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Exploring the relationship between marital quality and cognitive function: A systematic review



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ABSTRACT

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Keywords: Marital quality Marital satisfaction Marital strain Cognitive function Memory Executive function Immediate recall Delayed recall Cognitive function is an important indicator of healthy aging as it is central to maintaining functional independence, performing job-related tasks, decision-making, and improving quality of life. Therefore, researchers seek to identify biopsychosocial factors that can help preserve cognitive function in aging individuals. One such factor is the maintenance of good quality marital relationships. Research has consistently shown that married individuals fare better in terms of both physical and psychological health compared to their unmarried counterparts. However, being married is not universally beneficial - the quality of a marriage is also important to consider. To explore the issue further, we conducted a systematic review to examine the association between marital quality and cognitive function. PubMed, PsycINFO, and Scopus were searched for eligible articles examining any measure of marital quality and any cognitive outcome from the inception of each database to January 9th, 2024. Following two levels of citation screening by two independent reviewers, we included 15 articles representing 11 unique studies. Data were synthesized narratively following the Synthesis without Meta-Analysis guidelines and a risk of bias assessment was conducted using the Joanna Briggs Institute checklist. Most articles had a low risk of bias. Although some findings suggested more positive marital quality was associated with improved cognitive function, the results were not uniformly positive; some results were inverse or null, depending upon factors such as differences in study designs and measures of marital quality or cognition. This review is the first attempt to synthesize the literature on this topic. Our findings highlight that any examination of marital status and cognition should also consider contextual factors such as marital quality.

1. Background

Cognitive function refers to a collection of mental processes involved in completing basic and complex life-sustaining tasks such as thinking, reasoning, learning, remembering, and problem-solving (Kiely, 2014). The Diagnostic and Statistical Manual of Mental Disorders - 5th Edition (DSM-5) identifies six domains of cognitive function: executive function, complex attention, learning and memory, language, perceptual-motor function, and social cognition (Sachdev et al., 2014). Collectively, these domains form what is known as 'global' cognitive function. Cognitive function is an important component of healthy aging because it is central to maintaining functional independence, performing job-related tasks, decision-making, and improving overall quality of life. Although a certain level of decline in one's cognitive ability is commonly linked to the aging process, substantial declines may be a sign of various neurocognitive disorders such as Alzheimer's disease (Tuokko et al., 2017). Therefore, a key focus for public health is to identify biopsychosocial factors that can help preserve cognitive function in aging individuals. One such factor is the maintenance of good quality social relationships.

The closest and most emotionally meaningful relationship in adulthood is often with one's spouse, especially in older age as the size of one's social networks shrink and individuals tend to rely more on their intimate relationships for emotional and practical support (Carstensen et al., 1999). Research has consistently shown that married individuals fare better in terms of physical and psychological health compared to their unmarried counterparts (Holt-Lunstad et al., 2008; Wang et al., 2020; Wyke and Ford, 1992). Also, older adults generally prefer to continue living independently in their communities as they age (Penning and Wu, 2014) and spousal relationships are crucial in facilitating such independence. Compared to other support providers (i.e., children, family, and friends), spouses are more likely to provide instrumental support (e.g., help with household chores) (Penning and Wu, 2014; Walker and Luszcz, 2009) and often serve as a form of informal

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healthcare during times of illness, which can positively impact the recovery process (Wyke and Ford, 1992). In addition, the pooling of economic resources in a marriage may provide many health benefits including increased access to good quality nutrition, health insurance, and transportation to/from medical appointments (Liu and Umberson, 2008). Support from a marital partner can also improve help-seeking behaviours and promote treatment compliance among older adults, especially in men (Vaingankar et al., 2020). Conversely, being unmarried has been associated with more severe chronic conditions, higher systolic blood pressure, greater depressive symptoms, mortality, and cognitive impairment (Grundy and Tomassini, 2010; Liu et al., 2019; Spiker, 2014; Wang et al., 2020; Wyke and Ford, 1992).

Overall, marriage provides unique institutional, economic, and psychosocial benefits that cannot be obtained from other types of relationships (Liu and Umberson, 2008). However, being married is not universally beneficial. The health advantages of marriage can be tempered by the quality of the marriage itself (Carr et al., 2014). In some cases, single people may have better health outcomes than those who are unhappily married (Holt-Lunstad et al., 2008). For example, divorce ending a stressful or abusive marriage may improve one's health (Spiker, 2014). Therefore, any examination of marital status and health should also consider contextual factors such as marital quality to provide a more comprehensive understanding of this association.

Marital quality refers to the level of satisfaction with one's marriage and positive attitudes toward one's spouse (Y. Kim, 2021). Although researchers have used varying definitions to define marital quality, it is widely acknowledged that marital quality consists of both positive (e.g., love, support, and satisfaction) and negative (e.g., conflict, demands, and strains) components (Xu et al., 2016). More positive marital quality may be associated with greater cognitive function, as it can improve the provision of instrumental and emotional support from spouses, the promotion of healthy lifestyle behaviours, and the encouragement of coping resources, all of which help to reduce perceived stress. Elevated stress is a common risk factor for cognitive decline as it can lead to less effective functioning of neural networks in the brain during the acquisition, consolidation, and retrieval of information (de Souza-Talarico et al., 2011; McManus et al., 2022; Sandi, 2007). For example, the hypothalamic-pituitary-adrenal axis is often activated in response to stress, leading to the subsequent production of the stress hormone cortisol (de Kloet et al., 1999). As a result, high levels of circulating cortisol can have detrimental effects on one's cognitive functioning (de Kloet et al., 1999). In addition, researchers have found positive associations between marital quality and life satisfaction, as well as happiness (Carr et al., 2014), which are both linked to cognition (Zainal and Newman, 2022) and reduced stress, which adds support to examining the association between marital quality and cognition.

According to the stress-buffering hypothesis, a greater quality of support from loved ones, such as spouses, may help to mitigate the impact of stressful life events on an individual's health by providing a sense of stability, positive affect, self-worth and the resources to reframe stressful situations as less serious and potentially solvable. (Cohen and Wills, 1985). Thus, consistently met needs may help to buffer physiological stress reactions and support cognitive health through the introduction of effective coping mechanisms (Cohen and Wills, 1985; Kuiper et al., 2016). Thus, individuals who experience less stress as a result of their marriage may exhibit improved cognitive functioning. Conversely, lower marital quality may be a source of stress, which can negatively impact cognitive performance through various physiological pathways.

A previous systematic review investigated the impact of marital status on cognitive functioning, finding that single and widowed individuals have an elevated risk of developing dementia compared to married individuals (Sommerlad et al., 2018). In addition, a more recent review by Haghighi and Oremus (2023) examined whether marital status impacts the association between social support and memory in middle-aged and older adults. The findings of this review suggested some positive associations between functional social support from a spouse or partner and memory. However, effect sizes were small and similar to other sources of support (e.g., children, relatives, and friends). To our knowledge, no reviews have specifically examined the relationship between the quality of one's marriage and cognitive function. The purpose of this systematic review is to examine the association between marital quality and cognitive function.

2. Methods

This review was reported according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines (Page et al., 2021). Our protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO) (registration number: CRD42024499371).

2.1. Eligibility criteria

Included articles must have examined the impact of marital quality or a similar variable (e.g., marital adjustment or satisfaction) on cognitive function. More specifically, articles that met the following eligibility criteria were included in the review:

Study designs: Cohort, case-control, and cross-sectional studies of any publication date and setting, published in English in scholarly or academic journals. Randomized controlled trials were not considered because of the inability to randomize the exposure variable (marital quality).

Participants: Participants included adults aged 18 years or over, recruited from any setting (e.g., hospital, community-dwelling, long-term care facility), who were either married or in common-law relationships. We accepted all definitions of "common law" used in the included articles.

Exposure: The main exposure variable was marital quality, as defined in the Background section above. Specifically, reviewers included articles that examined the quality of marital relationships, including measures of positive marital experiences such as marital satisfaction, marital adjustment, or the enjoyment of time with one's spouse. Articles examining negative marital experiences such as marital strain or conflict were also included. In the absence of a gold standard measure of marital quality, the reviewers accepted any means of measuring the construct, e. g., validated instruments or single questions asking about levels of marital quality on a Likert scale.

Outcome: Cognitive function was the main outcome variable. Articles could measure cognitive function globally or by domain (e.g., memory, executive function) using any instrument or combination of tools. Articles focusing solely on clinical diagnoses of cognitive disorders, such as Alzheimer's disease, were excluded.

2.2. Search strategy

We searched PubMed, PsycINFO (through APA PsycNET), and Scopus from the inception of each database to January 9th, 2024. A search strategy was created in PubMed with the help of a medical librarian using Medical Subject Headings from the National Library of Medicine. The first author subsequently adjusted the PubMed search syntax to align with the parameters of the other two databases. No restrictions were applied to any of the searches. We also manually searched the reference lists of included articles to identify potentially relevant articles that might not have been captured by the search strategy. Please refer to Appendix A for the search strategy used for each database.

