Within-person associations among self-perceptions of memory, depressive symptoms, and activity participation in older adults

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None

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## Abstract

**Background and Objectives**: Self-perceptions of memory problems may impact older adults' mood as well as their activity participation, thereby negatively affecting health and well-being. We examined within-person associations among self-reported memory, depressive symptoms, as well as physical, social, and cognitive activity participation in older adults without cognitive impairment.

**Research Design and Methods:** Samples were drawn from the Einstein Aging Study (EAS), National Health and Aging Trends Study (NHATS), Rush Memory and Aging Project (MAP), and Minority Aging Research Study (MARS), with over 8,000 participants (65+ years) included across datasets. In a series of coordinated analyses, multilevel structural equation modeling was used to examine within-person relationships over periods of up to 20 years.

**Results:** Across EAS, NHATS, and MAP/MARS samples, we found that older adults' self-perceptions of memory did not directly co-vary with activity participation over time. However, we did find an indirect association in NHATS such that within-person changes in depressive symptoms were associated with changes in self-reported memory, and these contributed to lower physical as well as social activity participation.

**Discussion and Implications:** Older adults' activity participation is important for health, but maximizing engagement requires understanding potentially impeding factors. We found some evidence that as self-perceptions of memory change over time, associated depressive symptoms may contribute to lower activity participation. Inconsistent findings across data sets, however, suggest future research is needed to understand individual characteristics that may influence these relationships.


**Keywords:** subjective memory, coordinated analyses, longitudinal

## Background and Objectives

Engagement in leisure activities (i.e., activities that individuals pursue in their free time; Pressman et al., 2009) is consistently associated with positive outcomes in older adults, including enhanced well-being and cognitive health (Lee et al., 2019; Yamashita et al., 2019). However, a variety of factors can impede older adults' activity engagement. Often disease and disability are considered, but factors such as depressive symptoms and self-perceptions of memory can also negatively influence activity participation (Litwin, 2012; Wion et al., 2020). Even in the absence of frank cognitive impairment, experiencing memory problems can provoke changes in behavior, including withdrawal from or decreased participation in leisure activities. Several investigations have demonstrated negative associations between self-reported memory problems and physical or social activities (Griep et al., 2017; Lee, 2016). However, evidence to date is largely limited to cross-sectional studies and little is known regarding the role of depressive symptoms in these relationships.

The Hopelessness Theory of Depression (Abramson et al., 1989) helps us understand why depressive symptoms may be important to consider in the relationship between self-perceptions of memory and activity participation. This theory posits that individuals who develop depressive symptoms tend to ascribe negative life events to internal, stable, and global factors instead of external, unstable, and specific factors, which can precipitate feelings of hopelessness. According to the theory, memory problems could be a negative event attributed to internal causes that cannot be controlled (e.g., aging; Cherry et al., 2019) or as global indicators of one's cognitive abilities. Ascribing experiences with memory problems to these causes could lead to feelings of hopelessness about the future, and thereby the development of depressive symptoms. For example, an older adult with perceived memory problems would be more likely to experience depressive symptoms if they attribute these problems to their personal abilities (internal factors), believe these personal abilities will not change or improve (stable factors), and will therefore influence their cognitive abilities as a whole (global factors). There is also empirical evidence linking perceptions of memory problems, depressive symptoms, and activity participation. For example, cognitive symptoms such as forgetfulness and difficulty concentrating are common during depressive episodes (Conradi et al., 2011), and depressive symptoms are known to impact physical as well as social activity participation, even in late life (Kupferberg et al., 2016; Litwin, 2012). What is not known however, is whether self-perceptions of memory problems directly influence older adults' participation in leisure activities, or whether they indirectly affect participation through depressive symptoms.

One challenge in addressing this question is that there is no standard measure for assessing self-perceptions of memory. Variations in item content and structure (e.g. ratings of current performance vs. decline over time) may affect individuals' interpretations of and responses to questions about their memory (Hill et al., 2018). Relatedly, a recent study found that associations between self-reported memory problems and leisure activities depended on the specific question asked (Takechi et al., 2020). Different types of self-reported memory items also show differential associations with depressive symptoms: the self-perception of memory decline is a more consistent predictor of future outcomes than self-reported current memory performance (Mogle et al., 2020). Therefore, it is important to consider how different aspects of self-perceptions of memory relate to activity participation in older adults, and to consider how they may co-vary over time.

