Health Psychology

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Online First Publication, January 25, 2018. http://dx.doi.org/10.1037/hea0000589

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0278-6133/18/$12.00 http://dx.doi.org/10.1037/hea0000589

# A Prospective Study of Marital Quality and Body Weight in Midlife

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***Objective:*** Few studies have gone beyond studying marital status to examine effects of marital quality on body weight. This study examined the association of marital quality with weight change and incident obesity in midlife. It differentiated positive and negative components of marital quality considering overall marital quality, marital support, and marital strain. ***Method:*** Data are from 2,636 adults from the Midlife in the United States study who participated in 2 waves of data collection 10 years apart. Marital quality was self-reported. Body weight was assessed with self-reported height and weight. Generalized estimating equations examined primary associations also considering potential confounders and mediating factors including sociodemographics, baseline health conditions, and health behaviors. ***Results:*** Overall marital quality was inversely associated with weight gain ($\beta = -0.70$, 95% confidence interval [CI] [−1.38, −0.01]). Marital support was inversely related to both weight gain ($\beta = -1.48$, 95% CI [−2.80, −0.16]) and incident obesity (risk ratio = 0.79, 95% CI [0.65, 0.96]). Marital strain was not associated with either weight change or incident obesity. The association between marital support and incident obesity remained when marital strain was simultaneously included in the model. There was evidence that the associations of marital support and marital strain with incident obesity might differ by gender, and were evident only in men. ***Conclusion:*** This study shows a supportive marital relationship is associated with healthier body weight in midlife. It also indicates marital support may have effects over and beyond the mere absence of marital strain. Findings suggest the potential utility of involving spouses/partners in obesity prevention and treatment.

*Keywords:* marital quality, marital support, marital strain, obesity, weight change

*Supplemental materials:* http://dx.doi.org/10.1037/hea0000589.supp



The rate of obesity is high, ranging from 22% to over 35% across U.S. states (Ogden, Carroll, Kit, & Flegal, 2014; Segal, Rayburn, & Martín, 2016). A number of biological, behavioral, and psychosocial risk factors for obesity have been identified including genetic predisposition (Albuquerque, Stice, Rodriguez-Lopez, Manco, & Nobrega, 2015), unhealthy lifestyles (Mozaffarian, Hao, Rimm, Willett, & Hu, 2011), depression (Luppino et al., 2010), and low socioeconomic status (SES; Wang & Beydoun, 2007). In addition, low social support has also been linked to unhealthy body weight in men (Oliveira, Rostila, de Leon, & Lopes, 2013). Most research to date has focused on factors that might increase risk of obesity, rather than identifying factors that could confer protection. Novel insight may be gained by identifying factors that protect against becoming obese.

Having positive social relationships has been linked to better health outcomes. As a result, investigators have begun to consider having positive social relationships as a health asset (Berkman, Kawachi, & Glymour, 2014). The marital relationship, the primary and most intimate social relationship for most adults (Troxel, Matthews, Gallo, & Kuller, 2005), represents a critical source for

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The original Midlife in the United States study was supported by the John D. and Catherine T. MacArthur Foundation Research Network on Successful Midlife Development. Follow-up data collection was supported by the National Institute on Aging (P01-AG020166). Claudia Trudel-Fitzgerald received a postdoctoral fellowship from the Fonds de Recherche du Quebec—Sante. Funding agencies had no role in the data collection, analysis, or interpretation; nor were they involved in the writing or submission of this article. We thank the staff of the clinical research centers at Georgetown University, University of Wisconsin—Madison, and University of California, Los Angeles, for their support in conducting this study.

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health assets of this nature. While much of the prior work has examined effects of marital status per se, some research has focused on marital quality, arguing that the supportive aspect of the relationship rather than status is what provides the critical health protective component (Gallo, Troxel, Matthews, & Kuller, 2003). Empirical evidence suggests that being married and having a supportive marital relationship confers benefits across a number of health outcomes (Kiecolt-Glaser & Newton, 2001). Consequently, we might expect that a positive marital relationship would increase likelihood of maintaining a healthy body weight. However, evidence to date suggests that the effect of being married on body weight may be an exception to the general pattern of findings (i.e., being married is a health asset). Specifically, prior work has found that entering marriage is associated with subsequent weight gain, whereas marital dissolution is often related to subsequent weight loss (Dinour, Leung, Tripicchio, Khan, & Yeh, 2012).

To date, few studies have gone beyond studying marital status to examine effects of marital quality on body weight. Prior work has suggested that marital quality is a two-dimensional construct comprised of positive (e.g., marital support and marital communication) and negative (e.g., marital strain and marital disagreement) components (Fincham & Linfield, 1997). Other work has also suggested that positive and negative components of marital quality appear to be orthogonal and can co-occur, and therefore studies of marital quality must consider both (Kiecolt-Glaser & Newton, 2001). Higher marital support has been linked to healthier functioning such as lower levels of inflammation in women (Donoho, Crimmins, & Seeman, 2013). In contrast, higher marital strain has been linked to adverse health such as higher risk of incident coronary heart disease (Eaker, Sullivan, Kelly-Hayes, D'Agostino, & Benjamin, 2007).

