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To What Degree Does Martial Quality Predict Longevity? A Meta-Analysis of Prospective Studies

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Doctor of Philosophy

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ABSTRACT

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A Meta-Analysis of Prospective Studies

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Strong social relationships consistently predict the quality of both physical and mental health. Society commonly recognizes the marriage relationship as one of the most committed, enduring relationships. While marital status alone can strongly predict health, it appears that moderating factors exist in this association. The quality of one's marriage can have a greater effect on health than marital status alone. We conducted a meta-analysis examining the strength of the influence that marital quality has on physical health, specifically indicated by mortality rates. To identify relevant articles, we searched multiple online databases (Embase, Psycinfo, Family and Society Studies Worldwide, and Academic Search Ultimate) up to May 2021. We included studies that had a measure of marital quality linked with a measure of mortality. We identified 23 articles, with a combined total of 73,492 participants. We pre-registered this analysis with the PROSPERO International Prospective Register of Systematic Reviews Registration #CRD42020145352. Members of the research team coded each relevant article for the variables in the study. We then analyzed the data using random effects models. Results indicated that a statistically significant relationship exists between marital quality and survival across all studies reviewed, with high-quality marriage being positively associated with improved survival rates (OR = 1.265, 95% CI = 1.08 to 1.48, p = .003, n = 10, HR = 1.15, 95% CI = 1.05 to 1.26, p = .004, n = 12). Moderation analyses identified that the association tended to be much stronger when studies evaluated patients with a physical illness than when studies involved community samples with ostensibly normal levels of physical health. Thus, the influence of marital quality on longevity is most pronounced when one of the spouses has poor health. These results support an increased focus on marital considerations in psychology, public health, and medical care.

Keywords: marital quality, marriage, longevity, mortality, spouse, family, marital happiness, marital satisfaction, meta-analysis

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I am grateful for my colleagues, friends, and family members who provided feedback on wording, grammar, and ideas, as well as an open ear when I needed to talk. Lastly, I extend a heartfelt thank you to my amazing husband, who has provided immeasurable support and encouragement throughout the years of this process. He has contributed many evenings and weekends to editing, proofreading, brainstorming, and encouraging me on my dissertation. Thank you for your willingness to sacrifice and thank you for believing in me.

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DESCRIPTION OF DISSERTATION STRUCTURE AND CONTENT

This dissertation has been prepared in the publication-ready format. This format contains a brief literature review, followed by a methods section, a results section, and a discussion section. Preparing the document in this shortened form allows the dissertation content to be submitted to a journal for publication as an article following the dissertation defense. Although the full literature review is too long for the publication-ready format, it is contained at the end of this document, in Appendix A. The complete list of search terms used in the article searches can be found in Appendix B of this document. A copy of the coding sheet can be found in Appendix C of this document, and the rationale for the coding variables can be found in Appendix D.

Introduction

Over the past century, research has shed light on a number of key factors that bolster health or that undermine it. Individuals and health organizations turn to this research to find solutions and to take preventative measures. Marital quality is not often considered when identifying health-related factors, however, past findings highlight a relationship between marital quality and health (Robles et al., 2014). Studies also show a connection between marital quality and mortality rates (King & Reis, 2012, Whisman et al., 2018). Our study sought to deepen the focus on marital quality as an identifiable factor that relates to longevity.

A high-quality marriage inherently provides a form of social support from the spouse. While commonly known predictors of physical health include blood pressure, cholesterol level, substance abuse, physical exercise, and obesity, recent research has confirmed that another factor contributes to long-term health more than any of those factors: The quality of social relationships (Holt-Lunstad et al., 2010). Although this research finding may have appeared somewhat surprising to professionals in the medical fields, research has consistently correlated a lack of social support with poor individual health (Morina et al., 2021). In other words, psychological factors strongly influence public health (Ogden, 2012). This places importance on the social support aspect of a good marriage.

Another aspect of a high-quality marriage that researchers link to health, is the marriage status itself. After parenting and the parent-child relationship, people commonly recognize marriage as the most intimate and impactful interpersonal relationship (Glenn & Weaver, 1981; see also Brown et al., 1975). Because of the intimate, enduring nature of marriage, a marriage relationship has the potential to benefit or harm personal health. Research has consistently shown

the association between marriage and health benefits (Gove, 1973; Kiecolt-Glaser & Newton, 2001; Robles et al., 2014; Wyke & Ford, 1992).

Marriage may impact health through pathways such as access to material resources, lower stress levels (Wyke & Ford, 1992), medical regimen adherence (Cohen et al., 2007; DiMatteo, 2004; Gallant, 2003), lifestyle habits such as less smoking (Bourassa et al., 2019; Ramsey et al., 2019; Rankin-Esquer et al., 1997), or, for men, healthier diets (Horwath, 1989). With these benefits in mind, it is not surprising that marriage is also linked to a lower risk of mortality (Bourassa et al., 2019; Gove, 1973; Sbarra et al., 2011; Wang et al., 2020; see also Deng et al., 2021). Shor et al. (2012) identified a 30% higher mortality risk for separated and divorced individuals, compared to married individuals, in their meta-analysis. Interestingly, multiple meta-analyses have identified that the higher mortality risk among the divorced (or separated) has a greater impact on men than women (Sbarra et al., 2011; Shor et al., 2012; Wang et al., 2020). Other studies addressing other aspects of marital quality and health-related factors have also found gendered differences (Hee Kim & Joo, 2021).

Beyond marital status, research needs to consider the impact of marital quality. Marital quality is important because of the impactful nature of the marriage relationship. Marriage can be a large piece of an individual's life, so if something is amiss in the quality of the marriage, it understandably affects the individuals in the marriage. Marriage impacts multiple aspects of daily life. Marriage and associated expectations and interactions are part of most societies and cultures for the majority of adults (Goldstein & Kenny, 2001). This common relationship has seen some decline in prevalence over the years, perhaps in some part due to increasing cohabitation rates (Bumpass et al., 1991) and shifts in cultural expectations (Cherlin, 2005).

However, marriage rates remain high (Bronson & Mazzocco, 2018), impacting a large segment of the population.

Another factor that contributes to the impactfulness of marriage is the long-lasting nature of the relationship. Marriages are normatively intended to endure, which is beneficial if one is in a positive marriage but can be disastrous for those in a poor-quality marriage. For those in relationships with abuse, marriage means they are chronically exposed to danger, which can be detrimental to their health, wellbeing, and life expectancy (Eby et al., 1995; Theran et al., 2006; Velopulos et al., 2019). However, for those in high-quality relationships with reliable support from their spouse, marriage means they will continue to have that resource available to them. Because marriage can either be a chronic stressor, or an enduring asset, based on the quality of the marriage, marital quality is an important factor to consider when examining the relationship between marriage and health (Holt-Lunstad et al., 2008).

Researchers have indicated that high-quality marriages are linked to good health (Robles et al., 2014) and that a high-quality marriage may have even greater health benefits for individuals than the benefits associated with simply being married (Holt-Lunstad et al., 2008; Romano et al., 1997). Naturally, those in high-quality marriages will receive the benefits of social support and marital status since a high-quality marriage fills both the social and spousal roles. However, additional benefits may emerge in marriage, contingent on marital quality.

Empirical studies suggest that individuals in high-quality marriages, with higher marital satisfaction, may experience lower risk of both mortality and psychological concerns than individuals who are in lower-quality marriages (Lawrence et al., 2019; Romano et al., 1997; Whisman et al., 2018). Conversely, low marital quality can be harmful to individuals' physical and mental health (Kiecolt-Glaser et al., 1987; Kiecolt-Glaser & Newton, 2001; Tulloch &

Greenman, 2018). Although, we recognize that marital quality is not a dichotomous concept, it does have the potential to reach an extreme end of the spectrum and be better or worse for one's health than many other factors.

Researchers have previously conducted studies and meta-analyses on the association between marital status and health. Researchers have also explored health in relation to marital quality, but as of yet, no one has carried out a meta-analysis on the association of marital quality and longevity, specifically. Therefore, we conducted a meta-analysis examining the strength of the influence that marital quality has on physical health, specifically indicated by mortality rates.

Literature Review

Marital Quality as a Predictor of Overall Health

Researchers have identified the well-established effect of marital *status* on physical health and well-being in numerous studies. Expanding on this research, authors examined how the *quality* of marital relationships affects physical health and well-being (Kiecolt-Glaser & Newton, 2001). Because health and longevity are often linked together, we review both below, in terms of their relationship with marital quality.

Physiological Indicators of Health

Researchers have found that greater marital happiness leads to better self-reported health (Proulx & Snyder-Rivas, 2013; Wickrama et al., 1997). Beyond self-report, high marital quality is linked to greater health, as indicated by lower cardiovascular reactivity, lower risk of mortality (Robles et al., 2014), and lower levels of ambulatory blood pressure (Holt-Lunstad et al., 2008). Additionally, poor marital quality is correlated with worse immune functioning (Kiecolt-Glaser et al., 1987). These physiological manifestations emphasize the importance of marital quality as a contributing factor for good health.

Poor marital quality or negative spousal interaction patterns can affect blood pressure specifically (Ewart et al., 1983; Ewart et al., 1991; Holt-Lunstad et al., 2008). Studies show that couple disagreements (Smith et al., 1998), cynical hostility (Smith & Brown, 1991), or hostile interactions with a spouse (Ewart et al., 1991) can elevate blood pressure for women. For men, blood pressure elevations have been linked to disruptive or negative behaviors in marriage (Ewart et al., 1983). Additionally, lower marital cohesion or satisfaction are associated with worse blood pressure for both husbands and wives (Baker et al., 1999; Holt-Lunstad et al., 2008). These findings attest to the influence of psychological factors on blood pressure.

Negative marital interactions can also affect heart rate (Robles & Kiecolt-Glaser, 2003). Some studies reported these findings exclusively for the wives or husbands in the study depending on what the negative interaction was (e.g., disagreements, hostility; Smith & Brown, 1991). Marital quality appears to moderate the effect that marital status has on health, specifically measured by biomarkers such as cardiovascular activity, blood pressure, and immune functioning.

Mental Health

Additionally, there are mental health benefits associated with high-quality marriages. Both high marital quality and partner satisfaction are negatively correlated with depression (Holt-Lunstad et al., 2008; Romano et al., 1997) while low marital quality is positively correlated with depression (Bulanda et al., 2021, Kiecolt-Glaser et al., 1987). High marital quality is also linked to lower stress and anxiety levels and higher life satisfaction (Holt-Lunstad et al., 2008; Postler et al., 2022), while lower happiness in marriage is connected to low self-esteem and lower overall happiness (Hawkins & Booth, 2005). In a study of male cardiac patients, researchers determined that those who feel more emotionally connected in their marriage are

happier and more satisfied with life in general (Waltz, 1986), indicating a link between marital quality and life satisfaction.

High levels of conflict in marriage are also correlated with symptoms of depression (Choi & Marks, 2008). One study found that individuals in discordant marriages had ten times the likelihood of suffering from depressive symptoms than individuals not in discordant marriages (O'Leary et al., 1994). For individuals suffering from depression, their perception of how critical their spouse is towards them can predict, very accurately, the likelihood of future relapses (Hooley & Teasdale, 1989). A greater likelihood of relapse into depression exists for those who rate their spouses as more critical when compared with those who rate their spouses as less critical (Hooley & Teasdale, 1989). Distressing marriages and negative spousal interactions can clearly harm individual mental health.

Diet, Physical Exercise, and Sleep Habits

Both high activity levels and a healthy diet can contribute to health and longevity. Sher et al. (2014) found that those who reported greater marital satisfaction increased activity levels more rapidly and maintained these increases better than their less maritally satisfied counterparts, regardless of conditions within the study. Additionally, those in this study with high marital satisfaction also had lower initial levels of saturated fats in their diets than those who had lower marital satisfaction (Sher et al., 2014). This study, as well as other studies, identifies those in satisfying, less distressing marriages as having healthier diets than those in distressed, dissatisfying marriages (Sher et al., 2014; Yang & Schuler, 2009).

Another interesting aspect of health to consider is sleep. Poor sleep can affect the body's immune response, illness progression, mental health, and so forth (Irwin, 2015). Kane et al. (2014) reported results for wives and husbands related to sleep. They reported that on days when

a wife self-discloses more to her spouse, her sleep quality improves (Kane et al., 2014). Additionally, for husbands, higher patterns of self-disclosure are linked to shorter durations of wakefulness during the night (Kane et al., 2014). As spousal communication patterns influence sleep, other areas of health and well-being will likely be impacted.

Marital Quality and Mortality

The previously mentioned studies addressed how marital quality affects physical health in general, which ties to mortality in many cases. Some studies have more specifically examined how marital quality can affect mortality. Researchers found that individuals with high satisfaction, connection, or happiness in marriage, or those with higher marital quality in general, had higher survival rates (King & Reis, 2012; Rohrbaugh et al., 2006; Wells et al., 2022; Whisman et al., 2018). Lawrence et al. (2019) found that participants who were less happy in their marriage were about 40% more likely to die than those who were more happy in their marriage. King and Reis (2012) identified that participants who were more satisfied in their marriages were more than three times as likely to survive through the 15-year follow-up. These impactful findings lend further support for examination of the link between marital quality and longevity.

Other studies provide gender-specific results. Some results identified that, for women, marital satisfaction, conflict, and overall marital quality was correlated with mortality rates (Bulanda et al., 2016; Kimmel et al., 2000), while other studies showed interactions between marital satisfaction and mortality for men as well (Isiozor et al., 2019; Lev-Ari et al., 2021). Another study found that equity in making decisions and feelings of companionship are correlated with lower death rates for women, but not for men (Hibbard & Pope, 1993). Although

some studies may have results specific to males or females, there is a great deal of support for the connection between good marital quality and survival.

Some of the reasoning potentially underlying why marital quality is correlated with mortality rates could be due to the benefits of shared affection and meaningful social support. If one has a high-quality marriage, they may feel that support is more readily available to them and matches their needs at the time. The matching hypothesis highlights that social support is more meaningful when it matches what the individual needs (Lakey & Cohen, 2000). Other research posits that although a link exists between *received* partner responsiveness and lower mortality rates, the presence or lack of *perceived* partner responsiveness moderated the relationship between support and mortality rates (Selcuk & Ong, 2013). A high-quality marriage may provide a partner who is committed to giving appropriate social support consistently, which allows their partner to know the support is available if and how they need it.