The lack of a measurement standard for self-reported memory as well as differences in sample characteristics (e.g., race-ethnicity, socioeconomic status), study design, and analytical approach limits the ability to draw conclusions across existing evidence. However, one method of accomplishing efficient replication is through coordinated analysis. This method allows for examination of the same research questions, using the same analytic approach, across multiple independent datasets, maximizing opportunities for direct comparison of results (Hofer & Piccinin, 2009). Replicating findings across longitudinal studies can clarify whether results are generalizable or are sensitive to differences in design factors such as sample characteristics or measurement approach. Given the heterogeneity of these factors in the current literature examining self-perceptions of memory (Rabin et al., 2015), a coordinated analysis is a valuable approach to examining these longitudinal relationships.

The purpose of this study was to investigate intraindividual (i.e., within-person) changes in relationships among self-reported memory, depressive symptoms, and physical, social, and cognitive activity participation over time in older adults without cognitive impairment. Applying a coordinated analytic approach across datasets from four longitudinal aging studies, we examined the following: 1) does activity participation co-vary with self-reported memory within individuals over time?; and, 2) do depressive symptoms partially explain these relationships? To explore how different aspects of self-reported memory may relate to activity participation, we conducted analyses using different item types that captured aspects of current memory performance as well as perceived memory decline, as available across datasets. We hypothesized that at times when participants reported poorer self-perceptions of memory they would also report lower activity participation, and that poorer self-reported memory would be associated with higher depressive symptoms, and in turn, decreases in activity participation.

## Research Design and Methods

### Coordinated Analysis

Replication of analyses across independent samples is a critical component to efficiently advancing science. Coordinated analysis (i.e., identical analyses conducted across different datasets) allows examinations of relationships across samples using conceptually equivalent measures of the constructs of interest (Hofer & Piccinin, 2009). Although measures may differ across studies, the same covariates, measurement scoring, and modeling can be used in order to obtain comparable results across datasets, and can be immediately compared for differences across studies to identify sources of discrepancy. Each sample in the current study included at least one measure of self-reported current memory performance as well as a measure of perceived memory decline, in addition to measures of depressive symptoms and activity participation. This allowed us to examine similarities and differences in findings across different aspects of self-reported memory.

**Participants**

Samples were drawn from four longitudinal studies of aging: the National Health and Aging Trends Study (NHATS; Kasper & Freedman, 2014), the Einstein Aging Study (EAS; Katz et al., 2012), the Rush Memory and Aging Project (MAP; Bennett et al., 2018), and the Minority Aging Research Study (MARS; Barnes et al., 2012). While NHATS is a nationally-representative sample, EAS, MAP, and MARS represent unique samples of older adults from specific regions of the United States, further described below. To be included in the current study, participants met the following criteria: 65 years of age or older, completed self-reported memory measures, interviews conducted in English, and no evidence of mild cognitive impairment (MCI), Alzheimer's disease, or other dementia per the parent study protocols when provided (EAS, MAP, MARS). Since NHATS does not identify individuals with MCI or dementia as part of their protocol, we excluded NHATS participants who scored less than or equal to 1.5 SD below the normative mean on one or more cognitive domains at two contiguous waves, or at the last available wave (see Kasper & Freedman, 2018). A flowchart describing the sample selection process is provided in Supplementary Figure 1 and full sample demographics are presented in Table 1. Due to the use of similar recruitment techniques, study methods, and the same measures for our concepts of interest across MAP and MARS, these datasets were combined in the current study.

**NHATS.** NHATS is a longitudinal cohort study that aims to understand trends in late-life functioning among older adults as well as factors that may reduce disability and enhance quality of life and independent functioning. The sample is nationally representative of adults age 65 and older who are Medicare beneficiaries in the United States. Data collection began in 2011 and occurs via annual interviews. The NHATS sample included 6,718 participants (80% White; 20% Black; 58% female; $M_{age}$ = 70-74, $SD$ = 1.42), with up to eight waves of data per participant.

**EAS.** EAS is a longitudinal cohort study exploring cognitive aging and dementia among community-dwelling older adults in an urban, multi-ethnic area of New York City. To be eligible for the study, participants must be 70 years of age or older, speak English, and live independently. Data collection began in 1993 and occurs annually via in-person comprehensive medical and neuropsychological examinations. The EAS sample included 663 participants (71% White; 29% Black; 64% female; $M_{age}$ = 78.1, $SD$ = 5.23), with up to 11 waves of data per participant.

