ABSTRACT

Title of Dissertation: THE LONGER-TERM IMPACT OF PERCEIVED DISCRIMINATION ON COUPLE RELATIONSHIP FUNCTIONING: EXAMINING PSYCHOLOGICAL AND PHYSIOLOGICAL PATHWAYS AMONG MIDDLE-AGED AND OLDER-AGED ADULTS IN THE UNITED STATES

Jingshuai Du, Doctor of Philosophy, 2023

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The current study aimed to investigate the longer-term impact of everyday discrimination and major lifetime discrimination at Time 1 (T1; 2008 and 2010) on couple relationship functioning at Time 3 (T3; 2016 and 2018) across 8 years. It also aimed to explore if psychological (measured by depressive symptoms) and physiological stress responses (measured by allostatic load) at Time 2 (T2; 2012 and 2014) mediated the longitudinal association between discrimination and couple relationship functioning among middle-aged and older-aged adults in the United States (U.S.). To answer the study aims, I conducted a longitudinal mediation path analysis (N = 2,344) in Mplus Version 8 using data from the Health and Retirement Study, an ongoing national survey of the health and aging experience of U.S. adults aged 51 and older residing in the community. The primary longitudinal mediation model with control variables demonstrated good model fit ($\chi^2[4] = 21.78$, $p < 0.01$, CFI = 0.99, RMSEA = 0.04, SRMR = 0.01). The analysis results suggested that depressive symptoms at T2 significantly mediated the longitudinal association between the two types of discrimination and the two types of couple

relationships spanning 8 years while controlling for race, age, gender, education, number of reasons for everyday discrimination and T1 assessments of couple support and couple strain. However, allostatic load was not found to be a significant mediator between the two types of discrimination and the two aspects of couple relationship functioning (couple support and couple strain). The direct relationship between discrimination (everyday and major lifetime discrimination) and couple relationship functioning (couple strain and couple support) was not significant either. The results from the multi-group analysis suggested that several structural paths differed significantly across gender, age groups, and number of reasons for everyday discrimination, but none of the paths differed significantly based on race. Overall, the current study did not find evidence supporting the pathway from perceived discrimination to couple relationship functioning through allostatic load. It provided evidence supporting depressive symptoms as a mediating mechanism between perceived discrimination and couple relationship functioning. Future work should develop innovative methods for assessing and measuring allostatic load to test its possible mediation role between perceived discrimination and couple relationship functioning. Moreover, effective and culturally-responsive interventions and programs are needed to decrease all types of discrimination and depression in order to improve couple relationship functioning among middled-aged and older-aged adults in the U.S.

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by

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Chapter 1: Introduction

The number of middle-aged and older-aged adults[1], especially those age 65 or older in the United States (U.S.), has grown remarkably in the past 10 years and is expected to continue to grow significantly in the future (Administration on Aging, 2021; Mather et al., 2015). For example, the population of people age 65 and older increased from 39.6 million in 2009 to 54.1 million in 2019 (a 36% increase) and is projected to reach 94.7 million in 2060 (Administration on Aging, 2021). As people age, they are at a significant risk for developing multiple chronic diseases and associated functional impairment, such as trouble seeing, hearing, difficulty with mobility, communication, cognition and self-care. These health challenges can seriously impact their daily activities, happiness, mental health, and overall quality of life (Administration on Aging, 2021; Centers of Disease Control and Prevention, 2020).

It has been consistently shown that marital quality is positively related to individual adults' own physical and psychological health (Kiecolt-Glaser & Newton, 2001; Proulx et al., 2007; Robles et al., 2014) as well as their children's health and family wellbeing (Benzies et al., 2004; Hair et al., 2009). These benefits can be especially meaningful and crucial for people in their later life as they face economic, health, and social vulnerabilities (Administration on Aging, 2021; US Census Bureau, 2021). For example, several recent longitudinal studies have shown that middle-aged and older-aged adults with a higher level of marital quality was associated with better sleep quality (Lee et al., 2017), better psychological health (Hung et al., 2019; Irani et al., 2021a), lower cognitive decline (Liu et al., 2021), lower disability decline and functional limitations (Choi et al., 2016; R. B. Miller et al., 2013), and lower mortality risk (Stanton et al.,

[1] "Middle-aged and older-aged adults" refer to people aged 50 and older in the present study. Specifically, "middle-aged adults" refer to people aged 50-64. "Older-aged adults" refer to people aged 65 and older. "Adults in later life" also refer to the same age range unless otherwise noted.

2019). Thus, considering the growing percentage of middle-aged and older-aged population in the U.S., as well as the consequential health implications of marital quality, it is important to investigate the possible predictors for couple relationship functioning for people in later life.

As a salient and chronic social stressor, discrimination has been increasingly studied by scholars and researchers in the past two decades. However, most of this research has focused on the association between discrimination and individual physical and mental health outcomes, such as all-cause mortality, cancer, depression and anxiety (T. T. Lewis et al., 2015; Paradies et al., 2015; Schmitt et al., 2014). There are few studies on the impact of discrimination in the couple context (Doyle & Molix, 2014c; Kwon, 2020). Theories on stress and couple relationships have advanced in recent years and posit that external stressors, such as discrimination, can harm couple relationships when the stressors of one partner spill over to their relationship, and lead to detrimental effects on their couple relationship quality, such as increased conflict and hostility, decreased support, warmth and couple satisfaction (Bryant et al., 2010; Karney & Bradbury, 1995; Randall & Bodenmann, 2009). In fact, several recent empirical studies have highlighted these detrimental effects of discrimination particularly among couples from groups that are frequently stigmatized, including racial minorities such as African Americans (Doyle & Molix, 2014c; Lavner et al., 2018; Lincoln & Chae, 2010), Latinos (Trail et al., 2012), Asian Americans (Kwon, 2020), sexual minority groups (Ballester et al., 2021; Doyle & Molix, 2014a), women (Doyle & Molix, 2014b), overweight and obese individuals (Boyes & Latner, 2009; Carels et al., 2020) as well as people with chronic health conditions (Shrout & Weigel, 2021). The overarching finding from these studies is that more perceived discrimination is associated with more couple relationship strain and less couple relationship satisfaction (Ballester et al., 2021; Kwon, 2020; Lavner et al., 2018; Shrout & Weigel, 2021). While these studies are a significant

addition to literature, most of them are cross-sectional, which limits our understanding of the directionality of effects, and seldom do they investigate the longer-term impact of discrimination on couple relationship functioning (Doyle & Molix, 2014c; Kwon, 2020). Furthermore, there are even fewer studies on factors that might mediate the relationship between experiences of discrimination and quality of couple relationships (Kwon, 2020; Lincoln & Chae, 2010; Trail et al., 2012), limiting a comprehensive understanding of how discrimination might impact couple relationship functioning.

There is a growing body of literature on two stress responses, psychological and physiological, as the underlying mechanisms driving the negative effects of stress on health outcomes, such as discrimination-related stress on health (Clark et al., 1999) and couple relationship-related stress on health (Priest et al., 2015, 2019, 2020; Woods et al., 2020). The conceptual frameworks from these studies posit that people's experiences of stress may activate their individual psychological stress responses, such as depressive symptoms, and physiological stress response, such as allostatic load, which, in turn, may lead to worsened physical health (Clark et al., 1999; Priest et al., 2015, 2019, 2020; Woods et al., 2020). Allostatic load is a measure of cumulative biological risk in the face of chronic physiological stress reactivity (McEwen, 1998).Though the psychological and physiological stress responses were conceptualized as mediators between stress and individual health in these studies, these two mechanistic pathways are also reflected in the theory of stress and couple relationship. For example, Bodenmann and their colleagues (Bodenmann, 1997; Bodenmann et al., 2007) proposed the systemic-transactional model (STM) and argued that couples' external stress can reduce their relationship quality through decreased individual psychological and physical well-being (Bodenmann et al., 2007). In the present study, I use psychological stress response (e. g.,

depressive symptoms) and physiological stress response (e.g., allostatic load) to represent these two mediating pathways from stress and couple relationship functioning. Given the cross-sectional finding of psychological and physiological stress reactivity serving as the mediators between discrimination-related stress and couple relationship functioning (Doyle & Molix, 2014c), as well as evidence from long-term study on stress and couple relationship (Bodenmann & Cina, 2006; Neff & Karney, 2007), we argue that individual experiences of discriminated-related stress may result in heightened psychological (e.g., depressive symptoms) and physiological (e.g. allostatic load) stress responses, which, in turn, will spill over into their romantic relationships and adversely impact their relationship functioning.

Discrimination on the basis of one's social group membership is complex and it varies by social identity attribution (e.g., gender, race, age), level (institutional, interpersonal, and internalized), intensity (e.g., minor, severe), and frequency (e.g., every day, major life-time; . Besides differences in social status upon which unfair treatment/discrimination is based (e.g., gender, race, age), two primary forms of discrimination based on time, period, severity and frequency have been distinguished: everyday discrimination and major life discrimination. Everyday discrimination refers to recurrent indignities and irritations in everyday situations, and major life-time discrimination consists of discrete and major events that limit ones' access to resources and opportunities (Essed, 1991). Given the complexity of experiences of discrimination, research studies need to include measures that assess multiple forms of discrimination based on social identity (e.g., gender, race, age) as well as discrimination experiences in different time periods (e.g., everyday discrimination, major life-time discrimination).Several studies have also highlighted the importance of including both everyday discrimination and major-life discrimination as they differentially predict health outcomes (Y.

Lee et al., 2018; Luo et al., 2012). However, when studying the impact of discrimination on close relationships, the majority of studies have only used everyday discrimination measure (Kwon, 2020; Lincoln & Chae, 2010; Trail et al., 2012), and focused on one type of social identity-based discrimination, such as racial discrimination, or sexual orientation discrimination (Ballester et al., 2021; Trail et al., 2012).

Although there is some initial evidence about the link between discrimination and couple relationships, several gaps remain to be filled. To address these gaps, the current study aims to investigate the longer-term impact of everyday and major life-time discrimination at Time 1 on couple relationship functioning at Time 3 across 8 years. Moreover, it also aims to explore if psychological and physiological stress responses at Time 2 mediate the association between discrimination and couple relationship functioning among middle-aged and older-aged adults. To answer these questions, the present study conducted a longitudinal mediation path analysis model. The study used data from Health and Retirement Study (HRS), an ongoing national survey of the health and aging experiences of U.S. adults aged 51 and older. In addition to assessing middle-aged and older-aged adults' experiences of discrimination and their psychological stress response (depressive symptoms), the present study is innovative in its inclusion of the measure of allostatic load by assessing seven biomarker data, such as C-reactive protein, blood pressure, cystatin C, and hemoglobin A1C, a more objective and accurate way to measure physical health (Umberson & Thomeer, 2020), to assess physiological stress response.

The study is significant because understanding if and how discrimination impacts couple relationships among older adults can inform crucial implications for future policy and clinical practice aimed at improving older people's relationship quality and therefor improving their health outcomes. This study advanced the current literature by examining the longer-term impact

of two major types of discrimination (everyday and major life-time discrimination) on couple relationships for older adults, and it brings a multidisciplinary approach by incorporating social, psychological and biological perspectives.

Chapter 2: Literature Review & Theoretical Framework

In this chapter, I detailed the existing literature on topics relevant to this study proposal. First, I introduced key developmental changes related to demographic shifts and health challenges among middle-aged and older-aged adults in the U.S. Next, I examined the link between marital status, marital quality, and health among middle-aged and older-aged adults in the U.S. Third, I presented a conceptual understanding of discrimination. Fourth, I reviewed the link between discrimination and health among middle-aged and older-aged. In the fifth section, I examined the link between stress and couple relationships[2]. In the sixth section, I focused on the link between stressful discrimination experiences and couple functioning. In the seventh section, I examined the psychological and physiological mediating mechanism linking discrimination and couple relationship functioning. Finally, I presented the main theoretical frameworks and relevant constructs from these frameworks guiding the present study, and proposed a conceptual model and research hypotheses for the present study.

Section 1: Middle-aged and older-aged adults in the U.S.

The U.S. is experiencing drastic shifts in the age distribution of its population. The number of middle-aged and older-aged adults, especially those age 65 and older, has grown

[2] The present study includes middle-aged and older-aged adults who are married and non-married coupled individuals to be inclusive of non-married coupled individuals. I use "couple relationships" "romantic relationships" and "close relationships" interchangeable to reflect this sample characteristic. It seems many studies used the wordings of "marital relationships" or "marital quality" in their paper while their samples include both married coupled individuals and non-married coupled individuals. So, sometimes I also use "martial quality" and "marital relationships" in the present paper to be consistent with the original literature.

remarkably in the past 10 years and is expected to continue to grow (Administration on Aging, 2021; Mather et al., 2015). Between 2009 and 2019, the number of Americans aged 45-64 increased by 4% from 80.3 million to 83.3 million. In the same time period, the number of Americans aged 65 and older increased by 36% from 39.6 million to 54.1 million. In 2019, people aged 65 and older represented 16% of the population and are expected account for 23% of the population by 2060 (Administration on Aging, 2021; Mather et al., 2015). Much of the demographic shift is due to the emergence of baby boomers, adults born mid-1946 to mid-1964, into older adulthood (Batsis & Zagaria, 2018).

Similarly, there has been a striking shift in the marital biographies of U.S. adults aged 50 and older as well. Since 1990s, the national trend of divorce among adults 50 years or older has risen significantly (Mayol-García et al., 2021). More older adults are divorced compared with previous generations. From 1990 to 2015, the rate of divorce among couples over the age of 50 rose from 5 from every 1,000 married individuals to 10 from every 1,000, and the rate of divorce among adults 65 and older almost tripled from 1990 to 2015 (Stepler, 2017). In addition, there is also a sizeable gender age gap in the divorce rate — in 2020, a larger percentage of older men (70%) than older women (48%) were married, and more women (17%) were divorced or separated than men (14%) (Administration on Aging, 2021). The increase in divorce rate among middle-aged and older-aged adults will put pressure on their well-being because this means more older adults may live alone in old age without either the financial and social support or informal caregiving provided by a spouse.

As people age, they are at significant risk for developing multiple chronic diseases and associated functional impairment in a variety of domains (Administration on Aging, 2021; Centers of Disease Control and Prevention, 2020). In 2019, 22% of adults age 65 and older

reported trouble seeing, 31% reported difficulty hearing, 40% reported trouble with mobility, 8% reported difficulty with communication, 27% reported trouble with cognition, and 9% reported difficulty with self-care (Administration on Aging, 2021). Obesity and cognitive decline are two serious and growing public health concerns facing today's middle-aged and older-aged adults (Flegal et al., 2016; Jessen et al., 2014). The rates of obesity have increased dramatically in the past 30 years and it is projected to continue to increase in the future, as successive cohorts are becoming obese at younger ages (J. M. Lee et al., 2010; Mather et al., 2015). This is problematic given that obesity is a serious risk factor for a variety of chronic conditions including four of the ten leading causes of death in the U.S. – heart disease, type II diabetes, stroke, and several forms of cancer (Flegal et al., 2005). Cognitive decline can range from mild cognitive impairment to dementia, a severe condition associated with disability, increased need for medical and personal care, and premature death (Centers for Disease Control and Prevention, 2019). Today, more than 16 million older Americans are living with either a slight or a severe decline in cognitive abilities (Centers for Disease Control and Prevention, 2011). As more and more people are aging and facing unique health challenges such as obesity, cognitive decline or other diseases, and disability, they are more likely experience discrimination based on their age, weight or disability (Hooker et al., 2019; Phibbs et al., 2019).

Section 2: Marital status, martial quality and health among middle-aged and older-aged adults.

First of all, marital status matters in relation to people's health. Numerous studies have established that being married is associated with better mental and physical health compared with being unmarried (Carr & Springer, 2010). Adults in later life, as suggested earlier, are at significant risk for developing multiple chronic diseases and associated functional impairment (Centers of Disease Control and Prevention, 2020); the health benefits of being married can be

especially meaningful for them as they face economic, health, and social vulnerabilities while aging. For example, older people who are married tend to have fewer chronic conditions, mobility limitations, disabilities, and lower levels of depression than those who are unmarried (Hughes & Waite, 2009; Lin & Brown, 2012; Sbarra et al., 2014). In addition, they also experience lower odds of multimorbidity (Wang et al., 2022), suicide (Qin et al., 2003) and mortality (Bulanda et al., 2016; Johnson et al., 2000; Manzoli et al., 2007) based on studies in the U. S. as well as across the world. The current increase in divorce rates among middle-aged and older-aged adults is particularly concerning because this means that more middle-aged and older-aged adults may live alone in their late life without support from a partner/spouse, imposing an additional strain on their health and well-being.

In additional to marriage itself, the quality of the marriage is also an important factor to consider since there are some aspects of marriage that can be either protective or detrimental (Miller et al., 2013). Generally, marital quality is defined as couples' subjective appraisal of their marital relationship including positive (e.g., partner support) and negative aspects of relationships (e.g., partner strain and conflict; Umberson et al., 2006), and is considered to be best understood by including both in research (Bookwala, 2005; Umberson et al., 2006). In fact, several studies have suggested that negative marital quality is more predictive of health than positive aspects, so it is important to include both aspects when assessing marital quality (Kiecolt-Glaser et al., 2015; Kiecolt-Glaser & Newton, 2001; Liu & Waite, 2014). In the present study, the positive aspects of couple functioning refer to the extent to which one partner perceives that their romantic partner cares about, understands, and supports their thoughts and feelings. The negative aspects of the couple relationship are conceptualized as the extent to

which one partner considers their partner as critical, irritating and demanding (Walen & Lachman, 2000).

Several recent literature reviews on marital quality and health have shown that positive marital quality is related to better physical and psychological health while negative marital quality is related to worse health outcomes (Kiecolt-Glaser & Newton, 2001; Proulx et al., 2007; Robles et al., 2014). Regarding people in later life, several recent longitudinal studies have provided direct evidence between marital quality, such as perceived partner support or strain, and numerous health outcomes including cognitive decline (Liu et al., 2021), sleep quality (Kang et al., 2015; J. H. Lee et al., 2017), weight loss/gain and obesity (Chen et al., 2018; Kang et al., 2015), psychological health (Hung et al., 2019; Irani et al., 2021b), self-rated health, disability decline and functional limitations (Choi et al., 2016; R. B. Miller et al., 2013) and mortality risk (Stanton et al., 2019). For instance, it was found that an increase in positive marital quality was associated with a slower rate of cognitive decline while an increase in negative marital quality was associated with a faster rate of cognitive decline over 10 years among middle-aged and older-aged adults men, using nationally representative longitudinal data (N = 7,901) from the Health and Retirement Study (Liu et al., 2021). Another longitudinal study (N = 2,636) looking into weight gain and obesity among middle-aged and older-aged adults using data from Midlife in the U.S. found that overall marital quality was inversely related to both weight gain and incidence of obesity over 10 years (Chen et al., 2018).

Further, marital quality is a key predictor of one's marital success, with unhappy marriages being more likely to end in divorce (Tach & Halpern-Meekin, 2012). Additionally, from the earlier review on the link between marital status and health, we know that middle-aged and older-aged adults who are divorced/unmarried have worse health conditions than middle-

aged and older-aged adults who are married (Carr & Springer, 2010). This suggests that in addition to the direct relationship between marital quality and physical health outcomes, marital quality can also have an indirect impact on physical health outcomes through change in marital status. Regardless of whether martial quality impacts health directly, or indirectly through marital status, the consequential health implications of marital quality for middle-aged and older-aged adults suggest that it is important to investigate the possible predictors for marital functioning for people in their later life.

Though marital quality has been the focus of much couple relationship research, most prior research focuses on the general population, or on the early years of marriage and across the transition to parenthood (Durtschi et al., 2017; Langer et al., 2008; Neff & Karney, 2007). Marital quality in late life has received much less consideration. Though some of the recent studies have investigated the health outcomes of marital quality for middle-aged and older-aged adults (Hung et al., 2019; Liu et al., 2021; Stanton et al., 2019), rarely do they examine what and how major stressful circumstances in later life may be related to their marital functioning. The current study aims to fill this literature gap by examining the role of stressful experiences related to discrimination on couple relationship functioning among middle-aged and older-aged adults in the U.S.

