



Associations between cognitive function and marital status in the United States, South Africa, Mexico, and China

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ABSTRACT

We investigate the associations between marital status and cognitive well-being among adults aged 50 and older across four settings: the United States, rural South Africa, Mexico, and China. Using a standardized measure of immediate word recall, we assess whether people in each non-married status have worse cognitive function than their married counterparts, and the extent to which these associations vary across settings. We theorize that the practices around marriage in each setting, as well as the social stigma attached to marital dissolution, will reveal differing associations between marital status and cognition. Results suggest that, among women, being in a widowed marital status is associated with lower cognitive function in each setting except Mexico (after accounting for education and employment), while being separated/divorced or never married is associated with lower cognitive function only among women in the U.S. and Mexico. Among men, being widowed is associated with lower cognitive function relative to being married in each setting except South Africa (after accounting for education and employment), and being never married is associated with lower cognitive function in the U.S. and China (but not in South Africa or Mexico, after accounting for education and employment). Men also face relatively lower cognitive function if separated/divorced in the U.S. and South Africa. We discuss possible reasons for these associations across settings.

1. Introduction

Married people tend to have better mental and physical health when compared with their never married, divorced, or widowed counterparts (Barrett, 2000; M. E. Hughes & Waite, 2009; Sasson & Umberson, 2013; L. J. Waite, Luo, & Lewin, 2009; Wong & Waite, 2015). Marriage may provide opportunities for greater cognitive stimulation (Sundström, Westerlund, Mousavi-Nasab, Adolfsson, & Nilsson, 2014), which can lead to observable differences in cognitive health between these groups. However, there is evidence that the benefits associated with marriage and disadvantages associated with singlehood, divorce, and widowhood may depend on the social norms and stigma specific to the respective setting (Axinn et al., 2020; Perkins et al., 2016). Understanding the link between marital status and cognitive health across disparate settings is an important step in addressing global concerns about cognitive impairment and dementia (Prince et al., 2013).

In this paper, we investigate how marital status can be associated with cognitive function among aging adults in four countries, spanning different regions of the world: the United States, rural South Africa, Mexico, and China. These four countries exhibit different social, marital, cultural, economic, and political contexts. By investigating associations

between marital status and cognitive function across these settings, we are able to offer important insight into whether or not the benefits or detriments of singlehood, marriage, divorce, and widowhood to cognitive health are universal and how associations may be driven by setting-specific values and norms.

We use data from the U.S. Health and Retirement Study (HRS) and three HRS sister studies in South Africa, the Mexico, and China —¹ to investigate associations between marital status and a harmonized indicator of cognitive function (immediate word recall) among men and women ages 50 and older. Because measurement and understanding of cognitive health is lacking in settings like sub-Saharan Africa, much of Latin America, and much of Asia, this investigation is an important contribution to existing research, as it offers new insight into associations between marriage and cognition across the globe.

2. Background and contextual framing

2.1. Cognitive aging

With populations living to older ages across the globe, greater attention has been placed on measurement and protection of cognitive

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¹ Data from each of these studies can be accessed via the Gateway to Global Aging site, at <https://g2aging.org/>.

function in older age (Prince et al., 2016). Cognitive abilities, such as memory, language, and executive function underlie everyday functional processes and may be among the best predictors of independence, health, and well-being of older adults (Greiner, Snowden, & Schmitt, 1996; Skirbekk, Loichinger, & Weber, 2012). Later life cognitive trajectories vary considerably (M. L. Hughes, Agrigoroaei, Jeon, Bruzzese, & Lachman, 2018), with some older adults maintaining strong cognitive ability into their 8th or 9th decade of life and others experiencing earlier cognitive decline that ultimately impairs their ability to perform occupational and social roles. Growing prevalence of cognitive impairment and dementia constrains productivity and resources at the societal level and interferes with quality of life and well-being at the individual level. Therefore, it is important to identify factors, such as marital status, that may affect the trajectories of cognitive function in older age.

Although older adults in low- and middle-income countries (LMICs) may be particularly vulnerable to effects of cognitive impairment and dementia, population-based studies of cognitive aging in these regions remain rare (Patterson, 2018). Cross-national comparisons of cognitive impairment and its associated risk factors are challenged by the lack of comparability of measures and definitions of cognitive impairment across studies. Differences in educational attainment, literacy, income, and exposure to healthcare may affect cognitive test performance and how cognitive test scores should be interpreted (Langa et al., 2020). In this paper, we use a measure of cognitive function that was harmonized across the four studies, so that we can compare patterns of associations between marital status and cognitive well-being across distinct settings.

2.2. Marriage and cognitive health

Marriage and committed partnership (e.g., cohabitation) may offer important protections against cognitive decline as people age. Married people often experience more social interaction, which can stimulate their cognitive function and protect against cognitive decline (Amieva et al., 2010; Helmer et al., 1999; Sundström et al., 2014). Interactions with one's spouse, alone, offers this type of stimulation on a daily basis, and has been found to be a crucial protector against cognitive decline (Mousavi-Nasab, Kormi-Nouri, Sundström, & Nilsson, 2012; Sundström et al., 2014).