**MAP/MARS.** MAP is a longitudinal cohort study examining the aging process and risk factors that may contribute to Alzheimer's disease. Participants are primarily recruited through continuing care retirement communities and low-income housing throughout the northwestern Illinois area. MARS is a longitudinal cohort study examining cognitive and functional outcomes in older adults who self-identify as African American. Participants are recruited from various settings including churches, retirement communities, and social service centers in Chicago and outlying areas. In both MAP and MARS, participants must be 65 years of age or older and have no diagnosis of dementia at the time of recruitment. Data collection began in 1997 and 2004, respectively, and occurs annually via in-person comprehensive medical and neuropsychological examinations. Based on our eligibility criteria, we included 940 older adults from MAP/MARS (63% White; 37% Black; 78% female; $M_{age}$ = 76.4, *SD* = 7.10).

**Measures**

Consistent with our coordinated analytic approach, multiple variables were recoded to create equivalent versions across all datasets, as described below (see Supplementary Table 1 for full details including item wording and response options). This allows a straightforward comparison of results across models to inform substantive conclusions. Descriptive statistics for the study measures described below are provided in Supplementary Tables 2 and 3.

***Self-Reported Memory***

Across samples, multiple items were used to measure self-reported memory. These represent two overall aspects of self-perceptions of memory: 1) current memory performance (frequency of memory problems in EAS, MAP/MARS; memory rating in NHATS), and 2) perceived memory decline (over one year in EAS, NHATS; over ten years in EAS, MAP/MARS). Response options were reverse scored or re-coded as necessary to ensure that higher scores represent poorer self-perceptions of memory performance across datasets. Self-reported memory items that assess perceived decline were recoded to dichotomous variables in each dataset (1 = *declining*; 0 = *not declining*) due to the low frequency (~2-4%) of participants responding that their memory improved over time and to facilitate coordinated analysis. All self-reported memory items and response options (original and re-coded, where applicable) from each dataset are provided in Supplementary Table 1.

***Activity Participation***

Leisure activity is typically divided into three domains for research purposes – physical, social, or cognitive – based on an activity's predominant component (e.g., reading is cognitive, walking is physical). Activity measures differed across the samples by domain and characteristics (e.g., frequency of participation), as follows: 1) participation in physical and social activities over the past two weeks and cognitive activities over the past month (EAS; (Verghese et al., 2003); 2) participation in physical and social activities in the past month (NHATS; Freedman & Kasper, 2019); and, 3) participation in physical activities over the past two weeks, social and cognitive activities in the past year (MAP/MARS; Barnes et al., 2012; Bennett et al., 2018). For the purposes of coordinated analysis, we recoded all activity items to dichotomous scoring (1 = *yes*; 0 = *no*). All items and response options (original and re-coded, where applicable) from each dataset are provided in Supplementary Table 1. The final EAS dataset for the current study included 40 activity items, NHATS included 7, and MAP/MARS included 17. In all datasets, sum scores (i.e., total number of activities endorsed) were created for the physical, social, and cognitive activity items, with higher scores indicating participation in more activities within the respective domain.

***Depressive Symptoms***

Depressive symptoms were assessed using the 15-item Geriatric Depression Scale (GDS-15; Sheikh & Yesavage, 1986) in EAS, the Patient Health Questionnaire-2 (PHQ2; Kroenke et al., 2003) in NHATS, and the 10-item version of the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977) in MAP/MARS. One item (*"Do you feel you have more problems with memory than most?"*) was eliminated from the GDS final score due to its overlap with self-reported memory. Response options for the GDS and CES-D were dichotomous (1 = *yes*; 0 = *no*) whereas response options for PHQ-2 were on a four-point scale (1 = *not at all*, 2 = *several*, 3 = *more than half the days*, and 4 = *nearly every day*). Scores ranged from 0 – 14 for the GDS, 0 – 10 for the CES-D, and 2 – 8 for the PHQ- 2, with higher scores indicating more depressive symptoms. The GDS-15 and CES-D measures have moderate to good validity and reliability (GDS: α = 0.729; CES-D: α = 0.90) when measuring depressive symptoms in older adults (Cosco et al., 2017; Friedman et al., 2005). The PHQ-2 has high sensitivity (100%) and specificity (77%) for detecting major depression in older adults (Li et al., 2007).

