigma^2 = .33$, $SE = .01$, $p < .001$). However, this leaves just under 80% of the within-person variance unexplained, necessitating further exploration and facilitates the need to address the hypotheses of this paper.

Lower Level Mediation

Lower level mediation analyses were run to assess changes in views of aging across the three waves of data. In study 1, the outcome variable remains consistent across all analyses looking at changes in general views of aging. As change is the main examination of this study, all variables are at Level 1. Changes in physical health, mental health, and cognitive health were run as separate predictors. Changes in the six categories of activity engagement were used as separate mediators for each model. Results are described for each of the mediation models, organized by the predictor type (health). Each model was run controlling for age, gender, and education at the first wave. Race of the participant was originally included as a control variable, but the models would not converge when included in either study, see the discussion section for future directions. Additionally, as physical health and mental health were coded so that higher scores indicate worse health, these indicators were multiplied by -1 in the results to ease interpretability and align these results with the other predictors from both studies.

Physical health. The first set of analyses examined whether changes in physical health had a significant indirect effect on changes in views of aging, mediated through changes in the different activity categories (see Table 6). There was significant evidence of partial mediation with changes in overall activity engagement, physical activity, experiential activity, and social activity. In contrast, the direct but not indirect pathways were significant for developmental and

passive activities. In sum, the direct effects were all significant, indicating that declines in physical health were associated with worse views of aging across the three time points (Table 6). Overall, physical, experiential, and social activities were significant partial mediators between changes in physical health and views of aging, with declines in these activities being associated with more negative views of aging.

Table 6

1-1-1 Multilevel Mediation Models with Physical Health as Predictor

	X-M	M-Y	X-Y	Total Effects			Total Indirect Effects		
Activity		Estimate (SE)		Estimate (SE)	LCL	UCL	Estimate (SE)	LCL	UCL
Overall	.17* (.01)	.22* (.02)	.43* (.02)	.48* (.02)	.45	.51	.05* (.01)	.04	.07
Physical	.51* (.02)	.11* (.01)	.42* (.02)	.48* (.02)	.44	.51	.06* (.01)	.04	.08
Developmental	.17* (.02)	.09* (.01)	.47* (.02)	.47* (.02)	.44	.51	.01 (.01)	-.01	.02
Experiential	.15* (.02)	.09* (.01)	.47* (.02)	.48* (.02)	.45	.51	.01* (.01)	.01	.03
Social	.13* (.01)	.15* (.01)	.45* (.02)	.47* (.02)	.44	.50	.03* (.01)	.01	.04
Passive	.07* (.02)	-.01 (.01)	.48* (.01)	.49* (.02)	.45	.52	.01 (.01)	-.0	.02

*p<.01

Mental health. Next, lower-level mediation models were run with changes in mental health predicting changes in views of aging, mediated by the various activity categories. As can be seen in Table 7, changes in overall activity level partially mediated the association between mental health and views of aging. Physical activities and social activities were also significant partial mediators. There was no evidence of mediation for developmental (b = .01, SE = .01, p =

.47), experiential (*b* = -.01, *SE* = .01, *p* = .07), or passive activities (*b* = -.01, *SE* = .01, *p* = .22). In all models with mental health as the predictor, the direct effects were significant suggesting negative changes in mental health were associated with negative changes in views of aging. In sum, physical and social activities as well as overall activity level partially mediated the association between changes in mental health and general views of aging, with declines in mental health predicting declines in activity, which in turn predicted declines in views of aging over time.

Table 7

1-1-1 Multilevel Mediation Models with Mental Health as Predictor

	X-M	M-Y	X-Y	Total Effects			Total Indirect Effects		
Activity		Estimate (SE)		Estimate (SE)	LCL	UCL	Estimate (SE)	LCL	UCL
Overall	.09* (.01)	.23* (.02)	.33* (.01)	.35* (.01)	.32	.38	.02* (.01)	.01	.04
Physical	.23* (.02)	.11* (.01)	.31* (.01)	.35* (.02)	.32	.38	.04* (.01)	.02	.05
Developmental	.08* (.02)	.09* (.01)	.36* (.01)	.35* (.02)	.32	.38	-.01 (.01)	-.02	.01
Experiential	.10* (.02)	.09* (.01)	.35* (.01)	.36* (.01)	.33	.39	.01 (.01)	.00	.02
Social	.06* (.01)	.17* (.01)	.33* (.01)	.35* (.02)	.32	.38	.02* (.01)	.01	.03
Passive	-.03 (.02)	-.02* (.01)	.36* (.01)	.36* (.02)	.33	.40	.01 (.01)	-.01	.02

*p<.01

Cognitive health. Similar to physical health and mental health, changes in overall activity partially mediated the association between changes in cognitive health and views of aging (Table 8). However, it is important to note that the model would not converge if the

pathway between cognitive health and views of aging was allowed to randomly vary. Changes in developmental activity (b = .01, SE = .01, p = .05) and experiential activity were significant partial mediators with all pathways allowed to vary. There was no evidence of mediation for physical activity (b = .01, SE = .01, p = .19), social activity (b = .01, SE = .01, p = .14), or passive activity (b = .01, SE = .01, p = .27). Direct effects were significant in all models suggesting there was an association between changes in cognitive health and views of aging. In sum, overall, developmental, and experiential activities partially mediated the association between changes in cognitive health and views of aging. Higher cognitive health predicted higher overall activity levels, and in turn more positive views of aging over time.

Table 8

1-1-1 Multilevel Mediation Models with Cognitive Health as Predictor

	X-M	M-Y	X-Y	Total Effects			Total Indirect Effects		
Activity		Estimate (SE)		Estimate (SE)	LCL	UCL	Estimate (SE)	LCL	UCL
Overall	.10* (.02)	.25* (.02)	.11* (.01)	.14* (.02)	.11	.17	.03* (.01)	.01	.04
Physical	.14* (.02)	.11* (.01)	.13* (.02)	.15* (.02)	.11	.18	.01 (.01)	-.01	.03
Developmental	.19* (.02)	.09* (.01)	.12* (.02)	.14* (.02)	.09	.17	.01^ (.01)	.00	.03
Experiential	.17* (.02)	.10* (.01)	.13* (.02)	.15* (.02)	.11	.18	.02* (.01)	.01	.03
Social	.07* (.01)	.19* (.02)	.14* (.02)	.15* (.02)	.11	.18	.01 (.01)	-.01	.03
Passive	-.05 (.02)	-.01 (.01)	.15* (.02)	.15* (.02)	.12	.19	.01 (.01)	-.01	.02

*p<.01 ^p<.05

Effect sizes of significant mediation models. Lastly, for all the significant mediation models, effect sizes were calculated to allow for comparisons of the relative effect within the

model. See Table 9 for adjusted upsilon effect sizes and lower and upper confidence limits. All effect sizes for the significant mediation models were below recommendations for small effect sizes (.0196; Cohen, 1988). Within the physical health model, the mediation with physical activity had the largest effect size (.002) in comparison to the other activity categories. Physical activity also had the largest effect size for the model with mental health as a predictor (.002). Lastly, within the cognitive health models, both overall and developmental activities had the same effect sizes (.002). Due to the small effect sizes across all the models, comparisons or difference tests are relatively meaningless as the mediation models do not account for much of the variance.

