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**The Relationship between Physical Health Problems
and Couple Violence and Conflict in Survivors of the 2004 Tsunami:
Mediation by Marital Satisfaction**

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Abstract

The impact of the 2004 East Asian Tsunami on Buddhist, Sri Lankan mothers' relationships was investigated in this study. More specifically, the relationship between increased violence and conflict post-Tsunami and the daily intrusiveness of Tsunami-related persisting physical health problems was examined in a sample of 170 women, nearly four years after the disaster. Mediation by marital satisfaction, on the relationship between these variables, after controlling for mental health status was also tested. Increased couple violence or conflict post-Tsunami was significantly and positively related to the daily effect of persistent physical health problems resulting from the Tsunami. Full mediation was revealed through a pronounced path model negatively linking increased couple violence and conflict with marital satisfaction, and negatively linking marital satisfaction to the influence of physical health challenges.

Keywords: Tsunami, violence, marital satisfaction

Introduction

A natural disaster of unparalleled precedence for property damage and death struck the eastern Asian coast on December 26, 2004. The effects of this disaster were devastating, with the death toll spiraling over 100,000 within the first minutes (Anderson 2007). The survivors were exposed to traumatic experiences surrounding the death of loved ones and the ambiguity involved in looking for the missing (Bronisch et al. 2006). The dramatic effects of the disaster suggest that there might be far reaching and long-lasting psychological, emotional, and physical effects (Wickrama and Kaspar 2007; Wickrama and Wickrama 2008). More research is needed to understand how the 2004 Tsunami continues to influence survivors. We also need to know the effects on family relationships of the 2004 Tsunami disaster.

Studies examining the mental health of disaster survivors immediately following disasters are abundant (Assanangkornchai, Tangboonngam, and Edwards 2004; Catapano et al. 2001; Suar, Mandel and Kuntia 2002). The most commonly researched constructs examined in this research are symptoms of posttraumatic stress disorder (PTSD) and depressive symptoms. Several studies identify possible factors that account for these symptoms including disaster events, property loss, and personal characteristics (Assanangkornchai, Tangboonngam and Edwards 2004; Caldera, Pango and Kullgren 2001; McMillen, Smith and Fisher 1997; Sattler, DeAlvarado and DeCastro 2006; Weidmann, Fehm and Fydrich 2008; Wickrama and Kaspar 2007). However, there is a gap in the research concerning the impact of disaster exposure on relationship dynamics, and what impact relational problems may have on physical health.

When addressing family relationship dynamics it is important to evaluate the role of gender within the relationships (Enarson and Morrow 1998). Disasters are social phenomena that would typically impact women more than men, due to female responsibilities and power dynamics (Houghton, Wilson, Smith and Johnston 2010). Women face specific vulnerabilities in the wake of disasters such as sexual violence, reproductive concerns, and higher mortality rates and lower social status, especially in the developing world (Carballo, Hernandez, Schneider and Welle 2005; Wickrama and Wickrama 2008).

Increased risk for domestic violence has also come to be accepted as a consequence of disasters (Houghton et al. 2010), although reporting of violence and crimes routinely decreases in the disaster context (Zahran et al. 2010). Fothergill (1996) also concluded that women are at higher risk of death in disasters generally, and that domestic violence intensifies in the context of disaster. Thus, increased risk of emotional abuse, sexual exploitation, and violence are well documented risks faced by women and girls who are disaster survivors (Enarson, Fothergill and Peek 2006). Other research has suggested that availability of some type of protective service for women is associated with greater reports of an increase in violence (Wilson, Phillips and Neal 1998). Conversely, areas

without direct access to a protective service may not report or recognize an increase in violence post-disaster (Houghton et al. 2010; Wilson et al. 1998).

It is thus evident that gender tends to exert influence on the level of exposure to disaster risks and losses. Men and women also have different reactions to and manifestations of the stress of a natural disaster (Fothergill 1996). More gender inclusive research surrounding disasters is needed for a more complete understanding of the risks and challenges women face.

Physical health problems or injuries are typical among disaster survivors generally across gender stratification (Wickrama and Wickrama 2008). Physical health problems may also persist to influence quality of life long after a disaster (Wu et al. 2006). Thus, it is important for us to understand the factors that predict the way that these health problems are perceived, experienced, and managed in daily life—long after the incidence of a disaster. It is possible that relationship factors including conflict or violence relate to the intensity of effect that physical health problems have on daily living. This study is intended to address in part, the ways in which post disaster violence and conflict relate to women's marital satisfaction and physical health problems. Specifically, it is intended to further our understanding of the challenges that women survivors face, and the mechanisms by which those challenges are affected.