***Covariates***

Participants' sex (0 = *male*; 1 = *female*), race (0 = *White/non-Hispanic*; 1 = *Black/non-Hispanic*), age, education, and income were included as covariates. For the purposes of coordinated analysis, education and income were re-coded into equivalent categorical variables across datasets (education: 1 = *less than high school*; 2 = *high school*; 3 = *post-secondary education/associate degree*; 4= *bachelor's or higher*; income: 1 = < *$15K*, 2 = *$15K* - *$30K*, 3 = > *$30K*). Continuous age was available in EAS and MAP/MARS. NHATS releases a categorical variable for age with six categories (1 = *65-69*; 2 = *70-74*; 3 = *75-79*; 4 = *80-84*; 5 = *85-89*; 6 = *90+*). Given the large number of age categories in NHATS, we were able to treat age as continuous across all models.

**Statistical Analysis**

Analyses were conducted in a series of steps. We first calculated descriptive statistics and correlations including variance decompositions to examine change across time in activity participation. We then fit multilevel structural equation models in Mplus (v. 8) to identify within-person associations of self-reported memory and activity participation, after accounting for between-person associations of these variables. Multilevel modeling was appropriate given the nested nature of the data (waves nested in persons). All within-person variables were baseline centered to identify how *changes* in self-reported memory were related to *changes* in activity participation (Sliwinski & Buschke, 1999).

As shown in Figure 1, we were interested in both the direct effect of self-reported memory on activity participation (designated as Path c') as well as the indirect effect via depressive symptoms (designated as Path a * b). Using the methods described by Preacher and colleagues (2011), we calculated the indirect effect of self-reported memory on activity participation through depressive symptoms. Models accounted for the effects of all covariates on both depressive symptoms and activity participation. Given the large samples and the number of statistical tests conducted, we used a p-value of .01 as our criterion level of significance. To provide an evaluation of the size of significant indirect effects, we compare the size of the indirect effect to the estimated one-year change in activity participation.

## Results

### Change across Time

Inter-correlations among the key study variables are presented in Supplementary Tables 2 and 3. Correlations between self-reported memory and activity participation were significant in NHATS only. We examined variance decompositions to determine the percentage of variance due to change in activity participation across waves. In EAS, 17.1% to 32.3% of the variance in physical, social, and cognitive activities could be attributed to changes within-persons across waves. In NHATS, 31.6% and 45.1% of the variance in physical and social activities was related to changes within-persons across waves. In MAP/MARS, 47.3% to 58.9% of the variance in physical, social, and cognitive activities was related to changes within-persons across waves.

### Within-Person Direct Effects

#### *Trajectories of Activity Participation*

All models first examined changes in physical, social, and cognitive activity participation over time. In EAS, on average, participants' reports of physical activity did not change ($b$=0.02, $SE$=0.01, $p$=.13); however, reports of participation in social ($b$=-0.03, $SE$=0.006, $p$<.001) and cognitive ($b$=-0.04, $SE$=0.01, $p$<.001) activities declined over time. In NHATS, on average, participants' reports of physical ($b$=-0.017, $SE$=0.002, $p$<.001) and social ($b$=-0.038, $SE$=0.002, $p$<.001) activity participation declined over time. In MAP/MARS, on average, participants' reports of participation in physical ($b$=-0.016, $SE$=0.003, $p$<.001), social ($b$=-0.080, $SE$=0.004, $p$<.001), and cognitive ($b$=-0.017, $SE$=0.005,

$p$<.01) activities declined over time.

***Current Memory Performance and Activity Participation (Path c')***

After accounting for changes in activity participation due to time, within-person associations between current memory performance (operationalized as memory problem frequency in EAS and MAP/MARS, current memory rating in NHATS) and activity participation were examined (see Table 2). Memory problem frequency was not associated with physical, social, or cognitive activity participation in EAS or MAP/MARS. Additionally, no significant within-person associations were found between current memory rating and physical or social activities in NHATS.

***Perceived Memory Decline and Activity Participation (Path c')***

After accounting for changes in activity participation due to time, within-person associations between perceived memory decline (operationalized as perceived one-year decline in EAS and NHATS, perceived ten-year decline in EAS and MAP/MARS) and activity participation were examined (see Tables 3,4). No significant within-person associations were found between perceived (one- and ten-) year memory decline and physical, social, or cognitive activities.

**Within-Person Indirect Effects**

***Current Memory Performance and Activity Participation (Indirect Effects: a * b)***

The within-person indirect effect of current memory rating on physical and social activity through depressive symptoms was significant in NHATS (see Table 2). The amount of change in activity engagement for physical activity was a little more than half of the change expected with each additional year of aging while the change in social activity engagement was more than that expected with an additional year of aging. No significant indirect effects of current memory performance on physical, social, or cognitive activity participation were found in EAS or MAP/MARS.