Table 9
Effect Sizes for Significant Mediation Models

Model	Mediator	Adjusted υ ($\beta_{YX\text{-}M}$)	LCL	UCL
Physical Health				
	Overall Activity	.001	.009	.002
	Physical Activity	.002	.001	.003
	Experiential Activity	.0002	.0001	.0003
	Social Activity	.0003	.0001	.0004
Mental Health				
	Overall Activity	.0009	.0006	.001
	Physical Activity	.002	.001	.003
	Social Activity	.0002	.00009	.0003
Cognitive Health				
	Overall Activity	.002	.002	.004
	Experiential Activity	.0006	.0003	.0009
	Developmental Activity	.002	.0009	.003

*Small effect size = .0196

Summary

Consistent with expectations, results from Study 1 found that changes in all three types of health were associated with changes in general views of aging. Taking this a step further, changes in activity engagement demonstrated significant but small mediation effects across the three health-predictor type models (physical, mental, cognitive health). Additionally, with

regards to the domain-specific expectations, the results did not demonstrate stronger mediation effects (indicated by effect sizes) within-domains. Changes in overall activity engagement demonstrated equally large effect sizes for the mediation models in comparison to within-domain activities for the models pertaining to physical health (physical activity) and cognitive health (developmental, experiential activity).

Study 2

Factor Scores for Health and Views of Aging

Similar to Study 1, PCAs were performed using SPSS to create factor scores based on regression weights for the three health variables. Following similar guidelines, the PCA resulted in a good fit for a 1-factor solution for all three health factors (see Table A4 in appendix). Factor scores were then computed for each type of health at each wave using the Bartlett approach.

A confirmatory factor analysis was performed to confirm the three subscales of the Expectations Regarding Aging scale using AMOS 26 (SPSS; IBM). Model fit using the three subscales at the first time point was adequate ($RMSEA_{p<.05}$ = .07; CFI = .92; TLI = .87). Reliability was quite high (α = .85 to .88) at each time point for the entire scale. Standardized regression weights varied from .48 to .81 across the three subscales, and correlations between the three subscales varied from .60 (mental and cognitive) to .77 (mental and physical). The fit did vary across time points, but overall the fit was acceptable for the three-subscales.

Unconditional Models

Next, fully unconditional models were run for each of the three ERA subscales to establish significant between- and within-person change. There was significant between (Level 2) and within (Level 1) person variability for all three subscales of the ERA. Table 10 shows the percentage of within-person variability for each subscale along with a mean score for the ERA.

All three domains demonstrated significant between and within-person variability across the three waves, with the largest within-person variability being associated with the cognitive health domain.

Table 10

Study 2 Null Model and Intraclass Correlation

Measure	Estimates: τ_{00}	S.E.	Estimates: σ^2	S.E.	*p*	ICC (% within)
VoA_mean	.20	.03	.06	.01	<.001	23.43%
VoA _physhealth	.28	.04	.11	.01	<.001	28.74%
VoA_menthealth	.20	.03	.10	.01	<.001	33.54%
VoA _cog	.25	.03	.13	.11	<.001	34.10%
Physical Health	.52	.08	.48	.04	<.001	47.91%
Mental Health	.58	.09	.47	.04	<.001	45.00%
Cognitive Health	.84	.10	.19	.02	<.001	18.24%
Overall Activity	.48	.06	.12	.01	<.001	20.36%

Note. VoA = Views of Aging measured by Expectations Regarding Aging (Sarkisian et al., 2005).

After running fully unconditional models, models were run with wave as a predictor controlling for age, gender, and education at the first wave to determine how much variability was associated with time itself. Wave was not a significant predictor for the physical (p = .27) or mental health (p = .56) domains of the ERA. However, wave was a significant predictor for the cognitive health domain (b = .05, SE = .02, p = .02). In contrast to Study 1, as time passed in this sample, views of aging in the cognitive domain became more positive which may be potentially attributable to the selective nature of the sample or to continued participation in a longitudinal study associated with cognitive engagement. The R^2_{within} value estimated that wave accounted for 20.35% of the within-person variance in ERA in the cognitive domain. These results warranted

need for further investigation of predictors, particularly since time alone was not a significant predictor of the within-person variance for two of the three subscales.

Lower Level Mediation

Similar to Study 1, lower level mediation analyses were run to assess within-person changes in views of aging across the three waves of data. In contrast to study 1, there are three subscales within the views of aging measure (physical health, mental health, cognitive health). Models were run so that the category of health and views of aging were consistently matched, such that changes in physical health was only a predictor for models with views of aging in the physical health domain as the outcome. Only activity engagement categories were varied within the mediation models to explore how different types of activities mediated the association between same-domain health and views of aging. Results are described for each of the mediation models, organized by domain (physical health, mental health, cognitive health). Each model was run controlling for age, gender, and education at the first wave.

Physical health. Separate lower level mediation models were run using physical health as the predictor, eight different activity categories including overall activities as mediators, and views of aging in the physical health domain as the outcome. There was no significant mediation for any of the categories of activity (see Table 11). All models did have significant direct effects, suggesting there was a significant association between changes in physical health and changes in views of aging in the physical health domain (b = .10, SE = .03, p <.05). Models with physical, social, and tv activities would not converge unless the direct pathways from physical health to views of aging were not allowed to vary randomly. However, in all other activity categories this pathway was allowed to vary.

Table 11
1-1-1 Multilevel Mediation Models with Physical Health as Predictor

	X-M	M-Y	X-Y	Total Effects			Total Indirect Effects		
Activity		Estimate (SE)		Estimate (SE)	LCL	UCL	Estimate (SE)	LCL	UCL
Overall	.01 (.03)	.09* (.04)	.11* (.03)	.10* (.03)	.04	.16	-.01 (.01)	-.03	.01
Physical	.13 (.09)	.01 (.02)	.09* (.03)	.09* (.03)	.03	.15	-.02 (.01)	-.04	.01
Developmental	-.06 (.06)	.03 (.02)	.09* (.03)	.09* (.03)	.03	.16	.01 (.01)	-.01	.03
Experiential	-.03 (.05)	-.01 (.03)	.10* (.03)	.10* (.03)	.04	.16	-.01 (.02)	-.03	.03
Social	.04 (.04)	.01 (.04)	.11* (.03)	.09* (.03)	.04	.15	-.02 (.01)	-.04	.01
Technical	.16* (.07)	.03 (.02)	.09* (.03)	.09* (.03)	.03	.15	.01 (.01)	-.02	.03
Game	-.11 (.08)	.04* (.02)	.08* (.03)	.10* (.03)	.04	.16	.02 (.01)	-.01	.05
TV	.02 (.06)	.07* (.02)	.09* (.03)	.10* (.03)	.04	.15	.01 (.01)	-.02	.03

*p<.05

Mental health. Next, lower-level mediation models were run with mental health as the predictor and views of aging within the mental health domain as the outcome. There was evidence of partial mediation with physical activity as the mediator (b = .01, SE = .01, p < .05) There were no other significant mediators associated with mental health (see Table 12). Similar to physical health, the direct effects were significant for each model suggesting that changes in mental health were associated with changes in views of aging within the mental health domain (b = .10, SE = .03, p < .05). The direct pathway from mental health to views of aging in the mental

health domain was constrained when experiential and physical activities were the mediators due to convergence issues.

Table 12

1-1-1 Multilevel Mediation Models with Mental Health as Predictor

	X-M	M-Y	X-Y	Total Effects			Total Indirect Effects		
Activity		Estimate (SE)		Estimate (SE)	LCL	UCL	Estimate (SE)	LCL	UCL
Overall	.06 (.03)	.06 (.05)	.09 * (.03)	.10* (.03)	.03	.17	.02 (.02)	-.02	.04
Physical	.19^ (.09)	.01 (.02)	.08* (.03)	.10* (.02)	.05	.15	.01* (.01)	.00	.02
Developmental	.11 (.07)	-.01 (.02)	.09* (.03)	.09* (.03)	.02	.16	-.01 (.02)	-.04	.03
Experiential	-.02 (.06)	-.03 (.03)	.11* (.03)	.10* (.03)	.05	.16	-.01 (.01)	-.03	.02
Social	.09 (.05)	.10 (.05)	.11* (.04)	.11* (.03)	.04	.19	.00 (.01)	-.02	.03
Technical	.23* (.07)	.06* (.02)	.09* (.03)	.09* (.04)	.03	.17	.01 (.02)	-.02	.05
Game	-.05 (.08)	.01 (.02)	.11* (.03)	.10* (.03)	.03	.17	-.01 (.02)	-.04	.02
TV	.04 (.07)	.06* (.02)	.11* (.03)	.10* (.03)	.04	.17	-.01 (.01)	-.04	.02

*p<.05, ^p<.10

Cognitive health. Lastly, mediation models were run with cognitive health as the predictor and views of aging in the cognitive health domain as the outcome. The indirect effect of changes in overall activity on the pathway from changes in cognitive health to changes in views of aging was significant (b = -.05, SE = .02, p < .05). Developmental activities were nearing significant mediation but was non-significant (b = -.04, SE = .02, p = .08). In contrast to the other health domains, none of the direct effects were significant (p ~= .50). Direct pathways

from cognitive health to views of aging with experiential and technical activities as the mediators were constrained to allow for model convergence.