Section 3: Conceptualization of discrimination

Discrimination is defined as "a socially structured and sanctioned phenomenon, justified by ideology and expressed in interactions, among and between individuals and institutions, intended to maintain privileges for members of dominant groups at the cost of deprivation for others" (Krieger, 1999, p. 301). In its broadest conception, it refers to any social relationships that involve domination and oppression (Krieger, 1999). Though sharing a common foundation

of systemic unfair treatment, discrimination is a complex and multidimensional phenomenon, which varies by form (e.g., gender, race, age), type (e.g., everyday discrimination, major life-time discrimination), intensity (e.g., minor , severe), level (institutional, interpersonal, and internalized), frequency, and situational domains (e.g., work, neighborhood; Jones, 2000; Krieger, 1999; McNeilly et al., 1996b).

As suggested, discrimination is broadly understood as unfair treatment on the basis of one's social group membership (Thoits, 2010), so a core component is the social status upon which such treatment is based–this represents the particular form of discrimination. For example, racial discrimination is generally defined as unfair treatment targeted against racial minorities including African Americans, Latinos and Asians. Some of the main types of discrimination in the U.S. are based on race/ ethnicity, gender, sexual orientation, disability, age, and, although not always recognized as such, social class (Boyes & Latner, 2009; Lavner et al., 2018; Song et al., 2022; Stokes, 2018).

Further, people can experience multiple different forms of discrimination based on their social identity. For example, women of color may be subject to both gender and racial discrimination. Women of color in same sex partnerships may be subject to a combination of gender, race, and sexual orientation discrimination. Based on the perspective of intersectionality, these multiple social positions may interact with each other to create a unique experience and further compound the negative outcomes from discrimination (Bauer, 2014). In empirical studies, people who hold multiple stigmatized statuses are shown to have an elevated risk for poor mental, physical health and all-cause mortality than their more privileged counterparts (R. J. Cobb et al., 2021; Grollman, 2012; Lu et al., 2021). However, some scholars argue that in research, people tend to use an additive approach to measure intersectionality of discrimination,

which is “antithetical to the theoretical fidelity of intersectionality” (Bowleg, 2008, p. 314). They reject the additive measurement approach because it conceptualizes people’s discriminatory experiences as summative and independent and it implies their discriminatory experiences based on social identity can be ranked (Cuádraz & Uttal, 1999; Weber & Parra-Medina, 2003). In their article, Bowleg (2008) argues that “it is virtually impossible, particularly in quantitative research, to ask questions about intersectionality that are not inherently additive” (p. 314).

Another way to categorize discrimination into different types is through various factors related to the content, time period, frequency, and severity of the exposure (Grollman, 2012). Based on these characteristics, two primary types of discrimination including everyday discrimination and major life-time discrimination have been distinguished (Kessler et al., 1999; Thoits, 2010). Major lifetime discrimination consists of discrete, major events of discrimination which operates through limited opportunities and unequal access to resources and threatens one’s livelihood (Kessler et al., 1999). Examples of this type include “prevented from renting or buying a home in the neighborhood you wanted”, “denied a scholarship,” and “provided inferior medical care.” While these events occur less frequently, they are severe and, as a result, may have lasting health consequences (Pascoe & Richman, 2009). Everyday discrimination refers to recurrent indignities and irritations in everyday situations (Kessler et al., 1999)–for example, being “treated with less courtesy than others,” “given poorer service than other people at restaurants and stores,” and “called names or insulted.” Though considered as less severe acts, they are ubiquitous and are typically experienced on a continual basis, so they can have substantial deleterious consequences of well-being (Y. Lee et al., 2018). In fact, because of this reason, everyday discrimination has been shown to have a greater impact on health outcomes, especially emotional health outcomes (Ayalon & Gum, 2011; J. H. Lee et al., 2017; Luo et al.,

2012). Therefore, scholars emphasize that it is important to include both everyday discrimination and major-life discrimination in research studies (Clark et al., 1999). In the present study, I include both everyday and life-time discrimination for a more comprehensive assessment of discrimination.

Further, Jones (2000) offers a three-level framework for understanding racism, namely institutional discrimination, personally-mediated discrimination (interpersonal discrimination), and internalized discrimination that can be helpful for understanding discrimination more broadly in the present study. Institutional discrimination typically refers to discriminatory custom, practice or policies and laws carried out by state or non-state institutions. It manifests as differential access to the goods, services and opportunities because of social membership (Jones, 2000). Interpersonal discrimination refers to directly perceived discriminatory interactions between individuals. It manifests in instances of disrespect, mistrust and surveillance and undervaluing ability, and finally dehumanizing that leads to extreme situations such as hate crimes (Jones, 2000). Internalized discrimination refers to members of stigmatized groups accepting and taking on received communications and messages about their value and abilities (Jones, 2000). For the current study, discrimination mainly refers to interpersonal discrimination where people perceive their discriminatory experiences through interpersonal interactions. Based on the definition and examples of everyday and major lifetime discrimination, we can see everyday discrimination happens more at an interpersonal level while major lifetime discrimination reflects more about institutional discrimination.

Section 4: Discrimination and health among middle-aged and older-aged adults in the U.S.

Though many Americans, especially those with more privileges, believe that discrimination is not relevant in today's society (Grollman, 2012), perceived discrimination is a

relatively common social experience (Kessler et al., 1999; Luo et al., 2012). One third of U.S. adults reported at least one major discriminatory event, and over three fifths report everyday discrimination (Kessler et al., 1999). A recent study of 6,377 middle-aged and older-aged (79% Non-Hispanic Whites, 12.5% Non-Hispanic Blacks and 7.2% Hispanics) in the U.S. from the Health and Retirement Study found that about 63% of middle-aged and older-aged adults reported at least one form of everyday discrimination based on their social identity and 31% reported at least one major discriminatory event during their lifetime (Luo et al., 2012). Another study of 8,385 middle-aged and older-aged (77% Whites, 14.5 Blacks and 8.5% Latinos) from the same dataset, the Health and Retirement Study, reported that more than 70% of older adults experienced some form of everyday discrimination – a similar but higher percentage than reported in Luo's (2012) study (Ayalon & Gum, 2011). In terms of social identity-based discrimination, Luo's (2012) study showed that the most common forms of discrimination among middle-aged and older-aged adults in the U.S. were based on age (30%), physical disability or appearance (22%), gender (14%), and race, ancestry or national origin (14%).

Discrimination harms health. Hundreds of studies in the past two decades overwhelmingly documented the health-harming effects of discrimination (T. T. Lewis et al., 2015; Paradies et al., 2015; Schmitt et al., 2014). For people in their late life, these detrimental health consequences are exemplified as poor kidney function (R. Cobb, Thorpe, et al., 2020), inflammation (Cobb, Parker, et al., 2020) and low back pain (Edwards, 2008), and further confirmed by recent longitudinal studies on health outcomes including self-rated health and depression (Han & Richardson, 2015; Luo et al., 2012), cancer risk behaviors (Hooker et al., 2019) and cognitive aging (Zahodne et al., 2020).

As suggested in the previous section, some of the most common forms of discrimination experienced by middle-aged and older-aged adults are age, physical disability or appearance (weight) discrimination (Luo et al., 2012), so it is also important to review how these specific forms of discrimination impact middle-aged and older-aged adults health. A recent study (*N* =19,382) about weight discrimination among middle-aged and older-aged adults using Health and Retirement Study data indicated that more weight discrimination experienced by middle-aged and older-aged adults was associated with less participation in either vigorous or moderate physical activity. Additionally, the study also found that weight discrimination partially mediated the relationship between body weight and physical activity, suggesting that middle-aged and older-aged adults who were overweight or obese may be more likely to experience weight discrimination, which in turn, may lower their participation in physical activity (Phibbs et al., 2019). This can be particularly concerning considering the current high rates of obesity among middle-aged and older-aged adults and the vulnerability they face for weight discrimination (Phibbs et al., 2019). Similarly, in another study middle-aged and older-aged adults (*N*=4,467) reported experiencing high levels of age discrimination, and age discrimination experienced in 2008 was found to be significantly related to health behaviors that increase their risk for cancer such as physical activity, smoking, and drinking 6 years later in 2014 among study participants (Hooker et al., 2019). Further, another longitudinal study (*N* = 3,921) about age discrimination indicated that middle-aged and older-aged individuals with more perceived age discrimination in 2008 reported more negative self-perceptions of aging and more depressive symptoms over 4 years in 2012 than those who had perceived less age discrimination in 2008 (Han & Richardson, 2015).

Despite the overwhelming evidence of discrimination as a determinant of health for individuals, little research has investigated its role in romantic relationships.

Section 5: Stress and couple relationship

The link between discrimination and relationship functioning can be understood in the context of general stress and couple relationship functioning. Though past research mostly conceptualized stress on an individual level (e.g., Lazarus, 1999; Lazarus & Folkman, 1984), recent studies have started to adopt a systemic view defining stress as a dyadic phenomenon in couples (Randall & Bodenmann, 2009). According to this view, couples are highly interdependent in their day to day lives and the stress of one partner has an impact on the other partner. The stress of one partner can spill over to the couple system and affect their couple relationship as a whole (Bodenmann, 1997; Randall & Bodenmann, 2009).

In the context of couple relationships, stressors have been classified based on three dimensions: (1) external vs internal; (2) major vs minor; and (3) acute vs chronic (Randall & Bodenmann, 2009). External stressors refer to stress originating outside of the couple dyad such as stress at workplace or unsafety in the neighborhood. On the flip side, internal stressors represent stressors arising within the couple, and these stressors may look like conflicts from having different goals, attitudes, needs, or habits between couples. Major stressors are viewed as critical and serious life events such as severe illness, unemployment, or death of a significant other, while minor stressors refer to daily hassles such as being late for the meeting and so on. From the perspective of the duration of stress, acute stressors last a short period of time, on the other hand, chronic stressors can be long-lasting (Randall & Bodenmann, 2009). It is helpful to use this typology to understand discrimination as a stressor in relation to the present study. Based on this stress typology, everyday discrimination is a type of minor and chronic stressor, while

major lifetime discrimination can be understood as a major and acute stressor. Generally speaking, everyday discrimination and major life-time discrimination are both regarded as external stressors from the social environment outside of the couple system. It is worth mentioning here that in the past, most studies have tended to focus on major stressors (e.g., natural disaster) in close relationships and families; however, recent studies suggested that minor stress seems to play an even more important role in understanding couple functioning (Randall & Bodenmann, 2009).

Furthermore, the conceptual understanding of the relationship between stress and couple relationship has been empirical investigated using both cross-sectional and longitudinal studies (Falconier et al., 2015; Kelley et al., 2018; Langer et al., 2008; Neff & Karney, 2004). For example, both spouses' reports of financial stress was negatively associated with their overall marital quality among 373 married U.S. couples (Kelley et al., 2018). Another cross-sectional study about stress from daily hassles (e.g., work load, financial problems, conflicts with colleagues or friends) among 110 community-based couples in Switzerland suggested that increased stress from daily hassles may result in more stress internal to the couple's relationship such as arguments, feeling neglected by the partner, which in turn, decrease their relationship satisfaction (Falconier et al., 2015). Separation of deployment as a critical stressor was associated with a variety of aspects related to marital functioning including lower marital satisfaction, confidence in the relationship, positive bonding between spouses and dedication to the relationship for both husbands and wives among a sample of 434 couples consisting of active duty Army (Allen et al., 2010). Further, longitudinal studies indicate that experiences of stress may also have important consequences for the development of marital quality. For example, both husbands' and wives' changes in stress predicted changes in physical aggression towards each

other over the first 3 years of marriage among 103 newlywed couples (Langer et al., 2008). A 4-year marriage study among 82 couples showed that wives who experienced higher levels of external stress (e.g., involved in an accident, separation from partner due to work or travel) demonstrated the steepest declines in marital satisfaction throughout 4 years. Moreover, this study revealed another important finding which is that when spouses experience higher levels of stress, they not only perceive more specific problems within the relationship (e.g., trust, making decisions, showing affection), but also tend to blame partners for their negative marital behaviors, such as partner is being critical to them, or partner does not pay attention to what they are saying (Neff & Karney, 2004).

Section 6: Stressful discrimination experiences and couple relationship functioning

Following the link between stress and couple functioning, discrimination, as a salient and pervasive social stressor rooted in social inequality, has recently been recognized as an important external stressor for romantic relationships. In fact, several recent studies have suggested that threats to one's social identity (race/ethnicity, gender, sexual orientation et al.), including discrimination, can have detrimental effects on the quality of romantic relationships among members of groups that are frequently stigmatized, including racial minorities such as African Americans (Doyle & Molix, 2014c; Lavner et al., 2018; Lincoln & Chae, 2010; Riina & McHale, 2010), Latinos (Molina et al., 2016; Trail et al., 2012) and Asian Americans (Kwon, 2020), sexual minority groups (Doyle & Molix, 2014a; Song et al., 2022), women (Doyle & Molix, 2014b), overweight and obese individuals (Boyes & Latner, 2009; Carels et al., 2020) as well as people with chronic health conditions (Shrout & Weigel, 2021).

Many of the studies mentioned above focus on the impact of discrimination on individual health through their couple relationship quality (Doyle et al., 2018; Kwon, 2020; Molina et al.,

2016; Priest et al., 2020; Wofford et al., 2019). This line of research examines the notion that discrimination may contribute to additional stress in the form of spouse/partner strain and family conflict, which in turn impacts individual health. For example, a study on 1,462 married/cohabitating Asian Americans found that perceived discrimination indirectly influenced psychological distress via spousal/partner strain and family conflict (Kwon, 2020). Another study among 2,554 Latinos reported similar findings that greater exposure to everyday discrimination was associated with higher levels of family cultural conflict and, in turn, increased psychological distress (Molina et al., 2016). Further, using dyadic data analysis, it was revealed that more frequent experiences of discrimination from both partners was associated with their poorer self-rated health and higher depression through their higher levels of couple relationship strain among 1,949 older couples from the Health and Retirement study (Wofford et al., 2019).

A few studies have tested potential mediators between discrimination and couple relationship functioning (Doyle & Molix, 2014a, 2014c; Shrout & Weigel, 2021; Song et al., 2022; Trail et al., 2012). For instance, a study on 330 Latino newlyweds investigated the mediating role of verbal aggression in couple relationships and suggested that more discrimination for husbands was associated with lower levels of couple relationship quality through their higher level of verbal aggression towards their wives (Trail et al., 2012). In a recent study, researchers explored dyadic stress (i.e., issues arising within the relationship itself, such as communication problems; incompatibility; divergent goals, values, habits and attitudes; or unrealistic expectations) as a mediator between discrimination and couple relationships among 133 same-sex couples (Song et al., 2022). Additionally, this study indicated that dyadic stress fully mediated the link between perceived discrimination and relationship satisfaction among

same-sex couples (Song et al., 2022). In Doyle and Molix's (2014a) two cross-sectional studies, they found that self-image partially mediated the relationship between discrimination and couple relationships among two samples composed of 630 racial minority participants (Study 1) and 47 Gay men (Study 2). In addition, Doyle and Molix (2014c) also examined the psychological and physiological pathways as the mediation mechanism driving the deleterious effects from discrimination and relationship strain including couple relationship strain, and found that emotion dysregulation and chronic inflammation fully mediated the effect of perceived everyday discrimination on relationship strain (relationship strain with spouses, families and friends) among 592 African Americans.

It is important to note that the majority of the studies on discrimination and couple relationships functioning discussed above have been cross-sectional, limiting causal inference. To our best knowledge, only two of these studies attempted to address this issue by employing a longitudinal design (Shrout & Weigel, 2021) and a quasi-experimental study design (Doyle & Molix, 2014b). Shrout and Weigel (2021) conducted a longitudinal two-wave study to examine the relational health consequences of experienced stigma among 124 individuals with concealable chronic health conditions (e.g., chronic pain, autoimmune diseases, and mental illness). Their study revealed that chronic health condition–related experienced stigma was associated with poorer relational health (e.g., commitment, satisfaction, love, passion, trust and intimacy) 4 months later. In the study of quasi-experimental design, African Americans currently involved in romantic relationships were randomly assigned to the stigma salience group where they read an article describing the prevalence and consequences of discrimination against African Americans (a social group to which they belonged) in the U.S., or the control group where they read an identical article describing prevalence and consequences of discrimination

against the Inuit in Canada (a social group to which they did not belong), and the results showed that for individuals involved in shorter relationships, social stigma salience led to decreased self-reported relationship quality.

As a summary, the majority of the studies on discrimination and couple relationships functioning are cross-sectional, which limits our understanding of the directionality of effects, and seldom do they investigate the longer-term impact of discrimination on couple relationship functioning (Doyle & Molix, 2014c; Kwon, 2020). Furthermore, there are even fewer studies on factors that might mediate the relationship between experiences of perceived discrimination and couple relationship functioning (Kwon, 2020; Lincoln & Chae, 2010; Trail et al., 2012), limiting a comprehensive understanding of how discrimination might impact couple relationship functioning. To address these gaps, the present study replicated the two pathways used in Doyle & Molix's (2014c) study and examined how perceived discrimination experienced at Time 1 impacts these two pathways at Time 2, which, in turn, may impact relationship functioning at Time 3, 8 years later.

Section 7. Psychological and physiological mechanisms linking perceived discrimination and couple relationship functioning

There is a growing body of literature on two stress responses, psychological and physiological, as the underlying mechanisms driving the negative effects of stress on health outcomes, such as discrimination-related stress on health (Clark et al., 1999) and couple relationship-related stress on health (Priest et al., 2015; 2019; 2020; Woods et al., 2020). The conceptual frameworks from these studies posit that people's experiences of stress may activate their individual psychological stress responses (depressive symptoms) and physiological stress response (allostatic load), which, in turn, may lead to worsened physical health (Clark et al., 1999; Priest et al., 2015, 2019, 2020; Woods et al., 2020)

Though the psychological and physiological stress responses were conceptualized as mediators between stress and individual health in these studies, these two mechanistic pathways are also reflected in the theory of stress and couple relationship. For example, Bodenmann and their colleagues (Bodenmann, 1997; Bodenmann et al., 2007) proposed the Systemic-Transactional Model (STM) and argued that couples' external stress can reduce their couple quality through decreased individual psychological and physical well-being (Bodenmann et al., 2007). Though not termed as exactly the same as the two pathways from these studies mentioned earlier, they reflect the emotional and physical dimensions of health. Further, guided by Clark et al's (1999) conceptual framework of discrimination and health, Doyle & Molix (2014c) applied the two pathways to the context of close relationships and investigated how perceived everyday discrimination impacted couple relationship strain through the psychological and physiological stress responses in a sample of 592 African Americans.

However, among the studies that have examined mediators between perceived discrimination and couple relationships, most of them focus only on one mediating pathway, either physiological or psychological. For example, in Shrout & Weigel's (2021) article, they investigated how chronic health condition-related stigma impacted couple relationships through health-compromising behaviors (e.g., drug and alcohol use) and physical health problems (e.g., exacerbated chronic health condition and increased illness symptoms), which represent the physical dimension of the mechanism. Most of the remaining studies investigated mediators such as self-image and verbal aggression between discrimination and couple relationships (Doyle & Molix, 2014a; Song et al., 2022; Trail et al., 2012), and these mediators reflect more about the psychological dimension of the mechanism. To our best knowledge, Doyle & Molix's (2014c) study is the only study that included both the psychological and physiological pathways as the

mediating mechanisms between discrimination and couple relationship strain. Though the current study may appear similar to Doyle & Molix's study (2014c), it extended and advanced their study in different ways. First, besides everyday discrimination, the present study also added lifetime discrimination to represent a more comprehensive assessment of discrimination. Second, in Doyle & Molix's (2014c) study, they only assessed one biological system, the inflammation system, as the physiological stress response. The present study included seven biomarkers including C-reactive protein, blood pressure, and cystatin C, hemoglobin A1c, total cholesterol, high-density lipoprotein (HDL) cholesterol, and body mass index across inflammatory, cardiovascular and metabolic systems to represent the physiological stress response. Third, the present study not only investigated couple relationship strain as an outcome but also looked at couple relationship support, as they are both important when assessing couple relationship functioning (R. B. Miller et al., 2013). Lastly, Doyle & Molix's (2014c) study only included African Americans whereas the present study utilized a more representative sample of current U. S. populations that included White, African American, Latino and others.

