Investigating the Effects of Discrimination Experiences on Everyday Metamemory Accuracy

Timothy K. Ly, MA[1, 2,*]

Rebecca S. Allen, PhD, ABPP[1, 2,*]

https://orcid.org/0000-0002-2563-4996

Jeanne M. Cundiff, PhD[1, 2]

Jason DeCaro, PhD[1, 3]

[1] Alabama Research Institute on Aging, The University of Alabama, Tuscaloosa, AL, USA

[2] Department of Psychology, The University of Alabama, Tuscaloosa, AL, USA

[3] Department of Anthropology, The University of Alabama, Tuscaloosa, AL, USA

*Address correspondence to Timothy K. Ly, MA. E-mail: tkly@crimson.ua.edu

ABSTRACT

Objectives: Lifetime and daily experiences of discrimination contribute to impaired performance on cognitive assessments. However, the underlying mechanism by which discrimination negatively impacts cognition is unclear. Recent research investigating stress-induced impairment of metamemory may address the relationship between discrimination experiences and cognitive impairment.

Method: The aim of this study was to determine the relationship of lifetime and daily experiences of discrimination, daily affect balance, baseline objective cognitive performance, and sociodemographic variables (age, race, ethnicity, and sex) with metamemory accuracy across the lifespan (ages 20-75). Impaired metamemory accuracy was defined by the number of subjective cognitive complaints. Diary data from the Midlife in the United States (MIDUS Refresher 1) Daily Diary Project (N = 782) was used for these analyses.

Results: Results from linear mixed model analyses showed significant within-person effects of daily discrimination, where people who reported more daily discrimination also reported lower metamemory accuracy, and daily affect balance, where people who reported very negative affect also reported lower metamemory accuracy. Additionally, linear mixed model analyses revealed significant between-person effects of race on metamemory accuracy, with individuals from minoritized racial groups generally reporting poorer metamemory accuracy. Daily discrimination experiences also interacted with other variables in predicting day-to-day metamemory accuracy.

Discussion: These findings add to our understanding of how psychosocial stress in the form of daily discrimination experiences may impair metamemory processes contributing to increased subjective cognitive complaints. Future research should consider the contribution of daily experiences of discrimination across the lifespan to poor cognitive outcomes in later life.

Keywords: Subjective Cognitive Decline, Discrimination, Daily Diary, Multilevel Modeling

INTRODUCTION

Subjective cognitive decline (SCD), the self-perceived decline in cognitive functioning is a growing public health issue (Jessen et al., 2014, Reisberg et al., 2008, Tandetnik et al., 2015). More specifically, longstanding interest in subjective memory impairment (SMI) as a promising predictor of pre-clinical Alzheimer's disease (AD) continues to garner support (Jessen et al., 2010, Jessen et al., 2014, Johansson, Allen-Burge, & Zarit, 1997, Reisberg et al., 2008, Studart, & Nitrini, 2016). Interest in SMI is based on the premise that individuals with intact self-awareness and self-reflection, otherwise known as metamemory, will become aware of changes in their memory and cognitive performance prior to other indicators. As such, the accuracy of an individual's metamemory is associated with the extent to which their subjective cognitive decline maps onto their objective cognitive performance (Chapman et al., 2022), such that lower metamemory accuracy is related to greater report of subjective cognitive decline. Moreover, metamemory accuracy mediates the relationship between subjective cognitive complaints and normative objective cognitive performance, wherein greater metamemory accuracy is associated with fewer objective cognitive deficits (Giffard et al., 2020).

Subjective cognitive complaints and metamemory errors may be exacerbated by emotional distress. The transactional theory of stress and coping (Lazarus & Folkman, 1984; Park & Folkman, 1997; Berjot & Gilet, 2011) posits that cognitive appraisals of threat elicit adoption of coping strategies. Appraisals can be seen as thoughts or cognitions, such that primary appraisals are primary cognitions and secondary appraisals are thoughts *assessing* the primary cognitions, making secondary appraisals metacognitive in nature (Rucker, Turnes, & Petty, 2011). Emotional and psychological distress are positively associated with subjective memory complaints, indicating a link between negative affect and impaired metamemory accuracy (Tomita et al., 2014; Seo et al., 2017; Colvin et al., 2018).

Furthermore, biological reactivity to psychosocial stress (e.g., elevated blood cortisol levels) impairs metamemory accuracy (Reyes et al., 2015; 2020). Much remains unknown, however, regarding the mechanism by which stress affects metamemory accuracy.

Discrimination as a stressor

One potential stressor that may impact metamemory accuracy is discrimination. Discrimination has been identified as a chronic psychosocial stressor contributing to disparities in acute and long-term mental, physical, and cognitive health. While research efforts have largely focused on the implications of racism and ethnic discrimination on mental and physical health, more recent research has focused on the impact of discrimination on cognitive health disparities. Studies have shown how experiences of perceived racism and discrimination negatively influence specific cognitive domains (e.g., executive functioning and processing speed) (Barnes et al., 2012; Sutin et al., 2015) and subjective cognitive decline (Coogan et al., 2020). Furthermore, a study examining everyday discrimination and subsequent cognitive abilities found broad and enduring effects of discrimination on cognitive aging, especially executive functioning and visuoconstruction (Zahodne et al., 2020). In a broader study comparing the influence of lifetime and recent experiences of discrimination on executive functioning, Keating and colleagues (2021) found that recent discrimination experiences among individuals who also endorsed experiencing lifetime discrimination were associated with greater impairment of cognitive flexibility and working memory compared to those that did not experience a recent experience of discrimination.

Need for Study and Study Overview

Although some studies have sought to understand the relationship between stress and metacognition (Langer et al., 2020; Reyes et al., 2015, 2020; Spada et al., 2008), there are few if any studies investigating the effect of daily discrimination experiences on metamemory accuracy. Furthermore, some studies have found both age-related objective and subjective

cognitive decline in healthy individuals as young as 18, creating a need to understand how metamemory accuracy changes across the lifespan (Salthouse, 2009; Van Patten et al., 2022). The present study was a secondary data analysis of the Midlife in the United States Refresher epidemiological dataset (MIDUS Refresher; 2011-2014), the MIDUS Refresher Cognitive Project (2011-2014), and the MIDUS Refresher Daily Diary Project (2012-2014).