On the other hand, singlehood, divorce, and widowhood may present disadvantages to cognitive health, as people in these marital groups are more likely to be isolated and/or have smaller social networks (Cornwell, 2012; Kalmijn, 2003), which may affect the biological mechanisms that lead to cognitive decline (e.g., inflammatory markers, cerebrovascular changes) (Fratiglioni, Wang, Ericsson, Maytan, & Winblad, 2000; Håkansson et al., 2009). In the case of widowhood, the stress associated with bereavement may impact such biological mechanisms (Williams & Umberson, 2004; Wu-Chung, Leal, Denny, Cheng, & Fagundes, 2022). Similarly, stress—which may be associated with either widowhood or divorce—can increase depression and other health issues, which are associated with cognitive decline (Aggarwal et al., 2014; Johansson et al., 2010). In fact, there is evidence that widowhood can increase the risk of dementia (Aartsen, Van Tilburg, Smits, Comijs, & Knipscheer, 2005; Karlamangla et al., 2009). There is also evidence from Europe that individuals in the more selective single/never married group have worse cognitive outcomes than other groups (Amieva et al., 2010; Fratiglioni et al., 2000; Helmer et al., 1999; Mousavi-Nasab et al., 2012; Sundström, Westerlund, & Kotyrló, 2016).

Marital dissolution also has the potential to benefit cognitive well-being if the marriage was of poor quality, as its dissolution may then result in a reduction in exposure to stress (Liu, Zhang, & Zhang, 2021). However, a paper by Xu, Thomas, and Umberson (2015) found that negative aspects of marital quality may slow cognitive decline, suggesting that conflict in a marriage requires cognitive processes that may lead even individuals in poor quality marriages to have better cognitive outcomes than non-married individuals.

Investigation of associations between marital status and cognitive

health may be impacted by selection bias. Existing research suggests that healthier people are more likely to marry and to stay married (Braithwaite & Holt-Lunstad, 2017; Ikeda et al., 2007; Koball, Moiduddin, Henderson, Goesling, & Besculides, 2010; Simon, 2002; Umberson, 1992). It is likely that that similar selection issues operate in the association between cognitive health and marriage, and the selection of people into and out of marriages differs by setting.

Moreover, the impacts of marital dissolution—both divorce and widowhood—may be difficult to identify using cross-sectional data, especially in settings where these statuses are undesirable and there is incentive to remarry quickly. We may better identify associations between widowhood and cognitive function, since widowhood, compared with divorce, tends to happen later in the lifecourse when the risk of cognitive decline is greater (Hu & To, 2018).

2.3. Setting-Specific expectations for marriage and cognitive health

Although marriage and cohabitation may offer some universal benefits, the specific benefits conferred by particular marital statuses may differ depending on the context and the cultural significance attached to marriage, singlehood, divorce, and widowhood. The permanence of marriage, as well as the stigma associated with non-marital statuses, impacts the lived experiences of individuals in ways that may affect their cognitive outcomes.

In the United States, there is a high value placed on marriage (Thornton & Young-DeMarco, 2001), as evidenced by the widely held expectation and hope to marry (Edin & Kefalas, 2011; L. Waite & Gallagher, 2002). At the same time, U.S. society places a high value on individualism (Poortman & Liefbroer, 2010), and so remaining single (i.e., never marrying) is not particularly undesirable and, therefore, may not substantially impact social ties or be associated with worse cognitive outcomes. Similarly, the U.S. has one of the highest rates of divorce in the world (Cherlin, 2009), and divorce is a fairly normalized experience. Hence, the social networks of divorced people may not differ much from their married counterparts, and their cognitive health may be similar. On the other hand, widowhood can be associated with greater social isolation in the U.S. (Wenger, Davies, Shahtahmasebi, & Scott, 2008), and this may mean greater cognitive decline among widow(er)s relative to married people. Extant literature suggests that married people in the U.S. have relatively better cognitive outcomes than their never married, divorced, and widowed counterparts (Liu, Zhang, Burgard, & Needham, 2019; Liu, Zhang, Choi, & Langa, 2019).

In Mexico, Catholicism is an important force shaping people's views on family-related behaviors (Hirsch & Nathanson, 2001), and may play a prominent role in the value and perceived permanence of marriage, as well as the undesirability of divorce. Marriage remains nearly universal, and the average age at marriage for Mexicans is relatively young (Fussell & Palloni, 2004). As such, singlehood, may be associated with social stigma. Likewise, divorce rates are relatively low, which, combined with the influence of Catholicism, likely creates social stigma around divorce. Such stigma may lead to less social connectedness, and, by extension, worse cognitive health among both widowed and divorced people than their married counterparts. On the other hand, extended family systems are central in Mexico (Fussell & Palloni, 2004), and so families may help support divorced or widowed members in ways that protect against cognitive decline.

In South Africa, we focus on a rural Black South African population in a cluster of villages called Agincourt. In this setting, marital experiences are impacted by the legacy of apartheid, during which many Black South African men migrated to work in urban areas and left their families behind (Hosegood, McGrath, & Moultrie, 2009). This separation resulted in an increase in marital breakdown (Budlender & Lund, 2011). Marriage remains an aspiration among young adults, although those who marry tend to do so relatively late in life (Hosegood et al., 2009). Given the necessity for independence and self-sufficiency that resulted from the splitting of families during apartheid (Hosegood et al., 2009),

singlehood may not be associated with substantial social or cognitive disadvantage. Similarly, with divorce being common (Budlender & Lund, 2011; Hosegood et al., 2009), experiencing such an event may not impact people's social ties or lives in a way that affects their cognitive health. Widowhood, too, is a common experience, given the prevalence of HIV and non-communicable disease in the region (Gaziano et al., 2017; Kahn, 2011; Nojilana et al., 2016; Wade et al., 2021). As such, we may likewise not expect to observe impacts of widowhood experience on cognitive function. However, in one study in Agincourt, both widowed and divorced people were found to face lower odds of receiving emotional support than their married counterparts (Jennings, Mkhwanazi, & Berkman, 2018), and this may be an important indicator that could link to worse cognitive health.