Psychological stress response as a mediator.

The relationship between discrimination and couple relationship functioning may be mediated through psychological distress, such as depressive symptoms—one type of psychological response to stress. Numerous existing studies have provided empirical evidence that experiences of discrimination may contribute to depression (Schmitt et al., 2014; Williams & Mohammed, 2009). Schmitt et al's (2014) meta-analytic review of 382 articles on the impact of discrimination on mental health well-being reported that high levels of perceived discrimination across multiple forms (e.g., race, gender, sexual orientation, physical illness, weight and so on) is associated with increased psychological distress, such as depression.

Studies also show that greater psychological distress may subsequently contribute to poor relationship health outcomes. This phenomenon can be explained by the literature on emotion contagion that refers to the tendency to catch or experience another person's emotional distress through interaction (Hatfield et al., 1993). When one partner experiences psychological distress conferred from pervasive discriminatory experiences, it may spread from an individual into their close relationship via emotional contagion (Wofford et al., 2019). Hence, researchers believe that psychological distresses, such as depression, are not just individual matters. Instead, they are interpersonal events that can impair couples' interactions and relationships.

Substantial research has indicated that there is a robust association between a partner's depressive symptoms and lower relationship satisfaction (Finkbeiner et al., 2013; Heene et al., 2005; Kouros & Cummings, 2011; Li & Johnson, 2018). For example, a recent study with 63 clinical couples showed that females' relationship satisfaction was influenced by their male partners' depression (Li & Johnson, 2018). Another study with 82 heterosexual couples indicated that both partners' depression symptoms were associated with experiencing less pleasure from their partner's intimate behavior, which in turn, were associated with their lower relationship satisfaction (Finkbeiner et al., 2013). Further, a longitudinal study with 296 heterosexual couples adds causal evidence of the link between depression and marital outcomes by showing that high levels of depressive symptoms for husbands predicted subsequent decreases in their martial satisfaction, as well as in their wives' martial satisfaction over 3 years (Kouros & Cummings, 2011). Overall, the existing research supports a pathway from perceived discrimination to couple relationship functioning through increased depression symptoms.

Physiological stress response as a mediator.

Another mediator that may drive the deleterious effects of discrimination on couple relationship functioning is an increased physiological stress response, measured through

allostatic load in the present study. Allostatic load is a measure of cumulative physiological dysregulation across multiple systems including the cardiovascular, immunologic, neuroendocrine and metabolic systems because of chronic and repeated stress (McEwen, 1998). It reflects the accumulative cost of adaptations and accommodations that the body activates to respond to repeated demands from the environment (McEwen, 1998). The theory of allostatic load suggests that chronic stress creates "wear and tear" on regulatory systems, which can accumulate over time damage mental and physical health (McEwen, 1998). Studies show that among middle-aged and older-aged adults with higher allostatic load is associated with increased severity of depressive symptoms (Kobrosly et al., 2013), more cognitive impairment (Karlamangla et al., 2014), lower bone strength (Mori et al., 2014) and all-cause mortality (Karlamangla et al., 2006). Additionally, strains on a single biological system indicator such as inflammation has also been associated with health outcomes such as memory and cognitive performance decline (N. A. Lewis & Knight, 2021; Zahodne et al., 2019) among older adults. Both biomarkers from one single biological system (e. g., inflammation system) and a composite set of biomarkers related to multi-biological systems, such as allostatic load, are related to individual health outcomes. However, research indicated that the effect of allostatic load across multi-systems on health outcomes tends to be stronger than biomarkers from any singer biological system (Mori et al., 2014; Seeman et al., 1997). The present study used allostatic load from seven biomarkers across inflammatory, cardiovascular and metabolic systems to represent the physiological stress response.

In the previous section on "discrimination and health," I presented literature on the negative consequences of discrimination on physical health outcomes. As an objective measure of physical health, it has also been suggested that discrimination-related stress has an impact on

the overall allostatic load. For example, Miller et al's (2021) critical review of 11 articles on the association between discrimination and allostatic load demonstrated regardless of discrimination forms based on social identity (e.g., race, gender or age discrimination), more perceived discrimination is associated with higher allostatic load in adults, including longitudinal evidence. Out of these 11 articles, 5 were among middle-aged and older-aged adults (H. N. Miller et al., 2021), adding evidence particularly for this population.

Just as allostatic load may be detrimental to individual physical health, it may also corrode relationship quality. Saxbe and colleagues (2020) applied the theory of allostatic load to close relationships and proposed the idea that our relationships can be considered as adaptive regulatory systems, just like our physical regulatory systems. When their regulatory function is overused, especially under conditions of chronic stress, they can lose flexibility and efficiency, and thus induce potential "prices" to the relationship functioning. This price was coined as "social allostatic load" (Saxbe et al., 2020). Saxbe and their colleagues (2020) argued that within relationships, individuals with high allostatic load will have less flexible systems that are characterized by "more stereotyped interactions that either escalate quickly, show a lack of repair, or are marked by withdrawal and disengagement" (p. 473). Therefore, allostatic load is not only a physiological phenomenon, but also an interpersonal and relational process and it may damage couple relationships. For example, chronic inflammation marked by different biomarkers including Interleukin 6 (IL-6), E-Selectin and C-reactive protein (CRP) was associated with relationship strain including couple relationship strain (Doyle & Molix, 2014c). Another study with 60 heterosexual couples in the early stage of their relationships showed that high stress-related hormones such as cortisol and dehydroepiandrosterone sulfate predicted greater hostility and relationship breakup 6 months later among new couples (Schneiderman et al., 2014).

Further, similarly with the concept of emotional contagion in close relationships, people in romantic relationships also "catch" each other's physiological distress arousal and share the physiological states (Butler, 2011; Timmons et al., 2015). This phenomenon, often refereed to as physiological entanglement, physiological linkage or physiological synchrony, is defined as the covariation between two people in their physiological states (Timmons et al., 2015). In empirical studies, couples' physical linkage was shown to be highly correlated with relationship distress. For example, in Timmons et al (2015)'s review of physiological linkage, 13 out of 17 studies found significant associations between couples' physiological linkage and marital outcomes such as marital satisfaction, relationship conflict, hostility and quality of daily interactions between partners. To summarize, the existing research also supports that perceived discrimination may impact individuals' physiological stress responses, which in turn, will impact their future couple relationship functioning.

Section 8: Group differences on the impact of discrimination on couple relationship functioning

Though the impact of discrimination stress on couple relationship functioning has been well documented in the literature reviewed above, it is unclear if these impacts may differ based on people's group memberships, such as race, gender or age. Thus, it is important to review the literature on this topic.

How may the impact of discrimination stress on couple relationship functioning differ based on racial groups? The limited literature on this topic suggests that the impact may not differ based on the racial groups (Barnes et al., 2004; Wofford et al., 2019) or that the impact is weaker for Blacks compared with Whites among older adults (Ayalon, 2018). For example, Wofford's (2019) study examined the negative effect of one person's experience of discrimination on their partner and their relationship among 1,949 couples using HRS data. In

their follow-up analysis, Wofford tested whether the negative effects of discrimination on depression, self-rated health, chronic disease, and couple relationship strain were stronger for ethnic minorities (including Black, Latino and Other) compared with Whites. They did not find a significant interaction between perceived discrimination (everyday discrimination) and minority status, suggesting that the effects of perceived discrimination were equally harmful among Caucasian and ethnic minority participants. Another study among older adults (n = 8,385) investigating the relationship between discrimination and mental health across three racial groups found that race significantly moderated the relationship between discrimination and depression, and the Black group reported a significantly weaker association between discrimination and depression compared with the White group (Ayalon, 2018).

Similarly, the impacts of discrimination stress on couple relationships may differ based on gender. Previous research findings suggest that during stressful times, it seems wives support their husbands more compared to husbands supporting their wives (Neff and Karney, 2004). Thus, female partners may perceive their couple relationships differently compared with their male partners.

Section 9: Theoretic Frameworks

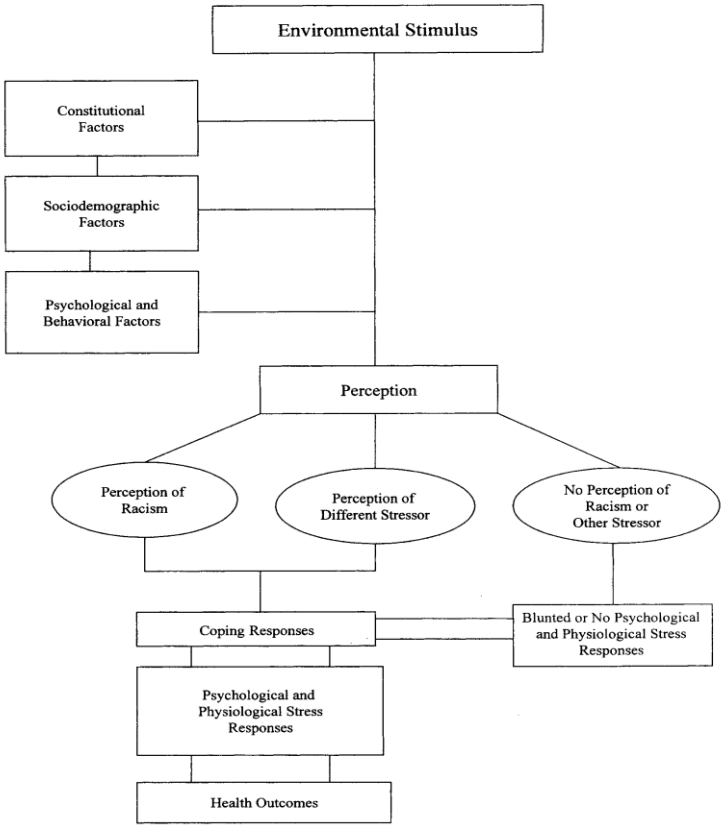
The present study was guided by three theoretic models including the biopsychosocial model of racism (Clark et al., 1999), social stress process theory (Pearlin et al., 1981; Pearlin & Bierman, 2013), and the systemic-transactional stress model (Bodenmann, 1995, 1997; Bodenmann et al., 2007). Though the three theoretical models all address stress, the first two mainly focus on individual health as an outcome with the second one offering conceptual implication for the context of couple relationships, and the latter one directly examines the impact of stress on couple relationship functioning. Informed by these three models, I propose a

new conceptual model for understanding stress and couple relationship functioning by combining individual stress responses from health perspective and theories of stress and couple relationships.

Biopsychosocial model of racism

Built on a general stress-coping model (Lazarus & Folkman, 1984), the biopsychosocial model of racism aims to provide a comprehensive and testable model to examine the biopsychosocial effects of racism on health [Figure 1]. The process of discrimination-related stress on health can be seen as combining four major conceptual domains: discriminatory experiences as the environmental stimuli, moderators (constitutional factors, sociodemographic factors and psychological and behavioral factors), mediators (racism as a perceived stressor, coping responses, psychological and physiological stress responses), and health manifestations of discrimination (Clark et al., 1999). More specifically, the model posits that perception of discriminatory experiences as stressful will initiate psychological and physiological responses that are influenced by constitutional, sociodemographic, psychological and behavioral factors, and coping responses. Over time, these stress responses are accumulated to influence health outcomes (Clark et al., 1999).

Figure 1. The biopsychosocial model of racism



These psychological responses may include anger, paranoia, anxiety, helplessness-hopelessness, frustration, resentment and fear, which, in turn, may influence the use of problematic coping responses such as anger suppression, hostility, aggression, verbal expression of anger or the use of alcohol or other substances. The physiological response may involve the immune, neuroendocrine and cardiovascular functioning (Clark et al., 1999). Within the biopsychosocial model, psychological and physiological stress responses are conceptualized to play the mediating role, explaining the association between perceptions of discrimination and impaired health outcomes. In the current study, we hypothesize that these two key stress responses will function as the underlying mediating mechanism in explaining the association between discrimination and couple relationship functioning. The application of this model including these two pathways in the context of couple relationships was examined in Doyle & Molilx's (2014c) work. Further, Clark et al (1999) distinguished between chronic and acute sources of discrimination, as these two sources of stress may differently predict self-reported health outcomes. In the current study, we will use the everyday discrimination scale to represent the chronic nature of discrimination, and the major lifetime discrimination scale to assess the acute nature of discrimination.

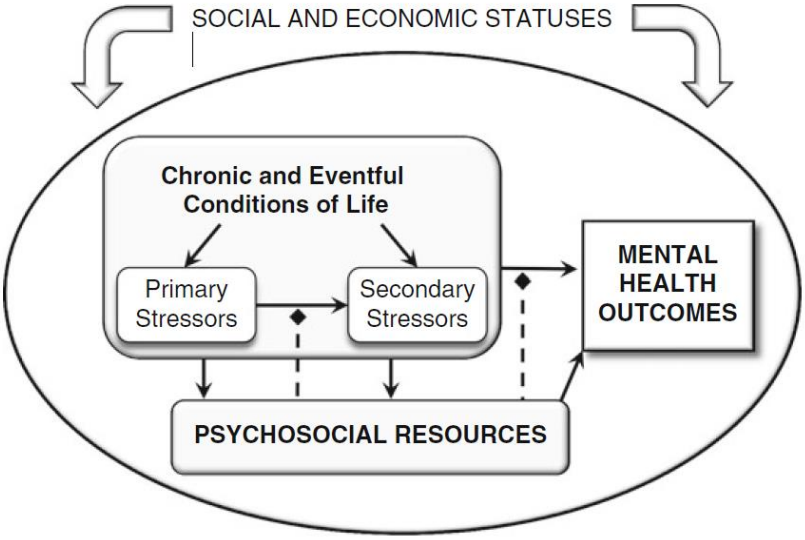
Social stress process theory

Social stress process theory posits that social stressors, of different types (e.g., acute and chronic) and from varying sources, such as discrimination, can become involved in a causal dynamic over time to influence individual mental well-being. Further, psychosocial resources, such as social support, mastery, and self-esteem can both mediate and moderate the effects of stressors on mental health [Figure 2] (Pearlin et al., 1981; Pearlin & Bierman, 2013). Stress proliferation is a pivotal aspect of the stress process and refers to new or "secondary" stressors that emerge from "primary" stressors. It also refers to the process of lateral spread of stressful

problems across roles (e.g., partners), as the form of "spillover" such as work-family conflict. This lateral proliferation can also become a source of stress for others that have a close relationship with the person dealing with social stressors (Pearlin & Bierman, 2013).

The concept of stress proliferation also offers a theoretical rationale for examining the longer-term impact of stressful discrimination experiences on couple relationship functioning. It suggests that people's earlier significant stressful experiences can have a meaningful impact on their health and well-being in later life through the process of stress proliferation. "It is often appropriate for research on stress and wellbeing to think in terms of causal chains that can stretch over substantial spans of time (Pearlin & Bierman, 2013, p. 329). Therefore, in order to understand the recent couple relationship functioning, it might be necessary to examine whether they are the proliferated products of the discrimination-based stress that were operant almost a decade ago.

Figure 2. The stress process



In relation to the current study, it is possible that when the demand of discrimination exceeds an individual partner's resources and coping abilities, this initial stressor will spillover to their partner and generate a new stressor of negative couple interactions such as increased couple criticism and decreased couple support or warmth, which will contaminate their couple relationship directly over time. This stress spillover phenomenon has also been thoroughly

illustrated and examined in the systemic-transactional stress model (Bodenmann, 1997; Bodenmann et al., 2007; Randall & Bodenmann, 2009) which I will introduce below as well as been conceptually expanded and integrated for studying sexual minority couples (LeBlanc et al., 2015). However, though the stress process model offers a conceptual framework to understand the relationship between discrimination as an initial stressor and couple relationship functioning as a secondary stressor, it is limited in that it doesn't address the mechanism driving the effects of stress on couple relationship functioning. For this purpose, we will integrate the systemic-transactional stress model.

The systemic-transactional stress model

The systemic-transactional stress model incorporates a systemic-transactional view of the stress-coping-process and proposes that stress and coping as interdependent and reciprocal processes between partners (Bodenmann, 1995, 1997; Bodenmann et al., 2007). Considering this mutual influence, the model also posits that an individual's stress in the context of a couple is always dyadic, namely dyadic stress. When the individual stress intensity or duration of exposition is too high or the concerned partner is not able to adequately cope (inadequate appraisals, ineffective coping, lack of resources), the individual stress of one partner may begin to affect the other. In this case, individual stress takes on a dyadic stress characteristic (Bodenmann, 1995, 1997; Bodenmann et al., 2007).

Further, the model proposed four mediating process through which couples' external stress may impact their couple relationship functioning: (1) Decreasing the time that partners spend together, which in turn leads to reduced shared positive experiences, a sense of togetherness, and increases the distance between the partners; (2) Decreasing the quality of communication by eliciting less positive interactions and more negative interactions and

withdrawal; (3) Increase in individual psychological distress such as depression or anxiety, and physical illness such as chronic pain or sleep disorders; 4) Increasing the likelihood that problematic personality traits will be expressed between partners in the form of rigidity or hostility (Bodenmann et al., 2007; Falconier et al., 2015). Though it is not the purpose of the present study to examine the interdependent influences from two partners and all of the four mediating pathways, it aims to examine both the psychological and physical/physiological pathways proposed by the model in explaining the association between perceived discrimination and couple relationship functioning.

In summary, each theoretical model addresses important aspects of the relationship between stress and couple functioning. Incorporating specific aspects of these models provides a more comprehensive conceptual model for the present study. Guided by the psychological and physiological/physical mediating pathways outlined by Clark et al. (1999) and Bodenmann et al. (2007), as well as the overarching conceptual framework of stress proliferation, I am proposing a new conceptual model [Figure 3] for understanding stress and couple relationship functioning. My conceptual model posits that individuals' experiences of perceived discrimination (everyday discrimination and major life-time discrimination) would impact their couple relationship functioning directly or indirectly through impacting their psychological (depressive symptoms) and physiological stress responses (allostatic load). The aims of the study were to investigate: (1) the relationship between frequency of perceived discrimination at Time 1(2008/2010) and partner support and partner strain 8 years later at Time 3 (2016/2018); and (2) if psychological (depressive symptoms) and physiological stress responses (allostatic load) at Time 2 (2012/2014) mediate the association between perceived discrimination at Time 1 and partner strain and partner support at Time 3. Specifically, the study had the following research hypotheses:

Hypothesis 1: Higher scores on perceived everyday discrimination and major life-time discrimination at Time 1(2008/2010) will significantly predict lower scores on perceived partner support 8 years later at Time 3 (2016/2018).

Hypothesis 2: Higher scores on perceived everyday discrimination and major life-time discrimination at Time 1 (2008/2010) will significantly predict higher scores on perceived partner strain 8 years later at Time 3 (2016/2018).

Hypothesis 3: Psychological and physiological stress response at Time 2 (2012/2014) will mediate the associations between perceived everyday discrimination and major life-time discrimination at Time 1 (2008/2010) with perceived couple support and strain at Time 3 (2016/2018). More specifically, higher scores on perceived everyday discrimination and major life-time discrimination at Time 1 will predict higher levels of psychological and physiological stress response at Time 2, which in turn, will predict lower levels of couple support and higher level of couple strain at Time 3.