The aim of this study was to utilize multilevel modeling via linear mixed modeling to examine how lifetime and daily experiences of discrimination, daily affect balance, baseline objective cognitive performance, and individual sociodemographic variables (age, educational attainment, race, and sex) affect everyday metamemory accuracy. Hypotheses included: (1) experiences of lifetime discrimination would be negatively associated with metamemory accuracy; (2) recent daily experiences of discrimination would, above and beyond the effect of lifetime discrimination, be negatively associated with metamemory accuracy; (3) daily affect balance would be positively associated with metamemory accuracy; (4) educational attainment would be positively associated with metamemory accuracy; (5) individuals from minoritized racial groups would report poorer metamemory accuracy; and (6) specific interactions of between- and within-person variables would negatively impact metamemory accuracy.

METHOD

Participants

This secondary data analysis used data from a subset of participants recruited from a nationally representative sample of adults aged 25-74 using a combination of random-digit dial (RDD) landline sampling frame, a list frame based on age brackets, and an RDD cell phone sampling frame (Ryff et al., 2016) that participated in the two cross-sectional studies (MIDUS Refresher Study (Ryff et al., 2014, 2017) and the MIDUS Refresher Study

Cognitive Project) and one diary study (MIDUS Refresher Study Daily Diary Project). Collected between 2011 and 2014, the MIDUS Refresher Study sought to examine the interplay of socioeconomic status, gender, psychosocial factors, and biological factors on mid- and later life health through phone interviews and self-administered questionnaires. The Cognitive Project assessed objective cognitive functioning (e.g., episodic verbal memory, working memory, verbal fluency, executive functioning, attention). The Daily Diary Project examined how sociodemographic factors, health status, and personality characteristics modify patterns of change in exposure to day-to-day life stressors.

Participants completed an 8-day telephone diary study of self-reported daily stressors and well-being. Study data collected in the MIDUS Refresher Study and MIDUS Refresher Daily Diary project is publicly accessible through the National Archive of Computerized Data on Aging. A total of 782 individuals (ages 26-75) that participated as a part of each of these MIDUS sub-studies were included in these analyses.

Measures

Baseline Data Collected from MIDUS Refresher Study and Cognitive Project

Demographics

Sex was coded dichotomously (0 = male; 1 = female). Age was captured as a continuous quantitative variable. Given the sample was predominantly white, race was categorically recorded and coded as follows: 0 = white; 1 = minoritized racial groups (included black, Asian, bi- and multi-racial, and "other"). Education was coded as 0 (less than high school), 1 (high school graduate), 2 (some college, no degree), 3 (graduated associate degree or vocational school), 4 (bachelor's degree), 5 (post-baccalaureate education/degree).

Lifetime Discrimination Exposure

Lifetime discrimination was assessed at baseline in the MIDUS Refresher Study via the 11-item subscale from the Major Experiences of Discrimination Scale (Williams et al.,

1997), in which participants subjectively report the number of lifetime discrimination experiences on the basis of race, ethnicity, gender, age, religion, physical appearance, sexual orientation, or other characteristics. The 11 categories include being discouraged from higher education, denied scholarship, not hired for a job, not given promotion, fired, prevented from renting or buying a home in the desired neighborhood, prevented from remaining in the neighborhood due to difficult neighbors, hassled by police, denied a bank loan, denied access to quality healthcare, and denied quality services. For analysis purposes, experience of lifetime discrimination was coded as follows: "0" = no endorsement of lifetime discrimination experiences and "1" = endorsement of 1 or more category of lifetime discrimination experiences.

Baseline Objective Cognitive Performance

Cognitive functioning at baseline was assessed using the Brief Test of Adult Cognition by Telephone (BTACT) (Tun & Lachman, 2006). The BTACT includes subtests indexing cognitive domains of episodic verbal memory, working memory, verbal fluency, processing speed, executive functioning, fluid intelligence, and attention. These subtests are computed into composite scores (the BTACT composite and the Forgetting composite) and standardized as z-scores based on normative data for the sample population.

Data Collected from the Daily Diary Project

Daily Discrimination Exposure

Everyday discrimination was assessed in the MIDUS Refresher Daily Diary Project using a 9-item subscale of Williams and colleagues' Everyday Discrimination Scale (1997), in which participants self-reported day-to-day experiences of discrimination as well as a perceived reason for their experienced discrimination. Participants were asked if they were treated differently, including receiving poorer service, being treated with less courtesy or less respect; were thought to be less smart, dishonest, or lacking; or were insulted or harassed.

Daily discrimination was dichotomously coded: endorsement of one or more items was coded as 1; no endorsement of daily discrimination was coded as 0. The coefficient alpha for daily discrimination was good (α = .92).

Daily Metamemory Accuracy

Metamemory accuracy was assessed using the daily cognitive failure questions (Goodman et al., 2022) from the MIDUS Refresher Study Daily Dairy Project, a 13-item measure in which participants subjectively report the number of cognitive failures (or instances of forgetting) perceived in the past 24 hours, including forgetting to do an errand; forgetting to take a medication; forgetting an appointment; forgetting why one entered a room; forgetting someone's name; forgetting where one put something; and forgetting a word that one wanted to use. As such, the number of cognitive complaints reported was used as a proxy for measuring metamemory accuracy, such that greater subjective cognitive complaints equated to lower metamemory accuracy.

Daily Affect Balance

Affect was assessed with daily mood questions in the MIDUS Refresher Study Daily Diary Project, a 27-item measure in which participants subjectively endorsed positive (13-items) and negative (14-items) affective states experienced daily during their study participation (Almeida & Kessler, 1998; Watson, Clark, & Tellegen, 1988). Participants were asked "how much of the time today did you feel…" on a scale of 1 ("none of the time") to 5 ("all of the time"). Affect balance is an individual difference construct depicting the balance of positive to negative emotions, where higher scores (or more positive values) indicate individuals have positive affect that "outweighs" the experience of negative affect (Veilleux et al., 2020). Affect balance was calculated as a valence between negative and positive affect states. The coefficient alpha for both measures of positive and negative affect were considered good (α = .96 and α = .89, respectively).

Data Preparation

Prior to data analysis, several variables were modified to facilitate the use of linear mixed models. Standardized scores for baseline objective cognitive performance provide information regarding an individual participant's cognitive abilities relative to individuals of their respective age group. Age as a predictor was grand mean centered because it is a Level 2 predictor. Metamemory accuracy was group mean centered based on their age group affiliation and z-scored to create meaningful zeroes to describe impaired metamemory accuracy.