In China, marriage is essentially universal, and family is central to social life (Guo, Chi, & Silverstein, 2015). Marriage is considered an important part of personal fulfillment (Hu & To, 2018). As such, singlehood is not a desirable status, and is likely associated with social stigma that may negatively impact cognitive health. Marriage is expected to last a lifetime, as it forms a new bond between two families (Hung, Kung, & Chan, 2004)—a bond that can have social, political, and economic importance (Huang, 2012; Hung et al., 2004). Divorce was not a recognized practice in China until the beginning of the 20th century (Hung et al., 2004), and has long been morally disapproved (Goode, 1993). Due to the strong intergenerational ties and marital commitments in Chinese society, divorce and widowhood can create anxiety for a person—especially women—and their families (Hu & To, 2018). Moreover, women who are widowed are expected to remain in that status and not remarry, out of faithfulness to their late husbands (Hung et al., 2004). The pressure to be married and benefits associated with marriage may lead to lower cognitive health among the unmarried. In fact, one study of Chinese adults found that those who were unmarried (single, widowed, or divorced) had higher odds of cognitive impairment than their married counterparts (Giri, Chen, Yu, & Lü, 2016).

2.4. Gender differences in marriage and cognition

The ways in which marital status is associated with cognitive well-being are likely to differ for men and women. Gendered social roles have been found to affect the link between marital status and health (Carr & Springer, 2010; L. Waite & Gallagher, 2002; Williams, 2003), which may, in part, be due to men's greater reliance on wives to help ensure their healthy behaviors (Umberson, 1992). Research on cognition has found men and women to face different risks for cognitive decline. For example, Sundström et al. (2016) found that single individuals were at the greatest risk of dementia among women, and that divorcees were at the greatest risk among men. Liu, Zhang, Choi, and Langa (2019) found that odds of dementia were greater for men than women in separated/divorced and widowed statuses. Still other work has found no gender differences in how marital status impacts cognitive outcomes (Liu, Zhang, Burgard, & Needham, 2019; Mousavi-Nasab et al., 2012).

The differential risk of cognitive decline for men and women in response to marital experiences is likely impacted by the social context of the specific setting, including differing family and gender roles (Budlender & Lund, 2011; Hirsch, 1999; Hu & To, 2018). For example, in Mexico, women's family roles are central, and their identity may be more tied to marriage than men's (Fussell & Palloni, 2004). As such, marital dissolution may be associated with greater stigma and have a more negative impact on cognitive outcomes for women. In the U.S. and China, too, expectations to prioritize the family and marriage above oneself often falls more on women than men (Katz-Wise, Priess, & Hyde, 2010; Zuo, 2003). To the extent that identity is more tied to marriage for women in certain settings, women's cognitive outcomes may suffer from non-marital statuses more than men's. Although gender roles are also salient in South Africa, (Budlender & Lund, 2011), their interplay with marriage may not be as pronounced due to the relatively low rates of

marriage and high rates of marital dissolution. However, there is evidence that widowed women can face blame for their husbands' death (Schatz, Madhavan, & Williams, 2011), and that women lose more social ties than men when they experience widowhood (Schatz et al., 2011; Sundström et al., 2014). Hence, widowhood may be more negatively associated with widowed women's cognitive outcomes than widowed men's in South Africa, too.

Given these important and inextricable gender differences in marital roles and expectations, we perform our analyses separately for men and women in each setting.

3. Data and methods

We use harmonized data from the U.S. Health and Retirement Study (HRS) and three of its sister studies in LMICs: The Health and Aging in Africa: A Longitudinal Study of an INDEPTH Community in South Africa (HAALSI),² the Mexican Health & Aging Study (MHAS), and the China Health and Retirement Longitudinal Study (CHARLS).

The HRS is a representative, longitudinal study of U.S. adults aged 50 and older. We rely on cognitive data from the 2014 survey (wave 12), among a sample of 18,747 individuals. This sample was based on six subsamples, including spouses (Sonnegg et al., 2014), and interviews were conducted either by telephone (computer assisted telephone interview (CATI)) or face-to-face (computer assisted personal interview (CAPI)) (Fisher, Hassan, Faul, Rodgers, & Weir, 2017). For more information on this sample, see HRS documentation (HRS, 2017). Our analytic sample includes all respondents with no missing data on any of the measures in our models, leaving us with 10,229 women and 6,963 men.

The HAALSI study participants were sampled from the existing framework of the Agincourt Health and Socio-Demographic Surveillance System (Agincourt HDSS) site in Mpumalanga province, a majority Black African area. Individuals aged 40 or older were eligible to be sampled. A sample of 6,281 respondents were randomly selected to participate, and interviews were completed with 5,059 (86%) individuals. We use data from the CAPI at wave 1, which took place between November 2014 and November 2015. Our analytic sample excludes people under the age of 50, in order to be comparable to the samples in HRS and the other sister studies. After using listwise deletion, our analytic sample includes 2,118 women and 1,841 men.

MHAS is a nationally representative, longitudinal study of older men and women in Mexico that began in 2001. Households in 32 states were sampled, with oversampling in the six states that account for 40% of all migrants to the U.S., due to the focus of MHAS on migration. We use data from the fourth wave, conducted in 2015 with CAPI, among a sample of 14,779. After using listwise deletion, our analytic sample includes 7,241 women and 5,266 men.