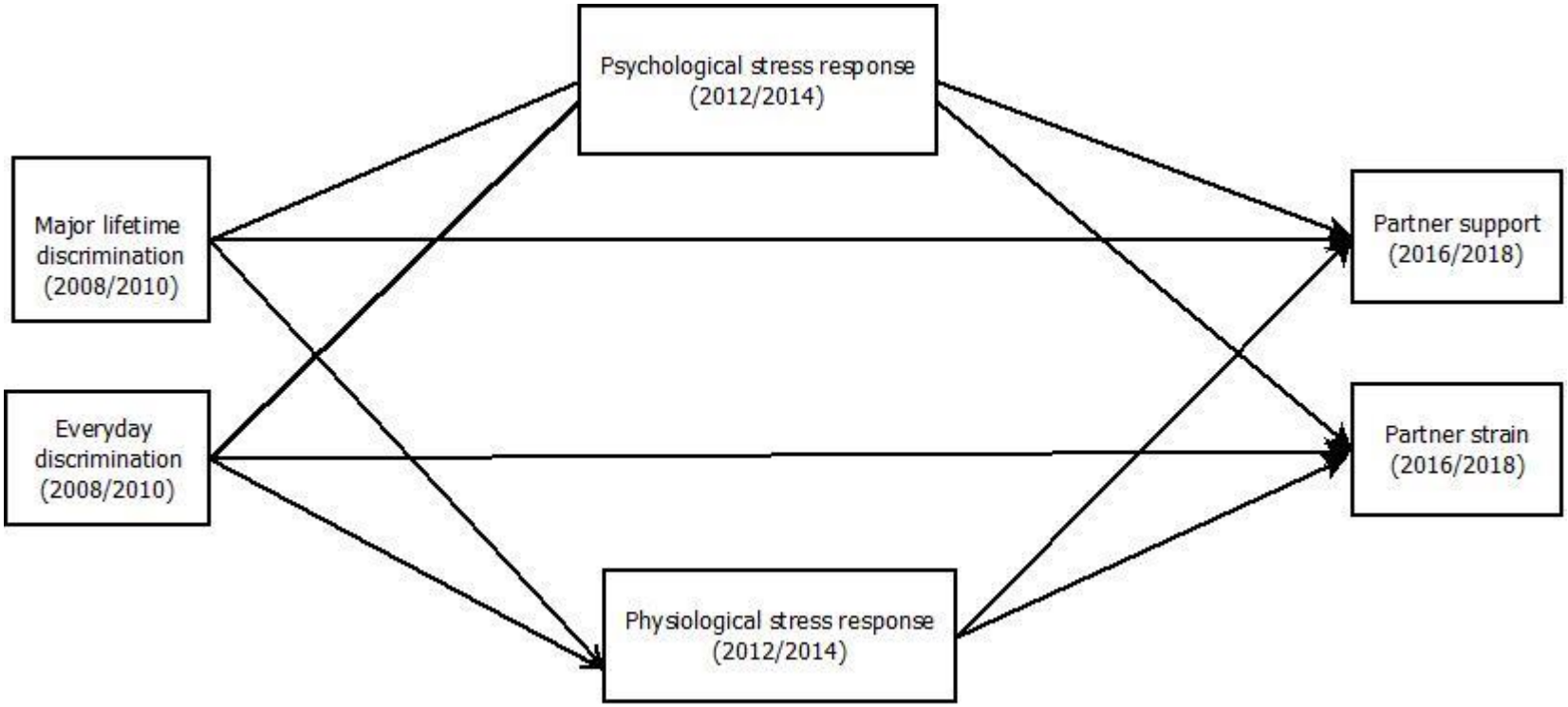


Figure 3. Proposed conceptual framework.

Chapter 3: Method

Dataset and sample

This dissertation is a secondary analysis of data from the Health and Retirement Study (HRS), an ongoing national survey of the health and aging experiences of U.S. adults aged 51 and older residing in the community (Servais, 2010). The HRS is a prospective cohort study being conducted by the University of Michigan with funding by the National Institute on Aging. Data on economic, social and physical well-being have been collected biennially since 1992 using face-to-face and phone interviews, and new cohorts are recruited every six years. The original response rate was 81.4% and response rates for subsequent waves range between 85% and 90%. Blacks and Hispanics were oversampled with response rates and longitudinal follow-up comparable to or better than Whites (Servais, 2010).

In 2006, HRS initiated what is referred to as an Enhanced Face-to-Face Interview (EFTF) that is administered to an alternating random half of the sample each wave. In addition to the core interview, HRS added the Psychosocial and Lifestyle in the form of self-administered questionnaires (SAQ) as well as a set of physical measures and biomarkers to the EFTF (Smith et al., 2017). The Psychosocial and Lifestyle SAQ cover six substantive areas of psychosocial measures including subjective well-being, lifestyle and experiences of stress, quality of social ties, personality traits, work-related beliefs and self-related beliefs. It includes measures of interests for the present study such as perceived discrimination, couple relationship functioning and psychological stress response (depressive symptoms) (Smith et al., 2017). The biomarker assessment included the collection of physical measures (e.g., blood pressure, height, weight, waist circumference, etc.), saliva for DNA sequencing, and dried blood spots for measuring cholesterol, hemoglobin A1c and C-reactive protein (Crimmins et al., 2008).

A random half of the HRS cohort was administered the assessments in 2006, while the other half-sample completed them in 2008. Both cohorts repeat the assessment s every four years, with the 2006 subsample being re-surveyed in 2010, 2014 and 2018, and the 2008 subsample re-surveyed in 2012 and 2016 (Smith et al., 2017). In order to increase the sample size and statistical power for the present study, respondents from two waves who completed the psychosocial measures and biomarker assessments in 2008 or 2010 were combined to create a Time 1 assessments. The same respondents who completed biomarker measures and psychosocial measures 4 years later in 2012 or 2014 were combined to create the Time 2 assessments, and similarly, the same participants who completed these assessments 4 years later in 2014 or 2018 were combined to create the Time 3 assessments. The reason of combining the 2008 and 2010 half-samples as the Time 1 observations instead of combining the 2006 and 2008 half-samples is because extra items have been added to the measures of everyday discrimination and major lifetime discrimination added since 2008. For the sake of consistency, I used the 2008/2010 as the baseline observations instead of using 2006/2008 as the baseline.

Only participants who completed the psychosocial data on these three time points as well as biomarkers at Time 2 were included in the sample, and this resulted in a total of 9,224 participants. Because I am interested in the impact of discrimination on couple relationship functioning across 8 years, I limited the sample to people who were married or partnered at baseline (N = 6,440) as well as participants who stayed in the same relationship across 8 years, and this yielded a total of 5,069 participants. Out of the 5,069 participants, 3,536 of them had a partner in the sample. In order to account for the issue of interdependency between a couple, I randomly exclude one partner from these cases where both partners were in the sample, and this resulted in 2,904 participants. Out of these 2,904 participants, after excluding 432 participants

who had missing data on any of the 7 biomarkers, 124 participants who were less than 50 years old, 4 participants whose race were “unknown”, it yielded a total of analytical sample of 2,344.

Measures

Independent variables

Experiences of discrimination were assessed by two discrimination measures including everyday discrimination and major lifetime discrimination. They are both from the Psychosocial and Lifestyle SAQ.

Everyday discrimination. Everyday discrimination was measured by the Everyday Discrimination Scale (Williams et al., 1997) consisting of six items that assess how often on a daily basis respondents experience hassles and chronic stress associated with perceived everyday discrimination. Participants are first prompted to think about: “In your day-to-day life, how often do any of the following things happen to you?” The six questions following this prompt include: “You are treated with less courtesy or respect than other people,” “You receive poorer service than other people at restaurants or stores,” “People act as if they think you are not smart,” “People act as if they are afraid of you,” “You are threatened or harassed,” and “You receive poorer service or treatment than other people from doctors or hospitals.” The response to the 6 items ranged from almost every day (1) to never (6) and were reverse coded as: never (1) to almost every day (6). The final score was calculated by averaging the six items, with higher scores representing greater experiences of everyday discrimination. The internal consistency ranged from 0.80 to 0.83 based on HRS samples (Smith et al., 2017). In the present sample, the internal consistency was good ($\alpha = .81$).

People who endorsed experiencing any of these six items were asked a follow up. “If any of the above have happened to you, what do you think were the reasons WHY these experiences have happened to you?”. A total of 11 responses were: “Your ancestry or national origin,” “Your

gender," "Your race", "Your age," "Your religion," "Your weight," "Your physical disability," "An aspect of your physical appearance," "Your sexual orientation" and 'Your financial status" and "Other." Participants marked "X" on the ones that applied to them. In order to measure participants' experiences of intersectionality of everyday discrimination, a new variable representing the number of social identity attributions for everyday discrimination participants experienced was created by summing up the ones marked by participants, ranging from 0 to 11. Based on the distribution of the variable, it was recoded into three groups: ⩽1 attributed reason, 2 attributed reasons and ⩾3 attributed reasons. Out of 2,344 participants, 2,034 participants answered the reasons for their everyday discrimination.

Major lifetime discrimination. Major life-time discrimination was assessed by the Major Lifetime Discrimination Scale (Williams et al., 2008) consisting of seven questions that ask respondents to indicate if they had received unfair treatment in different domains in their lives. Participants were given the following prompt first: "For each of the following events, please indicate whether the event occurred AT ANY POINT IN YOUR LIFE". The 7 items included: "At any time in your life, have you ever been unfairly dismissed from a job?," "For unfair reasons, have you ever not been hired for a job?," "Have you ever been unfairly denied a promotion?," " Have you ever been unfairly prevented from moving into a neighborhood because the landlord or a realtor refused to sell or rent you a house or apartment?," " Have you ever been unfairly denied a bank loan?," " Have you ever been unfairly stopped, searched, questioned, physically threatened or abused by the police?," and "Have you ever been unfairly denied health care or treatment?" Respondents indicated "Yes" (1) and "No" (0) to these 7 items. The final score was created by summing the number of affirmative responses with higher scores representing greater experience of major lifetime discrimination. The internal consistency was

reported as 0.62 (Gonzales et al., 2021). In the present sample, the internal consistency was 0.54, which was relatively low as well.

Mediating variables

Psychological stress response. Psychological distress, specifically depressive symptoms, was measured using the modified 8-item short form of the Center for Epidemiological Studies Depression Scale (CES-D, Steffick, 2000; Turvey et al., 1999). The original CES-D scale contained 20 items designed to assess the frequency of depressive symptoms in the general population (Radloff, 1977). Participants were asked to indicate how they felt for much of the time during the previous week using response choices of yes and no. The questions they were asked included: 1) I felt depressed; 2) I felt sad; 3) I felt lonely; 4) I felt happy; 5) I enjoyed life; 6) I had a disturbed sleep; 7) I felt like everything was an effort; 8) I could not get going. The depressive symptoms score was calculated by recoding necessary items and then summing the affirmative response with higher scores indicating a higher number of depressive symptoms. This revised 8-item short CES-D scale shows adequate internal consistency and a factor structure that is comparable to the full scale reported in the original study (Radloff, 1977), and this psychometric properties of the revised scale have been established in middle-aged and older-aged adults (Karim et al., 2015; Turvey et al., 1999). In HRS data, it showed good internal consistency across waves (Cronbach's alpha ranged from 0.81 to 0.82). In the present sample, the internal consistency was acceptable ($\alpha = .78$).

Physiological stress response. The physiological stress response was measured by allostatic load that reflected a measure of cumulative biological risk in the face of chronic physiological stress reactivity (McEwen, 1998). The allostatic load was assessed by seven biomarkers across three physiological systems including C-reactive protein (inflammatory system); blood pressure (systolic and diastolic blood pressure), and cystatin C (cardiovascular

system); hemoglobin A1c, total cholesterol, high-density lipoprotein (HDL) cholesterol, and body mass index. Each biomarker had a clinical cutoff that has been established in previous studies (Crimmins et al., 2003; Mitchell et al., 2020; Nguyen et al., 2019). These seven items were recoded as below (0) or above that cutoff (1). The final allostatic load score was calculated by summing the risk score across the seven biomarkers. The score ranges from 0 to 7 with higher scores representing higher allostatic load. Participants who were missing on any of these 7 biomarkers were excluded from the sample.

Dependent variables

Couple relationship functioning was assessed by two variables: intimate partner strain and intimate partner support from the Psychosocial and Lifestyle SAQ as well.

Intimate partner support. Intime partner support was measured by the short version of the Intimate Partner Support Scale (Walen & Lachman, 2000). It consisted of four items that assess the perceived frequency of positive and supportive interactions from a partner. Participants were asked to answer four questions about their partner or spouse. They were told to choose the answer that best showed how they felt about each statement. The three statements included: “How much do they really understand the way you feel about things?,” “How much can you rely on them if you have a serious problem?,” and “How much can you open up to them if you need to talk about your worries?” Responses range from 1 (*a lot*) to 4 (*not at all*) and were reversed coded as: 1 (*not at all*) to 4 (*a lot*). The final score was calculated by averaging the three items with higher score representing greater intimate partner stain. The internal consistency ranged from 0.78 to 0.80 based on 2014, 2012, 2010, 2008 and 2006 HRS samples (Smith et al., 2017). In the present sample, the internal consistency was good ($\alpha = .80$).

Perceived intimate partner strain. Intime partner strain was measured by the short version of the Intimate Partner Strain Scale (Walen & Lachman, 2000). It consisted of three items that assess the perceived frequency of negative and unsupportive interactions from a partner. Participants were asked to answer three questions about their partner or spouse. They were told to choose the answer that best showed how they felt about each statement. The four statements included: "How much do they make too many demands on you?," "How much do they criticize you?," "How much do they let you down when you are counting on them?" and "How much do they get on your nerves?". Responses range from 1 (*a lot*) to 4 (*not at all*) and were reversed coded as: 1 (*not at all*) to 4 (*a lot*). The final score was calculated by averaging the four items with higher score representing greater intimate partner support. The internal consistency ranges from 0.80 to 0.82 based on 2014, 2012, 2010, 2008 and 2006 HRS samples (Smith et al., 2017). In the present sample, the internal consistency was acceptable ($\alpha = .79$).

Covariates

Several demographic characteristics including gender, age, race, education, and number of social identity attributions for everyday discrimination may confound the relationship between perceived discrimination and couple relationship functioning. Several studies find that men, including middle-aged and older-aged adults men, report higher levels of marital happiness and quality than women (Bulanda et al., 2016; Park, 2018). More education is associated with middle-aged and older-aged adults' marital quality (Bulanda, 2011; Kaufman & Taniguchi, 2006). African Americans reported lower levels of marital quality and higher divorce than do Whites or Latinos (Bulanda & Brown, 2007; Kaufman & Taniguchi, 2006). As mentioned earlier, people who hold multiple stigmatized statuses were shown to have an elevated risk for poor mental, physical health and all-cause mortality than their more privileged counterparts (R. J. Cobb et al., 2021; Grollman, 2012; Lu et al., 2021). I controlled for these sociodemographic

factors as they may confound the relationship between perceived discrimination and couple relationship functioning among middle-aged and older-aged adults. Age was a continuous variable and gender was a dichotomous variable (Male was coded as the reference group). Race/ethnicity was categorized as: White (coded as the reference group), Blacks and Other (American Indian, Alaskan Native, Asian, Native Hawaiian and Pacific Islander). Education was measured by years of completed education. Number of social identity attributions was categorized as: ⩽1 social identity-based reason (coded as the reference group), 2 social identity-based reasons and ⩾3 social identity-based reasons. Given the longitudinal nature of the study design, I also controlled for intimate partner strain and support reported at Time 1 (these were measured in an identical way as reported above at Time 3).

Data analysis

The aims of the study were to investigate: (1) the relationship between frequency of perceived discrimination at Time 1 (2008/2010) and partner support and partner strain 8 years later at Time 3 (2016/2018); and (2) if psychological (depressive symptoms) and physiological stress responses (allostatic load) at Time 2 (2012/2014) mediate the association between perceived discrimination at Time 1 and partner strain and partner support at Time 3. To answer the study aims, I conducted a longitudinal mediation path analysis in Mplus Version 8 (Muthén & Muthén, 2017). Missing data were accounted for by using all available data through the full-information maximum likelihood approach. Data-model fit was assessed through three common indicators including standardized root mean squared residual (SRMR), root mean square error of approximation (RMSEA), and comparative fit index (CFI). CFI > 0.95, RMSEA < .06, and SRMR < .08 were used as criteria for evaluating adequate model fit (Hu & Bentler, 1999). With our current sample of 2,344 adults, we have a high level of power to run this model.

At first, I conducted descriptive analysis and inter-correlations among all variables. I also conducted the distribution analysis of attributed reasons for everyday discrimination. In section 2, ANOVA analysis examining the mean differences of variables of interests across race, gender, age group and number of social identity attributions was conducted. In this step, based on the distribution of participants' birth cohort at entry, I categorized them into three age groups: oldest old (born in 1914 - 1936), middle old (born in 1937 - 1947) and young old (born in 1948 - 1965).

For the main analysis in Section 3, as depicted in the statistical model of Figure 4, the couple strain and couple support variables at Time 3 (2016/2018) were directly regressed onto baseline everyday discrimination and major lifetime discrimination at Time 1(2008/2010), and were regressed onto psychological and physiological distress variables at Time 2 (2012/2014), which were regressed onto baseline everyday discrimination and major lifetime discrimination at Time 1(2008/2010), while controlling for couple strain and couple support at Time 1 as well as all of the demographic covariates[3] (model 1). The main paths of interest include the direct effects of everyday discrimination and major lifetime discrimination to couple strain and couple support, and the indirect effects of those associations through psychological and physiological distress as mediators. The indirect effects are defined as the product of the association between an independent variable (everyday or major lifetime discrimination) and a mediator (psychological distress or physiological distress), and the association between a mediator and an outcome (couple support or couple strain). The indirect effects were estimated by using bootstrapping procedures with 5,000 resamples. Both the direct and indirect effects were confirmed by the

[3] In this step, the paths from the predictors (everyday discrimination, major lifetime discrimination) to the mediators (psychological and physiological distress) also controlled the demographic covariates (race, gender, age, education and number of reasons for everyday discrimination).

significant direct and indirect paths from the bootstrapping procedure, and the 95% confidence intervals of those paths not including zero.

In section 4, building on the primary model in section 3. I conducted four follow-up multigroup analysis based on race (White vs Black), gender (Female vs Male), age (Oldest old vs Middle old vs Young old) and number of social identity attributions[4] (⩽1 social identity-based reason vs 2 social identity-based reasons vs ⩾3 social identity-based attributions) for everyday discrimination, The purpose of the multigroup analysis was to investigate if the associations among the study variables (there are 12 structural paths) differed based on these four demographic factors. Specifically, the multigroup analysis was conducted by three steps. In the first step, the primary model was run within each group separately (e.g., White, and Black separately) to see if the model fit well within each group based on race, gender, age and number of reasons for everyday discrimination. The results showed that the models demonstrated good model fit within each group based on the four demographic factors; In the second step, the primary model was run to see if the model fit well for the whole group simultaneously (e.g., White and Black together) based on the four demographic factors. These models also demonstrated good model fit and I was able to proceed for the third step; In the third step, I coded all of the 12 structural path differences as additional new variables (e.g., $\Delta a = a_1 - a_2$) to be tested automatically together with the primary model (Hancock, 2021). If a *p* value for a new variable is less than .05, then it suggests the corresponded path is significantly different between the two groups.

[4] Out of 2,344 participants. 2,034 participants answered the reasons for their everyday discrimination. Therefore, when I conducted the multigroup analysis based on number of social identity attributions for everyday discrimination, I deleted 310 participants who had missing data on this variable.

In section 5, I conducted additional three models to increase the robustness of the results. First, I checked the primary model without the number of attributed reasons for everyday discrimination as one of the control variables (model 2). Second, I ran the primary model after adding the T1 assessments of mediators (depressive symptoms and allostatic load) as additional control variables (model 3)[5], and had both the outcome variables (partner support and partner strain) and the mediators (depressive symptoms and allostatic load) regressed onto them. Last of all, to see if allostatic load could serve the role of mediation without depression built in the primary model, I also run the model without depressive symptoms while keeping the rest intact (model 4).

[5] Out of 2,344 participants, there were 1,781 participants who didn't participate in 2008/2010 biomarker assessments. After excluding these people, the sample size for model 3 was 1,781.