To our knowledge, only one empirical study has examined the association between marital quality and body weight, which was conducted in a sample of 169 first-married young couples without children (most were graduate students; Meltzer, Novak, McNulty, Butler, & Karney, 2013). The findings suggested that marital satisfaction was positively associated with weight gain over the 4-year follow-up. Investigators speculated this due to mating market dynamics, positing that individuals who are satisfied with their marriage will relax efforts to maintain a healthy diet and exercise, since they already have a desirable mate. In contrast, those in a stressful marital relationship may prioritize weight maintenance as a result of an underlying sense that the marriage may not survive and therefore they may subsequently need to attract a new mate (Meltzer et al., 2013). However, because the sample size was small and participants were mostly young and highly educated, it is unclear whether these results would be replicated in a larger sample of older adults. The study also measured one dimension of marital quality, namely marital satisfaction, leaving the role of other aspects of the relationship on weight outcomes unexplored.

Investigators have also posited that women may be more sensitive than men to marital quality, as women generally exhibit greater emotional and physiological responses during marital conflicts than men (Baumeister & Sommer, 1997). Prior studies in clinical samples also reported stronger effects of marital quality in women versus men in relation to some health outcomes such as survival from heart failure (Rohrbaugh, Shoham, & Coyne, 2006). However, whether gender may modify the association between marital quality and body weight has never been examined.

To provide additional insight into the role of marital quality in weight status, this study prospectively investigated the association between marital quality and body weight in midlife. Using data from the Midlife in the United States (MIDUS) study, this study can differentiate effects of positive and negative components of marital quality, including the overall marital quality, marital support (positive component), and marital strain (negative component). We included an array of covariates previously linked to marital quality and/or body weight including sociodemographic characteristics (Meltzer et al., 2013), baseline chronic health conditions (Bookwala, 2005), and depression (Luppino et al., 2010). Based on prior work speculating that marital quality may influence health behaviors which in turn affect physical health outcomes (Robles, Slatcher, Trombello, & McGinn, 2014), we conducted exploratory analyses to evaluate whether health behaviors might serve as a potential pathway linking marital quality to body weight. We additionally considered the possibility that initial levels of marital quality might presage marital dissolution, and it is actually change in marital status rather than marital quality per se that affects body weight. We also investigated whether effects of marital quality on body weight might differ between men and women. Based on the only prior study on marital quality and body weight conducted to date (Meltzer et al., 2013), we hypothesized that higher overall marital quality and marital support would each be associated with weight gain and higher risk of incident obesity, whereas marital strain would be related to weight loss and lower risk of incident obesity. As there has been evidence suggesting independent effects of marital strain and marital support on a range of health outcomes (Birditt, Newton, & Hope, 2014), we expected that marital support and marital strain would each be independently associated with body weight. Based on prior work (Rohrbaugh et al., 2006), we also hypothesized that the association between marital quality and body weight would be stronger in women than in men.

## Method

### Study Sample

Data are from the Midlife in the United States (MIDUS) study. The MIDUS study was initiated between 1994 and 1995 to examine psychosocial factors, health, and well-being in a middle-aged population of U.S. adults. At the first phase (MIDUS I), 7,108 noninstitutionalized individuals between 25 and 74 years old were recruited through random digit dialing from across the United States. Participants included 950 siblings and 957 twin pairs (Brim, Ryff, & Kessler, 2004). The second phase of the study (MIDUS II) was conducted between 2004 and 2005, and followed up with approximately 70% ($N$ = 4,963) of the original participants (Radler & Ryff, 2010). Compared to those who were lost to follow-up, participants remaining in the cohort were more likely to be female, White, more highly educated, and have higher income. A subgroup of respondents in the second phase ($N$ = 1,255) also participated in a biomarker project.

The analytic sample for this study was drawn from those individuals who participated in both phases of the MIDUS study ($N$ = 4,963). Since marital quality was queried only in those who reported being married or in a marriage-like relationship, those who reported being unmarried and not in a relationship at MIDUS

I were excluded ($N$ = 1,261). Participants were additionally excluded for the following reasons: missing data on any baseline marital quality measures ($N$ = 242); missing data on body weight measures at either MIDUS I or II ($n$ = 754); and missing data on any covariates ($n$ = 70). This yielded the analytic sample of 2,636 respondents (195 were either siblings or twins). Participants included and excluded from the analytic sample differed on several socioeconomic and health-related characteristics (Table S1, found in the online supplemental materials). For example, the included participants had higher SES (e.g., higher education and income) and were healthier (e.g., less depression, drinking, or smoking) than those excluded. As this study used deidentified and publicly available data, the institutional review boards (IRBs) at the authors' institution exempted it from review. The original MIDUS study was approved by IRBs at participating institutions, and participants provided written informed consent (Radler, 2014).

## Measures

**Independent variables.**

***Overall marital quality.*** Overall marital quality was assessed with a single question ("Would you describe your relationship with spouse/partner as excellent, very good, good, fair or poor?") queried at MIDUS I. Response options ranged from 1 (*excellent*) to 5 (*poor*), with responses reverse coded. Marital quality was used in analyses as a continuous variable, with higher scores representing higher marital quality.