***Perceived Memory Decline and Activity Participation (Indirect Effects: a * b)***

The within-person indirect effect of perceived one-year memory decline on physical and social activity through depressive symptoms was significant in NHATS (see Tables 3,4). Consistent with the results from the models of current memory, changes in physical activity engagement approximated about half the change expected from a single year of aging, while changes in social activity engagement were nearly three times that expected with each additional year of aging. No significant indirect effects of one- or ten-year perceived memory decline on physical, social, or cognitive activity participation were found in EAS or MAP/MARS.

## Discussion and Implications

Self-reported memory problems are associated with poorer quality of life and mental health among older adults, regardless of cognitive status (Stites et al., 2018). We sought to better understand one aspect of these relationships: how self-perceptions of memory in older adults without cognitive impairment relate to participation in physical, social, and cognitive activities, and whether depressive symptoms indirectly influence these activities. Previous research has linked poorer self-perceptions of memory with lower leisure activity participation as well as depression cross-sectionally (Wion et al., 2020), and longitudinal evidence suggests that older adults' perceived memory decline can precipitate the development of depressive symptoms (Mogle et al., 2020). The current study considered how these three phenomena relate over time, and specifically whether changes in self-reported memory are associated with changes in activity participation within individuals.

By coordinating analyses across datasets from four longitudinal studies of aging, we were able to examine relationships in large, diverse samples and immediately test the reproducibility of our findings to improve conclusions regarding generalizability (Hill & Mogle, 2018). Overall, we found that within-person associations were inconsistent across datasets, and consequently our hypotheses were only partially supported. First, older adults' poorer perceptions of their memory functioning (either as an assessment of their current functioning or perceived decline) at a given time point were not directly related to their activity participation at that time, in contrast to our expectations. Second, self-reported memory may have an indirect effect on activity participation through depressive symptoms. However, this effect was only found in our largest dataset (NHATS). Furthermore, this dataset did not include a measure of cognitive activities or perceived ten-year decline.

Previous research has demonstrated the common co-occurrence of self-reported memory problems with depressive symptoms as well as lower activity participation cross-sectionally (Hill et al., 2016; Wion et al., 2020), a tendency for depressive symptoms to follow reports of perceived memory decline in the year prior (Mogle et al., 2020), and lower activity participation in older adults with higher depressive symptoms (Kupferberg et al., 2016; Litwin, 2012). Our findings provide additional evidence regarding how these experiences may or may not relate within individuals over time. We found no evidence that changes in self-reported memory were directly associated with changes in physical, social, or cognitive activity participation in older adults without cognitive impairment, regardless of the aspect of self-reported memory assessed. This may be partially explained by individual characteristics, specifically that the influence of self-perceptions of memory on activity participation may be more strongly associated at the person-level rather than changes within individuals over time. Indeed, across datasets, between 40-80% of the variance in activities was due to stable between-person differences across time points, and individual factors such as personality are known to influence the reporting of memory problems as well as their impact on well-being (Hill et al., 2019; Kahlbaugh & Huffman, 2017).

We did find an indirect association in NHATS such that within-person changes in depressive symptoms associated with self-perceptions of memory (both current memory and perceived one-year decline) contributed to lower physical as well as social activity participation. The Hopelessness Theory of Depression can help explain these effects, as older adults who view the onset or persistence of memory problems as a signal of their own internal abilities, outside of their control, or as global indicators of their cognitive abilities, may develop associated depressive symptoms, which are known to negatively impact activity participation (Kupferberg et al., 2016; Litwin, 2012). The indirect effects of self-perceptions of current memory as well as perceived one-year decline on physical activity was rather small, about half of what could be expected from the reduction in activity due to one year of aging. However, these effects were larger for social activity participation, particularly the within-person indirect effect of perceived one-year memory decline: increases in perceived memory decline were associated with higher depressive symptoms, and in turn, decreases in social activity participation almost three times that expected from one year of aging. It is important to note, however, that these results were not found in EAS or MAP/MARS datasets. Although NHATS is nationally-representative, EAS and MAP/MARS represent different populations of older adults, most notably those who live in major metropolitan areas. Furthermore, both EAS and MAP/MARS include extensive medical and neuropsychological examinations as part of their study protocols. Identification of participants without cognitive impairment was likely more precise in these datasets, and our NHATS sample may have included participants with a broader range of cognitive functioning. NHATS is also a considerably larger dataset, and therefore we may have detected relationships in this dataset only due to the large sample size.