2.3. Study selection

All articles retrieved from the literature search described above were transferred into Covidence (Veritas Health Innovation, Melbourne, Australia) for duplicate identification/removal and screening. The first step of the screening process involved assessing the articles' titles and

abstracts. Those passing the first step were sent to full-text screening. Two independent reviewers screened each article using the following three questions, which were based on the eligibility criteria described above: (1) Does this article examine a study population of adults who are either married or in common-law relationships? (2) Does this article examine the association between marital quality and cognitive function? and (3) Does this article describe a primary or secondary analysis of data and, if so, does the study include a comparison group? During title and abstract screening, if both reviewers answered "yes" to all three questions or they did not have enough information to assess one or more of the questions, but they did not answer "no" to any question, then the article proceeded to full-text screening. At the full-text screening level, both reviewers had to assign "yes" responses to all three questions for an article to be included in the review. To promote harmonized screening, the first author trained all reviewers and provided examples of definitions and relevant tools to measure marital quality and cognitive function in advance. Disagreements between reviewers were settled by consensus or a third reviewer.

2.4. Data extraction process

A data extraction form was created with the following headings: authors, year of publication, country of data collection, study design, sample size, proportion of female participants, type and measure of marital quality, type and measure of cognitive function, covariates, and a summary of relevant findings. Two reviewers independently extracted data from each article using the same data extraction form and compared their responses to create a comprehensive spreadsheet with information from all included studies. Discrepancies were settled by consensus or a third reviewer.

2.5. Data synthesis

The results of the included articles were narratively synthesized and reported following the Synthesis without meta-analysis (SWiM) guidelines (Campbell et al., 2020) (Appendix B). SWiM aims to promote transparency in reporting systematic reviews that employ narrative synthesis, but do not include meta-analysis (Campbell et al., 2020). Based on informal comparisons of between-article differences, we concluded that a meta-analysis was not feasible due to substantial



Fig. 1. Study screening flow diagram.

variations in methodology across the included articles, particularly in terms of the measures of marital quality and cognitive function, covariates utilized in analyses, and statistical approaches employed to analyze the data.

The findings of the included articles were summarized using the regression coefficient ($_{\beta}$) or other effect measures reported in the articles (e.g., correlation coefficient). For synthesis purposes, we discussed findings separately for each cognitive outcome.

2.6. Risk of bias assessment

Each article was assessed for risk of bias using the Joanna Briggs Institute (JBI) Critical Appraisal Checklists (Moola et al., 2020). Two reviewers independently evaluated each article using these checklists and any disagreements were resolved by consensus.

3. Results

The literature search yielded 649 results. After removing 194 duplicates, 455 articles were screened at the title and abstract level and 36 progressed to full-text screening (Fig. 1). Full-text screening led to the exclusion of 21 articles primarily because they did not measure cognitive function as the outcome or they did not specifically measure the association between marital quality and cognitive function, despite including both variables in their analyses. Additionally, three articles examined the reverse association, treating cognitive function as the exposure variable and marital quality as the outcome. This left 15 articles for inclusion in the narrative synthesis (Gallagher and Stokes, 2021; Ge et al., 2017; J. Kim and Kwon, 2023; Y. Kim, 2021; Ko et al., 2007; Lindert et al., 2022; Liu et al., 2021; Min and Song, 2023; Sillars et al., 1990; Waldinger et al., 2015; Whisman and Delinsky, 2002; Windsor et al., 2014; Wuttke-Linnemann et al., 2020; Xu et al., 2016; Zahodne et al., 2019). A list of all excluded articles and their reason for exclusion is available at: https://doi.org/10.6084/m9.figshare.25521454.v2.

Among the 15 included articles, six employed cross-sectional analyses (Gallagher and Stokes, 2021; Ge et al., 2017; Ko et al., 2007; Sillars et al., 1990; Whisman and Delinsky, 2002; Wuttke-Linnemann et al., 2020) and nine utilized longitudinal analyses (J. Kim and Kwon, 2023; Y. Kim, 2021; Lindert et al., 2022; Liu et al., 2021; Min and Song, 2023; Waldinger et al., 2015; Windsor et al., 2014; Xu et al., 2016; Zahodne et al., 2019). Several articles used secondary data from large panel studies such as the Health and Retirement Study (HRS) (Sonnega and Weir, 2014), the Korean Longitudinal Study of Ageing (KLoSA) (Korea Employment Information Service, 2015), and the Midlife in the United States (MIDUS) study (Brim et al., 2004). Some studies (e.g., Gallagher and Stokes, 2021; Kim and Kwon, 2023; Kim, 2021; Lindert et al., 2022; Liu et al., 2021; Min and Song, 2023; Zahodne et al., 2019) used a sample of participants drawn from the national population, whereas other studies (e.g., Sillars et al., 1990; Waldinger et al., 2015; Whisman and Delinsky, 2002; Wuttke-Linnemann et al., 2020) used a local sample of participants drawn from the same city or county. Most articles included a sample of community-dwelling adults. Sample sizes ranged from 29 (Wuttke-Linnemann et al., 2020) to 10,390 (Zahodne et al., 2019). A summary of findings from the included articles can be found in Table 1.

Most of the included studies (73.33%) were conducted in the United States. All the included articles had an approximately even-split sample of male and female participants, with the exception of Min and Song's (2023) sample, which was composed of predominantly female participants. The average age of participants was lowest in Sillars et al.'s (1990) sample (men: 34 ± 10.5 years; women: 32.6 ± 10.2 years) and highest in Waldinger et al.'s (2015) sample (men: 80.8 ± 3.4 years; women: 75.7 ± 6.8 years). The most common variables included as covariates in adjusted analyses were age, gender, education, and income.

Marital quality was defined and measured differently across the

included studies. To assess positive aspects of marital quality, many studies (e.g., Kim and Kwon, 2023; Kim, 2021; Liu et al., 2021; Xu et al., 2016) asked participants questions such as the level of satisfaction with their marriages, how often their partner understood the way they felt about things, how much they could rely on their partner if they had a serious problem, how much they could open up to their partner and talk about their worries, how much they could relax and be themselves around their partner, or the degree of closeness of their relationship. Conversely, to assess negative aspects of marital quality, many studies (e.g., Gallagher and Stokes, 2021; Ge et al., 2017; Lindert et al., 2022; Liu et al., 2021; Min and Song, 2023) asked participants questions such as how often their partner makes too many demands on them, criticizes them, lets them down when they are counting on them, or gets on their nerves. Several validated instruments were also used to measure marital quality, including the Quality of Marriage Index (Norton, 1983), Dyadic Adjustment Scale (Spanier, 1976), and Locke-Wallace Marital Adjustment Test (Locke and Wallace, 1959).

3.1. Global cognitive function

Nine articles examined the association between marital quality and some form of global cognitive function index in a mixture of crosssectional and longitudinal analyses (Gallagher and Stokes, 2021; Ge et al., 2017; J. Kim and Kwon, 2023; Y. Kim, 2021; Ko et al., 2007; Liu et al., 2021; Min and Song, 2023; Wuttke-Linnemann et al., 2020; Xu et al., 2016). The findings of each of these articles are presented below. Gallagher and Stokes (2021) found that marital strain was signifi-

cantighter and stokes (2021) found that marital strain was significantily inversely correlated with cognitive functioning in both husbands (r = -0.07) and wives (r = -0.06). Conversely, enjoyment of time with a spouse was significantly positively correlated with cognitive functioning in both husbands (r = 0.07) and wives (r = 0.06). Ko et al. (2007) reported negative, though statistically non-significant, correlations between marital satisfaction and cognitive function in both husbands (r = -0.06) and wives (r = -0.09). Furthermore, Wuttke-Linnemann et al. (2020) found that, in a sample of persons with dementia, marital quality was positively correlated with their cognitive functioning (r = 0.16). However, this association was not statistically significant. Ge et al. (2017) reported a positive association between spousal strain and global cognitive function ($\hat{\beta} = 0.10, 95\%$ CI = 0.04, 0.16).

