

## ARTICLE

# The asymmetric effects of improving and declining marital satisfaction on cognitive function

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## Abstract

**Objective:** This study examines the association between marital satisfaction and cognitive function, while distinguishing between the effects of improving and declining marital satisfaction. Moreover, potential differences in these asymmetric effects of marital satisfaction between middle-aged and older adults are explored.

**Background:** Marital satisfaction is known to promote cognitive function. However, previous studies have assumed that the effects of improving and declining marital satisfaction are symmetrical.

**Method:** Using seven waves of data from the Korean Longitudinal Study of Aging 2006–2018 ( $N = 7407$ ), we employ a novel asymmetric fixed effects model to estimate the effects of improving and declining marital satisfaction separately. Stratified analyses were conducted by age group and gender.

**Results:** The association between declining marital satisfaction and cognitive function ( $b = -0.292$ ,  $p < .001$ ) was stronger than the association between improving marital satisfaction and cognitive function ( $b = 0.102$ ,  $p < .001$ ). These asymmetric effects were predominantly driven by older adults. The effect of declining marital satisfaction on cognitive function was significantly greater for older adults than middle-aged adults ( $-0.395$  vs.  $-0.148$ ). We did not find gender differences.

**Conclusion:** Findings suggest that the negative impact of declining marital satisfaction on cognitive function outweighs the positive effects of improving marital satisfaction, especially among older adults. Reducing marital dissatisfaction and fostering healthy marital relationships

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are crucial strategies to promote the cognitive well-being of older adults.

#### KEYWORDS

dementia, gender, longitudinal research, marital quality, marital relations, mental health

## INTRODUCTION

Cognitive function is a critical indicator of an individual's well-being and a predictor of future public health trends (Bäckman et al., 2005). Cognitive function is a broad term that represents one's mental capacities. It encompasses several domains including perception, thinking, reasoning, language, and decision-making. Cognitive impairments often serve as early markers for neurodegenerative diseases (Ritchie et al., 2010); these conditions are costly not only in terms of direct medical expenses but also through their impact on increased caregiving responsibilities, lost work productivity, heightened demands on welfare systems, and social exclusion or stigmatization experienced by affected individuals (Wimo et al., 2017). Therefore, investigating factors that shape individuals' cognitive function may provide important empirical evidence that could inform interventions designed to improve individuals' quality of life and reduce societal costs.

Marital quality may be a crucial determinant of cognitive function. Marriage is a unique social institution with a lasting impact on an individual's life course. The consequences of marriage permeate various facets of social life. Marriage directly affects emotional and psychological outcomes, influences behaviors and lifestyles, and reshapes the broader social contexts in which individuals operate (Robles et al., 2014). Given the influential role of marriage on an individual's life experiences, the social dynamics within a marriage may significantly impact cognitive function. Consistent with this perspective, several studies have investigated the relationship between marital quality and cognitive outcomes (Huo et al., 2022; Liu et al., 2021; Xu et al., 2016). Moreover, recent advancements in quasi-experimental design have enriched our understanding of this relationship by addressing potential selection biases (J. Kim & Kwon, 2023).

Although previous studies described above draw from a rich theoretical foundation and provide invaluable empirical evidence regarding the association between marriage and cognitive function, many of these studies exhibit conceptual limitations due to their analytic design (York & Light, 2017). An implicit but common assumption in the empirical models in previous studies is that the influence of marital quality on cognitive outcomes operates symmetrically. This implies that improvements or deteriorations in marital quality influence cognitive outcomes equally but in opposite directions. However, cognitive function may not identically respond to both improvements and declines in marital quality, as the underlying mechanisms driving these associations might differ. Similarly, while marriage and divorce may appear to be opposites, they create distinct life experiences that are not mere reflections of one another.

To address these challenges, our study adopts an approach grounded in asymmetric models (Allison, 2019). Within this framework, the main effects are decomposed into positive and negative changes. This enables distinct interpretations of each effect. We argue that an asymmetric perspective offers a more appropriate lens for examining the relationship between marital quality and cognitive function. While existing theoretical paradigms allude to the effects of either improved or reduced marital quality, they avoid differentiating between them, largely due to the inherent limitations of symmetric models. In this study, we examine potential heterogeneity in asymmetric marital satisfaction effects on cognitive function by age and gender—two crucial demographic factors. We endeavor to determine whether asymmetry in the effects of marital quality is more pronounced in particular demographic groups.

In this study, we use marital satisfaction, a global indicator of marital quality, as a primary determinant of cognitive function. We draw upon a nationally representative panel study from South Korea (hereafter, Korea). Korea's context presents a unique opportunity to examine the relationship between marital satisfaction and cognitive function because people there place a remarkable emphasis on marriage (Raymo et al., 2015). In Korean culture, marital satisfaction is not merely about personal happiness. Rather, marriage serves a larger role. It is a signal of family well-being and it remains a societal expectation. If any asymmetries in the relationship between marital satisfaction and cognitive function exist, they are likely to be pronounced in a context such as Korea. Moreover, Korea's Confucianist and patriarchal traditions uniquely influence marital experiences across different age and gender groups (Lee et al., 2004). This enables us to investigate whether and how improvements or deteriorations in marital satisfaction affect cognitive function differently across demographic groups. This study illuminates novel patterns in the complex relationship between marital satisfaction and cognitive function and may be used to inform policy interventions to promote cognitive health and well-being.

## BACKGROUND

### Marital satisfaction and cognitive function

Cognitive function refers to a diverse set of mental capabilities associated with acquiring, processing, and utilizing knowledge (Salthouse, 2010). These capabilities cover various domains, such as perception, attention, memory, language, problem-solving, decision-making, and executive function (D. C. Park & Reuter-Lorenz, 2008). The implications of declines in cognitive function have been extensively examined in past research. Numerous studies have highlighted the link between cognitive function and an individual's capacity for independent living and involvement in daily activities (Jefferson et al., 2008). Importantly, declines in cognitive function are known to be an early marker of neurodegenerative diseases such as Alzheimer's (Bäckman et al., 2005). Early detection and proactive interventions may delay the onset or mitigate the progression of these diseases (Ritchie et al., 2010). Beyond the individual-level impacts, the consequences of declines in cognitive function are profound; cognitive impairments place significant burdens on families. For instance, caregiving responsibilities have been found to be associated with elevated stress and harmful to the health of caregivers (Schulz & Sherwood, 2008). In addition, a cognitively healthier population translates to decreases in healthcare expenses related to dementia care and associated hospitalizations (Wimo et al., 2017). Therefore, understanding the determinants of cognitive function is vital to address both present and impending public health and population aging challenges.

Marital satisfaction, defined as an individual's sense of fulfillment and happiness within their marital relationship, is widely recognized as a global indicator of marital quality. Although this global measure often relies on an individual's subjective evaluation of satisfaction with marriage, research indicates that this global measure is appropriate to examine what is a complex underlying construct. For instance, one study demonstrated that positive and negative aspects of marriage are distinctively linked to this global indicator and that the nature of this relationship varies between men and women (Boerner et al., 2014). While acknowledging the multidimensional nature of marital dynamics is important, studies have indicated that this overarching measure of marital satisfaction aligns closely with a more comprehensive assessment that captures diverse aspects of marital interactions (Heyman et al., 1994; Ward et al., 2009).

