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Characterization of Marital Violence Using Data from Six Countries in the World Health Organization World Mental Health Survey Initiative

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Characterization of marital violence using data from six countries in the World Health Organization World Mental Health Survey Initiative

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Dissertation submitted
to the School of Public Health
at West Virginia University

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ABSTRACT

Characterization of marital violence using data from six countries in the World Health Organization World Mental Health Survey Initiative

Cara Mangine Stokes

Intimate partner violence (IPV) is a pervasive global public health problem that occurs in all settings and cultural groups. Traditionally, IPV research has largely focused on identifying risk factors from those who have already been victimized. In contrast to descriptive statistics, this project utilized predictive modeling methods to develop a robust model to predict risk for IPV, defined as moderate physical violence occurring within current marriages. Data for this project come from six countries participating in the World Health Organization (WHO) World Mental Health (WMH) Survey Initiative. Analyses capitalized on the availability of data containing detailed pre-marital factors from both members of currently married couples and considered both independent and joint effects. All potential predictors were broken into four defined predictor groups; demographics and relationship characteristics, adverse experiences in childhood, violence in dating relationships, and pre-marital psychiatric disorders.

Among the 1,515 couples within our sample, 14.4% (se, 0.98) experienced female victimization of IPV as reported by either the husband or the wife. Separate analyses for each predictor group resulted in ten significant variables; three demographics and relationship characteristic predictors, two childhood adversity predictors, two dating experience predictors, and three mental disorder predictors. All ten predictors were used to construct a final predictive model. Predicted probabilities of marital violence for each couple were then calculated from the final model's coefficients. Given the possibility of overfitting our model, we then used the method of replicated 10-fold cross-validation with 20 replicates and generated predicted probabilities of marital violence for each couple in this simulated data set (20 times our original sample size, n=30,300). A Receiver Operating Characteristic and Area Under the Curve were calculated to quantify overall prediction accuracy of the model in the observed and simulated data sets. Model fit indices were strong as the estimated Area Under the Curve for the observed data was 0.75 and 0.70 for the simulated data. The top 5% of respondents with the highest predicted risk included 18.6% of all cases of marital violence. This is just under four times the proportion expected by chance.

The World Mental Health survey findings advance our understanding of the extent to which marital violence varies within the context of the couple. Traditionally, research on IPV utilize report from one person, typically the female victim. Our results suggest that this practice does not adequately describe IPV as it is inherently a dyadic experience. These results are valuable in providing a foundation for more targeted primary prevention efforts.

Dedication

To my parents, Cheryl and James, without your never-ending support, I would not have had the courage to make this dream a reality. I'll never forget sitting outside with my Dad discussing my concerns and the feasibility of pursuing a PhD to which he responded, like any good Italian would, "throw it on the wall and see if it sticks".

To my grandma, Mom Mom, a true rebel. Your unapologetic pursuit of happiness and education during a time when women were discouraged from doing so will always be an inspiration.

To my husband, Bill, I wouldn't have become Dr. Stokes rather than Dr. Mangine for just anyone! I love you more every day. Thank you for your support and understanding the obligations attached with earning a PhD.

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List of Abbreviations and Nomenclature

AOO	Age of onset
AUC	Area under the curve
CDC	Centers for Disease Control and Prevention
CI	Confidence interval
CIDI	Composite International Diagnostic Interview
CTS	Conflict Tactics Scale
DIS	Diagnostic Interview Schedule
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition
IPV	Intimate partner violence
ISCO	International Standard Classification of Occupations of the International Labour Organization
MFF	Maladaptive family functioning
OR	Odds ratio
ROC	Receiver operating characteristic
VAW	Violence against women
WMH	World Mental Health
WHO	World Health Organization

Chapter 1. Introduction

Chapter 1. Introduction

1.1 History of Intimate Partner Violence

Since 1993, the United Nations has recognized violence against women as a violation of basic human rights [1]. At the 49th World Health Assembly in 1996, violence against women (VAW) was again recognized as a major and growing global public health problem [1]. In 2008, the United Nations Secretary-General solidified commitment to a world free from VAW and girls when he launched the UNiTE to End Violence against Women campaign. The UNiTE campaign designates the 25th of each month as "Orange Day", a day to raise awareness and take action against violence against women [2]. The topic was then further addressed during the 76th and 96th World Health Assemblies in 2014 and 2016 respectively [3, 4]. In 2015, the United Nations adopted Sustainable Development Goal 5 on gender equality and empowerment of women. The adoption of this goal, which aims to eliminate all forms of violence against women and girls by 2030, marked an important symbolic commitment to reducing the burden of VAW [5]. In accordance with Sustainable Development Goal 5, a Global Plan of Action was developed building on existing World Health Organization (WHO) work to achieve its goals [6]. While the administrative actions and global commitments described above are important steps towards raising awareness of the support for ending VAW, significant gaps in our understanding of the factors driving the phenomenon and how to prevent it remained. Therefore, each of these efforts have included the need for studies to address these gaps and disentangle the complex web of factors associated with risk for violence against women and development of strategies for prevention.

1.2 Epidemiology of IPV

While victims of intimate partner violence (IPV), the most common form of VAW, can be of any gender, epidemiologic studies have consistently identified that women endure the overwhelming burden of victimization [1, 7-11]. IPV refers to any behavior within an intimate relationship that

causes physical, sexual and/or mental harm or suffering [12]. Such behaviors are typically divided into four main categories; physical violence, sexual violence, stalking and psychological aggression/controlling behaviors [13, 14]. However, victims can experience behaviors from multiple categories with multiple levels of severity [1, 15].

Physical violence refers to the intentional use of physical force with the potential for causing death, long-term disability, or harm. This can include many different behaviors such as pushing, shoving, throwing, grabbing, biting, choking, shaking, hair pulling, slapping, punching, hitting, burning, or use of a weapon [13]. Sexual violence is more complex and can be divided into five different categories; rape or penetration of the victim, victim was made to penetrate someone else, non-physically pressured unwanted penetration, unwanted sexual contact, and non-contact unwanted sexual experiences [12, 13].

While physical and sexual violence are typically defined by various forms of physical contact, stalking and psychological violence are not. Stalking is defined as a pattern of repeated unwanted attention that leaves the victim fearful for their own safety or the safety of someone else; such as a family member or close friend [16]. Psychological aggression includes emotional abuse such as insults, belittling, constant humiliation or intimidation and threats to take their children [12, 13]. Psychological aggression can also include controlling behaviors which range from isolating victims from friends and family to restricting access to financial resources, employment, education and/or medical care [13].

Although we define violence in isolated categories, co-occurrence, typically referred to as polyvictimization, is common. A multi-country study found a substantial overlap between physical and sexual violence by intimate partners from 15 sites in 10 countries. In this study up

to 56% of all victims experienced polyvictimization, with substantially lower proportions reporting physical violence or sexual violence alone (32% and 12%, respectively) [14].

In recognition of the complexities surrounding IPV, the WHO recently conducted the first global comprehensive review of data on the prevalence of IPV victimization among women. Data for this project were obtained from 79 countries and two territories and were aggregated to generate a global prevalence estimate and as by WHO region for regional prevalence estimates. Results from this effort suggest that roughly one in three women worldwide have been victims of IPV during her lifetime [11]. When examined by WHO region, the South-East Asian region had the highest prevalence with approximately 38% of women reporting victimization, followed by Eastern Mediterranean/Africa, the Americas and Europe/Western Pacific reporting 37%, 30%, and 25% respectively [11]. As this report generated the first global and regional estimates of violence against women, it provides a significant contribution to understanding the pervasiveness of the problem. However, estimates should be interpreted with caution as data from non-population-based studies were included in analyses [11]. Additionally, many countries were systematically excluded from analyses as their prevalence estimates were based on inappropriate survey questions [11]. For instance, questions assessing VAW were based on perceptions of victimization rather than operationalized using behaviorally specific actions (e.g. were you a victim of violence? vs. has your partner ever slapped you?).

1.3 Risk Factors of IPV

1.3.1 Demographic Characteristics

The relationships between demographic characteristics and IPV have been extensively investigated [17]. While some variation exists in the relationships between demographic characteristics and different forms of violence, education and age have been consistently

identified with risk for IPV victimization. Education, specifically low levels of education, has been identified as a risk factor for both perpetration and victimization. This relationship has been identified across different studies in multiple settings and cultural groups [18-25]. One study identified that women with no formal education were 4.5 to 5.6 times more likely to experience IPV compared to those with more than 12 years of education [18]. Similarly, the same study identified that lower-educated males were 1.2 to 4.1 times more likely to perpetrate IPV than higher-educated males [18].

When examining differences in the associations between education and IPV victimization across countries, the evidence is inconsistent. Existing population level studies in China and India reported that women with higher levels of education relative to their partner were more likely to experience physical violence victimization [18, 26]. However, results were mixed in another cross-national study of couples. Among the ten nationally representative samples included in this study, four identified statistically significant associations with educational differences between the couple. In Haiti, women with less education relative to their partner were more likely to experience IPV where in the Dominican Republic, Malawi and Rwanda, they were less likely [15].

Younger age has been identified as a risk factor for both perpetration and victimization of IPV. Results from one study reported that rates of male perpetration of IPV are highest at younger ages and decrease with time [27]. A more recent 10-year panel study validated these findings and reported that the prevalence of IPV decreased 21% over the study period (28% to 7%) [27]. Similar findings were found for female IPV victimization. For example, a recent cross-national study identified that younger women aged 15-24 reported higher levels of IPV during the last 12 months than women aged 25-39 in nine of the 10 countries included [28].

When examining age differences between couples and risk for IPV the results are also inconsistent. Investigators from a Kenyan study of couples reported that women who were less than 10 years younger than their spouse were significantly more likely to experience any form of IPV compared to those who were the same age (OR 1.60; 95% CI 1.31-1.96) [29]. Yet there is evidence that the relationship between age differences and risk for IPV victimization may be, in part, a function of the sociocultural structure. A multi-national study exploring couple characteristics and risk for IPV victimization identified significant association with age difference in only one of the ten nationally representative samples included. This study found that in Zambia, there was a lower risk of violence for women whose spouses were at least five years older when compared to couples who were closer in age, including those who were the same age (OR 0.60; 95% CI not reported) [15].

Taken together, results from existing studies suggest that education and age are meaningful risk factors for IPV victimization. However, there is also evidence of cultural differences in the relationships between age, education, and risk for IPV victimization.

1.3.2 Childhood Adversities

Another regularly explored set of risk factors for IPV victimization are adverse childhood experiences; most notably exposure to parental violence [17, 30, 31]. Exposure to parental violence, particularly when the respondent's father perpetrates physical violence against the child's mother (or mother figure), has been identified as a risk factor for both victimization and perpetration of IPV [15, 31-33]. A systematic review identified that males exposed to parental violence were three to four times more likely to perpetrate IPV than those who were not similarly exposed [30]. Additionally, results from a recent study examining male perpetration in six countries (Bangladesh, Cambodia, China, Indonesia, Sri Lanka, and Papua New Guinea)

reported that the population attributable fraction of witnessing abuse of their mother on physical IPV ranged from 14.8-28.2% across countries [34].

For females, the relationship between childhood adversity and risk for IPV has been consistently identified; though with varying degrees of magnitude. One longitudinal study of females in the United States reported that females exposed to parental violence were 1.8 times more likely to be victims of IPV as adults when compared to those without similar exposure [32]. Investigators from one cross-sectional study analyzing nationally representative data from ten countries reported similar results with odds ratios ranging from 1.5-3.0 [15].

While exposure to parental violence has been the most commonly reported childhood adversity associated with IPV, others, including exposure to physical abuse, sexual abuse, and parental neglect, have also been identified as significant predictors [32, 35-37]. These associations have been reported for both risk for victimization and perpetration although, evidence suggests gender may modify these relationships. One cohort study in the United States found that both physical abuse and neglect were positively associated with female victimization by a future partner (OR 2.52, OR 1.64 respectively) [36].This same study identified significant associations between neglect in childhood and male perpetration of physical violence resulting in injury (OR 1.64) where physical abuse in childhood was not associated with later risk [36].

Sexual abuse in childhood has been found to be a significant risk factor for both victimization and perpetration of IPV. For females, one study found that the odds of victimization by a former or current spouse were significantly higher for those who had been sexually abused as children when compared to those who had not been similarly victimized (OR 3.05) [32]. For males, sexual abuse victimization as a child has been found to be significantly associated with future IPV perpetration. One study reported that the odds of male perpetration towards a current

partner were significantly higher for those who had been sexually abused in childhood when compared to those who had not been similarly abused (OR 2.00; 95%CI 1.33-2.99) [30, 35].

Although the relationships between childhood adversity and IPV have been well defined, most studies have only considered individual categories of adversity or composite measures that do not allow for the assessment of differences associated with cumulative adversity. When analyses do consider adversity co-occurrence, relationships with notable childhood experiences, such as witnessing parental violence and IPV are attenuated or null [38, 39]. For example, one longitudinal study found that the effects of childhood exposure to parental violence on subsequent IPV risk were weak when adjusting for other co-occurring adversities during childhood [40]. Another study including adolescents in dating relationships found that a broad range of childhood adversities were positively associated with the IPV victimization including, but not limited to, witnessing parental violence [37]. These findings suggest that increased risk of IPV may be, in part, attributable to a constellation of childhood adversities rather than one single category or experience.

1.3.4 Dating Experiences

Women who have been abused by intimate partners in previous relationships are more likely to experience future IPV victimization when compared to those without similar exposures. One study in India reported that women exposed to IPV in dating relationships were nearly four times more likely to report later IPV victimization [20]. Similarly, males with a history of previous abuse were almost three times more likely to perpetrate IPV in subsequent relationships [41].

1.3.5 Psychiatric Disorders

The relationships between psychiatric disorders and risk for IPV are complicated and assessment of these relationships has been limited by reliance on cross-sectional study

designs. A majority of the existing studies are unable to assess temporality and, as a consequence, report on associations with IPV rather than the identification of predictors of violence. However, the existing literature provides sound evidence of relationships between some psychiatric disorders and risk for IPV perpetration and victimization. For instance, antisocial behavior disorder has been the most commonly examined disorder to be associated with male perpetration of IPV [22, 27, 42]. However, one study with a cross-national sample of couples reported that for males, having any externalizing disorder was a stronger predictor of marital violence than antisocial behavior disorder alone [43]. Alcohol abuse disorder has also been considered highly associated with perpetration of IPV against an intimate partner and, to a lesser degree, with IPV victimization [44]. One study in South Africa reported that men who abused alcohol were 2.3 times more likely to perpetrate IPV than those who did not report alcohol abuse [45, 46]. A study examining a battery of past-year psychiatric disorders and their association with IPV reported that women with any anxiety disorder, any disruptive behavior disorder, any substance use disorder, and an aggregate measure of any psychiatric disorder had an increased odds of victimization when compared to those without these disorders [47].

Additional risk factors for IPV victimization are shown in Table 1.1. For convenience, characteristics shown in Table 1.1 have been grouped into four levels of action consistent with the ecological model including social, community, relationship, and individual factors [1, 48, 49].

Table 1.1 Risk factors for intimate partner violence against women

Perpetration by men	Victimization by women
INDIVIDUAL LEVEL	
Demographics	**Demographics**
♦ Low income	♦ Young age
♦ Low education	♦ Low education
♦ Unemployment	♦ Separated/divorced marital status
♦ Low socio-economic status / income	♦ Low socio-economic status/income
	♦ Separated/divorced marital status
	♦ Pregnancy
Childhood adversities	**Childhood adversities**
♦ Intra-parental violence	♦ Intra-parental violence
♦ Abuse (physical, sexual, neglect)	♦ Abuse (physical, sexual, neglect)
Psychiatric disorders	**Psychiatric disorders**
♦ Antisocial behavior disorder / externalizing disorders	♦ Depression
Substance use	**Substance use**
♦ Harmful use of alcohol	♦ Harmful use of alcohol
♦ Illicit drug use	♦ Illicit drug use
♦ Attitude towards violence	♦ Attitudes towards violence
RELATIONSHIP LEVEL	
♦ Multiple partners/infidelity	♦ History of violence in dating relationships
♦ Low resistance to peer pressure	♦ Educational disparity
♦ History of violence in dating relationships	
♦ Educational disparity	
COMMUNITY LEVEL	
♦ Weak community sanctions	♦ Weak community sanctions
♦ Poverty	♦ Poverty
SOCIETAL LEVEL	
♦ Traditional gender norms and social norms supportive of violence	♦ Traditional gender norms and social norms supportive of violence
Source: adapted from the WHO's report on prevention of violence against women	

1.4 Health Outcomes Associated with IPV

While evidence suggests women may also be perpetrators of IPV, they typically do not inflict physical injury as often or as severely as males [16, 50]. The National Intimate Partner and Sexual Violence Survey estimated that just under 30% of female victims of IPV experienced a negative IPV-related health outcome compared to just 10% of male victims [16]. According to the most recent global estimate, nearly 40% of all homicides of women were committed by male intimate partners compared to 6% of male homicides committed by their female intimate partners [51].

It has been estimated that women who have been victims of IPV were twice as likely as women without history of victimization to report poor health status (physical or mental), regardless of the amount of time that has passed since victimization [52]. Adverse outcomes associated with IPV are typically divided into four categories; physical, mental, sexual/reproductive, and behavioral [53]. Physical injuries are the most common and can include bruises, welts, lacerations, broken bones or teeth, and death [1]. In addition to easily identifiable physical injuries, other physical conditions such as irritable bowel syndrome, fibromyalgia, and asthma have been reported as outcomes of IPV [1].

Comparatively fewer studies have reported on mental disorders as outcomes of IPV. However, the existing literature provides evidence of several notable disorders. These include depression [54], suicidality, post-traumatic stress disorder, anxiety, and substance use disorders [55, 56]. One recent study reported that women with high lifetime exposure to IPV were 10 times as likely as women without similar exposure to have an anxiety disorder and were nearly 15 times as likely to have attempted suicide [57].

Negative sexual and reproductive health consequences related to IPV victimization include a myriad of disorders and diagnoses. One of the most common being sexually transmitted diseases such as HIV/AIDS [54, 58, 59]. However, the relationships between IPV victimization and risk for infectious disease is complicated as it could occur through direct pathways such as forced sexual intercourse within marriages, or through indirect pathways such as being in a relationship with a partner who has unprotected sex with multiple partners [48]. Other negative sexual and reproductive health outcomes can include unintended pregnancy, pelvic inflammatory disease, obstetric fistulas, and painful sexual intercourse [54, 60]. IPV during pregnancy can result in miscarriage, premature birth, stillbirth, fetal injury, and abortions (including unsafe abortions) [61].

A list of common health consequences are shown in Table 1.2 and can be proximal or distal to the event. Consequences of IPV are broad and can range from negative outcomes affecting the victim, the victim's family and friends, and society as a whole [10, 12, 54, 62-64]. Importantly, most outcomes of IPV can be considered as part of each level in the ecological model including social, community, relationship, and individual levels. For instance, mental disorders can be viewed as individual level outcomes as they impact the victim, relationship level outcomes as they can impact relationship dynamics, community level outcomes as they can impact community functioning, and societal levels as they accrue costs.

Table 1.2 Common consequences of intimate partner violence against women

Physical	• Acute or immediate physical injuries, such as bruises, abrasions, lacerations, punctures, burns and bites, as well as fractures, and broken bones or teeth • Traumatic brain injuries, injuries to the eyes, ears chest and abdomen • Gastrointestinal conditions, long-term health problems, and poor health status, including chronic pain syndromes • Death, including femicide and AIDS related death
Mental	• Depression • Post-traumatic stress disorder • Substance use disorders • Sleeping and eating disorders • Stress and anxiety disorders • Self-harm and suicide • Poor self esteem
Sexual and reproductive	• Unintended/unwanted pregnancy • Abortion / unsafe abortion • Sexually transmitted infections, including HIV • Pregnancy complications/miscarriage • Vaginal bleeding or infections • Chronic pelvic infections • Fistula • Painful sexual intercourse • Sexual dysfunction
Behavioral	• Harmful alcohol and substance use • Multiple sexual partners • Increased likelihood for subsequent violence • Lower rates of contraceptive and condom use

Source: adapted from the WHO Health consequences of IPV

1.5 Estimated Cost of IPV

In addition to the negative health consequences associated with IPV, victimization has been associated with significant economic burden including costs associated with health service delivery, lost income, decreased productivity, and lost future income opportunities [65].

Research on the costs associated with female IPV victimization is less available with varying criteria and methodologies limiting our ability to support international comparisons. Despite this limitation, a recent systematic review of data from nine countries estimated that the costs associated with IPV perpetrated against women ranged from 1.2 to 2 percent of the gross domestic product [65]. In 2003, the Centers for Disease Control and Prevention (CDC) estimated that the total cost of IPV perpetrated against women was over $8.3 billion in indirect and direct costs in the United States [62]. This includes a loss of 8 million days of paid work and almost 5.6 million days of household productivity each year [66].

1.6 Current Prevention Efforts

Prevention programs typically focus on a single level of action. These levels include primary, secondary, and tertiary prevention strategies. Primary prevention aims to prevent IPV before it occurs. This approach is predicated on the ability to identify and address the "upstream" determinants before IPV occurs. Secondary prevention focuses on the immediate response to IPV after is has occurred. Tertiary prevention focuses on the long-term care in the wake of IPV such as rehabilitation and post-traumatic growth [48].

Over the past few decades, there have been a limited number of primary prevention efforts that show promising results [48, 67, 68]. Examples include school-based programs to prevent dating violence such as Healthy Relationships in Canada [69] and Shifting Boundaries and Safe Dates in the United States [70, 71]. All three of these programs have resulted in reductions in dating violence among adolescents. However, with the exception of Healthy Relationships, studies did not report gender specific results. As male perpetrated violence against women is such a pervasive and negatively impactful issue, it is important to understand the effectiveness of these programs in reducing male IPV perpetration.

In addition to school-based programs, there have been two additional prevention efforts to reduce IPV using relationship education techniques. These include The Creating Healthy Relationships Program [72, 73] and the Prevention and Relationship Enhancement Program [74], both of which are interventions for currently married couples aimed to strengthen relationship quality and teach coping and conflict management skills. These programs have shown promising results in their effectiveness to reduce IPV among intervention couples compared to controls.

The majority of funding and resources to address IPV have been directed towards secondary and tertiary efforts with comparatively limited focus on primary prevention programs [48]. In response to this gap, the WHO and CDC have identified a need to scale-up evidence-based primary prevention programs with rigorous evaluation [6, 16]. This is of particular importance, as secondary and tertiary prevention efforts rely on identifying previous victims primarily through healthcare or legal systems. However, there is evidence that victims of IPV may not be willing to access these services [14]. The number of countries with domestic violence legislation has grown substantially from four in 1993 to 76 in 2013 [75]. Despite this advance, most have had problems with implementation. Problems include a lack of funds allocated to support the newly introduced laws or cultural resistance to adherence by male-dominated judiciary and police systems [68, 76].

Chapter 2. Specific Aims

Chapter 2. Specific Aims

More than two decades have elapsed since violence against women was identified as a global public health problem and violation of basic human rights. It has been estimated that one in three women worldwide have been victims of physical and/or sexual violence, most frequently perpetrated by an intimate partner [11]. IPV refers to any behavior by an intimate partner that causes physical, sexual, and/or mental harm or suffering [12]. Intimate partners include current or former spouses, boyfriends or girlfriends, dating partners, or sexual partners [16]. Consequences associated with IPV include a myriad of negative health outcomes including homicide, physical injuries, sexually transmitted infections, post-traumatic stress disorder, depression, anxiety, substance use disorders, and increased risk for suicide [54]. Due to the negative impact of IPV, there has been interest in new strategies for identifying persons at risk for victimization. Effectively identifying persons at risk for IPV could provide a foundation for the development of targeted primary prevention strategies.

A recent review of prevention interventions for IPV suggest there is limited evidence to support the use of primary prevention strategies [68]. Primary prevention has historically been difficult as IPV is a complicated, multi-factorial phenomenon with multiple risk factors and potential bidirectional relationships between victimization and perpetration. In an attempt to partially address this complexity, the **overall objective of this project** is to develop a model to predict risk of marital violence directed towards women, a common form of IPV. We used data from heterosexual couples in six countries from the World Health Organization's World Mental Health (WMH) Survey Initiative. Using these data, we examined possible predictors occurring prior to the participant's current marriage. Factors were categorized into distinct groupings derived from existing evidence and use in prior studies. In each predictor group, we estimated models for husbands and wives separately then together to examine joint effects of exposures between both members of the couple. Few studies have examined risk factors of IPV from the spousal

dyad. This analytic approach will allow us to identify whether additive interactions of exposures among the couple differ from exposures for each spouse independently (i.e., does it matter if the wife or husband had the exposure irrespective of the other or is there a joint effect for shared experience between both members).