CHARLS is also a nationally representative, longitudinal study of the population aged 45 years and older, living in private households in China. A sample of 17,708 individuals from 10,257 households were initially recruited from 450 primary sampling units (cun, shequ, or juweihui) in 150 counties, through multistage probability sampling. We use data from wave 3, collected in 2015. After using listwise deletion, our analytical sample consists of 6,553 women and 6,457 men.

4. Measures

We use immediate word recall to operationalize cognitive function. We use this measure because it was conducted similarly across the four studies. Although each study includes a wider cognitive battery, the other measures included are not as standardized across studies (e.g., differing time lags involved in delayed word recall measures, in addition

² INDEPTH is a global network of health and demographic surveillance systems, designed to collect information on health in communities in Africa, Asia, and Oceania.

to other setting-specific modifications). Immediate word recall is also sensitive to age- and pathology-related cognitive decline, and previous studies that have done similar cross-national comparisons of cognitive function have found that results using immediate word recall parallel patterns observed in other cognitive domains (Skirbekk et al., 2012). In each study, except for MHAS, respondents were read 10 words and asked to recall as many of those 10 words as possible. In MHAS, respondents were asked to recall 8 words, instead of 10. Because of the difference in maximum value in MHAS compared to the other studies, we standardize the measure of immediate word recall in each study sample for comparability.

A series of categorical variables indicating marital status serve as our independent variables of interest. The category of married reflects those who reported being “married or living with a partner” (“partnered” in HRS) or in a civil union (for MHAS only). The category of never married reflects those who reported being never married in each study except for MHAS, where the response option was “single”. The category of separated or divorced indicates reports of being separated/deserted or divorced in HAALSI, divorced or separated from a marriage or civil union in MHAS, or simply separated or divorced in HRS and CHARLS. Finally, the category of widowed reflects reports of being widowed, including from a civil union in MHAS.

We also control for a number of covariates in our models. First, we control for whether the respondent has been married more than once, as this is likely to affect their social standing and may relate to cognitive well-being. We also control for the respondent’s age, with a series of dummies by decade of age.

Next, we control for educational attainment, which is operationalized slightly differently in each data set due to differing access to education across settings. In HRS, the most educated of the four samples, we code education into three dummy variables: (1) less than high school, (2) secondary (Completed high school or GED), and (3) tertiary (some college or more). In the HAALSI sample the measures we use are: (1) no formal education, (2) some or complete primary, and (3) some secondary or higher. In MHAS, educational attainment is categorized into (1) no formal, (2) some/completed primary, (3) some/completed lower or upper secondary, and (4) some/completed lower or upper tertiary. Finally, in CHARLS, educational attainment is coded as (1) no formal, (2) some or completed primary (did not finish primary school but capa; Sishu; Elementary school), (3) secondary (including middle school, high school), and (4) tertiary (including vocational school; some/completed college or more).

Our measures of employment status also differ slightly across settings. Across the samples, we code reports of part or full time work as employed (in CHARLS, this refers to non-agricultural work, due to large numbers of people working in agriculture), which we treat as the reference category. In HRS, HAALSI, and MHAS, we include a dummy variable to indicate that the respondent reported being a homemaker (translated to be interpreted as “home manager” in HAALSI); a similar response option was not included in CHARLS. In CHARLS we include a dummy variable to indicate agricultural work. Finally, across samples, the variable indicating that the respondent is not working includes reports of being unable to work, disabled, sick, or unemployed. Responses were categorized and prioritized (in the case of “check all that apply” in HAALSI) as follows: employed, homemaker/manager of the home (in all but CHARLS), agricultural work (in CHARLS only), retired, and not working.

Next, we include a measure to reflect the number of children that the respondent ever had, top coded at 10.

Lastly, we control for a series of measures to indicate respondents’ overall health, physical ability, and mental health status. We first use a measure of self-rated health, which reflects respondents’ report, on a five-point scale, of their current health. This measure was distributed differently across the four settings. Taking the differing distributions into consideration, we collapse into a 3-point scale in each dataset. In HRS, 1 indicates “poor,” or “fair,” 2 indicates “good,” and 3 indicates

“excellent,” or “very good.” In HAALSI, a code of 1 indicates “moderate,” “bad,” or “very bad;” 2 indicates “good;” and 3 indicates “very good.” In MHAS, 1 indicates “good,” “fair,” or “poor;” 2 indicates “very good;” and 3 indicates “excellent.” In CHARLS, 1 indicates “poor;” 2 indicates “fair;” and 3 indicates “good,” “very good,” or “excellent.”

We account for respondents’ limitations in activities of daily living (ADLs) with a measure that indicates the presence of at least one of four possible ADLs that are common across the four studies: difficulty with bathing or showering, difficulty with eating, difficulty with getting into or out of bed, and difficulty with using the toilet. Finally, we include a measure to indicate depressive symptoms that were asked across studies: felt depressed, everything was an effort, sleep was restless, was happy, felt lonely, and could not get going. In each study except for CHARLS, response options for these items were “yes”—which was coded as 1 (symptomatic)—and “no”—which was coded as 0 (not symptomatic). In CHARLS, the response options were “rarely or none of the time,” “some or little of the time,” “occasionally or a moderate amount of the time,” or “most or all of the time”. We coded the first two of these options as “no” (asymptomatic) and the last two as “yes” (symptomatic). “Was happy” was reverse coded, and then the items were summed to create the depression score.