Several potential mechanisms could explain the link between marital satisfaction and cognitive function. First, a satisfying marriage often provides emotional support, which not only acts as a protective buffer but may also generate positive emotions and enhance psychological resources (Cohen & Wills, 1985). Conversely, marital dissatisfaction heightens stress and

negative emotions, potentially impairing cognitive function (Kiecolt-Glaser & Newton, 2001). Second, marital satisfaction may influence behavioral choices and lifestyle habits, which in turn affect cognitive function. Couples in satisfying relationships are more likely to engage in health-promoting behaviors and support each other in maintaining these habits (Chen et al., 2023; DiMatteo, 2004). On the other hand, strained marriages tend to promote riskier behaviors, which could negatively impact cognitive function (Whisman et al., 2006). Third, marital satisfaction shapes an individual's social environment, and this has implications for cognitive functioning. A fulfilling marital relationship provides a vibrant social network that fosters cognitive stimulation through shared activities, conversations, and various types of social engagement (Barnes et al., 2004; Fratiglioni et al., 2004). In contrast, marital dissatisfaction could lead to social isolation marked by limited spousal interaction and detachment from a spouse's social network (Claxton & Perry-Jenkins, 2008; Kearns & Leonard, 2004). In sum, as the dynamics of a marriage evolve over time, they exert effects that ripple across these dimensions, which in turn may influence cognitive trajectories in complex ways.

Previous studies have documented the significant impacts of marital dynamics on cognitive function. However, many of these studies are constrained by an inherent symmetrical perspective that assumes the mechanisms influencing cognitive function operate uniformly, regardless of whether marital satisfaction improves or deteriorates (York & Light, 2017). These studies, therefore, have been unable to explicitly differentiate the potential impacts of improving versus deteriorating marital satisfaction. Our theoretical framework posits that changes in marital satisfaction, be they positive or negative, are driven by distinct mechanisms that influence cognitive function. For instance, a satisfying marital relationship may enhance cognitive function through mechanisms related to emotional support, whereas marital dissatisfaction may predominantly exert its influence via pathways related to stress and negative emotions. These two mechanisms, albeit interrelated, are not simply opposites of one another. We argue that they warrant individual scrutiny. An asymmetrical perspective that discerns the differential impacts of improving and deteriorating marital satisfaction yields a more nuanced and complete understanding of the association between marital satisfaction and cognitive function (Allison, 2019).

## Asymmetric effects of marital satisfaction on cognitive function

By focusing on the mechanisms mentioned above, we can theorize about the contrasting impacts of improving versus deteriorating marital satisfaction on cognitive function. Research highlighting the positive effects of increased marital satisfaction points to the crucial role of emotional support. Having emotional support may positively influence cognitive function by fostering positive emotions and promoting an overall positive psychological state. For example, having emotional support heightens one's sense of belonging and improves one's self-esteem (G. E. Kim et al., 2020; Penninx et al., 1997). Beyond this direct effect, having emotional support may protect individuals from potentially harmful effects of stress by lessening negative perceptions of and reactions to stressful daily events (Cohen & Wills, 1985). Individuals with higher levels of emotional support from their partner may feel as if they have someone to help them through tough moments and circumstances.

In addition, couples in satisfying marriages are more likely to adopt health-promoting behaviors. For instance, regular physical activity, known to promote cognitive functioning, is more prevalent among those in supportive relationships (Kiecolt-Glaser & Newton, 2001). Adhering to medical guidelines and having a balanced nutritional intake, which are behaviors more commonly observed among happy couples, have also been found to have positive implications for cognitive function (Chen et al., 2023; DiMatteo, 2004). Furthermore, a thriving marital relationship provides a conducive environment for cognitive stimulation through social engagement. Regular interactions, shared activities, and diverse dialogues in satisfying marital

contexts can invigorate cognitive processes, thereby helping individuals maintain mental acuity and exercise memory retention (Fratiglioni et al., 2004). Increased social connectedness resulting from a happy marriage can enhance or preserve cognitive function, given that diverse and consistent social engagements are associated with neuroprotective attributes (Barnes et al., 2004).

On the other hand, the consequences of deteriorating marital satisfaction are also significant. The mechanisms behind the effects of a strained marriage in which partners are dissatisfied differ from the mechanisms that undergird the effects of a happy marriage. While studies on improved marital satisfaction highlight the importance of emotional support, those on deteriorating marital satisfaction emphasize the stress and negative emotions resulting from marital dissatisfaction. A decrease in marital satisfaction has been linked to the development of chronic stress, and long-term chronic stress can elevate the risk of cognitive impairments and susceptibility to Alzheimer's disease (Rothman & Mattson, 2010). Negative emotional states arising from low marital satisfaction hinder working memory capacity, which is crucial for everyday information processing tasks (Figueira et al., 2017).

From a behavioral standpoint, those with diminished marital satisfaction are more likely to engage in unhealthy behaviors such as binge drinking (Whisman et al., 2006). Excessive alcohol consumption can harm the fronto-cerebellar circuit, known to be vital for cognitive function regulation (Hayes et al., 2016). Furthermore, diminished marital satisfaction limits interactions between spouses. This curtails activities that promote cognitive stimulation, such as shared leisure activities and attendance to social events (Claxton & Perry-Jenkins, 2008). Dissatisfied marriages may also cause partners to retreat from each other and their shared social circles, which may increase the likelihood of social isolation and loneliness. Both of these factors are linked to an increased risk of Alzheimer's disease and cognitive decline (Wilson et al., 2007).

Although these theoretical frameworks suggest that both improvements and declines in marital satisfaction can significantly impact cognitive function, it remains unclear whether these effects are asymmetrical. The reliance on symmetrical approaches in prior research leaves us without an empirical prior that furthers our understanding about differential effects (York & Light, 2017). Specifically, many previous studies utilize linear regression models with cross-sectional data. Because this approach is based on between-individual variation, it treats the effects of both positive and negative shifts in marital satisfaction as identical, albeit in opposing directions. Similarly, longitudinal studies that use panel data to leverage within-individual variation yield a weighted average of the effects of both marital satisfaction enhancement and deterioration. These approaches may provide misleading results when comparing different groups because distinct mechanisms may underlie similar observed patterns. For instance, a disadvantaged group might suffer more from marital satisfaction deterioration and not gain as much from marital satisfaction improvements. Conversely, an advantaged group might derive more benefit from marital satisfaction improvements and may be better able to mitigate the downsides of the marital relationship better than others. Symmetrical methodological approaches overlook these complexities. Consequently, without models that decompose the effects of marital satisfaction and dissatisfaction, our understanding of these processes remains limited.

## Age heterogeneity in the asymmetric effects of marital satisfaction

The impact of decreasing marital satisfaction on cognitive function may be more pronounced among older adults than middle-aged adults. Older adults tend to be more vulnerable to cognitive decline and neurodegenerative diseases such as Alzheimer's disease (Gonzales et al., 2022). Age-related changes in the brain, such as reduced neuroplasticity and increased susceptibility to oxidative stress, make older adults more susceptible to negative effects of stress and psychological distress caused by marital dissatisfaction (Kline & Mega, 2020). Furthermore, the natural



predisposition to develop cognitive declines as one ages lessens the likelihood of enhanced cognitive performance due to improved marital satisfaction among older adults. Moreover, compared to middle-aged adults, older adults often have limited opportunities to bolster their cognitive reserve, which refers to the brain's capacity to manage cognitive deterioration through preexisting cognitive skills, educational attainment, and life experiences (Ablitt et al., 2009). Consequently, the negative impact of decreasing marital satisfaction on cognitive function may outweigh the positive effects of increasing marital satisfaction, given that older adults may possess fewer resources and means to counteract cognitive declines (Pettigrew & Soldan, 2019).

