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Relationships Among Alcohol Use, Hyperarousal, and Marital Abuse and Violence in Vietnam Veterans

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Alcohol use (frequency and quantity) and the hyperarousal feature of PTSD were examined in relation to male-perpetrated marital abuse and violence using data from 376 couples who participated in the National Vietnam Veterans Readjustment Study. Veteran's self-reported hyperarousal was significantly associated with partner's report of physical violence and psychological abuse toward her. Differential relationships were found between veteran's self-reported drinking frequency and drinking quantity and the outcomes; of the two components, only the average quantity consumed per occasion was independently related to husband-to-wife violence. Moreover, a complex interaction emerged between hyperarousal and the two dimensions of alcohol consumption in predicting violence, with the relationship between hyperarousal and violence varying as a function of both drinking frequency and drinking quantity.

KEY WORDS: drinking frequency; drinking quantity; hyperarousal; marital violence.

There is ample evidence documenting that interpersonal conflict and violence are serious problems in the United States, and that much of this aggression occurs in the home environment between spouses or partners. As examples, Straus and Gelles (1992) estimated that over 1.8 million women are battered by their

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partners in a given year, and Carlson (1984) noted that some 3.3 million children witness interparental aggression annually, both figures that are likely underestimates of the true prevalences (Goodman, Koss, Fitzgerald, Russo, & Keita, 1993). More recently, Schafer, Caetano, and Clark (1998) estimated that more than 1 in 5 couples in the United States experiences at least one violent episode annually. In the current study, we sought to document the associations of husband's alcohol consumption and posttraumatic stress disorder (PTSD) symptomatology with male-perpetrated abuse and violence within Vietnam veteran families. Since alcohol abuse and PTSD are highly comorbid (see reviews by Keane & Wolfe, 1990, and Stewart, 1996), our goal was to determine how specific components or features of these conditions (specifically, drinking frequency, drinking quantity, and PTSD's hyperarousal symptom cluster) might be jointly implicated in the occurrence of marital aggression. Moreover, we were interested in the possibility that drinking frequency and drinking quantity might be differentially implicated in marital abuse and violence. For example, does drinking frequently, but not to excess, operate differently in conjunction with hyperarousal symptomatology than does drinking to excess on a particular occasion?

Much of the research on alcohol consumption and marital abuse and violence has shown an overall positive relationship, suggesting that greater alcohol use is associated with higher levels of aggression. Coleman, Weinman, and Hsi (1980) found that husbands and wives with a history of violence were more likely to report using alcohol "frequently" or "often" than were couples with no such history. Hotaling and Sugarman (1986) found husbands' alcohol use to be a risk marker for husband-to-wife violence across seven of nine previous studies. In their review of the alcohol and violent crime literature, Murdoch, Pihl, and Ross (1990) concluded that there is a clear association between alcohol abuse and marital violence, independent of other marital problems such as indebtedness, incompatibility, and marital satisfaction. Controlling for similar variables, Leonard and Blane (1992) found a significant relationship between a measure of problematic or risky drinking behavior and marital aggression. Finally, in a national study of 2,033 women, Kaufman Kantor and Straus (1989) concluded that husband's drunkenness was a significant predictor of minor and severe marital violence, observing that 70% of female victims of severe violence reported that their husbands were drunk at least once in the last year, compared to 50% for victims of minor violence and 31% of nonvictims.

A less clear relationship between drinking behavior and marital abuse and violence has been shown by several studies that assessed drinking as a composite score of the frequency and quantity of alcohol consumption. For example, despite finding that both a pathological drinking pattern and a recent diagnosis of dependence predicted husband-to-wife marital violence, Leonard, Bromet, Parkinson, Day, and Ryan (1985) found that current alcohol consumption, indexed as the average daily volume of drinking, was not related to physical marital conflict.

Using data from a nationally representative sample of 5,159 families, Kaufman Kantor and Straus (1987) noted a strong link between their frequency/quantity index of alcohol consumption (the Drinking Index) and spousal abuse, where patterns of excessive drinking were associated with more spousal abuse. On the other hand, Hutchinson (1999) found a weak relationship between classification on the Drinking Index and wives' reports of incidents of threats or battering. Interestingly, the relationship between drinking and aggression was nonlinear, with the two highest rates of perpetration observed in men who were abstinent and high-rate drinkers; binge drinkers were among those exhibiting the lowest rates of perpetration.