Data Analysis Plan

Due to the nested nature of the Daily Diary Project, multilevel modeling via linear mixed models in SPSS were used to test study hypotheses. The multilevel analyses were sequentially specified, by incorporating additional predictors into each successive model, to produce nested models that could be statistically compared. Models were fitted using maximum-likelihood estimation. Three indices were interpreted to assess the fit of these nested models. The -2 log likelihood (-2LL) indicated the extent to which the model coincides with the underlying data, with a lower -2LL signifying better model fit. Change in chi-square statistic, computed from the difference in -2LL between two nested models, determined whether subsequent models were better. Additionally, Akaike's information criterion (AIC) and Schwarz's Bayesian criterion (BIC) were considered when judging model fit, where lower values indicated better fit. For models with significant effects, post hoc pairwise comparisons of estimated marginal means of the number of cognitive complaints were conducted and adjusted for multiple comparisons using the Šidák correction.

Before proceeding with linear mixed models, a null model was generated to determine whether linear mixed modeling would be suitable based on interclass correlation, the amount of variance attributed to nesting. The current analyses called for a two-level model: Level 1

measures within-person effects and contains the outcome variable of metamemory accuracy, and the predictors of perceived daily discrimination and daily affect balance from the Daily Diary Project that are nested within each individual participant, Level 2 represents each individual participant's demographics and measures between-person effects. The models constructed examined the following fixed effects: age, education, sex, race, baseline objective cognitive performance, endorsement of lifetime discrimination, experiences of daily discrimination and daily affect balance.

Models 1 and 2 involved random intercepts with fixed-effect Level 1 and Level 2 predictors. Model 1 built upon the null model by adding in Level 1 predictors of daily experience of discrimination and daily affect balance on metamemory accuracy during the 8-days of study participation in the Daily Diary Project. Model 2 incorporated Level 2 predictors collected at baseline (age, education, sex, race, baseline cognitive performance, lifetime discrimination experience). Model 2 also examined within and across level interactions between within and between-person variables. Fit statistics comparing these models with the null model determined whether adding each subsequent group of predictors improved model fit. This was a complete case analysis, such that the analytical sample includes all individuals who completed more than one day in the diary study, making the total analytical sample 782 individuals.

RESULTS

Sample Characteristics

Demographics

There were 782 individuals from the MIDUS Refresher Study who were enrolled in the MIDUS Refresher Daily Diary Project. Participants ranged from ages 26-75 (mean age = 47.91 years (SD = 12.67 years)) with a majority of individuals in their midlife (n = 459,

58.7% of the sample). Most participants were female (55.6%) and non-Hispanic White (76.4%). Regarding educational attainment, approximately half of all participants held at least a bachelor's degree (49.9%). In terms of retention rates, 80.2% (627/782) of the respondents completed all eight interview days and 93.2% completed at least six interview days (728/782) (see Table 1).

Cognitive Abilities

Additionally, individuals had baseline cognitive data collected prior to participating in the Daily Diary Project (mean = 9 months, SD = 4.28 months; range 3 to 22 months). Overall cognitive abilities among the individual participants varied from -2.62 to 2.96 points (z-scored values), with 96% falling within normal cognitive functioning. Regarding memory functioning, individual participants varied between -2.37 to 3.90 points (z-scored values), with 95.8% of individuals falling within normal range of memory functioning. Bivariate correlation analyses showed that the average number of cognitive complaints was not significantly correlated with either overall cognitive functioning (r = -.031) or memory functioning (r = -.024). This indicated that the greater number of cognitive complaints was not significantly related to objective cognitive performance.

Discrimination Experiences

Overall, 446 individuals (57.03%) endorsed lifetime experiences of discrimination at baseline and 236 individuals (30.2%) reported experiencing at least one incident of discrimination while participating in the Daily Diary Project. Cumulatively, 404 incidences of experienced discrimination were analyzed in the current study. Information pertaining to the perceived type of discrimination experienced can be found in Table 2.

Metamemory Accuracy

Self-reported cognitive complaints were recorded as a proxy for metamemory accuracy. The three most common cognitive complaints reported by participants were forgetting where you put something (n = 937), forgetting a word (n = 711), and forgetting someone's name (n = 633). On average, male participants reported more cognitive complaints compared with female participants. More information can be found in Table 3.

Linear Mixed Models Analyses

Null Model

The null model characterizes the variance attributable to between (Level 2) and within person (Level 1) differences in the number of subjective cognitive complaints. Within-person (Level 1) variance was calculated to be .740 and between-person (Level 2) variance was calculated to be .674. The interclass correlation coefficient (ICC) calculated from these two variances was .477 and significant. An ICC > .10 is considered sufficient justification for using multilevel modeling to examine between and within-person factors contributing to differences in subjective cognitive complaints (Hox, Moerbeek, & van de Schoot, 2017). See Table 4 for model fit comparisons.

Model 1 – Daily discrimination experiences and daily affect balance on metamemory accuracy (Within-Person Effect)

Model 1 examined the within person relationship between daily discrimination experiences, daily affect balance, and metamemory accuracy. There were significant fixed effects of daily discrimination experience (β = -.462, SE = .084, $p < .001$) and daily affect balance (β = -.055, SE = .008, $p < .001$) on metamemory accuracy. Individuals that reported experiencing discrimination on a given day also reported .462 more cognitive complaints (95% CI [.298,.627], $p < .001$) compared with days in which they did not experience an incident of discrimination. Positive affect balance was associated with .054 fewer cognitive

complaints (95% CI [.038,.072], p < .001) (see Table 5). Model fit indices were enhanced when compared with the null model. However, between person difference still accounted for 56.3% of the variance, providing justification to examine the effect of Level 2 predictors on subjective cognitive complaints.