The asymmetric effects of improving versus deteriorating marital satisfaction might vary by age group due to psychological factors. Older adults often grapple with chronic stressors and negative experiences over an extended period of time, including within their marital relationships (G. R. Park & Kim, 2023). Prolonged exposure to stress can lead to cumulative damage to cognitive function (J. Kim & Park, 2023a). Consequently, the negative impact of decreasing marital satisfaction, typically accompanied by chronic stress, may accumulate over time and result in more significant cognitive impairments for older adults compared to middle-aged adults. Moreover, marital dissatisfaction has a broader impact on the overall well-being of older adults compared to middle-aged adults. This is because older adults lean more heavily on their partners for emotional support (Cornwell & Waite, 2009). When marital satisfaction decreases, the resulting emotional distress can have a more profound effect on their well-being (Carr et al., 2016), which could further cognitive decline.

Behavioral and social perspectives also suggest that adverse impacts of deteriorating marital satisfaction may be stronger for older adults compared to middle-aged adults. While heightened marital satisfaction motivates younger individuals to be physically active, older adults often suffer from physical limitations and other health challenges. These changes limit their ability to modify their activity habits dramatically. Similarly, dietary routines of older individuals are typically more ingrained and less adaptable to changes in marital satisfaction. Conversely, extensive research indicates that a decline in marital satisfaction can lead to engagement in risky behaviors such as heavy alcohol consumption (Bulanda et al., 2023). Given older adults' predisposition to cognitive decline, the ramifications of such behaviors may be immediate and profound (Topiwala & Ebmeier, 2018). Furthermore, older adults tend to navigate smaller social networks due to life events such as retirement or health problems. As their social circles become smaller, their reliance on their partners for social interaction might intensify with age (E. Y. Cornwell & Waite, 2009). A strained marital relationship can thus lead to feelings of loneliness and social isolation, both of which are closely linked to cognitive decline among older adults (Wilson et al., 2007).

## Gender heterogeneity in the asymmetric effects of marital satisfaction

Previous studies have extensively explored how gender moderates the relationship between marital satisfaction and mental health, but the results of these studies have been mixed (Proulx et al., 2007). Gender disparities might exist for several reasons. These reasons may be separated into biological and psychosocial dimensions. However, research on the former is limited. Some research suggests that sex hormones, specifically testosterone and estrogen, accelerate cognitive decline, but these findings are not definitive (Boss et al., 2014). Given the existing ambiguity surrounding neurobiological differences between men and women, a more fruitful approach is to examine how marital satisfaction influences psychosocial factors such as psychological status, behaviors, and social life differently across genders.

Previous literature emphasizes that marital satisfaction impacts women more than men. Social role theory posits that, through socialization processes, women and men internalize distinct social roles. Women are traditionally socialized to be caregivers and tend to be more

emotionally invested in relationships compared to men (Eagly, 1997). Cross and Madson (1997) found gender differences in constructions of the self; while men often fostered an independent self-construal, women leaned toward an interdependent self-construal. Due to this divergence in self-definition, women are more inclined to internalize changes in the marital relationship as personal, rather than as a byproduct of relational dynamics (Moberg & Lazarus, 1990). This intensified sense of relational duty could amplify the association between marital satisfaction and cognitive function in women. In support of this, previous research has documented that marital status is more closely associated with depressive symptoms among women than men (Beach et al., 2003).

While studies highlighting how changes in the marital relationship may disproportionately impact women focus on internal psychological processes, those suggesting a more pronounced effect among men emphasize changes in external factors, such as behavior and social interactions. Coping mechanisms in response to a dissatisfied marriage may differ by gender. Men might be more inclined to adopt maladaptive coping methods, such as increased substance abuse or avoidance behaviors, that exacerbate cognitive decline (Leonard & Eiden, 2007). In contrast, women may be more likely to seek social support outside of their marital relationship or engage in healthier coping strategies (Yang et al., 2023), mitigating the negative effects on cognitive function. Social engagement patterns in relation to marital dynamic shifts may also vary by gender. Some research suggests that men are less proactive in cultivating and sustaining social ties compared to women (Klaus, 2021). Married men often engage in social activities or access social networks largely influenced by their wives' initiatives (Bookwala, 2017; Kalmijn, 2007). Thus, the deterioration of a marital relationship might lead to men's estrangement from social circles and might decrease their engagement in social activities, while women's social involvement might remain relatively stable (B. Cornwell, 2011). These behavioral and social mechanisms hint at a potentially stronger association between marital satisfaction and cognitive function among men.

## The Korean context

In Korea, marriage holds profound societal and cultural significance. Rooted in Confucian traditions that emphasize family unity, marriage is often considered as a foundational aspect of adulthood and an important achievement in someone's social life. In such a cultural context, an individual's marital status can influence their social standing, sense of identity, and perceived role within their community. Even amidst rapid modernization and evolving family dynamics, the value placed on marriage persists. For instance, a sizable proportion of the population still regards marriage as an indispensable social institution (Raymo & Park, 2020). Although recent years have seen a decline in marriage rates in Korea, 98% of individuals born between 1985 and 1989 were married by age 45 (Raymo & Park, 2020). In terms of divorce, only 5% of marriages from the 1991 cohort ended within the first 5 years (H. Park & Raymo, 2013). This figure stands in stark contrast to the nearly double divorce rate observed in the United States (Abdel-Sater, 2022). Given the salience of marriage in the Korean context, it is reasonable to posit that marital satisfaction is a key determinant shaping cognitive function.

Korea's cultural context offers unique marital experiences shaped by age and gender. Embedded in its collectivist culture, an individual's social identity is defined by their relationships and obligations to others (Triandis, 1989). Often, this social identity is anchored in traditional roles, such as marriage. The importance of marriage amplifies with age, as individuals confront potential identity shifts due to retirement and diminished social interactions with broader social networks. Research indicates that individuals' social network size in Korea decreases more drastically with age than it does in the United States (Yee, 2000). Consequently, in one's later years, marriage emerges as a paramount source of support and companionship

(Cheng & Chan, 2006). Furthermore, Korea's patriarchal culture delineates distinct social roles and responsibilities for men and women. Traditionally, Korean men have been viewed as breadwinners, while women have been expected to manage household chores, nurture family ties, and care for family members (Lee et al., 2004). Given women's traditional caregiving roles, it is plausible that men's cognitive function is in part sustained by the support they receive from their spouses (J. Kim & Kwon, 2023). Hence, the heterogeneity in the association between marital satisfaction and cognitive function by age and gender might manifest more prominently in the Korean context.

## The present study

This study utilizes seven waves of data from the Korean Longitudinal Study of Aging (KLoSA) to examine the relationship between marital satisfaction and cognitive function. For our analyses, we first estimate standard fixed effects (FE) models to investigate whether there is a longitudinal association between marital satisfaction and cognitive function when accounting for unobserved individual-level heterogeneity. It is worth noting that standard FE models assume symmetrical effects of both increasing and decreasing marital satisfaction. This may obscure any true asymmetric effects. To overcome this limitation, we also estimate asymmetric FE models which decompose the independent variable into positive (representing an increase in marital satisfaction) and negative (representing a decrease in marital satisfaction) components. This approach enables estimation of the effects of both increasing and decreasing marital satisfaction separately. Furthermore, considering the theoretical discussions surrounding age differences in cognitive reserve, access to resources, and the significance of partnership, we conduct age-stratified analyses to explore potential differences in the asymmetric effects of marital satisfaction on cognitive function between middle-aged and older adults. In addition, we further stratify by gender to investigate whether asymmetric effects of marital satisfaction vary by gender.