Perhaps the connection between marital quality and mortality could be linked to better adherence to health standards and goals, or an improved diet because one has a partner who is committed to them for life and will work towards health goals with them. Additionally, being in a high-quality marriage relationship could provide motivation to discontinue bad habits, such as smoking or engaging in risky behaviors. Some of these factors overlap with benefits seen among the married in general, but those with high marital quality may see these benefits in a more robust way. A spouse may be more invested in helping their spouse stick to health goals if the relationship quality is greater. A spouse may receive advice and encouragement for their goals in a more helpful way if they feel cared for by the spouse offering the suggestions. In these ways, marital quality provides a dynamic that is inherently different from marital status alone.

Counterintuitive Findings

Much of the literature highlights how good marital quality is beneficial, however, some articles yield surprising findings. Birditt and Antonucci (2008) provided some evidence that higher spousal demands, or criticism, correlated with greater survival rates. They explained that although the results may initially seem counterintuitive, perhaps spousal demands encourage independence and self-efficacy in the ailing spouse, which could be beneficial (Birditt & Antonucci, 2008). Choi and Marks (2011) also provided interesting results, stating that, for low-income men, being in a high-conflict relationship is better for their survival than being single. A third study, by Benazon et al. (2006), reported that spousal criticism did not correlate with patient mortality.

Reviewing these articles highlights the purpose behind this meta-analysis. Although much of the research posits that higher marital quality is linked to greater survival, some studies suggest that it is linked to worse survival, or not correlated. The current results are mixed. With the discrepancies in the results, a meta-analysis is warranted to help provide clarity about this association.

Research Questions

The review of the literature on this topic left us with questions to investigate further. Although the literature largely supports the presence of an association between marital quality and mortality, the magnitude and moderating factors of this association had not yet been determined. We anticipated understanding the strength of this association would illustrate the significance of the issue, while identifying the moderating marital and health factors would provide clarity regarding how the association functions.

In the 2014 meta-analysis by Robles et al., the authors address the association between marital quality and physical health, as measured by either subjective or objective clinical endpoints. Within the objective clinical end points category, Robles et al. (2014) includes mortality. We note the fact that they include mortality in their review; however, mortality as an outcome was only one variable evaluated in their review (with a greater focus on other objective or subjective health measures). Only seven of the articles included in their study addressed mortality, and for four of those articles they did not differentiate between mortality or a host of other events as the endpoint. We believe that our work expands on this research with a more direct focus on the effect that marital quality can have on mortality. Additionally, our study builds further on the Robles et al. (2014) work by including nine and a half additional years of studies, using a greater number of articles with mortality as an endpoint, and examining moderating variables. Some of these moderating variables that we examined included gender, cohort effects, and cultural differences, as well as marital quality measure type; positive or negative.

When studies use mortality as a dependent variable, we can gain clear, unambiguous data. Mortality can be viewed as the ultimate indicator of health, since good health would ideally help someone live longer. Mortality can also be reliably measured, which helps to avoid the subjectivity of endpoints such as self-reported health or reported health behaviors. These reasons make mortality an ideal endpoint for studies, although it is sometimes overlooked in research outside of the medical field. These factors led us to focus on mortality as the endpoint for this work.

With past research in mind, we addressed the following research questions in this meta-analysis:

1. What is the magnitude of the association between marital quality and subsequent mortality reported in longitudinal studies (in terms of odds ratios and hazard ratios)?
2. What factors moderate the association between marital quality and subsequent mortality?

Methods

Search Strategy

To identify relevant articles, we searched multiple databases, including Embase, Psycinfo, Family and Society Studies Worldwide, and Academic Search Ultimate. We conducted these searches with synonyms of terms representing the concept of mortality (e.g., mortality, longevity, survival, fatality) paired with synonyms of terms related to marital quality (e.g., marital satisfaction, marital strain, marital conflict, high or low marital quality, partner support, domestic violence, marriage intimacy), and an indication of data collection (e.g., hazard ratio, odds ratio, survival rate, mortality risk). We used the "explosion" feature in Embase and used both text words and keywords for all other databases. The searches covered articles from January 1980 up to May 2021. Searches were conducted by a team of undergraduate and graduate students, under the supervision of the doctoral student, dissertation chair, and a dissertation committee member.

In addition to the database searches, we manually conducted forward and backward searches on the articles selected for inclusion in the study. Backward searches examined articles' reference sections to locate other articles which could contain relevant data. Forward searches examined articles that have cited the paper after its publication. Both procedures were useful in expanding the coverage, and therefore the generalizability, of this meta-analysis.

On seven occasions we contacted the author of a study to gain further information on their article. On one occasion, we found an article that was close to meeting all search criteria, but it did not include all the specific data that we needed. We contacted the author of the study to gather additional data. With the author's replies, we were able to gain the information needed to include this study in the meta-analysis, when we otherwise would not have been able to use it. We contacted four authors to request assistance in finding the full article to go along with an abstract that seemed related to our study. Two authors did not reply. One author replied with the article. The other author replied suggesting a different study, which did not meet the inclusion criteria from our study. Additionally, we contacted one author to ask if their study provided data on marital quality or status. They replied that the study contained data about marital status, which meant that it could not be included in our analysis. Lastly, we contacted one author to gain more information about their article but did not hear back from them.

Inclusion Criteria

The criteria for inclusion in the study were that the article must include mortality data for at least one of the two spouses and must include a measure of marital quality completed by at least one of the two spouses while both spouses were living, with the mortality data analyzed relative to the measure of marital quality. We excluded studies that only reported marital distress occurring after bereavement (such as death of a child, including infant mortality). We also excluded retrospective evaluations of marital quality after the death of a spouse.

We included data reporting mortality from any cause, including accidents, violence, or suicide. All but three of the studies we located reported all-cause mortality, with no study that met all other criteria reporting only death from accident, suicide, or violence.

We also included any measure of the quality of a marriage relationship, either positive aspects (e.g., marital satisfaction, happiness in the marriage) or negative aspects (e.g., partner withdrawal, criticism). Originally, we anticipated finding a wide variety of indicators of marital quality, such as trust, forgiveness, closeness, equality, commitment, communication, honesty, support, companionship, affection, intimacy, conflict, dysfunction, withdrawal, marital stress/distress, distancing, intimate partner violence, and hostile interactions, but we located few studies that addressed these specific factors.

The marriage relationship is unique because of the committed, enduring nature of the relationship. To preserve the integrity of the marriage relationship definition for this study, we did not include studies with a sample of only cohabiting partners (rather than spouses) as participants. Complications could have arisen from the inclusion of such studies, due to the differences between the two types of relationships (e.g., A person who consistently cohabited over a five-year period may have had multiple cohabiting partners in that frame of time, but married couples are less likely to have rotating partners during the same period of time; Nock, 1995). Additionally, medical forms most often request marital status and they may, or may not, request cohabitation status. In many meta-analyses, in the medical field especially, marital status is recorded, whereas cohabitation status may not be recorded. Because of this, data on married couples, rather than cohabiting couples, were much more accessible and reliable. Ultimately, marriage represents a formal commitment to a partnership that may have different qualitative effects on health than cohabiting or dating relationships. For all these reasons we excluded studies that exclusively provided data from cohabiting individuals.

Ideally, all participants included in the relevant effect sizes would be married so that the comparison between the two groups could examine marital quality rather than marital status or

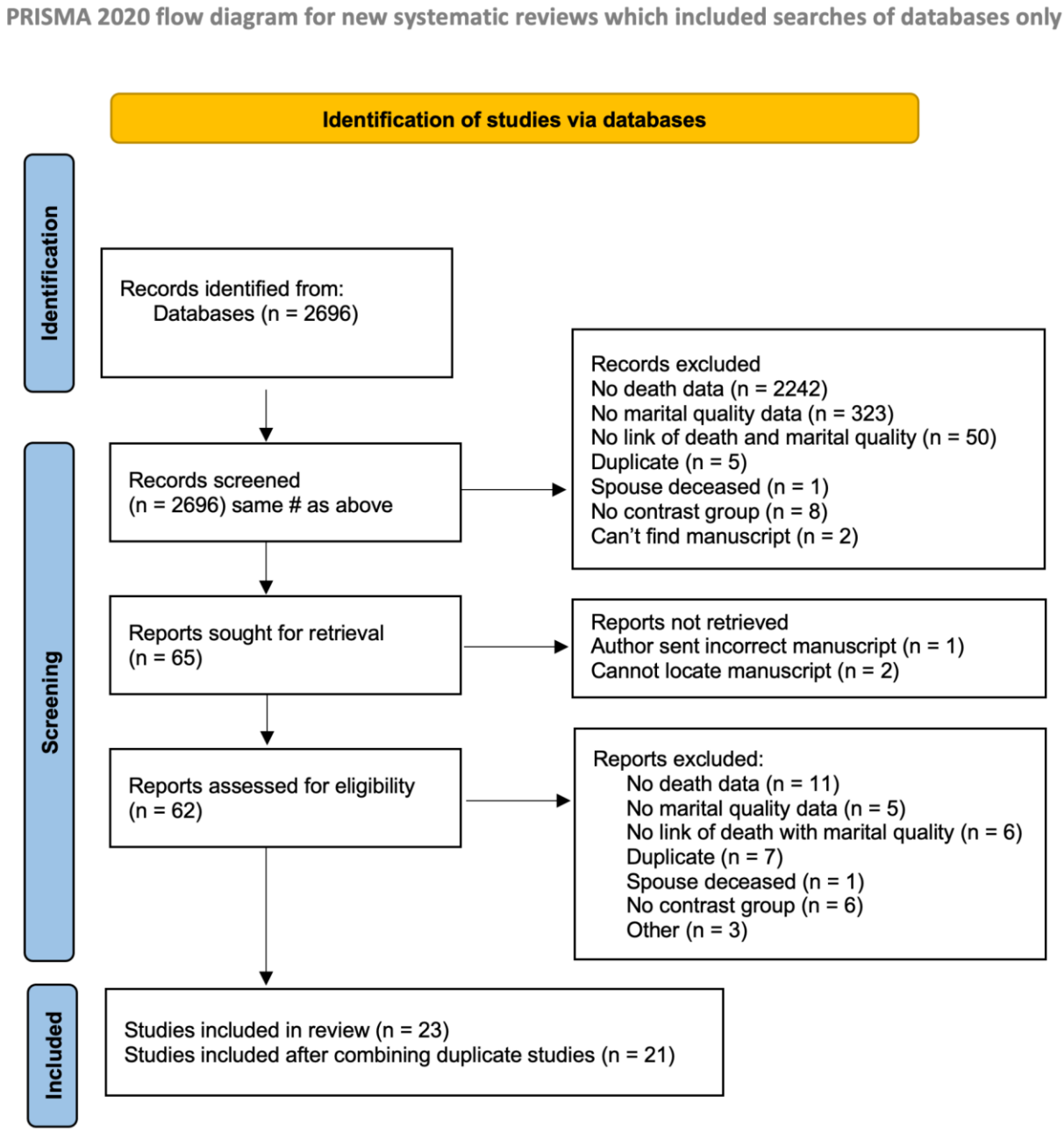
other factors. However, some of the more recent studies have included a mix of married and cohabiting or dating partners in their data and did not differentiate between the spouses and the partners for their analyses. Therefore, we included studies that mixed at least 60% of the total married with 40% or less cohabiting individuals because (a) a limited number of studies exist on this topic, (b) in almost all societies, there are more couples married than there are cohabiting, and (c) we expected the inclusion would enable a statistical comparison between mixed studies and studies in which all participants were married. Articles in which the authors did not distinguish between married and cohabiting couples may still provide important data about marital quality and mortality. Sixteen (76%) of the studies in this analysis reported that 100% of the participants were married. Two more (10%) of the studies reported over 95% of the participants were married. One study reported 61% of their participants were married, and the others were in stable relationships. The remaining 2 studies (10%) defined marriage as being married or in a marriage-like situation. Based on cohabitation rates in the general population reported in the 2020 U.S. Census data, we can assume that these studies met our cut-off criteria (U.S. Census Bureau, n.d.).

When multiple articles that contained duplicate data emerged, we included the most recent follow-up, or the article with the longest follow-up time and excluded the others. This allowed us to have the most accurate and up-to-date data, while avoiding redundancies. When we came across relevant abstracts of articles in languages other than English, we used translation technology or consulted with individuals who speak the language to gain an understanding of whether the study met our inclusion criteria. We planned to include studies of any language if they met the inclusion criteria, however, all studies that we identified that met our criteria were in English.

Articles that clearly met the criteria for the study were placed in a folder for future coding. Articles that may have potentially met these criteria were added to a list of articles to review and determine inclusion in, or exclusion from, the study. Members of the research team reviewed the articles and included or excluded them based on further investigation of the article content. Team members noted the reason for exclusion on a separate spreadsheet for articles that did not meet the necessary criteria for this study. See Figure 1 for a flow diagram of articles identified, excluded, and included.

Figure 1

Prisma Flow Diagram



Note. Retrieved from Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., et al. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ, 372*(71). https://doi.org/10.1136/bmj.n71

Coding Process

After articles were reviewed and either excluded or included in the study, members of the research team coded a number of different variables for each included article. The team members continually engaged in training with the dissertation chair on the expected procedures of the coding process. Weekly team meetings were held to promote consistency in coding patterns and provide a time to address questions or discrepancies in the coding.

Pairs or groups of students met to code each article and record their findings in a spreadsheet document accessible by all team members. After completion of the initial coding for the article, another pair or group of team members subsequently coded the article and entered their data into the spreadsheet document. This process ensured that each article was reviewed by several individuals. Upon completion of the first two rounds of coding, team members reviewed the first and second sets of coded information to ensure that they matched, indicating consensus of information. If discrepancies arose, they were reviewed and resolved by the graduate student and the dissertation chair.

We coded variables including gender and age of the participants, number of participants included in the study data, what type of measure of marital quality is used (e.g., marital happiness, spousal trust, presence of abuse), and the effect sizes. Effect sizes consisted of both odds ratios and hazard ratios. All effect sizes were coded in a uniform direction, with values greater than one indicating that higher quality marriages predicted longer survival relative to lower quality marriages, and values lower than one indicating that higher quality marriages resulted in shorter survival relative to lower quality marriages. Whenever authors reported data in a format that differed from our outlined direction, the data was inverted. This allowed us to accurately combine data reported in various formats.

We registered the meta-analysis through the PROSPERO International Prospective Register of Systematic Reviews. This allowed us to submit our protocol and planned methods for the study, which helps to reduce the chance of duplicate studies, and reporting bias (University of York Centre for Reviews and Dissemination, 2022). The PROSPERO registration number for this study is CRD42020145352.

When all the data had been reviewed for consensus, and any discrepancies resolved, we analyzed the data using random effects models. We began by conducting an analysis of the average effect size from all odds ratio (OR) data included in the studies, along with a corresponding analysis of between-study heterogeneity. We then ran analyses to check for possible moderating variables in the association, using random effects weighted subgroup comparisons for categorical variables and simple regression models with continuous variables. We repeated these steps with the hazard ratio (HR) data reported in studies. To estimate the likelihood of publication bias, we generated funnel plots, ran both Egger's and Peters' regression tests, and conducted separate trim-and-fill analyses for HR and OR data.