Table 13

1-1-1 Multilevel Mediation Models with Cognitive Health as Predictor

	X-M	M-Y	X-Y	Total Effects			Total Indirect Effects		
Activity		Estimate (SE)		Estimate (SE)	LCL	UCL	Estimate (SE)	LCL	UCL
Overall	.08 (.05)	.02 (.05)	.06 (.04)	.01 (.05)	-.09	.11	-.05* (.02)	-.10	-.01
Physical	.14 (.13)	-.02 (.02)	.02 (.04)	.01 (.05)	-.09	.10	-.02 (.02)	-.06	.03
Developmental	.01 (.09)	.04 (.02)	.06 (.04)	.02 (.05)	-.09	.11	-.04 (.02)	-.08	.01
Experiential	.11 (.08)	-.01 (.03)	.01 (.04)	.02 (.04)	-.06	.10	.02 (.01)	-.02	.05
Social	.01 (.05)	.02 (.04)	.04 (.04)	.03 (.04)	-.06	.12	-.02 (.02)	-.05	.02
Technical	.25* (.08)	.02 (.02)	.01 (.04)	.01 (.04)	-.07	.08	-.01 (.02)	-.03	.03
Game	.27* (.11)	.01 (.02)	.05 (.04)	.02 (.05)	-.07	.12	-.02 (.02)	-.06	.02
TV	-.08 (.10)	.05 (.03)	.05 (.04)	.03 (.05)	-.07	.12	-.03 (.02)	-.06	.01

*p<.05

Effect sizes of significant mediation models. Effect sizes were calculated for the two significant mediation models (see Table 14). However, cautious interpretation is needed as the sample size was smaller than recommended for calculating the adjust upsilon (recommend n = 500). Effect sizes for both significant mediation models were below recommendations for small effects (.0196).

Table 14
Effect Sizes for Significant Mediation Models

Model	Mediator	Adjusted υ ($\beta_{YX\text{-}M}$)	LCL	UCL
Mental Health				
	Physical Activity	-0.00002	-0.00008	0.0003
Cognitive Health				
	Overall Activity	0.003	0.0005	0.008
	Developmental Activity^	-0.00005	-0.0002	0.0005

*Small effect size = .0196, ^model significance $p<.10$

Domain-specificity without mediators. Given that mediation effects for Study 2 were very small or not significant, follow-up analyses were run to assess how the changes in the different types of health predicted changes in views of aging within and outside of those domains. Controlling for age, gender, and education at the first timepoint, changes in physical health ($b = .10$, $SE = .03$, $p < .001$) and mental health ($b = .06$, $SE = .03$, $p = .03$) predicted changes in views of aging within the physical health domain. Only changes in mental health significantly predicted changes in views of aging in the mental health domain ($b = .11$, $SE = .03$, $p < .001$). Lastly, only changes in mental health ($b = .06$, $SE = .03$, $p = .03$) predicted changes in views of aging in the cognitive health domain.

Summary

Results from Study 2 found evidence for significant mediation associated with changes in physical activities within the mental health domain and changes in overall activities within the cognitive health domain. Changes in developmental activities only approached significant mediation. In line with expectations, changes in physical health and mental health were both significant predictors of changes in views of aging. However, changes in cognitive health were not associated with changes in views of aging in the cognitive health domain. Additionally, changes in mental health predicted changes in all types of views of aging. Overall, the results

from Study 2 did not support the role of domain specificity in determining the mediating role of activity engagement on the effects of health on views of aging.

Discussion

In the present project, I explored the longitudinal associations between changes in health, activity engagement, and views of aging in two separate studies. Across both studies, this project furthered examined a) the longitudinal associations between three types of health and views of aging, b) the mediating role of changes in activity engagement, and c) the domain specificity of these associations. I will discuss the findings associated with each aim, present limitations of the present project, and conclude with contributions and future directions of the project.

Aim 1: Health and Views of Aging

The first aim sought to establish and further support the idea that changes in different aspects of health would be associated with changes in views of aging. Findings from both studies found support for the idea that changes in physical and mental health were associated with changes in views of aging. This supports and builds upon previous literature which has explored how changes in physical health, such as experiencing a cardiovascular event or increases in number of chronic conditions, results in more negative changes in views of aging (Sargent-Cox et al., 2012; Wurm et al., 2019). Novel findings from both studies furthered this body of literature by finding that decline in mental health was a significant and strong predictor of negative changes in views of aging across domains. Change in cognitive health was also explored as a predictor of changes in views of aging, but resulted in mixed findings across studies, revealing only small support in Study 1 and no support in Study 2.

The findings from this project bring to light important information for understanding how different types of health are associated with changes in views of aging in older adulthood. Mental

health changes stood out as an important indicator of changes in views of aging, across sample populations and domains. Interestingly, physical health has been the main type of health explored in relation to changes in views of aging, whereas findings from this project suggest it may be equally or more important to pay attention to mental health when trying to understand and predict how older adult's feel about their aging. This is one of the first studies to assess how changes in mental health predict changes in views of aging, whereas past studies focused on cross-sectional or longitudinal associations between previous attitudes towards aging and future mental health, finding that worse attitudes predicted worse mental health (Bryant et al., 2012; Shenkman et al., 2018). While holding negative views of aging across the lifespan is detrimental for mental and physical health, the findings from this study suggest the need to further understand how changes in both types of health differentially impact views of aging across the adult lifespan. This is particularly important for creating future interventions, as supporting mental health may have more broad-ranging implications than previous research has asserted.

Cognitive health was also explored as another aspect of health-based resources thought to impact changes in views of aging in older adulthood. However, there was mixed to no support for this relationship. This may be due to the way cognitive health was measured, which will be discussed in the limitations section. However, the results also align with previous research which has found that cognitive complaints, but not cognitive performance, predicted changes in attitudes towards own aging over 20 years (Siebert et al., 2020). While Siebert et al. (2020) did not assess how changes in cognitive performance or cognitive complaints were associated with changes in views of aging, their findings suggest that cognitive health may be differentially related to views of aging depending upon whether cognitive health is based upon subjective or objective assessments. Feeling and noticing that your cognitive health has changed may be a

more salient indicator of changes in views of aging, such that the person is aware and may further associate these changes with the aging process. In contrast, objective assessments may give us less information about how the individual experiences daily life changes as a result of their cognitive health declines. In Study 1, a combination of subjective and objective measures was used to create a single cognitive health score at each time point, whereas in Study 2, only objective cognitive assessments were used. This was due to a lack of comparable scales assessing crystallized cognitive, specifically verbal, ability in Study 1 and a desire to have subjective indicators within each type of health. These differences may explain why the effects were much weaker for cognitive health in comparison to those for mental health and physical health. In fact, Siebert et al. (2020) also found the effects of subjective cognitive complaints washed away when controlling for depression, which may suggest that cognitive health alone is not a strong predictor of changes in views of aging. Together, the findings from both studies demonstrated that changes in physical health and mental health were associated with changes in views of aging, but that change in cognitive health was not a strong predictor of changes in views of aging in older adulthood.