## DATA AND METHODS

### Data

The data utilized in this study were obtained from the KLoSA, a nationally representative longitudinal study focusing on adults aged 45 years and older in Korea. Since 2006, the KLoSA has conducted biennial surveys to collect information on various characteristics such as socioeconomic status, mental health, and physical health among older adults. The sampling frame for the study was created based on enumeration districts derived from the Population and Housing Census of Korea Statistics. Survey participants were selected using a multi-stage stratified sampling process that took into account their housing type (apartment or regular housing) and geographical location (urban or rural). This study relied on longitudinal data spanning 12 years, from 2006 (Wave 1) to 2018 (Wave 7). All participants provided informed consent, and the data were anonymized prior to being uploaded to a publicly accessible database. Ethical approval was exempted as the study involved secondary analysis of publicly available data.

Of the total 53,717 observations across seven waves, 41,162 (76.63%) were observations of individuals who remained married at the time of the survey. The primary reason for becoming unmarried was widowhood, accounting for 20.66% of cases, followed by divorce at 2.07% and separation at 0.65%. Cases of transitioning out of a marital union were excluded since questions about marital satisfaction were only posed to currently married respondents. From the 41,162 observations, 647 had to be omitted due to the inability to compute the transition variable for



marital satisfaction between two waves. This resulted in 40,515 eligible observations across seven waves.

Of the eligible observations described above, 1526 observations (3.8%) were excluded due to suspected dementia based on a Korean Mini-Mental State Examination (K-MMSE) score of 17 or lower (G. R. Park & Kim, 2022). Additionally, 1487 observations (3.8%) were dropped due to missing values on the dependent variable, and 695 observations (1.9%) were excluded due to missingness on the independent and control variables. As a result, the analysis was conducted using 36,807 observations (6896 participants for Wave 1, 6114 for Wave 2, 5429 for Wave 3, 5048 for Wave 4, 4758 for Wave 5, 4476 for Wave 6, and 4086 for Wave 7). Given the unbalanced nature of the panel data structure, the final analytic sample size—defined as the number of respondents with valid data points in any of the waves—consisted of 7407 respondents. This sample size exceeds the number of observations from the initial wave. This discrepancy exists because some respondents were missing from the initial wave due to data missingness but then they reappear in subsequent waves with complete data.

## Measures

### Dependent variable

Cognitive function was assessed using the K-MMSE, a validated measure established by previous research (T. H. Kim et al., 2010). The K-MMSE is a brief 30-point questionnaire designed to assess cognitive function. The K-MMSE evaluates a range of cognitive domains, including time orientation (year, month, date, day of the week, and season), place orientation (4 items in their address), registration (3 random words), attention (Serial subtraction of 7 from 100), recall (initial 3 words), language (naming of watch and pen, following idiom, following the 3 steps, following order, and writing 1 full sentence), and visual construction (figure copying with 2 overlapping pentagons). The K-MMSE has a sensitivity of 0.70–0.83 for detecting dementia (T. H. Kim et al., 2010). The K-MMSE is a reliable measure; it has a Cronbach's alpha of .84 and a test–retest reliability score of 0.85 (Jeong et al., 2004). The K-MMSE scores range from 0 to 30.

### Independent variable

Marital satisfaction was evaluated using a single-item measure based on the following question: "In general, how satisfied are you with your marriage?" Participants were asked to rate their overall satisfaction with their marriage on a scale from 0 to 100, with a 10-point increments. Higher scores indicated higher levels of marital satisfaction. For ease of interpretation, we standardized marital satisfaction scores to have a mean of zero and a standard deviation of one.

### Control variable

Our models include a comprehensive set of control variables. We adjust for sociodemographic characteristics including age, gender, educational attainment (categorized into four groups: elementary or lower, middle school, high school, and college or higher), number of children, household size, and region of residence (categorized into three groups: large city, small city, and rural area). Inclusion of these control variables is intentional as previous research has recognized their relevance. Cognitive abilities decline with age (Harada et al., 2013). Cognitive function and marital satisfaction vary by gender (J. B. Jackson et al., 2014; Levine et al., 2021).

Educational attainment has shown to be associated with cognitive reserves and coping mechanisms that can impact cognitive function (Fletcher et al., 2021). The number of children and household size might affect stress levels as well as available cognitive resources, and region of residence may reflect cultural, environmental, and lifestyle differences that might influence both marital satisfaction and cognitive function (Kowal et al., 2021).

In addition to sociodemographic control variables, we also include the following three economic control variables: household income (logged), homeownership (based on whether the respondent lived in owner-occupied or privately rented housing), and economic activity (determined by whether the respondent was economically active). Household income can influence both marital satisfaction and cognitive function by influencing the levels of stress, access to health care, and overall quality of life (Cagney & Lauderdale, 2002; G. L. Jackson et al., 2017). Homeownership not only represents financial stability, it may also be indicative of a settled, structured environment that fosters healthy marital relationships and potentially supports cognitive function (Cagney & Lauderdale, 2002; Ryu & Fan, 2023). Economic activity or employment status can influence self-worth, daily routines, and social interactions, all of which can have ripple effects on marital dynamics and cognitive well-being (Zülke et al., 2021).

In addition to sociodemographic and economic control variables, we control for the following health-related variables: number of chronic diseases (measured by the sum of 10 doctor-diagnosed chronic conditions: hypertension, diabetes mellitus, cancer, chronic lung disease, liver disease, heart disease, cerebrovascular disease, psychological disease, arthritis or rheumatoid arthritis, and prostatic disease), activities of daily living (ADLs) score (determined by whether the respondent reported needing assistance with at least one of the following seven activities: dressing oneself, washing one's face, bathing oneself, eating, going out of the room, using a toilet, and regulating urine and bowel movements), and depressive symptoms (measured by the 10-item Center for Epidemiological Studies-Depression scale). The number of chronic diseases can directly influence cognitive function. Indeed, conditions such as hypertension, diabetes, and cardiovascular diseases have known cognitive implications (Maresova et al., 2019). Additionally, these diseases may impact marital satisfaction by introducing stress, caregiving demands, and/or emotional strain into a relationship (Korporaal et al., 2013). The ADLs score can be a direct marker of one's functional health and independence. A lower ADLs score, indicating greater dependence, may affect both marital dynamics and cognitive capacities (Fang et al., 2001; Sun et al., 2022).

## Statistical analysis

To examine the relationship between marital satisfaction and cognitive function, this study begins with conventional pooled ordinary least squares (OLS) models:

$$y_{it} = \alpha + \beta MS_{it} + \mathbf{X}_i \delta + \mathbf{Z}_{it} \delta + \varepsilon_{it}$$

$y_{it}$  refers to the cognitive function of individual  $i$  at time  $t$ . The independent variable,  $MS_{it}$ , refers to marital satisfaction of individual  $i$  at time  $t$ .  $\mathbf{X}_i$  denotes a vector of time-constant covariates, and  $\mathbf{Z}_{it}$  represents a vector of time-varying covariates. Time-constant covariates include gender, educational attainment, and number of children. Time-varying covariates include age, marital status, household size, logged household income, homeownership, economic activity, place of residence, number of chronic diseases, ADLs, and depressive symptoms.  $\varepsilon_{it}$  is the idiosyncratic error term that varies with individuals and time. Pooled OLS estimates may be biased due to unobserved individual-level heterogeneity. For example, unobserved factors, such as personality traits, marital history, genetics, preexisting

cognitive reserve, home environment, and cultural background, may influence both marital satisfaction and cognitive function (Sayehmiri et al., 2020).