Specific Aim 1: Identify demographic factors and relationship characteristics associated with marital violence**.** Our primary hypothesis is that select combinations of demographic characteristics including age, education and relationship history will be associated with variability in risk for marital violence not explained by the independent effects of these factors.

Specific Aim 2: Identify adversities experienced during childhood that are associated with marital violence. We hypothesize that childhood adversities, particularly exposure to parental violence, will be associated with marital violence for both husbands and wives. We also propose that higher rates of cumulative adversity, measured as either a greater number of childhood adversities experienced by either partner or the combined experience of both partners, will be associated with increased risk for violence in the current marriage.

Specific Aim 3: Identify dating experiences, such as violence in dating relationships, associated with marital violence. We hypothesize that the joint effect of dating violence for both partners will be associated with increased risk for marital violence stronger than that of the independent effects from individual members of the couple.

Specific Aim 4: Identify pre-marital psychiatric disorders associated with marital violence. We hypothesize that externalizing disorders for husbands and internalizing disorders for wives will be associated with increased risk for marital violence. We also propose that interactions

between couples such as husbands with externalizing disorders married to wives with internalizing disorders will be associated with increased risk for marital violence.

Specific Aim 5: Develop and assess a model predicting marital violence using information on demographic characteristics, relationship characteristics, dating experiences and psychiatric disorders identified in analyses as part of Aims 1-4.

2.1 Potential Impact/Significance

This project is expected to make a significant contribution to public health. It is well documented that IPV is a highly complicated phenomenon with few evidence-based prevention strategies. In creating a predictive model, our results will provide suggestive evidence that useful models could be developed in future prospective studies to target primary prevention of marital violence.

Additionally, we will be able to capitalize on the availability of data containing detailed pre-marital factors in four distinct predictor sets. Results will aid in elucidating complicated relationships associated with risk for IPV victimization such as co-occurrence of a multitude of childhood adversities and pre-marital psychiatric disorders. Findings from this project will allow public health practitioners to identify when and where prevention may have the greatest impact with more targeted prevention efforts.

Chapter 3. Approach/Methods

Chapter 3. Approach/Methods

Data for this project were obtained from six countries participating in the World Health Organization's World Mental Health (WMH) Survey Initiative.

3.1 WMH Survey Initiative

In the mid-1990s, the WHO Global Burden of Disease Study estimated that mental disorders and substance abuse were among the highest ranked diseases in the world [77]. However, a substantial gap in comparable prevalence estimates and total health-care dollars allocated to treatment [78] led to the launch of the WMH Survey Initiative [79]. The WMH Survey Initiative is a project of the Assessment, Classification, and Epidemiology Group at the WHO aimed to conduct rigorous general population surveys in nationally or regionally representative samples around the world. This Consortium now includes a coordinated series of nationally or regionally representative surveys in 27 countries, representing all WHO regions. All samples are based on multistage household probability methods of selection. Since probability sampling requires a frame that provides a high level of coverage for the defined survey population, sampling frames were carefully selected for each country [80]. Investigators took into account the extent of the coverage, the cost of developing and using the frame, and the experience and capacity of the intended organization carrying out data collection [80]. Generally, three types of frames were selected; a database of individual contact information in the form of national population registries, voter registration lists, postal address lists, or house-hold telephone directories; a multistage area probability frame [81]; or a hybrid multistage frame that combined area probability methods in the initial stages and a registry or population lists in the final stages of sample selection [80]. Further details about the sampling are available from related publications [80].

The WMH Survey Initiative continues to generate cross-national data on mental, substance use, and behavioral disorders [79]. The collaborative structure of the WMH Survey Initiative has also resulted in an expansion of the infrastructure for psychiatric epidemiologic research. WMH data have been used in hundreds of publications in peer reviewed journals [82] and a total of five published books with a sixth book projected for publication in summer 2018. WMH data continues to provide critical information for the improvement of population mental health around the world [83]. Resulting research provides a critical foundation for interventions, policies, treatment, and service delivery.

3.2 WMH Composite International Diagnostic Interview

All countries involved in the WMH Survey Initiative used the WHO WMH Composite International Diagnostic Interview (CIDI). The first generation CIDI was developed by the WHO in 1990 using the Diagnostic Interview Schedule (DIS) as a foundation for the identification of common mental disorders [84]. In addition to the definitions and criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) from the DIS, the CIDI included International Classification of Diseases (ICD-10) criteria expanding its utility and capability for translation into many languages [79]. One major criticism of the WHO CIDI was that measures of risk factors, consequences, patterns, and correlates of treatment for mental disorders were not included, inhibiting flexibility in research efforts. Therefore, the WHO WMH-CIDI was created and expanded the previous version of the CIDI to include these metrics. The result was a comprehensive, fully-structured interview for the assessment of mental disorders and related factors. Masked clinical reappraisal interviews found good concordance between DSM-IV diagnoses based on the CIDI,[85] and those based on the Structured Clinical Interview for DSM-IV [86, 87]. Prior to the use of the WMH-CIDI, rigorous training must be obtained at a WHO-authorized training center to maintain data quality. Training also provides standardized methods for data management and analysis which is critical for making cross-national comparisons.

The WMH-CIDI was designed to be used by trained lay interviewers for the assessment of mental disorders separated into 42 sections, some of which were optional. Internal subsampling was used to reduce respondent burden by dividing the interview into two parts, Part I and Part II. All respondents completed Part I of the survey, which assessed core mental disorders, while Part II was administered to 40-60% of the Part I respondents. Part I core disorders include anxiety disorders, mood disorders, substance use disorders, and personality disorders. Part II participants consisted of all those who met lifetime criteria for any core disorder plus a probability sub-sample of approximately 25% of other Part I respondents (weighted by the inverse of their probability of selection). Part II assessed additional disorders including post-traumatic stress disorder, neurasthenia, nicotine dependence, eating disorders, premenstrual dysphoric disorder, obsessive-compulsive disorder, psychosis, pathological gambling, attention deficit disorder and hyperactivity, oppositional defiant disorder, conduct disorder, and separation anxiety disorder. Part II also assessed a wide range of potential outcomes and predictors of mental disorders by including interview sections to the core survey. For example, the optional marriage module, which assessed a wide range of items such as history of intimate partner violence, could be added to Part II. Additional information on the CIDI including all sections and their order are available elsewhere, https://www.hcp.med.harvard.edu/wmhcidi/. Weights were used to adjust the Part II samples for differential probabilities of selection within households and to match samples to population socio-demographic distributions. Further details about the sampling and weighting of the WMH surveys are available from related publications [80]. Interviewer training and field quality control procedures for utilization of the WMH-CIDI were cross-nationally standardized [88].

3.3 WMH Couples Sample

Several countries interviewed a secondary probability subsample of the selected primary

respondents' spouses allowing for examination of couples characteristics. Utilizing a secondary

probability subsample allows the couples to be weighted to a nationally or regionally

representative sample of couples [43, 80]. Both members of each couple in the couples sample

were administered identical surveys.

To be included in the sample used for this project, country specific surveys had to have

collected a couples sample and survey instruments had to assess physical violence in the

current marriage, dating violence, and traumatic experience. Restriction using these criteria

resulted in selection of data from six countries (Brazil, Bulgaria, The People's Republic of China,

Lebanon, Nigeria, and the United States). Only three of the countries included offered

compensation for participation. The United States provided cash at $50/$100, Nigeria provided

a bath towel, and Lebanon provided free psychiatric consultations. The WMH-CIDI was

translated from English to Brazilian-Portuguese [89], Bulgarian, Chinese [90], Arabic [91],

Hausa, Ibo, Efik, and Yoruba [92, 93] for countries included in this project. Translation and back

translation of surveys followed standard WHO procedures [94].

Surveys were administered to all respondents by lay face-to-face interviewers who obtained

informed consent before administering the interview. Interviewers explained the purpose of the

survey and made it clear that participation was voluntary, that respondents could decide to not

answer any questions, and all responses would be treated as confidential. Recruitment and

consent procedures were approved by Human Subjects and Ethics committees in each country.

Verbal consent was accepted in all countries included in this project with the exception of Brazil

where written consent was required. Interviewer training and field quality control procedures

were cross-nationally standardized [88]. Computer-assisted interviewing was used in the United

States only where the remainder of participating countries used a paper and pencil instrument. Given the highly sensitive nature of the questions asked in the survey, a certificate of confidentiality was obtained to protect data from subpoena and every effort was made for interviews to be conducted in private.

Samples were selected in multistage clustered area probability household samples representative of specific metropolitan areas (Brazil, People's Republic of China, and Nigeria) or the entire nation (the remaining countries). The overall response rate across all countries was 74.7% ranging from 70.0% in Lebanon to 81.3% in Brazil for the couples sample resulting in a total sample 1,515 heterosexual couples (3,030 individuals; or 1,515 husbands and 1,515 wives). Sample sizes ranges from 422 couples in Bulgaria to 104 couples in the People's Republic of China. Further sample characteristics are shown in Table 3.1.

Interviewers were trained to report certain metadata metrics such as whether someone was present during the interview. The proportion of interviews conducted where the wife's husband was present during the interview varied by country ranging from 11.5% in Nigeria to 49.8% in Lebanon with a total of 28.7% across all surveys.

Table 3.1. Sample characteristics

Survey	Sample characteristics[a]	Field dates	Age years	Part II sample size (n) [b]	Response rate[c],%	Couples sample Size (n)[d]
Brazil	Sample of household residents in the São Paulo metropolitan area.	2005-8	18+	(1,848)	81.3	(133)
Bulgaria	Nationally representative sample of household residents.	2002-6	18+	(1,152)	72.0	(422)
People's Republic of China	Sample of household residents in the Shanghai and Beijing metropolitan areas.	2001-3	18+	(5,201)	74.7	(104)
Lebanon	Nationally representative sample of household residents.	2002-3	18+	(482)	70.0	(159)
Nigeria	Sample of households in 21 of the 36 states in the country, representing 57% of the national population.	2002-4	18+	(1,076)	79.3	(305)
United States	Nationally representative sample of household residents.	2001-3	18+	(1,607)	70.9	(392)
Total				(11,366)	74.7	(1,515)

[a] Most World Mental Health (WMH) surveys are based on stratified multistage clustered area probability household samples in which samples of areas equivalent to counties or municipalities were selected in the first stage followed by one or more subsequent stages of geographic sampling (e.g. towns within counties, blocks within towns, households within blocks) to arrive at a sample of households, in each of which a listing of household members was created and one or two people were selected from this listing to be interviewed. No substitution was allowed when the originally sampled household resident could not be interviewed. These household samples were selected from census area data.
[b] The sample comprised part 2 respondents who were currently married or cohabiting, and answered the questions about violence in current marriages, experience of violence in dating relationships and traumatic experiences.
[c] Response rate is calculated as the ratio of the number of households in which an interview was completed to the number of households originally sampled, excluding from the denominator households known not to be eligible either because of being vacant at the time of initial contact or because the residents were unable to speak the designated languages of the survey
[d] The number of heterosexual couples in each country sample.

3.3.1 Outcome Measure

The Conflict Tactics Scale (CTS), developed by Dr. Murray Straus, is the most widely used

measurement tool for IPV (Straus, 2012). It was first developed in the early 1970s and was used

in the US National Family Violence Survey in the mid-1970s [95]. It was then revised in the

1990s resulting in the modified CTS [96] which has been adapted and used in many studies

including the WHO multi-country study on women's health and domestic violence against

women, the largest cross-national study on violence against women [14]. Widespread use of the

CTS is due, in part, to its assessment of specific actions making it easy to make direct

comparisons of violence regardless of culture. For instance, rather than asking a participant whether he/she had been a victim of domestic violence, questions in the CTS assess whether their partner had ever hit or pushed them [96]. Additionally, the CTS has been validated in many countries [97, 98] including 29 male-dominated nations [99] making it the most valid and reliable instrument with empirical evidence for assessing the frequency and severity of IPV. Of importance to this project, the CTS has been validated in three countries included; the United States [98], Brazil [100], and China [99, 101]. Though the CTS has yet to be validated in Bulgaria, it has been validated in Romania, a culturally similar country [99].

Due to its wide spread use and reliability, survey instruments assessed violence using questions from the modified CTS lending to the creation of our outcome measure. The outcome for this project is female victimization of moderate physical violence. Respondents were provided with a list of specific violent actions in a respondent booklet which they were given during the interview. They were asked if each of the described actions had ever occurred in their current marriage. Moderate physical violence was defined for respondents as "pushed, grabbed or shoved, threw something, slapped or hit". The response categories were "never, rarely, sometimes, or often". The outcome was coded as "yes" if either the wife reported ever being a victim of moderate physical violence from her current husband and/or the husband reported ever perpetrating moderate physical violence towards his current wife. If the respondent's spouse was present during the interview, they were asked to not look at the booklet or to sit behind the respondent. Interviewers were trained to assess for emotional distress following completion of the survey and followed specific protocols for connecting participants to appropriate clinical services if necessary.

Candidate predictor variables of marital violence were grouped into four classes; demographics/relationship characteristics; childhood adversities; dating experiences; and psychiatric disorders.

3.3.2 Demographics / Relationship Characteristics

Demographic characteristics considered as part of this project included the participant's education level, highest level of parent education, highest parent occupation, whether or not respondent was in their first marriage, number of previous marriages, age when first married, age at start of current marriage, and years married or living together in current marriage. Participating countries varied in the age students started school and duration of each stage of education. To accommodate these differences, four milestones of education were defined by within country standards as completing primary education, completing secondary education, entry into tertiary education, and graduation from tertiary education (including university or other higher levels of education after secondary education) [102] and are referred to as low, low-average, high-average, and high respectively. Parental occupation was first classified into 28 categories and 10 major groups defined by the International Standard Classification of Occupations of the International Labour Organization (ISCO-88) [103]. The 10 groups were then further classified into skill-level categories defined by ISCO-88 as elementary (unskilled and semi-skilled labor), low-average prestige (clerks, service and sales, skilled workers, craft and related, and plant/machine operators), high-average prestige (technicians), and high prestige (professionals). Finally, respondents were asked the age they were when they were first married. Age of first marriage was then placed into discrete gender and country specific quartiles to reflect young, young-average, old-average, and old age.

3.3.3 Childhood Adversities

Childhood adversities were assessed using 12 dichotomously-scored measures about experiences occurring before age 18. These included physical abuse, sexual abuse and neglect, father's death, mother's death, other parental loss, parent with a mental disorder, parent with a substance disorder, parent criminality, witnessing family violence, having had a life threatening illness, and experience of economic adversity in childhood.

Physical abuse of the respondent by a parent or caregiver was assessed using the modified CTS [95, 96]. Sexual abuse was assessed with questions regarding sexual assault, attempted rape and rape and included age at which these abuses first occurred. Sexual abuse is the only childhood adversity measure where we were unable to identify the relationship between perpetrator and victim. Neglect was assessed with a battery of questions used in studies of child welfare that asked about frequency (often, sometimes, rarely, never) of not having adequate food, clothing or medical care, inadequate supervision, and being required to do chores that were age-inappropriate [104]. Parental death and divorce considered only loss of biological parents. Another measure of parental loss or displacement measured adoption after the age of two, or any household disruption that lasted for six months or longer that either involved a caregiver leaving the respondent's home (e.g. the biological mother abandoned that family) or the respondent left home (e.g. foster care placement, lived with other relatives, adoption, or placed in a detention center). Parent mental illness was assessed as either the mother or father displaying signs or symptoms of depression (i.e., ever having periods lasting two weeks or more where mother or father was sad or depressed most of the time), generalized anxiety disorder (i.e., mother or father ever have periods of a month or more when they were constantly nervous, edgy, or anxious), or panic disorder (i.e., mother or father ever complained about anxiety attacks where all of a sudden she felt frightened, anxious or panicky). Parent substance abuse was assessed with questions regarding mother or father having problems with alcohol or drugs

including treatment and interruption with daily life or activities. Parental criminality was assessed with questions about whether a parent either engaged in criminal activities like burglary or selling stolen property or was ever arrested or sent to prison from criminal activity (5). Family violence was assessed with the modified CTS including an item on the respondent's age when they first observed inter-parental violence. Respondent physical illness was created by multiple items. The respondent either reported having a life threatening illness and age of onset. This question allowed the respondent to define life threatening themselves but did not capture their illness if they answered positively. Additional items assessing life threatening illness consisted of either having cancer, epilepsy, diabetes, or AIDS under the age of 18. Family economic adversity was assessed with an item indicating whether or not the respondent was on welfare in childhood or parents did not work during childhood.

3.3.4 Dating Experiences

Dating experiences include exposure to any violence in dating relationships (reported perpetration or victimization of moderate physical violence), age of first sexual intercourse, and age respondent started dating. Exposure to violence in dating relationships was assessed using the modified CTS [96]. Two variations of age of first sexual intercourse were created. One where age was placed into roughly equal quartiles combining reports from wives and husbands allowing for consistent age cutoffs; young (less than 18 years old), young-average (18-19 years old), old-average (20-22 years old), and older than average (23 years or older). The second variation was country and gender specific quartiles with the same labels as the previous iteration; young, young average, old-average, and older than average.

3.3.5 Psychiatric Disorders

Age of onset (AOO) of eight internalizing disorders (panic disorder, generalized anxiety disorder, post-traumatic stress disorder, separation anxiety disorder, social phobia, specific phobia, major depressive disorder, and broad bipolar disorder) and seven externalizing disorders (conduct disorder, oppositional defiant disorder, alcohol abuse with or without dependence, alcohol dependence with or without abuse, drug abuse with or without dependence, drug dependence with or without abuse, and intermittent explosive disorder) were collected. Diagnoses of mental disorders were based on Version 3.0 of the WMH-CIDI [105]. Pre-marital onset of mental disorders was defined as having a disorder with AOO less than marrying their current spouse (i.e. AOO was less than the age respondent was at current marriage).

3.4 Analysis

The goal of the analysis was to determine if the predictor variables, at their values prior to marriage, are associated significantly with the subsequent occurrence of marital violence. All data management and analysis was completed in SAS software, Version 9.4 (SAS Institute Inc., Cary, NC, USA). Analyses utilized a data set in which each couple was represented by a single observation allowing us to examine potential interactions between spouses [43]. The prevalence of marital violence was estimated as the proportion of couples where either the husband and/or the wife reported moderate physical violence in their current marriage. All analyses were weighted and the sum of the consolidated weights across respondents was standardized in each survey for purposes of pooled cross-national analysis to equal the observed number of couples within the sample. The design-based Taylor series method [106, 107] was used to adjust for the weighting and clustering of observations. Weighted prevalence of marital violence

was estimated using cross-tabulations for each country separately and then for all six countries together.

3.4.1 General Overview of Analyses for Specific Aims 1-4

Specific aims one through four followed the same analytic strategy to identify the most robust predictors of marital violence for each predictor class pooled across surveys. All analyses were completed first for wives and husbands separately and then together (i.e. we modeled wives predictors separate from husbands, husbands separate from wives, and then modeled the significant predictors from each together as well as examining joint effects of exposures between wives and husbands). All categorical variables were dummy coded for ease of interpretation on risk of marital violence at each level [108, 109].

Descriptive analyses were completed using frequency tables for all potential predictors in each of the four predictor classes. Then cross-tabulations were generated with each predictor and marital violence to examine distributions across levels and to calculate Chi-Square tests to assess significant associations between the two [110]. Bivariate associations were further examined with simple logistic regression models for each predictor variable [108, 110].

Then logistic regression models were estimated to examine bivariate associations between predictors and marital violence controlling for several variables referred to as methodological controls. Methodological controls included dummy variables for each of the six country specific surveys (Bulgaria as the reference), within country quartiles of the years each couple was married (quartile 4, or long, as the reference), and whether or not a person was present during the interview for the wife (alone or with a child under the age of six years old as the reference). Two additional control variables were included for specific aims four and five which were wife's age and husband's age. Including dummy control variables for each survey indicated that

coefficients would represent pooled within-survey coefficients [111]. Logistic regression coefficients were exponentiated and reported as odds-ratios with 95% confidence intervals. Statistical significance was evaluated using 0.05-level two sided tests.

Multivariate logistic regression models were then estimated. Models included a series of similar procedures for each group to find the most robust set of predictors and their best functional form such as threshold of risk for composite scores or significant levels in categorical variables. Standard errors were adjusted for the complex sampling design considering weights, strata, and clusters [106, 107]. Regression coefficients were exponentiated and reported as odds-ratios with 95% confidence intervals. Design-based Wald Chi-Square tests were used to test the mean difference in odds for parameter estimates and the potential joint significance for sets of parameters by adjusting the degrees of freedom within tests [109]. Adjusting the degrees of freedom allows us to test hypotheses about regression coefficients within models. We can examine the joint significance of a set of predictors relative to the entire model (when degrees of freedom equal that of the number of predictors in the group) and if they are significantly different from one another (the degrees of freedom are one less than the number of predictors in the group). For example, in a hypothetical model with all 12 childhood adversities included for wives, we could test their joint significance with a Wald Chi-Square test with 12 degrees of freedom. We could also test whether they are significantly different than one another with 11 degrees of freedom. This method has been used in previous studies using WMH data to confirm significance of associations [43, 112].

For simplicity, an explanation of each type of model is described below using the childhood adversity predictor group in specific aim 2 as an example.

(i)   Dummy variables for each predictor in the predictor class would be included in a model with tests for the significance of differences in slopes.

      a. For example, a separate predictor for each of the 12 childhood adversities was included in a single model.

      b. Chi-square tests for the significance of differences in slopes was used to determine if certain childhood adversities were more important than others in predicting marital violence.

(ii)   A count of the number of predictors in the class would be included in a model. For example, the model would include a variable for the number of adversities respondent's experienced in childhood (values ranging from 0-12).

      a. This type of model is contingent on the results of analyses from (i), specifically if the slopes do not differ across predictors in the class. If the slopes of individual adversities do not significantly differ from each other this means that they do not provide unique information to the model independently.

(iii)   A model with the combination of (i) and (ii) where predictors for both type and number are included.

      a. For example, this model could include the 12 childhood adversity variables as well a variable for the number of childhood adversities each respondent has experienced.

      b. Respondents with exactly one adversity in the set would be coded 0 for the count of adversities. Or if dummy variables were to be used for each number, dummies would only be included for two or more adversities). This is done in recognition that this specification essentially treats the counts as collapsed

interactions that evaluate the extent to which joint associations among the predictors are additive.

(iv) A modified model of (iii) to isolate a variables best functional form by identifying levels and interactions with the highest risk.

    a. For example, a separate count variable of specific childhood adversities which have previously been evidenced as latent constructs such as maladaptive family functioning childhood adversities [113] would be included in the model.

(v) A modified version of (iv) to identify joint predictive effects of exposures between wives and husbands on marital violence

    a. For example, the model would include a separate variable indicating the joint exposure of childhood adversities between both members of the couple (i.e. both wife and husband were exposed to maladaptive family functioning childhood adversities). This would be modeled individually and in the presence of wife and husbands independent exposure, irrespective of their spouse's experience. This will allow for the possibility that interactions vary in strength as a function of the strength of main effects.

The above multi-step analysis approach has been used in previous studies using WMH data [111, 114, 115].

3.4.2 Aim 1 Analytic Plan

Analyses first examined bivariate associations between marital violence and three demographic subgroups; wife's demographic characteristics, husband's demographic characteristics, and demographic differences within couples, referred to as relationship characteristics. Chi-square tests of difference were calculated to identify differences between categories controlling for country, the number of years the couple was married and whether or not a person was present during the interview for the wife. Then a series of multivariate models were estimated including significant variables from each subgroup to identify the most robust predictors from this predictor group.

3.4.3 Aim 2 Analytic Plan

 Analyses first examined bivariate associations between marital violence and childhood adversities. Chi-square tests of difference were calculated to identify differences between categories controlling for country, the number of years the couple was married, and whether or not a person was present during the interview for the wife. Clustering of the 12 childhood adversities was examined in factor analyses of tetrachoric correlations with promax rotations. Indicator variables for childhood adversities do not follow a Gaussian distribution requiring tetrachoric correlation coefficients for factor analyses rather than Pearson correlation which assume a continuous variable with a normal distribution [116]. Promax (oblique) rotation was used for factor solutions allowing for slightly correlated factors [117] in order to account for the shared covariance between adversities. This method has been previously used with WMH data when examining childhood adversities [113]. A series of multivariate models were then estimated to identify the most robust predictors in this group. This process was repeated separately for wives then for husbands.