***Marital support.*** Marital support was measured with a validated six-item Spouse/Partner Support Scale (Schuster, Kessler, & Aseltine, 1990; Table S2, found in the online supplemental materials) at MIDUS I. The scale assessed the perceived emotional support from the spouse/partner (e.g., "How much does your spouse or partner really care about you?"). Response options ranged from 1 (*a lot*) to 4 (*not at all*). All responses were reverse coded so that a higher score represented greater support. An overall score was calculated as the mean across the six items, and was used in analyses as a continuous variable. The Cronbach's alpha of the scale was .90 in this sample.

***Marital strain.*** Marital strain was measured with a validated six-item Spouse/Partner Strain Scale (Schuster et al., 1990; Table S2, found in the online supplemental materials) at MIDUS I. The scale assessed the perceived demands and negative behaviors from the spouse/partner (e.g., "How often does your spouse or partner make too many demands on you?"). Response options ranged from 1 (*often*) to 4 (*never*). All responses were reverse coded so that a higher score represented greater strain. An overall marital strain score was calculated as the mean of the six items, and was used as a continuous variable. In the current sample, the Cronbach's alpha of the scale was .87.

**Dependent variables.**

***Weight change.*** Weight change between waves was calculated by subtracting weight at Wave I from weight at Wave II, and was considered as a continuous score. As the biomarker project participants ($N$ = 1,255) received a physical exam, their self-reported weight was compared with the measured weight, and demonstrated very good concordance ($r$ = .95). Weight change was winsorized at the 1st and 99th percentiles (i.e., participants with weight change less than the 1st percentile or greater than the 99th percentile were assigned the value for the 1st and 99th percentiles separately), to minimize possible influence of extreme outliers.

***Incidence of obesity.*** Body mass index (BMI; in kg/m$^2$) was calculated on the basis of self-reported height and weight at both phases. BMI $\geq$30 kg/m$^2$ was defined as obese, and BMI $<$30 kg/m$^2$ as nonobese (World Health Organization, 1995).

**Covariates.**

***Sociodemographic characteristics.*** At MIDUS I, participants self-reported their age (in years), gender (male, female), race (White, Black, other races), education level (less than high school, high school, some college, and college or more), household income (in U.S. dollars, income greater than $300,000 was recoded as $300,000 to minimize risk of deductive disclosure), and relationship status (married, in domestic partnership). Household income was used as a continuous variable in regression analyses. However, for descriptive analyses in Table 1, tertiles of income were created: $0–$37,500, $38,000–$75,500, and $76,000–$300,000. Relationship status change during follow-up (remained married or in partnership vs. became unmarried or ended the partnership) was assessed according to the change in marital status reported at both phases.

***Major depression.*** Past-year major depression was measured with the 19-item Composite International Diagnostic Interview Short Form (CIDI-SF; Kessler, Andrews, Mroczek, Ustun, & Wittchen, 1998) at MIDUS I. Diagnosis of major depression requires the presence of either depressed affect or anhedonia at least most of the day, nearly every day for 2 weeks, and four or more accompanying symptoms (e.g., fatigue, changes in appetite, sleep problems, excessive guilt). Test–retest reliability and clinical validity of the CIDI-SF has been demonstrated in prior work (Aalto-Setala et al., 2002; Blazer, Kessler, McGonagle, & Swartz, 1994).

***Chronic conditions.*** Participants reported (yes, no) whether they ever had the following conditions: cancer, heart attack (or taking medications for controlling heart problems), stroke, and diabetes (or taking medications for controlling diabetes). The total number of chronic conditions reported was calculated, ranging from 0 to 3 (no participants reported all four conditions).

***Health behaviors.*** Smoking, drinking, and physical activity were self-reported at MIDUS I. Participants who reported smoking cigarettes regularly at the time of assessment were considered current smokers. Respondents who ever regularly had at least one drink for 3 or more days per week were considered regular drinkers. Responses to frequency of moderate (e.g., bowling or using a vacuum cleaner) and vigorous (e.g., running or lifting heavy objects) physical activity ranged from 0 to 14 times/month, and were considered as continuous variables.

## Statistical Analyses

All statistical analyses were performed in SAS 9.4 ($p < .05$ significance level, two-tailed). Linear regression models were first used to examine the associations of baseline marital support and marital strain with other participant characteristics.

To investigate whether marital quality was associated with subsequent weight change, generalized estimating equations (GEE) with normal distribution were used ($N$ = 2,636). Overall marital quality, marital support, and marital strain (all three variables were standardized at $M$ = 0, $SD$ = 1, for easier interpretation) were considered