5. Results

Table 1 displays the means of the measures in our models across the four samples. The U.S sample has the highest value on cognitive function, followed by the South African sample, then the Mexican sample, then the Chinese sample. The next notable characteristic is marital status: Across samples, a greater proportion of men are married (from 72% in the South African sample to 90% in the Chinese sample) than women (ranging from 32% in the South African sample to 82% in the Chinese sample). Lifetime singlehood is a rare experience across the samples, ranging from 0.1% among Chinese women to 5% among U.S. men and women. The proportion in a separated or divorced status varies across samples, with very few Chinese men and women (1%) in this status, slightly more Mexican men and women (13% and 7%, respectively) in this status, and more South African or U.S. men and women in this status (11%–16%). Widowhood is a more common status for women than men across settings, in line with established gendered trends in mortality (Nathanson, 1984). Just 17% of women in the Chinese sample are widowed, while about a quarter of the Mexican and U.S. women are widowed. In South Africa, half (52%) of women are widowed. The proportion of men in a widowed status ranges from 8% in the U.S. and Chinese samples to 10% and 13% in the Mexican and South African samples, respectively.

Table 2 displays results from ordinary least squares (OLS) regression predicting the standardized value of immediate word recall (cognitive function) for women across the samples. We consider a p-value of .10 or less to be significant, and the level of significance is indicated in the tables. In the U.S. sample, women who were never married, separated or divorced, or widowed are found to have worse cognitive function than their married counterparts. In the rural South African sample, being widowed is associated with worse cognitive function relative to being married, but neither being never married nor separated/divorced is shown to have a significant association. In the Mexican sample, being separated/divorced is associated with lower cognitive function relative to being married, while being either never married or widowed is not significantly differently associated with cognitive function than being married. Finally, in the Chinese sample, similar to the South Africa sample, being widowed is associated with significantly lower cognitive function relative to being married, but differences between being married and being either never married or separated/divorced are nonsignificant.

Many covariates in Table 2 are also significantly associated with cognitive function, with significance levels differing across samples. Among Mexican women, having been married more than once is

Table 1
Descriptive statistics (means or proportions, standard deviations in parentheses).

	U.S. (HRS)		South Africa (HAALSI)		Mexico (MHAS)		China (CHARLS)	
	Women	Men	Women	Men	Women	Men	Women	Men
Immediate word recall (unstandardized)	5.50 (1.74)	5.09 (1.70)	4.21 (1.77)	4.29 (1.86)	4.03 (1.42)	3.77 (1.45)	3.61 (1.94)	3.77 (1.80)
Marital status								
Married or living with partner	0.54	0.75	0.32	0.72	0.56	0.80	0.82	0.90
Never married/single	0.05	0.05	0.03	0.04	0.05	0.03	0.001	0.01
Separated or divorced	0.16	0.12	0.13	0.11	0.13	0.07	0.01	0.01
Widowed	0.25	0.08	0.52	0.13	0.26	0.10	0.17	0.08
Covariates								
Married more than once	0.32	0.35	0.08	0.42	0.95	0.97	0.03	0.04
Age								
50–59	0.29	0.27	0.36	0.32	0.29	0.23	0.42	0.39
60–69	0.29	0.31	0.31	0.34	0.37	0.37	0.39	0.39
70–79	0.26	0.27	0.19	0.23	0.25	0.29	0.16	0.18
80–89	0.16	0.15	0.14	0.11	0.10	0.11	0.03	0.04
Education								
No formal	–	–	0.56	0.45	0.18	0.15	0.40	0.12
Some/completed primary	–	–	0.34	0.38	0.53	0.51	0.37	0.47
Some/completed secondary	–	–	0.08	0.14	0.21	0.21	0.21	0.36
Less than high school	0.18	0.17	–	–	–	–	–	–
High School Grad or GED	0.35	0.32	–	–	–	–	–	–
Some/completed tertiary	0.47	0.52	0.03	0.03	0.08	0.13	0.02	0.06
Employment status								
Not working	0.14	0.13	0.55	0.50	0.16	0.20	0.01	0.001
Employed	0.33	0.38	0.09	0.14	0.24	0.57	0.14	0.30
Homemaker	0.14	0.01	0.13	0.09	0.50	0.01	–	–
Retired	0.39	0.47	0.23	0.28	0.10	0.22	0.40	0.27
Agriculture	–	–	–	–	–	–	0.45	0.43
Number of children	2.59 (1.71)	2.50 (1.75)	5.65 (2.38)	5.55 (2.50)	4.68 (2.39)	4.64 (2.37)	2.86 (1.40)	2.73 (1.40)
Self-rated health	2.08 (0.81)	2.09 (0.81)	1.81 (0.70)	1.89 (0.72)	1.06 (0.31)	1.10 (0.39)	1.97 (0.67)	2.07 (0.67)
ADL, at least one	0.15	0.11	0.06	0.06	0.15	0.10	0.22	0.15
Depressive symptoms	1.33 (1.66)	1.08 (1.49)	1.39 (1.35)	1.24 (1.23)	2.49 (1.97)	1.83 (1.71)	2.10 (1.43)	1.65 (1.27)
N	10,229	6,963	2,118	1,841	7,241	5,266	6,553	6,457

Table 2
OLS regression of marital status on immediate word recall (standardized), women.