After identifying predictors for each spouse separately, a series of multivariate models were estimated for the couple. Models included independent spousal report of childhood adversities as well as shared experience between the couple to identify the most robust predictors in this predictor group.

3.4.4 Aim 3 Analytic Plan

Analyses first examined bivariate associations between marital violence and dating experiences. Chi-square tests of difference were calculated to identify differences between categories controlling for country, the number of years the couple was married and whether or not a person was present during the interview for the wife. A series of multivariate models were estimated to identify the most robust predictors. This process was repeated separately for wives then for husbands. Finally, a series of multivariate models were estimated including independent spousal report of dating experiences as well as shared experience between the couple to identify the most robust predictors in this predictor group.

3.4.4 Aim 4 Analytic Plan

Analysis first examined bivariate associations between marital violence and pre-marital psychiatric disorders. Chi-square tests were used to identify differences between categories controlling for country, the number of years the couple was married, whether or not a person was present during the interview for the wife, and respondent's age. Then a series of multivariate models were estimated to identify the most robust predictors. This process was repeated separately for wives then for husbands.

After identifying predictors for each spouse, a series of combination variables were created reflecting joint experience of pre-marital psychiatric disorders between the couple. Bivariate associations were examined with chi-square tests to identify differences between categories controlling for country, the number of years the couple was married, whether or not a person was present during the interview for the wife, wife's age, and husband's age. Then a series of multivariate models were estimated including independent spousal report of pre-marital psychiatric disorders as well as shared experience between the couple to identify the most robust predictors in this predictor group.

3.4.2 Aim 5 Analytic Plan

Significant variables identified in Aims 1-4 were used to construct a final predictive model. We generated a predicted probability of marital violence for each respondent from the model coefficients. A receiver operating characteristic (ROC) curve was calculated from this summary predicted probability [118]. A ROC curve is a plot of sensitivity as a function of (1-specificity) [109] summarizing predictive power where the slope of the curve shows the ratio of the probability of identifying a true positive (a case of marital violence) over a true negative (no marital violence). The Area Under the Curve (AUC) was then calculated to quantify overall prediction accuracy of the model [119]. The AUC is a measure of predictive power called the concordance index or C statistic which ranges from 0-1, 1 indicating perfect predictive power [109]. This provides a measure of the model's ability to discriminate between subjects who experienced the outcome of interest (marital violence) versus those who did not [108]. As a general rule, an AUC of 0.5 suggests no discrimination between the model's ability to discriminate between those with the outcome to those without. An AUC of 0.7-0.8 is considered an acceptable discrimination, 0.8-0.9 is excellent and 0.9 is outstanding. In practice, an AUC of 0.9 is extremely unusual and unlikely [108].

Additionally, we evaluated concentration of risk of marital violence among the 5% of respondents with highest predicted risk of marital violence based on the final model, which we defined as the proportion of all observed cases of marital violence that was found among this 5% of respondents.

Given the possibility of overfitting our model due to a large number of predictors examined, we then used the method of replicated 10-fold cross-validation with 20 replicates [120, 121] and generated a predicted probability of marital violence for each respondent. A ROC and AUC were calculated to quantify overall prediction accuracy of the simulated data (20 times the original sample size, n=30,300). As with the observed data, we evaluated concentration of risk of marital violence among the 5% of respondents with highest predicted risk of marital violence. Using 10-fold cross-validation with 20 replicates corrects for the over-estimation of overall model prediction accuracy when estimating AUC and concentration of risk [120]. Essentially, this method randomly partitions the sample into 10 equal subsamples. Of these, a single subsample is retained as validation data for testing the model and the remaining nine are used as training data. This is repeated 10 times with one of the subsamples used as the validation data exactly one time. We then replicated this process 20 times, hence the name 10-fold cross validation with 20 replications [121].

Chapter 4. Results

Chapter 4. Results

Assessment of marital violence used the modified CTS [96] definition of moderate physical violence including pushing, grabbing, shoving, throwing something, slapping, or hitting. Comparative prevalence estimates of spousal report are shown in Table 4.1. Prevalence of husbands reporting perpetration of violence towards his current wife across surveys was 9.1% (162 respondents). Prevalence of wives reporting victimization of violence from their current husbands was also 9.1% (162 respondents). Although prevalence estimates were the same for husbands and wives, concordant responses were low. When looking at concordant responses, the prevalence of both reporting violence (i.e. husband reported perpetration towards current wife and wife reported victimization from current husband) was 3.8% (76 couples). As shown in Table 4.1, the combined measure of female victimization of violence (via either husband or wife report) was 14.4% (248 couples) which was used as the outcome measure for this project.

Table 4.1. Prevalence of marital violence ever in current marriage in the 6 World Mental Health Survey countries with couples samples, as reported by either spouse[a] (n=1,515)[a]

Violence report	% (se)	(n)
Husband reports perpetration[b]	9.10 (0.81)	(162)
Wife reports victimization[c]	9.10 (0.81)	(162)
Either spouse report marital violence	14.40 (0.98)	(248)
Both report marital violence	3.80 (0.56)	(76)

Abbreviations: se, standard error, n, number of observed cases of the outcome in the sample.
[a] Based on weighted data. Marital violence is defined as moderate physical violence
[b] husband reports perpetration of marital violence towards his current wife (whether or not wife reports victimization)
[c] wife reports victimization of marital violence from her current husband (whether or not husband reports perpetration)

Prevalence estimates differed significantly across all surveys ($\chi^2_5 = 27.9$, p<0.001) ranging from 8.8% in Lebanon to 22.2% in the United States (Table 4.2).

Table 4.2. Prevalence of marital violence ever in current marriage in the 6 World Mental Health Survey countries with couples samples, as reported by either spouse[a]

	Couples sample size[b]	% (se)	(n)
Brazil	133	21.80 (3.21)	(33)
Bulgaria	422	10.67 (1.59)	(52)
People's Republic of China	104	16.25 (3.20)	(21)
Lebanon	159	8.75 (3.23)	(14)
Nigeria	305	12.16 (2.65)	(50)
United States	392	22.22 (1.77)	(78)
Total	1515	14.40 (0.98)	(248)

Abbreviations: se, standard error, n, number of observed cases of the outcome in the sample.
[a] Based on weighted data
[b] The number of heterosexual couples in each country sample.

4.1 Aim 1 Results

4.1.1 Aim 1 Bivariate analysis

As shown in Table 4.3, the highest education level for both wives and husbands was high-average, 34.26% and 35.83% respectively. The most common parent occupation categories for wives and husbands was low-average prestige, at 47.39% and 48.94% respectively. An overwhelming majority of respondents were in their first marriage with just under 90% of wives and approximately 84% of husbands reporting no previous marriages.

For wives, the odds of marital violence were significantly higher among those with low (OR 2.5; 95%CI 1.4-4.4) and low-average education levels (OR 1.8; 95%CI 1.0-3.2) when compared to those with high education. The odds of marital violence were also significantly higher among wives who were not in their first marriage (OR 1.9; 95% CI 1.2-2.9). Similarly, the odds of marital violence were significantly higher for husbands with low (OR 3.2; 95% CI 1.9-5.3), low-average (OR 2.7; 95% CI 1.7-4.3), and high-average education levels (OR 2.1; 95% CI 1.4-3.2) when compared to those with high education. Additionally, the odds of marital violence were

significantly higher among husbands whose age of first marriage was in the young quartile (OR 1.7; 95% CI 1.1-2.7) when compared to those in the old quartile.

Table 4.3. Prevalence and bivariate associations of marital violence ever in current marriage, as reported by either spouse, with demographic characteristics: separate models for predictors reported by wives and husbands (n=1,515)[a]

	Wives		Husbands	
	% (se)	OR (95% CI)	% (se)	OR (95% CI)
Education				
Low	16.40 (1.11)	2.5 (1.4-4.4)*	15.91 (1.11)	3.2 (1.9-5.3)*
Low-average	28.03 (1.43)	1.8 (1.0-3.2)*	25.84 (1.54)	2.7 (1.7-4.3)*
High-average	34.26 (1.63)	1.4 (0.9-2.3)	35.83 (1.62)	2.1 (1.4-3.2)*
High	21.35 (1.61)	1.0	22.43 (1.39)	1.0
		$\chi^2_{(3)}$ 10.7, p=0.01		$\chi^2_{(3)}$ 24.5, p<0.001
Highest parent education				
Low	42.03 (1.43)	1.4 (0.8-2.5)	47.67 (1.67)	2.1 (1.0-4.5)
Low-average	31.04 (1.40)	1.3 (0.7-2.1)	29.59 (1.40)	2.1 (1.0-4.4
High-average	17.05 (1.24)	1.0 (0.6-1.9)	14.74 (1.02)	1.1 (0.5-2.8)
High	9.87 (1.01)	1.0	8.00 (0.86)	1.0
		$\chi^2_{(3)}$ 2.0, p=0.17		$\chi^2_{(3)}$ 6.9, p=0.08
Highest parent occupation				
Never worked	1.32 (0.25)	1.2 (0.3-5.4)	1.45 (0.39)	1.0 (0.2-4.9)
Low	31.51 (1.46)	1.6 (0.9-2.8)	35.04 (1.57)	1.7 (0.9-3.4)
Low-average	47.39 (1.46)	1.3 (0.8-2.1)	48.94 (1.62)	1.5 (0.9-2.6)
High-average	5.45 (0.61)	1.1 (0.6-2.3)	4.04 (0.58)	0.7 (0.2-2.1)
High	14.33 (1.07)	1.0	10.53 (1.07)	1.0
		$\chi^2_{(4)}$ 3.3, p=0.50		$\chi^2_{(4)}$ 6.1, p=0.20
In first marriage				
Yes	89.14 (1.00)	1.0	83.75 (1.01)	1.0
No	10.86 (1.00)	1.9 (1.2-2.9)*	16.25 (1.01)	1.02 (0.7-1.5)
		$\chi^2_{(1)}$ 7.6, p=0.006		$\chi^2_{(1)}$ 0.0, p=0.92
Age when first married				
Young	25.76 (1.62)	1.6 (1.1-2.5)*	27.44 (1.55)	1.7 (1.1-2.7)*
Young-average	28.02 (1.50)	0.9 (0.6-1.4)	17.73 (1.19)	0.7 (0.4-1.3)
Old-average	22.13 (1.33)	1.0 (0.7-1.6)	33.62 (1.56)	1.2 (0.7-1.9)
Old	24.09 (1.19)	1.0	21.22 (1.46)	1.0
		$\chi^2_{(3)}$ 7.0, p=0.07		$\chi^2_{(3)}$ 9.9, p=0.02

Abbreviations: se, standard error, n, number of observed cases of the outcome in the sample.
* significant at the 0.05 level, two sided test
[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife

A total of eight relationship factors were specified reflecting interactions between couple characteristics, Table 4.4. These include two variables measuring the highest education level within the couple, two variables measuring education differences, a variable measuring marital

differences, a variable measuring age differences, an eight category variables combining age

difference, age when first married and number of marriages, and a four category variable

combining age when first married between spouses.

Table 4.4. Prevalence and bivariate associations of marital violence ever in current marriage, as reported by either spouse, with relationship characteristics of demographics (n=1,515)[a]

			% (se)	OR (95% CI)
Highest education level in couple				0.7 (0.6-0.8)*
Highest education level in couple categories				
Low			9.01 (0.82)	3.5 (2.0-6.1)*
Low-average			22.59 (1.44)	2.2 (1.2-3.8)*
High-average			37.70 (1.73)	1.8 (1.1-2.7)*
High			30.69 (1.62)	1.00
				$\chi^2_{(3)}$ 20.3, p<0.001
Education difference – 3 categories				
Wife > = husband			75.94 (1.21)	1.8 (0.8-4.2)
Husband 1 level higher than wife			19.48 (1.20)	1.5 (0.6-3.6)
Husband 2 or more education levels higher			4.58 (0.70)	1.00
				$\chi^2_{(2)}$ 2.3, p=0.31
Education difference 5 categories				
Wife 2 or more levels higher			3.73 (0.53)	1.9 (0.7-5.2)
Wife 1 level higher			17.17 (1.13)	1.8 (0.7-4.5)
same education level between spouses			55.04 (1.40)	1.8 (0.8-4.2)
Husband 1 level higher			19.48 (1.20)	1.5 (0.6-3.6)
Husband 2 or more levels higher			4.58 (0.70)	1.00
				$\chi^2_{(4)}$ 1.9, p=0.59
Age difference categories				
Wife 2 or more years older			6.34 (0.82)	2.0 (1.1-3.8)*
Wife 1 year older			4.21 (0.60)	1.2 (0.6-2.5)
Wife and husband same age			8.90 (0.93)	1.00 (0.6-1.8)
Husband 1 year older			9.61 (0.83)	0.8 (0.4-1.4)
Husband 2 or more years older			70.95 (1.52)	1.00
				$\chi^2_{(4)}$ 9.1, p=0.06
Couple marriage categories				
Wife more marriages than husband			4.93 (0.65)	2.7 (1.5-4.8)*
Husband more marriages than wife			11.46 (0.94)	1.1 (0.7-1.8)
Both previously married			4.06 (0.64)	1.0 (0.4-2.1)
Both in first marriage			79.54 (1.24)	1.00
				$\chi^2_{(3)}$ 11.5, p=0.009
Age when first married and age differences – 8 combinations				
Husband young when first married	Wife more marriages than husband	Wife 2 or more years older than husband		
1	1	1	0.35 (0.19)	0.6 (0.1-6.3)
1	1	0	0.74 (0.25)	1.7 (0.3-10.2)
1	0	1	2.73 (0.57)	3.1 (1.3-7.4)*
0	1	1	1.01 (0.35)	6.1 (1.8-21.2)*

1	0	0	23.61 (1.53)	1.8 (1.2-2.7)*
0	1	0	2.82 (0.56)	3.4 (1.6-6.9)*
0	0	1	2.24 (0.41)	1.5 (0.5-4.3)
0	0	0	66.89 (1.57)	1.00
				$\chi^2_{(7)}$ 24.7, p=0.001

Age when first married - 4 combinations

Husband young when first married	Wife young when first married		
1	1	12.91 (1.13)	2.0 (1.2-3.2)*
1	0	14.53 (1.29)	1.9 (1.2-3.0)*
0	1	12.86 (1.20)	1.9 (1.2-3.0)*
0	0	59.71 (1.63)	1.00
			$\chi^2_{(3)}$ 16.4, p=0.001

Abbreviations: se, standard error, n, number of observed cases of the outcome in the sample.
* significant at the 0.05 level, two sided test
[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife

Bivariate analyses identified five of the eight variables as statistically significant. For the variables assessing educational differences, only the two measuring the highest education level within the couple, regardless of which member, reached statistical significance. As a continuous variable, the odds of marital violence decreased as the highest educational attainment level of the couple increased (OR 0.7; 95% CI 0.6-0.8). As a categorical variable, the odds of marital violence were significantly higher among couples with the highest education level as low, (OR 3.5; 95% CI 2.0-6.1), low-average, (OR 2.2; 95% CI 1.2-3.8), and high-average, (OR 1.8; 95% CI 1.1-2.7) when compared to those whose highest education level was in the high category. Examination of the difference in education did not identify any statistically significant results. Results suggest that the odds of marital violence increase in couples where the wife has achieved a higher education level than her husband. However, odds ratios for this difference were not statistically significant.

When considering age differences between members of the couple, the odds of marital violence reached statistical significance when the wife was two or more years old than her husband (OR 2.0; 95% CI 1.1-3.8) when compared to couples where the husband was two or more years

older than the wife. Additionally, the odds of marital violence reached statistical significance for couples where the wife was in more marriages than the husband (OR 2.7, 95% CI 1.5-4.8) when compared to couples where both were in their first marriage. As these two variables potentially measure the same thing, a tetrachoric correlation coefficient was calculated with dummy variables for each of the significant levels (wife two or more years older than husband and wife in more marriages than husband) resulting in a moderately strong positive relationship ($\rho = 0.5$).

Results from analyses of education and marriage history differences identifies complex associations between these factors. Therefore, a variable combining the three dummy variables for husband being young when first married, the wife having more marriages than her husband, and the wife being two or more years older than her husband was then constructed. This variable reflects all eight possible combinations to identify specific levels of increased risk of marital violence.

4.1.2 Aim 2 Multivariate analysis

Model 1 – Model 1 included variables indicating whether the wife was in her first marriage, highest occupation of the husband's parents, husband being young when first married, highest education level in the couple, whether the wife was in more marriages than her husband, and whether the wife was two or more years older than her husband (Table 4.5, Model 1). These variables were significant as a set within the model (χ^2_6 42.3, p<0.001) however, only one predictor reached statistical significance. As a continuous variable, the odds of marital violence decreased as the highest educational attainment level of the couple increased (OR 0.8; 95% CI 0.6-0.9). Comparing whether the wife was in her first marriage to marital differences between the couple suggests that wives independent experience of previous marriages was not

statistically associated with risk of marital violence (1.0; 95% CI 0.5-2.0). The number of her previous marriages relative to her current husband was associated with an increase in odds (OR 2.2; 95% CI 0.9-5.3). However, the difference in number of previous marriages was also insignificant.

Model 2 – Model 2 did not include the variable measuring whether the wife was in her first marriage. The highest education of the couple retained significance (OR 0.8 95% CI 0.6-0.9) where wife being in more marriages than her current husband reached statistical significance (OR 2.2, 95% CI 1.2-4.1), (Table 4.5, Model 2).

Model 3 – Since parental occupation for the husband remained insignificant, this variable was removed from Model 3. The highest education level within the couple (OR 0.7; 95% CI 0.6-0.9) and wife being in more marriages than her current husband (OR 2.2; 95% CI 1.2-4.1) retained significance, where the indicator variable for the husband being young when first married and the wife being two or more years older than her husband remained insignificant, (Table 4.5, Model 3).

Model 4 – Despite associations identified in bivariate analyses, the indicator variable for the wife being two or more years older than her current husband had not reached statistical significance in any of the multivariate models. As a result, we dropped this variable resulting in our final model for this predictor set. The final model included the husband being young when first married (OR 1.5; 95% CI 1.1-2.2), the highest education level within the couple (OR 0.7; 95% CI 0.6-0.9), and the wife being in more marriages than her current husband (OR 2.4; 95%

CI 1.3-4.4). The odds ratios for these parameter estimates were significant as a set (χ^2_3 36.7, p<0.001), (Table 4.5, Model 4).

Supplemental results from preliminary models are available in Appendix A, Table 1.

Table 4.5. Multivariate models of marital violence ever in current marriage, as reported by either spouse, with demographics from both spouses and relationship characteristics (n=1,515)[a]

	Bivariate models	Model 1	Model 2	Model 3	Model 4[b]
	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
I. Wife's Demographic characteristics					
Education	0.7 (0.6-0.9)*				
Education categories					
Low	2.5 (1.4-4.4)*				
Low-average	1.8 (1.0-3.2)*				
High-average	1.4 (0.9-2.3)				
High	1.0				
	$\chi^2_{(3)}$ 10.7, p=0.01				
Highest parent education	0.9 (0.7-1.1)				
Highest parent education categories					
Low	1.4 (0.8-2.5)				
Low-average	1.3 (0.7-2.1)				
High-average	1.0 (0.6-1.9)				
High	1.0				
	$\chi^2_{(3)}$ 2.0, p=0.17				
Highest parent occupation	0.9 (0.7-1.0)				
Highest parent occupation categories					
Never worked	1.2 (0.3-5.4)				
Low	1.6 (0.9-2.8)				
Low-average	1.3 (0.8-2.1)				
High-average	1.1 (0.6-2.3)				
High	1.0				
	$\chi^2_{(4)}$ 3.3, p=0.50				
In first marriage					
Yes	1.0	1.0 (0.5-2.0)			
No	1.9 (1.19-2.9)*				
	$\chi^2_{(1)}$ 7.6, p=0.006				
Age when first married	0.9 (0.7-1.0)				
Age when first married categories					
Young	1.6 (1.1-2.5)*				
Young-average	0.9 (0.6-1.4)				
Old-average	1.0 (0.7-1.6)				
Old	1.0				

	$\chi^2_{(3)}$ 7.0, p=0.07				
II. Husband's demographic characteristics					
Education	0.7 (0.6-0.8)*				
Education categories					
Low	3.2 (1.9-5.3)*				
Low-average	2.7 (1.7-4.3)*				
High-average	2.1 (1.4-3.2)*				
High	1.0				
	$\chi^2_{(3)}$ 24.5, p<0.001				
Highest parent education	0.8 (0.6-0.9)*				
Highest parent education categories					
Low	2.1 (1.0-4.5)				
Low-average	2.1 (1.0-4.4				
High-average	1.1 (0.5-2.8)				
High	1.0				
	$\chi^2_{(3)}$ 6.9, p=0.08				
Highest parent occupation	0.9 (0.7-1.0)	0.9 (0.7-1.1)	0.9 (0.7-1.1)		
Highest parent occupation categories					
Never worked	1.0 (0.2-4.9)				
Low	1.7 (0.9-3.4)				
Low-average	1.5 (0.9-2.6)				
High-average	0.7 (0.2-2.1)				
High	1.0				
	$\chi^2_{(4)}$ 6.1, p=0.20				
In first marriage					
Yes	1.0				
No	1.02 (0.7-1.5)				
	$\chi^2_{(1)}$ 0.0, p=0.92				
Age when first married	0.9 (0.7-1.0)				
Age when first married categories					
Young	1.7 (1.1-2.7)*	1.4 (1.0-2.1)	1.4 (1.0-2.1)	1.5 (0.9-2.2)	1.5 (1.1-2.2)*
Young-average	0.7 (0.4-1.3)				
Old-average	1.2 (0.7-1.9)				
Old	1.0				
	$\chi^2_{(3)}$ 9.9, p=0.02				
II. Relationship characteristics					
Highest education level in couple	0.9 (0.6-0.8)*	0.8 (0.6-0.9)*	0.8 (0.6-0.9)*	0.7 (0.6-0.9)*	0.7 (0.6-0.9)*
Highest education level in couple categories					
Low	3.5 (2.0-6.1)*				
Low-average	2.2 (1.2-3.8)*				

High-average		1.8 (1.1-2.7)*				
High		1.00				
		$\chi^2_{(3)}$ 20.3, p<0.001				
Education difference – 3 categories						
Wife > = husband		1.8 (0.8-4.2)				
Husband 1 level higher than wife		1.5 (0.6-3.6)				
Husband 2 or more education levels higher		1.00				
		$\chi^2_{(3)}$ 2.3, p=0.31				
Education difference 5 categories						
Wife 2 or more levels higher		1.9 (0.7-5.2)				
Wife 1 level higher		1.8 (0.7-4.5)				
same education level between spouses		1.8 (0.8-4.2)				
Husband 1 level higher		1.5 (0.6-3.6)				
Husband 2 or more levels higher		1.00				
		$\chi^2_{(4)}$ 1.9, p=0.59				
Couple marriage categories						
Wife more marriages than husband		2.7 (1.5-4.8)*	2.2 (0.9-5.3)	2.2 (1.2-4.1)*	2.2 (1.2-4.1)*	2.4 (1.3-4.4)*
Husband more marriages than wife		1.1 (0.7-1.8)				
Both previously married		1.0 (0.4-2.1)				
Both in first marriage		1.00				
		$\chi^2_{(3)}$ 11.5, p=0.009*				
Age difference categories						
Wife 2 or more years older		2.0 (1.1-3.8)*	1.6 (0.8-2.9)	1.6 (0.8-2.9)	1.5 (0.8-2.9)	
Wife 1 year older		1.2 (0.6-2.5)				
Wife and husband same age		1.00 (0.6-1.8)				
Husband 1 year older		0.8 (0.4-1.4)				
Husband 2 or more years older		1.00				
		$\chi^2_{(4)}$ 9.1, p=0.06				

Age when first married and age differences – 8 combinations

Husband young when first married	Wife more marriages than husband	Wife 2 or more years older than husband	
1	1	1	0.6 (0.1-6.3)
1	1	0	1.7 (0.3-10.2)
1	0	1	3.1 (1.3-7.4)*
0	1	1	6.1 (1.8-21.2)*
1	0	0	1.8 (1.2-2.7)*
0	1	0	3.4 (1.6-6.9)*
0	0	1	1.5 (0.5-4.3)

0	0	0	1.00
			$\chi^2_{(7)}$ 24.7, p=0.001

Age when first married - 4 combinations

Husband young when first married	Wife young when first married		
1	1	2.0 (1.2-3.2)*	
1	0	1.9 (1.2-3.0)*	
0	1	1.9 (1.2-3.0)*	
0	0	1.00	
		$\chi^2_{(3)}$ 16.4, p=0.001	

Multivariate model χ^2	$\chi^2_{(6)}$ 42.3, p<0.001	$\chi^2_{(5)}$ 42.3, p<0.001	$\chi^2_{(4)}$ 37.3, p<0.001	$\chi^2_{(3)}$ 36.7, p<0.001

* significant at the .05 level, two sided test
[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife
[b] Model 4 identifies the final model for this predictor set

4.2 Aim 2 Results

4.2.1 Aim 2 Bivariate Analysis for Wives

Prevalence measures of childhood adversities are shown in Table 4.6 for wives and husbands separately. Overall, the prevalence of individual adversities ranged from a low of 1.9% (experienced economic adversity) to a high of 9.0% (other parental loss). Five of the 12 childhood adversities were significantly associated with elevated risk of marital violence in the bivariate models. Statistically significant variables included physical abuse (OR 2.5; 95% CI .5-4.3), sexual abuse (OR 4.7; 95% CI 2.2-9.4), neglect (OR 2.9; 95% CI 1.4-6.1), other parental loss (OR 1.8; 95% CI 1.2-2.7) and having a parent with a substance disorder (OR 2.1; 95% CI 1.1-4.0).