The application of standard FE models helps alleviate potential confounding or selection bias that could emerge from individual characteristics that influence both marital satisfaction and cognitive function. By leveraging within-person variation, standard FE models effectively address potential biases stemming from unobserved time-invariant confounding factors. The general form of standard FE models is as follows:

$$y_{it} = \alpha + \beta MS_{it} + Z_{it}\delta + \nu_i + \varepsilon_{it}$$

Individual FE, denoted as  $\nu_i$ , account for individual-specific and time-invariant factors. Time-constant covariates ( $X_i$ ) are omitted from models as they are absorbed by  $\nu_i$ . The coefficient  $\beta$  represents the within-person association between marital satisfaction and cognitive function. While standard FE models yield more robust estimates than pooled OLS models, they assume symmetrical effects of the independent variable and therefore imply that the magnitude of the effect of increasing marital satisfaction is identical to but in the opposite direction as the effect of decreasing marital satisfaction. To relax this assumption and allow for different magnitudes of both effects, we employ asymmetric FE models (Allison, 2019). To implement asymmetric FE models, we first decompose the independent variable into positive and negative components:

$$MS_{it}^+ = MS_{it} - MS_{it-1} \text{ if } (MS_{it} - MS_{it-1}) > 0, \text{ otherwise } 0$$

$$MS_{it}^- = -(MS_{it} - MS_{it-1}) \text{ if } (MS_{it} - MS_{it-1}) < 0, \text{ otherwise } 0$$

$MS_{it}^+$  represents increasing marital satisfaction and  $MS_{it}^-$  represents decreasing marital satisfaction. For  $t = 1$ , both  $MS_{it}^+$  and  $MS_{it}^-$  are 0 because there are no preceding wave observations. We then construct the accumulation variables defined as follows:

$$D_{it}^+ = \sum_{s=1}^t MS_{is}^+, D_{it}^- = \sum_{s=1}^t MS_{is}^-$$

$D_{it}^+$  represents the accumulation of all previous positive changes in marital satisfaction up to time  $t$ , while  $D_{it}^-$  represents the accumulation of all previous negative changes in marital satisfaction up to time  $t$ . This approach allows us to estimate the effects of increasing and decreasing marital satisfaction separately within FE models. For a more detailed discussion of this model, see Allison (2019). The following equation represents our preferred asymmetric FE model:

$$y_{it} = \alpha + \beta^+ D_{it}^+ + \beta^- D_{it}^- + Z_{it}\delta + \nu_i + \varepsilon_{it}$$

Within the FE framework, the coefficient  $\beta^+$  represents effects of increasing marital satisfaction, while  $\beta^-$  represents effects of decreasing marital satisfaction. To assess the equality of these effects, we conducted a Wald test for each model comparing  $\beta^+$  and  $\beta^-$ . Furthermore, we performed stratified analyses by age group to investigate potential differences in asymmetric effects of marital satisfaction between middle-aged and older adults. We use 65 years old as the threshold to distinguish between middle-aged and older adults because of the general consensus that this usually marks the beginning of older adulthood. This age cutoff, often seen as the retirement threshold in many countries, is also relevant due to the fact that it represents a period in the life course in which individuals develop more aging-related health issues.

As with most longitudinal studies involving older adults, the KLoSA is subject to the problem of sample attrition. The sample reduces in size from mortality and other factors such as study drop-out. To assess the potential impact of attrition-related selection bias on the relationship between marital satisfaction and cognitive function, we conduct a sensitivity analysis employing the inverse of the estimated probability of attrition (known as inverse probability weighting [IPW]) (Wooldridge, 2010). Using sociodemographic, economic, and health-related variables, we first estimate the predicted probability of an individual's continued participation in the study—that is, staying alive and not dropping out. Then, we calculate analytical weights from these probabilities, which were inversely proportional to the likelihood of survival and ongoing study involvement. Finally, we incorporate these weights into our analyses to explore the association between marital satisfaction and cognitive ability. Our findings confirmed that when we use IPW to account for attrition bias, our main study results and conclusions remain unchanged (results from these sensitivity analyses are available in Table S1 in the Online Supplementary File).

## RESULTS

Table 1 presents the sample characteristics of 7407 participants from Wave 1, stratified by age group (middle-aged vs. older adults). Approximately 48% of respondents were female. The mean age was 58.59 ( $SD = 9.6$ ). About 45% of the participants completed a high school education or higher. The mean cognitive function score was 27.09, with a standard deviation of 2.98, while the mean (unstandardized) marital satisfaction score was 71.92, with a standard deviation of 19.17. Significant differences between age groups were observed in all variables, except for homeownership. Middle-aged participants exhibited higher cognitive function (27.73 vs. 25.61) and greater marital satisfaction (72.46 vs. 70.67) compared to older adults.

Figure 1 presents the distribution of changes in marital satisfaction across survey waves. For approximately 25–35% of respondents in each wave, marital satisfaction did not change from what it was in the previous wave. The percentage of respondents for whom marital satisfaction remained stable across waves increased over time. The percentage of respondents who experienced an increase in marital satisfaction ranged from 29.47% (from Wave 1 to Wave 2) to 35.68% (from Wave 5 to Wave 6). Similarly, the percentage of respondents experiencing a decrease in marital satisfaction varied from 28.46% (from Wave 5 to Wave 6) to 44.70% (from Wave 1 to Wave 2). The distribution of temporal changes in marital satisfaction by age group is available in Figure S1 in the Online Supplementary File.

Table 2 presents the estimated associations between marital satisfaction and cognitive function. Columns 1, 2, and 3 show results for the pooled OLS, standard FE, and asymmetric FE models, respectively. The pooled OLS models in Column 1 indicate that there is a significant association between marital satisfaction and higher levels of cognitive function ( $b = 0.236$ ,  $p < .001$ ). As shown in Column 2, when accounting for unobserved individual heterogeneity, the association between marital satisfaction and cognitive function attenuates by approximately 16%. However, even after controlling for unobserved individual heterogeneity, the association remains statistically significant ( $b = 0.198$ ,  $p < .001$ ). This suggests unobserved heterogeneity at the individual level confounds a portion of the observed association between marital satisfaction and cognitive function.