Data Analysis

The odds ratio measure, used as a way to measure the dependent variable, mortality, details the odds that the event (mortality) will happen during the course of the study. The hazard ratio measure (also used as a way to measure the dependent variable) details when the event (mortality) happens during the study. While both measures provide knowledge about who is alive or dead at the end of the study, the hazard ratio shows who dies at what point along the way. Since the odds ratio and hazard ratio are inherently different measures, we analyzed the odds ratio and hazard ratio data separately.

Results

Descriptive Statistics

The researchers found 23 articles with usable data for analyses. Two sets of studies were based on the same dataset (Birditt & Antonucci, 2008 and Lantz et al., 2005; Bulanda et al., 2016 and Karraker & Latham, 2015). These four studies were therefore combined into two aggregates (a Birdtt & Antonucci/Lantz et al. aggregate and a Bulanda et al./Karraker & Latham aggregate). Thus, we analyzed a total of 21 independent datasets. Data included in the meta-analysis was based on a total of 73,492 participants. On average, the participants were 43% females and 57% males (with two studies including only males and one including only females). The mean age of all participants was 59.8 years old, with an average of 23.8% of participants dying over the course of the study. The average follow-up length of studies was 10.0 years (*SD* = 7.2).

Across the 21 studies, 18 (86%) were conducted in the United States of America, one was conducted in Asia, one in Finland, and one in Israel. Most of the studies (14, 67%) recruited participants from community settings, with seven (33%) recruiting from medical settings. None of the included studies recruited participants from mental health settings. A small minority of studies (5, 24%) included both married and cohabiting couples in their sample, but the vast majority (16, 76%) contained exclusively married couples. Fourteen out of 21 studies (66%) were conducted with individuals who had no specific health factor as an inclusion criteria for the study, while seven (33%) of the studies were conducted with participants who had a pre-existing health concern such as cardiovascular disease, cancer, or kidney disease. Eighteen of the studies (86%) reported all-cause mortality, while one study examined sudden cardiac death, one evaluated breast cancer-related deaths, and one used death from strokes or coronary heart disease as their mortality measure.

Six studies (29%) used a multidimensional/overall positive measure of marital quality (such as an aggregate of positive qualities, or a measure of general "marital quality"). Six studies (29%) used a specific positive marital attribute (such as happiness, love, confiding, or perceived partner support) as their measure of quality. One study (5%) included a multidimensional/overall negative measure of marital quality (an aggregate of satisfaction including dissatisfaction). Two studies (9%) used a specific negative measure of quality (criticism, or spouse seldom shows love). The last six studies (29%) used a measure of marital quality that included both positive and negative, or mixed, aspects of marital quality (such as an aggregate including both positive and negative measures).

Three of the studies (14%) included a standardized measure of marital quality, while the other 18 (86%) used non-standardized measures of marital quality, such as one- or two-item assessments. Three studies (14%) used raw data without any statistical controls in their analysis, while the rest all controlled for some combination of participant age, gender, and/or other variables. Nineteen of the studies (91%) stated that the couples in their analyses were all heterosexual, while one study was coded as a mix, containing both heterosexual and homosexual couples, and one study was coded as possibly containing both heterosexual and homosexual couples in the study.

One study (Benazon et al., 2006) contained both odds ratio data and hazard ratio data. We therefore included the outcome data from this article in both the OR and HR analyses, respectively.

Omnibus Analyses

We analyzed odds ratio data separately from hazard ratio data. The overall random effects weighted average for the 10 odds ratio datasets was 1.265 (95% CI = 1.08 to 1.48, p =

.003). These effect sizes ranged from -0.25 to 1.31 and were found to be heterogeneous (Q = 17.4, df = 9, p = .04).

The overall random effects weighted average for the 12 hazard ratio datasets was 1.15 (95% CI = 1.05 to 1.26, p = .004). These results were also characterized by statistically significant levels of heterogeneity (Q = 39.6, df = 11.0, p < .0001). Therefore, given the heterogeneity observed in the effect sizes across studies, we were justified in conducting follow-up moderator analyses.

To see Forest plots for the OR and HR data, see figure 2, and figure 3, respectively.

Figure 2

Forest Plot for OR Data

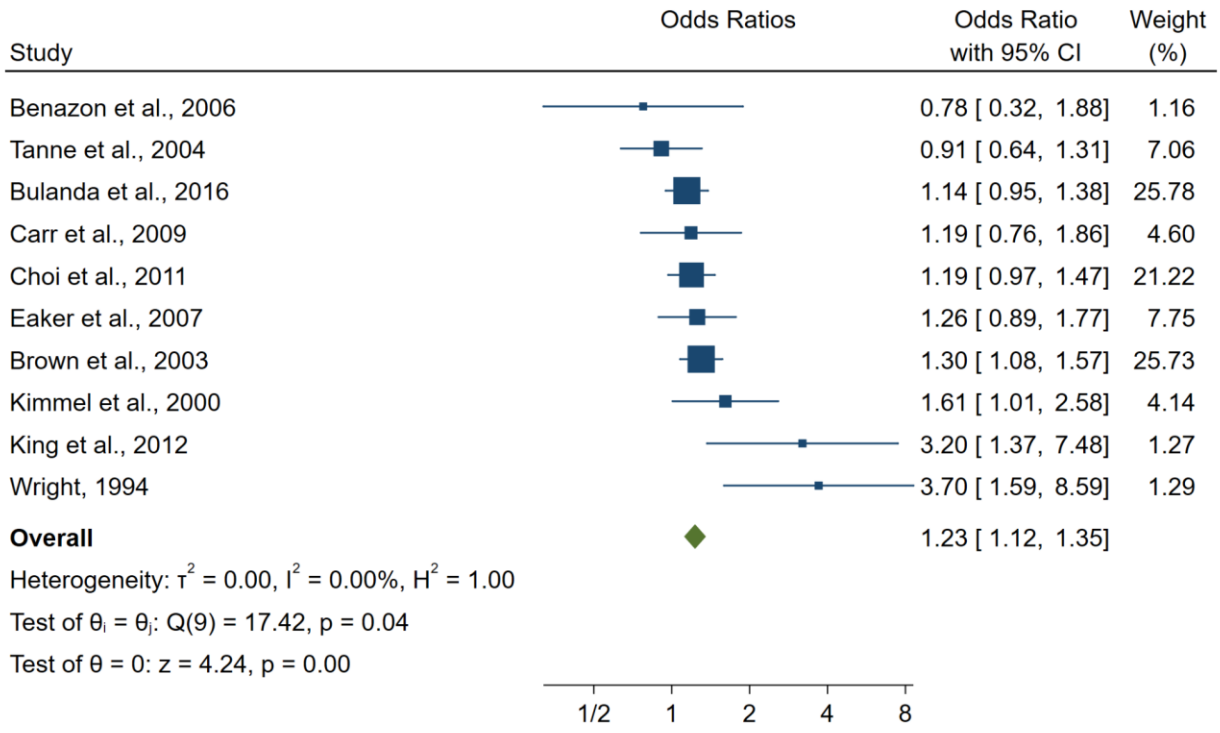
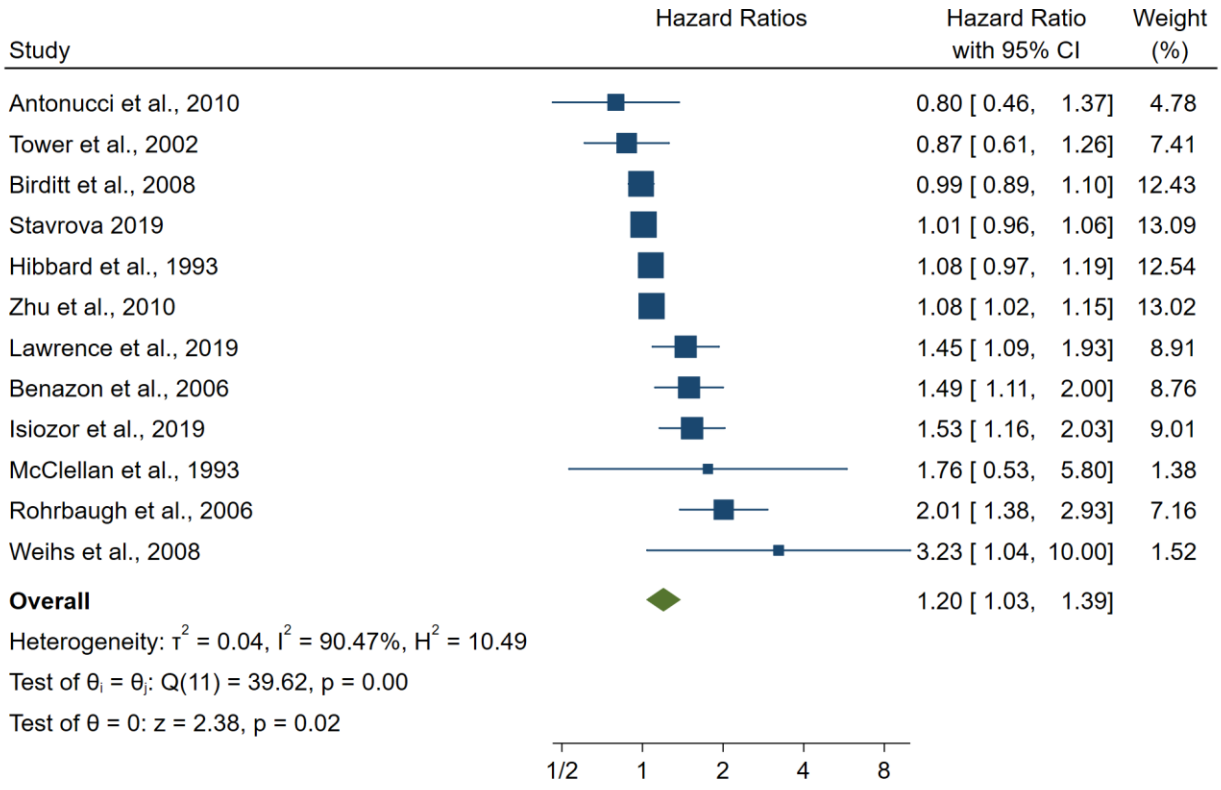


Figure 3

Forest Plot for HR Data



Moderation Analyses

Categorical Variables

We first assessed differences across the setting from which the participants and the data were gathered. We separated studies with participants gathered from the general population from studies with participants gathered from a medical setting, or a specific medical subpopulation. There was a statistically significant difference between the two groups. The results of healthy individuals differed from those recruited from a medical clinic. The average odds ratio for people recruited from a general community setting was 1.18 (95% CI = 1.03 to 1.35, $p = .0181$). In contrast, the average odds ratio for people recruited from a medical setting was 1.87 (95% CI = 1.30 to 2.68, $p = .0007$). The difference between the groups was statistically significant ($Q = 5.5$, $p < .02$). This OR data suggests that the association between marital quality and subsequent mortality was much stronger among individuals recruited from a medical setting than among those recruited from community settings. Similarly, the HR data showed a statistically significant difference ($Q = 14.2$, $p = .0002$) between participants recruited from general community settings versus medical settings. The random effects average HR for participants recruited from the general population was HR = 1.07 (95% CI = .994 to 1.15, $k = 8$), whereas the average random effects hazard ratio among individuals recruited from medical settings was 1.73 (95% CI = 1.36 to 2.20, $k = 4$). Thus, the hazard ratio and odds ratio data both indicated that the results were moderated by where the participants were recruited from.

We also examined geolocation, design type, pre-existing condition, type of death, analysis type, dependent variable, type of marriage, and standardized measure. For all of these variables there was either not a sufficient contrast to allow us to run the analysis, or no statistically significant differences in findings.

Continuous Variables

We used a random effects simple regression model to analyze continuous data. We evaluated participant average age at study initiation and found that the results were not statistically significant for the OR studies ($r = 0.20$, $p > .10$). However, for the data from the HR studies we found that participant average age at the start of the study was a statistically significant moderating variable ($r = -0.38$, $p = .089$). We ran a scatterplot and confirmed that the data indicated a negative correlation without outliers.

We also examined the age of participants at the end of the studies for the OR studies and found that it was not statistically significant ($r = 0.13$, $p > .10$). However, for the HR studies, we found that participant age at the end of the study was a statistically significant moderating variable ($r = -0.44$, $p < .05$). We ran a scatterplot to examine the data and confirmed that a negative correlation exists without outliers for the studies including HR data.

For the odds ratio studies there was a strong negative correlation present for length of follow up ($r = -.40$, $p = .14$); however, with the small number of studies, our statistical power was low and the correlation did not reach statistical significance. The magnitude of this correlation was large enough that we examined the data in a scatterplot. We found that a single outlier contributed to the observed highly negative correlation coefficient. Therefore, we concluded that there was no consistent relationship between the length of follow up and the effect size of the studies. We found that the correlation was also not significant for the hazard ratio studies ($r = .06$, $p = .78$).

We examined participant gender, operationalized as the percentage of female participants. The results for odds ratio studies were not moderated by the percentage of female participants ($r = -.06$, $p > .10$), but, for hazard ratio studies, the results reached statistical

significance (r = -.52, p = .01). We ran a scatterplot to examine the correlation and found an outlier, but the outlier did not account for the negative correlation. The scatterplot findings were somewhat ambiguous but seemed to indicate the presence of a mild negative correlation. To further examine these findings, we compared the one study with 100% female participants to the two studies with no female participants (100% male participants), but these studies did not differ ($p > 0.10$).

We examined the percent of participants who died during the course of the study. For the odds ratio data, we found a statistically significant association between the percentage of participants who died by the study's end and the effect size in that study (r = .73, p = .004). To confirm this unusually high correlation we examined the scatterplot of the data which showed that the data were indeed negatively distributed, and that there was indeed an accurate positive correlation. For the hazard ratio studies, we found no statistically significant results for this variable (r = .01, p = .96). Thus, the results obtained were inconsistent across the two different types of effect sizes.

We were unable to run the comparison analysis on the variable for marital quality type for both the odds ratio and hazard ratio studies due to an insufficient number of negative marital quality measures.

Analyses for Potential Publication Bias

When a researcher produces a study with an impressive effect size they may be more likely to try to get the study published than if the study produced a nonsignificant effect size. Additionally, because studies with large effect sizes may seem most compelling to readers, publishers are more likely to want to publish studies with large effect sizes than small. These factors contribute to a disproportionate number of studies with large effect sizes in publication.