A total of 56 of the 66 tetrachoric correlations between pairs of childhood adversities (85%) were positive among wives. The median correlation was 0.31 and interquartile range (25th to 75th percentiles) was (0.15-0.49). Factor analysis identified one dominant grouping representing maladaptive family functioning (MFF) (physical and sexual abuse, neglect, parent with a mental disorder, parent with a substance disorder, parental criminality and witnessing family violence), with factor loadings ranging from 0.60-0.86 for each item. With the exception of experiencing economic adversity, the remaining childhood adversities were less highly inter-correlated. However, for conceptual consistency, we chose not to include economic adversity as a measure of MFF [37, 113].

Table 4.6. Prevalence and bivariate associations of marital violence ever in current marriage, as reported by either spouse, with childhood adversities: separate models for predictors reported by wives and husbands (n=1,515)[a]

	Wives		Husbands	
	% (se)	OR (95% CI)	% (se)	OR (95% CI)
Physical abuse				
	6.2 (0.64)	2.5 (1.5-4.3)*	7.8 (0.80)	2.2 (1.4-3.5)*
		$\chi^2_{(1)}$ 11.6, p=0.001		$\chi^2_{(1)}$ 10.8, p=0.001
Sexual abuse				
	2.4 (0.49)	4.7 (2.2-9.4)*	0.5 (0.20)	1.9 (0.4-10.4)
		$\chi^2_{(1)}$ 11.6, p=0.001		$\chi^2_{(1)}$ 0.6, p=0.44
Neglect				
	3.7 (0.76)	2.9 (1.4-6.1)*	2.4 (0.47)	1.6 (0.7-3.7)
		$\chi^2_{(1)}$ 8.1, p=0.004		$\chi^2_{(1)}$ 1.2, p=0.28
Mother died				
	4.4 (0.59)	0.7 (0.3-1.6)	4.7 (0.56)	1.8 (0.9-3.5)
		$\chi^2_{(1)}$ 0.8, p=0.37		$\chi^2_{(1)}$ 3.3, p=0.07
Father died				
	8.4 (0.83)	0.8 (0.4-1.3)	8.6 (0.80)	1.3 (0.7-2.3)
		$\chi^2_{(1)}$ 1.0, p=0.33		$\chi^2_{(1)}$ 0.5, p=0.48
Other parental loss				
	9.0 (0.67)	1.8 (1.2-2.7)*	5.8 (0.62)	1.2 (0.6-2.2)
		$\chi^2_{(1)}$ 8.0, p=0.005		$\chi^2_{(1)}$ 0.2, p=0.68
A parent had a mental disorder				
	6.6 (0.79)	1.5 (0.9-2.8)	6.3 (0.72)	1.3 (0.6-2.4)
		$\chi^2_{(1)}$ 2.1, p=0.15		$\chi^2_{(1)}$ 0.4, p=0.51
A parent had a substance disorder				
	3.3 (0.63)	2.1 (1.1-4.0)*	2.5 (0.38)	2.5 (1.3-4.7)*
		$\chi^2_{(1)}$ 4.9, p=0.03		$\chi^2_{(1)}$ 7.7, p=0.006
A parent was involved in criminal behavior				
	2.3 (0.40)	1.8 (0.7-5.0)	2.5 (0.46)	1.9 (0.9-4.4)
		$\chi^2_{(1)}$ 1.7, p=0.20		$\chi^2_{(1)}$ 2.4, p=0.12
Witnessed family violence				
	4.3 (0.55)	2.1 (0.9-5.0)	4.0 (0.59)	1.9 (1.1-3.4)*
		$\chi^2_{(1)}$ 2.8, p=0.10		$\chi^2_{(1)}$ 1.0, p=0.03
Had a life threatening physical illness				
	3.0 (0.55)	0.7 (0.3-1.6)	4.4 (0.57)	0.7 (0.3-1.7)

	% (se)	OR (95% CI)	% (se)	OR (95% CI)
		$\chi^2_{(1)}$ 0.7, p=0.40		$\chi^2_{(1)}$ 0.6, p=0.44
Experienced economic adversity	1.9 (0.51)	1.2 (0.4-4.0)	2.2 (0.45)	0.9 (0.3-2.7)
		$\chi^2_{(1)}$ 0.1, p=0.72		$\chi^2_{(1)}$ 0.0, p=0.89
Maladaptive family functioning CAs count		1.5 (1.2-1.8)*		1.3 (1.1-1.6)*
Maladaptive family functioning CAs count categories				
0	82.5 (1.13)	1.00	83.4 (1.04)	1.00
Exactly 1	11.3 (0.85)	1.9 (1.2-3.1)*	11.6 (0.91)	2.2 (1.4-3.4)*
Exactly 2	3.2 (0.52)	3.1 (1.6-6.1)*	2.6 (0.38)	2.5 (1.3-4.5)*
Exactly 3	1.8 (0.45)	1.7 (0.5-6.0)	1.1 (0.36)	2.0 (0.5-7.9)
Exactly 4	0.7 (0.21)	7.8 (2.1-29.2)*	0.8 (0.25)	0.9 (0.3-3.1)
Exactly 5	0.2 (0.08)	6.5 (1.1-38.3)*	0.2 (0.10)	23.4 (2.6-213.2)
Exactly 6	0.1 (0.08)	0.0 (0.0-0.0)	0.3 (0.15)	0.9 (0.1-10.1)
Exactly 7	0.1 (0.10)	--[b]	0.04 (0.04)	--[b]
		$\chi^2_{(5)}$ 640.8, p<0.001		$\chi^2_{(5)}$ 189.9, p<0.001
Maladaptive family functioning CAs – 4 categories		1.6 (1.3-2.0)*		1.4 (1.2-1.8)*
Maladaptive family functioning CAs – 4 categories				
0	82.5 (1.13)	1.00	83.4 (1.04)	1.00
Exactly 1	11.3 (0.85)	1.9 (1.2-3.1)*	11.6 (0.91)	2.2 (1.4-3.4)*
Exactly 2	3.2 (0.52)	3.1 (1.6-6.0)*	2.6 (0.38)	2.5 (1.3-4.5)*
3 or more	3.0 (0.49)	3.2 (1.3-8.0)*	2.4 (0.48)	2.0 (0.8-4.9)
		$\chi^2_{(3)}$ 20.6, p<0.001		$\chi^2_{(3)}$ 16.1, p<0.001
Maladaptive family functioning CAs – 2 categories				
0	82.5 (1.13)	1.00	83.4 (1.04)	1.00
1 or more	17.6 (1.13)	2.3 (1.6-3.4)*	16.6 (1.04)	2.2 (1.5-3.2)*
		$\chi^2_{(1)}$ 17.3, p<0.001		$\chi^2_{(1)}$, 14.8, p<0.001

Abbreviations: se, standard error, CA, childhood adversity
* significant at the 0.05 level, two sided test
[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife
[b] estimate would not converge

4.2.2 Aim 2 Multivariate Analysis for Wives

Model 1 – Model 1 estimated the relative odds of marital violence across all 12 categories of childhood adversity (Table 4.7, Model 1). The odds of marital violence were significantly higher for wives who were physically abused (OR 1.9; 95% CI 1.1-3.6), sexually abused (OR 3.5; 95% CI 1.4-7.7), and those who experiences with other parental loss (OR1.7; 95% CI 1.1-2.6) when compared to wives without these experiences. Since we identified clustering MFF, differences in mean odds were examined for these seven childhood adversities within the model. As a set, all seven MFF childhood adversities were significant predictors of marital violence (χ^2_7 28.9, p<0.001) but were not significantly different from each other (χ^2_6 5.2, p=0.52). The remaining five adversities were not significant as a set (χ^2_5 8.3, p=0.14) nor were they significantly different from each other (χ^2_4 8.3, p=0.08).

Model 2 – Results from Model 1 supported the use of a count variable for the seven MFF childhood adversities, ranging from 0-7. Model 2 included this count variable. As the number of MFF childhood adversities increased, the odds of marital violence increased (OR 1.5; 95% CI 1.2-1.8) (Table 4.7, Model 2).

Model 3 – In a third model, a categorical variable representing the number of reported MFF adverse experiences was constructed. This measure had four levels; 0, exactly 1, exactly 2, and 3 or more. Dummy variables for each were included in Model 3, (Table 4.7). The odds of marital violence were significantly higher for wives with exactly one (OR 1.9; 95% CI 1.2-3.1), exactly two (OR 3.1; 95% CI 1.6-6.0), and three or more MFF childhood adversities (OR 3.2; 95% CI 1.3-8.0) when compared to those with none. Differences in mean odds shows that these categories were significant as a set (χ^2_3 20.6, p<0.001) but not significantly different from one another (χ^2_2 1.9, p=0.38).

Model 4 – Finally, an indicator variable for one or more MFF childhood adversities was included in the final model for wives, (Table 4.7, Model 4). This variable was significant (OR 2.3; 95% CI 1.6-3.4) when compared to wives with no MFF childhood adversities, (χ^2_1 17.3, p<0.001).

Supplemental results from preliminary models are available in Appendix A, Table 2.

Table 4.7. Multivariate models of marital violence ever in current marriage, as reported by either spouse, with wife's childhood adversities (n=1,515)[a]

	Model 1	Model 2	Model 3	Model 4
	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
Physical abuse	1.9 (1.1-3.6)*			
Sexual abuse	3.5 (1.4-7.7)*			
Neglect	1.8 (0.8-4.4)			
Mother died	0.7 (0.2-7.8)			
Father died	0.8 (0.5-1.4)			
Other parental loss	1.7 (1.1-2.6)*			
A parent had a mental disorder	1.0 (0.5-2.1)			
A parent had a substance disorder	1.3 (0.6-2.8)			
A parent was involved in criminal behavior	1.2 (0.4-3.6)			
Witnessed family violence	1.1 (0.4-3.1)			
Had a life threatening physical illness	0.6 (0.2-1.5)			
Experienced economic adversity	0.7 (0.2-2.2)			

Maladaptive family functioning CAs count		1.5 (1.2-1.8)*		
Maladaptive family functioning CAs count categories				
0				
Exactly 1				
Exactly 2				
Exactly 3				
Exactly 4				
Exactly 5				
Exactly 6				
Exactly 7				
Maladaptive family functioning CAs – 4 categories				
Maladaptive family functioning CAs – 4 categories				
0				
Exactly 1			1.9 (1.2-3.1)*	
Exactly 2			3.1 (1.6-6.0)*	
3 or more			3.2 (1.3-8.0)*	
Maladaptive family functioning CA – 2 categories				
0				
1 or more			2.3 (1.6-3.4)*	
Maladaptive family functioning difference in slopes χ^2 tests	$\chi^2_{(7)}$ 28.9, p<0.001 $\chi^2_{(6)}$ 5.2, p=0.52			
Remaining CAs difference in slopes χ^2 tests	$\chi^2_{(5)}$ 8.3, p=0.14 $\chi^2_{(4)}$ 8.3, p=0.08			
Multivariate model χ^2	$\chi^2_{(12)}$ 41.9, p<0.001	$\chi^2_{(1)}$ 15.9, p<0.001	$\chi^2_{(3)}$ 20.6, p<0.001 $\chi^2_{(2)}$ 1.9, p=0.38	$\chi^2_{(1)}$ 17.3, p<0.001

Abbreviations: se, standard error, CA, childhood adversity
* significant at the 0.05 level, two sided test
[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife

4.2.3 Aim 2 Bivariate Analysis for Husbands

The prevalence of childhood adversities are shown in Table 4.6 for wives and husbands

separately. Prevalence of individual adversities ranged from a low of 0.5% (sexual abuse) to a

high of 8.6% (father died). Three of the 12 childhood adversities were significantly associated

with elevated risk of marital violence in bivariate models. These included physical violence (OR

2.2; 95% CI 1.4-3.5), having a parent with a substance disorder (OR 2.5 95% CI 1.3-4.7), and

witnessing family violence (OR 1.9; 95% CI 1.1-3.4).

Fifty-three of the 66 tetrachoric correlations between pairs of childhood adversities (80%) were

positive among husbands. The median correlation was 0.29 and interquartile range (25th to 75th

percentiles) was (0.13-0.51). Similar to analyses of data from wives, results from factor analysis

identified one factor representing MFF (physical and sexual abuse, neglect, parent with a

mental disorder, parent with a substance disorder, parental criminality and witnessing family

violence), with factor loadings ranging from 0.59-0.90. With the exception of experiencing

economic adversity, the remaining childhood adversities were less highly inter-correlated.

However, for conceptual consistency, we chose not to include economic adversity as a measure

of MFF [37, 113].

4.2.2 Aim 2 Multivariate Analysis for Husbands

Model 1 – Model 1 estimated the relative odds of marital violence across all 12 categories of

childhood adversity (Table 4.8, Model 1). The odds of marital violence were significantly higher

in husbands who were physically abused (OR 2.1; 95% CI 1.2-3.8). Since we identified

clustering MFF, differences in mean odds were examined for these seven childhood adversities

within the model. As a set, all seven MFF childhood adversities were significant predictors of

marital violence (χ^2_7 18.8, p=0.0091) but were not significantly different from each other (χ^2_6 3.8,

p=0.67). The remaining five adversities were not significant as a set (χ^2_5 5.2, p=0.39) nor were they significantly different from each other (χ^2_4 4.4, p=0.35).

Model 2 – Results from Model 1 supported the use of a count variable for the seven MFF childhood adversities ranging from 0-7. Model 2 included this count variable. As the number of MFF childhood adversities increased the odds of marital violence increased (OR 1.3; 95% CI 1.1-1.6) (Table 4.8, Model 2).

Model 3 – In a third model, a categorical variable representing the number of reported MFF adverse experiences was constructed. This measure had four levels; 0, exactly 1, exactly 2, and 3 or more. Dummy variables for each were included in Model 3, (Table 4.8). The odds of marital violence were significantly higher for husbands with exactly one (OR 2.1; 95% CI 1.4-3.4) and exactly two (OR 2.5; 95% CI 1.3-4.5) when compared to those with none. Differences in mean odds shows that these categories are significant as a set (χ^2_3 16.1, p<0.001) but not significantly different from one another (χ^2_2 0.2, p=0.90).

Model 4 – Finally, an indicator variable for one or more MFF childhood adversities was included in the final model for husbands, (Table 4.8, Model 4). This variable was significant (OR 2.2; 95% CI 1.5-3.2) when compared to husbands with no MFF childhood adversities, (χ^2_1 14.8, p<0.001).

Supplemental results from preliminary models are available in Appendix A, Table 3.

Table 4.8. Multivariate models of marital violence ever in current marriage, as reported by either spouse, with husband's childhood adversities (n=1,515)[a]

	Model 1	Model 2	Model 3	Model 4
	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
Physical abuse	2.1 (1.2-3.8)*			
Sexual abuse	1.8 (0.4-9.0)			
Neglect	0.8 (0.4-2.7)			
Mother died	1.8 (0.9-3.4)			
Father died	1.2 (0.6-2.3)			
Other parental loss	1.0 (0.5-1.9)			
A parent had a mental disorder	0.9 (0.4-2.0)			
A parent had a substance disorder	1.7 (0.6-4.7)			
A parent was involved in criminal behavior	1.5 (0.5-4.5)			
Witnessed family violence	1.2 (0.5-2.6)			
Had a life threatening physical illness	0.7 (0.3-1.7)			
Experienced economic adversity	0.6 (0.2-2.0)			

Maladaptive family functioning CA count	1.3 (1.1-1.6)*			
Maladaptive family functioning CA count categories				
0				
Exactly 1				
Exactly 2				
Exactly 3				
Exactly 4				
Exactly 5				
Exactly 6				
Exactly 7				
Maladaptive family functioning CAs – 4 categories				
Maladaptive family functioning CAs – 4 categories				
0				
Exactly 1			2.1 (1.4-3.4)*	
Exactly 2			2.5 (1.3-4.5)*	
3 or more			2.0 (0.8-4.9)	
Maladaptive family functioning CAs – 2 categories				
0				
1 or more				2.2 (1.5-3.2)*
Maladaptive family functioning difference in slopes χ^2 tests	$\chi^2_{(7)}$ 18.8, p=0.009 $\chi^2_{(6)}$ 3.8, p=0.67		$\chi^2_{(2)}$ 0.2, p=0.9	
Remaining CAs difference in slopes χ^2 tests	$\chi^2_{(5)}$ 5.2, p=0.39 $\chi^2_{(4)}$ 4.4, p=0.35			
Multivariate model χ^2	$\chi^2_{(12)}$ 24.6, p=0.02	$\chi^2_{(1)}$ 9.0, p=0.003	$\chi^2_{(3)}$ 16.1, p<0.001	$\chi^2_{(1)}$ 14.8, p<0.001

Abbreviations: se, standard error, CA, childhood adversity
* significant at the 0.05 level, two sided test
[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife

4.2.5 Aim 2 Multivariate Analysis for the Couple

Model 1 – Model 1 included independent indicator variables for childhood adversities (MFF) from each member of the couple and an interaction variable representing shared experience between the couple where both spouses had at least 1 MFF childhood adversity (Table 4.9, Model 1). Results from this model identified significantly increased odds of marital violence for couples where the wife or husband had experienced one or more categories of childhood adversity independently (OR 2.4; 95% CI 1.5-3.8, OR 2.3; 95% CI 1.4-3.6 respectively). The interaction variable, however, was insignificant.

Model 2 – Therefore, the final model for this predictor set estimated each spouse's independent experience of 1 or more MFF childhood adversities. The odds for marital violence were significantly higher for wives with this exposure (OR 2.2; 95% CI 1.5-3.7) as were the odds for husbands (OR 2.1; 95% CI 1.4-3.1), (Table 4.9, Model 2). Odds ratios for these two predictors were significant as a set (χ^2_2 32.5, p<0.001) but not significantly different from one another (χ^2_1 0.0, p=0.85).

Table 4.9. Multivariate models of marital violence ever in current marriage, as reported by either spouse, with childhood adversities from both husband and wife (n=1,515)[a]

	Model 1	Model 2[b]
	OR (95%CI)	OR (95%CI)
I. Wife's childhood adversities		
Maladaptive family functioning CAs – 2 categories		
0		
1 or more	2.4 (1.5-3.8)*	2.2 (1.5-3.2)*
II. Husband's childhood adversities		
Maladaptive family functioning CAs – 2 categories		
0		
1 or more	2.3 (1.4-3.6)*	2.1 (1.4-3.1)*
	$\chi^2_{(2)}$ 20.0, p<0.001	
III. Couple childhood adversity characteristics	$\chi^2_{(1)}$ 0.0, p=0.9	
Spousal maladaptive family functioning CA combinations		
both had at least 1 MFF CA	0.8 (0.4-1.6)	
All other combinations		
Multivariate model χ^2	$\chi^2_{(3)}$ 31.3, p<0.001	$\chi^2_{(2)}$ 32.5, p<0.001
		$\chi^2_{(1)}$ 0.0, p=0.85

Abbreviations: CA, childhood adversity, MFF, maladaptive family functioning
* significant at the 0.05 level, two sided test
[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife
[b] Model 2 identifies the final model for this predictor set

4.3 Aim 3 Results

4.3.1 Aim 3 Bivariate Analysis for Wives

As shown in Table 4.10, the majority of wives dated before the age of 21 (77.5%) and just under

7% ever experienced any violence in dating relationships before the age of 21. The odds of

marital violence were significantly higher among those who experienced any violence in

previous dating relationships (OR 2.4; 95%CI 1.5-3.8) when compared to those who did not

experience violence in dating relationships.

Age of first sexual intercourse was viewed in quartiles defined two separate ways; gender and country specific quartiles and age defined quartiles combining report from husbands and wives. Considering the similar bivariate results, we decided to use the age defined variable for ease of interpretation. This variable was initially examined in quartiles, however, due to sparse cell sizes, we constructed a three category variable for age of first sexual intercourse collapsing old-average and older than average into one category. Categories reflected age of first sexual intercourse as young (less than 18 years old), young-average (18-19 years old), and average and older (20 years or older). The odds of marital violence were significantly higher among those who initiated sexual intercourse at an early age (OR 1.9; 95% CI 1.2-3.1) when compared those who were average and older than average at the time of first sexual intercourse.

Table 4.10. Prevalence and bivariate associations of marital violence ever in current marriage, as reported by either spouse, with dating experiences: separate models for predictors reported by wives and husbands (n=1,515)[a]

	Wives		Husbands	
	% (se)	OR (95% CI)	% (se)	OR (95% CI)
Dated before age 21				
	77.5 (1.3)	0.9 (0.6-1.4)	72.1 (1.3)	1.1 (0.6-1.8)
		$\chi^2_{(1)}$ 0.1, p=0.78		$\chi^2_{(1)}$ 0.0, p=0.85
Ever experienced any violence in dating relationships before the age of 21[b]				
	6.8 (0.8)	2.4 (1.5-3.8)*	4.4 (0.6)	2.9 (1.6-5.0)*
		$\chi^2_{(1)}$ 13.9, p<0.001		$\chi^2_{(1)}$ 13.3, p<0.001
Age of first sexual intercourse quartiles[c]				
Young (less than 18 years old)	24.0 (1.3)	1.5 (0.9-2.7)	27.5 (1.4)	2.5 (1.5-4.2)*
Young-average (18-19 years old)	24.5 (1.4)	1.0 (0.6-1.6)	21.7 (1.4)	1.5 (0.8-2.8)
Old-average (20-22 years old)	30.5 (1.3)	0.7 (0.4-1.2)	26.2 (1.4)	1.6 (1.0-2.6)
Older than average (23 years or older)	21.1 (1.2)	1.0	24.7 (1.2)	1.00
		$\chi^2_{(3)}$ 8.5, p=0.04		$\chi^2_{(3)}$ 14.7, p=0.002
Collapsed age of first sexual intercourse				
Young (less than 18 years old)	24.0 (1.3)	1.9 (1.2-3.1)*	27.5 (1.4)	1.9 (1.2-2.8)*
Young-average (18-19 years old)	24.5 (1.4)	1.2 (0.8-1.8)	21.7 (1.4)	1.1 (0.6-1.9)
Average and older (20 years or older)	51.6 (1.5)	1.0	50.9 (1.7)	1.0
		$\chi^2_{(2)}$ 8.5, p=0.04		$\chi^2_{(2)}$ 8.5, p=0.04
Within country, gender specific, age of first sexual intercourse quartiles[d]				
Young	21.7 (1.3)	1.9 (1.2-3.2)*	24.0 (1.4)	2.4 (1.5-3.9)*
Young-average	28.2 (1.3)	0.9 (0.6-1.4)	25.6 (1.2)	2.1 (1.2-3.7)*
Old-average	25.8 (1.3)	1.2 (0.7-1.8)	31.6 (1.6)	1.4 (0.9-2.2)
Old	24.3 (1.4)	1.0	18.8 (1.3)	1.0
		$\chi^2_{(3)}$ 9.7, p=0.03		$\chi^2_{(3)}$ 13.4, p=0.004

Abbreviations: se, standard error
* significant at the 0.05 level, two sided test
[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife
[b] Any violence is defined as ever being a victim or perpetrator of moderate physical violence in any dating relationships. The reference includes those who did not date before 21
[c] Ages from husbands and wives of first sexual intercourse were examined together to define quartiles
[d] Quartiles defined within country and only included wife's age of first sexual intercourse data

4.3.2 Aim 3 Multivariate Analysis for Wives

Model 1 –Model 1 (Table 4.11) included indicator variables for whether the wife dated before

the age of 21, if she had ever experienced any violence in dating relationships before age 21,

and indicator variables for young and young-average age of first sexual intercourse. The odds of

marital violence were significantly higher among those who had experienced any dating

violence (OR 2.2; 95%CI 1.4-3.5) and those who were young at age of first sexual intercourse

(OR 1.8; 95%CI 1.3-3.0). Odds ratios for these predictors were significant as a set (χ^2_4 21.2,

p<0.001) and were significantly different from each other (χ^2_3 13.3, p=0.004). Therefore, the two

final variables for wives in this predictor group were ever experiencing any violence in dating

relationships before the age of 21 and young age of first sexual intercourse.