Aim 2: Activity Engagement

The second aim of this project was to explore the mediating role of changes in activity engagement. Results from both studies demonstrated mixed support for the hypotheses. Overall, changes in activity engagement did partially mediate the association between changes in all types of health and views of aging in Study 1. In Study 2, changes in overall activities significantly mediated the model within the mental health domain and developmental activities significantly mediated the model within the cognitive health domain. Effect sizes for all significant mediation models were very small, suggesting that there were problems with the mediation models or that

the hypothesized mediators were not capturing the full picture. This highlights many new questions to explore in future research, such as what mechanisms are associated with changes in health and views of aging? Previous research by Sargent-Cox et al. (2012) found support for control beliefs as one potential mediator associated with changes in health and views of aging. Additionally, Klusmann et al. (2012) suggested that while engagement in physical activity was an important mediating mechanism, it altered views of aging by improving direct approach motivation. In other words, intervening on older adult's physical activity engagement resulted in greater motivation to continue engaging in physical activities. This study only explored activity engagement as a mediating mechanism, which may not capture important motivational pieces associated with these changes over time. Despite these limitations, some—albeit weak—support was found for the hypothesis that changes in activity engagement are a mechanism associated with changes in health and views of aging. To my knowledge, my study is the first to have explored a behavioral mechanism, specifically engagement in a variety of activities, as a mediating mechanism associated with changes in health and views of aging.

Aim 3: Domain Specificity of Predictors and Mediators

The final aim of this project was to explore the domain specificity of the models. In the first study, domain specificity was examined through matching the type of health with a related domain of activities. It was expected that changes in within-domain activity engagement would demonstrate the strongest mediation effects. Within the domain of physical health, this was represented by changes in physical activity engagement. Within the domain of cognitive health, this was represented by changes in cognitively demanding activities (developmental, experiential). No specific expectations were made for the mental health domain due to the broader associations between mental health and activity engagement. In Study 2, domain

specificity was examined by matching domains of health, activity category, and subscales of the views of aging measure with expectations, similar to Study 1, that within-domain mediation effects would be the strongest.

In both studies, effect sizes of the mediation models were too small to make any strong conclusions about the relative size of mediation effects. The hypotheses pertaining to domain-specificity were generally not supported due to the lack of strong mediation effects in any of the models. Follow-up analyses assessing the domain specificity of direct associations between health and views of aging found that changes in mental health were associated with changes in all types of views of aging. Additionally, changes in physical health were only associated with changes in views of aging within the physical health domain. As such, these findings further support the idea that change in mental health is a particularly strong and important predictor for changes in views of aging, regardless of the domain. In contrast, change in physical health was only predictive of change in views of aging within the same domain, suggesting that physical health may be a more domain specific predictor.

The lack of support for domain-specificity of the model is surprising. Much of the research pertaining to views of aging has supported the idea that views of aging are domain-specific in nature and may not be the same across all domains (Kornadt et al., 2019). For example, Kornadt et al. (2011) have found that older adults' stereotypes about a certain domain, such as the domain of health, do not necessarily generalize to their views of aging in a different domain, such as social relationships. While my research focused on health instead of same-domain stereotypes, I similarly expected that within-domain health would be a stronger predictor of within-domain views of aging, based in part on research by Bryant et al. (2012). Findings from both studies of this project demonstrated that activity category was not a salient within-

domain mediator. It is worth noting, however, that many of the studies looking at the domain-specific nature of views of aging have used cross-sectional samples, with little consideration of associations between health, activity, and views of aging over time. As such, when assessing domain specificity in relation to predictors of views of aging, it may be more important to assess the domain specificity of the predictor (type of health), with the domain of activity being less important.

Limitations

There are several limitations to this project that are important to highlight when considering generalizability and applicability of the findings. Firstly, the mediation models were each run separately for each type of health and all categories of activities. The true nature of these constructs, however, may require more complex analyses, such as a multi-level structural equation model (ML-SEM). By running each model separately, I was unable to control for the different types of health and activity category all within one model. Inclusion of all the predictors and mediators in one model, however, may allow for a more complex understanding of the interactions between physical, mental, and cognitive health and how they are associated with a variety of activities, and ultimately predict changes in views of aging. However, due to the small sample size in Study 2 and my desire to have consistent analyses across both studies, it was not possible to use ML-SEM for this project.

Some additional limitations of this project pertain to the scales and variables themselves. Firstly, while the term cognitive health was used to describe the variables in this study to better align with the general focus on health, the measurements used to represent cognitive health were mainly indicators of cognitive ability. Taken together, these measures may reflect general cognitive ability, but may not necessarily align with holistic representations of cognitive health,

which generally include sensory functioning, brain health, and motor functioning (National Institute on Aging, 2019). Additionally, the measure of cognitive health used in this research did not clearly distinguish between objective and subjective indicators of this construct, which previous research has suggested is important (e.g., Siebert et al., 2020). In general, the cognitive health measurements may not be optimal and it may be beneficial to either separate out subjective and objective indicators of cognitive health or to include a larger battery of cognitive health measurements to have a more general view of cognitive health.

Another potential issue in the present research has to do with the way activity engagement was measured. The retrospective nature of the questionnaire may be a limitation due to potential memory biases, a meta-analysis conducted by Neilson et al. (2008) found that there were significant differences between self-reported physical activity and actual activity energy expenditure. Expanding this to all types of daily activities, self-reported retrospective daily activity questionnaires may not be accurately capturing the daily experience of older adults. However, it may also be argued that the subjective changes in activity engagement are as important as objective changes at least within this model. In other words, if changes in activity engagement are supposed to exemplify the limitations of health and are important pieces of information an older adult uses to judge their own aging, then it may not be as important that the changes in activity engagement are accurate but rather that they are perceived to have changed.

Another limitation of this project may be the domain categorization of the activities. The domain of the activity category aligned physical activities with physical health and cognitively demanding activities with cognitive health. However, these activity domains are potentially artificial such that all categories of activities may be influenced by multiple aspects of health. Additionally, stronger mediation effects may have been found if activities were based on

perceived demands instead of using previously established categories. Bielak (2017) has reviewed similar concerns with activity engagement, finding that different ways of measuring activities (i.e., categories, activity characteristics) results in differing predictability of cognitive performance but that no single activity measurement predicted all types of cognitive performance. Collectively, the results from this study and previous research suggest there is a need to explore activity engagement through multiple methodologies to better understand its associations with health and views of aging.

Another measurement issue pertains to the views of aging measures. While this project sought to explore changes in views of aging, including views about one's own aging as well as views about aging in general, the measures used in the two different studies may have been capturing different subsets of views of aging. In Study 1, the views of aging measure specifically asked about their own aging experiences. In contrast, the measures used in Study 2 assess both general attitudes about aging alongside attitudes about one's own aging and displayed much less within-person variability (23%) than the measure used in Study 1 (40%). This suggests that there may be differences in within-person variability depending upon whether the measures pertain to one's own aging or to aging in general. Unfortunately, the ERA scales used in Study 2 also had a mix of both views of one's own aging and aging in general, but not an equal distribution that would have allowed me to explore differences in these types of views of aging. Research by Diehl et al. (2014) has suggested that there are many overlapping predictors associated with different types of views of aging but that there are also meaningful differences, such that views of one's own aging has been shown to be associated with one's own behavior more than their general views of aging. This may also be one explanation for why the strength of the mediation models was stronger in Study 1 in comparison to Study 2.

Contributions and Future Directions

Whereas the results of the present research found mixed evidence for my conceptual model and general hypotheses, the findings do provide some contribution to the field and our understanding of views of aging.