Liu et al. (2021) found that baseline positive marital quality was positively associated with baseline cognitive function ($\hat{\beta} = 0.22, 95\%$ CI = 0.09, 0.35), whereas baseline negative marital quality was inversely associated with baseline cognitive function ($\widehat{\beta}$ = -0.27, 95% CI = -0.41, -0.14). Neither baseline, nor changes in either positive or negative marital quality, were significantly associated with the rate of cognitive decline over a ten-year follow-up. When stratifying by sex, marital quality impacted cognitive trajectories differently in men and women. For men, higher baseline positive marital quality was associated with higher baseline cognitive function ($\hat{\beta} = 0.36, 95\%$ CI = 0.16, 0.57); an increase in positive marital quality over time was associated with a slower rate of cognitive decline ($\hat{\beta} = 1.61, 95\%$ CI = 0.41, 2.81). Furthermore, among men, higher baseline negative marital quality was associated with lower baseline cognitive function ($\hat{\beta} = -0.43$, 95% CI = -0.62, -0.23); an increase in negative marital quality over time was associated with a faster rate of cognitive decline ($\hat{\beta} = -1.37$, 95% CI = -2.65, -0.09). For women, higher baseline positive marital quality was associated with higher baseline cognitive function ($\hat{\beta} = 0.12, 95\%$ CI = -0.05, 0.29); an increase in positive marital quality over time was associated with a faster rate of cognitive decline ($\hat{\beta} = -0.33$, 95% CI = -2.22, 1.56). In addition, higher baseline negative marital quality was associated with lower baseline cognitive function ($\hat{\beta} = -0.13, 95\%$ CI = -0.32, 0.06); an increase in negative marital quality over time was associated with a slower rate of cognitive decline ($\hat{\beta} = 0.28, 95\%$ CI = -1.84, 2.39). However, none of these associations were statistically

Table 1

Data extraction table for studies included in the review.

Author, Year Country	Study Design	Data source	Sample Size; % _{female} Mean age	Type and measure of marital quality	Type and measure of cognitive function	Summary of findings
Gallagher and Stokes (2021) USA	Cross- sectional	Health and Retirement Study	2864 50% 66.6y	Marital strain: assessed using four items asking participants how often their partner makes too many demands on them, criticizes them, lets them down when they are counting on them, and gets on their nerves. <i>Enjoyment of time spent together:</i> assessed with one item – "Overall how enjoyable is the time you spend together with your spouse/nartner?"	Cognitive function: assessed using the TICS	For both husbands and wives, marital strain was significantly inversely associated with cognitive function, whereas enjoyment of time with their spouse was positively associated with cognitive function.
Ge et al. (2017) USA	Cross- sectional	Population Study of Chinese Elderly	3159 58.9% 72.8y	Spousal strain: assessed with two items asking participants about the frequency of being criticized or having too many demands made by the spouse.	Episodic memory: assessed using the immediate and delayed recall tests from the EBMT Executive function: assessed using the Symbol Digit Modalities Test Working memory: assessed using the Digit Span Backwards test Global cognitive function: calculated using scores from the above-mentioned tests and the Chinese version of the MMSE	Higher levels of spousal strain were associated with higher scores of episodic memory, executive function, and global cognitive function. Spousal strain was only significantly associated with working memory before adjusting for covariates.
Kim (2021) South Korea	Longitudinal	Korean Longitudinal Study of Aging	7427 46.40% 56.3y	Marital quality: assessed with one item – "How satisfied are you with your spouse?"	Cognitive health: assessed using the Korean version of the MMSE	Higher levels of marital quality were associated with higher levels of cognition; these effects were similar for men and women.
Kim and Kwon (2023) South Korea	Longitudinal	Korean Longitudinal Study of Aging	2573 39.8% 71.4y	Marital satisfaction: assessed with one item – "In general, how satisfied are you with your marriage?"	Cognitive function: assessed using the Korean version of the MMSE	Marital satisfaction was associated with an increase in cognitive function. There was a stronger positive association between marital satisfaction and cognitive function in men compared to women.
Ko et al. (2007) <i>USA</i>	Cross- sectional	Health and Aging study	287 50% Middle-aged group: wives: 43.8y husbands: 45.6y Older group: wives: 62.0y husbands: 64.4y	Marital satisfaction: assessed using the Locke-Wallace Marital Adjustment Test	Cognitive function: assessed using the Digit Span Forward and Backward subtests of the Wechsler Adult Intelligence Scale, the Verbal Meaning Test, Advanced Vocabulary Test, Letter and Pattern Comparison Tests, Primary Mental Abilities Spatial Relations and Letters Series Tests. Principal component analyses of these measures revealed one factor for cognitive function.	For both husbands and wives, marital satisfaction was not significantly correlated with cognitive function.
Lindert et al. (2022) USA	Longitudinal	Midlife in the United States study	1821 52.28% 55y	Marital strain: assessed with six items asking how much their spouse/partner criticizes them, makes too many demands, lets them down when they are counting on them, gets on their nerves, argues with them, and makes them feel tense.	<i>Episodic memory:</i> assessed using the immediate and delayed recall trials from the RAVLT. <i>Executive function:</i> assessed using the Category Verbal Fluency Test, Digit Span Backward Test, Number Series, 30 s and Counting Tasks and Stop and Go Switch Task.	For men, marital strain was significantly associated with declines in episodic memory, but not executive functioning. These trends were the same for the subsample of employed men. For women, marital strain was not significantly associated with changes in episodic memory or executive functioning. In the subsample of employed women, marital strain was significantly associated with declines in executive function, but not episodic memory.
Liu et al. (2021) USA	Longitudinal	Health and Retirement Study	7901 45.15% <i>65.5y</i>	Marital quality: assessed with eight items asking how much their spouse/partner	<i>Cognitive function:</i> assessed using the modified version of the TICS. A summary score	Higher levels of initial positive marital quality was associated with higher initial cognitive

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Table 1 (continued)

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Author, Year Country	Study Design	Data source	Sample Size; % _{female} Mean age	Type and measure of marital quality	Type and measure of cognitive function	Summary of findings
				understands the way they feel about things, how much they can rely on their spouse/ partner if they have a serious problem, how much they can open up to their spouse/ partner if they need to talk about their worries, how close their relationship is, how much the spouse/partner makes too many demands, criticizes them, lets them down when they are counting on them, and gets on their nerves. These eight items were grouped to form two dimensions: positive and negative marital quality.	was created by adding scores for the immediate and delayed recall, five trials of serial 7s, and backward counting tasks.	function, whereas higher levels of initial negative marital quality was associated with lower initial cognitive function. Neither initial levels nor the rate of change of either positive or negative marital quality were significantly associated with the rate of cognitive decline. For men, higher initial positive marital quality was associated with higher initial cognitive function, and an increase in positive marital quality over time was associated with slower cognitive decline. In addition, higher initial negative marital quality was associated with lower initial cognitive function, and an increase in negative marital quality over time was associated with faster cognitive decline. For women, neither positive nor negative marital quality were significantly associated with cognitive traiectories
Min and Song (2023) USA	Longitudinal	Midlife in the United States study	290 72% widowed: 65.3y married: 64.1y	<i>Marital quality</i> : positive dimensions included six items asking how much the spouse really cares about them, understands the way they feel about things, appreciates them, how much they rely on their spouse for help if they had a serious problem, how much they can open up to their spouse to talk about their worries, and how much they can relax and be themselves around their spouse. Negative dimensions included six items asking how often the spouse makes too many demands, argues with them, makes them feel tense, criticizes them, lets them down when they were counting on them, and gets on their nerves. Four groups were created using scores from each scale: high positivity and high negativity (ambivalent), high positivity and low negativity (supportive), low positivity and high negativity (aversive), and low positivity and low	Episodic memory: assessed using the mean standardized scores for the immediate and delayed verbal memory components of the BTACT. Executive function: assessed using the mean standardized scores for verbal fluency, processing speed, inductive reasoning, working memory, and the mean of the switch and non-switch trials from the attention switching and inhibitory control task components of the BTACT. Composite cognition: measured by adding the two factor scores for episodic memory and executive functioning.	trajectories. Marital quality was not associated with any of the cognitive measures in the overall sample. However, for widowed individuals, ambivalent relationships were associated with poorer overall cognitive functioning compared to aversive relationships. Also, widowed participants with either an ambivalent or supportive relationship had significantly lower levels of episodic memory than those with an aversive marital relationship. Among married individuals, marital quality was not significantly associated with overall cognitive functioning or episodic memory. Executive functioning was not significantly associated with marital quality for widowed or married individuals.
Sillars et al. (1990) USA	Cross- sectional	Independent study	74 50% wives: 32.6y husbands: 34y	negativity (indifferent). Marital satisfaction: assessed using the 10-item marital satisfaction subscale from Spanier's (1976) marital adjustment instrument	<i>Recall:</i> assessed using video- taped discussions of eight potential conflict topics. Couples were asked to discuss whether they perceived each topic to present a problem in their relationship. A few minutes later, participants were asked to recall their discussion of these topics as accurately as possible.	Marital satisfaction was negatively associated with recall of both negative and confrontive statements. No significant associations were found between marital satisfaction and the recall of conciliatory remarks or overall recall accuracy.
Waldinger et al. (2015) <i>USA</i>	Longitudinal	Independent study	162 50% women: 75.7y men: 80.8y	Marital satisfaction: assessed using the Short Marital Adjustment Test Marital disagreements: assessed	Memory: assessed using the Free and Cued Selective Reminding Test Executive Function: assessed	For women, marital disagreements was negatively correlated with memory, whereas marital satisfaction

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Table 1 (continued)