	U.S. (HRS)		South Africa (HAALSI)		Mexico (MHAS)		China (CHARLS)	
Intercept	–0.02	0.05	–0.32 **	0.11	–0.20 *	0.09	0.02	0.06
Marital status								
Married or living with partner	REF		REF		REF		REF	
Never married/single	–0.12 **	0.04	–0.11	0.12	–0.003	0.07	0.54	0.34
Separated or divorced	–0.10 ***	0.03	–0.05	0.06	–0.07*	0.03	0.02	0.12
Widowed	–0.15 ***	0.02	–0.13 **	0.05	–0.04	0.03	–0.12 ***	0.03
Covariates								
Married more than once	–0.003	0.02	–0.07	0.07	0.20 **	0.07	0.05	0.06
Age								
50–59	REF		REF		REF		REF	
60–69	–0.03	0.02	–0.09 +	0.05	–0.10 ***	0.03	–0.10 ***	0.03
70–79	–0.25 ***	0.03	–0.22 ***	0.06	–0.35 ***	0.03	–0.33 ***	0.04
80–89	–0.72 ***	0.04	–0.50 ***	0.07	–0.75 ***	0.04	–0.82 ***	0.07
Education								
No formal	–	–	REF		REF		REF	
Some/completed primary	–	–	0.31 ***	0.04	0.40 ***	0.03	0.46 ***	0.03
Some/completed secondary	–	–	0.54 ***	0.08	0.84 ***	0.04	0.95 ***	0.03
Less than high school	REF		–	–	–	–	–	–
High School Grad or GED	0.37 ***	0.03	–	–	–	–	–	–
Some/completed tertiary	0.60 ***	0.03	0.99 ***	0.13	0.92 ***	0.05	1.38 ***	0.08
Employment status								
Not working	–0.26 ***	0.03	0.11	0.07	–0.09 *	0.04	–0.02	0.18
Employed	REF		REF		REF		REF	
Homemaker	–0.09 **	0.03	0.26 **	0.09	–0.08 **	0.03	–	–
Retired	–0.10 ***	0.03	–0.01	0.09	0.04	0.04	–0.09 **	0.04
Agriculture	–	–	–	–	–	–	–0.09 *	0.03
Number of children	–0.02 ***	0.01	–0.002	0.01	–0.02 ***	0.01	–0.05 ***	0.01
Self-rated health	0.09 ***	0.01	0.17 ***	0.03	0.08 *	0.03	0.01	0.02
ADL, at least one	–0.15 ***	0.03	–0.11 **	–0.11	–0.06 +	0.03	–0.04	0.03
Depressive symptoms	–0.05 ***	0.01	–0.02	0.02	–0.03 ***	0.01	–0.06 ***	0.01
N	10,229		2,118		7,241		6,553	
R ²	0.23		0.18		0.24		0.26	

Two-tailed tests, + p < .10, *p < .05, **p < .01, ***p < .001.

associated with better cognitive function. Across samples, being older and having more education is associated with better cognitive function. In terms of employment status, not working is associated with significantly lower cognitive function relative to being employed among U.S. and Mexican women. Being a homemaker is associated with relatively worse cognitive function among U.S. and Mexican women, but relatively better cognitive function among South African women than being employed. (This difference in direction of associations is likely because this employment status was interpreted as “home manager” in the HAALSI survey (Jennings, Ralston, & Schatz, 2020).) For Chinese women, working in agriculture is associated with worse cognitive function relative to being employed. For women in the U.S., Mexico, and China, having more children and having more depressive symptoms are each associated with worse cognitive function. In the U.S., South Africa, and Mexico, better self-rated health is associated with better cognitive function, while having an ADL is associated with lower cognitive function.

In Table 3, we investigate these same associations among men, across the samples. In the U.S. sample, being never married, separated/divorced, or widowed has significant and negative associations with cognitive function, relative to being married. In the rural South African sample, being separated/divorced is associated with lower cognitive function at $p < .10$, but other marital statuses are not significantly different than being married in their associations with cognitive function. In the Mexican sample, being widowed is associated with significantly lower cognitive function than being married, but being never married nor being separated/divorced is associated with significantly different cognitive function than being married. In the Chinese sample, being either never married or widowed is associated with significantly lower cognitive function than being married, while being separated/divorced is not significantly associated with cognitive function relative to being married.

Many covariates operate similarly among men (in Table 3) as among

women (in Table 2), while there are also some differences. Notably, in Table 3, being married more than once is associated with better cognitive function only among Chinese men (at $p < .10$). Homemaker status is not significantly associated with cognitive function, relative to being employed, for men in any of the samples. Being retired is associated with worse cognitive function than being employed for men in both the U.S. and South Africa, while being retired is associated with better cognitive function among men in Mexico. Better self-rated health is associated with better cognitive function for men in each sample. Having at least one ADL is associated with significantly worse cognitive function for men in every sample except Mexico (for whom this association is nonsignificant). Finally, having more depressive symptoms is associated with worse cognitive function in each sample except China, where men have significantly better cognitive function if they reported more depressive symptoms.

Figs. 1 and 2 plot the marginal means of cognition function across marital statuses for men and women, respectively, in each of the four samples. Fig. 1 illustrates that being married or partnered is associated with a higher marginal mean value in cognitive function for women in the U.S. and South Africa, but similar value as being never married in Mexico. Unexpectedly, never married women in China are shown to have the highest marginal mean value on cognitive function. However, this should be interpreted with caution, given the very small cell size of this category. Across the samples of women, widows tend to have the lowest marginal mean value on cognitive function, with the exception of Mexico, where separated/divorced women have the lowest value.