Table 1
*Marital Support and Marital Strain by Sociodemographic and Health-Related Characteristics in the Full Sample (N = 2,636)*

| Variable | *n* | Marital support | | Marital strain | |
|---|---|---|---|---|---|
| | | Mean (*SE*) | *p* | Mean (*SE*) | *p* |
| Age (years) | | | .02 | | .02 |
| 20–39 | 793 | 3.63 (.48) | | 2.21 (.58) | |
| 40–49 | 761 | 3.56 (.54) | | 2.25 (.59) | |
| 50–59 | 595 | 3.62 (.54) | | 2.15 (.60) | |
| 60–69 | 389 | 3.65 (.52) | | 2.17 (.61) | |
| 70+ | 98 | 3.65 (.59) | | 2.16 (.58) | |
| Gender | | | <.001 | | .004 |
| Male | 1,280 | 3.68 (.46) | | 2.17 (.55) | |
| Female | 1,356 | 3.55 (.57) | | 2.23 (.62) | |
| Race | | | .10 | | .40 |
| White | 2,511 | 3.62 (.52) | | 2.20 (.59) | |
| Black | 68 | 3.53 (.65) | | 2.27 (.68) | |
| Other races | 57 | 3.50 (.64) | | 2.13 (.61) | |
| Education level | | | .47 | | .91 |
| Less than high school | 149 | 3.62 (.53) | | 2.17 (.64) | |
| High school | 744 | 3.59 (.56) | | 2.20 (.62) | |
| Some college | 765 | 3.61 (.51) | | 2.21 (.58) | |
| College or more | 978 | 3.63 (.50) | | 2.20 (.57) | |
| Household income | | | .42 | | .40 |
| Bottom tertile ($0–$37,500) | 508 | 3.59 (.58) | | 2.17 (.63) | |
| Middle tertile ($38,000–$75,500) | 957 | 3.62 (.51) | | 2.20 (.59) | |
| Top tertile ($76,000–$300,000) | 1,171 | 3.61 (.51) | | 2.21 (.58) | |
| Relationship status | | | .08 | | .60 |
| Married | 2,517 | 3.61 (.53) | | 2.20 (.59) | |
| In partnership | 119 | 3.69 (.43) | | 2.17 (.64) | |
| Remained married or in partnership at follow-up | | | <.001 | | <.001 |
| Yes | 2372 | 3.64 (.49) | | 2.18 (.58) | |
| No | 264 | 3.38 (.69) | | 2.41 (.67) | |
| Depression | | | .0002 | | <.001 |
| Yes | 255 | 3.50 (.57) | | 2.39 (.64) | |
| No | 2,381 | 3.63 (.52) | | 2.18 (.58) | |
| Number of chronic conditions | | | .55 | | .76 |
| 0 | 2,246 | 3.62 (.51) | | 2.20 (.58) | |
| 1 | 352 | 3.60 (.57) | | 2.22 (.65) | |
| 2 | 36 | 3.56 (.62) | | 2.18 (.66) | |
| 3 | 2 | 3.25 (1.06) | | 2.58 (.35) | |
| Current smoker | | | .03 | | .81 |
| Yes | 438 | 3.56 (.58) | | 2.21 (.65) | |
| No | 2,198 | 3.62 (.51) | | 2.20 (.58) | |
| Regular drinker | | | .34 | | .002 |
| Yes | 1,052 | 3.60 (.52) | | 2.24 (.59) | |
| No | 1,584 | 3.62 (.53) | | 2.17 (.59) | |
| Moderate activity | | | .0005 | | .12 |
| Bottom tertile | 811 | 3.56 (.57) | | 2.23 (.61) | |
| Middle tertile | 368 | 3.60 (.55) | | 2.21 (.60) | |
| Top tertile | 1,457 | 3.65 (.49) | | 2.18 (.58) | |
| Vigorous activity | | | <.0001 | | .002 |
| Bottom tertile | 787 | 3.54 (.57) | | 2.25 (.61) | |
| Middle tertile | 829 | 3.60 (.53) | | 2.21 (.62) | |
| Top tertile | 1,020 | 3.68 (.47) | | 2.15 (.55) | |
| Baseline weight status[a] | | | .02 | | .06 |
| Nonobese | 2,096 | 3.62 (.51) | | 2.19 (.58) | |
| Obese | 540 | 3.57 (.55) | | 2.24 (.63) | |
| Weight status at follow-up[b] | | | .0007 | | .02 |
| Nonobese | 1,906 | 3.63 (.51) | | 2.18 (.59) | |
| Obese | 730 | 3.56 (.56) | | 2.24 (.61) | |

*Note.* Linear regression models were used to examine the associations of marital support and marital strain with other participant characteristics.
[a] The baseline body mass index had a mean of 26.64 kg/m$^2$, had a standard deviation of 4.82 kg/m$^2$, and ranged from 17.82 to 43.42 kg/m$^2$. [b] The body mass index at follow-up had a mean of 27.78 kg/m$^2$, had a standard deviation of 5.34 kg/m$^2$, and ranged from 18.23 to 46.80 kg/m$^2$. The weight change during follow-up had a mean of 6.50 pounds, had a standard deviation of 16.58 pounds, and ranged from −45 to 60 pounds.

independent variables in separate models, and all models adjusted for clustering by family. For all analyses, three sets of models were evaluated. The base model controlled for sociodemographic factors including age, gender, race, height, educational attainment, household income, and initial relationship status (married or in a domestic partnership). We also adjusted for subsequent relationship status change (remained married or in partnership vs. became unmarried or ended the partnership) to account for the possibility that baseline marital quality may be a proxy for subsequent marital status change. A second model further adjusted for baseline health conditions, including major depression and the number of other weight-related chronic conditions. A third, fully adjusted model additionally controlled for baseline health behaviors including drinking, smoking, and physical activity that may lie on the pathway linking marital quality to body weight. We also included marital support and marital strain simultaneously in the model to examine their independent effects.