Literature Review

Marital Satisfaction and Physical Health

There is currently evidence that suggest a relationship between physical health problems and marital and family relationships (Booth and Johnson 1994; Dush, Taylor, and Kroeger, 2008; Kiecolt-Glaser and Newton, 2001; Murray, Murray, and Daniels 2007; Trief et al. 2006). For example, research has linked high levels of marital quality to positive health benefits (Lillard and Waite 1995). Furthermore, it seems the reverse is also evident in that low relationship quality has been found to relate to lower levels of heart health for men and women (Smith et al. 2007). The relationship seems to be bi-directional, as Booth and Johnson (1994) found that spouses suffering a physical health problem experienced a decrease in marital interaction reported by their spouse. This suggests that chronic health problems have first and second order effects on the relationship. Health problems and pain have an impact on personal functioning and contentment. The indirect relationship is due to the lifestyle changes necessary to address health problems which affect the marriage. As Booth and Johnson (1994) noted, the sick spouse increases behaviors that are deemed problematic to the marriage, subsequently lowering levels of happiness.

Longitudinal methods have also been applied to the question of marital relationships and physical health problems. Trief et al. (2006) found that marital distress is related to

the level of distress in relation to chronic illness and to the level of distress across time. From these studies, it is evident that there may be a direct observable relationship between relationship quality and the experience of physical health problems. However, other related factors that are a part of daily family relationships could impact the level of symptom distress.

Murray, Murray and Daniels (2007) found that daily life stress, as well as negative life events, predicted symptom severity in those with chronic health conditions. Additionally, one's ability to regulate emotion, and the time of onset also predicted symptom severity. The relationship between emotional regulation and symptom severity is also bi-directional. It is possible that the daily stress and negative life events common in family relationships can have an impact on symptom severity.

Violence and Physical Health

Physical violence is a family interaction pattern and a regulatory coping style that could impact physical health. Those experiencing higher levels of marital violence may also suffer from high levels of daily stress that are likely to impair physical health. For example, several studies have highlighted the detrimental effects of intimate partner violence (IPV) on physical health (Humphries and Lee 2009; Plichta 2004; Woods, Hall, Campbell, and Angott 2008). These studies have linked IPV to specific physical health symptoms such as increased mortality, injury and disability, chronic pain, neuromuscular and sleep disturbances, and gynecological problems.

While these studies have identified a relationship between IPV and specific physical health indicators, the samples used were predominantly European American. In light of the current study it is also important to consider potential cultural differences which may be present in this relationship. Although there is evidence that the phenomena of IPV is experienced globally (Díez et al. 2009), the universal existence of the link between IPV and physical health is less evident. More recent research has attempted to establish this link internationally. For example, Díez et al. (2009) compared various physical and psychological health indicators for Spanish women who had or had not experienced IPV. Women who experienced IPV reported two times more physical health problems (i.e., migraines, respiratory problems, and abdominal pain) and three times more psychological health problems (i.e., hypersomnia, loss of energy, and difficulty making decisions) than those who did not report IPV.

Additionally, Vung, Ostergren, and Krantz (2009) examined this relationship in a sample of rural Vietnamese women and found that those who were exposed to IPV within the last year reported significantly higher levels of memory loss, pain and discomfort, sadness and depression, and suicidal thoughts than those who reported no abuse. Finally, Yoshihama, Horrocks and Kamano (2009) found in a sample of Japanese women that, even when controlling for socio-demographic factors, childhood sexual abuse, and sexual

abuse perpetrated by someone other than a partner; women who reported IPV were at significantly higher risk for health problems than those who reported no IPV.

Disaster, Violence, and Gender

Fothergill (1996), as well as Enarson and Morrow (1998), note that there is a lack of attention to gender in disaster research. Their conclusion is that the research has done little more than ask respondents to provide gender classification, and subsequently lacks depth. The lack of research in this area limits the theoretical conceptualization of disasters both socially and contextually. Furthermore, funding sources for disaster research have not tended to focus on the examination of social inequity.

This trend is beginning to change as there is more attention to the influences of gender on behavior before, during and after disasters. Additionally, women's organizations' response to disasters is on the rise (Enarson and Morrow 1998). Researchers have shown that, in general, women who experienced natural disaster are at greater risk for depressive symptoms and PTSD during the short and long term (Najarian et al. 2001; Steinglass and Gerrity 2006). These studies suggest that women's exposure to natural disaster also results in secondary stressors including increased economic insecurity, expanded care giving responsibilities, and a disrupted family life (Enarson 2004). These secondary stressors may in turn contribute to women's mental and physical health problems.

These secondary stressors, which often comprise resource losses from natural disaster victims, are closely linked to the displacement from the family home. While prolonged displacement from the family home itself operates as a powerful stressor for mothers, it may also proliferate as other stressors exerting cumulative impact on mental health. Displacement from the family home erodes economic, relational, and physical aspects of the family. This includes a loss of livelihood of mothers (e.g., cottage industries); the weakening of family relations; and the creation of family, parental, and marital conflicts; along with a breakdown of their proximal social network. Particularly, parental and marital conflicts may operate as powerful stressors for mothers.