Table 4.11. Multivariate models of marital violence ever in current marriage, as reported by either spouse, with wife's dating experiences (n=1,515)[a]

	Wives	
	Bivariate Models OR (95% CI)	**Multivariate Model 1 OR (95% CI)**
Dated before age 21		
	0.9 (0.6-1.4)	0.8 (0.5-1.2)
	$\chi^2_{(1)}$ 0.1, p=0.78	
Ever experienced any violence in dating relationships before the age of 21[b]		
	2.4 (1.5-3.8)*	2.2 (1.4-3.5)*
	$\chi^2_{(1)}$ 13.9, p<0.001	
Age of first sexual intercourse quartiles[c]		
Young (less than 18 years old)	1.5 (0.9-2.7)	
Young average (18-19 years old)	1.0 (0.6-1.6)	
Old-average (20-22 years old)	0.7 (0.4-1.2)	
Older than average (23 years or older)	1.0	
	$\chi^2_{(3)}$ 8.5, p=0.04	
Collapsed age of first sexual intercourse		
Young (less than 18 years old)	1.9 (1.2-3.1)*	1.8 (1.1-3.0)*
Young average (18-19 years old)	1.2 (0.8-1.8)	1.3 (0.8-1.9)
Average and older (20 years or older)	1.0	
	$\chi^2_{(2)}$ 8.5, p=0.04	
Within country, gender specific age of first sexual intercourse quartiles		
Young	1.9 (1.2-3.2)*	
Young-average	0.9 (0.6-1.4)	
Old-average	1.2 (0.7-1.8)	
Old	1.0	
	$\chi^2_{(3)}$ 9.7, p=0.03	
Multivariate model χ^2		$\chi^2_{(4)}$ 21.2, p<0.001
		$\chi^2_{(3)}$ 13.3, p=0.004

* significant at the 0.05 level, two sided test
[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife
[b] Any violence is defined as ever being a victim or perpetrator of moderate physical violence in any dating relationships. The reference includes those who did not date before 21
[c] Ages from husbands and wives of first sexual intercourse were examined together to define quartiles

4.3.3 Aim 3 Bivariate Analysis for Husbands

As shown in Table 4.10, the majority of husbands dated before the age of 21 (72.1%) and 4.4%
ever experienced any violence in dating relationships before the age of 21. The odds of marital
violence was significantly higher among those who experienced any violence in dating
relationships (OR 2.9; 95%CI 1.6-5.0) when compared to those who did not experience violence
in dating relationships.

Age of first sexual intercourse was viewed in quartiles defined two separate ways; gender and country specific quartiles and age defined quartiles combining report from husbands and wives. For consistency, we decided to use the age defined variable for ease of interpretation. This variable was initially examined in quartiles, however, due to sparse cell sizes, we constructed a three category variable for age of first sexual intercourse collapsing old-average and older than average into one category. Categories reflected age of first sexual intercourse as young (less than 18 years old), young-average (18-19 years old), and average and older (20 years or older). The odds of marital violence were significantly higher among those who initiated sexual intercourse at an early age (OR 1.9; 95% CI 1.2-2.8) when compared those who were average and older than average at the time of first sexual intercourse.

4.3.4 Aim 3 Multivariate Analysis for Husbands

Model 1 –Model 1 (Table 4.12) included indicator variables for whether the wife dated before the age of 21, if she had ever experienced any violence in dating relationships before age 21, and indicator variables for young and young-average age of first sexual intercourse. The odds of marital violence were significantly higher among those who had experienced any dating violence (OR 2.9; 95%CI 1.6-5.0) and those who were young at age of first sexual intercourse (OR 1.9; 95%CI 1.3-2.9). Odds ratios were significant as a set (χ^2_4 27.1, p<0.001) and were significantly different from each other (χ^2_3 12.7, p=0.005). Therefore, the two final variables for wives in this predictor group were ever experiencing any violence in dating relationships before the age of 21 and young age of first sexual intercourse.

Table 4.12. Multivariate models of marital violence ever in current marriage, as reported by either spouse, with husband's dating experiences (n=1,515)[a]

	Husbands	
	Bivariate Models OR (95% CI)	Model 1
Dated before age 21		
	1.1 (0.6-1.8)	0.8 (0.5-1.4)
	$\chi^2_{(1)}$ 0.0, p=0.85	
Ever experienced any violence in dating relationships before the age of 21[b]		
	2.9 (1.6-5.0)*	2.9 (1.6-5.0)*
	$\chi^2_{(1)}$ 13.3, p<0.001	
Age of first sexual intercourse quartiles[c]		
Young (less than 18 years old)	2.5 (1.5-4.2)*	
Young average (18-19 years old)	1.5 (0.8-2.8)	
Old-average (20-22 years old)	1.6 (1.0-2.6)	
Older than average (23 years or older)	1.0	
	$\chi^2_{(3)}$ 14.7, p=0.002	
Collapsed age of first sexual intercourse		
Young (less than 18 years old)	1.9 (1.2-2.8)*	1.9 (1.3-2.9)*
Young average (18-19 years old)	1.1 (0.6-1.9)	1.1 0.6-1.9)
Average and older (20 years or older)	1.0	
	$\chi^2_{(2)}$ 8.5, p=0.04	
Within country, gender specific age of first sexual intercourse quartiles		
Young	2.4 (1.5-3.9)*	
Young-average	2.1 (1.2-3.7)*	
Old-average	1.4 (0.9-2.2)	
Old	1.0	
	$\chi^2_{(3)}$ 13.4, p=0.004	
Multivariate model χ^2		$\chi^2_{(4)}$ 27.1, p<0.001
		$\chi^2_{(3)}$ 12.7, p=0.005

Abbreviations: se, standard error
* significant at the 0.05 level, two sided test
[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife
[b] Any violence is defined as ever being a victim or perpetrator of moderate physical violence in any dating relationships. The reference includes those who did not date before 21
[c] Husband and wife age of first sexual intercourse combined to define quartiles

4.3.5 Aim 3 Multivariate Analysis for the Couple

A total of six variables were generated reflecting interactions between the couple (Table 4.13). These included two variables for interactions between spouses and experience of dating violence and four variables for interactions between ages of sexual initiation for each member of the couple.

Table 4.13. Prevalence and bivariate associations of marital violence ever in current marriage, as reported by either spouse, with couple dating experiences (n=1,515)[a]

	% (se)	OR (95% CI)
Either husband and/or wife ever experienced any violence in any dating relationships[b]	10.1 (1.0)	2.7 (1.8-4.0)* $\chi^2_{(1)}$ 24.6, p<0.001
Both husband and wife ever experienced any violence in any dating relationships	1.2 (0.3)	3.5 (1.2-10.3)* $\chi^2_{(1)}$ 5.4, p=0.02
Age of first sexual intercourse combination 1[c] Wife young (<18) – husband either young or young average (<=19)[d]	16.3 (1.3)	1.8 (1.1-3.0)* $\chi^2_{(1)}$ 6.1, p=0.01
Age of first sexual intercourse combination 2[c] Wife young (<18) – husband older than average (20+)[d]	7.6 (0.8)	1.3 (0.7-2.5) $\chi^2_{(1)}$ 0.7, p=0.41
Age of first sex combination 3[c] Wife not young (>=18) - husband either young or young average (<=19)[d]	32.8 (1.5)	1.0 (0.6-1.5) $\chi^2_{(1)}$ 0.0, p=0.88
Age of first sex combination 4[c] Either wife young (<18) and/or husband young or young average (<=19)[d]	56.8 (1.6)	1.7 (1.1-2.6)* $\chi^2_{(1)}$ 5.8, p=0.02

Abbreviations: se, standard error
* significant at the 0.05 level, two sided test
[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife
[b] Any violence is defined as ever being a victim or perpetrator of moderate physical violence in any dating relationships. No includes those who did not date before 21
[c] Husband and wife age of first sexual intercourse combined to define quartiles, quartiles are shown in table 3.1.
[d] Compared to all other combinations

Model 1 – Model 1 included both wives and husband's independent experience with dating violence and indicator variables for young and young-average age of first sexual intercourse. Of these, the odds of marital violence were significantly higher in couples where the wife experienced any dating violence (OR1.9; 95%CI 1.2-3.1), the husband experienced any dating violence (OR 2.4; 95% CI 1.3-4.4), and the husband was young at age of first sexual intercourse (OR1.6; 95% CI 1.1-2.5) (Table 4.14, Model 1).

Model 2 – Model 2 included both wives' and husbands' independent experience with any dating violence, a variable for both spouses having experienced any violence in previous dating relationships, and three interaction variables for combinations of sexual initiation between spouses. Spousal experience of dating violence remained significant irrespective of the other spouses experience (wives - OR 2.1; 95% CI 1.3-3.4; husbands - OR 2.6; 95%CI 1.3-5.3). The indicator variable for both members of the dyad experiencing any dating violence was not significant. Among the interaction variables, the only significant predictor was the combination where the wife was young at first sexual intercourse and husband was either young or young-average (OR 2.0; 95% CI 1.1-3.6) when compared to all other combinations (Table 4.14, Model 2).

Model 3 – Model 3 (Table 4.14) retained all variables from Model 2 with the exception of the indicator variable for both spouses experiencing dating violence. The odds ratios for independent spousal experience of any dating violence before 21 were significant as a set (χ^2_2 18.2, p<0.001) but were not significantly different from each other (χ^2_1 0.2, p=0.67). As in Model 2, the only interaction variable for age of first sexual intercourse between spouses was where the wife was young at first sexual intercourse and husband was either young or young-average

(OR 2.0; 95% CI 1.1-3.5) when compared to all other combinations. Odds ratios for the three interaction variables were not significant as a set (χ^2_3 5.5, p=0.14) nor were they significantly different from each other (χ^2_2 1.6, p=0.046).

Model 4 – Based on results from Models 1-3, a new interaction variable was created indicating the wife being young at first sexual intercourse and the husband being young or young average. The difference between this variable and the significant one from Models 2 and 3 (combination 1) is that this variable used "and/or" criteria rather than "and" resulting in more flexible criteria (Combination Category 4, Table 4.14). The odds of marital violence were significantly higher in this group (OR 1.7; 95% CI 1.1-2.6) when compared to all other possible combinations (Table 4.14, Model 4).

Model 5 – Results from Model 3 suggest that wives' and husbands' independent experience of dating violence were significant predictors of marital violence as a set but were not significantly different from one another. As a result, Model 5 included an interaction variable for either wife and/or husband experienced dating violence before 21. The odds of marital violence were significantly higher among these couples (OR 2.7; 95% CI 1.8-4.0) when compared to those where neither spouse experienced dating violence (Table 4.15, Model 5).

Model 6 – Analyses conducted in Model 6 (Table 4.15) examined difference between both interaction variables for spousal experience of dating violence (either partner vs. both partners). The interaction variable defined as either spouse having experienced any dating violence was significant (OR 2.5; 95% CI 1.7-3.8) when compared to couples where neither spouse experienced dating violence. The interaction variable for both was insignificant.

Model 7 – The final model in this predictor group included the interaction variable for either spouse having experienced any prior dating violence before the age of 21 (OR 2.6; 95% CI 1.7-3.8) and the interaction variable for either the wife was young and/or the husband was either young or young average at age of first sexual intercourse (OR 1.6; 95% CI 1.1-2.5). As a set, these variables were significant (χ^2_2 31.0, p<0.001) and were not significantly different from each other (χ^2_1 2.1, p=0.14) (Table 4.15 Model 7).

Supplemental results from preliminary models are available in Appendix A, Table 4

Table 4.14. Multivariate models of marital violence ever in current marriage, as reported by either spouse, with dating experiences reported from both husband and wife (n=1,515)[a]

	Model 1	Model 2	Model 3	Model 4
	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
I. Wife's dating experiences				
Ever experienced any violence in dating relationships before the age of 21[b]				
	1.9 (1.2-3.0)*	2.1 (1.3-3.4)*	2.0 (1.2-3.1)*	
Collapsed age of first sexual intercourse				
Young (less than 18 years old)	1.5 (0.9-2.6)			
Young average (18-19 years old)	1.1 (0.7-1.7)			
Average and older (20 years or older)				
II. Husband's dating experiences				
Ever experienced any violence in dating relationships before the age of 21[b]				
	2.4 (1.3-4.4)*	2.6 (1.3-5.3)*	2.3 (1.3-4.3)*	
			$\chi^2_{(2)}$ 18.2, p<0.001	
Collapsed age of first sexual intercourse			$\chi^2_{(1)}$ 0.2, p=0.67	
Young (less than 18 years old)	1.6 (1.1-2.5)*			
Young average (18-19 years old)	1.0 (0.5-1.8)			
Average and older (20 years or older)				
III. Couple dating experiences				
Either husband and/or wife ever experienced any violence in any dating relationships				
Both husband and wife ever experienced any violence in any dating relationships				
		0.6 (0.2-2.5)		
Age of first sexual intercourse combination 1[c] - Wife young (<18) – husband either young or young average (<=19)				
		2.0 (1.1-3.6)*	2.0 (1.1-3.5)*	
Age of first sexual intercourse combination 2[c] - Wife young (<18) – husband older than average (20+)				
		1.7 (0.8-3.5)	1.7 (0.8-3.5)	
Age of first sexual intercourse combination 3[c]				

- Wife not young (>=18) - husband either young or young average (<=19)		1.4 (0.9-2.3)	1.4 (0.8-2.3)	
			$\chi^2_{(3)}$ 5.5, p=0.14	
Age of first sexual intercourse combination 4[c]			$\chi^2_{(2)}$ 1.6, p=0.46	
- Either wife young (<18) and/or husband young or young average (<=19)				1.7 (1.1-2.6)*
Multivariate model χ^2	$\chi^2_{(6)}$ 37.7, p<0.001	$\chi^2_{(6)}$ 33.9, p<0.001	$\chi^2_{(5)}$ 32.2, p<0.001	$\chi^2_{(1)}$ 5.8, p=0.02
	$\chi^2_{(5)}$ 8.5, p=0.13	$\chi^2_{(5)}$ 4.2, p=0.52	$\chi^2_{(4)}$ 2.8, p=0.59	

* significant at the 0.05 level, two sided test
[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife
[b] Any violence is defined as ever being a victim or perpetrator of moderate physical violence in any dating relationships. The reference includes those who did not date before 21
[c] Compared to all other combinations

Table 4.15 Continued multivariate models of marital violence ever in current marriage, as reported by either spouse, with dating experiences from both husband and wife (n=1,515)[a]

	Model 5	Model 6	Model 7[d]
	OR (95%CI)	OR (95%CI)	OR (95%CI)
I. Wife's dating experiences			
Ever experienced any violence in dating relationships before the age of 21[b]			
Collapsed age of first sexual intercourse			
Young (less than 18 years old)			
Young average (18-19 years old)			
Average and older (20 years or older)			
II. Husband's dating experiences			
Ever experienced any violence in dating relationships before the age of 21[b]			
Collapsed age of first sexual intercourse			
Young (less than 18 years old)			
Young average (18-19 years old)			
Average and older (20 years or older)			
III. Couple dating experiences			
Either husband and/or wife ever experienced any violence in any dating relationships	2.7 (1.8-4.0)*	2.5 (1.7-3.8)*	2.6 (1.7-3.8)*
Both husband and wife ever experienced any violence in any dating relationships		1.7 (0.5-5.3)	
Age of first sexual intercourse combination 1[c] - Wife young (<18) – husband either young or young average (<=19)			
Age of first sexual intercourse combination 2[c] - Wife young (<18) – husband older than average (20+)			
Age of first sex combination 3[c] - Wife not young (>=18) - husband either young or young average (<=19)			

Age of first sex combination 4[c]
- Either wife young (<18) and/or husband young or young average (<=19)

1.6 (1.1-2.5)*

Multivariate model χ^2 $\chi^2_{(1)}$ 24.6, p<0.001 $\chi^2_{(2)}$ 25.0, p<0.001 $\chi^2_{(2)}$ 31.0, p<0.001

$\chi^2_{(1)}$ 0.4, p=0.55 $\chi^2_{(1)}$ 2.1, p=0.14

* significant at the 0.05 level, two sided test
[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife
[b] Any violence is defined as ever being a victim or perpetrator of moderate physical violence in any dating relationships. The reference includes those who did not date before 21
[c] Compared to all other combinations
[d] Model 7 identifies the final model for this predictor set

4.4 Aim 4 Results

4.4.1 Aim 4 Bivariate Analysis for Wives

The prevalence estimates for mental disorders among wives included in this project are shown

in Table 4.16. Overall, the prevalence of individual disorders ranged from a low of 0.3% (drug

abuse with or without dependence) to a high of 7.8% (panic disorder). Five of the 15 childhood

adversities were significantly associated with elevated risk of marital violence in bivariate

models. These included post-traumatic stress disorder (OR 3.3; 95% CI 1.3-8.5), separation

anxiety disorder (OR 2.2; 95% CI 1.1-4.7), specific phobia (OR1.7; 95% CI 1.1-2.7), oppositional

defiant disorder (OR 4.1; 95% CI 1.3-12.7), and intermittent explosive disorder (OR 7.8; 95% CI

2.6-23.5).

Table 4.16. Prevalence and bivariate associations of marital violence ever in current marriage, as reported by either spouse, with mental disorders: separate models for predictors reported by wives and husbands (n=1,515)[a]

	Wives[b]		Husbands[c]	
	% (se)	OR (95% CI)	% (se)	OR (95% CI)
Panic disorder / agoraphobia				
	7.8 (0.4)	1.0 (0.4-2.5)	0.8 (0.2)	1.2 (0.3-4.3)
		$\chi^2_{(1)}$ 0.0, p=0.93		$\chi^2_{(1)}$ 0.8, p=0.10
Generalized anxiety disorder				
	1.8 (0.3)	2.1 (0.8-5.2)	1.1 (0.2)	1.5 (0.4-6.0)
		$\chi^2_{(1)}$ 2.6, p=0.11		$\chi^2_{(1)}$ 0.3, p=0.60
Post-traumatic stress disorder				
	1.6 (0.3)	3.3 (1.3-8.5)*	0.8 (0.3)	3.2 (1.0-10.1)
		$\chi^2_{(1)}$ 6.2, p=0.01		$\chi^2_{(1)}$ 3.7, p=0.05
Separation anxiety disorder				
	2.9 (0.4)	2.2 (1.1-4.7)*	1.7 (0.4)	3.3 (1.5-7.1)*
		$\chi^2_{(1)}$ 4.6, p=0.03		$\chi^2_{(1)}$ 9.5, p=0.002
Social phobia				
	3.9 (0.5)	1.2 (0.6-2.3)	3.1 (0.4)	1.3 (0.6-45)
		$\chi^2_{(1)}$ 0.2, p=0.69		$\chi^2_{(1)}$ 0.4, p=0.52
Specific phobia				
	9.9 (0.9)	1.7 (1.1-2.7)*	5.9 (0.7)	1.4 (0.8-2.6)
		$\chi^2_{(1)}$ 4.7, p=0.03		$\chi^2_{(1)}$ 1.3, p=0.25
Major depression				
	3.8 (0.6)	1.8 (0.9-3.3)	2.3 (0.3)	1.9 (1.1-3.4)*
		$\chi^2_{(1)}$ 3.3, p=0.07		$\chi^2_{(1)}$ 5.1, p=0.02
Broad bipolar				
	0.6 (0.2)	3.7 (0.6-22.2)	0.4 (0.1)	1.2 (0.4-3.5)
		$\chi^2_{(1)}$ 2.1, p=0.15		$\chi^2_{(1)}$ 0.1, p=0.77
Conduct disorder				
	0.7 (0.2)	0.8 (0.1-4.3)	1.8 (0.40	3.0 (1.4-6.7)*
		$\chi^2_{(1)}$ 0.1, p=0.78		$\chi^2_{(1)}$ 7.9, p=0.005
Oppositional defiant disorder				
	1.0 (0.3)	4.1 (1.3-12.7)*	1.5 (0.3)	1.8 (0.7-4.7)
		$\chi^2_{(1)}$ 6.2, p=0.01		$\chi^2_{(1)}$ 1.3, p=0.25
Alcohol abuse with or without dependence				
	1.3 (0.3)	1.2 (0.5-3.0)	5.5 (0.7)	2.9 (1.6-5.3)*

		$\chi^2_{(1)}$ 0.2, p=0.66		$\chi^2_{(1)}$ 12.60, p<0.001
Alcohol dependence with or without abuse				
	0.6 (0.1)	2.3 (0.8-6.9)	1.4 (0.3)	4.3 (1.4-13.2)*
		$\chi^2_{(1)}$ 2.4, p=0.12		$\chi^2_{(1)}$ 6.6, p=0.01
Drug abuse with or without dependence				
	0.6 (0.2)	2.8 (0.8-10.8)	2.1 (0.3)	2.6 (1.1-6.1)*
		$\chi^2_{(1)}$ 2.4, p=0.12		$\chi^2_{(1)}$ 5.1, p=0.02
Drug dependence with or without abuse				
	0.3 (0.1)	4.0 (0.9-18.0)	0.6 (0.2)	4.23 (0.9-20.3)
		$\chi^2_{(1)}$ 3.2, p=0.07		$\chi^2_{(1)}$ 3.3, p=0.07
Intermittent explosive disorder				
	0.8 (0.2)	7.8 (2.6-23.5)*	3.2 (0.7)	3.4 (1.8-6.4)*
		$\chi^2_{(1)}$ 13.7, p<0.001		$\chi^2_{(1)}$ 14.1, p<0.001
Internalizing mental disorders count		1.5 (1.2-1.9)*		1.50 (1.1-2.0)
Internalizing mental disorders count categories				
0	83.3 (1.1)	1.0	88.3 (0.8)	1.0
Exactly 1	10.9 (0.9)	1.7 (1.1-2.7)*	8.8 (0.7)	2.0 (1.2-3.3)*
Exactly 2	3.8 (0.5)	2.1 (0.9-5.1)	2.2 (0.4)	1.9 (1.0-3.9)
3 or more	2.0 (0.4)	3.0 (1.3-6.5)*	0.8 (0.2)	2.6 (0.6-11.2)
		$\chi^2_{(3)}$ 12.1, p=0.007		$\chi^2_{(3)}$ 9.8, p=0.03
		$\chi^2_{(2)}$ 1.6, p=0.44		$\chi^2_{(2)}$ 0.1, p=0.93
1 or more internalizing disorders				
	16.7 (1.1)	1.9 (1.2-2.8)*	11.7 (0.8)	2.0 (1.3-3.2)*
		$\chi^2_{(1)}$ 8.70 p=0.003		$\chi^2_{(1)}$ 9.3, p=0.002
1 or more internalizing disorders (no externalizing)				
	14.7 (1.0)	1.4 (0.9-2.2)	7.5 (0.8)	1.1 (0.7-1.9)
		$\chi^2_{(1)}$ 2.7, p=0.09		$\chi^2_{(1)}$ 0.3, p=0.59)
Externalizing mental disorder count		1.6 (1.1-2.3)*		1.9 (1.5-2.4)*
Externalizing mental disorder count categories				
0	97.0 (0.4)	1.0	90.0 (0.9)	1.0
Exactly 1	1.9 (0.3)	2.1 (1.0-4.5)	6.3 (0.7)	3.1 (1.7-5.5)*
Exactly 2	0.5 (0.2)	3.5 (0.7- 18.2)	2.2 (0.4)	2.2 (1.0-4.8)
3 or more	0.6 (0.1)	2.6 (0.7-9.7)	1.4 (0.4)	6.6 (2.2-19.5)
		$\chi^2_{(3)}$ 8.1, p=0.04		$\chi^2_{(3)}$ 29.9 p<0.001

	$\chi^2_{(2)}$ 0.3, p=0.85		$\chi^2_{(2)}$ 2.90, p=0.24
1 or more externalizing disorders			
	3.0 (0.4)	2.4 (1.3-4.4)*	10.0 (0.9)	3.2 (2.0-4.9)*
		$\chi^2_{(1)}$ 7.9, p=0.005		$\chi^2_{(1)}$ 26.4, p<0.001
1 or more externalizing disorders (no internalizing)			
	0.9 (0.2)	0.9 (0.2-3.2)	5.8 (0.7)	2.2 (1.3-4.0)*
		$\chi^2_{(1)}$ 0.0, p=0.85		$\chi^2_{(1)}$ 7.7, p=0.006
1 or more internalizing disorders and 1 or more externalizing disorders			
	2.0 (0.4)	3.5 (1.7-7.2)*	4.2 (0.6)	3.4 (1.8-6.6)*
		$\chi^2_{(1)}$ 11.6, p=0.001		$\chi^2_{(1)}$ 13.4, p<0.001

* significant at the 0.05 level, two sided test
[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife
[b] Models included the age of the wife
[c] Models included the age of the husband

4.4.1 Aim 4 Multivariate Analysis for Wives

Model 1 – Model 1 estimated the relative odds of all 15 mental disorders simultaneously (Table 4.17, Model 1). Of these, only intermittent explosive disorder was significantly associated with marital violence (OR 4.5; 95% CI 1.4-14.7). Differences in mean odds were tested for two groupings of disorders, eight internalizing disorders, and seven externalizing disorders. The calculated odds ratios for externalizing disorders were significant as a set (χ^2_7 21.10, p=0.004), but were not significantly different from each other (χ^2_6 10.0, p=0.12). Internalizing disorders were not significant as a set nor were they significantly different from each other.