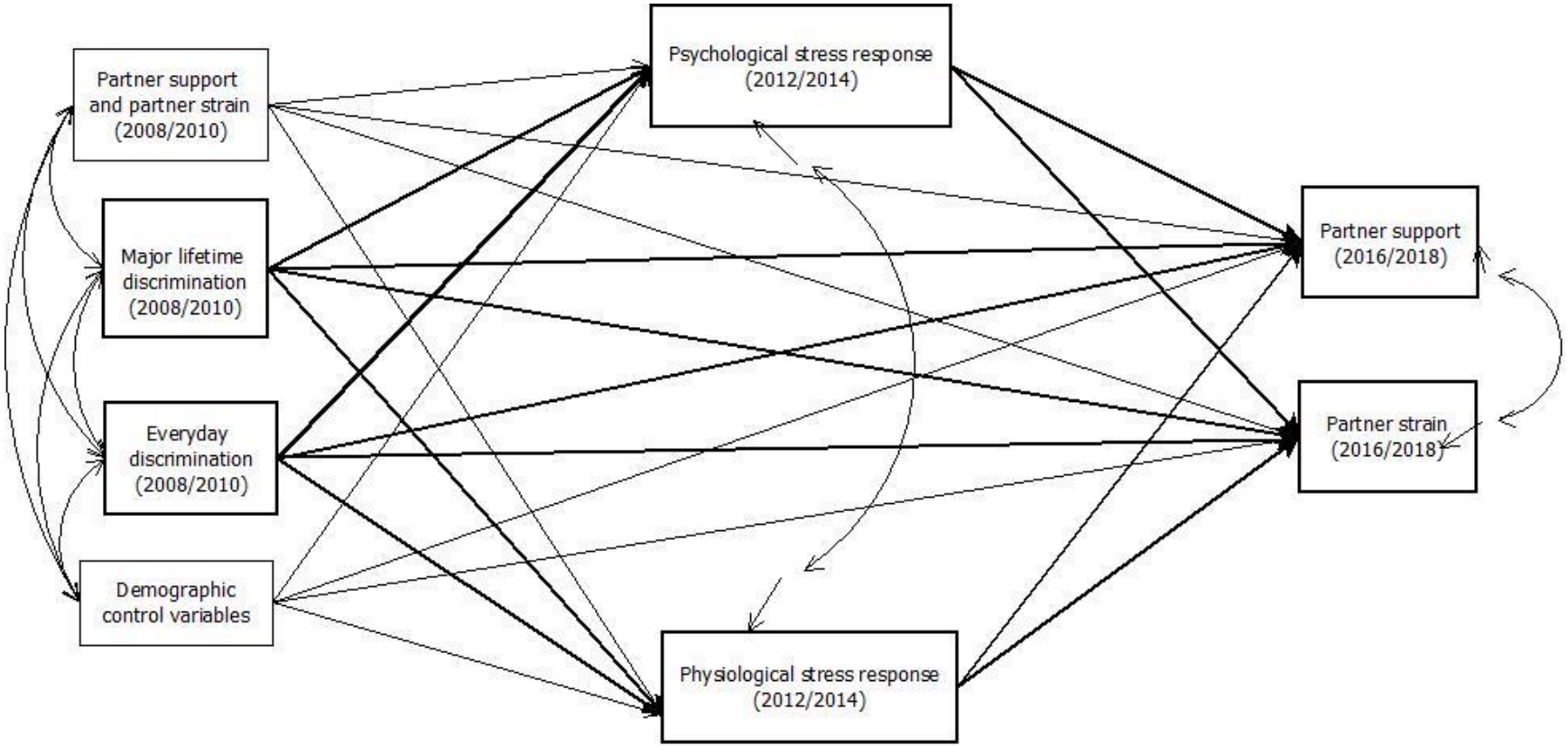


Figure 4: Proposed statistical model.

Note: Control variables include demographic variables (gender, age, education, income, race and number of attributed reasons for everyday discrimination), partner support and partner strain at Time 1. In Model 3, I added the T1 assessments of depressive symptoms and allostatic load as control variables and had both the outcome variables (partner support and partner strain) and the mediators (depressive symptoms and allostatic load) regressed onto them. Double-arrow line means correlation between two variables. Single-arrow line represents causal direction from one variable to another variable.

Chapter 4: Results

Section 1: Demographic characteristics and descriptive analysis

Demographics. The final analytic sample consisted of 2,344 participants. Out of 2,344 participants, 57.3% participated (*n* = 1,343) in the Enhanced Face-to-Face Interview (EFTF) in 2006 and participated in the follow-up assessments in 2010, 2014 and 2018, whereas 42.7% (*n* = 1,001) participated the EFTF in 2008 and participated in the follow-up assessments in 2012 and 2016. In reference to age of the participants, 17.7 % (*n* = 414) of them were in the oldest old group, 37.9 % (*n* = 884) of them were in the middle old group, and almost half of them (44.5%, *n* = 1,046) were in the young old group, with a mean age of 63.98 years (range = 50-94 years) for the whole sample. Nearly 49% of the sample (*n* = 1146) identified as male and a little over half of the sample (*n* = 1,198, 51%) identified as female. Almost half (47.4%, *n* = 1,111) of the sample reported that their highest degree of education was a high school diploma. The sample reported 13 years of education on average (range = 0 -17 years). The majority of them were White (*n* = 1883, 80.3%), followed by Black (*n* = 262, 11.2%) and other (*n* = 199, 8.5%; American Indian, Alaskan Native, Asian, Native Hawaiian and Pacific Islander). The majority reported being married at baseline in 2008/2010 (*n* = 2,212, 94.8%). Table 1 displays the sample demographic characteristics.

Table 1. Sample characteristic (N = 2,344).

Demographic characteristics	Mean (range) or count (%)
Respondents' assignment for EFTF interview	
Received EFTF in 2006, 2010, 2014 and 2018	1,343 (57.3)
Received EFTF in 2008, 2012, 2016 and 2020	1,001 (42.7)
Age (2008/2010)	63.98 (50-94)
Birth cohort at entry	
Oldest old	414 (17.7)
1914-1923	10 (0.4)
1924-1930	109 (4.7)
1931-1936	295 (12.6)

Middle old	884 (37.7)
1937-1941	428 (18.3)
1942-1947	456 (19.5)
Young old	1,046 (44.6)
1948-1953	587 (25.0)
1954-1959	431 (18.4)
1960-1965	28 (1.2)
Gender	
Male	1,146 (48.9%)
Female	1,198 (51.1%)
Race	
White	1,883 (80.3%)
Black	262 (11.2%)
Other	199 (8.5%)
Education	13.18 (0-17)
Highest degree of education	
No degree	302 (12.9)
GED	112 (4.8)
High school diploma	1,111 (47.4)
Two year college	107 (4.6)
Four year college	398 (17.0)
Master degree	228 (9.7)
Professional degree (Ph.D., M.D., J.D.)	72 (3.1)
Some college/degree unknown	14 (0.6)
Marital status (2008/2010)	
Married	2,212 (94.8)
Separated/divorced	93 (4.0)
Widowed	19 (0.8)
Never married	18 (0.7)
Marital status unknown	2 (0.09)
Born in the U.S.	
Born in the U.S.	2,011 (85.8)
Born in a foreign country	330 (14.1)
Country of birth unknown	3 (0.1)

Note. Age and marital status were assessed at baseline.

Sample description. On average, the sample reported low frequency of everyday discrimination (M = 1.52, SD = 0.64, range = 1-5) and lifetime discrimination (M = 0.57, SD = 0.96, range = 0-7). The sample also reported low levels of depressive symptoms (M = 1.00, SD = 1.64, range = 0-8) and allostatic load (M =1.83, SD = 1.31, range = 0-6). Couple support was high (M = 3.50, SD = 0.62, range = 1-4) and the sample reported moderate levels of couple strain (M =1.92, SD = 0.65, range = 1-4). Notably, all of the variables are correlated significantly with each other except the correlation between lifetime discrimination and allostatic load. Descriptive

statistics including variable means, standard deviations, and correlations between variables of interests are presented in table 2.

Table 2. Correlation matrix, means and standard deviation for variables.

Variables	1	2	3	4	5	6	*M*	*SD*
1. Everyday discrimination (1-5)							1.52	0.64
2. Lifetime discrimination (0-7)	.28**						0.57	0.96
3. Depressive symptoms (0-8)	.16**	.13**					1.00	1.64
4. Allostatic load (0-7)	.05*	.04	.12**				1.83	1.31
5. Couple support (1-4)	-.15**	-.05*	-.18**	-.08**			3.50	0.62
6. Couple strain (1-4)	.21**	-.08**	.19**	.07**	-.55**		1.92	0.65

Note. Everyday discrimination (N = 2034), lifetime discrimination (N = 2032), depressive symptoms (N = 2344), allostatic load (N = 2344), couple support (N = 1861), couple strain (N = 1858). * $p < .05$, ** $p < .01$, *** $p < .001$

Distribution analysis of attributed reasons for everyday discrimination was also conducted and Table 3 displays its results. Among 2,344 participants, the most common attributed reason for everyday discrimination was based on age (experienced by 26.1% of the sample), followed by gender (11.2%), financial status (10.5%), physical appearance (9.3%), race (8.5%), weight (7.9%), ancestry or national origin (5.8%). In reference to the attributed reasons for everyday discrimination, 1,553 (66.3%) people attributed their experiences of everyday discrimination to one or zero social identity-based reason. 227 (9.7%) people attributed their experiences of everyday discrimination to two social identity-based reasons. 254 (10.8%) people attributed their experiences of everyday discrimination to three or more social identity-based reasons.

Table 3. Distribution of attributed reasons for everyday discrimination

Reasons of everyday discrimination	Count (%)
Your ancestry or national origin	118 (5.8)
Your gender	227 (11.2)
Your race	173 (8.5)
Your age	531 (26.1)

Your religion	76 (3.7)
Your weight	162 (7.9)
A physical disability	81 (3.9)
An aspect of your physical appearance	189 (9.3)
Your sexual orientation	31 (1.5)
Your financial status	214 (10.5)
Other	224 (11.0)
Number of reasons for everyday discrimination	
≤1	1,553 (66.3)
= 2	227 (9.7)
≥3	254 (10.8)

Note. Out of 2,344 participants, 2,034 answered the questions about the reasons for their everyday discrimination. The distribution was based on the sample size of 2,034.

Section 2: Bivariate analysis.

ANOVA analysis with post hoc tests were performed to investigate the mean differences of the study variables across race, gender, age and number of reasons for everyday discrimination in the present sample. The results indicated that Black people in this sample reported significantly more everyday discrimination than White participants, and more lifetime discrimination than both White and Other. Both Blacks and Other participants were more likely to report higher levels of depressive symptoms and allostatic load than Whites. In addition, Black participants also reported more couple strain than Whites. In terms of gender, males reported more everyday discrimination and lifetime discrimination compared to females. Females reported more depressive symptoms and less couple support from their partner compared to males.

Regarding age, young old adults were more likely to experience more everyday discrimination, lifetime discrimination, and depressive symptoms compared with the two older age groups. However, they had a lower allostatic load than the middle old adults. Regarding number of social identity attributions for everyday discrimination, participants that experienced ≥3 social identity-based reasons for everyday discrimination reported most lifetime

discrimination, everyday discrimination, depressive symptoms, and couple strain, followed by people who experienced 2 social identity attributions for everyday discrimination, and people who experienced ≤1 social identity attribution for everyday discrimination. In addition, participants who experienced ≥3 types of social identity-based reasons for everyday discrimination had a higher allostatic load than the other two groups. Participants who experienced 2, or ≥3 social identity attributions for everyday discrimination reported lower couple support compared with participants who experienced <=1 type of social identity-based reason for everyday discrimination. Overall, the data suggests this sample had considerable differences in the study variables across sociodemographic characteristics. In general, Blacks reported more discrimination, depressive symptoms, and allostatic load than Whites. Males reported more discrimination, but females reported more depressive symptoms and less couple support. Young old adults reported more discrimination and depressive symptoms. Participants who experienced more numbers of social identity-based reasons for everyday discrimination were more likely to report higher discrimination, depressive symptoms, allostatic load, couple strain, and lower couple support. Table 3 displays mean differences in the primary study variables across the different sociodemographic groups represented in this sample.

Table 4. Mean differences of study variables based on sociodemographic background.

	Everyday discrimination	Lifetime discrimination	Depressive symptoms	Allostatic load	Couple support	Couple strain
Race						
White	1.49[a]	0.52[a]	0.90[a]	1.78[a]	3.50	1.90[a]
Black	1.66[b]	1.03[b]	1.36[b]	2.14[b]	3.42	2.03[b]
Other	1.57[ab]	0.53[a]	1.49[b]	1.90[b]	3.51	1.98[ab]
Gender						
Male	1.58[a]	0.69[a]	0.87[a]	1.79	3.60[a]	1.91
Female	1.46[b]	0.45[b]	1.13[b]	1.86	3.41[b]	1.93
Age						
Oldest old	1.39[a]	0.44[a]	0.84[a]	1.82	3.52	1.88
Middle old	1.46[a]	0.52[a]	0.89[a]	1.92[a]	3.52	1.92
Young old	1.63[b]	0.67[b]	1.16[b]	1.76[b]	3.48	1.92

Identity attributions	1.34^{a}	0.46^{a}	0.76^{a}	1.75^{a}	3.56^{a}	1.84^{a}
<=1	1.88^{b}	0.76^{b}	1.17^{b}	1.93^{a}	3.40^{b}	2.03^{b}
=2	2.27^{c}	1.04^{c}	1.65^{c}	2.19^{b}	3.26^{b}	2.22^{c}
>=3						

Note. ANOVA analysis was conducted for examining mean differences. The values with different superscript letters in a column are significantly different (p <0.05). Everyday discrimination (n = 2034), lifetime discrimination (n = 2032), depressive symptoms (n = 2344), allostatic load (n = 2344), couple support (n = 1861), couple strain (n = 1858).

Section 3. Path analysis results

The primary longitudinal mediation model with control variables (model 1) demonstrated good model fit ($\chi^2[4] = 21.78$, $p < 0.01$, CFI = 0.99, RMSEA = 0.04, SRMR = 0.01). Table 5 displays all of the information involving both standardized and unstandardized results from the model. Standardized pathway estimates for the significant structural paths are shown in Figure 1. Both everyday discrimination and lifetime discrimination at Time 1 (2008/2010) were significantly associated with higher depressive symptoms 4 years later at Time 2 (2012/2014) while controlling for participants' age, gender, education, race and number of attributed reasons for everyday discrimination. This suggests that greater frequency of everyday discrimination and lifetime discrimination at Time 1 were associated with higher score of depressive symptoms at Time 2 while controlling for all the covariates. depressive symptoms at Time 2 (2012/2014) was significantly associated with both partner support and partner strain 4 years later at Time 3 (2016/2018) while controlling for participants' age, gender, education, race, number of attributed reasons for everyday discrimination as well as Time 1 assessments of partner support and partner strain. Specifically, more depressive symptoms at Time 2 was associated with higher partner strain and lower partner support 4 years later at Time 3 while controlling for all of the covariates. The paths between both types of discrimination at Time 1 and allostatic load at Time 2, as well as the paths between allostatic load at Time 2 and both types of couple relationships at Time 3

were nonsignificant. This model explained 35.9% of the variance in the couple support and 34.9% of the variance in the couple strain.

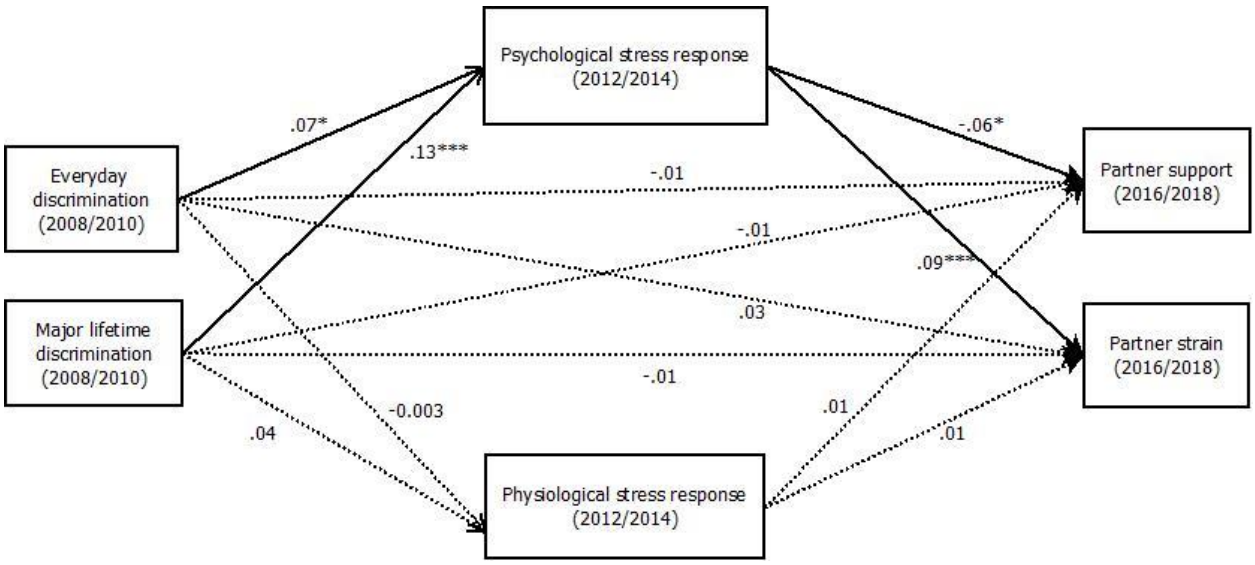


Figure 5. Model 1: Primary longitudinal mediation model with controls. $\chi^2(4) = 21.78$, $p < 0.01$, CFI = 0.99, RMSEA = 0.04, SRMR = 0.01. Solid lines indicate significant paths, and dotted lines indicate nonsignificant paths. Values shown are standardized estimates. For simplicity, race, education, gender and other covariates are not shown. * $p < .05$, ** $p < .01$, *** $p < .001$ (two-tailed).

Table 5. Path analysis results from the primary longitudinal mediation model with controls (*N* = 2,334).

	Depressive symptoms (T2)			Allostatic load (T2)			Couple support (T3)			Couple strain (T3)		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Age	-0.002	0.004	-0.01	0.01**	0.003	0.07	-0.003	0.002	-0.04	0.002	0.002	0.03
Female[a]	0.31***	0.07	0.09	0.10	0.06	0.04	-0.08**	0.03	-0.06	-0.04	0.03	-0.03
Schlyrs	-0.11***	0.01	-0.21	-0.07***	0.01	-0.17	0.001	0.01	0.01	0.001	0.01	0.01
Black[b]	0.13	0.12	0.03	0.25**	0.09	0.06	0.02	0.05	0.01	0.02	0.05	0.01
Other	0.30*	0.14	0.05	0.01	0.10	0.003	0.03	0.05	0.01	-0.02	0.06	-0.01
Reason 2[c]	0.29*	0.13	0.06	0.18	0.10	0.04	-0.07	0.04	-0.03	0.04	0.05	0.02
Reason >=3	0.64***	0.16	0.13	0.40***	0.11	0.10	-0.12*	0.05	-0.06	0.14**	0.05	0.07
Evedis	0.18*	0.08	0.07	-0.01	0.06	-0.003	-0.01	0.03	-0.01	0.03	0.03	0.03
Lifedis	0.21***	0.05	0.13	0.05	0.03	0.04	-0.01	0.02	-0.01	-0.01	0.02	-0.01
Depress							-0.02*	0.01	-0.06	0.04***	0.01	0.09
Allosta							0.003	0.01	0.007	0.01	0.01	0.01
Cpsupp T1							0.53***	0.03	0.50	-0.12***	0.03	-0.11
Cpstra T1							-0.10***	0.03	-0.11	0.49***	0.03	0.48
R^2		0.12			0.05			0.36			0.35	

Note. [a] Reference = Male. [b] Reference = White. [c] Reference = Those who reported ≤1 reason for everyday discrimination. Schlyrs = school years. Reason 2 refers to the group who experienced 2 social identity attributions for everyday discrimination; Reason >=3 refers to the group who experienced 3 or more than 3 social identity attributions for everyday discrimination. Evedi = everyday discrimination; Lifedis = major lifetime discrimination; Depress = Depressive symptoms; Allosta = allostatic load; Cpsupp = couple support; Cpstra = couple strain; T2: 2012/2014. T3: 2016/2018. * $p < .05$, ** $p < .01$, *** $p < .001$ (two-tailed).