This is referred to as publication bias, or the "file drawer problem" (Rosenthal, 1979) and assumes that many studies with non-significant effect sizes get left in researchers' file drawers (so to speak) and never progress toward publication. As a consequence, when meta-analysts search databases for potential studies to analyze, there is a high likelihood of finding significant-effect-size studies. This can be problematic because not including less-significant studies may make the meta-analysis results appear more significant than they really are. We therefore needed to assess for this bias in our work.

Sample Size and Associated Regression Tests

Studies with relatively few participants are more likely to report null effects and also to remain unpublished. We therefore examined the association between sample size and effect size to ascertain the possibility of publication bias if studies with smaller sample sizes tended to have larger effect sizes. For the odds ratio studies, there was a statistically significant negative relationship between the number of participants in the studies and the effect size (r = -.51, p = .053). This correlation suggested the possibility of publication bias, but the association between sample size and the hazard ratio results did not reach statistical significance (r = -.19, p = .41). These simplistic correlations have several limitations, so we ran separate regression models specifically designed to evaluate publication bias.

The results of the Egger's regression test were not statistically significant for the odds ratio data (Q = 0.2, p > .10) or the hazard ratio data (Q = 0.06, p > .10). This means that publication bias was unlikely. Results from the Peters alternative regression test, used with odds and hazard ratio data, were statistically significant for both the odds ratio data (Q = 9.3, p = .002) and hazard ratio data (Q = 8.2, p = .004). Thus, the regression tests provided mixed results regarding the presence of publication bias, but the method of Peters et al. (2006) has been shown

to be preferable to Egger's test with odds ratio data. This raised concerns about possible publication bias, which led us to examine scatterplots for further information.

Scatterplot and Nonparametric Trim and Fill Analyses

Scatterplots of effect size by standard error suggested two asymmetric data points in the odds ratio data and four asymmetric data points for the hazard ratio data. Asymmetric data points could indicate the possibility that publication bias could have resulted in six total missing studies. The funnel plots for the OR and HR data are included in Figure 4 and Figure 5, respectively.

Figure 4

Odds Ratio Data Funnel Plot

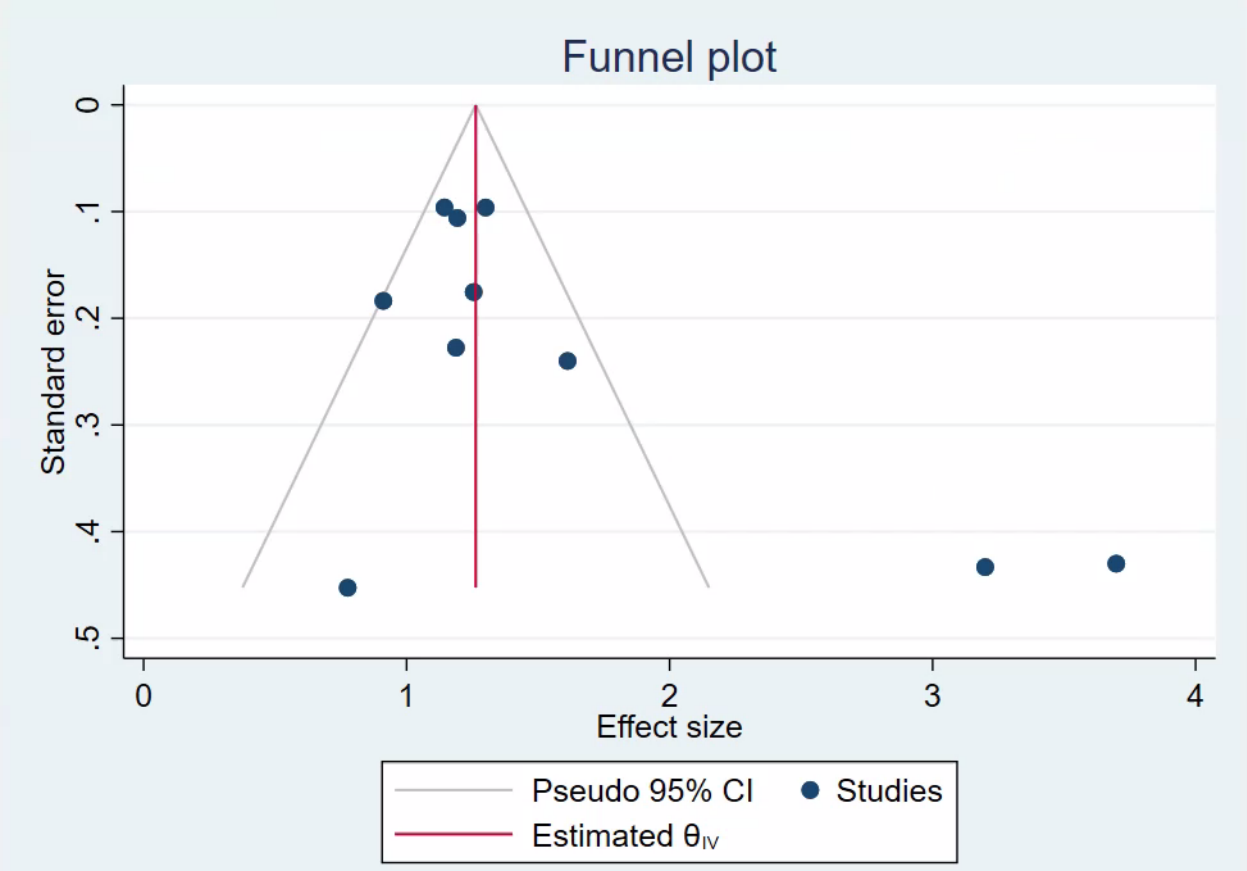
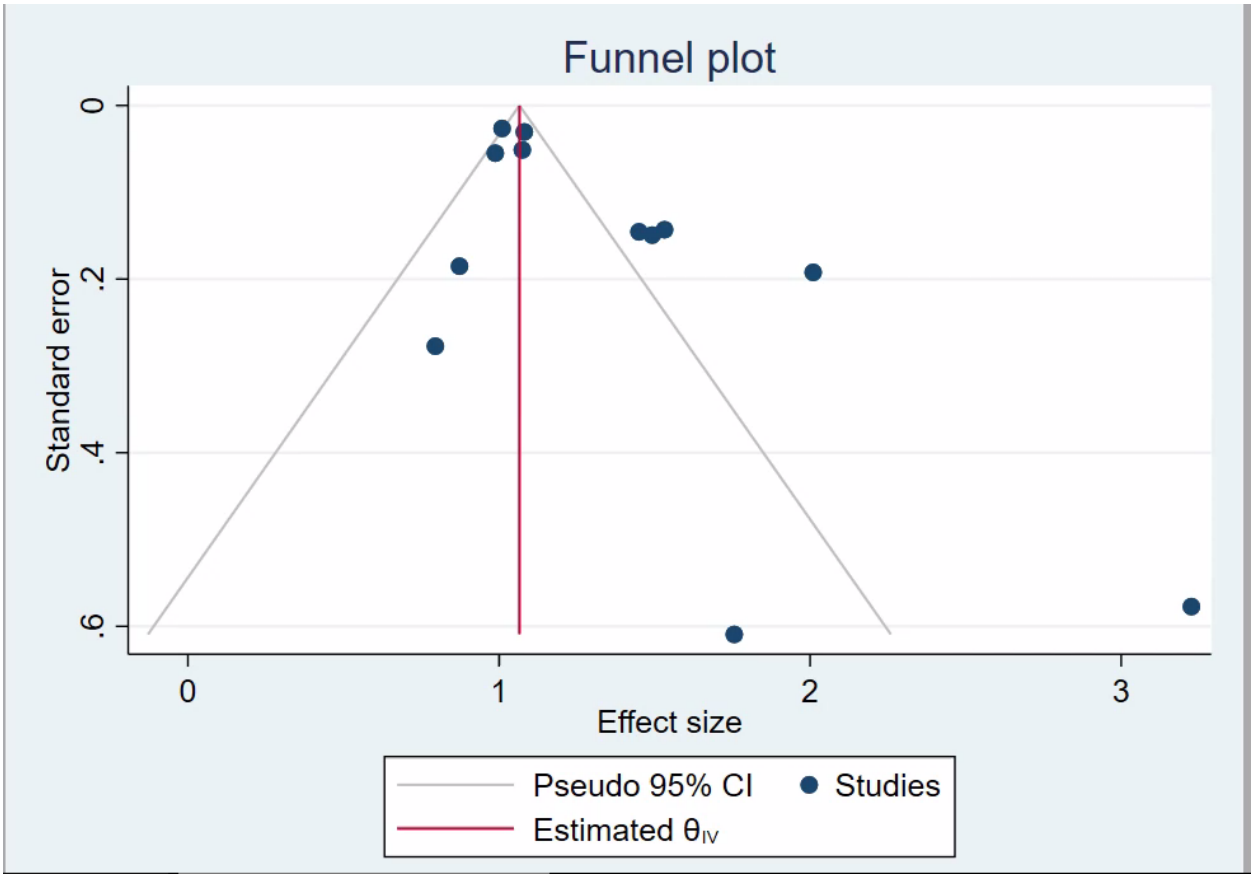


Figure 5

Hazard Ratio Data Funnel Plot



However, follow-up statistical analyses provided a more complete picture of the data distribution. Duval and Tweedie (2000) outlined a method of estimating and accounting for effect sizes of unpublished studies called “trim and fill” analyses. When running these analyses with both the odds ratio and hazard ratio data, no “missing” studies were identified in the distribution. This method thus did not suggest that publication bias adversely affected the results.

Because of the limited number of studies included in our analysis, it is hard to entirely rule out, or make strong claims regarding, publication bias. Future meta-analyses may have a greater ability to examine the threat of publication bias when more studies on this topic have been produced.

Discussion

According to data from the US Census Bureau 2020 American Community Survey 5-Year Estimates, about half of adults in America are currently married (48.1%). Adding those who are separated, widowed, or divorced, the total percentage of adults who are or were married is 66.4, about two-thirds of the population (U.S. Census Bureau, n.d.). This demonstrates how the majority of adults in America are impacted by a marriage relationship. The prevalence of marriage makes the findings of this analysis widely applicable.

The combined percentage of divorced and separated is 12.6% (U.S. Census Bureau, n.d.). We can assume that those who are separated or divorced had aspects of a poor-quality marriage that led them to the separation/divorce. Additionally, among the married there are naturally some who have poor-quality relationships. In one nationally representative study of married couples, 31% of couples were categorized as having a distressed relationship (Whisman et al., 2008). A previous study, with a smaller sample size, identified 20% of couples as “discordant” (Beach et

al., 2005). This indicates that there are many adults who are impacted by poor-quality marital relationships who could benefit from this research.

In light of the relationship between marital quality and mortality, epidemiologists, healthcare providers, and medical researchers should include marital quality as a measure in their research. Although marital quality itself is a more abstract concept, it is linked to a concrete, medically relevant outcome: mortality. With these findings about how marital quality is particularly significant for participants gathered from medical settings, in terms of lower mortality rates, it is especially important to consider marital quality. Because medical setting populations are a focus in medical fields, it is very appropriate to continue to study something that has a great impact on this population. This presents reasoning for healthcare/medical research personnel to consider use of the marital quality concept in future research.

Family scientists should likewise include health/mortality as a primary outcome in their research. Many studies have centered around more typical family scientist outcomes, or when they have included mortality as an outcome, it has been one of many other outcomes. This can obscure the relationship between one variable and the mortality outcome. Using mortality as a primary outcome creates clear, well-defined results. These results may also feel more compelling when related to life and death.

Marital Quality and Health/Survival Outcomes

The analyses indicated that having a high-quality marriage is positively associated with improved survival over time. The magnitude of the association was stronger for studies reporting odds ratio data than studies reporting hazard ratio data, which tended to statistically control for relevant factors such as participants' age and gender. Nevertheless, the hazard ratio data

remained statistically significant, with the magnitude of the association being equivalent to the degree to which a healthy diet predicts mortality (e.g., Milajerdi et al., 2018).

One difficulty that this study highlights is that a poor-quality marriage is linked to poor survival. Unfortunately, oftentimes participants either stay in a poor-quality marriage, or get divorced, which research shows is also linked to poor survival (Sbarra et al., 2011; see also Bourassa et al., 2019). This creates a predicament for those in unhappy marriages. One study, however, posits that having many social connections may mitigate the effects of the higher mortality risk associated with divorce (Manvelian & Sbarra, 2020). Future studies can further address this predicament.

Out of all meta-analyses we identified, the Robles et al. (2014) meta-analysis was previously the closest to addressing this topic. While they included 126 studies, and our study only contained 23 studies, our analysis had roughly the same amount of participants analyzed (approximately 72,000). Our findings are also closely related. They reported that greater marital quality was linked to greater health and longevity (Robles et al., 2014), and the current analysis provided more support for the marital quality and longevity link.

The findings from the current study align with the broader research literature that has investigated aspects of physical health besides mortality, with those studies typically concluding that marital relationships provide both beneficial effects and detrimental effects depending on the nature of the relationship (Bookwala, 2005; Isiozor et al., 2019; Lawrence et al., 2019; Robles et al., 2014). Our research extends prior research by focusing on marital quality rather than marital status, which has more often been evaluated (Verbrugge, 1979; Wong et al., 2018; Wyke & Ford, 1992). The data we reviewed that were specific to marital quality align with prior assertions that positive marital quality exerts protective effects on physical health (Bulanda et al., 2016; Robles

et al., 2014; Umberson & Williams, 2005). Our findings support previous work, specific to mortality, indicating the presence of a correlation between marital quality and mortality (King & Reis, 2012; Whisman et al., 2018).

Since the findings of this meta-analysis confirm the relevance of marital quality for physical health outcomes, our review enables the field to shift from the broad question of relevance to more specific research questions about which populations most benefit and about whether or not interventions to improve marital quality yield corresponding benefits to physical health.

Differences Across Participants

Differences Across Physical Health Status

Robles et al. (2014) pointed out the need to address the critical question of "for whom marital quality impacts health" (p. 39). Our work provides a key insight on this line of questioning, with findings indicating that marital quality impacts longevity greatly for those experiencing a health condition. The relationship between marital quality and survival among those in poor health is much stronger than the correlation in the general population. Although some research has suggested that poor physical health negates the influence of marriage on physical health (Zheng & Thomas, 2013), at least one prior study produced results similar to ours (Birditt & Antonucci, 2008), with marital quality influencing mortality rates for those with chronic illnesses but not for the general population. A key consideration for future research is to identify the factors responsible.