Fig. 2 illustrates that married men have higher marginal means on cognitive function than their counterparts in other statuses in the U.S., South Africa, and China. In Mexico, separated/divorced men have the highest value on cognitive function, slightly higher than their married counterparts. In each country except South Africa, where separated/divorced men have the lowest value, never married men have the lowest marginal mean value on cognitive function.

Table 3
OLS regression of marital status on immediate word recall (standardized), men.

	U.S. (HRS)		South Africa (HAALSI)		Mexico (MHAS)		China (CHARLS)	
Intercept	−0.27 ***	0.05	−0.51 ***	0.12	−0.13	0.15	−0.24 ***	0.06
Marital status								
Married or living with partner	REF		REF		REF		REF	
Never married/single	−0.24 ***	0.05	−0.12	0.13	−0.16	0.14	−0.45 ***	0.10
Separated or divorced	−0.14 ***	0.03	−0.14 +	0.07	0.03	0.05	−0.08	0.10
Widowed	−0.11 **	0.04	−0.05	0.07	−0.10 *	0.04	−0.14 **	0.04
Covariates								
Married more than once	0.003	0.02	0.05	0.04	−0.08	0.14	0.10 +	0.06
Age								
50–59	REF		REF		REF		REF	
60–69	−0.03	0.03	−0.07	0.06	−0.14 ***	0.03	−0.06 *	0.03
70–79	−0.30 ***	0.03	−0.18 **	0.07	−0.35 ***	0.04	−0.35 ***	0.04
80–89	−0.75 ***	0.04	−0.39 ***	0.09	−0.82 ***	0.05	−0.68 ***	0.07
Education								
No formal	–	–	REF		REF		REF	
Some/completed primary	–	–	0.24 ***	0.05	0.27 ***	0.04	0.42 ***	0.04
Some/completed secondary	–	–	0.48 ***	0.07	0.64 ***	0.05	0.77 ***	0.04
Less than high school	REF		–	–	–	–	–	–
High School Grad or GED	0.33 ***	0.03	–	–	–	–	–	–
Some/completed tertiary	0.64 ***	0.03	0.96 ***	0.13	0.90 ***	0.05	1.09 ***	0.06
Employment status								
Not working	−0.21 ***	0.04	0.06	0.07	−0.07 *	0.03	0.31	0.31
Employed	REF		REF		REF		REF	
Homemaker	−0.06	0.55	−0.09	0.10	−0.03	0.13	–	–
Retired	−0.17 ***	0.03	−0.17 *	0.08	0.08 *	0.03	−0.02	0.03
Agriculture	–	–	–	–	–	–	−0.09 **	0.03
Number of children	−0.02 **	0.01	0.01	0.01	−0.02 ***	0.01	−0.05 ***	0.01
Self-rated health	0.07 ***	0.01	0.28 ***	0.03	0.13 ***	0.03	0.06 ***	0.02
ADL, at least one	−0.13 ***	0.04	−0.11 **	0.04	−0.06	0.04	−0.11 **	0.03
Depressive symptoms	−0.04 ***	0.01	−0.09 ***	0.02	−0.03 ***	0.01	0.05 ***	0.01
N	6,963		1,841		5,266		6,457	
R ²	0.23		0.19		0.15		0.20	

Two-tailed tests, + $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

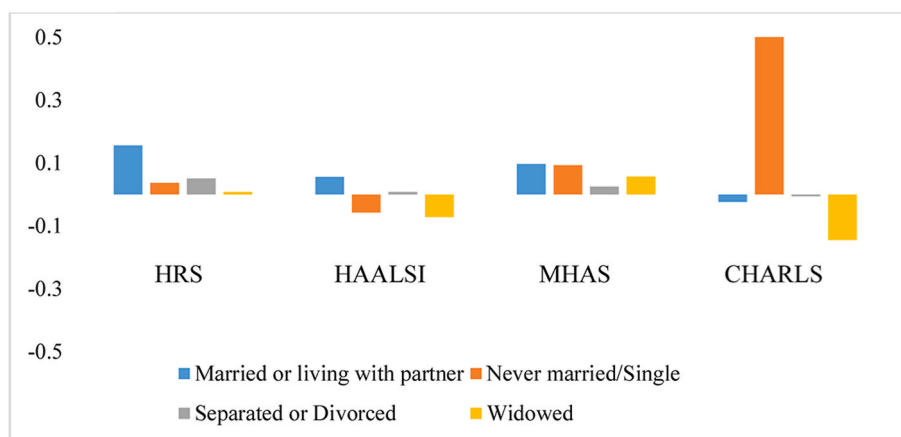


Fig. 1. Marginal means among women. Note: Means are from fully adjusted models.