Author, Year Country	Study Design	Data source	Sample Size; % _{female} Mean age	Type and measure of marital quality	Type and measure of cognitive function	Summary of findings
				by asking "In the last 24 h, did you have a disagreement with your partner, even about something small?" over 8 days.	using the Trail Making Test Part B, Controlled Oral Word Association (F-A-S) Test and Category Generation (CAT) Test	was positively correlated with memory. A significant interaction was also found between attachment style and marital disagreements such that for women who were less securely attached, more frequent marital conflicts was associated with poorer memory functioning 2.5 years later. No significant associations were found between marital satisfaction or disagreements and memory for men. In addition, neither marital satisfaction nor marital disagreements were significantly correlated to executive function among men or women.
Whisman and Delinsky (2002) USA	Cross- sectional	Independent study	86 50% 41y	Marital satisfaction: assessed using the Quality of Marriage Index	Incidental recall: participants were presented with a list of words describing personality traits and were asked to rate whether these words accurately described their spouse. Participants were then asked to write down as many words as they could remember from the list of words shown.	For both husbands and wives, marital satisfaction was significantly inversely associated with the amount of negative adjectives endorsed and recalled. No significant associations were found for the association between marital satisfaction and the amount of positive adjectives endorsed and recalled.
Windsor et al. (2014) Australia	Longitudinal	PATH Through Life Study	1618 49.3% 62.5y	Positive spouse exchanges: assessed with five items asking about emotional closeness and spouse dependability (e.g., "how much does your partner understand the way you feel about things?"). Negative spouse exchanges: assessed with five items asking about marital tension and disagreements (e.g., "how much tension is there between you and your partner?").	Episodic memory: assessed using an immediate recall task comprising the first trial of the California Verbal Learning Test. Working memory: assessed using the Digits Backward subtest of the Wechsler Memory Scale. Perceptual speed: assessed using the Symbol-Digit Modalities Test.	Positive spouse exchanges was not significantly associated with episodic memory, working memory, or perceptual speed. Negative spouse exchanges was not significantly associated with episodic memory or perceptual speed, but it was negatively associated with working memory.
Wuttke-Linnemann et al. (2020) <i>Germany</i> Xu et al. (2016) USA	Cross- sectional Longitudinal	Independent study Americans' Changing Lives survey	29ª 20.7% 76y 841 58% 68y	Marital quality: assessed using the short version of the PFB marital quality questionnaire <i>Positive marital experience:</i> assessed with three items – "How satisfied are you with your marriage?", "How much does your husband/wife make you feel loved and cared for?", and "How much is he/she willing to listen when you need to talk about your worries or	Cognitive impairment: assessed using the MMSE Cognitive limitations: assessed using the Short Portable Mental Status Questionnaire	Marital quality was not significantly correlated with cognitive impairment. Greater negative marital experiences were significantly associated with a slower rate of increase in cognitive limitations over time. Positive marital experiences were not significantly associated with changes in cognitive limitations
Zahodne et al. (2019) USA	Longitudinal	Health and Retirement Study	10,390 59.68% 68.6y	Negative marital experience: assessed with two items – "How often do you feel bothered or upset by your marriage?", and "How often would you say the two of you typically have unpleasant disagreements or conflicts?" Spousal support: assessed with three items asking how much the spouse really understands	<i>Episodic memory:</i> assessed using a variant of the Consortium to Establish a	Spousal strain was negatively associated with initial memory but was not significant
				use way they feel about things, how much they can rely on them if they have a serious problem and open up to them if they need to talk about your worries.	registry for Alzneimer's Disease list learning task	associated with memory change over time. Spousal relationship quality was not significantly associated with initial memory or memory change over time.

Table 1 (continued)

Author, Year Country	Study Design	Data source	Sample Size; % _{female} Mean age	Type and measure of marital quality	Type and measure of cognitive function	Summary of findings
				Spousal strain: assessed with four items asking how often the spouse makes too many demands on them, criticizes them, lets them down when they are counting on them, and gets on their nerves. Spousal relationship quality: assessed with a summary score of the two above mentioned scales.		

Notes. BTACT = Brief Test of Adult Cognition by Telephone; EBMT = East Boston Memory Test; MMSE = Mini-Mental State Examination; PFB = Partnerschaftsfragebogen; RAVLT = Rey Auditory Verbal Learning Test; TICS = Telephone Interview for Cognitive Status; USA = United States of America; y = years. ^a Wuttke-Linnemann et al. (2020) included a sample size of 58 participants (i.e., 29 patients and 29 caregivers). However, given that cognitive function was only assessed in patients (and not caregivers), only results for patients were reported.

significant among women.

Xu et al. (2016) found that negative marital experiences were inversely associated with cognitive limitations over time ($\hat{\beta} = -0.00$, 95% CI = -0.01, -0.00). These findings suggest that greater negative marital experiences had beneficial effects on cognitive functioning. Conversely, positive marital experiences were not significantly associated with changes in cognitive limitations over time ($\hat{\beta} = 0.00$, 95% CI = -0.01, -0.00).

Kim (2021) reported that greater marital quality was significantly associated with higher levels of cognitive function when examining both within ($\hat{\beta} = 0.99, 95\%$ CI = 0.82, 1.16) and between-person effects ($\hat{\beta} = 1.78, 95\%$ CI = 1.47, 2.09). Moreover, when examining the interaction between marital quality and gender, it was found that only the within-person effects of these interaction terms showed significant associations with cognitive function. Specifically, compared to men, women reported negative associations between marital quality and cognitive function ($\hat{\beta} = -0.68, 95\%$ CI = -1.01, -0.34). Conversely, the between-person effects showed that the association between marital quality and cognitive function did not significantly differ by gender ($\hat{\beta} = 0.26, 95\%$ CI = -0.34, 0.86).

Kim and Kwon (2023) found that marital satisfaction was significantly positively associated with cognitive function in their overall sample ($\hat{\beta} = 0.31$, 95% *CI* = 0.20, 0.41). Similar positive associations were also reported in their gender-stratified subsamples of men ($\hat{\beta} = 0.39$, 95% *CI* = 0.26, 0.52) and women ($\hat{\beta} = 0.18$, 95% *CI* = 0.02, 0.34).

Min and Song (2023) reported that individuals with ambivalent ($\hat{\beta} = 0.04, 95\%$ CI = -0.13, 0.21) or supportive relationships ($\hat{\beta} = 0.06, 95\%$ CI = -0.07, 0.18) had better cognitive functioning compared to those in aversive relationships. Conversely, individuals in indifferent relationships had poorer cognitive functioning compared to those in aversive relationships ($\hat{\beta} = -0.13, 95\%$ CI = -0.29, 0.03). However, when examining the interaction between widowhood status and marital quality prior to bereavement, it was found that widowed individuals whose relationship with their deceased spouse was ambivalent ($\hat{\beta} = -0.36, 95\%$ CI = -0.70, -0.02), supportive ($\hat{\beta} = -0.17, 95\%$ CI = -0.39, 0.06), or indifferent ($\hat{\beta} = -0.02, 95\%$ CI = -0.34, 0.31), had poorer cognitive functioning compared to widowed individuals who had aversive relationships; only the interaction between widowhood status and ambivalent relationships was statistically significant.

3.2. Memory

Eight articles examined the association between marital quality and different types of memory (Ge et al., 2017; Lindert et al., 2022; Min and

Song, 2023; Sillars et al., 1990; Waldinger et al., 2015; Whisman and Delinsky, 2002; Windsor et al., 2014; Zahodne et al., 2019).

Sillars et al. (1990) reported negative partial correlations between marital satisfaction and overall recall accuracy (r = -0.04), the recall of negative (r = -0.32) and confrontive statements from a spouse (r = -0.35), controlling for the number of total statements provided. The authors noted that the p-values for the recall of negative and confrontive statements were both <0.10, however, no specific p-value was provided. In addition, marital satisfaction was positively associated with the recall of conciliatory statements (r = 0.05), though this association was not statistically significant.

Whisman and Delinsky (2002) reported positive correlations between marital satisfaction and the number of positive adjectives endorsed and recalled in both husbands (r = 0.09) and wives (r = 0.19). Conversely, negative correlations were reported between marital satisfaction and the number of negative adjectives endorsed and recalled for both husbands (r = -0.43) and wives (r = -0.60). However, only the associations for the recall of negative adjectives were statistically significant. These associations remained statistically significant after controlling for the frequency of negative adjectives endorsed (husbands: r =-0.31; wives: r = -0.30) and depression (husbands: r = -0.42; wives: r =-0.58).

Windsor et al. (2014) reported positive, though statistically non-significant, correlations between positive spouse exchanges and both episodic memory (r = 0.18) and working memory (r = 0.04) in unadjusted and adjusted analyses. Conversely, negative spouse exchanges were negatively correlated with both episodic (r = -0.08) and working memory (r = -0.11), though only the association for working memory was statistically significant.