Model 2 – Individual characteristics on metamemory accuracy (Between-Person Effect)

Model 2 built upon Model 1 by examining how differences in individual characteristics were associated with between-individual differences on metamemory accuracy. There were significant main effects of education (β = 1.31, SE = .515, p = .011), race (β = -.392, SE = .194, p = .044), and lifetime discrimination experiences (β = -.480, SE = .173, p = .006). Individuals with less than a high school education were more likely to report greater cognitive complaints. Individuals from minoritized racial groups were more likely to report greater cognitive complaints compared with white individuals. The main effects of daily affect balance (β = -.055, SE = .013, p < .001)—in which individuals reporting more positive affect reported fewer cognitive complaints—and daily discrimination experiences (β = -.577, SE = .196, p = .003)—in which individuals that reportedly experienced discrimination in the diary study reported greater cognitive complaints—on metamemory accuracy on a given day remained significant. There were no significant main effects for age (β = -.003, SE = .013, p = .838), baseline cognitive performance (β =-.024, SE = .041, p = .556), and sex (β = -.119, SE = .282, p = .672). See Table 4 for model fit indices.

Model 2 also examined interactions between Level 1 and Level 2 variables. There was a significant interaction between daily experience of discrimination and endorsement of lifetime discrimination experiences (β = -1.34, SE = .458, p = .003), such that individuals that denied experiencing discrimination—whether lifetime or during their participation in the Daily Diary Project—reported 1.34 (95% CI [.444,2.24]) fewer cognitive complaints compared with individuals that endorsed experiencing discrimination in their lifetime and

while participating in the Daily Diary Project. Additionally, pairwise comparisons demonstrated a positive trend among individuals that endorsed experiencing lifetime discrimination and reported experiencing an incident of discrimination on a given day, indicated by an increase in reported subjective cognitive complaints.

There was a significant interaction between daily discrimination and race (β = .356, SE = .175, p = .042), such that after experiencing an incident of discrimination individuals from minoritized racial groups report .736 (95% CI [.526,.945]) greater cognitive complaints compared with white individuals that did not report experiencing discrimination. Furthermore, when both white and participants from minoritized racial groups reported experiencing an incident of discrimination on a given day, individuals from minoritized racial groups reported .291 (95% CI [.155,.426]) more cognitive complaints. There was a significant interaction between daily discrimination and daily affect balance (β = .021, SE = .009, p = .017), such that individuals that reported very negative affect and experienced discrimination on a given day reported 2.04 (95% CI [.014, 4.08]) more cognitive complaints. Lastly, there was an interaction effect between daily affect balance and age (β = .001, SE = .0004, p = .011), such that as age increased, more positive affect was reported (see Table 5).

DISCUSSION

The results of this study extend our understanding of how lifetime and daily discrimination impacts metamemory accuracy, contributing to greater subjective cognitive complaints. Specifically, findings indicated that individuals who endorsed experiencing daily discrimination exhibited poorer metamemory accuracy. Reports of daily discrimination experiences variably affect metamemory accuracy across midlife, depending on race, education, and lifetime experiences of discrimination. Moreover, findings suggest that

intervention targeting affect balance in individuals with lifetime and daily experiences of discrimination as a potential mechanism underlying subjective cognitive decline.

Findings from modeling within-person effects extended prior research by demonstrating how daily discrimination experiences may influence metamemory accuracy. Daily experiences of discrimination were negatively associated with metamemory accuracy reported on a given day for a given person, indicating an average individual experiencing an incident of daily discrimination was more likely to report more subjective cognitive complaints compared with someone that did not experience an incident of daily discrimination. This finding corroborates prior research on the impact of stereotype threats on stress processes that negatively impact self-efficacy and identity (Berjot & Gilet, 2011). Therefore, an experience of discrimination, which undermines a person's identity and value, can impair a person's accurate appraisal of their abilities—in this case, their memory. In other words, daily experiences of discrimination were associated with impaired metamemory accuracy.

Beyond daily experiences of discrimination, daily affect balance was significantly associated with metamemory accuracy, where more positive affect was associated with fewer reports of cognitive complaints. This observed effect replicates previous research on negative affect, depressed mood, and mood disorders in relation to subjective cognitive impairment and decline (Brown et al., 2022; Lee et al., 2021). Furthermore, the number of cognitive complaints reported fluctuated depending on affect, where very negative affect was associated with much greater reports of cognitive complaints compared to individuals with more balanced or positive affect.

Significant interactions between daily affect balance and daily discrimination experiences with individual characteristics provide a contextual understanding of how daily experiences impact everyday metamemory accuracy. The interaction observed between age

and affect balance relates to research linking emotion regulation and aging, where older adults often exhibit more affect balance and greater emotion regulation skills (Isaacowitz, Livingstone, & Castro, 2017). Furthermore, older adults are more likely to focus on positive affect, and this may contribute to fewer subjective cognitive complaints reported in older versus younger adults (Carstensen, Fung, & Charles, 2003). Thinking from the lens of the revised model of stress and coping (Folkman & Lazarus, 1985; Park & Folkman, 1997), as people age, they gain more resources to cope with and make meaning of psychological stress that emerges from threatening stimuli, while also gaining more perspective when appraising whether a stimulus is threatening or not. The results of this micro-longitudinal study suggest, developmentally, individuals may become better at coping with subjective cognitive concerns.

The interaction observed between daily affect balance and daily discrimination provides context into how these two predictors related to metamemory impairment. When an individual reported very negative affect and experienced an incident of discrimination, they were more likely to report greater cognitive complaints. However, when an individual reported very negative affect absent of experiencing an incident of discrimination, their report of cognitive complaints was only marginally greater, suggesting daily discrimination experiences exacerbated the influence of negative affect on subjective cognitive complaints.

More importantly, significant main and interactional effects related to race and education enhance our understanding of how discrimination experiences impact social determinants of health. The main effect of race on metamemory accuracy parallels prior research on racial disparities and subjective cognitive impairment (Parisi et al., 2021). Furthermore, the main effect of race where individuals from minoritized racial groups reported greater subjective cognitive complaints adds to findings by Gupta (2021), which identified younger age, less education, lower income, and less access to healthcare as

contributors to greater disparities in subjective cognitive decline among Black and Hispanic individuals in the United States. The main effect of educational attainment on metamemory accuracy reflected the established correlation between higher education level and lower prevalence of subjective cognitive decline (Chen et al., 2021). Lower educational attainment has been found to be associated with reduced help-seeking behavior (Azar et al., 2023).