The results of the mediation/indirect effects analysis partially supported hypotheses. As shown in Table 6, for the paths between the two types of discrimination (everyday discrimination and lifetime discrimination) at Time 1 and couple support at Time 3, only depressive symptoms significantly mediated the associations between the two types of discrimination and couple support. Specifically, the bootstrapped indirect effect of everyday discrimination on couple support through depressive symptoms was statistically significant (standardized indirect effect = - 0.004, 95% CI = [- 0.011, - 0.001]) and the indirect effect of lifetime discrimination on couple support through depressive symptoms was also significant (standardized indirect effect = - 0.008, 95% CI = [- 0.016, - 0.002]). In other words, both higher frequency of everyday discrimination and lifetime discrimination at T1 contributed to more depressive symptoms at T2, which in turn, contributed to less couple support at T3. Allostatic load was not found to be a significant mediator between the two types of discrimination to couple support. The direct effect between everyday discrimination and couple support was not significant (standardized direct effect =- 0.01, 95% CI = [- 0.069, 0.038]). Similarly, the direct effect between lifetime discrimination and couple support was not significant (standardized direct effect =- 0.01, 95% CI = [- 0.058, 0.043]).

Based on Table 7, similar mediation results were found for the paths between the two types of discrimination (everyday discrimination and lifetime discrimination) at Time 1 and couple strain at Time 3. Only depressive symptoms significantly mediated the associations between the two types of discrimination and couple strain. Specifically, the indirect effect of everyday discrimination on couple strain through depressive symptoms was significant (standardized indirect effect = 0.006, 95% CI = [0.001, 0.015]) and the indirect effect of lifetime discrimination on couple strain through depressive symptoms was also significant (standardized

indirect effect = 0.011, 95% CI = [0.005, 0.020]). In other words, both higher frequency of everyday discrimination and lifetime discrimination at T1 contributed to more depressive symptoms at T2, which in turn, contributed to more couple strain at T3. Allostatic load was not found to be a significant mediator between the two types of discrimination and couple strain. The direct effect between everyday discrimination and couple strain was not significant (standardized direct effect =0.025, 95% CI = [0.005, 0.021]). Similarly, the direct effect between lifetime discrimination and couple strain was not significant (standardized direct effect =- 0.01, 95% CI = [- 0.006, 0.040]).

Table 6. Mediation results for the two paths from everyday discrimination and lifetime discrimination to couple support

	Standardized effect	Standard error	95% CI
Path 1: EVEDIS (T1) → CPSUPP (T3)			
Total	-0.017	0.027	(-0.073, 0.035)
Indirect			
EVEDIS to DEPRESS to CPSUPP	-0.004*	0.003	(-0.011, -0.001)
EVEDIS to ALLOSTA to CPSUPP	0.000	0.001	(-0.002, 0.001)
Direct			
EVEDIS to CPSUPP	-0.013	0.027	(-0.069, 0.038
Path 2: LIFEDIS (T1) → CPSUPP (T3)			
Total	-0.016	0.026	(-0.066, 0.035)
Indirect			
LIFEDIS to DEPRESS to CPSUPP	-0.008*	0.003	(-0.016, -0.002)
LIFEDIS to ALLOSTA to CPSUPP	0.000	0.001	(-0.001, 0.003)
Direct			
LIFEDIS to CPSUPP	-0.008	0.026	(-0.058, 0.043)

Note. EVEDIS = everyday discrimination; CPSUPP = couple support; DEPRESS = Depressive symptoms; ALLOSTA = allostatic load. * $p < .05$, ** $p < .01$, *** $p < .001$ (two-tailed).

Table 7. Mediation results for the two paths from everyday discrimination and lifetime discrimination to couple strain

	Standardized effect	Standard error	95% CI
Path 1: EVEDIS (T1)⟶CPSTRA (T3)			
Total	0.031	0.027	(-0.022, 0.085)
Indirect			
EVEDIS to DEPRESS to CPSTRA	0.006*	0.003	(0.001, 0.015)
EVEDIS to ALLOSTA to CPSTRA	0.000	0.001	(-0.002, 0.001)
Direct			
EVEDIS to CPSTRA	0.025	0.027	(0.005, 0.021)
Path 2: LIFEDIS (T1)⟶CPSTRA (T3)			
Total	0.002	0.025	(-0.049, 0.051)
Indirect			
LIFEDIS to DEPRESS to CPSTRA	0.011*	0.004	(0.005, 0.020)
LIFEDIS to ALLOSTA to CPSTRA	0.000	0.001	(-0.001, 0.003)
Direct			
LIFEDIS to CPSTRA	-0.010	0.026	(-0.061, 0.040)

Note. EVEDIS = everyday discrimination; CPSTRA = couple strain; DEPRESS = depressive symptoms; ALLOSTA = allostatic load. * $p < .05$, ** $p < .01$, *** $p < .001$ (two-tailed).

Section 4. Multi-sample analysis results

Driven by previous literature suggesting the group differences on the impact of discrimination on couple relationship functioning and the significant mean differences on certain variables of interests based on race, gender, age, and number of attributed reasons for discrimination (indicated in section 2), I conducted sensitivity analyses to investigate if associations among the study variables (there are a total of 12 structural paths) differed based on these four demographic factors. Building on the primary model 1 reviewed above, I conducted four follow-up multigroup analysis based on race, gender, age, and number of social identity attributions for everyday discrimination. Table 8 displays the summary of the multi-group analysis.

When comparing all the 12 path associations between White (n = 1,883) and Black (n = 262) groups, the only path that was significantly different was from everyday discrimination to

couple strain (White: B = -0.004, p = 0.998; Black: B = 0.18, p = 0.036; Difference: ΔB = -0.181, p = 0.046). None of the other paths were statistically significantly different.

When comparing the 12 path associations between female (n = 1,198) and male (n = 1,146) groups, four paths were significantly different (see Figure 6). Specifically, it appeared the impact of depressive symptoms on couple support was more harmful for males than female partners, although the association was only significant for male partners (Female: B = -0.004, p = 0.71; Male: B = -0.05, $p < 0.01$; Difference: ΔB = 0.046, p = 0.004). Similarly, it appeared the impact of allostatic load on couple support was more harmful for male partners than female partners, although the associations were not significant within either group (Female: B = 0.022, p = 0.107; Male: B = -0.015, p = 0.22; Difference: ΔB = 0.037, p = 0.043). However, it appeared the impact of major lifetime discrimination on couple support was more harmful for female partners than male partners, although the association was only significant for female partners (Female: B = -0.056, p = 0.021; Male: B = 0.027, p = 0.101; Difference: ΔB = -0.083, p = 0.005). Similarly, it appeared the impact of major lifetime discrimination on couple strain was more harmful for female partners than male partners, although the association was not significant for females and was marginally significant for males (Female: B = 0.036, p = 0.134; Male: B = -0.036, p = 0.054; Difference: ΔB = 0.072, p = 0.018). Overall, the results appeared to suggest that the impact of depressive symptoms and allostatic load on couple support tended to be more harmful for males than females. However, the impact of major lifetime discrimination on couple support and couple strain appeared to be more harmful for females than males.

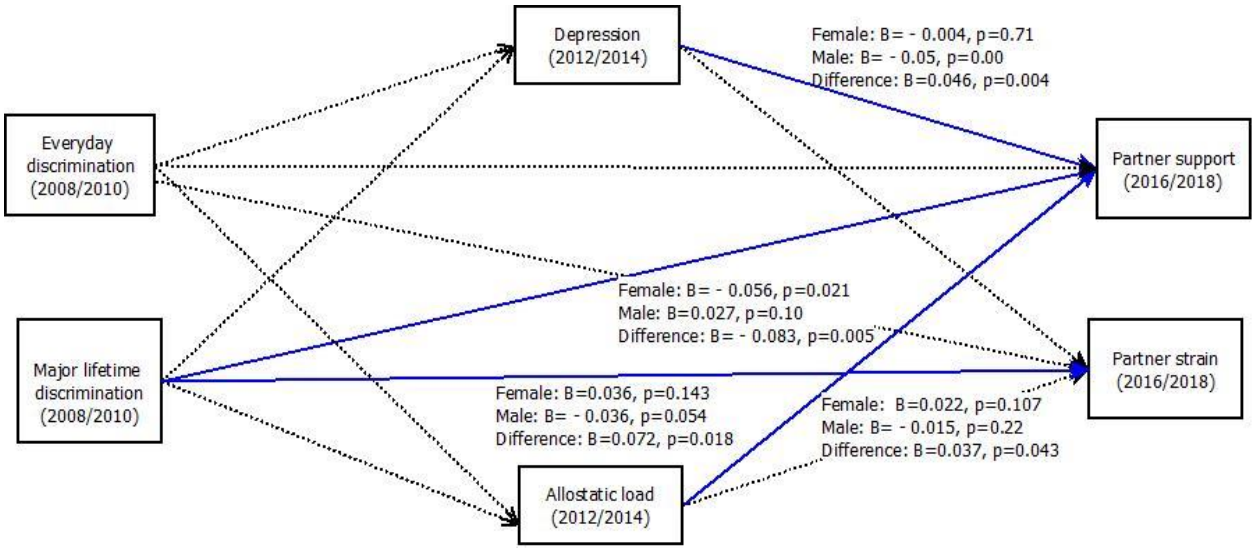


Figure 6. Multigroup analysis based on gender. Solid blue lines indicate the paths (associations) that were significantly different between females and males. Dotted black lines indicate the paths (associations) that were not significantly different between females and males.

Regarding the moderating effect of age on the 12 structural paths, I compared the path differences among three pairs: oldest old (n = 414) and middle old (n = 884); oldest old and young old (n = 1,046); middle old and young old. When comparing the 12 path associations between oldest old and middle old, two paths were significantly different between the two groups (see Figure 7). Specifically, it appeared that the impact of major lifetime discrimination on couple support was more harmful for the middle old group than the oldest old group, although the association was only significant for the middle old group (oldest old: B = 0.069, p = 0.072; middle old: B = -0.048, p = 0.029; Difference: ΔB = 0.117, p = 0.008). Similarly, the impact of major lifetime discrimination on couple strain appeared to be more harmful for the middle old group than the oldest old group as well, although the association was only significant for the middle old (oldest old: B = -0.033, p = 0.35; middle old: B = 0.063, p = 0.01; Difference: ΔB = -0.096, p = 0.026). There were no significantly different paths between the oldest old and the young old. When comparing the 12 path associations between the middle old and the young old, three paths were significantly different between the two groups (see Figure 8). Specifically, it

appeared that the impact of major lifetime discrimination on depressive symptoms was more harmful for the young old than the middle old group, although the association was only significant for the young old group (Middle old: $B = 0.073$, $p = 0.216$; Young old: $B = 0.309$, $p < 0.01$; Difference: $\Delta B = -0.237$, $p = 0.006$). However, the impact of major lifetime discrimination on couple strain appeared to be more harmful for the middle old than the young old (Middle old: $B = 0.063$, $p = 0.01$; Young old: $B = -0.055$, $p = 0.012$; Difference: $\Delta B = 0.118$, $p < 0.01$). Similarly, the impact of everyday discrimination on couple support appeared to be more harmful for the middle old than the young old as well (Middle old: $B = -0.087$, $p = 0.038$; Young old: $B = 0.053$, $p = 0.033$; Difference: $\Delta B = -0.139$, $p = 0.006$). Overall, the results appeared to suggest that the impact of discrimination on couple support and/or couple strain was more harmful for the middle old group compared with the oldest old and the young old groups.

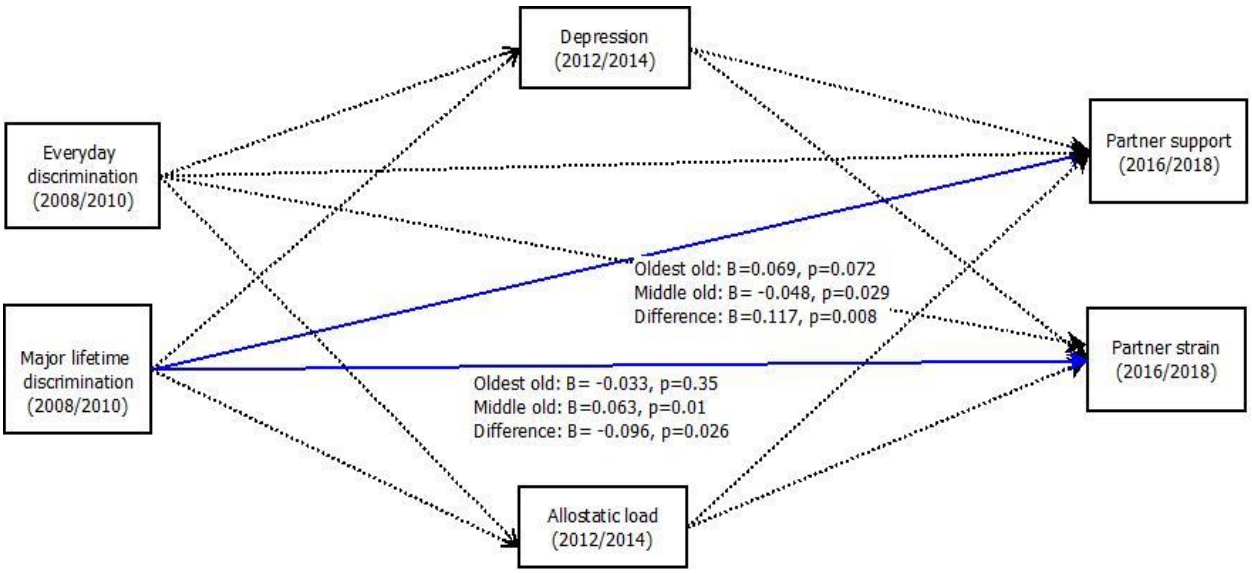


Figure 7. Multigroup analysis based on age (Oldest old vs middle old). Solid blue lines indicate the paths (associations) are significantly different between the oldest old group and the middle old group. Dotted black lines indicate the paths (associations) are not significantly different between these two groups.

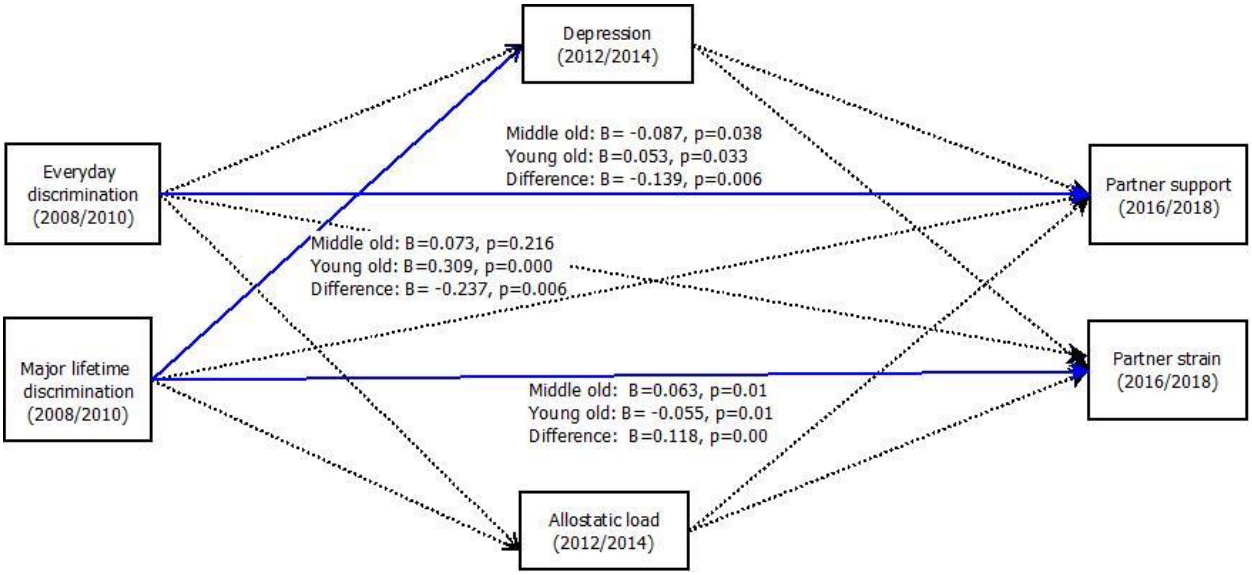


Figure 8. Multigroup analysis based on age (Middle old vs young old). Solid blue lines indicate the paths (associations) are significantly different between the middle old group and the young old group. Dotted black lines indicate the paths (associations) are not significantly different between the two groups.

Regarding the moderating effect of number of attributed reasons for everyday discrimination on the 12 paths, I compared the path differences among three pairs as well: ≤1 reason (n = 1,553) and 2 reasons (n = 227); 2 reasons and ≥3 attributed reasons (n = 254); ≤1 reason and ≥3 attributed reasons. When comparing the 12 path associations between ≤1 and 2 reasons, two paths were significantly different between the two groups (see Figure 9). Specifically speaking, it appeared that the impact of depressive symptoms on couple support was more harmful for people who reported 2 reasons of everyday discrimination compared with the ≤1 group, although the association was only significant for the 2 reasons group (≤1: B = -0.005, p = 0.65; =2: B = -0.058, p = 0.013; Difference: ΔB=0.053, p = 0.036). Similarly, the impact of depressive symptoms on couple strain appeared to be more harmful for people who reported 2 reasons of everyday discrimination compared with the ≤1 group as well (≤1: B = 0.024, p = 0.03; =2: B = 0.087, p < 0.01; Difference: ΔB = -0.063, p = 0.02); When comparing the 12 path

associations between ≤1 and ≥3, two paths were significantly different between the two groups (see Figure 10). Specifically, it appeared that the impact of depressive symptoms on couple support was more harmful for people who reported ≥3 reasons compare with people who reported ≤1 reason, although the association was not significant for the ≤1 group (≤1 1: B = -0.005, p =0.65; ≥3: B = -0.056, p = 0.012; Difference: ΔB = 0.051, p = 0.036). However, when looking at the impact of major lifetime discrimination on couple strain, it appeared to be more harmful for people who reported ≤1 reason compared to people who reported ≥3 reasons, although the association was only significant for the ≥3 group (≤1 1: B = 0.011, p = 0.546; ≥3: B = -0.088, p = 0.012; Difference: ΔB = 0.099, p = 0.014); Lastly, there was only one path that was significantly different between 2 reasons and ≥3 reasons. Specifically, it appeared that the impact of major lifetime discrimination on couple strain was more harmful for people who reported 2 reasons compared with people who reported ≥3 reasons, although the association was only significant for the ≥3 group (=2: B = 0.027, p = 0.52; ≥3: B = -0.088, p = 0.014; Difference: ΔB=0.115, p=0.037). Overall, when looking at the impact of depressive symptoms on couple support and couple strain, it appeared to be more harmful for people who reported 2 or ≥3 reasons, compared with people who reported ≤1 reason. On the contrary, when looking at the impact of major lifetime discrimination on couple strain, it appeared to be more harmful for people who reported ≤1 or 2 reasons compared with people who reported ≥3 reasons.