This project was able to provide a more in-depth exploration relating to the conceptualization of health by breaking it down into physical health, mental health, and cognitive health. In both studies, changes in physical and mental health were found to be associated with changes in views of aging. However, findings relating to changes in cognitive health were mixed across the two studies. This builds upon previous literature by expanding the types of health and resources which have been shown to undergird daily activity engagement (Hess et al., 2018). These findings also partially replicate the within-person association between changes in health and activity engagement observed by Wurm et al. (2017, 2019), but places it within a broader context. Although Wurm et al. (2019) found that individuals who experienced a cardiovascular event also experienced declines in their views of aging, this effect may be more expansive than previously hypothesized such that they are not limited to solely changes in physical health. Findings from this project suggest that changes in other aspects of health can also have influential impacts on our views of aging over time. Understanding that changes in mental and cognitive health, in addition to physical health, are associated with changes in views of aging is important to build upon previous mechanisms and for informing future interventions. While more research is needed to understand how changes in physical, mental, and cognitive health collectively contribute to changes in views of aging, this study provides support for the idea that changes in all three types of health need to be taken into consideration when understanding within-person changes in views of aging.

Although the effect sizes of the mediation models are too small to make any substantial conclusions regarding the strength of the mediation effects, this study was the first to systematically explore changes in activity engagement as a mediating mechanism associated with changes in health and views of aging. Previous research has looked at control beliefs as a potential mechanism and found similar results with support for partial mediation (Sargent-Cox et al., 2012). From the current project and results of past studies, it may be important to explore how both behavioral and attitudinal mechanisms work together over time, and how changes in both behavior and attitudes reflect the impact of experiencing health changes on our views of aging. For example, experiencing declines in our physical health may not only influence out-of-home activity engagement, but also our beliefs about how much control we have over the aging process, with these collective experiences possibly eliciting more negative responses to the aging process. By examining changes in activities alone, without attitudinal or motivational factors, we may not be getting the full picture of how views of aging change across the older adult lifespan. However, the current project made an important first step by assessing different types of activity engagement as a potential mechanism, which can then be used as a platform for future research to continue building upon.

Lastly, this project explored the importance of domain specificity in the model. Whereas current literature suggests that views of aging are domain specific (e.g., Kornadt et al., 2019), the present project was unable to find clear patterns for domain specificity in the mechanisms behind how views of aging change. This may be due to the ways through which domains were used. Domain-specificity was explored by aligning similar activity categories to the type of health and views of aging domain. However, as discussed earlier, the activity categories used may not be a salient representation of one domain. Experiencing declines in physical activities may be

representative of declines in all types of health not just physical health, in other words, the domains of activity and health may be less clear. While it was hypothesized that there would be a linkage between activity category and domain of health, there may not be a salient association between these two constructs based on domain.

In terms of future directions, there were many remaining gaps in the findings of both studies to explore further. Results from both studies demonstrated incredibly small effect sizes, suggesting that there is a need for future investigation to address potential measurement limitations of the current project and to explore additional mechanisms such as control beliefs. Another future direction to explore relates to the nature of change in different types of views of aging. While this project explored within-person changes in a more general conceptualization of views of aging, it seems important to understand how views about one's own aging may differ from views about aging in general. Based on results from this study and previous research by Diehl et al. (2014), we might expect changes in views about one's own aging to be more affected by changes in activity engagement in comparison to general views of aging. This study was unable to make conclusions about the within-person trajectories of views of one's own aging in comparison to general views due to the measurements available, but this is an important topic to explore in order to better understand the mechanisms associated with different types of views of aging and how it may be possible to alter them.

While this research explored a within-person approach, it may also be important to explore between-person characteristics associated with views of aging to better understand the findings. Age has often been used as moderator in literature looking at health and activity engagement, such that the association between health and activity engagement is reduced in the oldest old (Queen & Hess, 2018). Growney and Hess (2020), on the other hand, found that

changes in emotional health continued to be associated with changes in activity engagement across the older adult lifespan. However, more research is needed to understand how changes in health, activity engagement, and views of aging are moderated by the age of the individual. Beyond this, very little literature exists studying how racial and cultural differences within the U.S. play a role on views of aging. The literature that does exist suggests that there are shared ideas of characteristics of aging-well among different racial and ethnic groups in the U.S. but that there are also meaningful differences in aging expectations and stereotypes suggesting that changes in activity engagement may play a different role for different groups of individuals (Laditka et al., 2009; Menkin et al., 2017). Additionally, as the models would not converge when race was included as a covariate in both studies, this suggests a need for further exploration and understanding of between-person differences in the model. Understanding how views of aging change within-person is important, but also providing context and understanding for whom this information applies to is vital information for applying this knowledge to intervention and real-world settings.

Conclusions

The results of these two studies build upon previous research finding that changes in health impact views of aging across the older adult lifespan. These studies further this understanding by demonstrating that changes in physical health, mental health, and cognitive health predict changes in views of aging. Additionally, there was some evidence supporting the idea that changes in activity engagement may be one mediating mechanism associated with these changes. However, these findings also suggest there is a need to explore other analytic strategies and mechanisms which may work in tandem with activity engagement to influence within-person changes in views of aging. Collectively, the findings from this project should be used as a

steppingstone for future research and to guide interventions focused on improving views of aging.

REFERENCES

Baltes, P. B., & Baltes, M. M. (1990). Psychological perspectives on successful aging: The model of selective optimization with compensation. *Successful aging: Perspectives from the behavioral sciences*, *1*(1), 1-34.

Baltes, P. B. (1997). On the incomplete architecture of human ontogeny: Selection, optimization, and compensation as foundation of developmental theory. *American Psychologist, 52*(4), 366–380. https://doi.org/10.1037/0003-066X.52.4.366

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

Beyer, A., Wolff, J. K., & Wurm, S. (2016). Can views on aging be changed within an exercise program? Findings from an intervention study. *Gerontologist, 56*, 690-690. https://doi-org /10.1093/geront/gnw162.2809

Bielak, A.A.M. (2017) Different perspectives on measuring lifestyle engagement: a comparison of activity measures and their relation with cognitive performance in older adults. *Aging, Neuropsychology, and Cognition*, *24*(4), 435-452, https://doi.org/10.1080/13825585.2016.1221378

Brothers, A., & Diehl, M. (2017). Feasibility and efficacy of the AgingPlus Program: Changing views on aging to increase physical activity. *Journal of Aging and Physical Activity*, *25*(3), 402-411. https://doi.org/10.1123/japa.2016-0039

Bryant, C., Bei, B., Gilson, K., Komiti, A., Jackson, H., & Judd, F. (2012). The relationship between attitudes to aging and physical and mental health in older adults. *International Psychogeriatrics, 24*(10), 1674-1683. https://doi.org/10.1017/S1041610212000774

Cheng, S.-T. (2017). Self-Perception of Aging and Satisfaction with Children's Support. *The Journals of Gerontology: Series B*, 72(5), 782–791. https://doi.org/10.1093/geronb/gbv113

Cohen, J. (1988). Statistical power analysis for the behavioral sciences. L. Erlbaum Associates.

Cohen-Mansfield, J., Shmotkin, D., Blumstein, Z., Shorek, A., Eyal, N., & Hazan, H. (2013). The old, old-old, and the oldest old: continuation or distinct categories? An examination of the relationship between age and changes in health, function, and well-being. *The International Journal of Aging and Human Development, 77*(1), 37-57. https://doi-org/10.2190/AG.77.1.c

Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The Satisfaction with Life Scale. *Journal of Personality Assessment, 49*(1), 71-75.

Diehl, M., Wahl, H.-W., Barrett, A. E., Brothers, A. F., Miche, M., Montepare, J. M., Westerhof, G. J., & Wurm, S. (2014). Awareness of aging: Theoretical considerations on an emerging concept. *Developmental Review, 34*(2), 93–113.

DiStefano, C., Zhu, M., & Mã, D. (2009). Understanding and Using Factor Scores: *Considerations for the Applied Researcher. 14*(20), 12.

Ekstrom, R. B., French, J. W., Harman, H. H., & Dermen, D. (1976). Manual for the kit of factor-referenced cognitive tests. Princeton, NJ: Educational Testing Service.