The interaction between daily discrimination experiences and race highlights racial disparities related to impaired metamemory accuracy (Hill-Jarret & Jones, 2021; John et al., 2020). The heightened response of individuals from minoritized racial groups to incidents of discrimination is consistent with prior work associating racial discrimination with poorer memory and greater cognitive decline (Barnes et al., 2012; Seblova et al., 2022). Exposure to adverse and stressful experiences and the subsequent emotional and physiological reactivity promotes dysregulation and, possibly, impairs metamemory accuracy. The interaction of daily discrimination experiences and lifetime discrimination experiences describe how the experience of discrimination contributes to disparities in subjective cognitive complaints. While individuals that denied any discrimination experiences on average reported substantially fewer cognitive complaints, individuals that endorsed lifetime experiences of discrimination displayed a profile indicating a greater average number of subjective cognitive complaints. Furthermore, individuals that experienced an incident of daily discrimination reported even more cognitive complaints compared to those that did not, suggesting prior experience with discrimination increases an individual's response to discrimination, resulting in greater impairment of metamemory accuracy. This finding is related to previous research on the impact of perceived lifetime discrimination as a psychosocial stressor contributing to greater cognitive impairment (Keating et al, 2022; Leger et al, 2022; Zahodne et al., 2021). Moreover, this finding adds to research on the negative impact of lifetime discrimination as a psychosocial stressor on cognition and metamemory, where discrimination not only

negatively influences an individual's objective cognitive performance (Barnes et al., 2012) but also their beliefs, confidence, and judgments about their cognitive performance. These impairments in metamemory accuracy could lead to stereotype embodiment (Levy, 2009) and contribute, eventually, to actual memory deficits later in life.

Lastly, the lack of correlation between objective cognitive performance at baseline and subjective cognitive complaints reflects the larger body of literature (Burmester, Leathem, & Merrick, 2016). A meta-analysis conducted by Burmester and colleagues (2016) noted a small but significant correlation between more severe subjective memory complaints and poorer objective cognitive performance; however, the level of cognitive performance was higher and subjective memory complaints were fewer in the current sample. Nevertheless, the inclusion of baseline cognitive performance significantly improved model fit.

Limitations of Current Study

There were several limitations with using the MIDUS micro-longitudinal dataset. First, although MIDUS sought to recruit a representative sample, individuals that chose to participate in the Daily Diary Project from the main MIDUS Refresher Study were predominately non-Hispanic White. Self-reported incidents of discrimination were likely skewed towards the experience of the majority group, making it difficult to assess the full impact of various forms of discrimination that an individual might experience in everyday life. This also precluded the investigation of the role of ethnic cultural differences (i.e., Latinx) between discrimination experiences and metamemory accuracy. Second, there was an overwhelming number of responses that indicated "other" as a reason for discrimination, precluding an expanded discussion on whether different types of discrimination may differentially affect metamemory accuracy. Third, the timing between objective cognitive assessment and subsequent participation in the Daily Diary Project (between three and 22

months) may inaccurately capture an individual's current cognitive abilities during the Daily Diary Project.

Implications and Directions for Future Research

Despite limitations, the current findings have implications for both science and practice. Scientifically, reasons why Hispanic adults may demonstrate relatively better metamemory accuracy within the context of experienced discrimination need to be further studied. Clinically, the long-term influence of lifetime and daily discrimination on metamemory accuracy may escalate to repeated threats to accurate memory judgments, feed internalized ageism, and potentiate actual cognitive decline. Future studies should examine the relations of experienced discrimination on metamemory accuracy and objective cognitive performance concomitantly and longitudinally.

Future directions may include uncovering and understanding the underlying mechanism of how psychosocial stressors like discrimination impact metamemory accuracy, such as leveraging the power of blood and saliva-based biomarkers of stress. The work of Reyes and colleagues (2015, 2020) has shown that psychosocial stress and biological stress reactivity were associated with impaired metacognitive accuracy. Examining changes in biological stress responses to daily stressful situations can provide a framework for a mechanism and pathway for intervention for subjective cognitive decline across the lifespan.

FUNDING

Data used in the analyses of this study were provided by Midlife in the United States (MIDUS), a national longitudinal study of health and well-being supported by John D. and Catherine T. MacArthur Foundation Research Network and the National Institute on Aging at the National Institutes of Health (P01-AG020166 and U19-AG051426).

CONFLICT OF INTEREST

The authors of this study have no conflicts of interest to disclose.

DATA AVAILABILITY

Data used in the analyses of this study was provided by Midlife in the United States (MIDUS), a national longitudinal study of health and well-being. Data from MIDUS is publicly available. The authors of this study do not plan to make such publicly available data available to other researchers and advise other researchers to reach out to the MIDUS data management and research team for access to the data. This study was not preregistered.

REFERENCES

Almeida, D. M., & Kessler, R. C. (1998). Everyday stressors and gender differences in daily distress. *Journal of Personality and Social Psychology*, 75, 670-680. https://doi.org/10.1037//0022-3514.75.3.670

Azar, M., Chapman, S., Joyce, J., Schultheis, M., Zhang, Z., Waltrip, L., Shaglow, S., Zeiger, P., Sunderaraman, P., & Cosentino, S. (2023). Education as a moderator of help seeking behavior in subjective cognitive decline. *Alzheimer Disease & Associated Disorders*, *37*(3), 184-188. doi: 10.1097/WAD.0000000000000571

Barnes, L. L., Lewis, T. T., Begeny, C. T., Yu, L., Bennett, D. A., & Wilson, R. S. (2012). Perceived discrimination and cognition in older African Americans. *Journal of the International Neuropsychological Society*, 18(5), 856–865. https://doi.org/10.1017/S1355617712000628

Brown, M. J., Joseph, C., James, T., Haider, M. R., Zahnd, W. E., & Cohen, S. A. (2022). Gender and Racial/Ethnic Disparities in Social Determinants of Health and Subjective Cognitive Decline: The Mediating Role of Depression. *Journal of gerontological nursing*, *48*(2), 13-22. https://doi.org/10.3928/00989134-20220110-01

Burmester, B., Leathem, J., & Merrick, P. (2016). Subjective Cognitive Complaints and Objective Cognitive Function in Aging: A Systematic Review and Meta-Analysis of Recent Cross-Sectional Findings. *Neuropsychology review*, *26*(4), 376–393. https://doi.org/10.1007/s11065-016-9332-2

Carstensen, L. L., Fung, H. H., & Charles, S. T. (2003). Socioemotional selectivity theory and the regulation of emotion in the second half of life. *Motivation and emotion*, *27*, 103-123. https://doi.org/10.1023/A:1024569803230