Recent findings in a review of literature on women experiencing disasters concluded that women were limited in mobility, suffered from gender inequality, and were primarily in charge of childcare in the family (Fothergill, 1996), which resulted in higher physical risk during and after the disaster. Likewise, Enarson and Morrow (1998) discuss how women's roles, vulnerabilities in disaster and community response have been neglected in the research literature although women's loss of power and inequality has been illustrated following several disasters. Carballo, Hernandez, Schneider and Welle (2005) explain that during the 2004 Asian tsunami, many women were killed in attempts to rescue or stay with their children. Furthermore, women faced challenges in returning to the workforce after the disaster due to their childcare roles. Other gender disparities were

thought to have contributed to much higher mortality rates for women. Examples of this included mandated clothing and long hair which limited mobility and got caught in debris and branches making escape from the tsunami waves impossible. Women in these communities were often unaccustomed to being in the water beyond bathing and were ill-prepared to attempt to swim.

Women and girls who survive disasters are often at increased risk for subjection to sexual violence, rape, exploitation, sexually transmitted diseases, unwanted pregnancies and abortions, numerous reproductive health risks and serious medical issues for those who are pregnant at the time of impact (Carballo et al. 2005; Fothergill 1996; Enarson et al. 2006). The physical implications of these risks are devastating. Women generally manifest the stress of disasters primarily in emotional and mental health distress, while men tend to externalize the distress in behavioral ways including increased alcohol consumption (Fothergill 1996). This differential in experiencing the stress of a disaster needs to be understood more clearly as it may relate to the perpetration of violence against women post-disaster.

The increase in violence following disaster has been described as a process of the stressor revealing gender stratifications that undergird social organization and oppress women (Wilson et al. 1998). Domestic violence has been found to increase post-disaster, although its reporting is typically decreased in the wake of the disaster itself (Fothergill 1996; Wilson et al. 1998, Zahran et al. 2009). This increase makes attention to conflict and violence a salient issue for female disaster survivors. Furthermore, while we know some of the factors that may contribute to this problem, including increased stress and isolation, there is a need for further research to understand the dynamics of this increase in violence (Houghton et al. 2010).

Because women are the primary caretakers of the family, they are also the keepers of the emotional reactivity of family members. This reactivity also indirectly affects female caregivers, as they are the emotional keepers of the family. Figley (1995) indicates the treatment of emotional suffering includes the absorption of the upsetting material, which can be costly for caregivers. Helping professionals report that working with trauma victims has resulted in anxiety, sadness, and even depression. This phenomenon is now referred to as *compassion fatigue* (Figley 1995). The role of primary caregiver exacerbates the potential for compassion fatigue among female caregivers, especially those survivors exposed to increased violence and conflict in the family.

Furthermore, Kleber et al. (1995) suggest that those exposed to a primary victim of trauma may become worn out, or exhausted. This concept has come to be known as the *energy depletion perspective*. Research explicating the challenges and mechanisms of stress among the female care giving survivors provides more insight into their role during a disaster.

Violence and marital satisfaction

In addition to negative effects on physical health, violence has also been shown to be detrimental to marital satisfaction (see Stith, Green, Smith, and Ward 2008 for a review). Aggression in marriage perpetrated by the husband was also found to relate to less use of intimate language in the marriage, and staying together for commitment and roles (Langhinrichsen-Rohling et al. 1998). Other evidence regarding the relationship between marital satisfaction and violence reveals that this relationship may be particularly salient for women. For instance, Byrne and Arias (1997) found that the relationship between marital satisfaction and marital violence in women was moderated by attributions surrounding spouse behavior. More specifically, for women, the relationship between marital satisfaction and marital violence was significant and negative when attributions linked negative intent to partner behavior. When the women in the sample assumed positive intent in partner behavior, the relationship between satisfaction and violence was not significant.

Further differences in gender and violence in marriage are highlighted in the literature. Lawrence and Bradbury (2007) performed a longitudinal analysis of newlywed heterosexual couples across the first four years of marriage to identify a directional relationship between physical violence and marital satisfaction. Their results indicated both a direction of influence and gender differences. Specifically, physical violence more strongly predicted marital satisfaction than the reverse. This indicates a possibility that violence exists as a causal precursor to lower marital satisfaction. The authors also found that husband aggression directed toward his wife predicted marital discord whereas wife aggression predicted a dissolution of the marital relationship altogether. This finding denotes that different relational outcomes may follow marital aggression depending on the perpetrator's gender.