A relevant phenomenon, called the buffering effect of social support (Lin et al., 1985), posits that significant life stressors will have diminished negative effects on an individual if the individual has appropriate social support from someone they are close with. Support for the

buffering effect is prevalent in the social science literature (Giesbrecht et al., 2013; Koeske & Koeske, 1990; Lin et al., 1985; Steers et al., 2019; Van Emmerik et al., 2007). Our findings align with the buffering effect because they show how support from one's spouse (someone who is close to the participant) can lessen the detrimental effects of an illness or health condition (an impactful stressor). In this regard, we could consider the results of our study somewhat expected or intuitive.

Differences Across Gender

Although the analyses were mixed, we observed a small negative association between the percentage of female participants and the hazard ratios. This suggests the possibility that the association between marital quality and mortality was somewhat smaller in studies with a higher percentage of females than males. The hazard ratio data support the observations of some prior studies (Bulanda et al., 2016; Kimmel et al., 2000; Rohrbaugh et al., 2006) reporting that the association between marital quality and mortality may be stronger for women than for men. However, other research indicated that although men benefit from high-quality marriage (Isiozor et al., 2019), both men's health and women's health are similarly affected by marital quality (Umberson et al., 2006). The odds ratio data in our review exhibited no differences as a function of participant gender composition, but odds ratio data typically did not control for confounding factors that were controlled in the hazard ratio analyses. In any case, it must be remembered that the percentage of female participants is a very distal variable, not nearly as relevant as direct comparisons of women with men, which we were unable to conduct due to the lack of gender-specific data in the studies we evaluated.

Differences Across Age

We also observed an association between hazard ratio data and participant average age. This finding could suggest that the influence of marital quality on survival may be greater for those who are older. Similar findings have been reported in previous work with health or survival endpoints (Liu & Waite, 2014; Umberson et al., 2006). Additionally, research on other topics has identified the elderly as a vulnerable population (Fields, 1996; Hiemstra et al., 2018; Villwock et al., 2014), with some research suggesting no difference (Kudielka et al., 2004).

This finding was not replicated in the odds ratio studies, so we remain cautious about the influence of age. Future research will be needed to determine how age interacts with marital quality and physical health.

Limitations of the Study and Implications for Future Research

One of the main limitations of our meta-analysis is the small number of studies that met the inclusion criteria. With only 21 studies available to include in our analysis, conclusions may not be as compelling as they otherwise would be with a larger sample of data. Future researchers should conduct more studies on this topic, so that a meta-analysis in years to come may have a greater pool of data and produce more reliable results. Other researchers have called for more "large randomized controlled trials" on marital quality topics (Tulloch & Greenman, 2018). We add our voice to theirs.

Additionally, future meta-analyses may need to have less strict criteria for inclusion in the analysis, thereby allowing more data to contribute to the results. For the purposes of this study, we chose more strict criteria partially because we wanted our concepts to be well defined, and partially because we did not know how many studies would meet our criteria. We wanted to have criteria that would narrow the searches, without being too exclusive. Our inclusion and

exclusion criteria served the purposes of this study, but future researchers should consider using more inclusive criteria, and evaluating the extent to which the current results continue.

Although our analyses did not suggest a reasonable likelihood of potential publication bias adversely influencing the findings, statistical estimates cannot confirm that publication bias did not occur. Future reviews can continue to evaluate the possibility of publication bias.

Future reviews can also consider other factors that possibly impact or restrict the nature of the available literature. For instance, the topic of marital quality affecting physical health does not clearly fit in any one academic discipline. Family science scholars tend not to consider mortality as an outcome - and epidemiologists rarely consider the independent variable of marital quality. It could also be that research findings may differ across disciplines, for instance if family science scholars administer more detailed measures of marital quality than epidemiologists.

An additional limitation is that, with some of the niche samples in the studies in our analysis, the results may not be as generalizable. There are likely many differences between studies that use nationally representative data, and those that use community, or population-specific samples. Studies that have smaller, more niche, samples, as 15 of the studies in this analysis do (71%), will have less generalizable results.

A limitation that is inherent in meta-analytic work is that we cannot attest to the scientific and methodological rigor of the studies included in the analysis. There is a great deal of variability in how well methods for a study are planned and executed. For the purpose of our analysis we included all studies that we found that fit the inclusion criteria, without assessing the methodological strength of each study. This could be a potential limitation of our study, but realistically, strategies such as randomization to conditions cannot occur with marital quality research. Although the dependent variable of mortality tends to be very reliable, one of the

methodological weaknesses of individual studies was a failure to control for other predictors of mortality among the studies reporting odds ratios. We urge future reviewers to attend to measurement issues and the degree to which statistical controls are included in analyses to account for plausible confounds, such as socioeconomic status and pre-existing health status.

A final consideration to take into account is that marital quality is a difficult construct to define and measure. Marital quality includes many different aspects, such as personal satisfaction, partner cohesion, perceived partner support and confiding, as well as negative conditions of criticism and withholding affection. No single study measured all aspects of marital quality, and distinct components were evaluated across studies. A specific limitation is that the reliability of measurement may be restricted in studies not using previously published measures. Additionally, with the small sampling of studies that fit our inclusion and exclusion criteria, we were not able to find meaningful results comparing the different types of marital quality. With a larger group of studies, researchers could assess whether there are differences between how negative marital quality impacts mortality and how positive marital quality affects mortality. Future reviews can consider measurement reliability and also more precisely categorize the aspects of marital quality measured so as to conduct more refined comparisons.

Implications for Future Practice and Policy

With the results of this study indicating that marital quality is correlated with longevity, it is worth considering potential avenues for fostering improvements in marital quality. Future research could assess the efficacy of programs and interventions aimed to increase marital quality (e.g., marital counseling, seminars or classes, bibliotherapy). Some researchers have also called for more attachment-based interventions for couples (Tulloch & Greenman, 2018). It is plausible that interventions that lead to better marital quality could benefit health through

indirect pathways (Tulloch & Greenman, 2018) such as having tangible and emotional support from one's spouse, encouragement in health behaviors, and access to resources.

Conclusion

The purpose of our research was to examine the magnitude of the association between marital quality and mortality, as well as identify the moderating factors in this association. This meta-analysis examined data from 21 studies with a total of 73,492 participants and found a correlation between high marital quality and longevity. These findings have implications for public health policy and family life. The results support the importance of considering marital quality as a health factor.

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APPENDIX A

Expanded Review of the Literature

Social Relationships and Health

Multiple aspects of human connection, such as social support and social integration reportedly contribute to good health (Cohen, 2004; DeLongis et al., 1988). Social support denotes the availability of social resources for a person, whereas social integration refers to the variety of social roles a person plays and the different relationships that they have (Cohen, 2004). Other aspects of social connection include attachment, frequency of interactions, perception of available support, etc. (Blazer, 1982). Further, support can be expanded to include different types of support such as tangible support, informational support, and emotional support (Schaefer et al., 1981). Factors such as resources, relationships, interactions with others, support, and so forth, play a vital role in human well-being and health (Cohen, 2004).

Social support can affect health through a variety of avenues. Inflammation, blood pressure, immune functioning, and recovery speed can all be influenced by social support (Egbert et al., 1964; Lutgendorf et al., 2005; Morisky et al., 1985; Yang et al., 2014). Peer groups can provide social support, and peer group norms may influence health factors such as exercise levels, personal diet, and drug use (Cohen et al., 2000). Friends and acquaintances can largely influence personal lifestyle.

In addition to these tangible, physical indications of social support and social integration, emotional factors can influence health as well (Holt-Lunstad et al., 2015). The support that one receives, or even perceives, can alter both physical and mental aspects of health (Cohen et al., 2000). Social isolation and feeling lonely or isolated elevates health risks in a similar fashion to obesity, drug use, lack of physical activity, and so forth (Holt-Lunstad et al., 2015).

Social support can also affect health by acting as a buffer against the negative effects of stress (Cohen & Wills, 1985). Social support may help stressed individuals to evaluate situations in a less threatening way, or to feel greater self-efficacy because of the perceived availability of resources needed to handle the stressful situation (Cohen & Wills, 1985). This indicates that mental processes are susceptible to influence based on social connection (Cohen & Wills, 1985; see also Aneshensel & Frerichs, 1982).

Perceived social support and social network size can even affect mortality rates (Pinquart & Duberstein, 2010). In a meta-analysis including data from 148 studies, researchers found that the odds of longevity increased by fifty percent under conditions of social support and relationship networks (Holt-Lunstad et al., 2010). Moreover, studies that used more complex models of social support demonstrated a ninety-one percent increase in odds of survival (Holt-Lunstad et al., 2010). Interestingly, studies have indicated that one of the main qualities of social support that influences survival is emotional support, especially when provided in close relationships (Ell et al., 1992). Knowing that a lack of social and emotional support increases risk of death, the importance of seeking to understand and ameliorate this problem appears obvious.

Overall, it seems commonly agreed upon that social support benefits health, well-being, and survival. The pathways through which social support can influence health are diverse. Biomarkers such as inflammation, high blood pressure, and poor immune functioning can indicate the presence of health concerns. These bodily indicators are susceptible to influence from different social support conditions. Several of the specific physical processes influenced by social factors are elaborated in the following sections.

Inflammation

Tissue inflammation has multiple adverse effects on health. Consequently, methods of lowering likelihood of inflammation prove very valuable. In one study, female cancer patients who experienced a greater closeness and attachment to others had lower levels of proinflammatory cytokines (inflammation promoting proteins, see Dinarello, 2000) than their less socially attached counterparts (Costanzo et al., 2005). In another study, the researchers found a modest, although not large, effect of social support on inflammation, but a stronger link between the negative inverse, social strain and inflammation (Yang et al., 2014). While the direction of the effects seems intuitive, with social support having a positive effect on health and social strain having a negative effect on health, the noteworthy aspects emerge in the magnitude of these effects. It appears that negative social support, or social strain, can impair health more than social support can benefit health (Yang et al., 2014). Cultivating close relationships and lessening social strain seems key to protecting against the harmful effects of inflammation.

Immune System

Social support can also influence health through a body's immune response (Lutgendorf et al., 2005). In a review by Uchino et al. (1996), the authors found evidence supporting a link between social support and the immune system. Lutgendorf et al. (2005) examined the specific immune responses of women with ovarian cancer and found that those with social support had indications of greater immunity, as determined by natural killer cell cytotoxicity. They also reported that those experiencing social strain had lower levels of natural killer cell cytotoxicity (Lutgendorf et al., 2005), indicating the presence of a connection between support and immune functioning. Additionally, Theorell et al. (1995) found a correlation between self-reported low availability of social support and lower levels of CD4 cells (which play an important part in

immune functioning) for patients with HIV. These studies reinforce the idea that the availability of social support influences the immune response.

Blood Pressure

Blood pressure can be indicative of various potential health problems (MacMahon et al., 1990; Verdecchia et al., 1994). Researchers found significantly higher measures of blood pressure in men who perceived lower levels of social support when compared with those who perceived high levels of social support (Knox, 1993). Researchers have also found that interventions involving familial support of patients led to patient improvements in blood pressure control more so than those receiving other intervention types (Morisky et al., 1985). Furthermore, those who had familial support interventions maintained or increased improvements at the two- and five-year follow-ups (Morisky et al., 1985).

Looking at more specific populations, similar results emerge. One study showed higher blood pressure for type-A individuals facing stressful tasks alone rather than accompanied by a friend (Kamarck et al., 1990). Another study found elevated blood pressure in African-American adults who rarely have emotional or instrumental support available to them, as opposed to those who have that support available to them the majority of the time (Strogatz et al., 1997). These studies give further evidence of the importance of social support as a means of maintaining healthy blood pressure.

Delayed Recovery

Social support may also influence speed of recovery from a physical health condition, such as cancer necessitating radiation or surgery. Studies have shown that patients with more support from hospital staff members (Egbert et al., 1964), or from their spouses (Kulik & Mahler, 1989) needed less pain medication and recovered more quickly than those without these

forms of support (Egbert et al., 1964; Kulik & Mahler, 1989). Researchers have also reported a link between social isolation and blood pressure recovery (Steptoe & Marmot, 2006). Contrastingly, in one laboratory study, those in the social support group reportedly did not see any quicker recovery than those in the group with no social support provided (Robles, 2007). However, these findings do not seem concerning due to the more contrived nature of social support that the researchers implemented, and the short-term recording of recovery time. Simply providing someone with a person to talk to before a stressor activity may not indicate regular, meaningful social support in the life of an individual. Additionally, the experiment rested on a minor recovery process, with measurements recorded over a short, two-hour time period. Perhaps more intrinsic forms of social support provide benefits over longer recovery times, rather than short increments.

The source of the social support may make a difference in the significance of the support. Support from family members may mean more to patients in recovery than support from hospital staff. Additionally, social support can aid in the recovery process as family members encourage patients to attend medical appointments or take necessary medication (Morisky et al., 1985). This medical regimen adherence appears to largely contribute to the speed of the patient's recovery.

Morbidity and Mortality

A large body of literature supports the idea that human relationships are important aspects of good health and longevity (Shor et al., 2013). Authors documented the risk of mortality as greater for those who have fewer social connections or less social support (Cohen et al., 2007; House et al., 1982; Umberson & Karas Montez, 2010). Studies indicate that, for female cancer patients, having more supportive friendships (Waxler-Morrison et al., 1991), or people that they can confide in (Maunsell et al., 1995) is associated with longer survival.

Social isolation and loneliness can lead to premature mortality (Holt-Lunstad et al., 2015). Some studies show this risk of mortality as potentially more than twice as high for less socially connected individuals, when compared to those with broader social networks (Berkman & Syme, 1979). It appears that there is a moderately strong correlation between mortality and impairments in perceived social support (Blazer, 1982). Impairments in social roles and attachments, or less frequent social interactions, are also linked to higher mortality rates (Blazer, 1982). This emphasizes the vital role of human relationships in promoting longevity.

Contrastingly, one study showed a relationship between social support and lower mortality rates for women, but not for men (Lyyra & Heikkinen, 2006). However, the study only included sixty-one men (Lyyra & Heikkinen, 2006). Perhaps a larger sample size would have yielded different results.

In a recent article, Holt-Lunstad et al. (2017), review the literature on this topic and advocate that social relationships become more of a focus in the realm of public health due to the significant health impacts that social relationships can have. The authors of this same article sum up the importance of relationships by saying "Humans need others to survive. Regardless of one's sex, country or culture of origin, or age or economic background, social connection is crucial to human development, health, and survival" (Holt-Lunstad et al., 2017, p. 527). Clearly, social connection indispensably contributes to survival.

Mental Health

In addition to associations between social support and physical health, associations with mental health have been observed. A correlation exists between perceived available social support and increased subjective well-being (Pinquart & Fröhlich, 2009).