As a secondary analysis, we examined whether overall marital quality, marital support, and marital strain were associated with incident obesity. Participants in this sample generally reported high BMI at baseline ($M = 26.64$, $SD = 4.82$), and only 39% of the participants had normal weight ($18.5\ kg/m^2 \leq BMI < 25\ kg/m^2$). To have sufficient sample size, we examined incidence of obesity among participants who were initially nonobese ($N = 2{,}096$), including those who were overweight, normal weight, or underweight, rather than just among those with normal weight at baseline ($N = 1{,}028$). We followed a similar modeling strategy as the primary analyses by using a set of GEE models, but with a Poisson distribution to account for the binary outcome. We also examined the independent effects of marital support and marital strain on incident obesity by including them simultaneously in the model.

Lastly, to investigate whether gender would modify the association of marital quality with weight change and incident obesity, we examined interaction terms of gender with baseline overall marital quality, marital support, and marital strain in separate models.

## Results

### Descriptive Analyses

In the full analytic sample ($N = 2{,}636$), participants were predominantly White (95.26%), higher percentage female (55.48%), and the majority had at least a high school degree (94.35%) (Table S1, found in the online supplemental materials). The prevalence of obesity increased from 20.49% to 27.69% over the follow-up (mean follow-up = 8.90 years), and the average weight change was a 6.50-pound increase ($SD = 16.58$). Included participants generally reported high levels of overall marital quality ($M = 3.98$, $SD = 0.98$) and marital support ($M = 3.61$, $SD = 0.52$), and low levels of marital strain ($M = 2.20$, $SD = 0.59$). Around 10.02% of included participants ($N = 264$) became unmarried or ended their partnership over the follow-up.

When considering the associations of baseline marital support and marital strain with other participant characteristics in the full analytic sample, participants who were older and male, and those who maintained their marital or domestic relationship over follow-up, were more likely to report high marital support and low marital strain at baseline (see Table 1). Those who were depressed, current smokers, regular drinkers, and physically inactive tended to report low marital support and/or high marital strain. Marital support and marital strain were inversely correlated in this sample ($r = -0.66$).

### Overall Marital Quality and Body Weight

Overall marital quality was inversely associated with subsequent weight gain. More specifically, 1 *SD* increase in overall marital quality was associated with a smaller weight increase by 0.73 pounds in the base model ($\beta = -0.73$, 95% confidence interval [CI] [−1.41, −0.06]). The association remained robust after further adjustment for health conditions ($\beta = -0.69$, 95% CI [−1.37, −0.01]), and then additionally adding health behaviors ($\beta = -0.70$, 95% CI [−1.38, −0.01]).

Findings were less robust with incident obesity. Specifically, 1 *SD* increase in overall marital quality was related to 10% lower risk of incident obesity (risk ratio [RR] = 0.90, 95% CI [0.81, 1.00], $p < .05$) in the base model. However, the association was attenuated when other covariates were included in the model ($RR_{\text{fully adjusted}} = 0.91$, 95% CI [0.82, 1.02]).

### Marital Support and Body Weight

Marital support was inversely associated with weight gain. Specifically, 1 *SD* increase in marital support was associated with lower weight increase by 1.55 pounds in the base model ($\beta = -1.55$, 95% CI [−2.85, −0.24]). The associations held when baseline health status ($\beta = -1.47$, 95% CI [−2.77, −0.16]) and health behaviors ($\beta = -1.48$, 95% CI [−2.80, −0.16]) were further adjusted for (see Table 2). When marital support and marital strain were simultaneously included in the model, the effect of marital support was attenuated ($\beta = -1.38$, 95% CI [−3.07, 0.32]), which may be in part due to the correlation between marital support and strain ($r = -0.66$).

Analyses on incident obesity yielded similar results. Specifically, there was a 22% lower risk of incident obesity associated with 1 *SD* increase in marital support (RR = 0.78, 95% CI [0.65, 0.94]). The association remained robust when other covariates were further added to the model ($RR_{\text{fully adjusted}} = 0.79$, 95% CI [0.65, 0.96]; see Table 3). When marital support and marital strain were simultaneously included in the model, the effect of marital support still held (RR = 0.77, 95% CI [0.59, 0.99]).

### Marital Strain and Body Weight

Marital strain was not associated with weight change in any model (e.g., $\beta_{\text{fully adjusted}} = 0.92$, 95% CI [−0.20, 2.04]). There was no evidence of an association between marital strain and risk of incident obesity either (e.g., $RR_{\text{fully adjusted}} = 1.12$, 95% CI [0.93, 1.36]).