William and Frieze (2005) further support this finding in their study in which they found that individuals in violent relationships had lower marital satisfaction than those in non-violent relationships. However, marital satisfaction in mildly or severely violent relationships was lower for woman than for men, further suggesting that violence in relationships influences marital satisfaction differently depending on gender.

Testa and Leonard (2001) suggest that women who experienced physical aggression from their husbands in the first year of marriage reported higher levels of stress and lower levels of marital satisfaction than those who didn't experience violence. However, this research lacks information about how the disaster experience and potential health problems influence the reactivity to violence. It is possible that marital satisfaction is key in understanding how past disaster marital conflict relates to post-disaster physical health problems.

The purpose of this study is to investigate the post-tsunami relationships between intimate partner violence, marital satisfaction, and physical health in a sample of Sri Lankan women. Specifically, we sought to investigate the relationship between marital

violence and physical health problems. Additionally, we hypothesized that this relationship would be mediated by marital satisfaction. Specific study hypotheses are listed below.

Hypotheses

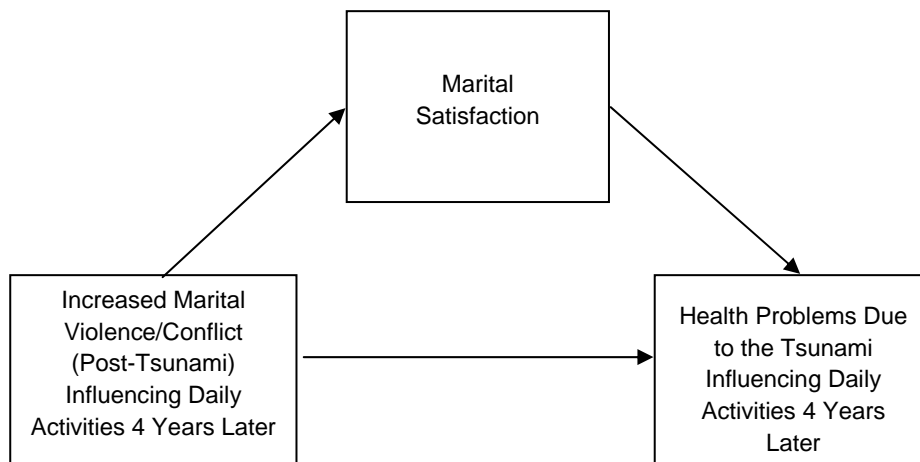
H1: The daily impact of tsunami related physical health problems will be positively related to post tsunami increases in violence and conflict.

H2: The post tsunami increases in violence will be negatively associated with marital satisfaction.

H3: Marital satisfaction will be negatively associated with the daily impact of tsunami related physical health problems.

H4: Marital satisfaction will completely mediate the relationship between post tsunami violence and conflict increases which impact daily life nearly four years after the tsunami and physical health problems which influence daily life nearly four years after the tsunami (See Figure 1).

Figure 1. Hypothesized Path Model of Increased Marital Violence/Conflict (Post-Tsunami) Influencing Daily Activities Nearly 4 Years Later via Marital Satisfaction.



Method

Sample

The data used were collected in 2008, almost four years following the disaster. Participants were 170 respondent mothers lived in a tsunami-exposed village, Polhena, within the Matara district in southern Sri Lanka. From the more than 50 villages in the Matara district were exposed to the tsunami, one village was selected as the study site using two criteria; (a) a high-exposure to the tsunami and (b) a substantial variation in

Tsunami-exposure among the families that inhabit the village. Polhena village fulfilled these criteria. This village was not exposed to the armed conflict in Sri Lanka, nor was it exposed to a natural disaster in the past.

Polhena residents rely heavily on the fishery industry, white- fiber industry, and tourism as their main occupations. Identification of families within each village relied on village voter registers prepared by the Department of Elections of Sri Lanka. Of the 240 registered qualified families (families with at least one adolescent child) living in Polhena, 70% ($N = 170$) provided data for this study. Because displaced families remained near their village of residence, the sample also included displaced families. Some of the non-participant families had lost their mothers during the tsunami. Other non-participant families could not be contacted because they were moving from one shelter to another during the study period. Still others refused to participate.

However, there were no significant differences between participants and non-participants in terms of government welfare receipt (food stamp and “Samurdi”, or government sponsored aid to low income families)—based on available data from the village officer) as well as in mothers’ age and family size. Likewise, participants economic (percent of government welfare receivers) and educational characteristics (average educational level) approximate those of general population in Sri Lanka.

Data Collection

Interview schedule and project staffing. Young women who either possessed undergraduate degrees or were working as part-time social workers from nearby areas were recruited to conduct the in-home interviews for data collection. Interviewers completed a two-day training session before data collection began. The first day of training focused on data collection methods and in-class exercises. The second training day provided a session for reviewing and pilot testing interview procedures.