To relax the assumption of symmetric effects of marital satisfaction, we employed asymmetric FE models (Column 3). The results in Column 3 demonstrate that a decrease in marital satisfaction is associated with a decrease in cognitive function, whereas an increase in marital satisfaction is associated with an increase in cognitive function. However, the association between decreasing marital satisfaction and cognitive function ( $b = -0.341$ ) is stronger than the association between increasing marital satisfaction and cognitive function ( $b = 0.102$ ). A Wald

**TABLE 1** Summary statistics, KLoSA ( $N = 7407$ ).

	(1)				(2)	(3)	Diff. (2) vs. (3)
	Total				Middle-aged adults ( $<65$ years old)	Older adults ( $\geq 65$ years old)	
	Mean/ Prop.	SD	Min.	Max.	Mean/Prop.	Mean/Prop.	
<i>Dependent variable</i>							
Cognitive function (MMSE)	27.09	2.98	18.00	30.00	27.73	25.61	<sup>a</sup>
<i>Independent variable</i>							
Marital satisfaction <sup>b</sup>	71.92	19.17	0.00	100.00	72.46	70.67	<sup>a</sup>
<i>Time-constant covariates</i>							
Female	0.48		0.00	1.00	0.53	0.37	<sup>a</sup>
Elementary or lower	0.37		0.00	1.00	0.26	0.60	<sup>a</sup>
Middle school	0.18		0.00	1.00	0.21	0.13	<sup>a</sup>
High school	0.32		0.00	1.00	0.39	0.18	<sup>a</sup>
College or higher	0.13		0.00	1.00	0.14	0.08	<sup>a</sup>
Number of children	2.85	1.33	0.00	9.00	2.41	3.88	<sup>a</sup>
<i>Time-varying covariates</i>							
Age	58.89	9.60	45.00	92.00	53.75	70.88	<sup>a</sup>
Married	1.00		0.00	1.00	1.00	1.00	<sup>a</sup>
Household size	3.13	1.25	1.00	11.00	3.31	2.70	<sup>a</sup>
Logged household income	6.75	2.02	0.00	11.00	7.14	5.79	<sup>a</sup>
Homeownership	0.80		0.00	1.00	0.79	0.81	
Economic activity	0.46		0.00	1.00	0.56	0.25	<sup>a</sup>
Large city	0.45		0.00	1.00	0.46	0.41	<sup>a</sup>
Small city	0.33		0.00	1.00	0.35	0.29	<sup>a</sup>
Rural	0.22		0.00	1.00	0.19	0.30	<sup>a</sup>
Number of chronic diseases	0.64	0.90	0.00	7.00	0.48	1.01	<sup>a</sup>
ADLs	0.02		0.00	1.00	0.01	0.05	<sup>a</sup>
Depressive symptoms	2.51	2.38	0.00	10.00	2.25	3.11	<sup>a</sup>
Observations	7407				5182	2225	<sup>a</sup>

*Note:* Summary statistics are based on 2006 data. Chi-squared tests for categorical variables and  $t$  tests for continuous variables were performed.

Abbreviation: ADLs, activities of daily living.

<sup>a</sup>Differences are statistically significant,  $p < .05$ .

<sup>b</sup>This measure was standardized in the regression models.



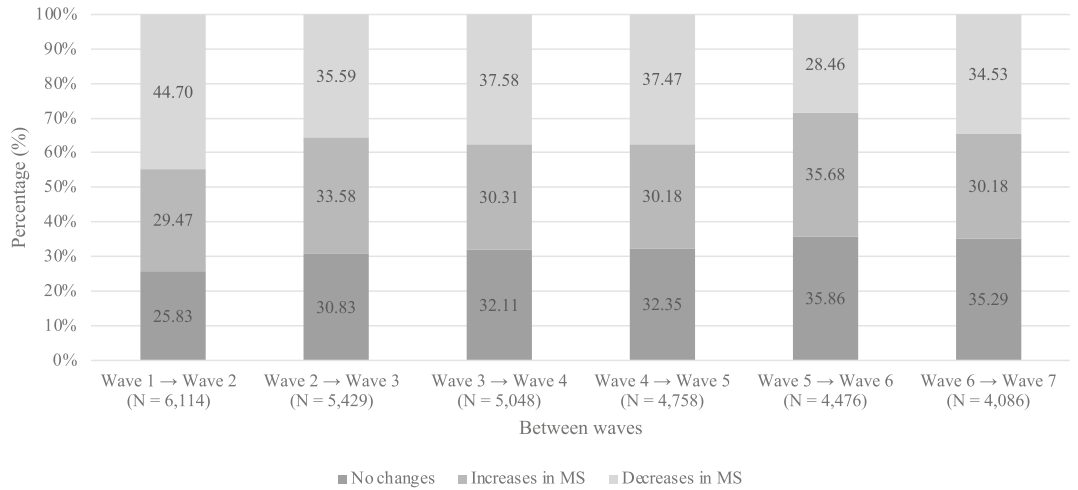


FIGURE 1 Temporal changes in marital satisfaction between waves. MS, marital satisfaction.

TABLE 2 Effects of marital satisfaction on cognitive function.

	(1)	(2)	(3)
	Cognitive function	Cognitive function	Cognitive function
Sample	Total	Total	Total
Estimation model	Pooled OLS	FE	FE
Time-constant covariates	Yes	No	No
Time-varying covariates	Yes	Yes	Yes
Marital satisfaction	0.236*** (0.021)	0.198*** (0.024)	
Increases in marital satisfaction (A)			0.102** (0.032)
Decreases in marital satisfaction (B)			−0.292*** (0.032)
p-Value for (A) = −(B)			.0000***
N (observations)	36,807	36,807	36,807

Note: Robust standard errors are shown in parentheses. All models include survey year dummy variables. Time-constant covariates include gender, educational attainment, and number of children. Time-varying covariates include age, marital status, household size, logged household income, homeownership, economic activity, place of residence, number of chronic diseases, ADLs, and depressive symptoms. Abbreviations: FE, fixed effects; OLS, ordinary least squares; RE, random effects. \*\* $p < .01$ . \*\*\* $p < .001$ .

test to assess whether 0.102 is statistically different from 0.292 confirmed that the difference is statistically significant ( $p < .001$ ). These findings indicate that the effects of marital satisfaction on cognitive function are asymmetric. Assuming symmetrical effects can mask that the impact of decreasing marital satisfaction is greater than the impact of increasing marital satisfaction.

Table 3 presents asymmetric FE estimates of the associations between marital satisfaction and cognitive function by age group (Column 1 for middle-aged adults and Column 2 for older adults). As shown in Column 1, for middle-aged adults, results indicate symmetrical effects of marital satisfaction: a decrease in marital satisfaction is associated with a decrease in cognitive function ( $b = -0.148$ ), whereas an increase in marital satisfaction is associated with an increase in cognitive function ( $b = 0.132$ ). However, effects of increasing and decreasing marital satisfaction are not statistically significant. In contrast, results in Column 2 show that the effects of

**TABLE 3** Effects of marital satisfaction on cognitive function, by age group.

	(1) Cognitive function	(2) Cognitive function
Sample	Middle-aged adults	Older adults
Estimation model	FE	FE
Time-constant covariates	No	No
Time-varying covariates	Yes	Yes
Increases in marital satisfaction (A)	0.132*** (0.035)	0.035 (0.063)
Decreases in marital satisfaction (B)	−0.148*** (0.034)	−0.395*** (0.059)
<i>p</i> -Value for (A) = −(B)	.7258	.0000***
<i>N</i> (observations)	20,300	16,507

*Note:* Robust standard errors are shown in parentheses. All models include survey year dummy variables. Time-constant covariates include gender, educational attainment, and number of children. Time-varying covariates include age, marital status, household size, logged household income, homeownership, economic activity, place of residence, number of chronic diseases, ADLs, and depressive symptoms.

Abbreviation: FE, fixed effects.