### Interaction Between Baseline Marital Quality and Gender in Relation to Body Weight

There was no interaction between marital quality and gender in relation to weight change. The interaction terms of gender with overall marital quality ($\beta = -0.47$, 95% CI [−1.80, 0.86]), marital support ($\beta = 0.49$, 95% CI [−2.15, 3.14]), and marital

Table 2
*Baseline Marital Support and Weight Change (in Pounds) Over the Follow-Up Period (N = 2,636)*

| Variable | Model 1 β [95% CI] | Model 2 β [95% CI] | Model 3 β [95% CI] |
|---|---|---|---|
| Marital support (standardized) | −1.55 [−2.85, −.24]* | −1.47 [−2.77, −.16]* | −1.48 [−2.80, −.16]* |
| Age (years) | −.35 [−.40, −.30]*** | −.35 [−.40, −.29]*** | −.34 [−.39, −.29]*** |
| Height (inches) | .15 [−.06, .35] | .14 [−.06, .34] | .14 [−.07, .34] |
| Female (vs. male) | .75 [−.97, 2.47] | .65 [−1.05, 2.36] | .93 [−.81, 2.67] |
| Race | | | |
| Black (vs. White) | 1.21 [−3.27, 5.70] | 1.25 [−3.23, 5.73] | 1.31 [−3.17, 5.79] |
| Other races (vs. White) | 1.35 [−3.47, 6.17] | 1.29 [−3.54, 6.12] | 1.29 [−3.55, 6.13] |
| Education level | | | |
| High school (vs. <high school) | .17 [−3.02, 3.36] | .26 [−2.91, 3.43] | .35 [−2.82, 3.52] |
| Some college (vs. <high school) | −1.71 [−4.95, 1.54] | −1.61 [−4.85, 1.62] | −1.49 [−4.73, 1.75] |
| ≥College (vs. <high school) | −2.67 [−5.88, .55] | −2.50 [−5.70, .70] | −2.33 [−5.56, .89] |
| Household income (per $1,000 increase) | .00 [−.01, .01] | .00 [−.01, .01] | .00 [−.01, .01] |
| Married (vs. in partnership) | −4.00 [−7.34, −.66]* | −3.95 [−7.27, −.63]* | −3.83 [−7.18, −.48]* |
| Remained married or in partnership at follow-up (yes vs. no) | 2.52 [.14, 4.89]* | 2.54 [.16, 4.92]* | 2.61 [.24, 4.98]* |
| Depressed (yes vs. no) | | 2.18 [−.34, 4.71] | 2.18 [−.34, 4.71] |
| Number of chronic conditions | | −.03 [−1.96, 1.90] | −.01 [−1.94, 1.92] |
| Current smoker (yes vs. no) | | | .59 [−1.29, 2.46] |
| Regular drinker (yes vs. no) | | | .33 [−.94, 1.59] |
| Moderate activity (times/month) | | | −.05 [−.20, .11] |
| Vigorous activity (times/month) | | | .10 [−.04, .23] |

*Note.* Generalized estimating equations with normal distribution and identity link were used in all models to estimate the mean change in weight by marital support at baseline, adjusting for clustering by family. CI = confidence interval.
* $p < .05$. *** $p < .001$.

strain (β = 0.04, 95% CI [−2.16, 2.23]) were not statistically significant in any model.

When considering incident obesity, however, the interaction terms among marital support ($\beta_{\text{fully adjusted}} = 0.43$, 95% CI [0.06, 0.79]), marital strain ($\beta_{\text{fully adjusted}} = -0.40$, 95% CI [−0.77, −0.02]), and gender were statistically significant, although there was still no evidence of gender interaction with overall marital quality in any model ($\beta_{\text{fully adjusted}} = 0.10$, 95% CI [−0.12, 0.32]). Stratified analyses suggested that marital support was associated with incident obesity in men ($RR_{\text{fully adjusted}} = 0.65$, 95% CI [0.49, 0.85]) but not in women ($RR_{\text{fully adjusted}} = 0.93$, 95% CI [0.72, 1.20]). Similarly, marital strain was associated with incident obesity in men ($RR_{\text{fully adjusted}} = 1.41$, 95% CI [1.05, 1.88]) but not in women ($RR_{\text{fully adjusted}} = 0.96$, 95% CI [0.76, 1.22]). This may be in part due to the fact that men had

Table 3
*Baseline Marital Support and Incidence of Obesity at Follow-Up Among Initially Nonobese Participants (N = 2,096)*

| Variable | Model 1 RR [95% CI] | Model 2 RR [95% CI] | Model 3 RR [95% CI] |
|---|---|---|---|
| Marital support (standardized) | .78 [.65, .94]** | .79 [.65, .95]* | .79 [.65, .96]* |
| Age (years) | .98 [.97, .99]*** | .98 [.97, .99]*** | .98 [.97, .99]*** |
| Female (vs. male) | .94 [.75, 1.18] | .93 [.73, 1.17] | .90 [.71, 1.15] |
| Race | | | |
| Black (vs. White) | 1.29 [.64, 2.60] | 1.33 [.66, 2.69] | 1.26 [.63, 2.51] |
| Other races (vs. White) | 1.16 [.59, 2.27] | 1.19 [.60, 2.34] | 1.13 [.57, 2.27] |
| Education level | | | |
| High school (vs. <high school) | .94 [.71, 1.23] | .93 [.71, 1.23] | .72 [.46, 1.11] |
| Some college (vs. <high school) | .59 [.43, .81]** | .60 [.43, .83]** | .66 [.42, 1.02] |
| ≥College (vs. <high school) | 1.39 [.90, 2.13] | 1.35 [.87, 2.10] | .41 [.25, .65]*** |
| Household income (per $1,000 increase) | 1.00 [1.00, 1.00] | 1.00 [1.00, 1.00] | 1.00 [1.00, 1.00] |
| Married (vs. in partnership) | .74 [.48, 1.13] | .74 [.48, 1.15] | .69 [.45, 1.08] |
| Remained married or in partnership at follow-up (yes vs. no) | 1.24 [.84, 1.83] | 1.23 [.83, 1.81] | 1.22 [.83, 1.79] |
| Depressed (yes vs. no) | | 1.21 [.87, 1.70] | 1.21 [.87, 1.68] |
| Number of chronic conditions | | 1.48 [1.13, 1.94]** | 1.48 [1.12, 1.94]** |
| Current smoker (yes vs. no) | | | .65 [.47, .90]** |
| Regular drinker (yes vs. no) | | | 1.04 [.82, 1.31] |
| Moderate activity (times/month) | | | .99 [.96, 1.02] |
| Vigorous activity (times/month) | | | .99 [.96, 1.01] |