Model 2 – Model 2 (Table 4.17) included two categorical variables for the number of internalizing disorders and number of externalizing disorders separately. Each had four levels including categories for no disorders, exactly 1 disorder, exactly 2 disorders, or 3 or more disorders. The odds ratios for categories of internalizing disorders were significant as a set (χ^2_3 8.0, p=0.04), however, only one those with three or more internalizing disorders reached statistical significance (OR 2.5; 95% CI 1.1-5.8) when compared to none. Odds ratios for externalizing disorder categories were insignificant as a set nor were they significantly different from each other.

Model 3 – The final model for wives in this predictor set (Model 3, Table 4.17) included two new indicator variables; diagnosis of one or more internalizing disorders and diagnosis of one or more externalizing disorders. The odds of marital violence were significantly higher for both (OR 1.8; 95% CI 1.1-2.8, OR 2.1; 95% CI 1.1-3.8 respectively). Odds ratios for both were significant as a set (χ^2_2 13.1, p=0.001) but were not significantly different from each other (χ^2_1 0.10, p=0.72).

Table 4.17. Multivariate models of marital violence ever in current marriage, as reported by either spouse, with wife's mental disorders (n=1,515)[a]

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Panic disorder / agoraphobia	0.4 (0.2-1.4)		
Generalized anxiety disorder	1.8 (0.7-4.9)		
Post-traumatic stress disorder	2.4 (0.8-7.5)		
Separation anxiety disorder	1.6 (0.7-3.4)		
Social phobia	0.7 (0.3-1.6)		
Specific phobia	1.6 (0.9-2.6)		
Major depression	1.3 (0.6-2.6)		
Broad bipolar	2.1 (0.3-15.4)		
Conduct disorder	0.5 (0.1-3.1)		
Oppositional defiant disorder	2.2 (0.7-11.5)		
Alcohol abuse with or without dependence	0.3 (0.0-2.7)		

Alcohol dependence with or without abuse

2.0 (0.2-20.0)

Drug abuse with or without dependence

2.3 (0.2-35.0)

Drug dependence with or without abuse

2.5 (0.3-24.3)

Intermittent explosive disorder

4.5 (1.4-14.7)*

Internalizing mental disorders count
Internalizing mental disorders count categories

    0   1.0

    Exactly 1   1.6 (1.0-2.7)

    Exactly 2   2.0 (0.8-4.9)

    3 or more   2.5 (1.1-5.8)*

    χ^2 $\chi^2_{(3)}$ 8.0, p=0.04

                                    $\chi^2_{(2)}$ 0.9, p=0.65

1 or more internalizing disorders (whether or not externalizing)

1.8 (1.1-2.8)*

Externalizing mental disorder count
Externalizing mental disorder count categories

    0   1.0

    Exactly 1   1.8 (0.8-4.1)

    Exactly 2   2.3 (0.5-11.0)

    3 or more   2.0 (0.6-7.5)

    χ^2 $\chi^2_{(3)}$ 4.6, p=0.20

                                    $\chi^2_{(2)}$ 0.1, p=0.97

1 or more externalizing disorders (whether or not internalizing)

2.1 (1.1-3.8)*

    Internalizing disorders difference in slopes χ^2 tests $\chi^2_{(8)}$ 12.2, p=0.14

	$\chi^2_{(7)}$ 7.6, p=0.37		
externalizing disorders difference in slopes χ^2 tests	$\chi^2_{(7)}$ 21.1, p=0.004		
	$\chi^2_{(6)}$ 10.0, p=0.12		
Multivariate model χ^2	$\chi^2_{(15)}$ 52.4, p<0.001	$\chi^2_{(6)}$ 14.0, p=0.03	$\chi^2_{(2)}$ 13.1, p=0.001
			$\chi^2_{(1)}$ 0.1, p=0.72

* significant at the 0.05 level, two sided test
[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife

4.4.1 Aim 4 Bivariate Analysis for Husbands

The prevalence of mental disorders among husbands are shown in Table 4.16. Overall, the prevalence of individual disorders ranged from a low of 0.4% (broad bipolar) to a high of 5.9% (specific phobia). Seven of the 15 childhood adversities were significantly associated with elevated risk of marital violence in the bivariate models. These included separation anxiety disorder (OR 3.3; 95% CI 1.5-7.1), major depression (OR 1.9; 95% CI 1.3-3.4), conduct disorder (OR 1.4-6.7), alcohol abuse with or without dependence (OR 2.7; 95% CI 1.6-5.3), alcohol dependence with or without abuse (OR 4.3; 95% CI 1.4-13.2), drug abuse with or without dependence (OR 2.6; 95% CI 1.1-6.1), and intermittent explosive disorder (OR 3.4; 95% CI 1.8-6.4).

4.4.1 Aim 4 Multivariate Analysis for Husbands

Model 1 – Model 1 estimated the relative odds of all 15 mental disorder simultaneously, Table 4.18, Model 1. Of these, separation anxiety disorder (OR 2.4; 95% CI 1.1-5.0), alcohol abuse with or without dependence (OR 2.3; 95% CI 1.1-4.6), and intermittent explosive disorder was significant (OR 2.8; 95% CI 1.2-6.3). Differences in mean odds for two groupings of disorders were examined, internalizing disorders, and externalizing disorders. Differences in mean odds were tested for two groupings of disorders, eight internalizing disorders, and seven externalizing disorders. The calculated odds ratios for externalizing disorders were significant as a set (χ^2_8 14.80, p=0.004), but were not significantly different from each other (χ^2_7 7.5, p=0.38). Results were the same for externalizing disorders as they were significant as a set (χ^2_7 26.20, p<0.001), but were not significantly different from each other (χ^2_6 6.0, p=0.42).

Model 2 – Model 2 (Table 4.18) included two categorical variables for the number of internalizing disorders and number of externalizing disorders separately. Each had four levels

measuring no disorders, exactly 1 disorder, exactly 2 disorders, or 3 or more disorders. The odds of marital violence was significantly higher among those with exactly 1 (OR 2.9; 95% CI 1.6-5.2) and 3 or more externalizing disorders (OR 6.2; 95% CI 2.0-20.4) when compared to none. Odds ratios for categories of externalizing disorders were significant as a set (χ^2_3 23.3, p<0.001), where only two categories reached statistical significance. Couples where the husband had exactly 1 disorder and 3 or more disorders had a higher odds of marital violence (OR 2.9; 95% CI 0.9-4.3; OR 6.2; 95% CI 2.0-20.4 respectively) when compared to those where the husband had none. Odds ratios for internalizing disorder categories were insignificant as a set nor were they significantly different from each other.

Model 3 – The final model for husbands in this predictor set (Model 3, Table 4.18) included two new indicator variables; diagnosis of one or more internalizing disorders and diagnosis of one or more externalizing disorders. The odds of marital violence were significantly higher for both (OR 1.6; 95% CI 1.0-3.0; OR 2.9; 95% CI 1.8-4.5 respectively). Odds ratios for both were significant as a set (χ^2_2 28.0, p<0.001) but were not significantly different from each other (χ^2_1 2.60, p=0.11).

Table 4.18. Multivariate models of marital violence ever in current marriage, as reported by either spouse, with husband's mental disorders (n=1,515)[a]

	Model 1	Model 2	Model 3
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Panic disorder / agoraphobia	0.7 (0.2-2.8)		
Generalized anxiety disorder	0.4 (0.1-2.5)		
Post-traumatic stress disorder	2.1 (0.5-8.7)		
Separation anxiety disorder	2.4 (1.1-5.0)*		
Social phobia	1.1 (0.5-8.7)		
Specific phobia	1.2 (0.7-2.3)		
Major depression	1.8 (0.9-3.5)		
Broad bipolar	1.0 (0.3-3.8)		
Conduct disorder	2.0 (0.9-4.5)		
Oppositional defiant disorder	0.6 (0.2-2.1)		
Alcohol abuse with or without dependence	2.3 (1.1-4.6)*		

Alcohol dependence with or without abuse

2.1 (0.7-6.3)

Drug abuse with or without dependence

1.2 (0.5-2.8)

Drug dependence with or without abuse

0.8 (0.2-3.6)

Intermittent explosive disorder

2.8 (1.2-6.3)*

Internalizing mental disorders count
Internalizing mental disorders count categories

    0   1.0

    Exactly 1   1.6 (1.0-2.6)

    Exactly 2   1.7 (0.9-3.5)

    3 or more   0.9 (0.2-3.8)

    χ^2 $\chi^2_{(3)}$ 5.2, p=0.16

                                            $\chi^2_{(2)}$ 0.8, p=0.66

1 or more internalizing disorders (whether or not externalizing)

1.6 (1.0-3.0)*

Externalizing mental disorder count
Externalizing mental disorder count categories

    0   1.0

    Exactly 1   2.9 (1.6-5.2)*

    Exactly 2   2.0 (0.9-4.3)

    3 or more   6.2 (2.0-20.4)*

    χ^2 $\chi^2_{(3)}$ 23.3, p<0.001

                                            $\chi^2_{(2)}$ 2.9, p=0.24

1 or more externalizing disorders (whether or not internalizing)

2.9 (1.8-4.5)*

    Internalizing disorders difference in slopes χ^2 tests $\chi^2_{(8)}$ 14.80, p=0.06

	$\chi^2_{(7)}$ 7.5, p=0.38		
externalizing disorders difference in slopes χ^2 tests	$\chi^2_{(7)}$ 26.20, p<0.001		
	$\chi^2_{(6)}$ 6.00, p=0.42		
Multivariate model χ^2	$\chi^2_{(15)}$ 46.80, p<0.001	$\chi^2_{(6)}$ 31.8, p<0.001	$\chi^2_{(2)}$ 28.0, p<0.001
			$\chi^2_{(1)}$ 2.6, p=0.11

* significant at the 0.05 level, two sided test

[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife

4.4.3 Aim 4 Multivariate Analysis for the Couple

Results from the multivariate models for wives and husbands separately suggested the need to

consider the interactions between psychiatric disorders among either member of the couple. As

a result, a three level interaction term was constructed indicating; both spouses having at least

one internalizing or externalizing disorder, only one partner having at least one internalizing or

externalizing disorder, and neither member of the couple having any internalizing or

externalizing disorder, shown in Table 4.19.

Model 1 – Model (Table 4.20) included this interaction variable (referred to as Combination

Category 1). Overall, the odds of marital violence were significantly higher for couples where

both had at least one internalizing or externalizing disorder (OR 4.2; 95% CI 2.5-7.1) and those

where only one partner had at least one internalizing or externalizing disorder (OR 2.1; 95% CI

1.3-3.2) when compared to couples where both spouses did not have any internalizing or

externalizing disorders. Odds ratios were significant as a set (χ^2_2 30.10, p<0.001) and they were

significantly different from each other (χ^2_1 8.30, p=0.004).

Results from Model 1 indicated the need to construct a series of 16 indicator variables

representing interactions between different disorders between spouses (Table 4.19). Potential

combinations included; 1. no internalizing or externalizing disorders, 2. any internalizing

disorders only (i.e. no externalizing disorders), 3. any externalizing disorders only (i.e. no

internalizing disorders), 4. any internalizing disorders whether or not externalizing, 5. any

externalizing whether or not internalizing, 6. Any internalizing disorders and any externalizing

disorders (i.e. both).

Table 4.19. Prevalence and bivariate associations of marital violence ever in current marriage, as reported by either spouse, with couple mental disorders (n=1,515)[a]

	% (se)	OR (95% CI)
Couple mental disorder combination category 1		
Both had at least 1 internalizing or externalizing disorder	7.1 (0.8)	4.2 (2.5-7.1)*
Only 1 partner had at least 1 internalizing or externalizing disorder	20.9 (1.2)	2.1 (1.3-3.2)*
No internalizing or externalizing disorders between the couple	72.0 (1.3)	1.0
		$\chi^2_{(2)}$ 30.1, p<0.001
Couple mental disorder combination category 2		
Both had at least 1 internalizing or externalizing disorder	7.1 (0.8)	4.2 (2.5-7.1)*
Only husband had at least 1 internalizing or externalizing disorder	10.4 (1.0)	2.5 (1.5-4.1)*
Only wife had at least 1 internalizing or externalizing disorder	10.5 (1.0)	1.7 (0.9-3.1)
No internalizing or externalizing disorders between the couple	72.0 (1.3)	1.0
		$\chi^2_{(3)}$ 31.5, p<0.001
Couple mental disorder combination category 3		
Wife both – husband both	0.7 (0.2)	14.3 (4.5-45.1)*
Wife both – husband either (not both)	0.6 (0.2)	12.7 (1.9-85.3)*
Wife both – husband neither	0.8 (0.2)	2.5 (0.5-14.1)
Wife externalizing only (independent of husband)	0.9 (0.2)	1.9 (0.5-6.7)
Wife internalizing only – husband both	1.0 (0.2)	6.8 (2.6-17.6)*
Wife internalizing only – husband externalizing only	1.6 (0.4)	8.6 (3.7-19.9)*
Wife internalizing only - husband internalizing only	2.7 (0.4)	1.6 (0.7-3.6)
Wife internalizing only - husband neither	9.4 (0.9)	1.7 (0.8-3.3)
Wife neither - husband both	2.3 (0.4)	5.3 (2.0-13.6)*
Wife had neither - husband had either (but not both)	8.1 (0.8)	2.0 (1.2-3.5)*
No internalizing or externalizing disorders between the couple	72.0 (1.3)	1.0
		$\chi^2_{(10)}$ 48.50, p<0.001
Couple mental disorder combination category 4		
Wife internalizing only - husband externalizing only	1.6 (0.4)	8.5 (3.7-16.2)*
Either OR both spouses had both	5.6 (0.6)	5.7 (3.0-10.8)*
All other combinations	20.8 (1.3)	1.9 (1.1-2.9)*
No internalizing or externalizing disorders between the couple	72.0 (1.3)	1.0
		$\chi^2_{(3)}$ 38.1, p<0.001
Couple mental disorder combination category 5		
Wife internalizing (whether or not externalizing) - husband externalizing (whether or not internalizing)	3.7 (0.6)	9.2 (4.6-18.3)*
All other combinations where at least one or both spouses had both	3.6 (0.6)	4.3 (2.0-9.2)*
All other combinations where at least 1 spouse had at least 1 internalizing or externalizing disorder (but not both)	20.8 (1.3)	1.8 (1.1-2.9)*

Wife had neither - husband had neither	72.0 (1.3)	1.0 $\chi^2_{(3)}$ 43.0, p<0.001
Wife any internalizing disorder (whether or not externalizing) – husband neither[b]	9.4 (0.9)	1.0 (0.5-1.9) $\chi^2_{(1)}$ 0.0, p=0.96
Wife internalizing only – husband any internalizing only[b]	2.7 (0.4)	0.8 (0.3-1.7) $\chi^2_{(1)}$ 0.5, p=0.50
Wife any internalizing only - husband any externalizing only[b]	1.6 (0.4)	4.7 (2.3-9.5)* $\chi^2_{(1)}$ 18.2, p<0.001
Wife any internalizing only - husband both[b]	1.0 (0.2)	3.1 (1.3-7.2) $\chi^2_{(1)}$ 6.8, p=0.009
Wife any externalizing only - husband neither[b]	0.4 (0.2)	1.4 (0.2-10.4) $\chi^2_{(1)}$ 0.1, p=0.75
Wife any externalizing only - husband any internalizing only[b]	0.1 (0.1)	5.7 (0.2-198.6) $\chi^2_{(1)}$ 0.9, p=0.34
Wife any externalizing only - husband externalizing only[b]	0.2 (0.1)	0.4 (0.2-1.2) $\chi^2_{(1)}$ 2.8, p=0.09
Wife any externalizing only - husband both[b]	0.3 (0.1)	--[c] --[c]
Wife both - husband neither[b]	0.8 (0.2)	1.1 (0.2-5.3) $\chi^2_{(1)}$ 0.0, p=0.95
Wife both - husband any internalizing only[b]	0.3 (0.1)	5.0 (0.8-29.4) $\chi^2_{(1)}$ 3.2, p=0.07
Wife both - husband any externalizing only[b]		

	0.3 (0.1)	5.2 (05-52.0)
		$\chi^2_{(1)}$ 2.0, p=0.16
wife both - husband both[b]		
	0.7 (0.2)	6.2 (2.1-18.6)*
		$\chi^2_{(1)}$ 10.9, p=0.001
Wife neither - husband neither[b]		
	72.0 (1.3)	0.4 (0.3-0.6)*
		$\chi^2_{(1)}$ 17.7, p<0.001
Wife neither - husband any internalizing only[b]		
	4.5 (0.6)	1.2 (0.6-2.3)
		$\chi^2_{(1)}$ 0.3, p=0.59
Wife neither- husband any externalizing only[b]		
	3.6 (0.5)	1.3 (0.7-2.5)
		$\chi^2_{(1)}$ 0.7, p=0.41
Wife neither - husband both[b]		
	2.3 (0.5)	2.9 (1.2-7.3)*
		$\chi^2_{(1)}$ 5.3, p=0.02

Abbreviations: both, at least 1 internalizing disorder and at least 1 externalizing disorder; internalizing only, at least 1 internalizing disorder no externalizing disorders; externalizing only, at least 1 externalizing disorder, no internalizing disorders; neither, 0 internalizing disorders, 0 externalizing disorders;
* significant at the 0.05 level, two sided test
[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, whether or not a person was present during the interview for the wife, age of the wife and age of the husband
[b] Compared to all other combinations
[c] Estimate would not converge

Model 2 – Bivariate results of the 16 interaction terms suggested the need for further consideration of joint effects between members of the couple. Therefore, another interaction variable with four levels was constructed. Categories for this measure included both spouses having at least one internalizing or externalizing disorder; only husband having at least one internalizing disorder or externalizing disorder, only wife having at least one internalizing or externalizing disorder, and neither having any internalizing or externalizing disorder. The absence of any internalizing or externalizing disorder was used as the reference and was referred to as Combination Category 2. Dummy variables for each level were included in Model 2 (Table 4.20). The odds of marital violence were significantly higher for couples where both had at least one of either disorder category (OR 4.2; 95% CI 2.5-7.1) and couples where only the husband had at least one of either disorder category (OR 2.5; 95% CI 1.5-4.1). Odds ratios were significant as a set (χ^2_3 31.5, p<0.001) and they were significantly different from each other (χ^2_2 8.7, p=0.01).

Model 3 – Since parameter estimates were significantly different from each other in Model 2, we decided to create another categorical variable to further evaluate the associations between psychiatric disorders. This variable combined the 16 interaction variables resulting in 11 mutually exclusive categories of interactions between psychiatric disorders (referred to as Combination Category 3). Dummy variables for each level were included in Model 3 (Table 4.20). Of these, five were statistically significant when compared to couples where both wife and husband had no mental disorders. Overall, the odds ratios were significant as a set (χ^2_{10} 48.5, p<0.001) and they were significantly different from each other (χ^2_9 31.0, p=0.01). These results suggest that there is a relative importance of the joint experience of mental disorder between spouses. Further examination is required to find the strongest combination in predicting marital violence.

Model 4 – Model 4 (Table 4.20) included various levels of combination category 2 and 3. Seven dummy variables from Combination 3 were included to estimate the relative importance of both partners having a disorder while controlling for couples where only one partner had a psychiatric disorder (three dummy variables from Category 2). Of the seven odds ratios from Combination 3, four were significant. Each of the significant associations were from couples where both members had a disorder. Differences in means shows that these variables are significant as a set (χ^2_7 25.2, p=0.001) and significantly different from each other (χ^2_6 24.0, p<0.001).

Model 5 – Model 5 (Table 4.21) included an interaction term with four levels including when both the wife and the husband had an internalizing disorder (alone), either one or both spouses had a disorder from either groups (i.e.; at least one internalizing disorder and at least 1 externalizing disorder), all other potential combinations of interactions, and neither spouse had any disorders. The odds of marital violence were significantly higher in each of these categories with odds ratios ranging from 1.8-8.5.

Model 6 – Results from the final model for this predictor set are included as Model 5 (Table 4.21). Model 5 included an interaction term breaking apart the levels of the interaction term included in Model 5 (Combination Category 4) resulting in Combination Category 5 with 4 categories. The odds of marital violence were significantly higher among couples where the wife had any internalizing disorder and the husband had any externalizing disorder (OR 9.2; 95% CI 4.9-18.3), all other combinations where at least one or both spouses had at least one internalizing or externalizing disorder (OR 4.3; 95% CI 2.0-9.2), and all other combinations where at least one spouse had one internalizing or externalizing disorder (but not both) (OR 1.8;

95% CI 1.1-2.9) when compared to couples where neither spouse had an internalizing or externalizing disorder. These variables were significant as a set (χ^2_3 43.0, p<0.001) and were significantly different from each other (χ^2_2 25.8, p<0.001).

Supplemental results from preliminary models are available in Appendix A, Table 5.