Another potential contributor to our findings is the way activities were assessed, as an overall count of number of activities rather than a granular measure of frequency or intensity of engagement. A count of activities may be less likely to vary substantially over time and changes in types of activities or frequency of participation rather than raw count may be more sensitive to changes in memory functioning. Despite possible issues with variability, 20-60% of the variation in the activity scores was due to change over time, indicating a sufficient proportion of variance for examining longitudinal predictors. A second potential source is the time scale over which we related activity participation and self-perceptions of memory. Examining changes in these constructs across years may be too long a time frame to observe strong coupling. Other factors will influence both self-perceptions of memory and engagement in all types of activities (e.g., physical health), reducing their direct relationships. One area of future research is to examine how the degree of engagement in preferred or important activities changes with self-reported memory, rather than dividing activity types into arbitrary categories of physical, social, and cognitive. This may more precisely capture any effects of withdrawal from activities that are most meaningful to older adults as a result of concerns about memory performance.

This study has several limitations that are important to consider. First, we examined self-perceptions of memory specifically. This focus on memory excludes other aspects of cognition such as executive function that have also been associated with activity participation (Daly et al., 2015). Second, our coordinated analysis approach required consistent scoring of measures across datasets, including reducing self-reported perceived decline measures to dichotomous variables and activity participation to sum scores by activity domain. Although an advantage of this approach is the ability to compare results across datasets, it could have obscured our ability to detect effects due to reduced variability. Consideration of activity characteristics in particular have important implications for cognitive and other health-related outcomes, so research that examines these in relation to memory perceptions is an essential next step. Third, we investigated the role of depressive symptoms on our relationships of interest, but other factors such as functional ability and social networks may play important roles as well. Although our coordinated analysis approach allowed us to immediately replicate results across datasets and examine within-person associations, factors influencing self-reported memory problems, depressive symptoms, and activity participation in older adults are complex and multi-faceted.

Despite these limitations, our study had several notable strengths. We used large, diverse samples, including one drawn from a nationally-representative study (NHATS) and another with exclusively African American participants (MARS). We also examined how self-reported memory relates to activity participation within individuals over periods of up to 20 years, which builds on previous work in this area that has largely been cross-sectional (Wion et al., 2020). Furthermore, the variety of self-reported memory measures used across studies has been implicated as a factor contributing to inconsistent results and difficulty with interpretation (Rabin et al., 2015). Our study included measures of current memory performance as well as perceived memory decline, rather than a single approach. Finally, we examined the indirect effect of depressive symptoms on these associations, which builds on previous work linking self-reported memory and activity participation independently with depression.

**Conclusion**

Leisure activity engagement is known contributor to healthy aging, and older adults' participation in physical, social, and cognitive activity is influenced by psychosocial well-being. We examined the influence of self-perceptions of memory problems on activity, and the potential role of depressive symptoms. Our findings suggest that although self-reported memory problems have been associated with lower activity participation cross-sectionally, changes in self-reported memory within individuals may not be directly related to changes in activity participation over time. Rather, changes in depressive symptoms associated with self-perceptions of memory problems may contribute to lower physical and social activity participation.

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Table 1. EAS, NHATS, and MAP/MARS Sample Descriptions

| | EAS (n = 663) | NHATS (n = 6,718) | MAP/MARS (n = 940) |
|---|---|---|---|
| **Covariates** | n (%) | n (%) | n (%) |
| Sex | | | |
| Male | 241 (36.40) | 2,803 (41.72) | 208 (22.13) |
| Female | 421 (63.60) | 3,915 (58.28) | 732 (77.87) |
| Race | | | |
| White | 470 (70.89) | 5,356 (79.73) | 591 (62.87) |
| Black | 193 (29.11) | 1,362 (20.27) | 349 (37.13) |
| Age[a] | $M_{age}$ = 78.10 (5.23) | | $M_{age}$ = 76.40 (7.10) |
| 65-69 | | 1,803 (26.84) | |
| 70-74 | | 1,657 (24.67) | |
| 75-79 | | 1,389 (20.68) | |
| 80-84 | | 1,101 (16.39) | |
| 85-89 | | 509 (7.58) | |
| 90+ | | 259 (3.86) | |
| Education | | | |
| Less than High School | 65 (9.82) | 1,012 (15.07) | 45 (4.79) |
| High School | 166 (25.08) | 1,921 (28.61) | 194 (20.64) |
| Postsecondary Education | 142 (21.45) | 1,968 (29.31) | 282 (30.00) |
| Bachelors or Higher | 289 (43.66) | 1,813 (27.00) | 419 (44.57) |
| Income | | | |
| Less than $15,000 | 76 (12.69) | 3,401 (50.63) | 105 (11.80) |
| $15,000 – $30,000 | 221 (36.89) | 898 (13.37) | 189 (21.24) |
| $30,001 and above | 302 (50.42) | 2,419 (36.01) | 596 (66.97) |

*Note.* EAS: Einstein Aging Study; NHATS: National Health and Aging Trends Study; MAP: Memory and Aging Project; MARS: Minority Aging Research Study. [a]Age was included as a continuous variable in EAS and MAP/MARS.