*Note.* Generalized estimating equations with Poisson distribution and log link were used in all models to estimate the risk ratio of incident obesity by marital support among those who were nonobese at baseline, adjusting for clustering by family. RR = risk ratio; CI = confidence interval.
* $p < .05$. ** $p < .01$. *** $p < .001$.

higher baseline BMI ($mean_{BMI}$ = 25.71 in men vs. 23.86 in women, $p < .001$) and higher prevalence of overweight (prevalence = 49.84% in men vs. 29.72% in women, $p < .001$) at baseline compared to women in this sample.

## Discussion

This study found that marital support was inversely associated with weight gain and incident obesity over a 10-year follow-up, and the association with incident obesity held when marital strain was simultaneously included in the model. There was evidence that overall marital quality was also associated with less weight gain. However, marital strain was not associated with either weight gain or incident obesity. While gender did not modify the association between any marital quality variables and weight gain, there was evidence that marital support and marital strain may be associated with incident obesity primarily in men but not in women.

Three competing models regarding the relationship between marriage and body weight have been proposed. One is derived from a health regulation/social control framework, and suggests that a supportive marital relationship facilitates a behavioral regulatory function of marriage—spouses encourage each other to engage in healthy behaviors and avoid unhealthy practices, which in turn leads to healthier weight (Umberson, Crosnoe, & Reczek, 2010). In a nonsupportive marriage, marital strain can lead to increased stress, interfering with behavioral regulation and resulting in weight gain (Meltzer et al., 2013). For example, in empirical studies poor marital quality has been linked to elevated risk of eating disorders such as binge eating (Markey, Markey, & Birch, 2001; Whisman, Dementyeva, Baucom, & Bulik, 2012), which could lead to weight gain and obesity (Yanovski, 2003). Burman and Margolin (1992) also proposed another theory suggesting that positive experiences in the marital relationship may directly contribute to reducing an individual's emotional problems, which in turn may decrease risk of unhealthy behaviors and thereby promote the maintenance of healthy weight. In contrast, the mating market model (Meltzer et al., 2013) posits maintaining healthy weight is primarily driven by the motivation to attract a mate, whereby those in a stressful marital relationship may prioritize weight maintenance due to an underlying sense that the marriage may not survive and they may subsequently need to attract a new mate. Findings of this study provide support for the health regulation model and Burman and Margolin's theory.

Our findings are at odds with one prior study (Meltzer et al., 2013) which found a positive association between marital satisfaction and weight gain in a relatively small sample of young and highly educated couples ($N$ = 169 couples; mean age = 25.6 years in the husbands and 23.4 years in the wives; more than half were graduate students). We speculate that the inconsistent findings may be due to the age difference of study samples, in addition to the use of distinct marital quality measurements (e.g., the prior study assessed marital satisfaction, which captures something different than overall marital quality or support used in the current study) and the differences in analytic approaches. It is possible that effects of marital quality on body weight may vary across life stages. As individuals age, they may prioritize the benefits of maintaining healthy weight over appearance more strongly than during early adulthood, thereby reaping more health benefits of the relationship later versus earlier in adulthood (Clarke, 2002). The presence of a supportive and caring spouse/partner may thus facilitate the behavioral regulation function of marriage (either directly by increasing positive well-being in each partner or indirectly by partners encouraging healthier behavior in one another), increasing likelihood that individuals will maintain healthy weight. However, given that there are only two studies to date, additional work will help determine the role of marriage quality in maintaining healthy weight over the life course.

However, findings in this study are consistent with prior work suggesting that marital support was associated with reduced risk of other weight-related health problems such as inflammation (Bookwala, 2005). This study also adds to the growing evidence that positive and negative aspects of marital quality can have distinct effects on health, and a supportive marital relationship may have protective health effects over and beyond simply the mere absence of marital strain. It may be, therefore, important to measure marital support and marital strain separately, rather than assuming that a measure of one provides complete information about the other. Contrary to our expectation, we did not find an association between marital strain and body weight. It is possible that middle-aged couples have stayed in the marital relationship for a longer time and have developed effective strategies to cope with negative marital experiences, and therefore they both experience less strain and strain is less harmful to health, compared to younger couples who just embark on marriage. Another possibility is that because this study only included participants who were married or in a marriage-like relationship when assessed in midlife, those in stressful marital relationships may have ended their marriage in earlier life and were thus not eligible to be in our sample. This hypothesis is supported by the fact that the included participants generally reported low levels of marital strain ($M$ = 2.20 on a 1–4 scale), and that the included participants reported greater marital support and lower levels of marital strain compared to those excluded from the analyses.