An experienced local psychiatric therapist assisted with the training session and ensured that she would be available for any necessary therapy assistance during the interview period. The primary investigator (PI) of the project remained in the area during the survey to coordinate and monitor all research activities and advise the survey team. The PI regularly checked completed questionnaires for data quality and made corrective measures in interview protocol and data collection procedures when necessary.

It took 1.5 to 2.0 hours to complete an interview. It took two months to complete the data collection. The surveys (8th grade level) were translated from English to Sinhalese. The PI (Dr. Wickrama) translated study measures from English to Sinhalese jointly with an experienced local mental health professional (Marin, 1992). Appropriate revisions to aid understanding and clarity of items were made after pilot testing with five village respondents. These items were back-translated and pilot tested to ensure validity. The

translated versions underwent appropriate item revisions to aid understanding and improve clarity (Marin 1992; Wickrama and Wickrama 2008).

Measures

Persistent physical health problems. Persistent physical health problems resulting from the tsunami were assessed by asking respondents to rank the applicability of a statement with responses ranging on a 5-point Likert scale from “strongly disagree” to “strongly agree.” The statement was, “Tsunami related physical health problems interfere with my daily activities, even today.”

Marital satisfaction. Marital satisfaction was assessed using two items on the Tsunami Mental Health Study—Adult Questionnaire (Wickrama and Kaspar 2007). The Likert scale items were summed and divided by the number of items in order to form a mean composite. This measure demonstrated an adequate Cronbach’s alpha ($\alpha = .75$) in this sample. The items of marital satisfaction were answered on a 6 point Likert scale. The first question “Overall, how happy are you with your relationship,” ranged from “Extremely unhappy” to “Extremely happy”. The second question “Overall, how satisfied are you with your relationship,” ranged from “Not at all satisfied” to “Completely satisfied.”

PTSD symptoms. PTSD symptoms were measured using 16 items from the DSM-IV (American Psychiatric Association 1994) diagnostic interview. Internal consistency for the sample in the present study was $\alpha = .81$. In a previous study with a similar sample, Wickrama and Wickrama (2007) left out two items originally included in the interview in order to improve internal consistency. Because of the sample similarity, this sample was given the same 16 questions administered in this earlier study. The measure has valid psychometric properties (Renshaw, Rodrigues and Jones 2008).

The items asked respondents to consider symptom presence over the course of the past four months. Sample items include “Did you stay away from things that would remind you of the event?” and “Were you unable to feel strong emotions or were you emotionally numb (e.g., couldn't feel happy, sad, or excited about things)?” responses to each question were either “yes” or “no”. This measure has been used in different ethnic groups, including Sri Lankan, Southeast Asian, West Asian, African, Balkan, and Middle Eastern groups (Wickrama and Kaspar, 2007; Kaspar, 2002). The translated version of the PTSD symptoms measure, specified in the DSM-IV, has shown good psychometric properties for screening PTSD in a number of published studies (e.g., Kessler, Sonnega, Bromet and Hughes, 1995; Turner and Gil 2002).

Depressive symptoms. Depressive symptoms were assessed using 20 items from the Center for Epidemiological Studies Depressive Symptoms Scale (CES-D; Radloff 1977). The current sample demonstrated $\alpha=.84$ for internal consistency. This scale has been used in natural disaster (Wickrama and Kaspar 2007), as well as trauma, and marital (Renshaw et al. 2008) studies. The scale items are summed and composited and those scores totaling

at or over 16 points are considered above the clinical cut-off range. The items are measured on four point Likert scales with responses ranging from “rarely or none of the time” to “most or all of the time”. The statements that respondents are asked to rate over the past 7 days include “I had trouble keeping my mind on what I was doing”, and “I talked less than usual.”

Previous use of the English version of the CES-D in various studies (e.g., Wickrama and Bryant 2003) indicated that the measure possesses good psychometric properties. The use of translated versions of the CES-D in cross-cultural mental health studies in Asian populations including Sinhalese Buddhist samples exposed to trauma (e.g., Noh, Kaspar and Wickrama, 2007; Wickrama and Wickrama 2011) also indicated that translated forms maintain good reliabilities and validities. Translated depression measures in the present study were pilot tested and revised to improve clarity when necessary.

Post-tsunami increases in violence in conflict. Post-tsunami increases in violence or conflict were ascertained by asking respondents to rate the applicability of a statement with responses on a five point Likert scale ranging from “strongly disagree” to “strongly agree.” The statement was “Increased marital violence/conflicts after the tsunami interfere with my daily activities, even today.” This item is designed not only to detect increases in violent activity, but also to ascertain its continued effect on daily life years after the disaster.

Results

Path models were fit to the data using Mplus version 5 (Muthén and Muthén 1998-2007); univariate and bivariate analyses were performed using PASW Statistics 18, Release Version 18.0.0 (PASW 2009).