Ge et al. (2017) reported positive associations between spousal strain and both episodic ($\hat{\beta} = 0.11, 95\%$ CI = 0.03, 0.19) and working memory ($\hat{\beta} = 0.19, 95\%$ CI = -0.01, 0.39), though only the association for episodic memory reached statistical significance.

Lindert et al. (2022) found that marital strain was associated with greater declines in episodic memory over time among both men ($\hat{\beta} = 0.13$, 95% *CI* = 0.01, 0.25) and women ($\hat{\beta} = 0.04$, 95% *CI* = -0.10, 0.18). However, only the association for men was statistically significant. In a sub-analysis of employed participants, similar positive associations were reported between marital strain and episodic memory decline (men: $\hat{\beta} = 0.18$, 95% *CI* = 0.04, 0.32; women: $\hat{\beta} = 0.01$, 95% *CI* = -0.15, 0.17).

Waldinger et al. (2015) found that, at the bivariate level, marital satisfaction was positively correlated with memory in both men (r = 0.001) and women (r = 0.33), though only the associations for women were statistically significant. Moreover, the frequency of marital disagreements was negatively correlated with memory in both men (r = 1.0000)

-0.17) and women (r = -0.27). In a subsequent longitudinal multivariable analysis, the interaction between security of attachment and marital disagreements was found to be significantly positively associated with memory among women (p < 0.05), suggesting that for women who were less securely attached, greater marital conflicts were associated with poorer memory functioning 2.5 years later. Among men, however, the interaction between security of attachment and marital disagreements was not statistically significant.

Min and Song (2023) reported that individuals in ambivalent ($\hat{\beta} = 0.10, 95\%$ CI = -0.17, 0.38) or supportive relationships ($\hat{\beta} = 0.06, 95\%$ CI = -0.14, 0.26) had better episodic memory compared to those in aversive relationships. On the other hand, individuals in indifferent relationships had poorer episodic memory compared to those in aversive relationships ($\hat{\beta} = -0.12, 95\%$ CI = -0.39, 0.15). However, when examining the interaction between widowhood status and marital quality prior to bereavement, the authors found that widowed individuals whose relationship with their deceased spouse was ambivalent ($\hat{\beta} = -0.73, 95\%$ CI = -1.25, -0.21), supportive ($\hat{\beta} = -0.39, 95\%$ CI = -0.77, -0.01) or indifferent ($\hat{\beta} = -0.38, 95\%$ CI = -0.91, 0.15) had poorer episodic memory compared to widowed individuals who had aversive relationships; only the interactions between widowhood status and supportive relationships, were statistically significant.

Zahodne et al. (2019) found that spousal strain was negatively associated with initial memory ($\hat{\beta} = -0.04, 95\%$ CI = -0.06, -0.02) but was not associated with memory change over time ($\hat{\beta} = -0.04, 95\%$ CI = -0.11, 0.04). Spousal support was not significantly associated with initial memory ($\hat{\beta} = 0.02, 95\%$ CI = -0.01, 0.04) or memory change ($\hat{\beta} = -0.02, 95\%$ CI = -0.10, 0.06). After combining these two constructs into a single composite variable called 'spousal relationship quality', the authors reported that spousal relationship quality was not significantly associated with initial memory ($\hat{\beta} = 0.02; 95\%$ CI = -0.00, 0.04) or memory change ($\hat{\beta} = 0.00; 95\%$ CI = -0.00, 0.04) or memory change ($\hat{\beta} = 0.00; 95\%$ CI = -0.07, 0.08).

3.3. Executive function

Four articles examined the association between different aspects of marital quality and executive function (Ge et al., 2017; Lindert et al., 2022; Min and Song, 2023; Waldinger et al., 2015).

Waldinger et al. (2015) reported positive, but statistically non-significant, correlations between marital disagreements and executive function among both men (r = 0.05) and women (r = 0.12). Marital satisfaction was positively correlated with executive function among both men (r = 0.14) and women (r = 0.06), though these associations were also not statistically significant.

Ge et al. (2017) reported a significant positive association between spousal strain and executive function ($\hat{\beta} = 1.28$, 95% *CI* = 0.32, 2.24). Lindert et al. (2022) also reported positive, though statistically non-significant, associations between marital strain and declines in executive functioning over time among both men ($\hat{\beta} = 0.01$, 95% *CI* = -0.07, 0.09) and women ($\hat{\beta} = 0.05$, 95% *CI* = -0.01, 0.11). In the subsample of employed participants, marital strain remained positively associated with executive function declines (men: $\hat{\beta} = 0.01$, 95% *CI* = -0.07, 0.09; women: $\hat{\beta} = 0.09$, 95% *CI* = 0.01, 0.17); only the association for employed women was statistically significant.

Min and Song (2023) found that individuals in ambivalent ($\hat{\beta} = 0.10$, 95% CI = -0.17, 0.38) or supportive relationships ($\hat{\beta} = 0.06$, 95% CI = -0.14, 0.26) had better executive functioning compared to those in aversive relationships. On the other hand, individuals in indifferent relationships had poorer executive functioning than those in aversive relationships ($\hat{\beta} = -0.12$, 95% CI = -0.39, 0.15). However, when examining the interaction between widowhood status and marital

quality prior to be reavement, it was reported that widowed individuals whose relationship with their deceased spouse was ambivalent ($\hat{\beta} = 0.08, 95\%$ CI = -0.10, 0.25) or supportive ($\hat{\beta} = 0.02, 95\%$ CI = -0.10, 0.15) had better executive functioning compared to widowed individuals who had aversive relationships. Conversely, widowed individuals who had indifferent relationships with their deceased spouse had poorer executive functioning compared to widowed individuals who had aversive relationships ($\hat{\beta} = -0.14, 95\%$ CI = -0.31, 0.04); none of these associations reached statistical significance.

3.4. Perceptual speed

Windsor et al. (2014) found that positive spouse exchanges were not correlated with perceptual speed (r = 0.00). Conversely, negative spouse exchanges were inversely correlated with perceptual speed, but only prior to adjusting for covariates (unadjusted r = -0.08; fully adjusted: r = -0.07).

3.5. Risk of bias

Overall, 13 articles had a low risk of bias (cross-sectional: Gallagher and Stokes, 2021; Ge et al., 2017; Whisman and Delinsky, 2002; Wuttke-Linnemann et al., 2020; longitudinal: Kim and Kwon, 2023; Kim, 2021; Lindert et al., 2022; Liu et al., 2021; Min and Song, 2023; Waldinger et al., 2015; Windsor et al., 2014; Xu et al., 2016; Zahodne et al., 2019) and two had a moderate risk of bias (cross-sectional: Ko et al., 2007; Sillars et al., 1990). For cross-sectional studies, sources of bias were mainly related to the appropriateness of the statistical methods used, since some studies did not use regression models or adjust for any covariates in their examination of the association between marital quality and cognitive function. For cohort studies, sources of bias were mainly related to losses to follow-up. Specifically, many studies did not describe the reasons for losses to follow-up nor explain whether attempts were made to address these losses. For a more detailed summary of the risk of bias assessment, refer to Appendix C.

4. Discussion

This narrative synthesis described the association between marital quality and various domains of cognitive function. Overall, findings from the included articles suggested that more positive marital quality was associated with better cognitive performance. However, the results were not uniform across the 15 included studies or the different domains of cognitive function. In addition, the lack of statistical significance in several studies, likely due to underpowered analyses, did not allow us to draw firm conclusions about the strength and direction of this relationship.

Some of our findings align with a growing body of literature suggesting social relationships, particularly close intimate relationships with marital or common-law partners, provide a greater quality of support to individuals and positively influence one's well-being (Cohen and Wills, 1985; Feng et al., 2014; Mousavi-Nasab et al., 2012; Zaheed et al., 2021). More specifically, good quality marital relationships can provide individuals with stability, positive affect, and the resources to cope with potentially stressful situations. This may serve to counteract the physiological changes associated with stress (e.g., elevated blood cortisol levels) on the brain (Kuiper et al., 2016). Reduced emotional or mental strain can also help prevent atrophy of the hippocampus, a key brain region involved in cognitive function, and ultimately reduce structural changes associated with cognitive decline (Kuiper et al., 2016). However, while positive marital quality may buffer the harmful effects of stress on cognitive health through the provision of instrumental and emotional support (Cohen, 2004), negative marital quality may itself be a source of stress that can, in turn, undermine cognitive health. Interestingly, the provision of support from a marital partner did

not appear to be unanimously associated with better cognitive function across all 15 articles. The stress-buffering hypothesis emphasizes that support from loved ones may only have beneficial impacts on cognitive functioning when individuals have access to the types of social support that they believe will address the specific stressors in their lives (Cohen and Wills, 1985). Thus, it is possible that, for some participants, the support provided by their spouses did not adequately address their specific needs. Unfortunately, it was not possible to decipher between the impacts of different types of spousal support (e.g., tangible support, emotional support, informational support, etc.) on cognitive functioning, as the included articles did not provide sufficient information to make these comparisons.