Figure 1. Conceptual Multilevel Model Examining Within-Person Direct and Indirect Associations between Self-Reported Memory and Activity Participation.

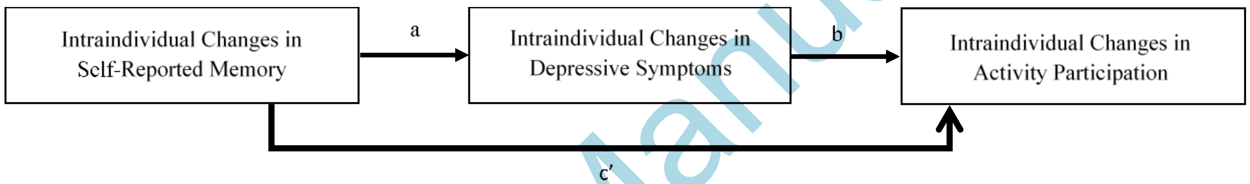

Table 2. Results of Multilevel Models Examining Within-Person Effects of Current Memory Performance, Depressive Symptoms, and Activity Participation across Datasets.

| | **Physical** | | | **Social** | | | **Cognitive** | | |
|---|---|---|---|---|---|---|---|---|---|
| | **EAS** | **NHATS** | **MAP/ MARS** | **EAS** | **NHATS** | **MAP/ MARS** | **EAS** | **NHATS** | **MAP/ MARS** |
| **Models** | **b (SE)** | **b (SE)** | **b (SE)** | **b (SE)** | **b (SE)** | **b (SE)** | **b (SE)** | **b (SE)** | **b (SE)** |
| **Direct Effects** | | | | | | | | | |
| Activity Participation | | | | | | | | | |
| Time | 0.026*** (0.006) | -0.012*** (0.003) | -0.008** (0.003) | -0.005 (0.003) | -0.003 (0.001) | -0.021*** (0.003) | 0.001 (0.005) | - | 0.003 (0.002) |
| Current Memory (c') | -0.041 (0.028) | -0.026 (0.010) | 0.032 (0.014) | -0.002 (0.012) | -0.012 (0.005) | -0.007 (0.014) | -0.043 (0.023) | - | 0.011 (0.010) |
| Depressive Symptoms (b) | -0.056*** (0.013) | -0.090*** (0.008) | -0.047*** (0.009) | -0.012 (0.006) | -0.054*** (0.004) | -0.030*** (0.008) | -0.010 (0.012) | - | -0.021*** (0.006) |
| Depressive Symptoms | | | | | | | | | |
| Time | 0.026 (0.021) | 0.009 (0.004) | 0.002 (0.008) | 0.025 (0.021) | 0.009 (0.004) | 0.002 (0.008) | 0.025 (0.021) | - | 0.002 (0.008) |
| Current Memory (a) | -0.122 (0.079) | 0.072*** (0.017) | 0.052 (0.056) | -0.122 (0.079) | 0.072*** (0.017) | 0.052 (0.056) | -0.122 (0.079) | - | 0.052 (0.056) |
| **Indirect Effects (a * b)** | 0.007 (0.005) | -0.007*** (0.002) | -0.002 (0.003) | 0.001 (0.001) | -0.004*** (0.001) | -0.002 (0.002) | 0.001 (0.002) | - | -0.001 (0.001) |

*Note.* EAS: Einstein Aging Study; NHATS: National Health and Aging Trends Study; MAP: Memory and Aging Project; MARS: Minority Aging Research Study. EAS, NHATS, and MAP/MARS datasets were analyzed in separate multilevel analyses by activity type. Current Memory = current memory problem frequency in EAS and MAP/MARS, current memory rating in NHATS; results are presented together for ease of comparison. b = unstandardized regression coefficient; SE = standard error.