Freund, A. M., & Baltes, P. B. (2002). The Adaptiveness of Selection, Optimization, and Compensation as Strategies of Life Management Evidence From a Preference Study on Proverbs. *The Journals of Gerontology: Series B, 57*(5), P426–P434. https://doi.org/10.1093/geronb/57.5.P426

Growney, C. M., & Hess, T.M. (2020). *The role of affect-based resources in older adults' information gathering and activity engagement*. Paper submitted for publication.

Hayes, A. F. (2017). Introduction to Mediation, Moderation, and Conditional Process Analysis, Second Edition: A Regression-Based Approach. Guilford Publications.

Hayes, A. F. (2018). Partial, conditional, and moderated moderated mediation: Quantification, inference, and interpretation. *Communication Monographs, 85*, 4-40.

Health and Retirement Study, ([HRS 2008, 2012, 2016 Public Survey Data]) public use dataset. Produced and distributed by the University of Michigan with funding from the National Institute on Aging (grant number NIA U01AG009740). Ann Arbor, MI, (2020).

Hershberger, S. L. (2005). Factor Score Estimation. In *Encyclopedia of Statistics in Behavioral Science*. American Cancer Society. https://doi.org/10.1002/0470013192.bsa726

Hervé, A. & Williams, L.J. (2010). Principal Component Analysis. *WIREs Comp Stat, 2*. 433–59. http://staff.ustc.edu.cn/~zwp/teach/MVA/abdi-awPCA2010.pdf.

Hess, T. M., Growney, C. M., & Lothary, A. F. (2019). Motivation moderates the impact of aging stereotypes on effort expenditure. *Psychology and Aging*, *34*(1), 56–67. https://doi.org/10.1037/pag0000291

Hess, T. M., Growney, C. M., O'Brien, E. L., Neupert, S. D., & Sherwood, A. (2018). The role of cognitive costs, attitudes about aging, and intrinsic motivation in predicting engagement in everyday activities. *Psychology and Aging, 33*(6), 953-964. https://doi.org/10.1037/pag0000289

Hess, T.M., & Knight, R.C. (2020). *Adult age differences in situational and chronic mental fatigue.* Manuscript submitted for publication.

Huxhold, O., Fiori, K. L., & Windsor, T. D. (2013). The dynamic interplay of social network characteristics, subjective well-being, and health: The costs and benefits of socio-emotional selectivity. *Psychology and Aging, 28*(1), 3. https://doi-org /10.1037/a0030170

Ihle, A., Gouveia, É. R., Gouveia, B. R., van der Linden, Bernadette W A, Sauter, J., Gabriel, R., . . . Kliegel, M. (2017). The role of leisure activities in mediating the relationship between physical health and well-being: Differential patterns in old and very old age. *Gerontology, 63*(6), 560-571. https://doi.org/10.1159/000477628

Jollife, I.T. (2002). Principal Component Analysis. 2nd ed. New York: Springer-Verlag. https://goo.gl/SB86SR.

Jopp, D., & Hertzog, C. (2007). Activities, self-referent memory beliefs, and cognitive performance: Evidence for direct and mediated relations. *Psychology and Aging*, *22*(4), 811–825. https://doi.org/10.1037/0882-7974.22.4.811

Jopp, D. S., & Hertzog, C. (2010). Assessing adult leisure activities: An extension of a self-report activity questionnaire. *Psychological Assessment, 22*(1), 108-120.

Kelley, K., & Preacher, K. J. (2012). On effect size. *Psychological methods, 17*(2), 137.

Kessler, R. C., Andrews, G., Mroczek, D., Ustun, B., & Wittchen, H. -U. (1998). "The World Health Organization Composite International Diagnostic Interview Short-Form (CIDI-SF). *International Journal of Methods in Psychiatric Research, 7*(4), 171-185.

Kim, S. H. (2009). Older people's expectations regarding ageing, health-promoting behaviour and health status. *Journal of Advanced Nursing, 65*(1), 84-91. https://doi.org/10.1111/j.1365-2648.2008.04841.x

Kleinspehn-Ammerlahn, A., Kotter-Grühn, D., & Smith, J. (2008). Self-Perceptions of Aging: Do Subjective Age and Satisfaction with Aging Change During Old Age? *The Journals of Gerontology: Series B, 63*(6), P377–P385. https://doi.org/10.1093/geronb/63.6.P377

Klusmann, V., Evers, A., Schwarzer, R., & Heuser, I. (2012). Views on aging and emotional benefits of physical activity: Effects of an exercise intervention in older women. *Psychology of Sport and Exercise, 13*(2), 236–242. https://doi.org/10.1016/j.psychsport.2011.11.001

Kornadt, A. E., & Rothermund, K. (2015). Views on aging: Domain-specific approaches and implications for developmental regulation. *Annual Review of Gerontology and Geriatrics, 35*(1), 121-144. https://doi.org/10.1891/0198-8794.35.121

Kotter-Grühn, D., Kleinspehn-Ammerlahn, A., Gerstorf, D., & Smith, J. (2009). Self-perceptions of aging predict mortality and change with approaching death: 16-year longitudinal results from the Berlin Aging Study. *Psychology and Aging, 24*(3), 654–667. https://doi.org/10.1037/a0016510

Kuhlmann, B. G., Kornadt, A. E., Bayen, U. J., Meuser, K., & Wulff, L. (2015). Multidimensionality of younger and older adults' age stereotypes: The interaction of life domain and adjective dimension. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 72*(3), 436-440. https://doi.org/10.1093/geronb/gbv049

Lachowicz, M. J., Preacher, K. J., & Kelley, K. (2018). A novel measure of effect size for mediation analysis. *Psychological Methods, 23*(2), 244–261. https://doi.org/10.1037/met0000165

Laditka, S. B., Corwin, S. J., Laditka, J. N., Liu, R., Tseng, W., Wu, B., Beard, R. L., Sharkey, J. R., & Ivey, S. L. (2009). Attitudes About Aging Well Among a Diverse Group of Older Americans: Implications for Promoting Cognitive Health. *The Gerontologist, 49*(S1), S30–S39. https://doi.org/10.1093/geront/gnp084

Lawton, M.P. (1975). The Philadelphia Geriatric Center Morale Scale: A revision. *Journals of Gerontology, 30*, 85-89.

Levy, B. R. (2009). Stereotype embodiment: A psychosocial approach to aging. *Current Directions in Psychological Science, 18*(6), 332-336.

Levy, B. R., Slade, M. D., & Kasl, S. V. (2002). Longitudinal benefit of positive self-perceptions of aging on functional health. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 57*(5), P409-P417.

Liang, J. & Bollen, K.A. (1983). The structure of the Philadelphia Geriatric Center (PGC) Morale Scale: A reinterpretation. *Journals of Gerontology, 38*, 181-189.

Meisner, B. A., Weir, P. L., & Baker, J. (2013). The relationship between aging expectations and various modes of physical activity among aging adults. *Psychology of Sport & Exercise, 14*(4), 569-576. https://doi.org/10.1016/j.psychsport.2013.02.007

Menec, V. H. (2003). The Relation Between Everyday Activities and Successful Aging: A 6-Year Longitudinal Study. *The Journals of Gerontology: Series B, 58*(2), S74–S82. https://doi.org/10.1093/geronb/58.2.S74

Menkin, J. A., Guan, S.-S. A., Araiza, D., Reyes, C. E., Trejo, L., Choi, S. E., Willis, P., Kotick, J., Jimenez, E., Ma, S., McCreath, H. E., Chang, E., Witarama, T., & Sarkisian, C. A. (2017). Racial/Ethnic Differences in Expectations Regarding Aging Among Older Adults. *The Gerontologist, 57*(suppl_2), S138–S148. https://doi.org/10.1093/geront/gnx078

Miche, M., & Wahl, H. W. (2013, November). "It's because of my age": The influence of experimentally increased salience of age-related changes in cognitive functioning on self-perceptions of aging. Poster presented at the 66th Annual Scientific Meeting of the Gerontological Society of America, New Orleans, LA.