Table 4.20. Multivariate models of marital violence ever in current marriage, as reported by either spouse, with mental disorders from both husband and wife (n=1,515)[a]

	Model 1 OR (95%CI)	Model 2 OR (95%CI)	Model 3 OR (95%CI)	Model 4 OR (95%CI)
III. Couple mental disorders				
Couple mental disorder combination category 1				
Both had at least 1 internalizing or externalizing disorder	4.2 (2.5-7.1)*			
Only 1 partner had at least 1 internalizing or externalizing disorder	2.1 (1.3-3.2)*			
No internalizing or externalizing disorders between the couple	1.0			
Couple mental disorder combination category 2				
Both had at least 1 internalizing or externalizing disorder		4.2 (2.5-7.1)*		1.5 (0.7-3.4)
Only husband had at least 1 internalizing or externalizing disorder		2.5 (1.5-4.1)*		5.2 (2.0-13.6)*
Only wife had at least 1 internalizing or externalizing disorder		1.7 (0.9-3.1)		1.7 (0.9-3.3)
No internalizing or externalizing disorders between the couple		1.0		
Couple mental disorder combination category 3				
Wife both – husband both			14.3 (4.5-45.1)	9.4 (2.6-34.3)*
Wife both – husband either (not both)			12.7 (1.9-85.3)*	8.3 (1.1-60.6)*
Wife both – husband neither			2.5 (0.5-14.1)	1.5 (0.3-8.8)
Wife externalizing only (independent of husband)			1.9 (0.5-6.7)	1.2 (0.3-5.0)
Wife internalizing only – husband both			6.8 (2.6-17.6)*	4.4 (1.5-13.0)*
Wife internalizing only – husband externalizing only			8.6 (3.7-19.9)*	5.6 (2.0-15.9)*
Wife internalizing only - husband internalizing only			1.6 (0.7-3.6)	
Wife internalizing only - husband neither			1.7 (0.8-3.3)	
Wife neither - husband both			5.3 (2.0-13.6)*	
Wife neither - husband had either (but not both)			2.0 (1.2-3.5)*	0.4 (0.1-1.1)
Wife neither - husband had neither			1.0	$\chi^2_{(7)}$ 25.2, p=0.001
				$\chi^2_{(6)}$ 24.0, p=0.001
Couple mental disorder combination category 4				
Wife internalizing only - husband externalizing only				
Either OR both had both				
All other combinations				
Wife had neither - husband had neither				

Couple mental disorder combination category 5

    Wife internalizing (whether or not externalizing) - husband externalizing (whether or not internalizing)

    All other combinations where at least one or both spouses had both

    All other combinations where at least 1 spouse had at least 1 internalizing or externalizing disorder (but not both)

    Wife had neither - husband had neither

$\chi^2_{(2)}$ 30.1, p<0.001	$\chi^2_{(3)}$ 31.5, p<0.001	$\chi^2_{(10)}$ 48.5, p<0.001	$\chi^2_{(10)}$ 48.7, p<0.001
$\chi^2_{(1)}$ 8.3, p=0.004	$\chi^2_{(2)}$ 8.7, p=0.01	$\chi^2_{(9)}$ 31.0, p=0.01	$\chi^2_{(9)}$ 28.5, p=0.001

Abbreviations: both, at least 1 internalizing disorder and at least 1 externalizing disorder; internalizing only, at least 1 internalizing disorder no externalizing disorders; externalizing only, at least 1 externalizing disorder, no internalizing disorders; neither, 0 internalizing disorders, 0 externalizing disorders;

* significant at the 0.05 level, two sided test

[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, whether or not a person was present during the interview for the wife, age of the wife and age of the husband

Table 4.21. Continued multivariate models of marital violence ever in current marriage, as reported by either spouse, with mental disorders from both husband and wife (n=1,515)[a]

	Model 5	Model 6[b]
	OR (95%CI)	OR (95%CI)

III. Couple mental disorders

Couple mental disorder combination category 1

    Both had at least 1 internalizing or externalizing disorder

    Only 1 partner had at least 1 internalizing or externalizing disorder

    No internalizing or externalizing disorders between the couple

Couple mental disorder combination category 2

    Both had at least 1 internalizing or externalizing disorder

    Only husband had at least 1 internalizing or externalizing disorder

    Only wife had at least 1 internalizing or externalizing disorder

    No internalizing or externalizing disorders between the couple

Couple mental disorder combination category 3

    Wife both – husband both

    Wife both – husband either (not both)

    Wife both – husband neither

    Wife externalizing only (independent of husband)

    Wife internalizing only – husband both

    Wife internalizing only – husband externalizing only

    Wife internalizing only - husband internalizing only

    Wife internalizing only - husband neither

    Wife neither - husband both

    Wife had neither - husband had either (but not both)

    Wife had neither - husband had neither

Couple mental disorder combination category 4

Wife internalizing only - husband externalizing only	8.5 (3.7-13.2)*	
Either OR both had both (at least 1 internalizing and at least 1 externalizing disorder)	5.7 (3.0-10.8)*	
All other combinations	1.8 (1.1-3.0)*	
Wife had neither - husband had neither	1.0	

Couple mental disorder combination category 5

Wife internalizing (whether or not externalizing) - husband externalizing (whether or not internalizing)		9.2 (4.6-18.3)*
All other combinations where at least one or both spouses had both (at least 1 internalizing and at least 1 externalizing disorder)		4.3 (2.0-9.2)*
All other combinations where at least 1 spouse had at least 1 internalizing or externalizing disorder (but not both)		1.8 (1.1-2.9)*
Wife had neither - husband had neither		1.0
	$\chi^2_{(3)}$ 38.10, p<0.001	$\chi^2_{(3)}$ 43.0, p<0.001
	$\chi^2_{(2)}$ 19.8, p<0.001	$\chi^2_{(2)}$ 25.8, p<0.001

Abbreviations: both, at least 1 internalizing disorder and at least 1 externalizing disorder; internalizing only, at least 1 internalizing disorder no externalizing disorders; externalizing only, at least 1 externalizing disorder, no internalizing disorders; neither, 0 internalizing disorders, 0 externalizing disorders;
* significant at the 0.05 level, two sided test
[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, whether or not a person was present during the interview for the wife, age of the wife and age of the husband
[b] Model 6 identifies the final model for this predictor set

4.5 Aim 5 Results

Model 1 – Model 1 (Table 4.22) shows results from the final analytic model including all 10 predictors identified in analyses conducted as part of Specific Aims 1-4; three from Aim 1 (demographic/relationship characteristics), two from Aim 2 (childhood adversity), two from Aim 3 (dating experiences), and three from Aim 4 (mental disorders). It also shows coefficients from each methodological control; dummy variables for each country, years married as measured in quartiles, whether or not a person was in the room during the interview of the wife, the wife's age, and husband's age. Of the parameters included, only five were significant. The odds of marital violence were significantly higher among couples where the wife had one or more childhood adversities (OR1.8; 95% CI 1.2-3.7), either spouse experiencing dating violence before the age of 21 years (OR 1.7; 95% CI 1.2-2.6), the wife having any internalizing disorder (whether or not externalizing) and the husband having any externalizing disorder (whether or not internalizing) (OR 5.0; 95% CI 2.5-10.3), or all other combinations where at least one or both spouses had at least one internalizing disorder or externalizing disorder (but not both) (OR 3.4; 95% CI 1.5-7.6). Additionally, the odds of marital violence decreased as the highest educational attainment level of the couple increased (OR 0.8; 95% CI 0.6-0.9). The odds of marital violence differed significantly for each aim's group of predictors as sets within the model. Within-group mean differences in odds were also tested for each aim's group of predictors, all of which were significant.

Table 4.22. Final multivariate model of marital violence ever in current marriage, as reported by either spouse, with all significant predictors identified in previous models (n=1,515)[a]

	Bivariate Models	Model 1
	OR (95% CI)	OR (95% CI)
I. Methodological Controls		
Country		
United States		0.9 (0.4-1.6)
Brazil		1.0 (0.5-1.9)
China		1.9 (1.1-3.5)*
Lebanon		0.8 (0.3-2.0)
Nigeria		0.8 (0.5-1.4)
Bulgaria		1.0
Years married quartiles		
short		1.1 (0.7-1.9)
short average		1.3 (0.8-2.1)
long average		1.4 (0.9-2.3)
long		1.0
Person in the room during the interview for the wife		
spouse in the room		0.4 (0.2-0.6)*
no spouse but someone over the age of 6 in the room		0.9 (0.6-1.3)
alone or with a child <6 years old		1.0
Wife's age		1.0 (1.0-1.1)
Husband's age		1.0 (1.0-1.0)
II. Demographics / relationship characteristics		
Husband's age when first married		
young	1.5 (1.0-2.2)*	1.3 (0.8-1.9)
young average		
old average		
old		

Highest education level in couple	0.7 (0.6-0.9)*	0.8 (0.6-0.9)*
Couple marriage categories		
Wife more marriages than husband	2.4 (1.3-4.4)*	1.8 (0.9-3.5)
Husband more marriages than wife		$\chi^2_{(3)}$ 18.6, p<0.001
Both previously married		$\chi^2_{(2)}$ 12.0, p=0.003
Both in first marriage		

III. Childhood adversities

Wife - maladaptive family functioning CAs – 2 categories		
0		
1or more	2.2 (1.5-3.2)*	1.8 (1.2-3.7)*
Husband - maladaptive family functioning CAs – 2 categories		
0		
1or more	2.1 (1.4-3.1)*	1.5 (1.0-2.3)
		$\chi^2_{(2)}$ 13.60, p<0.001

IV. Dating experiences $\chi^2_{(1)}$ 0.30, p=0.59

Either husband and/or wife ever experienced any violence in any dating relationships		
	2.6 (1.7-3.8)*	1.7 (1.2-2.6)*
Age of first sex combination 4 - Either wife young (<18) and/or husband young or young average (<=19)[d]		
	1.6 (1.1-2.5)*	1.3 (0.8-2.0)
		$\chi^2_{(2)}$ 9.40, p=0.009

V. Mental disorders $\chi^2_{(1)}$ 0.90, p=0.36

Couple mental disorder combination category 5		
Wife internalizing (whether or not externalizing) - husband externalizing (whether or not internalizing)	9.2 (4.6-18.3)*	5.0 (2.5-10.3)*
All other combinations where at least one or both spouses had at least 1 internalizing and at least 1 externalizing disorder	4.3 (2.0-9.2)*	3.4 (1.5-7.6)*
All other combinations where at least 1 spouse had at least 1 internalizing or externalizing disorder (but not both)	1.8 (1.1-2.9)*	1.6 (1.0-2.6)
Wife had neither - husband had neither		1.0
		$\chi^2_{(3)}$ 21.80, p<0.001
		$\chi^2_{(2)}$ 10.90, p=0.004
Multivariate model χ^2		$\chi^2_{(10)}$ 127.20, p<0.001

$\chi^2_{(9)}$ 104.40, p<0.001

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* significant at the 0.05 level, two sided test
[a] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, whether or not a person was present during the interview for the wife, wife's age and husband's age
[b] Any violence is defined as ever being a victim or perpetrator of moderate physical violence in any dating relationships. The reference includes those who did not date before 21
[c] Husband and wife age of first sexual intercourse combined to define quartiles
[d] Compared to all other combinations

The estimated AUC was 0.75 based on predicted probabilities in the observed data and 0.70 based on the simulated data of 20 replicates of 10-fold cross-validated predictions, (Figure 1). Based on the simulated data, the 5% of respondents with the highest predicted risk included 18.6% of all cases of marital violence. This is just under four times the proportion expected by chance, (Table 4.23). This is compared to 27.3% in the observed data which is five and a half times the proportion expected by chance.

Table 4.23. Concentration of risk among the top three ventiles of couples with highest predicted risk of marital violence in the total sample[a]

	Simulated Data[b] (n= 30,300)				Observed sample[c] (n=1,515)		
	Concentration of risk in ventiles predicted to have highest risk[d]				**Concentration of risk in ventiles predicted to have highest risk[d]**		
AUC	**Top 5%**	**Top 10%**	**Top 15%**	**AUC**	**Top 5%**	**Top 10%**	**Top 15%**
0.70	18.6	28.43	38.0	0.75	23.7	35.2	49.4

Abbreviations: AUC, area under the receiver operating characteristic curve
[a] Each ventile represents 5% of married couples in the sample ranked in terms of their predicted risk of marital violence
[b] Estimates calculated from 20 replicates of 10-fold cross-validation of the final model
[c] Estimates calculated from the final model
[d] Concentration of risk refers to the percent of all observed occurrences of the outcome in a ventile or ventiles of the predicted risk distribution.

Figure 1. AUC of marital violence final model, total sample weighted analysis
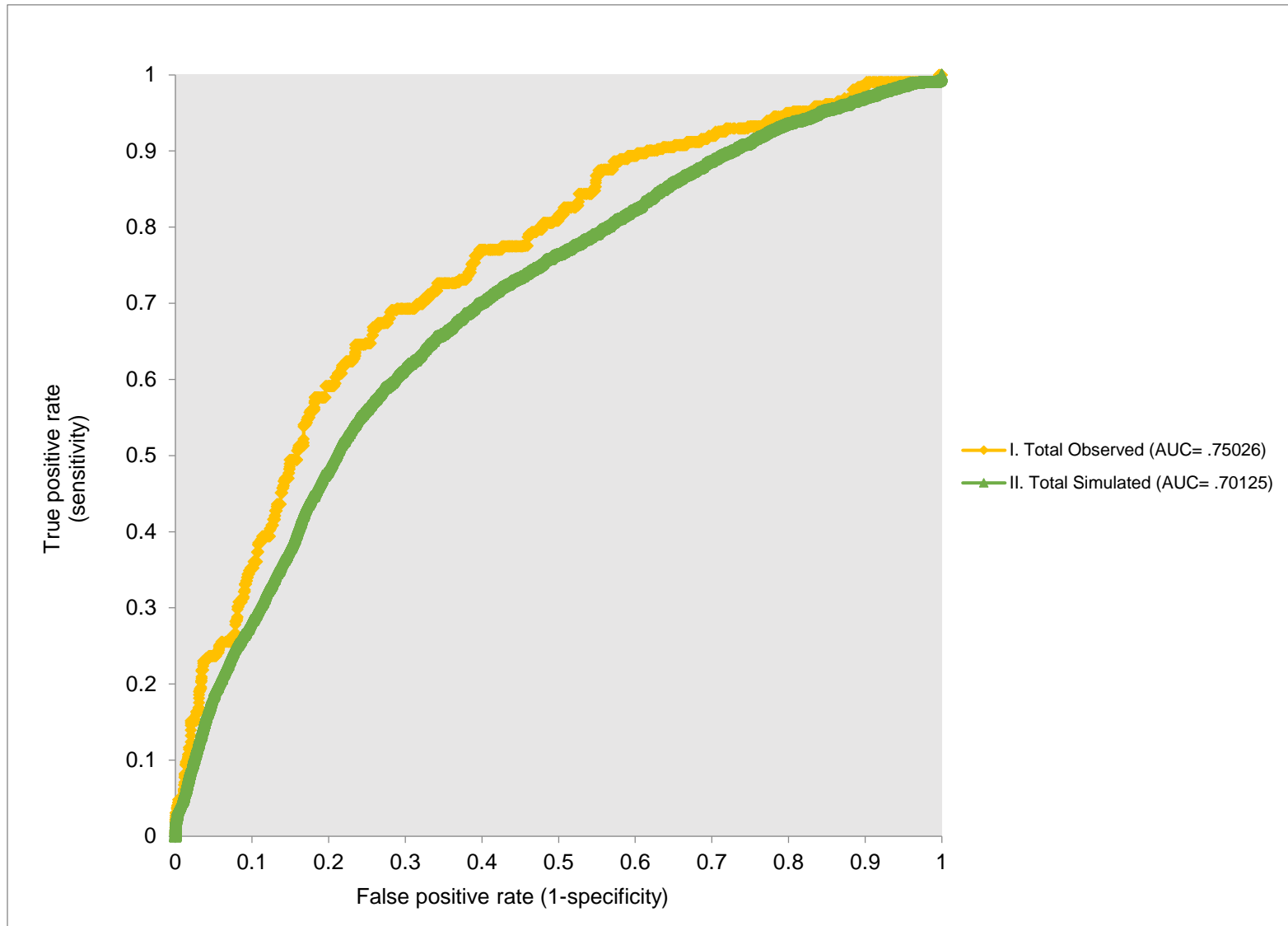
Abbreviations: AUC, area under the receiver operating characteristic curve

Chapter 5. Discussion

Chapter 5. Discussion

5.1 Prevalence Measures / Discordance in Reporting

Overall, concordance of spousal reports of marital violence was low. Only in about 25% of couples where at least one member reported physical violence did their spouse also report violence. Though we could have used the conservative estimate where reports of physical violence were concordant, we decided to combine reports where either spouse reported violence, which raised the estimate over 250%, from 3.8% to 14.4%. This decision is potentially justified as there are reasons to believe reports of violence are likely underestimates. Despite efforts for the safety and privacy of participants, there are reasons why spouses may avoid disclosure of violence particularly when there are potential cultural or legal consequences [122, 123]. Abused women may not feel comfortable revealing victimization as they may feel embarrassed or ashamed, fear reprisal by abusers, or the subject may be too personal to discuss with a stranger [124]. Reasons for non-disclosure of male perpetration, however, are less studied. Though, it is possible that males may not reveal perpetration because it may be viewed as a stigmatizing behavior with potential legal consequences [34] especially in countries where there is higher gender equality. Given the multitude of factors which influence reporting, who chose to use any report of violence. Additionally, the conservative estimate where reports of violence were concordant was dramatically lower than previously reported prevalence estimates giving us no reason to believe that this is closest to the truth [11, 14].

The primary goal of this project was to identify predictor variables, at their values prior to marriage, associated with subsequent marital violence. Statistically significant predictors, and their optimal functional form, would then be used to develop a model predicting risk for marital violence. Indicators of model fit suggest that we were successful as the AUC was 0.75 in the model with the observed sample and 0.70 in the model using the simulated data. The most

important finding from our study was that just under 30% (28.43%) of couples who experienced marital violence were among the top 10% of respondents with highest predicted risk scores in our cross-validated predictive model (simulated sample). This is noteworthy because cross-validation is designed to limit the possibility of over-fitting and suggests that our model's performance has external validity across other unknown samples [125]. Our model is a significant contribution to public health as it provides the first step and suggestive evidence that this and similar models could be used to support primary prevention of marital violence. In order for primary prevention to be successful, methods need to be developed to target high-risk couples for program intervention. Although relatively weak, the model from this project shows that it is possible to identify these couples better than chance.

Several tools have been developed to predict IPV victimization including the revised Danger Assessment Tool (DA), the Ontario Domestic Assault Risk Assessment (ODARA), the Spousal Assault and Risk Assessment Guide (SARA), and the Chinese Risk Assessment Tool for Victims (CRAT-V). However, the DA, ODARA, and SARA are all secondary prevention tools which predict re-victimization of IPV [126-128]. The CRAT-V was created with the goal of predicting violence for primary prevention. However, this tool was created using data from one city in China and would need to be tested using data from other areas. Furthermore, it only included factors from female respondents omitting the possibility of joint effects within the couple [129].

To date, few primary prevention efforts for IPV have shown promising results [68, 73]. The Creating Healthy Relationships program has shown results in reducing IPV among currently married couples [73]. This program was designed to reduce IPV in low-income, situationally violent couples (i.e. couples where violence tends to be more reciprocal, stay within the family, and not involve control or dominance) [130]. Though this program has been used to prevent IPV

in this specific population, it is possible that it has utility in a broader target group. Other primary prevention programs initially started by targeting isolated risk factors [68]. However, these programs were predicated on the assumption that efforts designed to achieve a significant reduction in victimization are optimally supported by the identification and targeting of specific risk factors associated with the outcome. These types of programs were inevitably unsuccessful because they ignore the possibility that while single risk factors are associated with IPV, they are not well-suited for consideration of the complex synergy between multiple characteristics. The predictive modeling techniques used in this project, provide evidence that it is possible to use a combination of factors to look beyond the individual characteristics, as is commonly done in public health practice, to stratify individuals based on their cumulative predicted risk.

Predictive modeling has been defined as the process by which a model is created to try to best predict the probability of an outcome [131]. One example of an intervention using predictive analytic methods in the public health sphere is the Veterans Health Administration's REACH VET initiative. This initiative was implemented in 2016 and aims to prevent suicide among veterans using machine learning models to identify those with the highest risk [132]. However, the long-term impact of this approach is unknown. The integration of predictive analytics in public health and clinical practice is in its infancy and it is unlikely that activities designed to estimate risk, in the absence of consideration of the effectiveness of treatments designed to prevent it, will achieve the desired reductions. It is possible that there may also be negative unintended consequences. Thoughtful piloting of intervention strategies, evaluation of outcomes associated with program participation, and continued model assessment are necessary components of any effort utilizing advanced analytics.

There is typically a trade-off between prediction and interpretation when using predictive modeling [131]. Typically, the higher the model's prediction accuracy, the more complex the

model becomes. This is a common issue when using machine learning methods, which maximize model performance (prediction) at the expense of individual interpretation of coefficients in a meaningful way [131]. As analyses in this project used logistic regression to build our predictive model, we have more flexibility regarding interpretation of parameter estimates [131] lending to several observations from Specific Aims 1-4.

In Aim 1, we hypothesized that demographic characteristics such as younger age and lower education would be significantly associated with marital violence. Surprisingly, the only significant gender-specific predictor retained in the final model was the husband's age when he first was married; specifically young age. As this variable was categorized into country specific quartiles, a uniform age cutoff for "young" in the sample is not possible. Age ranges per country were less than 21 years old in the United States, less than 22 years old in Brazil and Bulgaria, less than 23 years old in Nigerian and less than 25 years old in China. Surprisingly, this variable was not significant for wives.

We also proposed that differences in demographic characteristics between the couple would be associated with variability in risk for marital violence not explained by the independent effects of these factors alone. Results from previous research suggest an association with differences in IPV risk associated with differences in education. However, the evidence was mixed on whether risk increased when the husband had more education than his wife or when the wife had more education than her husband. Our analyses did not identify any significant interactions when comparing the husband's to the wife's education. Rather the highest education level in the couple was significant. Overall, the odds of marital violence decreased as the highest educational attainment level of the couple increased. Additionally, we examined potential age differences between couples as there was also evidence to expect this to be a strong predictor of marital violence. Bivariate models identified that couples where the wife was two or more

years older than her current husband had increased odds of marital violence. However, in the multivariate models, inclusion of this age difference did not reach statistical significance. Though interactions of age did not increase risk of marital violence, interactions between previous marriages were associated with increased risk. Relationships where the wife had more previous marriages than her husband had a significantly higher odds of marital violence when compared to all other combinations of differences in the number of marriages. This is potentially important because the wives' number of previous marriages was not a significant predictor of violence alone, but her number of previous marriages relative to her husband's was significant. In fact, none of the wives' demographic characteristics retained statistical significance in the multivariate models. Her characteristics were only significant when assessed in the context of the couple. The majority of research on IPV have prioritized solely interviewing women to understand IPV. However, given the complexity and inherent dyadic nature of IPV, it is pertinent to include both members of the couple as evidenced by the results of this project. Results show that the characteristics of the relationship are more important than the characteristics of the individuals.

Historically, prevention programs targeting specific demographic groups have primarily focused on women and girls [133]. Only recently have programs started using approaches that address men, women, boys and girls under the same agenda. One of the longest running programs using this approach is Stepping Stones, a small group intervention designed to prevent IPV in low socio-economic urban areas. Evaluation of this program has shown positive results in reducing male perpetration of IPV [134]. Our results support the need to include males in prevention programs such as Stepping Stones.

In Aim 2, we hypothesized that adverse childhood experiences would be associated with increased risk of marital violence, particularly exposure to parental violence in childhood.

Analyses included in this project identified a dominant grouping of seven childhood adversities

representing maladaptive family functioning (MFF). Though this grouping includes exposure to

parental violence, our results suggest that exposure to any one of the seven MFF childhood

adversities, for each spouse independently, increased risk for marital violence. This finding is

contrary to the majority of previous studies exploring the association of childhood adversities

and IPV, which consistently note that witnessing parental violence is the driving adversity in this

relationship. This is partially because most studies do not consider the battery of adversities

included in this project. Our findings reinforce the importance of considering a multitude of

childhood adversities in future research as measurement of single items may be inadequate.

This finding has important implications for prevention efforts because it means that prevention of

a single childhood adversity is unlikely to have important prevention effects. There are two ways

to view the complicated relationship between childhood adversity and IPV in terms of

prevention. Programs can either aim to prevent childhood adversities from occurring in the first

place or they can prevent perpetration or victimization of future IPV among individuals who have

already experienced an adversity. More resources have been directed toward the former [135],

however, none have followed subjects far enough in the future to determine whether reduction

of IPV has been an indirect effect of the programs.

Interventions targeting individuals who have experienced childhood adversities face several

challenges. First, reporting is extremely low for child maltreatment making it difficult to identify

victims [135]. Particularly if they don't have physical injury requiring treatment. This is

specifically relevant for interventions which rely on medical or criminal justice records [128] .

Also, these programs typically focus on single childhood adversities [128] ignoring the complex

relationships between other adversities and their co-occurrence. Our findings suggest it would

be beneficial for programs to focus on victims of any one of the seven MFF childhood adversities.

In Aim 3, we hypothesized that the joint effect of dating violence for both partners would be associated with increased risk for marital violence and that this joint effect would be stronger than that of the independent effects associated with the experience of either member of the couple. Results from analyses conducted as part of this project partially support this hypothesis. Overall, the odds of marital violence were significantly higher among couples where either spouse experienced dating violence. The significance of both members having experienced dating violence was tested but its relative importance never exceeded that of each spouse's independent exposure or the joint effect of either spouse having experienced violence in previous dating relationships. Additionally, we found that younger ages of sexual initiation for either spouse placed couples at risk for marital violence. This is a comparatively less studied risk factor for marital violence. However, our findings are consistent with current literature where early initiation of sexual intercourse was significantly associated with physical or sexual victimization of IPV [136]. It is possible that early initiation of sexual intercourse may be one measure of an underlying mechanism or construct that could partially explain risk of marital violence more accurately. Future research should consider the impact of other risky behaviors occurring in adolescence or earlier when compared with the experience of their peers.