****p* < .001. ***p* < .01.

Table 3. Results of Multilevel Models Examining Within-Person Effects of Perceived One-Year Memory Decline, Depressive Symptoms, and Activity Participation across Datasets.

| | Physical | | Social | | Cognitive | |
|---|---|---|---|---|---|---|
| | **EAS** | **NHATS** | **EAS** | **NHATS** | **EAS** | **NHATS** |
| **Models** | **b (SE)** | **b (SE)** | **b (SE)** | **b (SE)** | **b (SE)** | **b (SE)** |
| **Direct Effects** | | | | | | |
| Activity Participation | | | | | | |
| Time | 0.026$^{***}$ (0.006) | -0.013$^{***}$ (0.003) | -0.005 (0.003) | -0.004$^{***}$ (0.001) | 0.002 (0.005) | - |
| One-Year Decline (c') | -0.025 (0.032) | -0.049 (0.023) | -0.009 (0.017) | -0.023 (0.011) | -0.040 (0.026) | - |
| Depressive Symptoms (b) | -0.056$^{***}$ (0.013) | -0.091$^{***}$ (0.008) | -0.011 (0.006) | -0.054$^{***}$ (0.004) | -0.009 (0.012) | - |
| Depressive Symptoms | | | | | | - |
| Time | 0.023 (0.021) | 0.012$^{**}$ (0.004) | 0.023 (0.021) | 0.012$^{**}$ (0.004) | 0.023 (0.021) | - |
| One-Year Decline (a) | 0.118 (0.090) | 0.223$^{***}$ (0.032) | 0.119 (0.090) | 0.223$^{***}$ (0.032) | 0.118 (0.090) | - |
| **Indirect Effects (a * b)** | -0.007 (0.005) | -0.020$^{***}$ (0.003) | -0.001 (0.001) | -0.012$^{***}$ (0.002) | -0.001 (0.002) | - |

*Note.* EAS: Einstein Aging Study; NHATS: National Health and Aging Trends Study. EAS and NHATS datasets were analyzed in separate multilevel analyses by activity type. Results are presented together for the ease of comparison. Perceived one-year memory decline was not measured in MAP/MARS. One-Year Decline = Perceived one-year memory decline. b = unstandardized regression coefficient; SE = standard error.
$^{***}p < .001$. $^{**}p < .01$.

Table 4. Results of Multilevel Models Examining Within-Person Effects of Perceived Ten-Year Memory Decline, Depressive Symptoms, and Activity Participation across Datasets.

| | Physical | | Social | | Cognitive | |
|---|---|---|---|---|---|---|
| | **EAS** | **MAP/ MARS** | **EAS** | **MAP/ MARS** | **EAS** | **MAP/ MARS** |
| **Models** | **b (SE)** | **b (SE)** | **b (SE)** | **b (SE)** | **b (SE)** | **b (SE)** |
| **Direct Effects** | | | | | | |
| Activity Participation | | | | | | |
| Time | 0.026*** (0.006) | -0.008** (0.003) | -0.004 (0.003) | -0.021*** (0.003) | 0.001 (0.005) | 0.003 (0.002) |
| Ten-Year Decline (c') | 0.024 (0.030) | 0.037 (0.031) | -0.007 (0.013) | -0.018 (0.026) | -0.001 (0.026) | 0.025 (0.022) |
| Depressive Symptoms (b) | -0.056*** (0.013) | -0.047*** (0.009) | -0.013* (0.006) | -0.030*** (0.008) | -0.010 (0.012) | -0.021*** (0.006) |
| Depressive Symptoms | | | | | | |
| Time | 0.027 (0.021) | 0.003 (0.008) | 0.027 (0.021) | 0.003 (0.008) | 0.027 (0.021) | 0.003 (0.008) |
| Ten-Year Decline (a) | 0.033 (0.064) | 0.025 (0.060) | 0.033 (0.064) | 0.025 (0.060) | 0.033 (0.064) | 0.025 (0.060) |
| **Indirect Effects (a * b)** | -0.002 (0.004) | -0.001 (0.003) | 0.000 (0.001) | -0.001 (0.002) | 0.000 (0.001) | -0.001 (0.001) |

*Note.* EAS: Einstein Aging Study; MAP: Memory and Aging Project; MARS: Minority Aging Research Study. EAS and MAP/MARS datasets were analyzed in separate multilevel analyses by activity type. Results are presented together for the ease of comparison. Perceived ten-year memory decline was not measured in NHATS. Ten-Year Decline = Perceived ten-year memory decline. b = unstandardized regression coefficient; SE = standard error. ***$p < .001$. **$p < .01$.