To our knowledge, this is the first study that explores health behaviors as a possible pathway by which positive marital relationship affects body weight. Effects of marital quality were not substantially attenuated when baseline health behaviors were added to the model, and health behaviors were not predictive of body weight when included together with marital quality in the model, suggesting that these health behaviors may not lie on the pathway. However, the hypothesized behavioral pathway variables were assessed concurrently with marital quality in this study, and we were unable to fully consider temporal ordering in these associations, or to ensure that marital quality indeed preceded and contributed to each behavioral process. It is possible they may confound rather than mediate the association of interest in this study. Further research is needed to investigate potential mechanisms more rigorously.

We did not find interactions between marital quality and gender in relation to weight change. However, there was evidence of a gender interaction with regard to onset of obesity, such that marital support and marital strain were associated with incident obesity in men only. However, whether this is a true difference or an artifact of differences in baseline prevalence of overweight by gender remains to be determined. These

findings are inconsistent with prior work using clinical samples which suggested that marital quality has a stronger association with survival outcomes in women than in men (Rohrbaugh et al., 2006). It is possible that participants in clinical studies were generally older and sicker, and women were more likely to play the role of caregivers for their spouses in later life. Therefore, women's greater vulnerability to negative experiences in marital relationship observed in clinical studies may be partly explained by their greater exposure to stress associated with caregiving (Umberson & Williams, 2005). The inconsistent findings could also be attributed to differences in the measurement of marital quality. Specifically, the study by Rohrbaugh et al. used a composite measure of marital quality combining information from both interview and behavioral observation of the couples, which might have captured a more comprehensive picture of marital quality (Rohrbaugh et al., 2006).

This study has a number of important strengths. It is the first study to prospectively examine the association between marital quality and body weight in midlife, using validated measures of marital support and marital strain. It adds to the growing evidence that supportive social relationships may serve as a health asset. The study is one of the first to differentiate effects of multiple aspects of marital quality on body weight, while adjusting for a wide range of potential confounders. The long follow-up in this study also makes it possible to investigate the long-term effects of marital quality.

This study is, however, subject to certain limitations. First, body weight was self-reported, which may be subject to report bias. However, the self-reported weight showed high concordance with the measured BMI in a subset of participants in this study, and there is also evidence for validity of self-reported body weight in other cohorts (Courcoulas et al., 2013). The two-time assessment of body weight 10 years apart may provide a limited assessment of weight trajectories though. Second, overall marital quality was measured with a single question, which may have limited effectiveness in assessing marital quality which is likely a multifaceted construct. Accordingly, the weaker association of overall marital quality with body weight compared to marital support could be due in part to the lower reliability of a single-item measure. In addition, marital quality was assessed with self-reports in this study, whereas recent studies have suggested that behavioral assessments of relationship quality may predict cardiovascular health outcomes better than self-reports, and that future studies should consider both assessment approaches when possible (Smith & Baucom, 2017). Next, no formal mediation analysis could be performed, because marital factors and health behaviors were assessed concurrently. Also, there may be residual confounding by factors for which information was unavailable such as past marital history, relationship duration, and health status of the partner. Finally, we did not examine the same-sex and different-sex relationship separately in this study. Accumulating evidence has underscored the undesirable health outcomes among nonheterosexual individuals (Trudel-Fitzgerald, Chen, Singh, Okereke, & Kubzansky, 2016), supporting the relevance of conducting future research to examine the health effects of relationship quality among the lesbian, gay, bisexual, and transgender group.

Important next steps following this study include, for example, studying effects of marital quality on specific behaviors that are likely to contribute to weight gain or maintenance (e.g., dietary behaviors, eating disorders, sleep), examining the potential interactions between positive and negative aspects of the marital relationship quality in relation to body weight (Uchino, Holt-Lunstad, Uno, & Flinders, 2001), and investigating potential modifiers for the association of interest (e.g., age). Studies on marital quality and health have important clinical implications. In fact, marital therapy has been shown effective in improving marital satisfaction and reducing marital distress (Gurman, Lebow, & Snyder, 2015; Kung, 2000). There is also evidence suggesting that obesity treatment and weight loss programs are more likely to be effective when the spouse is involved, especially when the spouse is himself/herself successful in losing weight (Gorin et al., 2005). There are, however, a number of barriers to implementing couples therapies in practice (Snyder, Castellani, & Whisman, 2006). A less involved approach to couples therapy (Smith & Baucom, 2017), which requires less intensive resources and schedules, combined with Web-based weight loss programs, may be one scalable alternative to increasing partner involvement in weight loss interventions. Further research on marital quality and body weight is much needed to help understand the underlying mechanisms, inform more targeted and feasible interventions, and introduce new avenues of obesity prevention and treatment.

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Received May 17, 2017
Revision received October 31, 2017
Accepted November 4, 2017 ■