Univariate Analyses

Using the item indicators from the measures of marital satisfaction, PTSD and depressive symptoms; mean composites were created. The responses on these items were summed and divided by the number of items in order to provide an average response score for each participant on each measure.

Visual inspection of the histograms for the variable revealed them to be roughly symmetric in distribution. The mean score of each scale, and other univariate statistics are presented in Table 1.

Bivariate Analyses

Pearson correlations were chosen to assess the relationships the variables had with one another. These computed correlations are displayed in Table 2. The correlations that were significant confirmed our hypotheses as well as our proposed multivariate analyses.

For instance, increased marital violence was significantly correlated with both marital satisfaction, as well as physical health problems ($r = -.29^{**}$, $.15^*$ respectively). Furthermore, marital satisfaction also correlated significantly with persistent physical health problems ($r = -.24$). The way that marital satisfaction was significantly connected to both marital violence, and physical health indicated the possibility of a mediational relationship between the two. Furthermore, PTSD and depressive symptoms both significantly correlated with physical health problems, as well as with each other ($r = .31$, $.28$, $.54$ respectively). For this reason, it was decided that variance in physical health problems due to PTSD and depressive symptoms would be controlled in the multivariate analyses.

Table 1. Univariate Statistics for Study Variables

Variable	N	Mean (SD)	Median	Skew	Range
1. Persistent Physical Health Problems From the Tsunami	170	2.77 (1.16)	2.50	.27	1-5
2. Marital Satisfaction	160	4.10 (.87)	4.00	-0.81	1-6
3. Increased Marital Violence/Conflict that Influences Daily Life	169	2.15 (.88)	2.00	1.13	1-5
4. PTSD Symptoms	163	1.44 (.24)	1.44	-0.02	1-2
5. Depressive Symptoms	170	.98 (.49)	0.85	0.78	.35-2.05

Table 2. Pearson Correlations for Study Variables

Variable	1	2	3	4
1. Persistent Physical Health Problems From the Tsunami				
2. Marital Satisfaction	-.24*			
3. Increased Marital Violence/Conflict that Influences Daily Life	.15	-0.29*		
4. PTSD Symptoms	.31*	.10	-.10	
5. Depressive Symptoms	.28*	.03	.03	.54*

* $p < .05$; $160 \leq N \leq 170$

Multivariate analyses

Mplus 5.0 was used to estimate models with missing data by utilizing full information maximum likelihood (FIML) estimation (Muthén and Muthén 1998-2007). Given that these scores may be missing as a function of covariates or outcomes in model, FIML is an appropriate way to estimate missing data for the multivariate analyses using the full sample of the 170 respondents.

Two path models were incrementally fit to the data to verify the mediational relationship which was observed. First, persistent physical health problems was regressed on increased marital violence, and a significant path was observed ($\beta = .23$, $p < .05$) while controlling for variance in physical health problems due to PTSD and depressive

symptoms. Fit indices for the first model indicated a perfect fit, due to the fully constrained nature of the model, and 0 degrees of freedom. PTSD symptoms were also a significant predictor of the influence on daily activities of persistent physical health problems ($\beta = 1.11, p < .05$) but depression was not.

Next, the second path model was fit to the data to test for mediation by marital satisfaction of the relationship between increased marital violence and physical health observed in the first model. Physical health problems was regressed simultaneously on marital satisfaction and increased marital violence as well as PTSD and depressive symptoms, while marital satisfaction was also regressed on increased marital violence. This path model (as shown in Figure 2) revealed that the significant effect previously observed between increased marital violence and physical health problems was reduced to nonsignificance upon the inclusion of marital satisfaction ($\beta = .15, p = .13, t = 1.51$).

This model adequately fit the data as evidenced by the fit statistics ($\chi^2 = .34, df = 3, p = .84$; TLI = 1; RMSEA = 0, $p = .89$). To meet the full qualifications for mediation as specified by Baron and Kenny (1986), significant paths must also be observed between the predictor and the mediator as well as the mediator and the outcome. This condition was also met. The relationship between increased marital violence and marital satisfaction was significant ($\beta = -.28, p < .01$). Furthermore, the relationship between marital satisfaction and physical health problems was also significant ($\beta = -.311, p = .002, t = -3.14$). Finally, PTSD symptoms remained a significant predictor of the influence on daily activities of physical health problems ($\beta = 1.16, p < .01$) and depression remained nonsignificant.