Chapman, S., Joyce, J. L., Barker, M. S., Rizer, S., Sunderaraman, P., Huey, E. D., & Cosentino, S. (2022). Subjective cognitive decline is more accurate when metamemory is better. *Frontiers in Aging Neuroscience*, 101. https://doi.org/10.3389%2Ffnagi.2022.787552

Chen, G., Zhao, M., Yang, K., Lin, H., Han, C., Wang, X., & Han, Y. (2021). Education Exerts Different Effects on Cognition in Individuals with Subjective Cognitive Decline and Cognitive Impairment: A Population-Based Study. *Journal of Alzheimer's disease*, *79*(2), 653–661. https://doi.org/10.3233/JAD-201170

Colvin, L. E., Malgaroli, M., Chapman, S., MacKay-Brandt, A., & Cosentino, S. (2018). Mood and Personality Characteristics are Associated with Metamemory Knowledge Accuracy in a Community-Based Cohort of Older Adults. *Journal of the International Neuropsychological Society*, *24*(5), 498–510. https://doi.org/10.1017/S1355617717001345

Coogan, P., Schon, K., Li, S., Cozier, Y., Bethea, T., & Rosenberg, L. (2020). Experiences of racism and subjective cognitive function in African American women. *Alzheimer's & Dementia*, 12(1), e12067. https://doi.org/10.1002/dad2.12067

Folkman, S., & Lazarus, R. S. (1985). If it changes it must be a process: study of emotion and coping during three stages of a college examination. *Journal of personality and social psychology*, 48(1), 150. https://doi.org/10.1037//0022-3514.48.1.150

Giffard, B., Perrotin, A., Allain, P., Dayan, J., Eustache, F., Grellard, J. M., Faveyrial, A., Joly, F., & Lange, M. (2020). The role of metamemory on cognitive complaints in cancer patients. *Brain and behavior*, *10*(4), e01545. https://doi.org/10.1002/brb3.1545

Goodman, Z. T., Timpano, K. R., Llabre, M. M., & Bainter, S. A. (2022). Revisiting the factor structure and construct validity of the Cognitive Failures Questionnaire. *Psychological assessment*, *34*(7), 671–683. https://doi.org/10.1037/pas0001127

Gupta S. (2021). Racial and ethnic disparities in subjective cognitive decline: a closer look, United States, 2015-2018. *BMC public health*, *21*(1), 1173. https://doi.org/10.1186/s12889-021-11068-1

Hill-Jarrett, T. G., & Jones, M. K. (2022). Gendered racism and subjective cognitive complaints among older black women: The role of depression and coping. *The Clinical Neuropsychologist*, *36*(2), 479-502. https://doi.org/10.1080/13854046.2021.1923804

Hox, J., Moerbeek, M., & van de Schoot, R. (2017). Multilevel Analysis: Techniques and Applications, Third Edition (3rd ed.). Routledge. https://doi.org/10.4324/9781315650982

Isaacowitz, D. M., Livingstone, K. M., & Castro, V. L. (2017). Aging and emotions: experience, regulation, and perception. *Current opinion in psychology*, *17*, 79–83. https://doi.org/10.1016/j.copsyc.2017.06.013

Jessen, F., Wiese, B., Bachmann, C., Eifflaender-Gorfer, S., Haller, F., Kölsch, H., Luck, T., Mösch, E., van den Bussche, H., Wagner, M., Wollny, A., Zimmermann, T., Pentzek, M., Riedel-Heller, S. G., Romberg, H. P., Weyerer, S., Kaduszkiewicz, H., Maier, W., Bickel, H., & German Study on Aging, Cognition and Dementia in Primary Care Patients Study Group (2010). Prediction of dementia by subjective memory impairment: effects of severity and temporal association with cognitive impairment. *Archives of general psychiatry*, *67*(4), 414–422. https://doi.org/10.1001/archgenpsychiatry.2010.30

Jessen, F., Amariglio, R. E., van Boxtel, M., Breteler, M., Ceccaldi, M., Chételat, G., Dubois, B., Dufouil, C., Ellis, K. A., van der Flier, W. M., Glodzik, L., van Harten, A. C., de Leon, M. J., McHugh, P., Mielke, M. M., Molinuevo, J. L., Mosconi, L., Osorio, R. S., Perrotin, A., Petersen, R. C., Rabin, L. A., Rami, L., Reisberg, B., Rentz, D. M., Sachdev, P. S., de la Sayette, V., Saykin, A. J., Scheltens, P., Shulman, M. B., Slavin, M. J., Sperling, R. A., Stewart, R., Uspenskaya, O., Vellas, B., Visser, P. J., Wagner, M., Subjective Cognitive Decline Initiative (SCD-I) Working Group (2014). A conceptual framework for research on subjective cognitive decline in preclinical Alzheimer's disease. *Alzheimer's & dementia : the journal of the Alzheimer's Association*, *10*(6), 844–852. https://doi.org/10.1016/j.jalz.2014.01.001

Johansson, B., Allen-Burge, R. & Zarit, S. H. (1997). Self-reports on memory functioning in a longitudinal study of the oldest old: Relation to current, prospective, and retrospective performance. *Journal of Gerontology: Psychological Sciences*, *52*B, 139-146. https://doi.org/10.1093/geronb/52b.3.p139

John, S. E., Evans, S. A., Hanfelt, J., Loring, D. W., & Goldstein, F. C. (2020). Subjective memory complaints in White and African American participants. *Journal of geriatric psychiatry and neurology*, *33*(3), 135-143. https://doi.org/10.1177%2F0891988719868305

Keating, L., Kaur, A., Mendieta, M., Gleason, C., Basello, G., Roth, A., & Brondolo, E. (2021). Racial discrimination and core executive functions. *Stress and Health*. https://doi.org/10.1002/smi.3116

Langer, K., Hagedorn, B., Stock, L. M., Otto, T., Wolf, O. T., & Jentsch, V. L. (2020). Acute stress improves the effectivity of cognitive emotion regulation in men. *Scientific reports*, 10(1), 11571. https://doi.org/10.1038/s41598-020-68137-5

Lazarus, R. S., & Folkman, S. (1984). Stress, appraisal, and coping. Springer publishing company.