In addition, marital quality is a difficult concept to define, as evidenced by multiple definitions of marital quality used in the included articles. For example, while studies such as Zahodne et al. (2019) used a composite measure that encompassed both positive and negative dimensions of marital quality, other studies such as Gallagher and Stokes (2021) defined marital quality as the enjoyment of time spent with a spouse. Varying definitions of marital quality, as well as different sample characteristics among the included articles may have also contributed to equivocal relationships between marital quality and cognitive function. More specifically, not all participants in the included studies were married at the time of investigation. For example, Min and Song's (2023) sample was composed of a group of individuals who experienced the death of their spouse between two timepoints, in addition to a group of age- and gender-matched participants who remained married. Thus, the authors examined the interaction between widowhood status and pre-loss marital quality on cognitive function. Such intricacies may have provided nuanced interpretations of the association between the variables.

Future research would benefit from longer longitudinal comparisons of marital quality and cognitive function. Although many of the findings from the included studies were not statistically significant, these null findings did not necessarily suggest the absence of an association between marital quality and cognitive function, given the possibility of underpowered analyses. Furthermore, several studies found different associations between marital quality and several aspects of cognitive function when stratifying their results by sex. For example, Liu et al. (2021) found that marital quality shaped cognitive trajectories differently in men and women. More specifically, greater negative marital quality was associated with lower cognitive function at baseline, and an increase in negative marital quality over time was associated with a faster rate of cognitive decline among men, but not women.

Sex differences in marital quality have been extensively studied in the literature (Boerner et al., 2014; Chang and Fu, 2023; Fowers, 1991; Jackson et al., 2014), with findings suggesting nuanced differences between husbands and wives. For instance, Jackson et al. (2014) conducted a meta-analysis involving over 100,000 participants and found statistically significant differences in marital satisfaction across husbands and wives, with wives reporting less satisfaction in their marriages than husbands. These results are indicative of marital scholars' findings that men and women experience marriage differently (Bernard, 1972), with several theories having been proposed to explain these differences. For instance, societal gender expectations, division of labour, support provision and unequal power dynamics serve as key determinants of marital satisfaction between men and women (Bernard, 1972; Chang and Fu, 2023). Despite women's increased participation in employment, they still perform a disproportionate amount of household tasks, caregiving responsibilities, child care, and emotional work (Baxter, 2000; Bianchi and Milkie, 2010). Studies indicate that women are generally unhappy with this division of labor in their relationships (Dempsey, 2000) and this unhappiness is associated with lower marital satisfaction (Grote and Clark, 2001; Stevens et al., 2005). Moreover, research by Fowers (1991) has suggested that husbands evaluate their marriages more positively than wives across a variety of relationship dimensions, including finances, parenting, family and friends, and their

partner's personality, supporting the multifaceted nature of marriage. Such findings thus suggest traditional gender roles, in addition to biological sex, are important to consider in the association between marital quality and cognitive function. Differences in physiological reactivity to stress and help-seeking behaviour between men and women may also partly help to explain sex disparities (Liddon et al., 2018; Markey et al., 2005; Verma et al., 2011). Men also tend to generally restrict sources of emotional support to formal intimate relationships and are more likely to name their spouse as a confidante compared to women (Penning and Wu, 2014; Vaux, 1985). Conversely, married women are less likely to mention their husbands as their main source of emotional support (Vaux, 1985). Women generally have larger social networks, spend more time on social interaction, and receive emotional support from a wider range of network members than men (McLaughlin et al., 2010; Vaux, 1985). Thus, it is possible men may be more sensitive to strain or conflict in their marriages due to the importance placed on these relationships compared to women. These findings further emphasize the importance of context when examining the association between marital relationships and cognitive function. As well, the findings suggest any understanding of this relationship should consider sex as an effect modifier.

Furthermore, many of the articles in the current review undertook their investigations with a sample of married heterosexual couples. Future research may benefit from using more diverse sampling frames (i. e., common-law relationships or non-heterosexual couples). Additionally, including more relevant covariates in the analyses of these studies may help to reduce the risk of residual confounding. Measuring marital quality in other longitudinal panel studies such as the Canadian Longitudinal Study on Aging (CLSA) (Raina et al., 2019) may also provide meaningful insights about the quality of social relationships in other populations.

Overall, some findings suggested that having good quality marital relationships had a positive impact on cognitive function, while other results suggested the contrary. Many findings were statistically nonsignificant, but we could not ascertain whether this reflected low power or no actual associations between the variables of interest. Some of the mixed findings could be explained by study features that differed across the articles, such as measures of cognitive function, definitions of marital quality, design factors (e.g., length of follow-up and statistical analyses), sample sizes, and covariates. As social networks narrow in late life and intimate partnerships become more central, the findings of the current review may help to inform tailored public health initiatives aimed at improving marital quality, since this could be an effective strategy for promoting cognitive health in older adults.

4.1. Strengths and limitations

The current systematic review is the first to summarize and appraise research on the association between marital quality and cognitive function. Previous reviews have either examined marital status and its association with dementia or compared the association between spousal support and memory with other sources of support (i.e., support from children, family, or friends). Unlike these earlier reviews, we considered how the quality of one's marriage or common-law relationship, rather than their marital status itself, may impact cognitive function. Moreover, using the SWiM guidelines, we conducted a comprehensive literature search and thorough narrative assessment of each cognitive domain. In addition, a guidance document explaining the eligibility criteria and containing formal definitions of key variables (i.e., marital quality and cognitive function) was provided to all reviewers to promote consistency when conducting article screening, risk of bias assessment, and data extraction. Regular meetings were also held throughout the review process to promote a standardized approach across reviewers and address any concerns. Lastly, we appraised our review using the AMSTAR 2 checklist (Shea et al., 2017) and scored 12 out of 13 points (omitting three questions about meta-analysis) (see Appendix D).

Despite the strengths, this review is also limited by the inability to

perform a meta-analysis. Meta-analyzing the data was precluded due to the substantial heterogeneity in the methodologies used in the included articles, especially in terms of the definitions and types of marital quality used. Specifically, reviewers employed terms such as marital satisfaction, positive/negative marital experiences, spousal strain, and marital disagreements to describe marital quality, which may all demonstrate varying relationships with cognitive function based on the meaning of these constructs. Heterogeneity in types and measures of cognitive function also prevented us from conducting a meta-analysis. For instance, cognitive function was measured using several tools such as the Mini-Mental State Examination (Folstein et al., 1975), East Boston Memory Test (Scherr et al., 1988), and Rey Auditory Verbal Learning Test (Rey, 1964) among many others. Furthermore, this heterogeneity in the included articles extended to differences in sample sizes, study populations, covariates and statistical approaches used to analyze the data. Due to these differences, we could not identify discernible patterns in the effect sizes across the included studies. Statistical significance was not related to sample size, as some studies with larger sample sizes (e.g., Windsor et al. [2014]) did not find statistically significant results. Conversely, other studies with smaller samples (e.g., Sillars et al. [1990]) did report significant associations. In addition, some studies (e. g., Zahodne et al. [2019]) reported small regression coefficients that were statistically significant, while other studies (e.g., Liu et al. [2021]) reported regression coefficients of a larger magnitude that were not statistically significant at the 5% level.

5. Conclusion

The current systematic review suggests that more positive marital quality is generally associated with better cognitive performance. However, the evidence is equivocal and may vary depending on the specific domain of cognitive function assessed. Additionally, the studies included in this review did not consider various factors that are intertwined with marital quality, such as length of marriage or previous marital history. Future research examining the association between marital quality and cognitive function should take these additional contextual factors into account to provide a more comprehensive understanding of this relationship. Furthermore, researchers need to be consistent in defining and operationalizing marital quality and cognitive function to create a uniform evidence base. Such consistency will facilitate increased comparability across studies. Furthermore, researchers should clearly distinguish between 'sex' and 'gender' in future work, as well as focus on the role of gender as a social construct when exploring marital quality and cognition. Given the increasing prevalence of dementia, our findings on the significance of marital quality for cognitive health could provide evidence to inform policies to promote healthy aging by fostering supportive marital relationships.

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Activities NOT requiring ethics review

There are several categories of activities that do not require ethics review even though some of the activities may use methods and techniques similar to those used in research.

Making initial contact with individuals or communities to establish partnerships

Ethics review is not required for the "*initial exploratory phase* of the research where this phase involves "contact with individuals or communities intended to establish research partnerships or the design of a research proposal" (TCPS2, Article 6.11, p. 76).

As outlined in the TCPS2, "some types of research using quantitative, qualitative research, or a combination of these methods, as well as collaborative or community-based research may require prior contact and dialogue with individuals or communities as a normal and integral component to establish research collaborations or partnerships prior to the actual design of the research" (p. 77). Furthermore, "other research may, at their initial stages, not involve humans, but require engaging the research team, setting up equipment and other preparatory stages" (TCPS2, p. 77). All of these activities do NOT require ethics review.