Discussion

The purpose of this study was to investigate the relationship between increased marital violence/conflict on daily activities, marital satisfaction, and the influence of disaster related physical health problems on daily activities in a sample of post tsunami Sri Lankan women. Specifically, it was hypothesized that an increase in marital violence/conflict would be associated with persistent tsunami related physical health problems as well as lower marital satisfaction. Additionally, it was expected that lower marital satisfaction would be related to a higher influence on daily activities of persisting physical health problems. Finally, it was hypothesized that marital satisfaction would mediate the relationship between the influence on daily activities of an increase violence/conflict and persisting tsunami related physical health problems.

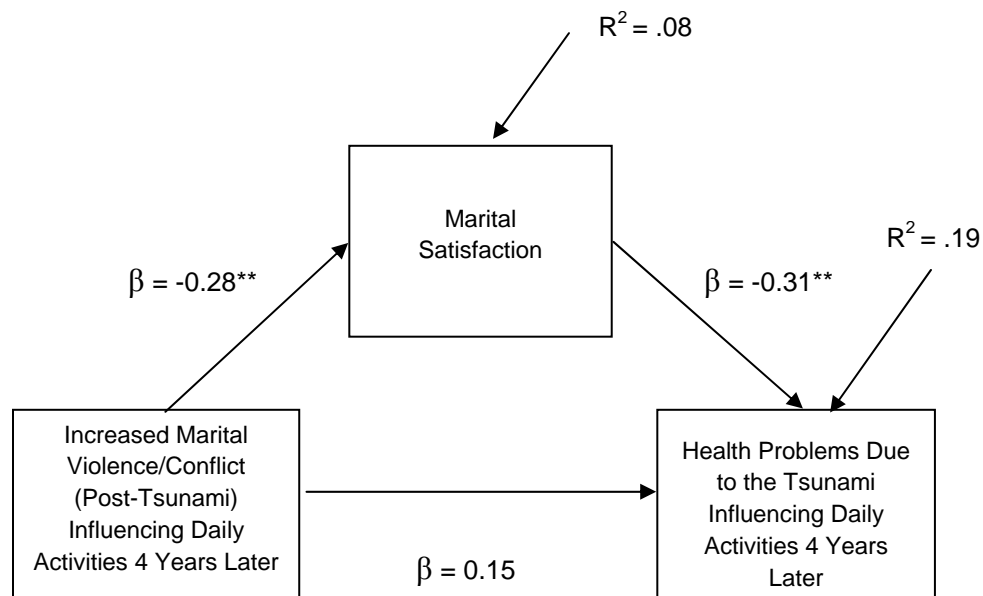
Consistent with previous research (Humphries and Lee 2009; Plichta 2004; Woods et al. 2008), we observed a relationship between the influence of increased marital violence/conflict and the daily impact of persistent physical health problems. Our findings are important because most of the research that has identified a relationship between marital violence and persistent physical health problems has been conducted in

the U.S. and has only recently been observed in cross-cultural samples (Díez et al. 2009; Vung et al. 2009; Yoshihama et al. 2009). Our findings add to this body of research by continuing to demonstrate the existence of this relationship in a cross-cultural sample.

A negative association between increased marital violence/conflict and marital satisfaction was also observed, confirming past research regarding this relationship (Stith et al. 2008). That this relationship was observed in the current study sample, which consisted solely of women, is not surprising given previous findings of increased prevalence of this relationship among women (Byrne and Arias 1997).

Marital satisfaction was also negatively associated with the daily influence of persistent physical health problems. This adds to past research, which suggests that health challenges influence relationship outcomes negatively (Booth and Johnson 1994; Murray et al. 2007; Trief et al. 2006). What this finding indicates is that the relationship between health problems and relationships may be bi-directional. Additionally, this relationship was maintained even when controlling for variance in the influence of persisting physical health problems due to PTSD and depressive symptoms. This is important to note, given previous findings that have observed a mediating effect of problematic behaviors in the relationship between physical health problems and relationship quality (Booth and Johnson 1994).

Figure 2. Estimated Path Model of Increased Marital Violence/Conflict (Post-Tsunami) Influencing Daily Activities Nearly 4 Years Later via Marital Satisfaction (N = 170)



* $p < .05$

** $p < .01$

$\chi^2 = .34$ $df = 3$ $p = .84$; TLI = 1; RMSEA = 0 $p = .89$

The relationship between increased violence/conflict and the persistent physical health problems was fully mediated by marital satisfaction. This effect continued after controlling for PTSD and depressive symptoms that have been known to impact the variance in physical health.

The support for the full mediation model poses interesting questions regarding the relationship between violence and physical health. For example, it would seem logical that those experiencing violence would also experience injury and physical health problems. However, even though violence and conflict may be present, marital satisfaction may actually be a vehicle through which marital violence influences persistent physical health problems. However, due to the cross-sectional nature of this study, we cannot assume any causal links from the results of the model. Specifically, the fact that all variables were measured at the same time does not allow us to rule out the possibility that marital violence and persistent physical health problems both influence marital satisfaction. Nonetheless, if the causal relationship between marital satisfaction and persistent physical health problems flows in the direction we hypothesize, then this would have important implications for clinicians and helpers in intervention planning. In other words, focus on conflict and violence intervention may decrease or perhaps mitigate problems in marital satisfaction and the daily impact of physical health issues.