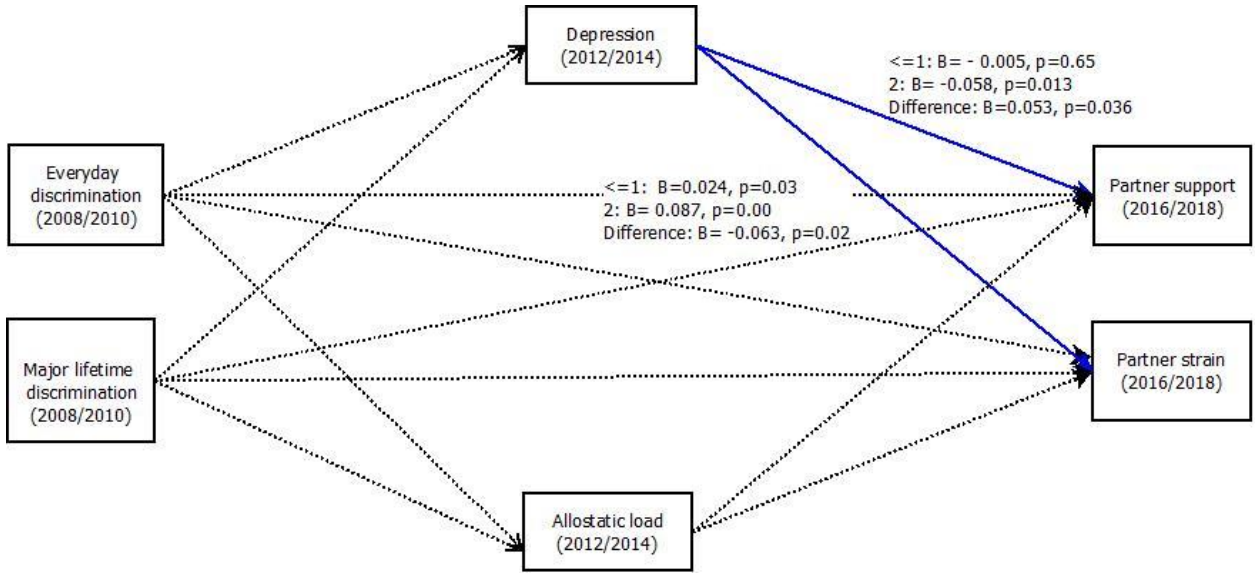


Figure 9. Multigroup analysis based on number of reasons for everyday discrimination (≤1 vs 2). Solid blue lines indicate the paths (associations) are significantly different between the ≤1 group and the 2 group. Dotted black lines indicate the paths (associations) are not significantly different between ≤1 group and 2 group.

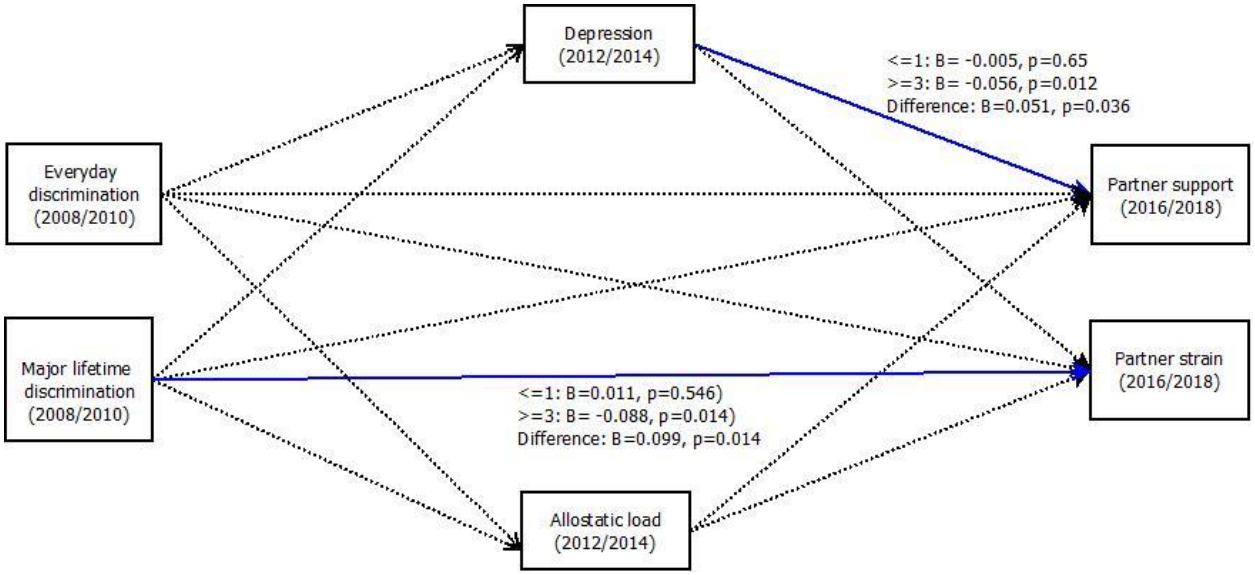


Figure 10. Multigroup analysis based on number of reasons for everyday discrimination (≤1 vs ≥3). Solid blue lines indicate the paths (associations) are significantly different between the ≤1 group and the ≥3 group. Dotted black lines indicate the paths (associations) are not significantly different between ≤1 group and ≥3 group.

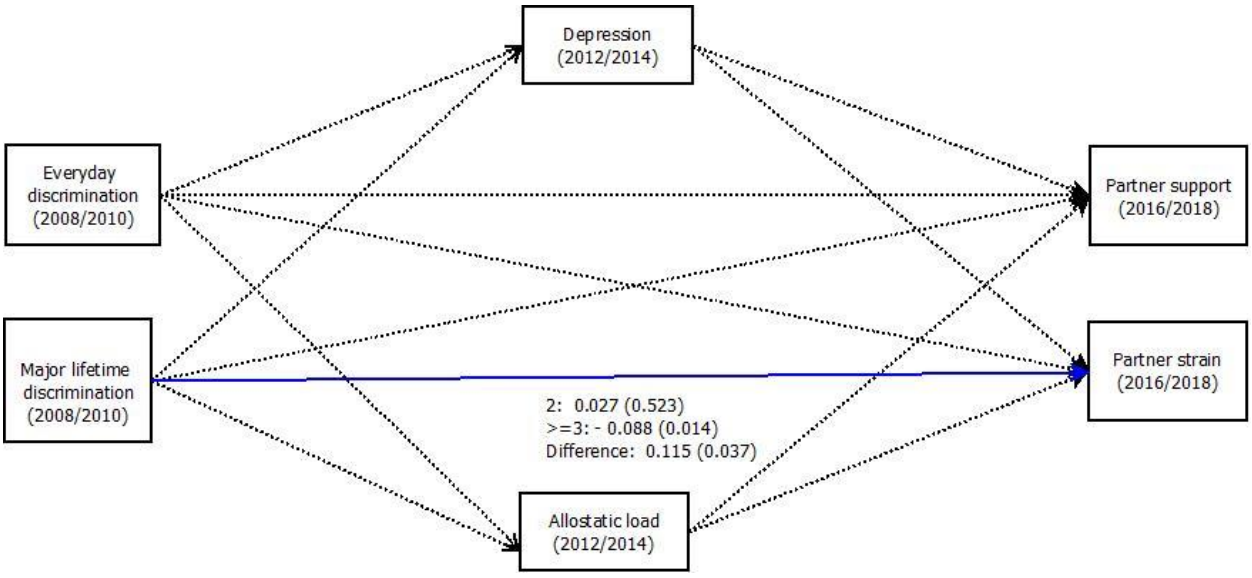


Figure 11. Multigroup analysis based on number of reasons for everyday discrimination (2 vs ≥3). Solid blue lines indicate the paths (associations) are significantly different between the 2 group and the ≥3 group. Dotted black lines indicate the paths (associations) are not significantly different between the 2 group and the ≥3 group.

Table 8. Summary of multi-group analysis based on race, gender, race and number of attributed reasons for everyday discrimination.

Paths		Major to depres	Evedis to depres	Major to allo	Evedis to allo	Depres to support	Depres to strain	Allo to support	Allo to strain	Major to support	Major to strain	Evedis to support	Evedis to strain
White/Black													-0.181±
Female/Male						0.046 **		0.037*		-0.083**	0.072*		
Age	Old/Mid									0.117**	-0.096*		
	Old/you												
	Mid/you	-0.237**									0.118***	-0.139**	
Reason	1/2					0.053*	-0.063*						
	1/3					0.051*					0.099*		
	2/3										0.115*		

Note. The number in the cells refers to the statistically (or marginally) significant difference for that given path between that given group. The blank cells means that there were no significant differences for that given path between that given group. 1/2 refers to the comparison between the group who experienced one or less than one social identity attribution for everyday discrimination and the group who experienced two social identity attribution for everyday discrimination; 1/3 refers to the comparison between the group who experienced one or less than one social identity attribution for everyday discrimination and the group who experienced three or more than three social identity attributions for everyday discrimination; 2/3 refers to the comparison between the group who experienced two social identity attributions for everyday discrimination and the group who experienced three or more than three social identity attributions for everyday discrimination. Old/Mid refers to the comparison between the group of oldest old adults and the group of middle old adults; Old/you refers to the comparison between the group of oldest old adults and the group of young old adults; Mid/you refers to the comparison between the group who were middle old adults and the group who were young old adults. ± $P = .05$

Major = major lifetime discrimination; Evedis = everyday discrimination; Depres = depressive symptoms; Allo = allostatic load. Support = couple support; Strain = couple strain.

* $p < .05$. ** $p < .01$. *** $p < .001$ (two-tailed).

Section 5. Robustness check

In order to verify the robustness of these results, I conducted an additional three models in this section. First, when investigating the relationships in the primary longitudinal model presented in section 2 (model 1), I controlled for 7 variables (race, age, gender, education and number of attributed reasons for everyday discrimination and T1 assessments of couple support and couple strain). Here I ran a second model with 6 control variables excluding the number of attributed reasons (model 2). The conceptual reason to run this model was informed by the critics that reject the additive approach, which was reflected in the way I used to measure participants' intersectionality of discrimination in the current study. Critics argue that the additive approach conceptualizes people's discriminatory experiences as summative, independent and it implies their discriminatory experiences based on social identity can be ranked, which is "virtually impossible"[6] (Bowleg, 2008; Cuádraz & Uttal, 1999; Weber & Parra-Medina, 2003).

The result of model 2 suggested the model demonstrated good model fit ($\chi^2[4] = 36.87$, $p = 0.00$, CFI = 0.99, RMSEA = 0.06, SRMR = 0.02). Standardized pathway estimates for the significant structural paths are shown in Figure 12. In this model, all the significant paths shown in the model 1 remained significant. In addition, results showed that everyday discrimination at Time 1 was significantly associated with allostatic load at Time 2 ($\beta = 0.048$, $p = 0.024$). Also, there was a direct effect between everyday discrimination at Time 1 and couple strain at Time 3 ($\beta = 0.059$, $p = 0.025$). These additional two significant paths are depicted in blue solid line in Figure 12.

I also checked the primary model after adding the T1 mediators as control variables in model 3. The sample size for this analysis was 1,781 after I excluded 563 participants who did

[6] For more information about this literature, please review the section 3, conceptualization of discrimination under the chapter 2, literature review and theoretical framework.

not participate in 2008/2010 biomarker assessments. The model 3 demonstrated good model fit ($\chi^2[4] = 7.59$, $p = 0.11$, CFI = 0.99, RMSEA = 0.02, SRMR = 0.01). As shown in Figure 13, the path analysis results suggested that, only lifetime discrimination was statistically significantly associated with depressive symptoms at T2 ($\beta = 0.107$, $p = 0.00$) and depressive symptoms at T2 was only statistically significant associated with couple strain at T3 ($\beta = 0.077$, $p = 0.011$). Everyday discrimination was no longer significantly associated with depressive symptoms at T2, and depressive symptoms was no longer associated with couple support at T3. For the indirect effects, only the indirect effect of lifetime discrimination on couple strain through depressive symptoms was found to be statistically significant (standardized indirect effect = 0.006, 95% CI = [0.002, 0.012]). The rest of the three indirect effect paths were not significant. For the direct effect between the two types of discrimination and two types of couple relationships, neither were significant.

In order to see if allostatic load could serve the role of mediation without depressive symptoms built into the primary model, I also ran the model without depressive symptoms while keeping the rest intact (model 4). The model demonstrated good model fit ($\chi^2[2] = 13.36$, $p = 0.00$, CFI = 0.99, RMSEA = 0.02, SRMR = 0.01). The results showed, even without depressive symptoms present in the model, both of everyday discrimination and lifetime discrimination at Time 1 were not significantly associated with allostatic load at Time 2. Allostatic load was not significantly associated with couple support and couple strain. The indirect effects between the two types of discrimination and two types of couple relationships through allostatic load were not found to be significant. The direct effects between the two types of discrimination and two types of couple relationships were not significant either.

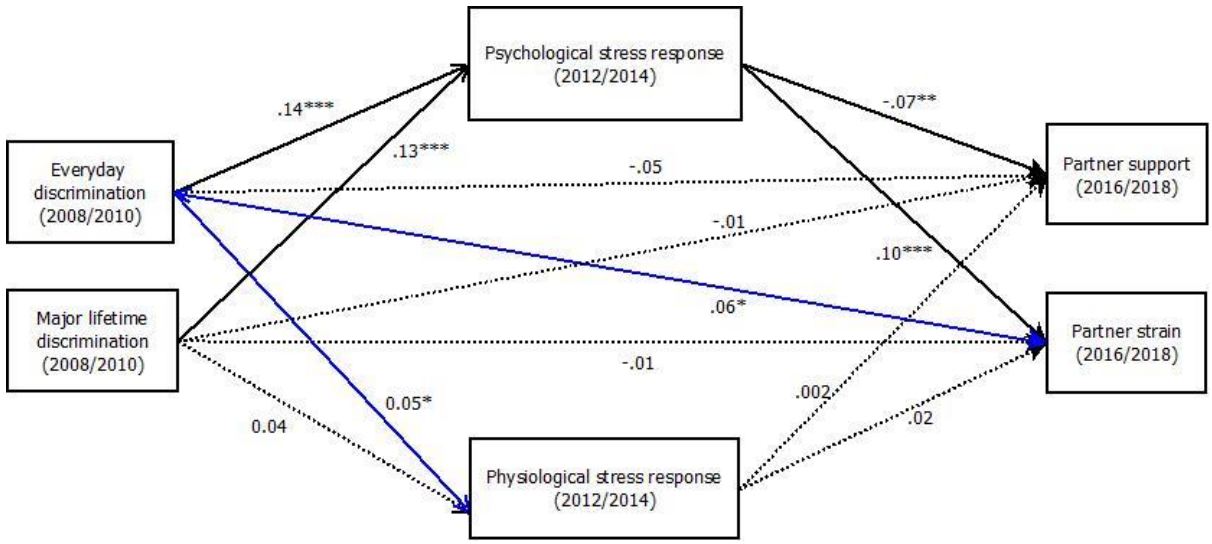


Figure 12. Model 2: Longitudinal mediation model without number of attributed reasons for everyday discrimination as a control. $\chi^2(4) = 36.87$, $p = 0.00$, CFI = 0.99, RMSEA = 0.06, SRMR = 0.02. Solid lines indicate significant paths, and dotted lines indicate nonsignificant paths. Solid blue lines indicate the two additional significant paths in this model. Values shown are standardized estimates. For simplicity, race, education, gender and other covariates are not shown. * $p < .05$, ** $p < .01$, *** $p < .001$

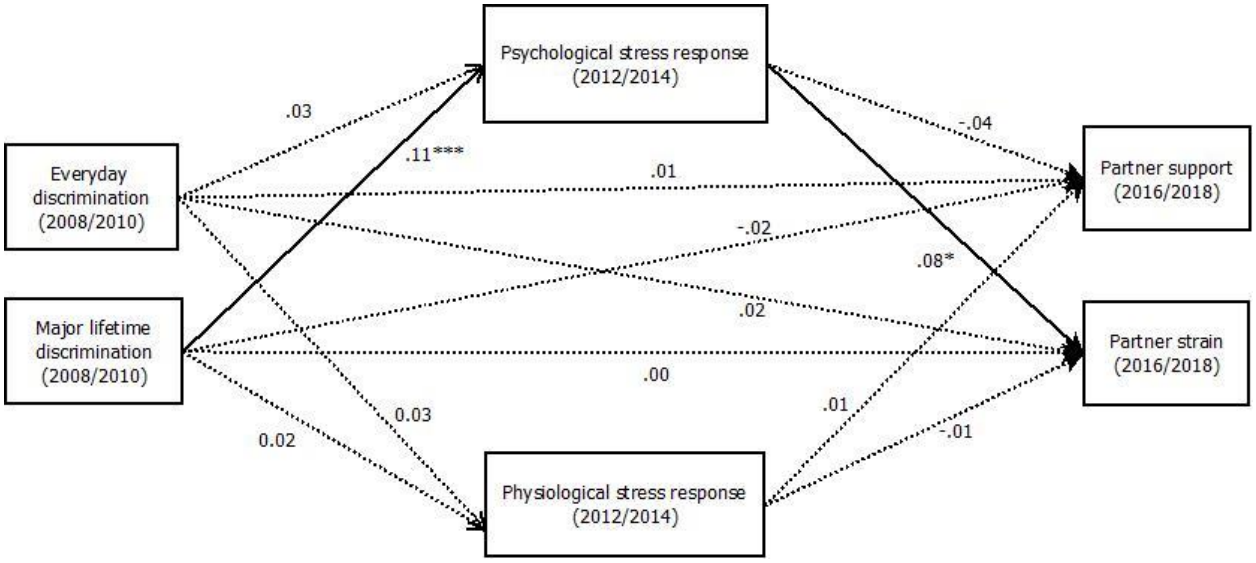


Figure 13. Model 3: Longitudinal mediation model after adding Time 1 assessments of mediators as controls. $\chi^2(4) = 7.59$, $p = 0.11$, CFI = 0.10, RMSEA = 0.02, SRMR = 0.01. Solid lines indicate significant paths, and dotted lines indicate nonsignificant paths. Values shown are standardized estimates. For simplicity, race, education, gender and other covariates are not shown. * $p < .05$, ** $p < .01$, *** $p < .001$

Chapter 5: Discussion

This study addresses critical gaps in the literature on the relationship between discrimination and couple relationship functioning. The majority of the studies on discrimination and couple relationships functioning is cross-sectional, which limits our understanding of the directionality of effects, and seldom do they investigate the longer-term impact of discrimination on couple relationship functioning. Furthermore, there are even fewer studies on factors that might mediate the relationship between experiences of discrimination and quality of couple relationships. To address these gaps, the present study aimed to investigate the longer-term impact of two forms of discrimination, everyday discrimination and major lifetime discrimination at Time 1, on couple relationship functioning, couple support and couple strain at Time 3, over 8 years. The study also sought to explore if depressive symptoms and allostatic load at Time 2 mediated the association between the two types of discrimination (everyday discrimination and major lifetime discrimination) and two types of couple functioning (couple support and couple strain) among middle-aged and older-aged adults.

The present study was guided by three theoretic models including the biopsychosocial model of racism (Clark et al., 1999), social stress process theory (Pearlin et al., 1981; Pearlin & Bierman, 2013), and the systemic-transactional stress model (Bodenmann, 1995, 1997; Bodenmann et al., 2007). Specifically, informed by the psychological and physiological/physical mediating pathways outlined by Clark et al. (1999) and Bodenmann et al. (2007), as well as the overarching conceptual framework of stress proliferation, I proposed a new conceptual model (Figure 3) for understanding stress and couple relationship functioning. My conceptual model posits that individuals' experiences of perceived discrimination (everyday discrimination and major life-time discrimination) would impact their couple relationship functioning directly or indirectly through impacting their psychological (depressive symptoms)

and physiological stress responses (allostatic load). Overall, the current study provides relatively strong evidence for parts of this proposed conceptual model.

In the following sections, I will first discuss the main results from the primary model[7] in greater detail in relation to the research questions and hypothesis. Some of the results from model 2 and model 3 will also be discussed here. Following this, I will discuss the results from the multi-group analysis based on race, gender, age and number of reasons for everyday discrimination. Those will be followed by a discussion of the strengths of the study, its limitations, recommendations for future research, practice, and policy, and the study's overall contributions to the literature.

Discussion of the main results

Our results from the primary model (i.e., model 1) suggested that greater frequency of both everyday discrimination and lifetime discrimination at T1 were significantly associated with higher score of depressive symptoms at T2 while controlling for the covariates (gender, age, race, education, number of attributed reasons for everyday discrimination). And more depressive symptoms at T2 was significantly associated with lower perceived couple support and higher perceived couple strain at T3 while controlling for all of the covariates (gender, age, race, education, number of attributed reasons for everyday discrimination, T1 assessments of couple support and couple strain). These findings are in line with the existing research supporting the path between discrimination and depressive symptoms (Schmitt et al., 2014; Williams & Mohammed, 2009), and the path between depressive symptoms and couple relationship functioning (Finkbeiner et al., 2013; Heene et al., 2005; Kouros & Cummings, 2011; Li &

[7] Model 1: Primary longitudinal mediation model with controls; Model 2: Longitudinal mediation model without number of attributed reasons for everyday discrimination as a control; Model 3: Longitudinal mediation model after adding Time 1 assessments of mediators as controls.