\*\*\**p* < .001.

marital satisfaction on cognitive function are asymmetric among older adults. According to the Wald test, there are significantly greater effects of decreasing marital satisfaction ( $b = -0.395$ ) compared to increasing marital satisfaction in this age group ( $b = 0.035$ ). Furthermore, using a postestimation test from the seemingly unrelated estimation procedure, we found that effects of decreasing marital satisfaction are significantly greater for older adults than middle-aged adults ( $p < .001$ ).

Before exploring potential gender differences in asymmetric effects of marital satisfaction between middle-aged and older adults, we first investigate whether there are gender disparities in asymmetric impacts of marital satisfaction on cognitive function (Table S2 in the Online Supplementary File). Gender-specific models suggest that there are no statistically significant gender differences in asymmetric effects. Specifically, both for men and women, decreasing marital satisfaction has a more pronounced effect on cognitive function than increasing marital satisfaction does.

Models in Table 4 investigate whether there are gender differences in asymmetric effects of marital satisfaction between middle-aged and older adults. Columns 1 and 2 present results for women and men in the middle-aged group, while Columns 3 and 4 display results for women and men in the older group. Gender-stratified analyses did not reveal any significant gender differences in patterns of asymmetric effects of marital satisfaction among middle-aged adults (Columns 1 and 2) or in patterns of asymmetric effects of marital satisfaction among older adults (Columns 3 and 4). A postestimation test based on the seemingly unrelated estimation procedure also failed to find gender differences in the middle-aged and older adult groups.

## DISCUSSION

Marital satisfaction plays a crucial role in an individual's health, overall well-being, and quality of life (South & Krueger, 2013). Recent studies have further emphasized the positive association between marital satisfaction and cognitive function (Liu et al., 2021; Xu et al., 2016). This study focused on a nationally representative sample of middle-aged and older adults in Korea and utilized an asymmetric FE model to separately estimate the effects of increasing and decreasing marital satisfaction on cognitive functioning. Consistent with prior research, results from

**TABLE 4** Effects of marital satisfaction on cognitive function, by age group and gender.

	(1)	(2)	(3)	(4)
	Cognitive function	Cognitive function	Cognitive function	Cognitive function
Sample	Middle-aged female adults	Middle-aged male adults	Older female adults	Older male adults
Estimation model	FE	FE	FE	FE
Time-constant covariates	No	No	No	No
Time-varying covariates	Yes	Yes	Yes	Yes
Increases in marital satisfaction (A)	0.120* (0.047)	0.155** (0.053)	−0.048 (0.096)	0.115 (0.083)
Decreases in marital satisfaction (B)	−0.144** (0.047)	−0.153** (0.049)	−0.307*** (0.093)	−0.458*** (0.076)
<i>p</i> -Value for (A) = −(B)	.7079	.9743	.0076**	.0026**
<i>N</i> (observations)	11,035	9265	6825	9682

*Note:* Robust standard errors are shown in parentheses. All models include survey year dummy variables. Time-constant covariates include gender, educational attainment, and number of children. Time-varying covariates include age, marital status, household size, logged household income, homeownership, economic activity, place of residence, number of chronic diseases, ADLs, and depressive symptoms.

Abbreviation: FE, fixed effects.

\**p* < .05. \*\**p* < .01. \*\*\**p* < .001.

standard FE models that assume symmetrical effects of marital satisfaction confirmed that there is a statistically significant relationship between marital satisfaction and cognitive function. Standard FE models suggest that the effects of increasing marital satisfaction on cognitive function are equal in magnitude to the effects of decreasing marital satisfaction. However, asymmetric FE models revealed that the impact of declining marital satisfaction on cognitive function is stronger than the impact of increasing marital satisfaction. These findings underscore the importance of relaxing the assumption of symmetry regarding the effects of marital satisfaction. An asymmetrical effects perspective offers a more comprehensive understanding of how marital satisfaction influences cognitive function among middle-aged and older adults.

The asymmetrical effects of marital satisfaction on cognitive function can be explained by several factors. The gradual erosion of cognitive function in unsatisfying marriages may be linked to accumulated stress, negative emotions, and strained interactions (Shrout et al., 2023). On the other hand, positive effects of increasing marital satisfaction may primarily influence emotional well-being rather than long-term cognitive outcomes (Carr et al., 2014). While an improvement in marital satisfaction can lead to immediate enhancements in emotional state, its direct influence on cognitive function may be more limited. Furthermore, decreasing marital satisfaction often coincides with the adoption of unhealthy coping behaviors, including increased alcohol consumption or substance abuse (Whisman et al., 2006), which elevate the risk of cognitive decline (Hayes et al., 2016). These detrimental behaviors can undermine cognitive function over time and contribute to the asymmetric effects observed. In contrast, although increasing marital satisfaction may promote healthier behaviors, such as engaging in positive health practices, the cognitive benefits derived from these changes may not have a direct impact on cognitive function. Cognitive improvements resulting from healthier behaviors may take more time to manifest or may not have a significant impact on cognitive function alone.

This study revealed heterogeneity in the asymmetric effects of marital satisfaction based on age group, but not gender. This study found that the impact of decreasing marital satisfaction on cognitive function is stronger among older adults than middle-aged older adults. This may be due to older adults' heightened vulnerability to cognitive decline and neurodegenerative

diseases (Gonzales et al., 2022). Age-related brain changes, reduced neuroplasticity, and increased susceptibility to stress make older adults more susceptible to the negative effects of marital dissatisfaction. Moreover, aging limits the potential for cognitive improvement through increased marital satisfaction and reduces opportunities to build cognitive reserve (Ablitt et al., 2009). Chronic stress and negative experiences within marriages accumulate over time, damaging cognitive function in older adults. Marital satisfaction has a broader positive impact on the general well-being of older adults, who rely heavily on marriages for support and companionship (Yoon et al., 2022). Marriage gains significance with age as it serves as the primary source of emotional support for folks who are married, especially in cultures that value marriage. Decreased marital satisfaction worsens emotional distress, magnifies feelings of isolation, and disrupts an importance source of social support. All of these may exacerbate cognitive decline in older adults.

However, our results also indicate that improvements in marital satisfaction can enhance cognitive function, especially among middle-aged adults. Most extant longitudinal studies examining the influence of marital satisfaction on cognitive function or mental health primarily focus on the detrimental effects of declines in marital satisfaction (J. Kim & Kwon, 2023). Some studies have attempted to measure positive and negative aspects of marital quality separately, using distinct question sets within the same model (Huo et al., 2022; Xu et al., 2016). However, this approach has conceptual and methodological limitations. It presupposes that an increase in positive marital experiences has an effect equal in magnitude but opposite in direction to a decrease in such experiences, and similarly for negative experiences. Moreover, introducing both positive and negative measures in the same model likely introduces biases, given the potential control of postexposure variables (Elwert & Winship, 2014). To the best of our knowledge, our study is among the first studies to disentangle the effects of increasing and decreasing marital satisfaction on cognitive function. Findings suggest that the benefits of improving marital satisfaction extend beyond emotional and mental well-being and may actually promote cognitive “regeneration” among middle-aged adults.