Creative practice

Ethics review is not required for creative practice activities involving the "process which an artist makes or interprets a work or works of art". This "may also include a study of the processes of how a work of art is generated" (TCPS2, Article 2.6, p. 20).

However, "research that employs creative practice to obtain responses from participants that will be analyzed to answer a research questions is subject to REB review" (p. 20). For example, when the individuals become the focus of the research such as asking observers or art exhibit patrons to provide comments on a work of art and/or provide their personal opinion or analysis of the work this is considered research.

Research that relies exclusively on publicly available information

Information that is legally accessible to the public and appropriately protected by law does not require ethics review. "Publicly available information is any existing stored documentary material, records or publications, which may or may not include identifiable information" according to the TCPS2 (p. 17).

However, "some types of information are legally accessible to the public in a certain form and for a certain purpose, as specified by law or regulations" such as registries of deaths, court judgments, or public archives and publicly available statistics including Statistics Canada public use files (p. 17). Publicly available archives in Canada or other countries at either the national, provincial, or municipal level may have policies that outline certain restrictions or access rights.

Information that is publicly accessible where there is no reasonable expectation of privacy does not require ethics review. "Research that uses exclusively publicly available information and may contain identifiable information, and for which there is no reasonable expectation of privacy", does NOT require ethics review. Examples include: identifiable information that may be disseminated publicly through print or electronic publications, film or digital recordings, exhibitions or events open for attendance by the public, etc.

Ethics review is also not required for "research that is non-intrusive, and does not involve direct interaction between the researcher and individuals through the Internet" and "for which there is no expectation of privacy" (p. 18). Examples include uncontrolled public access via the Internet to cyber-material such as documents, records, performances, online archival materials or published third-party interviews. Uncontrolled access means there is no login or password required to access the information, video, etc.

Source:https://uwaterloo.ca/research/office-research-ethics/researchch-human-participants/pre-submission-and-training/human-research -guidelines-policies-and-resources/does-my-data-collection-activity-re quire-ethics-review#activitiesnotrequiringreview.

As per the above information, our study is exempt from ethics review and clearance.

CRediT authorship contribution statement

Paniz Haghighi: Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Emma A.L.** Littler: Writing - review & editing, Validation, Investigation, Data curation. Dane Mauer-Vakil: Writing - review & editing, Validation, Investigation, Data curation. Michaella Miller: Writing - review & editing, Validation, Investigation, Data curation. Mark Oremus: Writing - review & editing, Visualization, Validation, Supervision, Project administration.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Search strategy used for each database

PSYCInfo[•]

Data availability

All data for this systematic review are contained in the tables and appendices included with the published article.

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We are grateful to Jackie Stapleton (liaison librarian for the School of Public Health Sciences at the University of Waterloo) for helping to develop the literature search strategy.

Search #1: ((title: (marital) OR title: (spousal) OR title: (marriage) OR title: (spouse)) NEAR/1 (title: (quality) OR title: (satisfaction) OR title: (adjustment) OR title: (strain) OR title: (conflict) OR title: (stress) OR title: (distress) OR title: (cohesion) OR title: (tension)) OR (abstract: (marital)) OR abstract: (spouse)) OR abstract: (marriage) OR abstract: (spouse)) NEAR/1 (abstract: (quality) OR abstract: (satisfaction) OR abstract: (adjustment) OR abstract: (strain) OR abstract: (conflict) OR abstract: (stress) OR abstract: (distress) OR abstract: (cohesion) OR abstract: (tension)) OR (Index Terms: (marital) OR Index Terms: (spousal) OR Index Terms: (maritage) OR Index Terms: (spouse)) NEAR/1 (Index Terms: (quality) OR Index Terms: (satisfaction) OR Index Terms: (adjustment) OR Index Terms: (strain) OR Index Terms: (conflict) OR Index Terms: (stress) OR Index Terms: (distress) OR Index Terms: (cohesion) OR Index Terms: (tension)))

Search #2: (title: (memory) OR title: ("cognitive function*") OR title: (cognition) OR title: ("executive function*") OR title: ("visuospatial processing") OR title: ("verbal learning") OR title: ("processing speed") OR title: ("intellectual functioning") OR title: ("language processing") OR title: ("cognitive decline") OR title: ("immediate recall") OR title: ("delayed recall") OR title: ("cognitive limit*") OR title: ("cognitive impair*") OR title: ("cognitive reserve") OR title: ("cognitive dysfunction")) OR (abstract: (memory) OR abstract: ("cognitive function*") OR abstract: (cognition) OR abstract: ("executive function*") OR abstract: ("visuospatial processing") OR abstract: ("verbal learning") OR abstract: ("processing speed") OR abstract: ("intellectual functioning") OR abstract: ("language processing") OR abstract: ("cognitive decline") OR abstract: ("immediate recall") OR abstract: ("delayed recall") OR abstract: ("cognitive limit*") OR abstract: ("cognitive impair*") OR abstract: ("cognitive reserve") OR abstract: ("cognitive dysfunction")) OR (Index Terms: (memory) OR Index Terms: ("cognitive function*") OR Index Terms: (cognition) OR Index Terms: ("executive function*") OR Index Terms: ("visuospatial processing") OR Index Terms: ("verbal learning") OR Index Terms: ("processing speed") OR Index Terms: ("intellectual functioning") OR Index Terms: ("language processing") OR Index Terms: ("cognitive decline") OR Index Terms: ("immediate recall") OR Index Terms: ("delayed recall") OR Index Terms: ("cognitive limit*") OR Index Terms: ("cognitive impair*") OR Index Terms: ("cognitive reserve") OR Index Terms: ("cognitive dysfunction"))

Search #3: #1 AND #2.

PubMed:

(marital quality[tw] OR marital satisfaction[tw] OR marital adjustment[tw] OR marital strain[tw] OR marital conflict[tw] OR marital stress[tw] OR marital distress[tw] OR marital cohesion[tw] OR marital tension[tw] OR spousal strain[tw] OR spousal conflict[tw] OR spousal satisfaction[tw]) AND (memory[tw] OR cognitive function*[tw] OR cognition[tw] OR executive function*[tw] OR visuospatial processing[tw] OR verbal learning[tw] OR processing speed[tw] OR intellectual functioning[tw] OR language processing[tw] OR cognitive decline[tw] OR cognitive reserve[tw] OR immediate recall[tw] OR delayed recall[tw] OR cognitive limit*[tw] OR cognitive impair*[tw] OR cognition[Mesh] OR cognitive dysfunction[Mesh]) Sconus:

(TITLE-ABS-KEY ((marital OR spousal OR marriage OR spouse) W/1 (quality OR satisfaction OR adjustment OR strain OR conflict OR stress OR distress OR cohesion OR tension)) AND TITLE-ABS-KEY (memory OR "cognitive function*" OR cognition OR "executive function*" OR "visuospatial processing" OR "verbal learning" OR "processing speed" OR "intellectual functioning" OR "language processing" OR "cognitive decline" OR "immediate recall" OR "delayed recall" OR "cognitive limit*" OR "cognitive impair*" OR "cognitive reserve" OR "cognitive dysfunction"))

Note: Rather than individually searching controlled vocabulary and natural language, we opted to use the [tw] term in PubMed to capture a broader scope of relevant articles within our search.

SWiM reporting item	Item description	Page in manuscript where item is reported	Other
Methods			
1 Grouping studies for synthesis	1a) Provide a description of, and rationale for, the groups used in the synthesis (e.g., groupings of populations, interventions, outcomes, study design)	6	
	1 b) Detail and provide rationale for any changes made subsequent to the protocol in the groups used in the synthesis	N/A	No deviation from protocol
2 Describe the standardized metric and transformation methods used	Describe the standardized metric for each outcome. Explain why the metric(s) was chosen, and describe any methods used to transform the intervention effects, as reported in the study, to the standardized metric, citing any methodological guidance consulted	6	
3 Describe the synthesis methods	Describe and justify the methods used to synthesize the effects for each outcome when it was not possible to undertake a meta-analysis of effect estimates.	6	
		(0	ntinued on next page)

Appendix B. SWiM reporting guideline

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(continued)

SWiM reporting item	Item description	Page in manuscript Other where item is reported
4 Criteria used to prioritise results for summary and synthesis	Where applicable, provide the criteria used, with supporting justification, to select the particular studies, or a particular study, for the main synthesis or to draw conclusions from the synthesis (e.g., based on study design, risk of bias assessments, directness in relation to the review question).	4-5
5 Investigation of heterogeneity in reported effects	State the method(s) used to examine heterogeneity in reported effects when it was not possible to undertake a meta-analysis of effect estimates and its extensions to investigate heterogeneity.	6
6 Certainty of evidence	Describe the methods used to assess certainty of the synthesis findings.	Addressed throughout the manuscript
7 Data presentation methods	Describe the graphical and tabular methods used to present the effects (e.g., tables, forest plots, harvest plots). Specify key study characteristics (e.g., study design, risk of bias) used to order the studies, in the text and any tables or graphs, clearly referencing the studies included.	6
Results		
8 Reporting results	For each comparison and outcome, provide a description of the synthesized findings, and the certainty of the findings. Describe the result in language that is consistent with the question the synthesis addresses, and indicate which studies contribute to the synthesis	7–15
Discussion		
9 Limitations of the synthesis	Report the limitations of the synthesis methods used and/or the groupings used in the synthesis, and how these affect the conclusions that can be drawn in relation to the original review question	15–18