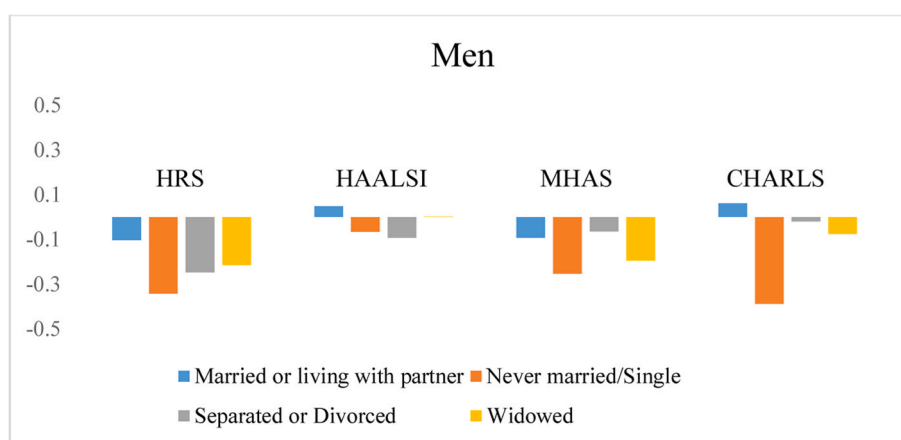


Fig. 2. Marginal means among men. Note: Means are from fully adjusted models.

6. Discussion

In this paper, we have investigated the associations between different marital statuses and cognitive function in four different parts of the world: the U.S., South Africa (Agincourt), Mexico, and China. Overall, our results suggest that marriage may offer protection against low cognitive function, but there are different patterns of associations as a function of type of non-married status, gender, and country. These differences may be owed to the particular norms and stigma attached to marriage in each setting.

We found that widowhood was most consistently associated with low cognitive function, relative to being married, for both men and women across settings. Widows and widowers face particular risk to their cognitive function after losing the companionship of a spouse to death (Håkansson et al., 2009; Sundström et al., 2014). They may find themselves, in some cases suddenly, without regular social interactions that can help protect against cognitive decline. The negative impacts of widowhood on cognitive health are shared across these settings. Only among South African men and Mexican women did widowhood not exhibit a significant negative impact on cognitive function.

Divorce was also expected to have a negative impact on cognitive function, especially in settings where divorce is uncommon and where divorced individuals may face greater stigma, such as Mexico and China (García-Ramos, 2021; Hung et al., 2004). Yet, we found no significant differences among men or women in divorced versus married statuses in China, or men in divorced status in Mexico relative to their married counterparts. We did find, on the other hand, that in the U.S.—where divorce is relatively common and socially acceptable—divorced men

and women face reduced cognitive function relative to their married counterparts. Similarly, South African men and Mexican women who were divorced had lower cognitive function than their married counterparts. Divorce may lead to engagement in fewer cognitively stimulating activities among older adults in the U.S., older men in South Africa, and older women in Mexico. Notably, it is among men in South Africa and women in Mexico that widowhood was not significantly associated with cognitive function, suggesting that divorce is a more salient status for these groups than widowhood.

Studies based in Europe have found singlehood to be associated with worse cognitive outcomes, compared with other marital groups. In our analyses, we found this to be true only for never married men and women in the U.S. and men in China. In South Africa and Mexico, and among women in China, we do not find evidence that singlehood is associated with significantly worse cognitive function than being married. In interpreting these results, it is important to keep in mind that singlehood is an uncommon status among people ages 50 and older, across settings, and this group of people is distinct and selective on factors that may be associated with poorer cognitive health. Nonetheless, our results suggest that single men and women in the U.S. and single men in China may face less cognitive stimulation than single people in these other settings.

There are several considerations to note, which limit the conclusions we can draw from these results. First, the HRS data offer a very large sample, much larger than the other three studies included in our investigation. As such, coefficients reach significance in the HRS models with greater frequency than in the HAALSI, MHAS, or CHARLS models. We therefore cannot make direct comparisons between the studies

regarding levels of significance. Second, the data on which we rely for these analyses are cross-sectional, which do not allow us to assess cognitive change. Moreover, the data do not allow consideration for marital histories or transitions. Third, there were slight differences in survey items and response options to indicate marital status across settings, which may impact our results. However, we took care to code marital categories in the most consistent way possible, across settings. Fourth, the data we use do not allow us to account for the quality of previous marriages. We are therefore unable to account for the possible beneficial (or harmful) impacts of the dissolution of poor quality marriages (Liu et al., 2021; Xu et al., 2015).

Overall, our findings suggest that cognitive responses to marital experiences may differ across settings and by gender. Marital experiences are among many factors with the potential to impact individuals' cognitive health. Our results suggest that the statuses of widowhood and divorce may be associated with lower cognitive function across settings, although the associations are sometimes more substantial for women and sometimes more substantial for men. This suggests that individuals who were previously married may face particular challenges to their cognitive well-being, perhaps via opportunities for cognitive stimulation and engagement. Setting-specific values and culture should be considered as policies are developed to address the cognition needs of those who are in post-marital statuses.

Statement of ethical approval

HAALSI was ethically approved by review committees at the University of the Witwatersrand Human Research Ethics Committee, the Harvard T.H. Chan School of Public Health Office of Human Research Administration (HCS OHRA) and the Mpumalanga Provincial Research and Ethics Committee.

Author statement

Elyse A. Jennings performed data analyses, provided much of the conceptualization of the paper, and wrote the majority of the manuscript. Meagan Farrell provided conceptualization and wrote portions of the manuscript focused especially on cognitive function. She also advised on the measurement and coding of the cognitive function outcome, and on related aspects of the analyses. Yuning Liu performed data analyses for the investigation of associations in the Chinese sample, wrote the methods related to the CHARLS data, and advised on conceptualization related especially to the analyses and results for the Chinese sample. Livia Montana was involved in the conceptualization of the entire study.

Declaration of competing interest

The authors declare no conflict of interest and no financial conflict of interest.

Data availability

Data are publicly available at the Gateway to Global Aging webpage or, in the case of HAALSI, at ICPSR and Dataverse.

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