While we identified notable age-related differences in the asymmetric association between marital satisfaction and cognitive function, our findings did not detect gender differences. This aligns with previous research that also reported no discernable gender differences in the link between marital quality and mental health or cognitive outcomes (Xu et al., 2016). The existing theoretical perspectives posit two primary mechanisms that might lead to divergent patterns. From a psychological standpoint, due to their relationship-oriented psychological attributes, women may be more susceptible to marital dynamics than men (Moberg & Lazarus, 1990). On the other hand, changes in marital satisfaction may have a stronger impact on men’s behaviors and social arrangements due their inclination toward maladaptive coping behaviors and dependence on their wives for social engagements (B. Cornwell, 2011; Kalmijn, 2007). These gender-specific mechanisms may have neutralized any gender differences in the asymmetric association between marital satisfaction and cognitive function. Another plausible explanation can be drawn from the literature on role convergence in older married couples. As couples grow older together, experiencing life events such as retirement or moving beyond the child-rearing phase, they often exhibit increased similarity in their biological, psychological, and behavioral traits (Lewis & Yoneda, 2021). This increasing similarity may lead to more homogeneous responses from both men and women to shifts in marital dynamics.

Our study draws from data in Korea and, in doing so, it offers a unique context to examine the implications of marital satisfaction. The deep-rooted cultural and societal emphasis on marriage in Korea enables us to unpack the complex asymmetrical relationships between marital satisfaction and cognitive function. Our findings show that a decline in marital satisfaction is significantly associated with cognitive decline. Furthermore, improved marital satisfaction might act as a protective factor or even enhance cognitive function, especially among middle-aged adults. This significant relationship might be less present in contexts where marriage does

not hold the same significance in shaping one's life experiences as it does in Korea. In addition, the collectivist and patriarchal nature of Korean society further elucidates age differences in the observed associations. Specifically, cognitive decline due to declines in marital satisfaction is more pronounced among older adults. Although it is widely acknowledged that older adults face higher risks of cognitive decline (Gonzales et al., 2022), the collectivist culture in Korea may amplify the mechanisms driving the association. In Korean society, an individual's social identity is closely tied to traditional roles (Triandis, 1989). Thus, diminishing marital satisfaction could trigger intense negative emotions and stress, promote maladaptive behaviors, and result in social isolation. Although not statistically significant, the larger magnitude of the coefficient for declining marital satisfaction in older men, compared to older women, may reflect the unique life course dynamics of relationships in older Korean couples. The patriarchal system burdens women in their early marital years. Indeed, women's marriages are often characterized by unequal power dynamics and financial dependence on their spouses (Lee et al., 2004). However, this pattern reverses later in life, with men growing increasingly reliant on their wives for care and companionship (Cheng & Chan, 2006).

This study has a few limitations that warrant acknowledgement. First, while we utilized FE models to account for time-constant confounders, both observed and unobserved, time-varying confounders can still introduce bias to the FE estimates (Wooldridge, 2010). Although this study controlled for a wide range of time-varying covariates, this strategy only mitigates, rather than eliminates, the potential bias arising from unobserved time-varying confounders. Moreover, given the analytical approach used (i.e., FE models), this study focused on individuals who experienced changes in marital satisfaction and overlooked those with consistent satisfaction levels during the study period. Future researchers may wish to investigate the characteristics of individuals with steady marital satisfaction, whether consistently high or low, and determine the effect of stable marital satisfaction effect on cognitive function.

Another limitation of this study is that the assessment of marital quality in this study relied solely on marital satisfaction ratings. Although widely employed in prior research, it may be subject to various interpretations. For instance, research has shown that older adults tend to view their relationships more positively than younger individuals in similar circumstances (Fingerman & Charles, 2010). This tendency may partly explain the more pronounced decline in cognitive function among older adults when marital satisfaction decreases. Future researchers may wish to consider incorporating additional dimensions of marital quality to identify which aspects of marriage have significant associations with health outcomes (Davey & Szinovacz, 2004). Furthermore, although the K-MMSE is widely used in the social sciences to evaluate cognitive function, it has limitations. It may be insensitive to mild cognitive impairment, is a generalized approach to cognitive assessment, and may be a biased measure for communities of certain educational and cultural backgrounds (Devenney & Hodges, 2017). Future research should incorporate a more detailed and comprehensive assessment of cognitive functioning (e.g., processing speed [Coding Task], reasoning [Raven Matrices], and memory [15 Words Test]).

Despite its limitations, this study possesses several strengths that expand the existing literature on marital satisfaction and health and well-being. This study focused on cognitive function as a health outcome, which has been relatively understudied in previous research. Cognitive function plays a vital role in various aspects of life, including daily functioning, decision-making, and overall quality of life. Moreover, cognitive decline and neurodegenerative diseases such as Alzheimer's disease pose significant challenges to individuals, families, and society as a whole. Thus, understanding the cognitive consequences of marital satisfaction beyond physical and mental health helps shed light on the complex relationship between marital satisfaction and cognitive function, providing valuable insights into preventive measures for cognitive decline and potentially informing interventions and therapies for relationship well-being.



In addition, this study stands out as the first to utilize asymmetric FE models to differentiate between the effects of increasing and decreasing marital satisfaction by relaxing the symmetry assumption present in earlier studies. This approach offers a more complex understanding of how marital satisfaction influences an individual's cognitive function and provides valuable insights into the mechanisms involved. Moreover, this study may be used to inform policy decisions that aim to mitigate cognitive decline and enhance the quality of life for older adults by providing evidence on the more pronounced asymmetric effects of increasing and decreasing marital satisfaction on cognitive function among older adults compared to middle-aged adults. Finally, this study relied on data that were nationally representative of middle-aged and older adults in Korea and collected over a period of 12 years, allowing us to generalize our findings to the general population.

The study's findings are policy-relevant. The positive association between marital satisfaction and cognitive function highlights the importance of promoting healthy and satisfying marital relationships. Policies and programs aiming to promote healthy aging can consider providing resources and support for couples facing relationship challenges. Such support may include offering interventions centered on conflict resolution, such as support groups. In these group environments, couples can share their experiences and learn from others going through similar challenges (Carlson et al., 2014). The stronger association between decreasing marital satisfaction and cognitive function suggests the need for early intervention and prevention strategies. Thus, efforts to identify and address marital dissatisfaction might be most impactful at its early stages. This can involve providing access to relationship support services, such as couples counseling or relationship education programs, to help couples navigate challenges and maintain satisfactory relationships (Rosen-Grandon et al., 2004).

Moreover, since a dissatisfying marriage can impair cognitive function through psychological, behavioral, and social pathways, interventions should address these mediating factors to mitigate the adverse effects of marital dissatisfaction. For instance, participating in couple activity challenges or community activities may help stimulate positive behaviors and promote bonding (Fratiglioni et al., 2004). The more pronounced asymmetric effects of marital satisfaction on cognitive function among older adults indicate the importance of tailored interventions for this age group. Policymakers may consider offering targeted support and resources for older couples to maintain or enhance marital satisfaction. This can involve programs that address the unique needs and challenges faced by older adults, such as age-related health issues, caregiving responsibilities, and social isolation (J. Kim & Park, 2023b; J. Kim & Yoon, 2022).

In conclusion, this study enhances our understanding of the link between marital satisfaction and cognitive function and advances the extant research on the relationship between marriage and health. The findings highlight that the impact of decreasing marital satisfaction on cognitive function is stronger than the impact of increasing marital satisfaction. Furthermore, these asymmetric effects are more noticeable among older adults compared to middle-aged adults. However, these asymmetric effects did not differ by gender. These findings suggest that interventions targeting marital quality represent an effective approach to enhancing cognitive function in middle-aged and older adults. Programs that promote marital satisfaction to prevent cognitive decline and enhance the overall well-being of individuals and couples may be particularly effective strategies to promote healthy aging across the life course.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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