National Institute on Aging. (2020, July 30). Cognitive Health and Older Adults. https://www.nia.nih.gov/health/cognitive-health-and-older-adults

Neilson, H. K., Robson, P. J., Friedenreich, C. M., & Csizmadi, I. (2008). Estimating activity energy expenditure: How valid are physical activity questionnaires*? The American Journal of Clinical Nutrition, 87*(2), 279–291. https://doi.org/10.1093/ajcn/87.2.279

Pachana N.A., Jetten J., Gustafsson L., Liddle J. (2017). To be or not to be (an older driver): social identity theory and driving cessation in later life. *Ageing Soc 37*:1597–1608. https://doi.org/10.1017/S0144686X16000507

Palgi, Y., Ayalon, L., Avidor, S., Segel-Karpas, D., & Bodner, E. (2018). On the edge: The association between extreme values of proportional felt-age and functioning. *Psychiatry Research, 270*, 538-543. https://doi.org10.1016/j.psychres.2018.10.035/

Piazza, J. R., Charles, S. T., & Almeida, D. M. (2007). Living With Chronic Health Conditions: Age Differences in Affective Well-Being. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 62*(6), P313–P321. https://doi.org/10.1093/geronb/62.6.P313

Preacher, K. J., & Kelley, K. (2011). Effect size measures for mediation models: quantitative strategies for communicating indirect effects. *Psychological methods, 16* (2), 93.

Preacher, K.J., & Selig, J.P. (2012). Advantages of Monte Carlo Confidence Intervals for Indirect Effects. *Communication Methods & Measures, 6*(2), 77–98. https://doi.org/10.1080/19312458.2012.679848

Queen, T. L., & Hess, T. M. (2018). Linkages between resources, motivation, and engagement in everyday activities. *Motivation Science, 4*(1), 26-38. https://doi.org/10.1037/mot0000061

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

Raudenbush, S. W., & Bryk, A. S. (2002). Hierarchical linear models: Applications and data analysis methods (2nd ed.). Thousand Oaks: Sage Publications.

Rucker, D. D., Preacher, K. J., Tormala, Z. L., & Petty, R. E. (2011). Mediation Analysis in Social Psychology: Current Practices and New Recommendations. *Social and Personality Psychology Compass, 5*(6), 359–371. https://doi.org/10.1111/j.1751-9004.2011.00355.x

Sargent-Cox, K. A., Anstey, K. J., & Luszcz, M. A. (2012). The relationship between change in self-perceptions of aging and physical functioning in older adults. *Psychology and Aging, 27*(3), 750-760.

Sargent-Cox, K. A., Anstey, K. J., & Luszcz, M. A. (2014). Longitudinal Change of Self-Perceptions of Aging and Mortality. *The Journals of Gerontology: Series B, 6*9(2), 168–173. https://doi.org/10.1093/geronb/gbt005

Sarkisian, C. A., Hays, R. D., Berry, S., & Mangione, C. M. (2002). Development, reliability, and validity of the expectations regarding aging (ERA-38) survey. *The Gerontologist, 42*(4), 534-542.

Sarkisian, C. A., Prohaska, T. R., Wong, M. D., Hirsch, S., & Mangione, C. M. (2005). The relationship between expectations for aging and physical activity among older adults. *Journal of General Internal Medicine, 20*(10), 911-915. https://doi.org/10.1111/j.1525-1497.2005.0204.x

Sarkisian, C. A., Steers, W. N., Hays, R. D., & Mangione, C. M. (2005). Development of the 12-item expectations regarding aging survey. *The Gerontologist, 45*(2), 240-248. https://doi.org/10.1093/geront/45.2.240

Schafer, M. H., & Shipee, T. P. (2010). Age identity in context: Stress and the subjective side of aging. *Social Psychology Quarterly, 73*(3), 245-264. https://doi.org/10.1177/0190272510379751

Sheikh, J. I., & Yesavage, J. A. (1986). Geriatric Depression Scale (GDS): recent evidence and development of a shorter version. *Clinical Gerontologist: The Journal of Aging and Mental Health.*

Shenkman, G., Ifrah, K., & Shmotkin, D. (2018). The association between negative attitudes toward aging and mental health among middle-aged and older gay and heterosexual men in Israel. *Aging & Mental Health, 22(*4), 503-511. https://doi.org/10.1080/13607863.2016.1274374

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

Silvia, P. J., Mironovová, Z., McHone, A. N., Sperry, S. H., Harper, K. L., Kwapil, T. R., & Eddington, K. M. (2016). Do depressive symptoms "blunt" effort? An analysis of cardiac engagement and withdrawal for an increasingly difficult task. *Biological Psychology, 118*, 52–60. https://doi.org/10.1016/j.biopsycho.2016.04.068

Stephan, Y., Chalabaev, A., Kotter-Grühn, D., & Jaconelli, A. (2013). "feeling younger, being stronger": An experimental study of subjective age and physical functioning among older adults. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences, 68*(1), 1-7. https://doi.org/10.1093/geronb/gbs037

Voss, P., Wolff, J. K., & Rothermund, K. (2017). Relations between views on ageing and perceived age discrimination: A domain-specific perspective. *European Journal of Ageing, 14*(1), 5-15. https://doi.org/10.1007/s10433-016-0381-4

Ware, J. E. (1993). SF-36 health survey: Manual and interpretation guide. Boston, MA: The Health Institute, New England Medical Center.

Wiese, B. S., Freund, A. M., & Baltes, P. B. (2002). Subjective Career Success and Emotional Well-Being: Longitudinal Predictive Power of Selection, Optimization, and Compensation. *Journal of Vocational Behavior*, *60*(3), 321–335. https://doi.org/10.1006/jvbe.2001.1835

Wechsler, D. (1997). Wechsler Adult Intelligence Scale (3rd ed.). New York, NY: Psychological Corporation.

Wolff, J. K., Warner, L. M., Ziegelmann, J. P., & Wurm, S. (2014). What do targeting positive views on ageing add to a physical activity intervention in older adults? Results from a randomised controlled trial. *Psychology & Health, 29*(8), 915-932. https://doi.org/10.1080/08870446.2014.896464

Wurm, S., Diehl, M., Kornadt, A. E., Westerhof, G. J., & Wahl, H. (2017). How do views on aging affect health outcomes in adulthood and late life? explanations for an established connection. *Developmental Review, 46*, 27-43. https://doi.org/10.1016/j.dr.2017.08.002

Wurm, S., Tomasik, M. J., & Tesch-Römer, C. (2008). Serious health events and their impact on changes in subjective health and life satisfaction: The role of age and a positive view on ageing. *European Journal of Ageing, 5*(2), 117-127. https://doi.org/10.1007/s10433-008-0077-5

Wurm, S., Warner, L. M., Ziegelmann, J. P., Wolff, J. K., & Schüz, B. (2013). How do negative self-perceptions of aging become a self-fulfilling prophecy? *Psychology and Aging, 28*(4), 1088-1097. https://doi.org/10.1037/a0032845

Wurm, S., Wiest, M., Wolff, J. K., Beyer, A., & Spuling, S. M. (2019). Changes in views on aging in later adulthood: The role of cardiovascular events. *European Journal of Ageing*, https://doi.org/10.1007/s10433-019-00547-5