In one study on the impact of bullying and lack of social relationships, the author found that those students who experienced bullying often, and had low levels of social support, understandably reported poor mental health (Rigby, 2000). In this study, the author noted that the bullying and lack of social support seemed to have a greater impact on female students than male students in terms of mental health. Other studies have found that having lower levels of social support, or lower satisfaction with social support, is associated with heightened symptoms of depression (Dumont & Provost, 1999; Hughes et al., 2014). Having lower levels of emotional or tangible support is also linked with depression (Schaefer et al., 1981). Evidently, social support can greatly influence mental well-being.

Social support also affects mental health by protecting against psychiatric disturbances. In an article by Brown et al. (1975), the authors looked at how social support and intimacy could buffer against psychiatric disturbance following severe, difficult events. The authors identified women who had experienced a severe event but also had emotional support from their husbands or boyfriends as 9.5 times less likely than those with lower levels of emotional support to experience the onset of a psychiatric disturbance (Brown et al., 1975). Interestingly, Brown et al. (1975) outlined the highest level of social support in their study as coming from a person whom one lived with and confided in, typically a spouse or romantic partner. This leads us to examine the power of marriage later in this article, as a relationship that generally engenders social support.

Theories of Social Influences on Physical Health

Much of the research on social support was conducted from one of two paradigms regarding the effects of emotional distress on physical health: the main effect or the buffering effect models (Cohen & Wills, 1985). Other ideas, such as the social baseline theory (Coan &

Sbarra, 2015), the matching hypothesis (Cohen & McKay, 1984; Cutrona & Russell, 1990), and the theory of social capital (Lin, 1999), are also utilized in research on this topic.

As previously mentioned, one hypothesized pathway through which social support can benefit individuals is by providing a buffer against stressful events. This theory, commonly referred to as the buffering model, posits that social support can help individuals in their response to stressors, but does not prove as useful in low stress circumstances (Cohen & Wills, 1985). Studies show a negative correlation between stress or burnout and social support suggesting that individuals can combat daily high stress levels through social support (Etzion, 1984). Kessler and Mcleod's (1985) view on social support and mental health identifies social support as more helpful for mental well-being during high stress situations than low stress situations. They even go so far as to say, "we believe that emotional support does not have a general influence on mental health in the absence of high stress" (Kessler & McLeod, 1985, p. 234). This view identifies social support as a benefit to health only insofar as the support buffers against the negative effects of life stressors.

Another theory, referred to as the direct effect model or the main effect model, states that social support provides benefits to individuals in all circumstances, regardless of present individual stress levels (Cohen & Wills, 1985). Studies that identify the benefits of social support without specifying stressors present can qualify as a support for this hypothesis since the studies imply that social support provides benefits regardless of circumstance (e.g., high stress or low stress).

A review of studies, by Cohen and Wills (1985), support both the main effect model and the buffering model depending on the type of support needed and provided. Resources provided through social support in stressful situations reinforce the buffering model, whereas overall

benefits to health, in the absence of major stressors, reinforce the benefits of overall social integration in a social network (Cohen & Wills, 1985).

Some of the other theories and hypotheses that address social influence on individuals include social baseline theory (Coan & Sbarra, 2015), the matching hypothesis (Cohen & McKay, 1984; Cutrona & Russell, 1990), and the theory of social capital (Lin, 1999). According to Coan and Sbarra's (2015) Social Baseline Theory, the human brain expects a baseline of social relationships and support from other individuals and exerts more cognitive effort in the absence of available social relationships. Since helpful social relationships are expected, when there is a lack of social relationships, or the presence of unhealthy relationships, it can harm mental health (Hughes et al., 2014; Rigby, 2000).

The matching hypothesis posits that social support and resources are helpful if they are a good match, or fit, with the present stressor (Lakey & Cohen, 2000; see also Cohen & McKay, 1984; Cutrona & Russell, 1990). Having social support that matches one's needs can affect health by lessening the impact of stressful stimuli.

The theory of social capital involves individuals making investments (e.g., time, effort, and resources) in social relationships with the expectation of future returns that will benefit the individuals (Lin, 1999). Another aspect of this theory is that individuals may invest in social relationships for an outcome that will benefit the whole group (Lin, 1999). If individuals foster symbiotic relationships with others, they will be better equipped to handle stressors that may arise through the variety of resources available to them. Managing life stressors well can help to mitigate the negative impact of stress on health.

Marital Status as a Predictor of Overall Physical Health

Research has clearly shown a correlation between marriage and good health (Schoenborn, 2004; Verbrugge, 1979). Married individuals are less likely to be in poor or fair health than divorced/separated, widowed, never married individuals, or those living with a partner (Schoenborn, 2004). Married individuals also have fairly low levels of acute health conditions and are less likely to suffer from chronic health conditions than their unmarried counterparts (Verbrugge, 1979).

Marital Status and Mortality

One of the most clearly defined indications of health is longevity, on the assumption that healthy individuals typically live longer than unhealthy individuals. Researchers consistently find that married individuals have lower mortality rates than unmarried individuals (Gove, 1973; Pinquart & Duberstein, 2010; Zhu & Gu, 2010). In a popularly cited article by Manzoli et al. (2007), the authors conducted a meta-analysis and found results indicating greater risk of death for divorced/separated, widowed, or never married individuals than for married individuals. Other researchers found that widowed individuals had a 22 percent higher risk of mortality when compared to married individuals (Shor, Roelfs, Curreli, et al., 2012) or a thirty percent higher risk of mortality when compared to married individuals (Shor, Roelfs, Bugyi, Schwartz, 2012, both studies recorded a slightly higher percentage for males and slightly lower for females when they split the analysis by gender). Hu and Goldman (1990) similarly report higher mortality risks for young divorced or widowed individuals, regardless of gender, than their comparative married counterparts.

In a notable study, with a sample size of 281,460 individuals, the authors identified a statistically significant increase in mortality risk for unmarried individuals in comparison with

married individuals (Johnson et al., 2000). One particular study showed an adjusted fatality rate for married males at 19.7 percent, compared to 26.7 percent fatality for unmarried males (Chandra et al., 1983). For females, the fatality rate was 23.3 for those who were married and 37.4 for those who were not married (Chandra et al., 1983). An additional meta-analysis found single individuals to be twenty-four percent more likely to die early than married individuals (Roelfs et al., 2011).

Among a sample of adults who underwent a specific surgery, King and Reis (2012) found that the participants were more likely to be alive fifteen years later if they were married. For cancer patients, researchers found a link between marriage and survival, where unmarried individuals had decreased chances of survival when compared with married individuals (Goodwin et al., 1987). Results indicate that widowed women with breast cancer are more likely to die than married women with breast cancer (Neale et al., 1986). These findings re-emphasize the protective nature of marriage in terms of mortality.

Some studies identify marriage as a particularly important protective factor against mortality for males (Gove, 1973, Wang et al., 2020). Married men seem to experience a much smaller risk of mortality than unmarried men (Gove, 1973; Lillard & Panis, 1996). In particular, widowed and divorced men appear to experience a greater risk for mortality than single men (Gove, 1973; Ikeda et al., 2007), and divorced men seem to experience an even greater risk for mortality than widowed men (Gove, 1973). In fact, other studies support the idea that divorced men experience a greater risk for death than any of their other single counterparts of either gender (Hu & Goldman, 1990), or married counterparts (Rosengren et al., 1989). These studies indicate that marriage can have a powerful influence on longevity for individuals, especially for males.

A variable to take into consideration when examining marital status and mortality is pre-existing health condition. Individuals experiencing poor health may be less likely to marry or remain married, and one study found that the protective effect that marriage can have on mortality rates becomes less prominent for participants with deteriorating health. The researchers found that the protective effect of marriage on mortality was essentially not present for individuals with very poor health (Zheng & Thomas, 2013). Thus, moderating variables such as physical health condition need to be evaluated when examining the relationship between marital status and mortality.

As for general health, not measured by mortality rates, the results seem less impactful. In a study of British men, the authors found no significant increase in risk of health problems between married and widowed/divorced men (Ebrahim et al., 1995). Lillard and Panis (1996) similarly reported no significant difference between the health of married, never married, and widowed men. However, they found that divorced men have worse health than the other marital status group members (Lillard & Panis, 1996). Therefore, some data on how marriage affects health differs from how it affects mortality. The results show a possibility of worse outcomes for divorced men, in terms of health, but overall, they show no significant differences between the groups.

Possible Causal Influences of Marital Status on Physical Health

As previously elaborated, marital status can influence physical health. Some of the ways through which this occurs are through medical utilization, regimen adherence, support of a healthy lifestyle, and through mental health pathways.

Medical Utilization/Adherence

Adherence to medical regimens, dietary plans, and life-style changes seem to be positively linked to social support (Cohen et al., 2007; Gallant, 2003). One study found that low perceived social support and low self-efficacy regarding regimen adherence were linked to poor follow-through with patient treatment plans for individuals with HIV (Catz et al., 2000). Individuals with practical and/or emotional support have a greater likelihood of adhering to a medical regimen than those without support in such forms (DiMatteo, 2004). Additionally, married individuals are more likely to have health insurance than unmarried individuals (Guner et al., 2014; see also Adshade, 2019). Having access to health insurance allows people to receive needed medical care more easily, which highlights the advantageous nature of this benefit. Support for adherence to medical regimens or healthy lifestyles, and likelihood of having insurance both contribute to the health of married individuals.

Individuals commonly recognize spousal support as a particularly strong and consistent form of social support. Married individuals have a greater likelihood than unmarried individuals of adhering to their medical regimen (DiMatteo, 2004) or completing their medical program (Rankin-Esquer et al., 1997). This is especially true when the spouse is supportive of the participation in the program, as observed in a study of male patients, which assessed the support of their wives (Doherty et al., 1983). We can reasonably assume that adherence to medical directives would benefit individual health more than nonadherence, which, once again, provides support for marriage as beneficial to health.

Interestingly, individuals who have open, engaging relationships with their spouses are less likely to seek out medical professionals with whom to discuss their physical concerns (Heins et al., 2016). The same result appears to exist for women whose husbands engage in protective

buffering (Heins et al., 2016). Protective buffering occurs when the husband expresses less concern regarding the health or physical problems of the wife (Heins et al., 2016). This habit may soothe the concerns of the wife and lessen the likelihood of her going to discuss her concerns with her general practitioner (Heins et al., 2016). This indicates that spousal support influences medical utilization patterns.

One study found that never married individuals use health services less often than married individuals, while divorced or widowed individuals use health services more (Joung et al., 1995). The authors address the idea that divorced or widowed individuals may utilize medical services more by reasoning that they are more likely to have a chronic condition than married individuals (Joung et al., 1995). Whatever the reasoning, there appears to be differences in medical service utilization between members of different marital status groups.

Lifestyle Support

Being married can affect mortality through lifestyle differences. As previously mentioned, Lillard and Panis (1996) found divorced men to experience greater mortality risk than married men. Upon further examination of these findings, the authors concluded that this increased risk was largely due to health differences between the two groups, as controlling for the health differences removed the discrepancy between the two groups, in terms of mortality risk (Lillard & Panis, 1996). This indicates that a basic lifestyle difference between married and divorced individuals may exist, which could lead to better or worse health outcomes and ultimately affect likelihood of death. Examples of such lifestyle differences could include exercise habits, diet, risk-taking behaviors, attendance of medical appointments, and so forth. One study found that unmarried individuals were more likely to smoke than their married counterparts (but, interestingly, drank less alcohol; Rankin-Esquer et al., 1997). However,

another study found that getting married, or remaining married, was related to lower alcohol consumption (Temple et al., 1991). Men who live alone maintain a less healthy diet than married men do; however, women who live alone maintain diets comparably healthy to their married counterparts (Horwath, 1989). This emphasizes the importance of the marriage relationship as a contributor to health habits, especially for men. Although one study found that married adults, especially married men, were more likely to be overweight or obese than their unmarried counterparts, overall, married adults were found to be healthier than other adults (Schoenborn, 2004).

Additionally, being married can benefit individuals physically by providing financial security, a higher standard of living, and greater material resources (Waite, 1995; Wyke & Ford, 1992). Those who remain married over time, as opposed to divorcing, cohabitating, or never marrying are richer at the end of their lives (Wilmoth & Koso, 2002; see also Waite & Gallagher, 2001). Married individuals generally save more than single people with similar income, which may account for some of this difference (Waite & Gallagher, 2001). Whatever the reasons may be, married individuals seem to have more material resources than unmarried individuals (Wyke & Ford, 1992). Wealth and assets can provide individuals with the opportunity to live in safer neighborhoods, afford the best medical care, and maintain a better diet (Waite, 1995). The benefits of the wealthy could additionally include gym memberships, personal trainers, meal plans from a dietician, and so forth, all of which could potentially bolster individual health.

Psychological Support

Married people report a higher level of overall happiness (Glenn, 1975) and psychological health than unmarried groups (Horwitz et al., 1996; Soulsby & Bennett, 2015). Married individuals also report lower levels of stress than single, divorced, separated, or

widowed individuals (Wyke & Ford, 1992). Specifically, in males, separated or divorced individuals are more distressed and lonelier than married individuals (Kiecolt-Glaser et al., 1988).

The transition into marriage can benefit the psychological well-being of individuals, especially for those who experienced depression before marriage (Frech & Williams, 2007). Individuals who experienced more depression before marriage receive greater psychological benefits from marriage than those who did not experience depression prior to the marriage (Frech & Williams, 2007). Additionally, unmarried individuals who experience hardships are more prone to depression than married individuals who experience hardships (Pearlin & Johnson, 1977). Overall, married individuals have a lower likelihood than unmarried individuals of developing mental illnesses (Ola & Mathur, 2016).

Increasing Divorce Rates in the U.S. as an Indicator of Marital Quality

Research on marriage also needs to account for the fact that marriages increasingly end in divorce. Divorce tends to impact American marriages more than marriages in other western countries (Schoen & Canudas-Romo, 2006). Although divorce rates have peaked and dipped, the rates in America have shown an upward trend in the data from 1980-2010 (Kennedy & Ruggles, 2014). Both marriages and divorces are more prevalent in America than in most other developed countries (Cherlin, 2005).

Part of this may be due to the changes over time in expectations surrounding marriages. Burgess and Locke (1945) conceptualized the historical changes in American marriages as a transition from the institutional era of marriage to the companionate era of marriage. A subsequent era, known as the individualized era, was later described by Cherlin (2004), beginning around the 1960s, or 70s to present. The transition to the individualized era meant that

marriages could have more of a focus on personal growth and satisfaction and meeting one's own needs rather than filling a role that society had laid out (Cherlin, 2004). This came along with greater flexibility in expectations of what a marriage should look like. Finkel et al. (2015) suggested that expectations of what a marriage should provide have changed from physical and safety needs to higher-level, self-esteem and self-actualization needs. This may make the marriages that meet those needs even more meaningful than marriages in the past, but marriages that fall short of these expectations may suffer more than marriages of the past (Finkel et al., 2015).