Lee, M., Nam, J. H., Yi, E., Bhimla, A., Nelson, J., & Ma, G. X. (2021). Differences in subjective memory impairment, depressive symptoms, sleep, and physical activity in African American and Asian American Elderly. *Brain Sciences*, *11*(9), 1155. https://doi.org/10.3390%2Fbrainsci11091155

Leger, K. A., Gloger, E. M., Maras, J., & Marshburn, C. K. (2022). Discrimination and health: The mediating role of daily stress processes. *Health Psychology*, 41(5), 332–342. https://doi.org/10.1037/hea0001173

Levy, B. (2009). Stereotype embodiment: a psychosocial approach to aging. *Current Directions in Psychological Sci*ence 18, 332–336. https://doi.org/10.1111/j.1467-8721.2009.01662.x

Markides, K. S., & Rote, S. (2015). Immigrant health paradox. In *Emerging trends in the social and behavioral sciences* (pp. 1–15). John Wiley & Sons, Inc.

Nelson, T. O. (1990). Metamemory: A theoretical framework and new findings. In *Psychology of learning and motivation* (Vol. 26, pp. 125-173). Academic Press.

Parisi, J. M., Sharifian, N., Rebok, G. W., Aiken-Morgan, A. T., Gross, A. L., & Zahodne, L. B. (2021). Subjective memory, objective memory, and race over a 10-year period: Findings from the ACTIVE study. *Psychology and aging*, *36*(5), 572. https://doi.org/10.1037/pag0000622

Park, C. L., & Folkman, S. (1997). Meaning in the context of stress and coping. *Review of General Psychology*, 1(2), 115-144. https://doi.org/10.1037/1089-2680.1.2.115

Reisberg, B., Prichep, L., Mosconi, L., John, E. R., Glodzik-Sobanska, L., Boksay, I., Monteiro, I., Torossian, C., Vedvyas, A., Ashraf, N., Jamil, I. A., & de Leon, M. J. (2008). The pre-mild cognitive impairment, subjective cognitive impairment stage of

Alzheimer's disease. *Alzheimer's & Dementia*, *4*(1 Suppl 1), S98–S108. https://doi.org/10.1016/j.jalz.2007.11.017

Reyes, G., Silva, J. R., Jaramillo, K., Rehbein, L., & Sackur, J. (2015). Self-Knowledge Dim-Out: Stress Impairs Metacognitive Accuracy. *PloS One*, 10(8), e0132320. https://doi.org/10.1371/journal.pone.0132320

Reyes, G., Vivanco-Carlevari, A., Medina, F., Manosalva, C., de Gardelle, V., Sackur, J., & Silva, J. R. (2020). Hydrocortisone decreases metacognitive efficiency independent of perceived stress. *Scientific Reports*, 10(1), 14100. https://doi.org/10.1038/s41598-020-71061-3

Rucker, D. D., Turnes, P. B., & Petty, R. E. (2011). 7. Metacognition: Methods to Assess Primary versus Secondary Cognition. *In Cognitive methods in social psychology* (pp. 200-228).

Ryff, C., Almeida, D. M., Ayanian, J. Z., Binkley, N., Carr, D. S., Coe, C., Davidson, R., Grzywacz, J., Karlamangla, A., Krueger, R., Lachman, M. E., Love, G., Mailick, M., Mroczek, D. K., Radler, B., Seeman, T. E., Sloan, R., Thomas, D., Weinstein, M., & Williams, D. R. (2017). Midlife in the United States (MIDUS Refresher 1), 2011-2014. ICPSR36532-v3. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2017-11-20. http://doi.org/10.3886/ICPSR36532.v3

Ryff, C., Almeida, D., Ayanian, J., Binkley, N., Carr, D. S., Coe, C., Davidson, R., Grzywacz, J., Karlamangla, A., Krueger, R., Lachman, M., Love, G., Mailick, M., Mroczek, D., Radler, B., Seeman, T., Sloan, R., Thomas, D., Weinstein, M., & Williams, D. (2016). National Survey of Midlife Development in the United States (MIDUS Refresher), 2011–2014. ICPSR36532-v2. Inter-University Consortium for Political and Social Research [distributor]. doi:10.3886/ICPSR36532.v2

Salthouse, T. A. (2009). When does age-related cognitive decline begin?. *Neurobiology of Aging*, *30*(4), 507-514. https://doi.org/10.1016%2Fj.neurobiolaging.2008.09.023

Seblova, D., Avila, J. F., Kraal, A. Z., Starks, T. M., Adkins- Jackson, P. A., Brickman, A. M., & Manly, J. J. (2022). Relationship of daily, institutional and structural racism with cognition in ethnically/racially diverse middle- age Americans. *Alzheimer's & Dementia*, *18*, e067224. https://doi.org/10.1002/alz.067224

Seo, E. H., Kim, H., Choi, K. Y., Lee, K. H., & Choo, I. H. (2017). Association of subjective memory complaint and depressive symptoms with objective cognitive functions in prodromal Alzheimer's disease including pre-mild cognitive impairment. *Journal of Affective Disorders*, *217*, 24–28. https://doi.org/10.1016/j.jad.2017.03.062

Spada, M. M., Nikčević, A. V., Moneta, G. B., & Wells, A. (2008). Metacognition, perceived stress, and negative emotion. *Personality and Individual Differences*, *44*(5), 1172-1181. https://doi.org/10.1016/j.paid.2007.11.010

Studart, A., Neto, & Nitrini, R. (2016). Subjective cognitive decline: The first clinical manifestation of Alzheimer's disease?. *Dementia & Neuropsychologia*, *10*(3), 170–177. https://doi.org/10.1590/S1980-5764-2016DN1003002

Sutin, A. R., Stephan, Y., Carretta, H., & Terracciano, A. (2015). Perceived discrimination and physical, cognitive, and emotional health in older adulthood. *The American Journal of Geriatric Psychiatry*, 23(2), 171–179. https://doi.org/10.1016/j.jagp.2014.03.007

Tandetnik, C., Farrell, M. T., Cary, M. S., Cines, S., Emrani, S., Karlawish, J., & Cosentino, S. (2015). Ascertaining Subjective Cognitive Decline: A Comparison of Approaches and Evidence for Using an Age-Anchored Reference Group. *Journal of Alzheimer's Disease*, *48 Suppl 1*(0 1), S43–S55. https://doi.org/10.3233/JAD-150251