APPENDICES

Appendix A: Tables

Table A1

Study 1: Correlations at Wave 1

Variable	1	2	3	4	5	6	7	8	9
1. Physical Health	-								
2. Mental Health	.45**	-							
3. Cognitive Health	-.31**	-.12**	-						
4. Views of Aging	-.52**	-.45**	.25**	-					
5. Average Activity	-.17**	-.09**	.14**	.17**	-				
6. Physical Activity	-.35**	-.18**	.13**	.24**	.56**	-			
7. Developmental Activity	-.14**	-.04	.26**	.14**	.55**	.17**	-		
8. Experiential Activity	-.10**	-.08**	.17**	.11**	.611**	.28**	.35**	-	
9. Social Activity	-.11**	-.06*	.06*	.10**	.52**	.22**	.28**	.22**	-
10. Passive Activity	.06*	.03	-.05*	.01	.66**	.02	.08**	.16**	.15**

**$p<.01$, *$p<.05$, *Note.* Physical and mental health are coded so that higher scores indicate worse health.

Table A2

Study 2: Correlations at Wave 1

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1.Physical Health	-												
2.Mental Health	.17*	-											
3.Cognitive Health	.24**	.16*	-										
4.Views of Aging_phys	.34**	.18*	.07	-									
5.Views of Aging_ment	.23**	.37**	.19*	.54**	-								
6.Views of Aging_cog	.26**	.26**	.1	.57**	.47**	-							
7.Average Activity	.04	.27**	.21**	.22**	.24**	.20*	-						
8.Physical Activity	.06	.24**	.22**	.10	.14	.14	.57**	-					
9.Developmental Activity	.03	.17*	.09	.33**	.20*	.28*	.42**	.12	-				
10.Experiential Activity	-.06	.10	.23**	.06	.1	.14	.52**	.20*	.25**	-			
11.Social Activity	-.05	.26**	.01	.06	.21*	.11	.54**	.34**	.24**	.30**	-		
12.Technical Activity	.11	.13	.25**	.08	.26**	.12	.58**	.27**	.15	.28**	.21**	-	
13.Game Activity	.03	.11	.12	.15	.12	.05	.55**	.02	.07	.06	.14	.16	-
14.TV Activity	-.05	-.02	-.18*	-.05	-.12	-.07	.37**	-.07	-.16	.10	.06	.01	.25**

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

Table A3

Study 1: Principal Component Analysis Output for Health Variables

Variable	Bartlett's Test of Sphericity			K-M-O			Component Value		
	Chi-Square, df=3 p<.001						Mean		
Wave	1	2	3	1	2	3	1	2	3
Physical Health	1130	1151	1030.76	.67	.66	.65	.80	.80	.79
Mental Health	655.18	684.1	653.10	.62	.60	.59	.75	.75	.75
Cognitive Health	161.13	126.9	155.16	.58	.56	.57	.67	.66	.67

*K-M-O= Kaiser-Meyer-Olkin Measure of Sampling Adequacy

Table A4

Study 2: Principal Component Analysis Output for Health Variables

Variable	Bartlett's Test of Sphericity			K-M-O			Component Value		
	Chi-Square, df=1 p<.001						Mean		
Wave	1	2	3	1	2	3	1	2	3
Physical Health	.55	14.84	4.69	.50	.50	.50	.73	.81	.77
Mental Health	35.90	55.73	42.12	.50	.50	.50	.86	.89	.87
Cognitive Health	41.91	37.69	58.91	.63	.65	.61	.74	.78	.73

*K-M-O= Kaiser-Meyer-Olkin Measure of Sampling Adequacy

Appendix B: Measures

Study 1: Questionnaires

Views of Aging

(Lawton, 1975; Liang & Bollen, 1983; Berlin Aging Study)

1. Things keep getting worse as I get older.*

2. I have as much as pep as I did last year.*

3. The older I get, the more useless I feel.*

4. I am as happy now as I was when I was younger.*

5. As I get older, things are better than I thought they would be.*

6. So far, I am satisfied with the way that I am aging.

7. The older I get, the more I have had to stop doing things that I liked.

8. Getting older has brought with it many things that I do not like.

*indicates items from Philadelphia Geriatric Morale Scale

Scale Responses: from (1) strongly disagree, (2) somewhat disagree, (3) slightly disagree, (4) slightly agree, (5) somewhat agree, to 6 (strongly agree)

Victoria Longitudinal Study Activities Questionnaire and Categories from HRS

(VLSAQ; Jopp & Hertzog, 2010)

Physical

Go to a sport, social, or other club?

Walk for 20 minutes or more?

Play sports or exercise?

Do home or car maintenance or gardening?

Experiential

Make clothes, knit, embroider, etc.?

Work on a hobby or project?

Read books, magazines, or newspapers?

Bake or cook something special?

Developmental

Attend an educational or training course?

Do word games such as crossword puzzles or Scrabble?

Play cards or games such as chess?

Do writing (such as letters, stories, or journal entries)?

Use a computer for e-mail, Internet or other tasks?

Social

Care for a sick or disabled adult?

Do activities with grandchildren, nieces/nephews, or neighborhood children?

Do volunteer work with children or young people?

Do any other volunteer or charity work?

Attend meetings of non-religious organizations, such as political, community, or other interest groups?

Passive

Pray privately in places other than a church or synagogue?

Watch television?

Scale Responses: 0 (Never), 1 (Not in the last month), 2 (At least once a month), 3 (Several times a month), 4 (Once a week), 5 (Several times a week) to 6 (Daily)

Study 2: Questionnaires

Views of Aging

(ERA-12; Sarkisian et al., 2005)

1. When people get older, they need to lower their expectations of how healthy they can be.[a]
2. Having more aches and pains is an accepted part of aging.[a]
3. It's an accepted part of aging to have trouble remembering names.[c]
4. I expect that as I get older, I will spend less time with friends and family.[b]
5. Forgetfulness is a natural occurrence just from growing old.[c]
6. Being lonely is just something that happens when people get old.[b]
7. Every year that people age, their energy levels go down a little more.[a]
8. As people get older, they worry more.[b]
9. I expect that as I get older, I will become more forgetful.[c]
10. It's normal to be depressed when you are old.[b]
11. The human body is like a car: When it gets old, it gets worn out.[a]
12. It is impossible to escape the mental slowness that happens with aging.[c]

Subscales of ERA: [a] physical health [b] mental health [c] cognitive health

Scale Responses: from (1) definitely true, (2) somewhat true, (3) somewhat false, to (4) definitely false.

Victoria Longitudinal Study Activities Questionnaire and Categories

Activity Categories	Items
Physical	I do aerobics or engage in exercise activities (for example, fitness training, workout, swimming, bicycling, jogging or walking). I engage in outdoor activities (for example, sailing, fishing, or backpacking). I do flexibility training (for example, stretching, yoga, tai chi). I do weight lifting, strength training, or calisthenics.
Games	I play word games (for example, Scrabble) or work crossword puzzles, acrostics, or anagrams. I play board or card games (for example, chess checkers, Pinochle or Bridge). I play knowledge games (for example, Trivial Pursuit). I play computer or video games.
Experiential	I garden indoors or outdoors. I read newspapers. I read books or magazines for leisure. I write a letter (for example, to a friend, relative, business, etc.; also includes electronic mail such as email, but must be longer and substantial).
Developmental	I engage in creative writing, writing poems, writing newspaper articles, etc. I read books or magazines as part of my job, career, or formal education. I go to the library. I enroll in a course at a college or university.
Social	I visit relatives, friends or neighbors. I go out with friends or eat out at a restaurant. I attend parties (e.g., birthday party). I give a dinner or party for friends.
Technical	I use software on a personal computer for communication and other household-related tasks like finance, word processing, and internet browsing. I use an electronic calculator. I do arithmetic or mathematical calculations. I engage in photography.
TV	I watch news programs on television. I watch documentary or educational programs on television. I watch game shows on television (for example, Wheel of Fortune or Jeopardy).

Scale Response: 1(Never), 2 (Less than once a year), 3 (About once a year), 4 (2 to 3 times a year), 5 (About once a month), 6 (2 to 3 times a month), 7 (About once a week), 8 (2 to 3 times a week), to 9 (Daily)
(VLSAQ; Jopp & Hertzog, 2010)