Marital Quality as a Predictor of Overall Health

Researchers have identified the well-established effect of marital *status* on physical health and well-being in numerous studies. Expanding on this research, authors examined how the *quality* of marital relationships affects physical health and well-being (Kiecolt-Glaser & Newton, 2001). Naturally, those in high-quality marriages will receive the benefits of social support and marital status since a high-quality marriage fills both the social and spousal roles. However, additional benefits may emerge in marriage, contingent on marital quality.

We recognize that marital satisfaction may change over time and is not a static concept (Lavner & Bradbury, 2010). If all individuals remained as satisfied with their partner as they were initially, it seems logical to assume that divorces would not occur. However, divorces still occur, indicating a decline in satisfaction from the initial feelings which drove the individuals to get married. While recognizing the complex, changeable nature of marital satisfaction, ratings of poor marital quality can still provide a useful indication that some negative aspect of marriage occurred at one point, regardless of the marital quality in the past or future. This is helpful for the purposes of our study regardless of the potentially changing nature of this variable over time.

Physiological Indicators of Health

Researchers have found that greater marital happiness leads to better self-reported health (Proulx & Snyder-Rivas, 2013; Wickrama et al., 1997). Beyond self-report, high marital quality is linked to greater health, as indicated by lower cardiovascular reactivity, lower risk of mortality (Robles et al., 2014), and lower levels of ambulatory blood pressure (Holt-Lunstad et al., 2008). Additionally, poor marital quality is correlated with worse immune functioning (Kiecolt-Glaser, Fisher, et al., 1987). These physiological manifestations emphasize the importance of marital quality as a contributing factor for good health.

Negative spousal interaction patterns can affect blood pressure specifically (Ewart et al., 1983; Ewart et al., 1991). Studies show that couple disagreements (Smith et al., 1998), cynical hostility (Smith & Brown, 1991), or hostile interactions with a spouse (Ewart et al., 1991) can elevate blood pressure for women. For men, blood pressure elevations have been linked to disruptive or negative behaviors in marriage (Ewart et al., 1983). Additionally, lower marital cohesion negatively influences blood pressure for both husbands and wives (Baker et al., 1999). These findings attest to the influence of psychological factors on blood pressure.

Negative marital interactions can also affect heart rate (Robles & Kiecolt-Glaser, 2003). In one study, couple disagreements elevated the heart rate of wives (Smith et al., 1998). Findings from another study indicated that cynical hostility elevates heart rate for men (Smith & Brown, 1991). Marital quality appears to moderate the effect that marital status has on health, specifically measured by biomarkers such as cardiovascular activity, blood pressure, and immune functioning.

While poor marital quality brings negative responses, high-quality marriages can be beneficial to the body's physiological responses. In a study by Coan et al. (2006), the authors

found that women's neurological responses to threat are attenuated when holding hands with someone, but the result is even more significant when the woman holds hands with her spouse, and is most significant when they have a very high-quality marriage (Coan et al., 2006). This indicates that response to stressors is moderated by marital quality. In an additional study, the researchers found that for couples with very poor marital quality, holding a spouse's hand did not attenuate the body's response to threat (Johnson et al., 2013), giving further evidence to the importance of marital quality.

Mental Health

Additionally, there are mental health benefits associated with high-quality marriages. Both high marital quality and partner satisfaction are negatively correlated with depression (Holt-Lunstad et al., 2008; Romano et al., 1997) while low marital quality is positively correlated with depression (Kiecolt-Glaser, Fisher, et al., 1987). High marital quality is also linked to lower stress levels and higher life satisfaction (Holt-Lunstad et al., 2008), while lower happiness in marriage is connected to low self-esteem and lower overall happiness (Hawkins & Booth, 2005). In a study of male cardiac patients, researchers determined that those who feel more emotionally connected in their marriage are happier and more satisfied with life in general (Waltz, 1986), indicating a link between marital quality and quality of life.

High levels of conflict in marriage also increase symptoms of depression (Choi & Marks, 2008). One study found that individuals in discordant marriages had ten times the likelihood of suffering from depressive symptoms than individuals not in discordant marriages (O'Leary et al., 1994). For individuals suffering from depression, their perception of how critical their spouse is towards them can predict, very accurately, the likelihood of future relapses (Hooley & Teasdale, 1989). A greater likelihood of relapse into depression exists for those who rate their spouses as

more critical when compared with those who rate their spouses as less critical (Hooley & Teasdale, 1989). Additionally, spousal criticism is indirectly linked to negative affect (via an avoidant coping style), whereas spousal support is indirectly linked with positive affect (via a positive coping style) (Manne et al., 1999). Distressing marriages and negative spousal interactions can clearly harm individual mental health.

Diet, Physical Exercise, and Sleep Habits

Both high activity levels and a healthy diet can contribute to health and longevity. One study found that those who reported greater marital satisfaction increased activity levels more rapidly, and maintained these increases better than their less maritally satisfied counterparts, regardless of conditions within the study (Sher et al., 2014). Additionally, those in this study with high marital satisfaction also had lower initial levels of saturated fats in their diets than those who had lower marital satisfaction (Sher et al., 2014). This study, as well as other studies, identifies those in satisfying, less distressing marriages as having healthier diets than those in distressed, dissatisfying marriages (Sher et al., 2014; Yang & Schuler, 2009). Although marital status may be linked with healthy diets, it seems that marital quality may more accurately be linked to these benefits, as married individuals in distressed relationships may lose some of the benefits of marital status itself on diet.

Another interesting aspect of health to consider is sleep. Poor sleep can affect the body's immune response, illness progression, mental health, and so forth (Irwin, 2015). One study found that, on days when a wife self-discloses more to her spouse, her sleep quality improves (Kane et al., 2014). Additionally, for husbands, higher patterns of self-disclosure are linked to shorter durations of wakefulness during the night (Kane et al., 2014). As spousal communication patterns influence sleep, other areas of health and well-being will likely be impacted.

Adverse Effects of Low-Quality Marriage

Although marriage has generally been identified as more beneficial to individuals than being single, if an individual is in a low-quality, dissatisfying marriage, it may be more harmful to their health and psychological well-being than being single (Chung & Kim, 2015; Ola & Mathur, 2016; Williams, 2003). Those who stay in unhappy marriages have worse overall health than divorced individuals (Hawkins & Booth, 2005). Lower self-esteem and life satisfaction are also linked to those who are in unhappy marriages, when compared with those who have divorced (Hawkins & Booth, 2005). Another study showed that those in low-quality marriages had higher ambulatory blood pressure levels than those who were not married, indicating that, in some aspects, unmarried individuals may have greater health benefits than the unhappily married (Holt-Lunstad et al., 2008).

Moderators/Mediators of the Association Between Marital Quality and Physical Health

Although many studies have provided support for the link between marital quality and health, some considerations may moderate the findings. Choi and Marks (2013) suggested that being happily married is more strongly associated with health benefits for those of higher socioeconomic status than for those of lower socioeconomic status. They also noted that being unhappily married may be associated with greater health detriments for those of lower socioeconomic status than for those of higher socioeconomic status (Choi & Marks, 2013). Although they stated that they cannot make "firm conclusions" from their findings, due to a series of limitations, they affirmed the importance of socioeconomic status as a potential moderating effect on the association between marital quality and health (Choi & Marks, 2013, p. 916).

Potential differences may exist between men and women in the importance of marital status and marital quality. Kimmel et al. (2000) found that, for women, but not for men, less conflict and higher satisfaction in a relationship correlated with decreased mortality risk. In another study, the researchers found that, for women, marital quality influenced health and mortality rates more than marital status alone but, for men, marital status more accurately influenced health and mortality (Bulanda et al., 2016). They reported that, "for men, ending a marriage raises the hazard of mortality regardless of marital quality prior to the dissolution" and "among women reporting low-quality marital interaction at baseline, becoming widowed is associated with a lower mortality risk than remaining married" (Bulanda et al., 2016, p. 125). It may be that, for women, marital quality has great significance but, for men, marital status alone influences mortality more prominently. However, other studies find no evidence for a gender discrepancy in the importance of marital quality and reaffirm the influence of marital quality on well-being for both genders (Williams, 2003).

Another factor that moderates the beneficial effect of *received* partner support is if *perceived* support exists in the dyad. Although a link exists between *received* partner responsiveness and lower mortality rates, Selcuk and Ong (2013) found that the presence or lack of *perceived* partner responsiveness moderated the relationship between support and mortality rates. Another study showed perceived partner support as negatively correlated with relationship stress and sexual stress (Martins et al., 2011). This illustrates how perception of partner support can affect individuals both physically and mentally.

Marital Quality and Mortality

The previously mentioned studies address how marital quality affects physical health in general. A few studies have more specifically examined how marital quality can affect mortality.

King and Reis (2012) found that individuals in high-satisfaction marriages were more likely to be alive at follow-up than those in low-satisfaction marriages. In a study by Rohrbaugh et al. (2006), the authors concluded that marital quality predicted eight-year survival for patients with heart failure. Lawrence et al. (2019) found that participants who were less happy in their marriage were about 40% more likely to die than those who were more happy in their marriage.

Other studies provide gender-specific results. Women in relationships with high satisfaction and low conflict, experienced decreased mortality rates in a work by Kimmel et al. (2000). In another study, the authors concluded for women, but not men, low-quality marital interactions increase mortality rates (Bulanda et al., 2016), while other studies showed interactions between marital quality and mortality for men as well. In a study of middle-aged Caucasian men, researchers found that dissatisfaction with marriage was correlated with sudden cardiac death (Isiozor et al., 2019). Although some studies may have results specific to males or females, there is a great deal of support for the connection between good marital quality and survival.

Much of the literature highlights how good marital quality is beneficial, however, some articles yield surprising findings. Birditt and Antonucci (2008) provided some evidence that higher spousal demands, or criticism, correlated with greater survival rates. They explain that although the results may initially seem counterintuitive, perhaps demands encourage independence and self-efficacy in the ailing spouse, which could be beneficial (Birditt & Antonucci, 2008). Choi and Marks (2011) also provided interesting results, stating that for low-income men, being in a high-conflict relationship is better for their survival than being single.

How Health Affects Marriage

While much evidence has been set forth indicating that marital factors affect health and mortality, it is important to also acknowledge the bidirectionality of this relationship: Health can also influence marital quality. Some studies describe how physical and mental health factors may contribute to selection into marriage (Brown & Giesy, 1986; Mastekaasa, 1992; Waldron et al., 1996), or how illnesses or disabilities may lead to marital dissolution (Karraker & Latham, 2015; Singleton, 2012). Other studies cover how health concerns, illnesses, and disabilities may affect the quality of a marriage (Hafstrom & Schram, 1984; Renne, 1970; Schulz & Tompkins, 1990; Williams & Freer, 1986).

Negative changes in health status can be disadvantageous to the quality of a marriage relationship (Booth & Johnson, 1994). This can be both through worse self-reported feelings, or through additional physical consequences that may come as a result of the initial decline in health. Spouses of individuals who have a chronic condition or disability may be more likely to feel dissatisfied in their marriage than those who do not have a chronic condition present in their marriage (Renne, 1970). Spousal caregiving stress is also linked to negative physical outcomes, such as heart disease, arthritis, or chronic back pain (Kim et al., 2015). In marriages where one spouse has a chronic illness, partners tend to see decreased immune system strength (Kiecolt-Glaser et al., 1991; Kiecolt-Glaser, Glaser, et al., 1987), higher levels of depression, less social connections (Kiecolt-Glaser et al., 1991), and greater distress (Kiecolt-Glaser, Glaser, et al., 1987; Revenson et al., 1991). The spouses also self-report low life satisfaction levels, less sleep, feelings of loneliness (Kiecolt-Glaser, Glaser, et al., 1987), less social or recreational activities, and less sexual engagement with their spouse (Revenson et al., 1991). All of these physical and

mental changes can affect marital quality by decreasing a spouse's positive feelings, or by adding additional burdens (such as immune system concerns, sleep troubles).

This topic is worth noting because of the complex nature of the relationship between marriage and health. There is evidence that both factors may play a role in influencing each other. While oversimplification of this relationship should be avoided, writers and readers alike should recognize the confines of any one particular study on this topic. For the purposes of this study we only examined this effect in one direction, focusing on how marriage, specifically, marital quality, affects health.

Research Questions

The review of the literature on this topic left us with questions to investigate further. Although the literature largely supports the presence of an association between marital quality and mortality, the magnitude and moderating factors of this association had not yet been determined. We anticipated understanding the strength of this association would illustrate the significance of the issue, while identifying the moderating marital and health factors would provide clarity regarding how the association functions.

In the 2014 meta-analysis by Robles et al., the authors address the association between marital quality and physical health, as measured by either subjective or objective clinical endpoints. Within the objective clinical end points category, Robles et al. (2014) includes mortality. We note the fact that they include mortality in their review; however, mortality as an outcome was only one variable evaluated in their review (with a greater focus on other objective or subjective health measures). Only seven of the articles included in their study addressed mortality, and for four of those articles they did not differentiate between mortality or a host of other events as the endpoint. We believe that our work expands on this research with a more

direct focus on the effect that marital quality can have on mortality. Additionally, our study builds further on the Robles et al. (2014) work by including nine and a half additional years of studies, using a greater number of articles with mortality as an endpoint, and examining moderating variables. Some of these moderating variables that we examined included gender, cohort effects, and cultural differences, as well as marital quality measure type; positive or negative.

With past research in mind, we addressed the following research questions in this meta-analysis:

1. What is the magnitude of the association between marital quality and subsequent mortality reported in longitudinal studies (aggregated in terms of odds ratios and hazard ratios)?
2. What factors moderate the association between marital quality and subsequent mortality?