The increase in domestic violence resulting from experiences with natural disasters (Houghton et al., 2010) was shown to significantly increase physical health problems of mothers. The present study also provides evidence for (a) this association between violence and poor physical health and (b) also for the mediating effect of marital satisfaction on this association. That is, the observed association between violence and poor physical health might be indirect, operating through marital satisfaction.

Another interesting aspect of the current findings relates to the nature of the sample. This sample consisted of women who had experienced a natural disaster. To date, no studies have demonstrated this specific relationship in this type of sample. Further research explicating how these variables relate is essential given that women are particularly vulnerable following disasters for increased violence, and face disproportionate risk to other challenges as well (Carballo et al. 2005). Furthermore, our findings provide valuable information to those clinicians who provide services to similar populations.

Limitations

The current study offers several important contributions to current understanding of domestic violence and physical health in the context of disaster. However, there are several limitations to acknowledge. First, due to the data being collected cross-sectionally, it is impossible to confirm causal relationships, or understand how the post disaster measures of marital violence, marital satisfaction, and persistent physical

health problems relate to pre-disaster assessment which is not possible to collect. Additionally, this study did not use comprehensive, or previously established, measures of marital violence, persistent physical health problems, or marital satisfaction. The difficulty of translating such measures prevented their use, and thus resulted in measures that might not have fully captured the constructs under investigation.

More rigorous instruments assessing these constructs are warranted for further study in this area. The measures utilized in this study for the influence of persistent physical health problems and marital violence or conflict, were both single item measures. This prevented the calculation of internal consistency reliability estimates. As single items, the measures may also fail to capture important details about participant experience. Future research on this topic could include a more detailed investigation of these variables. For example, to investigate disaster related health issues, it would be pertinent to understand the degree or intensity of the problem. Such a measure would also appropriately include the specific type of health problem incurred, and the specific connection of the physical health problem to the disaster, and more information about how and to what extent these issues impact daily life. Measures of violence that assess specific conflictual or violent behaviors and include participant perceptions of increases would perhaps offer a more complete assessment of how violence plays a role in the couple. Marital satisfaction could also be investigated in more detail using more indicators of the levels of satisfaction, contentment and happiness in the relationship. Finally, the study sample consisted exclusively of women. While this offers a distinct and important perspective on this topic, the generalizability of our findings is limited.

Clinical implications

These findings hold important implications for treatment of violence. For example, behavioral treatment of partner violence has been shown to decrease physical health problems (Weissbecker and Clark 2007). Our findings add interesting information that may inform future treatment endeavors. For example, inclusion of treatments aimed at improving marital satisfaction may also prove beneficial to physical health problems.

Additionally, our findings present information regarding a population who has suffered a major natural disaster. As mentioned previously, increased global attention to the mental health effects of natural disasters requires that helping professionals have accurate knowledge regarding the effects of such disasters on couple interactions. Our findings provide important information related to possible interventions with such couples. For example, the presence of physical health problems may indicate issues pertaining to domestic violence and marital satisfaction. Clinicians working with couples following natural disasters will likely benefit from research related to this population. Further, it will be important to incorporate these findings into extant literature on the treatment of violence in couples. Furthermore, research on the self-care of helpers in this

context is also necessary to prevent compassion fatigue, or secondary traumatization (Figley 1995) in the acute treatment of trauma or domestic violence. Helping clinicians avoid a depletion of their energy (Kleber et al. 1995) in helping violence and disaster victims will provide a foundation for effective treatment in this population.

Future directions

Future research should endeavor to develop and/or translate measures of violence and marital satisfaction for cross-cultural populations. Such efforts would facilitate data collection among populations who have traditionally been underrepresented in the literature. Additionally, more research is needed to better understand the impact of natural/man-made disasters on violence and marital satisfaction. There may be increases of changes in the way these are manifested. Finally, research with these populations and constructs should aim to obtain data from intact couples to further explore the relationships between violence, marital satisfaction, and physical health.

Conclusion

The present study demonstrates the long term persistent effects of a natural disaster on family interactions and physical health. Almost four years after exposure to the tsunami, mothers' experience with increased couple violence post tsunami influenced physical health problems resulting from the tsunami. Moreover, this study suggests that marital satisfaction of mothers serves as a more proximal influence on post tsunami physical health, thereby mediating the direct effect of post tsunami couple violence on post tsunami physical health. Marital satisfaction is shown to be a key resource in mediating the associations between marital conflict and physical health resulting from a natural disaster several years after exposure.

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