Tomita, T., Sugawara, N., Kaneda, A., Okubo, N., Iwane, K., Takahashi, I., Kaneko, S., & Yasui-Furukori, N. (2014). Sex-specific effects of subjective memory complaints with respect to cognitive impairment or depressive symptoms. *Psychiatry and clinical neurosciences*, *68*(3), 176–181. https://doi.org/10.1111/pcn.12102

Tun, P.A., & Lachman, M.E. (2006). Telephone assessment of cognitive function in adulthood: The Brief Test of Adult Cognition by Telephone. *Age and Ageing*, 35, 629-632. doi: 10.1093/ageing/afl095

Van Patten, R., Nguyen, T. T., Mahmood, Z., Lee, E. E., Daly, R. E., Palmer, B. W., Wu, T., Tu, X., Jeste, D. V., & Twamley, E. W. (2022). Physical and mental health characteristics of 2,962 adults with subjective cognitive complaints. *The International Journal of Aging and Human Development*, *94*(4), 459-477. doi:10.1177/00914150211026548.

Veilleux, J. C., Lankford, N. M., Hill, M. A., Skinner, K. D., Chamberlain, K. D., Baker, D. E., & Pollert, G. A. (2020). Affect balance predicts daily emotional experience. *Personality and Individual Differences*, *154*, 109683.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, 54, 1063-1070. https://doi.org/10.1037//0022-3514.54.6.1063

Williams, D. R., Yu, Y., Jackson, J. S., & Anderson, N. B. (1997). Racial differences in physical and mental health: Socio-economic status, stress and discrimination. *Journal of Health Psychology*, *2*(3), 335–351. https://doi.org/10.1177/135910539700200305

Zahodne, L. B., Morris, E. P., Sharifian, N., Zaheed, A. B., Kraal, A. Z., & Sol, K. (2020). Everyday discrimination and subsequent cognitive abilities across five domains. *Neuropsychology*, 10.1037/neu0000693. Advance online publication. https://doi.org/10.1037/neu0000693

Zahodne, L. B., Sharifian, N., Kraal, A. Z., Zaheed, A. B., Sol, K., Morris, E. P., Schupf, N., Manly, J. J., & Brickman, A. M. (2021). Socioeconomic and psychosocial mechanisms underlying racial/ethnic disparities in cognition among older adults. *Neuropsychology*, 35(3), 265–275. https://doi.org/10.1037/neu0000720

Tabel 1. *Descriptive Statistics of the Sample (N= 782)*

Variable	***N* (%)**
Age, years (M = 47.91 [SD = 12.67])	
26-39	217 (27.7%)
40-59	459 (58.7%)
60-75	106 (13.6%)
Education	
Less than High School	33 (4.2%)
High School/GED	127 (16.2%)
Some College, no degree	133 (17.0%)
Associate, Vocational School, 2-year College	99 (12.7%)
Bachelor's Degree	193 (24.7%)
Post-Baccalaureate Education/Degree	197 (25.2%)
Sex Assigned at Birth	
Male	347 (44.4%)
Female	435 (55.6%)
Race	
White	659 (84.3%)
Black	50 (6.4%)
Asian	7 (0.9%)
Native American/Alaskan Native	11 (1.4%)
Other	51 (6.5%)
Ethnicity	
Hispanic/Latino	32 (4.0%)

Table 2. *Summary Table of Reported Lifetime and Daily Discrimination Experiences*

Variable	***N* (%)**
Reported Lifetime Experience of Discrimination at Baseline	
Yes	446 (57.03%)
No	336 (42.97%)
Individuals With At Least 1 Incident of Daily Discrimination Experienced During Daily Diary Project Participation	
Yes	236 (30.2%)
No	546 (69.8%)
Perceived Reason for Daily Discrimination Experience (per incident of discrimination)	*n* = 404 incidences
Age	70
Race/Ethnicity	58
Sex/Gender	51
Physical Disability	47
Other Appearance	41
Height/Weight	40
Religion	12
Sexual Orientation	7
Other	223
Don't know	39
Refused to say	7

Note. Though not explicitly stated, an incident of discrimination may have more than one basis/reason for discrimination.

Table 3. *Summary of Subjective Cognitive Complaints Reported in Daily Diary Project*

Variable	***N***	***M***
Number of Reported Cognitive Complaints		
Forget where you put something?	937	
Forget a word?	711	
Forget someone's name?	633	
Forget why you enter a room?	569	
Forget errand or chore?	446	
Forget to finish something you started?	425	
Forget medication?	308	
Forget important information?	214	
Forget an appointment?	142	
Average number of cognitive complaints per age group		
26-39		
Male		.973
Female		.531
40-59		
Male		.923
Female		.784
60-75		
Male		.695
Female		.115

Table 4. *Comparison of Model Fit Indices*

Model	**Δdf**	**-2LL**	**AIC**	**BIC**	**χ^2 Difference (based on -2LL)**	**p-value**
Null	-	16183.17	16191.17	16217.81	-	-
1	10	16046.12	16060.12	16106.73	137.05	< .001
2	17	14931.29	14993.29	1519.50	1114.83	< .001

Table 5. *Summary of Fixed Effects*

Variable	**Model 1**		**Model 2**	
	β [95% CI]	p-value	β [95% CI]	p-value
Level 1 Predictors				
Daily Discrimination Experiences	-.462 [-.298, -.627]**	< .001	-.577 [-.984, -.216]**	.003
Daily Affect Balance	-.055 [-.072, -.038]**	< .001	-.055 [-.069, -.033]**	< .001
Level 2 Predictors				
Age			-.031 [-.072, .010]	.138
Education (< HS education)			1.30 [.291, 2.31]*	.012
Race			-.541 [-960, -.122]*	.011
Sex			-.365 [-.970, .240]	.237
Baseline Objective Cognitive Performance			-.024 [-.105, .057]	.556
Endorsement of Lifetime Discrimination			-.480 [-.820, -.140]**	.006
Within-Level Interactions				
Daily Discrimination Experiences x Daily Affect Balance			.021 [.005, .040]*	.017
Cross-Level Interactions				
Daily Discrimination Experiences x Race			.356 [.145, .930]*	.042
Daily Discrimination Experiences x Endorsement of Lifetime Discrimination			-1.34 [-2.24, -.444]**	.003
Daily Affect Balance x Age			.001 [.0003, .002]*	.011

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