Johnson, 2018). In addition, consistent with our hypothesis, depressive symptoms at T2 significantly mediated the longitudinal association between the two types of discrimination and the two types of couple relationship functioning spanning 8 years while controlling for all of the covariates. In other words, one partner's experience of discrimination adversely impacted their couple relationships 8 years later indirectly through their depressive symptoms. Notably, even after controlling for the T1 assessment of depressive symptoms in the model 3, the indirect effect of lifetime discrimination on couple strain through depressive symptoms was still present.

The finding that one partner's experiences of discrimination adversely contributed to their couple relationships 8 years later extends the existing concurrent research examining similar cross-over/spillover effects within couples and emotional contagion more broadly (Hatfield et al., 1993; Wofford et al., 2019). In addition, it demonstrated a potential mechanism– through depressive symptoms –in which a partner's stress from discrimination experiences translate to increased couple strain and decreased couple support, providing evidence for future interventions for improving couple relationships among middle-aged and older-aged adults in the U.S.

However, the paths between both types of discrimination at Time 1 and allostatic load at Time 2, as well as the paths between allostatic load at Time 2 and both types of couple relationship functioning at Time 3 were found to be nonsignificant. Contrary to our hypothesis, allostatic load was not found to be a significant mediator between the two types of discrimination and the two aspects of couple relationship functioning (couple support and couple strain). The direct relationship between discrimination (everyday and major lifetime) and couple relationship functioning (couple strain and couple support) was not significant either. These findings were not aligned with previous research supporting the relationship between discrimination and allostatic

load (H. N. Miller et al., 2021), and the relationship between allostatic load and couple relationship functioning (Doyle & Molix, 2014c; Schneiderman et al., 2014; Timmons et al., 2015).

A possible explanation for the absence of significant pathways between discrimination and allostatic load, and the pathways between allostatic load and couple relationship functioning may be related to the measure of allostatic load. To date, there is no gold standard to calculate allostatic load (Duong et al., 2017). Miller et al's (2021) critical review of 11 articles on the impact of discrimination on allostatic load showed that there were considerable differences in which biomarkers were included in the measurement of allostatic load and how the summary score is calculated. For example, some studies calculated allostatic load composite scores by summing biomarker scores, and some studies created allostatic load composite score by summing system level scores, while some of them used the z-score approach by either summing or averaging each biomarkers' z-score to create a summary allostatic load score (H. N. Miller et al., 2021). Because the differences in ways allostatic load was derived, it is likely to influence the final findings (H. N. Miller et al., 2021). Despite these discrepancies in allostatic load measurement, there is general consensus that the measure of allostatic load should include cardiovascular, metabolic, neuroendocrine (hypothalamic-pituitary-adrenal axis (HPA) and sympatho-adrenal-medullary (SAM) axis), and immune biomarkers (H. N. Miller et al., 2021). Though the present study used allostatic load from seven biomarkers across inflammatory, cardiovascular, and metabolic systems to represent the physiological stress response, it didn't include markers from the norepinephrine system or additional immune markers as HRS didn't have these markers in the current data.

Further, when reviewing the articles on the link between allostatic load/physiological markers and couple relationship functioning in particular, the majority of these articles used physiological markers from the neuroendocrine system (Timmons et al., 2015) as these biomarkers are associated with heightened arousal and the human stress response (Hugdahl, 1995). Therefore, it appears the lack of biomarkers in the neuroendocrine systems can be particularly impactful when examining the link between allostatic load/physiological markers and couple relationships. Besides the issue from the measurement of allostatic load itself, the research on the impact of allostatic load on couple relationship functioning is still in a nascent stage. The majority of existing evidence on the relationship between allostatic load/physiological markers is cross-sectional (Doyle & Molix, 2014c; Timmons et al., 2015) and the longitudinal evidence tends to be short-term, such as 6 months (Schneiderman et al., 2014). The longitudinal path from allostatic load to couple relationship needs further conceptual and empirical clarity.

It is worth noting another potential reason for the nonsignificant longitudinal association between the frequency of everyday discrimination and allostatic load (in model 1). In model 2, the frequency of everyday discrimination at T1 was significantly associated with allostatic load at T2 4 years later. This result is consistent with the existing literature on the relationship between everyday discrimination and allostatic load (H. N. Miller et al., 2021). The studies included in Miller et al.'s (2021) review did not test the effect of both the frequency of everyday discrimination and the number of attributed reasons for everyday discrimination on allostatic load simultaneously. The association between the frequency of everyday discrimination and allostatic load became nonsignificant after adding the control variable of multiple forms of everyday discrimination, suggesting that the number of reasons for everyday discrimination might be a stronger predictor of allostatic load and it weakened the effects of the frequency of

discrimination when considering them together in the analysis. This was also verified by the path analysis results (see Table 5) as it showed that number of reasons for everyday discrimination had a larger effect size on allostatic load than the frequency of everyday discrimination.

It is also important to remember what couple relationship functioning represents in the current study to better understand the interpretations of the findings. The current study assessed couple relationship functioning by including a positive aspect of couple relationship functioning, namely couple support, and a negative aspect of couple relationship functioning, namely couple strain. In this study, both couple support and couple strain reflect one partner's perception of the other partner's behaviors, such as they perceive their partner as caring, supportive, or critical and demanding. This is different from a more general assessment, such as self-reports of relationship quality or relationship satisfaction. Though research suggests a modest and consistent link between the behavior exchanges (e.g., being caring, supportive, or critical and demanding) in couples and marital satisfaction, it is possible that couples may still perceive their marriage as satisfying even when they experience relatively high levels of negative behavioral exchanges (Karney & Bradbury, 1995). For example, some couples or partners may perceive their negative interactions or behavioral exchanges as a way to resolve any disagreements or problems in their relationship (Karney & Bradbury, 1995). Thus, the interpretations of the results of this study should be in line with the actual representations of the outcomes (perceived support or strain from the other partner).

Discussion of the multi-group analysis results

Multi-group analysis based on race.

The multi-group analysis based on race suggested that the negative effect of perceived discrimination on depressive symptoms, allostatic load, couple support and couple strain didn't

differ between White and African American participants. This may appear unexpected considering that African Americans experience more discrimination than Whites and its impact is well documented in health disparities research (T. T. Lewis et al., 2015; Paradies et al., 2015; Schmitt et al., 2014). However, this finding is consistent with previous research among older population in the U.S.(Barnes et al., 2004; Wofford et al., 2019). Although another study (*n* = 8,385) found that race significantly moderated the relationship between discrimination and depression, it was the Black group who had a significantly weaker association between discrimination and depression compared with the White group (Ayalon, 2018). The absence of significant differences on the associations between discrimination and physical and mental health between Black and White groups or the weaker association between discrimination and physical and mental health for the Black group compared with the White group may be because Black older adults are accustomed to the effects of discrimination and thus appraised discrimination as less stressful compared to when they were younger, whereas Whites who were less likely to experience discrimination throughout their life, were more likely to be affected by it at older age (Ayalon, 2018). It is also possible that Black people develop positive coping skills and benefit from social or cultural resources, such as community support and religious beliefs, which serve as buffers and attenuate the impact of discrimination on health (Ayalon, 2018). A valuable step for future research will be to include coping skills and social support as moderators in this line of research.

Multi-group analysis based on gender.

Regarding the moderating effect of gender on the 12 structural paths, the results suggest two different pictures overall. One, the results appeared to suggest that when female partners experienced stress from major lifetime discrimination, they were more likely to report increased

couple strain and decreased couple support from their male partners compared to male partners. This is consistent with some previous research findings which suggest that under stress, it seems wives support their husbands more than husbands support their wives (Neff and Karney, 2004). This could explain that under stress from discrimination, females perceived their male partners as less supportive (e.g., less understood, less able to rely on partners and less able to open up when needed). The stronger, negative impacts of discrimination on couple relationship functioning for females compared with males can inform couple interventions considering the sizeable gender gap in the divorce rate — more women were divorced or separated than men (Administration on Aging, 2021).

Two, the results appeared to suggest that when male partners experienced depressive symptoms, they were more likely to report decreased couple support from their female partners compared to female partners. This result can be explained and supported by research findings that showed male partner's depression predicted lower female's relationship satisfaction (Kouros & Cummings, 2011; Li & Johnson, 2018), because females may be more relationally interdependent and male depression may provoke a more detrimental effect on female partners (Li & Johnson, 2018). Therefore, female partners may be less supportive and more critical of their male partners. It is also possible that when female partners struggle with depression, they are more likely to seek support from outside. For female partners, though, their male partners may respond to their depression with avoidance (Gabriel et al., 2016). The social support from friends and larger network may buffer the negative impacts of depression on their perception of their male partners' behaviors.

Multi-group analysis based on age.

The results from the multigroup analysis based on age appeared to suggest that the middle old group was at more risk for negative impacts of major lifetime discrimination on couple relationship functioning when compared with the young old or the oldest old. This result may be related to some of the features of life course transitions. Research suggested that whereas early midlife (the young old) is embraced with expected pinnacle of the work career and sense of community, during late midlife (the middle old in the present study), most people retire from the productive workforce, move down the social status ladder, and may need to take a job lower in status than preretirement when re-entering the workforce after retirement. These socially-defined transitions, together with other normative life events such as caring for parents, parental deaths, and children leaving home, may contribute to a heightened awareness of their own aging (Giasson et al., 2017). In contrast, the oldest old group (age 70-79; majority people in the oldest old group were in their 70s in the present study) are currently portrayed as the group with the highest life satisfaction (Giasson et al., 2017). In light of these age group differences in their life course transition, it is possible the middle old adults were more vulnerable to the negative impacts of discrimination on their couple relationship functioning. Currently, there is not much existing research examining the moderation role of age on the impact of discrimination on couple relationships functioning. More studies on this line of research are needed.

Multi-group analysis based on the number of reasons for everyday discrimination.

The multi-sample analysis based on the number of reasons for everyday discrimination also suggests two different pictures overall. One, it appeared to suggest that the impact of depressive symptoms on perceived couple support and couple strain was more harmful for people who reported 2 or ≥3 reasons, compared with the ≤1 group. Research shows that people who reported multiple types of social identity-based reasons for everyday discrimination

experience discrimination more frequently, in turn, they may perceive these events as more stressful than those who reported only one reason for everyday discrimination (Grollman, 2012). Therefore, it is possible that when these older adults who experienced 2 or ≥3 reasons struggle with depressive symptoms, they are more likely to need more support and understanding from their partners due to their higher level of stress, and may tend to view their partners as less supportive and more critical, compared with people who reported ≤1 reason.

Two, it appeared that the impact of major lifetime discrimination on couple strain tended to be more harmful for people who reported ≤1 or 2 reasons for everyday discrimination compared with people who reported ≥3 reasons. This could be explained by the joint effects of multiple stressors based on social stress process theory (Pearlin et al., 1981; Pearlin & Bierman, 2013). The social stress process theory suggests that when multiple stressors occur simultaneously in people's lives, two possible outcomes of their joint effect are likely: the multiple stressors can either exacerbate each other or the effect of one stressor becomes less salient in the presence of another stressor (Pearlin & Bierman, 2013). It is possible that when older adults experienced ≥3 reasons for everyday discrimination, instead of exacerbating the effects, the severe and lasting nature of major lifetime discrimination (Pascoe & Richman, 2009) becomes less salient or swamped by it. Another study found a similar pattern where the number of family stressors did not exacerbate the effect of racial discrimination on postpartum depression when looking at their interaction on postpartum depression among Asian and Pacific Islander women in the U.S. (Du & Steinberg, 2022). In their study, they found that there was no effect of family stressors for those who experienced racial discrimination and that there was no effect of racial discrimination for those who experienced the most family stressors, suggesting at

high levels of one stressor, the effect of the other stressor is negligible or swamped because of the high levels of the other stressor (Du & Steinberg, 2022).

Overall, the current study did not find evidence supporting the pathway from perceived discrimination to couple relationship functioning through allostatic load, it provided relatively strong evidence supporting depressive symptoms as a mediating mechanism between perceived discrimination and couple relationship functioning. It is notable that the prospective relationships between perceived discrimination and couple relationship functioning through depressive symptoms held over 8 years, even after controlling for concurrent level of couple support and couple strain at baseline. Though the three paths (path 1: everyday discrimination to depressive symptoms, then to couple support; path 2: everyday discrimination to depressive symptoms, then to couple strain; path 3: major lifetime discrimination to depressive symptoms, then to couple support) disappeared after controlling for baseline mediators in model 3, the other path from major lifetime discrimination to depressive symptoms, then to couple strain was still present. Thus, although causality cannot be fully determined (Jose, 2019), the findings support the notion that a general expectation that one's experience of discrimination contributes to more depressive symptoms, which continues to contribute to more couple strain and less couple support 8 years later.

Study strengths

This study has several important strengths. It is unique in both the size and composition of the sample that it is a large, relatively diverse and nationally representative, which increases the generalizability of our study findings. Next, the longitudinal mediation model allows us to examine the prospective relationships across 3 waves in 8 years, thus it increases our ability to make inferences about longitudinal prediction. Third, the study included both everyday and

lifetime discrimination to represent a more comprehensive assessment of discrimination. Fourth, the present study included both couple support and couple strain to assess couple relationship functioning as they are both important when assessing couple relationship functioning (R. B. Miller et al., 2013). Another strength is that by including key biomarkers, the study incorporates social, psychological and biological perspectives to the study, which is critical in the multidisciplinary understanding of the impact of discrimination on couple relationship functioning. In the end, the study advances the literature by distinguishing the unique sociodemographic (e.g., race, gender, age and multiple reasons for everyday discrimination) differences among the structural paths in the model.

Limitations and research implications

The results from this study should be viewed in consideration of its limitations. First, the study was limited in that only one partner's responses were examined, which restricted our ability to examine the potential partner effects within dyadic interactions. A necessary next step in understanding the impacts of discrimination on couple relationship functioning would be to include data from both partners to further investigate the model dyadically.

Second, although I included some important control variables, I did not include all potential covariates in the study. Past research had suggested that personality factors such as neuroticism and hostility were related to couple relationship quality (Karney & Bradbury, 1995). It is possible that these unmeasured personality factors may actually be responsible for the observed effects. However, past research has shown that experiences of discrimination remain consistent predictors of health and well-being outcomes after controlling for these confounding variables (from Doyle, 2014). In future research, it would still be valuable to include these variables in this longitudinal model with the couple functioning as the outcomes.

Another potential design limitation is that by excluding participants who were not in the same partnership (e.g., divorced or separated) over 8 years, likely this would have removed people with lower couple relationship quality because people who are divorced or separated are likely to have poorer couple relationship functioning. Consequently, this may have truncated the range of the outcome variables (couple support and couple strain) in the study, which could have impacted the study results. In addition, the multi-group analysis based on race excluded the group of "Other" (American Indian, Alaskan Native, Asian, Native Hawaiian and Pacific Islander), which limited our understanding how the paths may differ between White participants and the "Other" group, or Black participants and the "Other" group.

Next, it is possible the limited biomarkers comprising the present measure of allostatic load weakened the association between discrimination and allostatic load, and the association between allostatic load and couple relationship functioning, so the study failed to find the indirect effects of discrimination on couple relationship functioning through allostatic load. An important direction for future research is to advance the standard of allostatic load measurement. In addition, unfortunately, only the everyday discrimination scale asked about attribution. Querying about attribution for major lifetime discrimination can enhance our understanding of why individuals believe they were targeted for major lifetime discrimination. Latent class analysis, along with intersectionality theory, could be used to identify unique profiles of older individuals. Moreover, as I described under the Section 5 of the Chapter 4, the way I measured participants' intersectionality of everyday discrimination reflected an additive approach, which has been criticized by researchers because the approach conceptualizes people's discriminatory experiences as summative, independent and it implies their discriminatory experiences based on social identity can be ranked (Cuádraz & Uttal, 1999; Weber & Parra-Medina, 2003). Critics

suggest that it is difficult to quantitatively measure intersectionality when asking about attributed reasons for discrimination that are inherently additive. Therefore, future research should consider revising the questions to resolve this dilemma.

Finally, there were also a few other measurement limitations. All of the main variables of interests including lifetime discrimination, everyday discrimination, depressive symptoms, partner support and partner strain, except allostatic load, were assessed using self-report measures, thereby leaving the possibility for participants to respond with an element of social desirability. The measures assessed retrospective accounts, such as lifetime discrimination (at any point in life) and depressive symptoms (past one week) could have led to recall bias.

Future policy and practice implications

The present study has important implications for policy and practice interventions. Overall, my study suggests that discrimination is common for middle-aged and older adults in the U.S., particularly age discrimination (experienced by 26.1% of the sample in the study). The results also indicate that middle-aged and older adults' experiences of discrimination had a long-term impact on their mental health (higher depressive symptoms) and poor relationship functioning, even 8 years later. These findings suggest that middle-aged and older-aged adults might benefit from interventions that reduce discrimination (e.g., age discrimination) and depression to improve their couple relationship functioning. As a society, we should see prejudice and discrimination as a primary social problem which requires social change, and regard tackling prejudice and discrimination in all forms as a policy priority. Particularly related to age discrimination for this population, it is important to call for top-down, social and policy interventions as well as bottom-up advocacy to foster positive perceptions of aging (Levy et al., 2014).

Currently, the major types of prejudice-reduction interventions largely include mid-long term educational strategies (including but not limited to school-based interventions); intergroup contact by helping people create closer connections with members of different groups; diversity training and media campaigns (Burnes et al., 2019; Gronholm et al., 2017; Jhangiani & Tarry, 2014; Turner, 2020). The overall program evaluation research suggests that the evidence on the effectiveness is limited and sometimes mixed with different findings (Gronholm et al., 2017; Jhangiani & Tarry, 2014; Turner, 2020). A review of international evidence on prejudice reduction interventions provides a few suggestions for future interventions which can be helpful: "Interventions should be based on social-psychological theories and key lessons from the literature; interventions which facilitate positive intergroup contact, or are based on principles of perspective-taking or empathy-induction are considered to be effective; however, direct attempts at persuading people to recognize and change their attitudes have been known to be ineffective and often have unintentional negative effects; one-off activities make less impact and better results come from sustained activities over a period of time " (Cavanagh, 2015). Overall, research targeting discrimination intervention is lacking and it is important to invest more resources to this line of research.

At the institutional level, it is important and necessary for health care systems, such as health clinics, to establish routinely psychosocial assessments including discrimination and depression when middle-aged and older-aged adults come to see their primary care providers for their annual check-ups. Culturally sensitive training on how to discuss or assess discrimination based on race, age or weight, should be provided for health care providers, so they can assist older people to cope with such experiences or refer to mental health services.

At the individual level, mental health practitioners working with this population should validate their perceived experiences of prejudice, such as negative age stereotypes, help them avoid internalizing these negative experiences and help them to connect these stressful experiences and negative emotions, such as depression. They can also help them to identify protective factors (e.g., spirituality, religiosity, physical exercise, social contact with friends and family members) and their inner unique strengths. In the couple context, it is important for mental health practitioners to help couples recognize the impacts of their own discrimination experience and depression on their partner and help them develop new understanding and empathy for themselves and each other. In addition, as agents of social change, mental health practitioners should also join the efforts of tackling discrimination by advocating for minority groups though policy and laws.

Conclusion

In the current work, I tested a longitudinal mediation model incorporating both psychological and physiological pathways in order to examine if perceived discrimination can strain couple relationship functioning directly and indirectly through the two pathways for middle-aged and older-aged adults in the U.S. Overall, though the current study did not find evidence supporting the pathway from perceived discrimination to couple relationship functioning through allostatic load, it provided evidence supporting depressive symptoms as a mediating mechanism between perceived discrimination and couple relationship functioning. Future work should advance the standards and procedures for allostatic load measurement and measure allostatic load comprehensively to test its mediation role between perceived discrimination and allostatic load. Moreover, effective and culturally responsive interventions and programs are needed to decrease all types of discrimination and depression in order to improve couple relationship functioning among middled-aged and older-aged adults in the U.S.

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