Our findings in Aim 3 support our findings from earlier analyses indicating a need for research and prevention programs to include both male and female members of the relationship dyad. Two notable primary prevention programs are The Healthy Relationships Program and Safe Dates Program. Both of these programs recruit male and female participants and have shown reductions in both perpetration and victimization of dating violence [137, 138]. The Healthy Relationships program stratified results by gender and reported significant reductions of dating

violence victimization and perpetration in both males and females in the intervention group when compared to the control group [137]. Our findings support the approaches taken in these two programs in recruiting male and female participants as either partner experiencing dating violence predicts marital violence.

In Aim 4, we hypothesized that externalizing disorders for husbands and internalizing disorders for wives would be associated with increased risk for marital violence. In the gender specific analyses, we found that diagnosis of one or more internalizing disorder or one or more externalizing disorder resulted in an increased risk of marital violence. Importantly, results suggest that neither specific disorders nor the number of disorders within each category prior to marriage matter, but diagnosis of at least one does. However, when considering interactions between the couple, gender specific effects were not significant. Multivariate analyses with characteristics of the couple found significant interactions between disorders in spouses supporting our secondary hypothesis that interactions between couples, such as husbands with externalizing disorders married to wives with internalizing disorders, would be associated with an overall increase in risk for marital violence. We found three significant interactions with diminishing magnitude as the number and combination of disorders was reduced. Wives with internalizing disorders married to husbands with externalizing disorders were at highest risk of marital violence followed by all other combinations where at least one or both spouses had any disorder from both categories (i.e. at least one internalizing disorder and at least one externalizing disorder) and all other combinations where at least one spouse had any disorder from only one category (i.e. at least one spouse had at least one disorder from either category but not both). These results suggest the importance of internalizing and externalizing disorders as indicators of risk of marital violence regardless of which spouse is diagnosed. However, risk is particularly elevated when considering the synergistic effect of husbands with an externalizing disorder marrying wives with an internalizing disorder. The elevated risk for marital violence

associated with husbands having an externalizing disorders and the wife having an internalizing disorder suggest that there is likely a pathway to violence in couples where disruptive and impulsive men marry women who internalize their problems. It is possible that this finding is a function of assortative selection of partners and associated risk for marital violence in these relationships. Future research should consider this possibility.

Prevention programs targeting psychiatric disorders largely focus on males and integrate interventions for IPV into substance abuse programs. However, the rationale for these programs are criticized as they focus on the use of violence rather than on underlying beliefs leading to violence [139]. Results from evaluation of these programs are largely inconclusive [68, 140, 141]. One study found that treatment for alcohol abuse which included a component of IPV prevention resulted in a significant reduction of IPV perpetration [142].

One major recurring theme throughout Specific Aims 1-4 is the importance of the interaction between characteristics of the couple rather than independent gender specific factors. Seven of the 10 significant predictors identified were interactions between the couple. As noted multiple times throughout this project, with the exception of a few studies, the majority of studies have attempted to examine IPV solely using factors from female victims. Future research should include factors from both members of the couple in order to truly elucidate this complex phenomenon. Additionally, our findings support gender synchronized approaches for primary prevention which engage males and females rather than targeting specific genders.

This project has several notable strengths. Our data contained an assessment of marital violence and a multitude of predictors with the same survey instrument from both members of currently married couples. This allowed us to define the outcome of marital violence perpetrated towards women from either member. This method has been used in previous research [43]. As

noted in WHO guidelines, most IPV research among couples only asks the wife questions about violence in the relationship for the safety of the respondent and data collectors. However, this is only of particular concern for studies solely focused on assessing VAW [122]. As assessment of marital violence was a relatively small sub-section of a much larger study used for this project, this concern was not as significant [122]. Additionally, as mentioned in the methods section, every effort was made for surveys to be conducted in private due to the sensitive and potentially controversial questions asked of participants.

IPV is inherently a dyadic experience [99] yet relatively few studies have examined pre-marital predictors from both members of the couple [17]. Our data allows for potentially stronger inferences to be made about the characteristics of marital violence.

Finally, all predictors selected for the final model measured events and characteristics occurring prior to marriage; excluding those that might have occurred later as a direct or indirect result of violence during the marriage. This is particularly important when considering psychiatric disorders, as evidence suggests bi-directional relationships between exposure to violence and these outcomes [143].

Despite this studies strengths, this project has a number of potential limitations. Reliance on self-reported data could introduce recall bias and social desirability bias [144]. It is possible that respondents have forgotten events or made errors in the timing of events. Inaccuracies are especially likely in reported age of onset of psychiatric disorders [145]. It is also possible that respondents provided answers based on what they thought was the right answer, this is particularly relevant as the questions asked were highly sensitive with potential legal

repercussions. However, it was communicated to participants that a certificate of confidentiality was obtained to protect data from subpoena.

The survey did not include length of time in the relationship prior to marriage which may have resulted in over counting pre-marital psychiatric disorders as some disorders may have actually started after the start of the current relationship but prior to actual marriage. Additionally, the CIDI does not assess all psychiatric disorders. It is possible that inclusion of additional disorders may reveal different associations with marital violence. For example, it is possible that in couples where a member has gender dysphoria may increase risk for marital violence, particularly among heterosexual couples [146].

Our sample only includes currently married couples which has the potential to introduce selection bias, specifically survivor bias [144]. Consequently, this could result in an underestimate of the outcome of interest as some marriages where abuse occurred may have already ended in divorce. As an indirect way to address this bias, we controlled for duration of marriage in all models. Additionally, our decision to use the combined measure of IPV could introduce potential bias as we are assessing male perpetration and female victimization in the same measure. While prevalence of this combined estimate is more consistent with previous prevalence estimates of IPV, it is possible that we could be combining dissimilar things. However, we believe that use of the combined report is appropriate given the multitude of factors which may inhibit disclosure of violence for both spouses.

The assessment of violence in this proposal focuses solely on moderate physical violence using the CTS. As our assessment does not include severe physical, sexual, or emotional violence it may not provide a comprehensive assessment of all forms of violence within marriages. Additionally, despite its widespread use, the CTS has been criticized as questions of abuse are

based in the context of disputes, disagreements, or differences. This does not allow for the possibility that abuse can occur with any other form of conflict, or no conflict at all [147].

The use of logistic regression in building our predictive model may be suboptimal regarding prediction accuracy to other predictive analytic methods such as machine learning models [131]. However, our primary measures of prediction accuracy were acceptable. Additionally, the use of logistic regression allowed flexibility in interpreting model coefficients.

Despite the common method of pooling samples from multiple countries, we may have introduced bias in differences in culture between countries. We controlled for country in all analyses addressing this limitation, yet this method does not allow for subtle differences in culture within countries to be examined.

Our final predictive model shows that we are able to predict marital violence better than chance (four times better within the top ventile) but it is potentially not strong enough for offering specifically targeted primary prevention efforts. However, this may be attributed to the bias within our data as our sample only includes currently married couples. Despite this limitation, our results are promising enough for use in a prospective study to assess its predictive power in an uncensored sample. For instance, it would be possible to enroll couples from those receiving marriage licenses. These couples would complete self-administered questionnaires at baseline and would be followed in time for several years with repeated measures at specific intervals to assess a multitude of factors such as psychiatric disorders, divorce, reasons for divorce and whether or not there was violence within the marriage. We would then be able to apply our model to this sample and see if our model performance improved. If performance metrics were improved, we could then consider offering targeted primary prevention to future high-risk couples identified with the model.

Chapter 6. Conclusion

Chapter 6. Conclusion

Results from this project identify the importance of considering both members of relationship when conducting research on IPV. We were able to identify important findings drawing on the strengths of our data as we had detailed information from both members of currently married couples. We were able to consider the complexity and interplay between both partner's characteristics and found the relative importance of interactions between characteristics of the couple rather than independent gender specific factors. We recognize that this is not always feasible but emphasize its consideration whenever possible. Implications of this finding suggests that traditional IPV research does not adequately describe the inherent dyadic nature of the occurrence.

Given the global commitment to end VAW, we want to emphasize the importance of multinational collaborations such as the World Mental Health Survey Initiative. Prioritizing comparable cross-national data can enhance scientific rigour and aid in the appropriate allocation of services and funds.

Taken separately, each specific aim has identified several modifiable characteristics for preventing marital violence when considering prevention from the traditional risk factor approach. Identified factors could also be used to improve current prevention efforts on each level. For example, if a social worker, teacher, healthcare professional, or other identifies that a child has experienced any of the seven MFF childhood adversities, treatment could include efforts to prevent IPV in their future relationships. However, we have demonstrated that the importance of found risk factors in isolation do not predict a person's risk of marital violence

rather they are important together in order to calculate a predicted probability given their collective exposure.

Results from this project demonstrate that it is possible to predict marital violence among currently married couples using these pre-marital risk factors. Although predictive analytic methods have successfully been used in the health sphere such as improving treatment delivery and increasing the accuracy of diagnoses, we still have far to go in understanding these methods and their application in public health. Especially when results are intended to aid in preventing a highly sensitive and stigmatized behavior such as marital violence. We've only just taken the first step. Developing targeted primary prevention interventions using results from this project are contingent on improved model performance with uncensored samples. If successful, interventions would have to be undertaken with extremely thoughtful piloting and evaluation as unintended consequences are possible. However, given that IPV is such common and pervasive problem, investment in these next steps are warranted.

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Appendix A – Outtake Models

Table 1. Outtake[a] multivariate models of marital violence ever in current marriage, as reported by either spouse, with demographics from both spouses and relationship characteristics (n=1,515)[b]

	Model 5	Model 6	Model 7	Model 8	Model 9
	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
I. Wife's Demographic characteristics					
Education					
Education categories					
Low					
Low-average					
High-average					
High					
Highest parent education					
Highest parent education categories					
Low					
Low-average					
High-average					
High					
Highest parent occupation					
Highest parent occupation categories					
Never worked					
Low					
Low-average					
High-average					
High					
In first marriage					
Yes					
No					
Age when first married					
Age when first married categories					
Young					

Young-average					
Old-average					
Old					
II. Husband's demographic characteristics					
Education					
Education categories					
Low					
Low-average					
High-average					
High					
Highest parent education					
Highest parent education categories					
Low					
Low-average					
High-average					
High					
Highest parent occupation					
Highest parent occupation categories					
Never worked					
Low					
Low-average					
High-average					
High					
In first marriage					
Yes					
No					
Age when first married					
Age when first married categories					
Young			1.5 (1.0-2.2)*		
Young-average					
Old-average					
Old					
II. Relationship characteristics					
Highest education level in couple	0.7 (0.6-0.9)*	0.7 (0.6-0.8)*	0.7 (0.6-0.9)*	0.7 (0.6-0.9)*	0.7 (0.6-0.9)*
Highest education level in couple categories					
Low					

Low-average
High-average
High

Education difference – 3 categories
    Wife > = husband
    Husband 1 level higher than wife
    Husband 2 or more education levels higher

Education difference 5 categories
    Wife 2 or more levels higher
    Wife 1 level higher
    same education level between spouses
    Husband 1 level higher
    Husband 2 or more levels higher

Couple marriage categories
    Wife more marriages than husband   2.1 (1.2-3.8)*   2.3 (1.3-4.2)*
    Husband more marriages than wife
    Both previously married
    Both in first marriage

Age difference categories
    Wife 2 or more years older   1.7 (0.9-3.1)
    Wife 1 year older
    Wife and husband same age
    Husband 1 year older
    Husband 2 or more years older

Age when first married and age differences – 8 combinations

Husband young when first married	Wife more marriages than husband	Wife 2 or more years older than husband	
1	1	1	0.4 (0.0-4.50
1	1	0	1.3 (0.2-7.7)
1	0	1	2.8 (1.2-6.5)*
0	1	1	5.4 (1.4-20.4)*
1	0	0	1.6 (1.0-2.4)*
0	1	0	3.0 (1.4-6.5)*
0	0	1	1.29 (0.4-3.8)
0	0	0	

Age when first married - 4 combinations

Husband young when first married	Wife young when first married				
1	1				1.6 (0.9-2.6)
1	0				1.7 (1.1-2.8)*
0	1				1.7 (1.0-2.6)*
0	0				
Multivariate model χ^2		$\chi^2_{(3)}$ 27.7, p<0.001	$\chi^2_{(2)}$ 27.1, p<0.001	$\chi^2_{(2)}$ 26.3, p<0.001	$\chi^2_{(8)}$ 38.0, p<0.001

Multivariate model last column: $\chi^2_{(4)}$ 29.1, p<0.001

* significant at the .05 level, two sided test
[a] This table presents additional models estimated to identify the strongest predictors in this predictor set
[b] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife

Table 2. Outtake[a] Multivariate models of marital violence ever in current marriage, as reported by either spouse, with wife's childhood adversities (n=1,515)[b]

	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
Physical abuse	1.8 (0.7-4.7)	2.2 (1.1-4.5)*	1.7 (0.8-3.8)		2.1 (0.8-5.4)	
Sexual abuse	3.3 (1.2-8.7)*	4.0 (1.8-8.7)*	3.1 (1.2-8.0)*		3.8 (1.4-9.8)	
Neglect	1.7 (0.6-4.9)	2.5 (1.0-6.5)	2.1 (0.7-6.2)		2.4 (0.8-7.4)	
Mother died	0.7 (0.2-1.8)	0.6 (0.2-1.8)	0.6 (0.21-1.8)	0.6 (0.2-1.7)	0.6 (0.2-1.8)	0.6 (0.2-1.7)
Father died	0.8 (0.5-1.4)	0.8 (0.4-1.4)	0.8 (0.5-1.4)	0.8 (0.4-1.3)	0.8 (0.4-1.4)	0.8 (0.5-1.3)
Other parental loss	1.7 (1.1-2.6)*	1.7 (1.1-2.6)*	1.6 (1.1-2.5)*	1.6 (1.1-2.5)*	1.6 (1.1-2.6)*	1.6 (0.9-2.5)
A parent had a mental disorder	1.0 (0.4-2.2)	1.3 (0.6-2.6)	1.0 (0.5-2.1)		1.2 (0.5-2.7)	
A parent had a substance disorder	1.2 (0.5-3.2)	1.8 (0.8-3.9)			1.6 (0.6-4.3)	
A parent was involved in criminal behavior	1.1 (0.3-3.7)	1.4 (0.4-4.7)	1.2 (0.3-4.2)		1.3 (0.5-5.0)	
Witnessed family violence	1.1 (0.3-3.6)	1.6 (06-4.4)	1.2 (0.4-3.9)		1.5 (0.5-5.0)	
Had a life threatening physical illness	0.6 (0.3-1.5)	0.6 (0.3-1.6)	0.6 (0.3-1.5)	0.7 (0.3-1.6)	0.6 (0.3-1.6)	0.7 (0.3-1.6)
Experienced economic adversity						

	0.7 (0.2-2.3)	0.7 (0.2-2.1)	0.8 (0.3-2.1)	0.8 (0.2-2.8)	0.7 (0.2-2.2)	0.8 (0.3-2.9)
			$\chi^2_{(11)}$ 14.6, p=0.20			
Maladaptive family functioning CAs count						
Maladaptive family functioning CAs count categories						
0						
Exactly 1						
Exactly 2						
Exactly 3						
Exactly 4						
Exactly 5						
Exactly 6						
Exactly 7						
Maladaptive family functioning CAs – 4 categories	1.1 (0.5-2.2)			1.6 (1.3-2.0)*		
Maladaptive family functioning CAs – 4 categories						
0						
Exactly 1			1.4 (0.7-2.7)		1.1 (0.5-2.5)	1.9 (1.2-3.1)*
Exactly 2		0.8 (0.3-2.1)	1.4 (0.4-4.6)		0.9 (0.2-4.2)	3.0 (1.5-5.6)*
3 or more		0.3 (0.1-1.5)	0.9 (0.1-8.6)		0.4 (0.0-6.9)	3.3 (1.3-7.9)*
		$\chi^2_{(2)}$ 2.6, p=0.26	$\chi^2_{(3)}$ 2.7, p=0.43			
Maladaptive family functioning CAs – 2 categories						
0						
1 or more						
Multivariate model χ^2	$\chi^2_{(13)}$ 42.6, p<0.001			$\chi^2_{(6)}$ 29.1, p<0.001	$\chi^2_{(15)}$ 48.3, p<0.001	$\chi^2_{(8)}$ 32.4, p<0.001

Abbreviations: se, standard error, CA, childhood adversity
* significant at the 0.05 level, two sided test
[a] This table presents additional models estimated to identify the strongest predictors in this predictor set
[b] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife

Table 3. Outtake[a] multivariate models of marital violence ever in current marriage, as reported by either spouse, with husband's childhood adversities (n=1,515)[b]

	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)	OR (95%CI)
Physical abuse	1.2 (0.5-3.1)	2.6 (1.4-4.6)*	1.1 (0.5-2.7)		1.4 (0.6-3.4)	
Sexual abuse	1.3 (0.2-7.4)	1.9 (0.4-9.1)	1.1 (0.2-7.5)		1.2 (0.2-7.3)	
Neglect	0.7 (0.2-1.9)	1.3 (0.4-4.9)	0.9 (0.3-2.4)		1.0 (0.3-3.2)	
Mother died	1.8 (1.0-3.5)	1.8 (1.0-3.4)	1.9 (1.0-3.6)	1.8 (0.9-3.5)	1.9 (1.0-3.6)	1.9 (1.0-3.6)
Father died	1.2 (0.7-2.3)	1.2 (0.7-2.3)	1.2 (0.7-2.3)	1.2 (0.6-2.3)	1.2 (0.7-2.3)	1.2 (0.7-2.3)
Other parental loss	1.0 (0.5-2.0)	0.9 (0.5-1.9)	1.0 (0.5-1.9)	1.0 (0.5-1.9)	0.9 (0.5-1.9)	1.0 (0.5-1.9)
A parent had a mental disorder	0.6 (0.2-1.4)	1.2 (0.6-2.8)	0.6 (0.3-1.4)		0.7 (0.3-1.8)	
A parent had a substance disorder	1.2 (0.4-3.7)	2.5 (0.7-8.7)			1.8 (0.5-6.1)	
A parent was involved in criminal behavior	0.9 (0.3-2.8)	1.9 (0.7-5.8)	1.0 (0.3-3.2)		1.1 (0.4-3.3)	
Witnessed family violence	0.7 (0.3-1.6)	2.2 (0.9-5.0)	1.0 (0.4-2.7)		1.2 (0.5-3.3)	
Had a life threatening physical illness	0.7 (0.3-1.6)	0.7 (0.2-1.7)	0.7 (0.3-1.7)	0.7 (0.3-1.6)	0.7 (0.3-1.7)	0.7 (0.3-1.7)
Experienced economic adversity	0.6 (0.2-2.0)	0.6 (0.2-1.8)	0.6 (0.2-1.9)	0.5 (0.2-2.0)	0.6 (0.2-1.8)	0.6 (0.2-1.9)

		$\chi^2_{(12)}$ 22.3, p=0.03	$\chi^2_{(11)}$ 8.4, p=0.68		
Maladaptive family functioning CA count					
Maladaptive family functioning CA count categories					
0					
Exactly 1					
Exactly 2					
Exactly 3					
Exactly 4					
Exactly 5					
Exactly 6					
Exactly 7					
Maladaptive family functioning CAs – 4 categories	1.8 (0.9-3.6)		1.5 (1.2-1.8)*		
Maladaptive family functioning CAs – 4 categories					
0					
Exactly 1		2.5 (1.1-5.5)*		2.0 (0.9-4.6)	2.3 (1.4-3.6)*
Exactly 2	0.6 (0.2-1.5)	2.8 (0.9-9.1)		1.6 (0.4-7.2)	2.5 (1.3-4.5)*
3 or more	0.1 (0.0-1.4)	2.8 (0.3-29.7)		1.1 (0.1-22.4)	2.1 (0.9-5.1)
	$\chi^2_{(2)}$ 2.9, p=0.24				
Maladaptive family functioning CAs – 2 categories					
0					
1 or more					
Multivariate model χ^2	$\chi^2_{(13)}$ 30.4, p=0.004		$\chi^2_{(6)}$ 18.4, p=0.005	$\chi^2_{(15)}$ 36.6, p=0.001	$\chi^2_{(8)}$ 23.3, p=0.003

Abbreviations: se, standard error, CA, childhood adversity
* significant at the 0.05 level, two sided test
[a] This table presents additional models estimated to identify the strongest predictors in this predictor set
[b] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife

Table 4.. Outtake[a] multivariate models of marital violence ever in current marriage, as reported by either spouse, with dating experiences from both husband and wife (n=1,515)[b]

	Model 8
	OR (95%CI)

I. Wife's dating experiences

    Ever experienced any violence in dating relationships before the age of 21[c]

    Collapsed age of first sexual intercourse

        Young (less than 18 years old)

        Young average (18-19 years old)

        Average and older (20 years or older)

II. Husband's dating experiences

    Ever experienced any violence in dating relationships before the age of 21[c]

    Collapsed age of first sexual intercourse

        Young (less than 18 years old)

        Young average (18-19 years old)

        Average and older (20 years or older)

III. Couple dating experiences

    Either husband and/or wife ever experienced any violence in any dating relationships

    2.9 (1.0-8.4)

    Both husband and wife ever experienced any violence in any dating relationships

    Age of first sexual intercourse combination 1[d]
    - Wife young (<18) – husband either young or young average (<=19)

    2.2 (1.2-4-3.9)

    Age of first sexual intercourse combination 2[d]
    - Wife young (<18) – husband older than average (20+)

    1.8 (0.9-3.5)

    Age of first sex combination 3[d]
    - Wife not young (>=18) - husband either young or young average (<=19)

    1.4 (0.9-2.3)

Age of first sex combination 4[d]
- Either wife young (<18) and/or husband young or young average (<=19)

Multivariate model χ^2

$\chi^2_{(4)}$ 13.3, p=0.01

$\chi^2_{(3)}$ 3.6, p=0.30

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* significant at the 0.05 level, two sided test
[a] This table presents additional models estimated to identify the strongest predictors in this predictor set
[b] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, and whether or not a person was present during the interview for the wife
[c] Any violence is defined as ever being a victim or perpetrator of moderate physical violence in any dating relationships. The reference includes those who did not date before 21
[d] Compared to all other combinations

Table 5. Outtake[a] multivariate models of marital violence ever in current marriage, as reported by either spouse, with mental disorders from both husband and wife (n=1,515)[b]

	Model 5	Model 6
	OR (95%CI)	OR (95%CI)
I. Wife's mental disorders		
Any internalizing disorders	1.74 (1.1-2.7)*	
Any externalizing disorders	1.7 (0.9-3.1)	
Any internalizing disorders only (no externalizing)		1.6 (1.0-2.6)*
Any externalizing disorders only (no internalizing)		0.9 (0.2-3.5)
Any internalizing AND any externalizing		3.5 (1.6-7.9)*
II. Husband's mental disorders		
Any internalizing disorders	1.6 (1.0-2.5)	
Any externalizing disorders	2.8 (1.8-4.4)*	
Any internalizing disorders only (no externalizing)		1.6 (0.9-2.7)
Any externalizing disorders only (no internalizing)		2.9 (1.6-5.1)*
Any internalizing AND any externalizing		4.3 (2.0-8.8)*
Multivariate model χ^2	$\chi^2_{(4)}$ 38.10, p<0.001	$\chi^2_{(6)}$ 37.8, p<0.001
	$\chi^2_{(3)}$ 4.1, p=0.25	$\chi^2_{(3)}$ ₁4.1, p=0.02

Abbreviations: both, at least 1 internalizing disorder and at least 1 externalizing disorder; internalizing only, at least 1 internalizing disorder no externalizing disorders; externalizing only, at least 1 externalizing disorder, no internalizing disorders; neither, 0 internalizing disorders, 0 externalizing disorders;
* significant at the 0.05 level, two sided test
[a] This table presents additional models estimated to identify the strongest predictors in this predictor set
[b] Models were based on weighted data. Each model included dummy variable controls for WMH survey, years the couple was married, whether or not a person was present during the interview for the wife, age of the wife and age of the husband