References

Studies marked with an asterisk were included in the meta-analysis

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APPENDIX B

Copy of the Embase Search Terms

Select the “QUICK SEARCH” function for all three paragraphs, with AND selected between them

('mortality' OR 'survival' OR 'longevity' OR 'death' OR 'loss of life' OR 'remain* living' OR 'fatal*' OR died OR ‘dead’ OR 'remain* alive' or ‘decease*’ OR ‘dying’)
AND
('hazard* ratio' OR 'odds ratio*' OR ‘odds of survival’ OR 'risk ratio*' OR 'relative risk' OR 'proportional hazard*' OR 'cox model' OR 'cox multivariate' OR 'cox regression' OR 'cox survival' OR 'proportional hazard*' OR 'rate, survival' OR 'survival curve*' OR 'survival probabilit*' OR 'survival rate*' OR 'comparative studies' OR 'comparative study' OR 'analysis, meta' OR 'meta analysis' OR 'meta-analysis' OR 'metaanalysis' OR 'review, systematic' OR 'systematic review' OR longitudinal* OR predictive OR prospective OR “followed up” OR baseline OR ‘outcome compar*’ OR “national survey” OR ‘matched cohort’ OR ‘cohort design’ OR ‘cohort match*’ OR ‘logistic regress*’ OR ‘observational study’ OR ‘Poisson regression’ OR ‘Kaplan-Meier’ OR ‘Kaplan Meier’ OR ‘mortality risk’)
AND
(“Marital strain” OR “marital distress” OR “marital quality” OR “quality of marital” OR “quality of marriage” OR “marital satisfaction” OR “satisfaction with marriage” OR “spous* satisfaction” OR “marital cohesion” OR “spous* cohesion” OR “marital conflict” OR “spous* conflict” OR “marital adjustment” OR “spous* adjustment” OR “dyadic adjustment” OR “marital satisfaction” OR “marriage conflict” OR “spous* conflict” OR “conflict in marriage” OR “marital qualit*” OR “marriage qualit*” OR “relationship satisfaction” OR “marital intimacy” OR “marriage intimacy” OR “partner intimacy” OR “couple intimacy” OR “spous*intimacy” OR “marital closeness” OR “marriage closeness” OR “partner closeness” OR “couple closeness” OR “marital stability” OR “marriage stability” OR “marital instabili*” OR “marriage instabil*” OR “marital hardship” OR “marital problem*” OR “marriage problem*” OR “spous* problem” OR “marital consensus” OR “marriage consensus” OR “marital integration” OR “marriage integration” OR “marriage companionship” OR “marital companionship” OR “marital success” OR “marriage success” OR “marital happiness” OR “spous* happiness” OR “marriage happiness” OR “happiness in marriage” OR “quality marriage” OR “quality marital” OR “quality of spous*” OR “quality of matrimony” OR “attributions in marriage” OR “marital support” OR “supportive marriage” OR “supportive spouse” OR “supportive marital” OR “marital communic*” OR “marriage communication” OR “spous* communication” OR “couple communication” OR “spous* support” OR “positive marriage” OR “positive marital” OR “negative marital” OR “negative marriage” OR “negativ* in marriage” OR “negativ* among spous*” OR “negativ* in marital” OR “unsupportive marriage” OR “unsupportive marital” OR “marital dissatisfaction” OR “Marriage dissatisfaction” or “spous* dissatisfaction” or “couple* dissatisfaction” or “distance in marriage” OR “marital distance” OR “disagreement* in marriage” OR “disagreement* among spous*” OR “marital equity” OR “equity in marriage” or “satisfaction in marriage” or “satisfaction in marital” or “spous* commitment” OR “marital commitment” or “commitment in marriage” or “marital trust” or “conjugal trust” or “trust in marriage” or “passion in marriage” or “love in

marriage” or “love of spouse” or “marital love” or “marital passion” or “martial process*” or “marital stability” or “stability in marriage” or “marriage stability” or “marital instability” or “instability in marriage” or “marriage instability” or “strength of marital” or “strength of marriage” or “marital forgiveness” or “forgiveness in marriage” or “forgiveness among married” or “partner commit*” or “partner cohesion” or “partner distance” or “partner engagement” or “partner attach*” or “partner communicat*” or “partner satisfac*” or “partner happiness” or “partner support” or “partner attribution” or “partner quality”or “attachment security” or “securely attached” or “romantic love” or “marital interaction*” or “interactions* in marriage” or “interaction* between couples” or “marital stress” or “partner distress” or “marriage stress” or “marriage pathology” or “perception* of marriage” or “perception* of spouse” or “perception* of marital” or “marital affinity” or “marriage affinity” or “affinity in marriage” or “spous* affinity” or “partner affinity” or “marital affection*” or “marriage affection*” or “affection in marriage” or “spous* affection*” or “partner affection*” or “marital function*” or “marriage function*” or “marital wellbeing” or "marriage wellbeing” or “marital relations”)

APPENDIX C

Coding Sheet for Martial Quality Meta Analysis

A. Short Description
   a. For Authors with only one article included in our study: Last name of main author and the last two digits of year (ex. Belavich 98)
   b. For authors with multiple studies in one year: Last name + last two digits of year + lower case letter (in sequential order) (ex. Levin 99 a, Levin 99 b….etc)

B. APA-style citation (see APA manual), for example:
Author, I. B., & Colleague, U. R. (2004). Title of article. *Title of Journal, 44*, 345-543.

C. BLANK

D. Coder (s): Enter your names

E. Geographic location
   0. Multi-nation study across different world regions
   1. United States
   2. Canada
   3. Asia
   4. Scandinavia (Denmark, Sweden, Norway, Finland)
   5. Europe (other than #4)
   6. Africa
   7. South Pacific
   8. Middle East
   9. Central or South America
   10. Australia

F. Predominant Sample, *initial* data collection
   1. Normal, healthy, community population without any obvious distress or strain
   2. Recruited through a **mental health**, counseling, marital therapy, or similar support service. THESE ARE MENTAL/EMOTIONAL CONDITIONS.
   3. Recruited through a **medical** clinic, hospital, treatment center, or nursing home. THESE ARE PHYSICAL HEALTH CONDITIONS.

G. Percent female (no decimal places) THIS row (gender % will vary for all men, all women, or combined)

H. Definitely 100% married = 1
Cohabitation/partners included along with married people = 0
(If only cohabitation/partners are included for sure: exclude the article)

I. Mean Age of participants at first assessment (one decimal place, e.g. 62.4 years)

J. How the AGE variable was determined: Is "Mean Age" a guess or based on a given range?
   0. Actual mean value reported in article
   1. Median of range given
   2. Guess based on sample description

K. Length of follow-up (**in years**, use decimal points for partial years, with three months being .25) (Not from when the study itself started, but when they began measuring marital quality)

L. Design type
- 4. Prospective, Longitudinal multiple groups (≥ 2 time points, ≥ 2 groups)
  **Planned ahead of time
- 6. Retrospective archival analysis longitudinal (using records over time for a single group)
  **Looking backwards, after the fact

M. Cause of Mortality (Mortality related to the effect size, not the whole study- Look at the data)
1. All-cause Mortality (Death from anything, cause unspecified)
2. Cardiovascular Disease (CVD; Heart conditions)
3. Cancer
4. Stroke
5. AIDS
6. Suicide
7. Violence/accidents
8. Maternal mortality
9. Other specific illness not listed above

N. Pre-existing health condition (at intake/pre-test or screened on this condition, usually topic of study, purposefully selected participants)
0. None
1. Cardiovascular Disease (CVD; Heart conditions; Stroke)
2. Cancer
3. **Blank
4. AIDS
5. Diabetes
6. Depression
7. Dialysis; kidney/renal disease
8. Alcohol/drug dependence
9. Pregnancy
10. Neurological disorders/schizophrenia
11. Injury
12. lupus/auto-immune
13. Other condition not listed above
99. Multiple of the above

O. Odds ratio

VERIFY DIRECTION:(1) ascertain scaling(higher values=what?),(2) check interpretation/text

OR Values > 1 = high quality marriage had better outcome on mortality (longer survival)
(mortality decreased among high quality marriages relative to lower quality)

OR Values < 1 = high quality marriage had poorer outcome on mortality (decreased survival)
(mortality increased among high quality marriages relative to lower quality)

If this format does not match the data (e.g., authors reported that being in a high quality marriage predicts higher mortality but they also report an effect size that results in an OR greater than one), then (1) calculate the natural log odds ratio (variable P), (2) change the direction of the sign of the log odds ratio (e.g., if it was .18, make it a -.18) and inverse the value of the previous OR (divide 1 by the number, such as OR=.80 being 1/80, which is then OR=1.25).

P. **Log odds ratio** (enter natural log odds ratio, using CMA software or scientific calculator)
Verify direction:

Positive values = high quality marriage had a positive effect on mortality

Negative values = high quality marriage had a negative effect on mortality

Q. Standard Error of effect size (enter standard error using the CMA software package)

R. **Hazard Ratio** (if reported, otherwise, leave blank)

S. Natural **Log of the Hazard Ratio** (if reported, otherwise, leave blank)

T. Total sample size that *this effect size* is based on
Use the actual N for the analysis reported, not necessarily that reported in the methods.
For aggregates (4 or 6), use largest N if averaging 2s; use the summed N if combining 3s

U. Sample size, those who died (Or, only if death not reported, enter N of high quality marriages)

V. Sample size, those who survived (Or, only if survival not reported, N of low quality marriages)

W. Percent deceased (whole number of the percentage who had died at this particular point of follow-up, entered here whether reported or calculated). For instance 33% dead, enter 33.

X. What type of effect size?
1 = This is the ONLY effect size in this article
2 = This is one of >1 effect sizes with the <u>whole sample (all participants)</u>
IE, one of several effect sizes computed with the entire sample
(usually this happens when the whole group is given different measures)
3 = This is an effect size of a <u>subgroup</u> of participants (like women only or cancer mortality only) – one subset of the entire sample.
4 = Aggregate MAIN effect size (average of only 2s, using **log** OR values)
IE, you need to average multiple log ORs where more than one are reported.
5 = Aggregate PARTIAL group effect size (of 3s, computed by group) (RARE)
IE, average ESs for a subgroup (women only, Blacks only, cancer only)
6 = Aggregate MAIN effect size based on summed subgroups (average **log** OR 3s when there are more than one subgroup–and weight each log OR by % N)
7= different year outcome (example one-year follow up rather than four-year overall)
9= subgroups 3s summed when also overall data reported as 4s

Y. Stats used in the manuscript
1 = correlations (Pearson r, spearman rho, psi coefficient)
2 = partial correlations, beta weights (regression), path coefficients
3 = ANOVA (F-tests)
4 = t-test
5 = Odds ratio
6 = Risk ratio (see below)
6.1 = RR
6.2 = RR and marginal totals matrix
6.3 = RR substituted for OR (less than 10% prevalence of death)

6.4 = RR estimated for OR using % dead marginals & graph (more than 10% dead)
7= Hazard ratio
8 = Chi square
9 = Means & Standard Deviations, or D (mean diff)
10 = P value
11= Combination (Particularly for aggregates).
12 = log odds into OR
13 = frequency data (2x2 numbers)

Z. Percent Married – entered as whole number, so 100% = 100 (percent married out **of the effect size**, not out of the total N for the whole study- and this is ***married*** specifically as opposed to cohabiting)

AA. Dependent Measure
0 = comparison of survivors to non-survivors (group comparisons; binary dead/alive, 2x2)
1 = comparison of time to death (survival rates/curves, HRs; continuous level data)

AB. Location of data within the manuscript (where were the effect sizes found? (Page numbers, table numbers, etc.)

AC. Specification of marital quality comparison type

POSITIVE:
1= Overall or multidimensional high quality/ satisfaction/ happiness (or positive-only aggregate)
2= Specific positive marital attribute(s) (trust, forgiveness, closeness, equality, commitment, communication, honesty, support, companionship, affection, etc.)

NEGATIVE:
3= Overall or multidimensional low quality/ dissatisfaction/ unhappiness (or negative-only agg)
4= Specific negative marital attribute(s) (conflict, dysfunction, withdrawal, marital stress/distress, lack of support, distancing, etc.)
5= Abuse/ Intimate partner violence

MIXED:
9 = Both positive and negative aspects of relationship qualities (or overall aggregate when a study has both positive and negative measures)

AD. Standardization of Measure of Marital Quality
1 = Standardized
(Dyadic Adjustment Scale, Marital Adjustment Test, Kansas Marital Satisfaction Scale, Quality of Marriage Index, and Marital Comparison Level Inventory, etc.)

2 = Nonstandard
(measures designed specifically for a given study, single-item, latent variables in structural equation model)

AE. Type of statistical controls in analysis for this specific effect size (On this row)

0 = no controls = zero-order
1 = age only
2 = gender only
3 = age and gender
4 = age and other variables
5 = gender and other variables
6 = age and gender and other variables
7 = other variables not age and gender

AF. Clarifications of problematic coding issues for this study
IE, use this column to tell us how you coded things that were unclear – what page you found your evidence to support unclear codings, etc.

AG. Dataset; name of the data (Alameda County Study; "national study of aging")
If no name is provided, enter the name of the cities of data collection
If no city is listed, leave blank
Make sure that this study is not a part of a larger study

AH. Type of marriage (heterosexual or homosexual)
0 = no information available
1 = definitely heterosexual marriage (men and women)
2 = possibly mixed heterosexual marriage and homosexual couples
3 = mixed (both heterosexual and homosexual couples included in the study)
4 = only homosexual couples in this effect size

AI. ES Group - what group is reflected in this effect size? (is it women, men, and Agg., or is it high quality, low quality, or maybe even high communication, low satisfaction, etc.)

APPENDIX D

Rationale for Coding Variables, Including Possible Confounds

We selected variables for coding based on (a) basic descriptive information (e.g., contextualizing the data according to participant characteristics, such as geographic location), (b) prior research, and (c) our intuitive hypotheses.

Gender

Prior research has shown that marital satisfaction can differ by gender and that mortality rates also differ by gender.

Married/cohabiting

We coded whether the studies contained 100% married participants or a combination of married and cohabiting/ dating participants. Research has shown that differences exist between these two forms of relationship.

Type of Marital Quality

We assessed the type of marital quality measure used in each study. Some studies have indicated potential differences between positive forms of marital quality (support, closeness, trust, friendship, etc.) and negative forms of quality (criticism, annoyance, etc.). In addition to our research-based decision to code positive and negative forms of marital quality, we also hypothesized that potential differences may exist between a specific measure of marital quality, and an overall comprehensive measure (For example, an overall assessment of "marital quality" or "marital satisfaction" might produce results that provide a fuller picture than an assessment of a specific trait such as communication. A participant may rate their spouse low on communication and researchers may assume this is indicative of a poor marriage, when the

participant would have rated their overall marital quality as high if the study provided a way to measure that).

Measurement Type

We coded for whether the measure of marital quality was standardized or non-standardized. We did this to be able to assess whether previously standardized measures more reliably capture marital quality (e.g., in comparison to a single question or a non-standardized measure).

Age and Health Status

Age and health status can affect death rates, so we coded these variables to examine if they were possible confounds. Health status could also affect marital quality (because people with poorer health have added stressors in their marriage).

Length of Follow-up

We also coded for length of follow-up as a potential confounding variable since mortality rates increase over time.

Study Characteristics

Other variables were coded to double-check that the study fit our inclusion criteria such as design type (since this is a meta-analysis of prospective studies), marriage type (since this meta-analysis is examining heterosexual marriages), and data set name (to ensure that we did not include the same data multiple times unless the study provided data on new variables).