Appendix C. Risk of Bias Assessment using the JBI Critical Appraisal Checklists

Table C1

Quality assessment for cross-sectional studies

	Gallagher and Stokes (2021)	Ge et al. (2017)	Ko et al. (2007)	Sillars et al. (1990)	Whisman and Delinsky (2002)	Wuttke-Linnemann et al., 2020
1. Were the criteria for inclusion in the sample clearly defined?	Yes	Yes	Yes	No	Yes	Yes
2. Were the study subjects and the setting described in detail?	Yes	Yes	Yes	Yes	Yes	Yes
3. Was the exposure measured in a valid and reliable way?	Yes	Yes	Yes	Yes	Yes	Yes
4. Were objective, standard criteria used for measurement of the condition?	Yes	Yes	Yes	Unclear	Yes	Yes
5. Were confounding factors identified?	Yes	Yes	No	Yes	Yes	Yes
6. Were strategies to deal with confounding factors stated?	Yes	Yes	No	Yes	Yes	Yes
7. Were the outcomes measured in a valid and reliable way?	Yes	Yes	Yes	No	Yes	Yes
8. Was appropriate statistical analysis used?	No	Yes	No	Yes	Yes	Yes
Overall risk of bias	low	low	moderate	moderate	low	low

Table C2

Quality assessment for cohort studies

	Kim (2021)	Kim and Kwon (2023)	Lindert et al. (2022)	Liu et al. (2021)	Min and Song (2023)	Waldinger et al. (2015)	Windsor et al. (2014)	Xu et al. (2016)	Zahodne et al. (2019)
1. Were the two groups similar and recruited from the same population?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Were the exposures measured similarly to assign people to both exposed and unexposed groups?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3. Was the exposure measured in a valid and reliable way?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes
4. Were confounding factors identified?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5. Were strategies to deal with confounding factors stated?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6. Were the participants free of the outcome at the start of the study (or at the moment of exposure)?	Yes	Unclear	Unclear	Unclear	Unclear	Yes	Yes	Unclear	Yes
7. Were the outcomes measured in a valid and reliable way?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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Table C2 (continued)

	Kim (2021)	Kim and Kwon (2023)	Lindert et al. (2022)	Liu et al. (2021)	Min and Song (2023)	Waldinger et al. (2015)	Windsor et al. (2014)	Xu et al. (2016)	Zahodne et al. (2019)
8. Was the follow up time reported and sufficient to be long enough for outcomes to occur?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9. Was follow up complete, and if not, were the reasons to loss to follow up described and explored?	Yes	Yes	No	No	No	No	Yes	No	Yes
10. Were strategies to address incomplete follow up utilized?	Yes	Yes	No	No	No	No	Yes	Yes	Yes
11. Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Overall risk of bias	low	low	low	low	low	low	low	low	low

Appendix D. AMSTAR-2 Checklist

Questions	Overall Decision
1. Did the research questions and inclusion criteria for the review include the components of PICO?	⊠ Yes
Population	□ No
☑ Intervention	
☑ Comparator group	
☑ Outcome	
Timeframe for follow-up (Optional)	
2. Did the report of the review contain an explicit statement that the review methods were established prior to the co	nduct 🛛 Yes (if answered 'yes' to all seven
of the review and did the report justify any significant deviations from the protocol?	components)
☑ Review question(s)	\Box Partial yes (if answered 'yes' to the first
Search strategy	four components)
Inclusion/exclusion criteria	□ No
Risk of bias (RoB) assessment	
Data synthesis plan	
Plan for investigating causes of heterogeneity	
☑ Justification for deviations from the protocol	_
3. Did the review authors explain their selection of the study designs for inclusion in the review?	⊠ Yes
□ Explanation for including only randomized controlled studies (RCT)	∐ No
○ OR Explanation for including only non-randomized studies (NRSI)	
OR Explanation for including both RCTs and NRSI	
4. Did the review authors use a comprehensive literature search strategy?	☐ Yes (if answered 'yes' to all eight
Searched ≥ 2 relevant databases	components)
Provided key words and/or search strategy Provided key words and/or search strategy	Partial yes (if answered yes' to the first three components)
Provided Justification for publication restrictions (i.e., language)	three components) \Box No
Searched relevant grey interature Consultation extent surveys in the field	
Considered the reference lists of included studies	
Searched the reference has of included studies	
Searched that/study registries	
5 Did the review authors perform study selection in duplicate?	V Vec
S. For the review authors period in study selection in duplicate: ∇ A least two reviews independently agreed on selection of eligible studies and achieved consensus on which studies to i	nclude \Box No
OR Two reviewers independently agreed on selections and achieved good agreement (at least 80 percent) with the rem	ainder
selected by one reviewer	
6. Did the review authors perform data extraction in duplicate?	X Yes
\boxtimes At least two reviewers achieved consensus on which data to extract from included studies	
□ OR Two reviewers extracted data from a sample of eligible studies and achieved agreement of at least 80% with the rem	ainder
extracted by one reviewer	
7. Did the review authors provide a list of excluded studies and justify the exclusions?	\Box Yes (if answered 'yes' to both components)
Provided a list of all potentially relevant studies that were read in full-text form but excluded from the review	Partial yes (if answered 'yes' to the first
□ Justified the exclusion from the review of each potentially relevant study	component)
	□No
8. Did the review authors describe the included studies in adequate detail?	⊠ Yes
Described population in detail	□ No
Described intervention (including doses where relevant)	
Described comparators (including doses where relevant)	
Described study's setting	
Described time frame for follow-up	
9. Did the review authors use a satisfactory technique for assessing the RoB in individual studies that were included	in the Yes (if answered 'yes' to all four
review?	components)
☑ For reviews including only NRSI, must have assessed ROB from confounding	\Box Partial yes (if answered 'yes' to the first
△ AND selection bias	two components)
AND methods used to ascertain exposures and outcomes	□ No
AND selection of the reported result from among multiple measurements or analyses of a specified outcomes	
10. Did the review authors report on the sources of funding for the studies included in the review?	
□ Reported the sources of funding (when available) for individual studies included in the review	⊠ No
	(continued on next page)

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(continued)

Que	stions	Overall Decision
11.	If meta-analysis was performed did the review authors use appropriate methods for statistical combination of results?	□ Yes
	For reviews including only NRSI, the authors justified combining the data in a meta-analysis	□ No
	Used an appropriate weighted technique to combine study results, adjusting for heterogeneity if present	No meta-analysis conducted
	Statistically combined effect estimates from NRSI that were adjusted for confounding, rather than combining raw data, or	
	justified combining raw data when adjusted effect estimates were not available	
	Reported separate summary estimates for RCTs and NRSI separately when both were included in the review	
12.	ff meta-analysis was performed, did the review authors assess the potential impact of RoB in individual studies on the	□ Yes
re	sults of the meta-analysis or other evidence synthesis?	□ No
	Included only low risk of bias RCTs	No meta-analysis conducted
	OR, if the pooled estimate was based on RCTs and/or NRSI at variable RoB, the authors performed analyses to investigate	
	possible impact of RoB on summary estimates of effect.	
13.	Did the review authors account for RoB in individual studies when interpreting/discussing the results of the review?	🖾 Yes
	Included only low risk of bias RCTs	□ No
X	OR if RCTs and/or NRSI with moderate to high RoB were included, the review discussed the likely impact of RoB on the results	
14.	Did the review authors provide a satisfactory explanation for, and discussion of, any heterogeneity observed in the	🖾 Yes
re	sults of the review?	□ No
	There was no significant heterogeneity in the results	
X	OR if heterogeneity was present, the authors investigated the sources of any heterogeneity in the results and discussed their	
	impact on the results of the review	
15.	If they performed quantitative synthesis did the review authors carry out an adequate investigation of publication bias	□ Yes
(s	mall study bias) and discuss its likely impact on the results of the review?	□ No
	Performed graphical or statistical tests for publication bias and discussed the likelihood and magnitude of impact of publication	No meta-analysis conducted
	bias	
16.	Did the review authors report any potential sources of conflict of interest, including any funding they received for	⊠ Yes
С	nducting the review?	□ No
X	The authors reported no competing interest	
	OD The systems described their funding seconds and here there menaged retential conflicts of interest	

□ OR The authors described their funding sources and how they managed potential conflicts of interest

Notes. 13 out of the 16 questions were relevant to our review (i.e., items related to meta-analysis were not considered). Out of 13 questions, we scored 'yes' to 10 items, and 'partial yes' to two items.

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