Still other studies investigating the association of alcohol use with marital abuse and violence have partitioned alcohol use into separate dimensions of frequency of consumption and quantity of consumption on an estimated per-occasion basis. Neff, Holamon, and Schluter (1995) examined drinking frequency, drinking quantity, and total weekly alcohol consumption in a large community sample, and found that only drinking quantity was a consistent predictor of the incidence of marital violence. Barnett and Fagan (1993), in comparing groups of men who were and were not violent in their marriages, likewise found different results for frequency and quantity of consumption: While batterers drank significantly more on an average occasion, there was no significant difference between the two groups in how frequently they consumed alcohol. In fact, the only significant difference in drinking frequency between the two groups was the finding that nonviolent men drank wine significantly more often than did violent men. Other evidence for the differential effects of drinking frequency and drinking quantity has been provided by researchers investigating alcohol's effects on health outcomes such as coronary heart disease (Rehm, Ashley, & Dubois, 1997). Also, Graham and Schmidt (1999) showed more negative psychosocial outcomes to be related to higher quantity per drinking occasion, but not to drinking frequency, in a sample of older adults. Thus, a more informative approach to understanding the impact of alcohol abuse on male-perpetrated marital aggression may lie with the separation of drinking behavior into the components of frequency and quantity, a strategy that was adopted in the current study. By considering alcohol consumption in its disaggregated form—frequency and quantity individually as well as jointly in interaction—we sought to determine if there might be a differential impact on marital abuse and violence.

Furthermore, some contemporary evidence suggests that at least a partial explanation of partner battering and domestic violence within our society lies with the perpetrator's history of trauma exposure and the ensuing psychological and emotional consequences (Dutton, 1995; Finkelhor & Dziuba-Leatherman, 1994). Karney and Bradbury (1995) suggested that explanatory constructions of family relationships should include stressful life events and consider their implications for long-term marital quality. The effects of traumatic experiences indeed have

been shown to relate to marital abuse and violence. Carroll, Rueger, Foy, and Donahoe (1985) found PTSD-positive Vietnam veterans more prone to report hostility toward their partners, particularly physical aggression, and Jordan et al. (1992) observed that violence reported by the spouse or partner was significantly more prevalent in families of male Vietnam veterans with PTSD than in families of male Vietnam veterans without PTSD. Dutton (1995) examined levels of nonphysical and physical violence and trauma symptomatology in a sample of 132 men in treatment for wife assault and partners of 43 of these men, along with controls with no history of marital violence and their partners. He found that violent men reported significantly more PTSD-like symptoms than nonviolent men, and that scores on measures of verbal aggression and physical violence correlated significantly with the number of reported symptoms. Byrne and Riggs (1996) similarly noted that higher levels of PTSD were associated with higher levels of verbal and physical partner aggression in Vietnam veterans.

One component of PTSD symptomatology, hyperarousal, is of particular interest regarding its role in marital abuse and violence. According to the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; American Psychiatric Association[APA], 1994, p. 428), Criterion D of PTSD (persistent symptoms of increased arousal) reflects a tendency to be irritable, quick to anger, and hypervigilant, and includes such symptoms as sleep disturbance, concentration difficulties, and an exaggerated startle response. The effects of this symptom cluster have been examined in numerous studies, with individuals with PTSD displaying higher resting heart rates than those without PTSD (Pallmeyer, Blanchard, & Kolb, 1986) and elevated physiological response (e.g., heart rate, systolic blood pressure, skin conductance) to trauma-relevant stimuli (e.g., Blanchard, Kolb, Pallmeyer, & Gerardi, 1982; Malloy, Fairbank, & Keane, 1983; Orr, Pitman, Lasko, & Herz, 1993; Pitman, Orr, Forgue, de Jong, & Claiborn, 1987). In addition, elevated physiological reactions in PTSD-positive Vietnam veterans have been observed in response to nonspecific stressors, such as a hospital visit (Gerardi, Keane, Cahoon, & Klauminzer, 1994). Hyperarousal may be especially important, in combination with alcohol consumption, to explaining incidents of marital abuse and violence, in light of alcohol's physiologic effects. Specifically, past research has shown alcohol to potentiate psychomotor activity, an effect that has been proposed to increase the expression of violence (e.g., Graham et al., 1998; Pihl, Peterson, & Lau, 1993). With the increased physiologic arousal caused by PTSD, we might expect this effect of alcohol to be more pronounced in individuals exhibiting higher levels of hyperarousal symptomatology, leading to an even greater tendency toward violence. Hyperarousal also was selected as the key feature of PTSD in the present study since prior work with this sample (King & King, 2000) revealed that it was the one symptom cluster that had a direct effect on husband-to-wife violence. Emotional numbing, for example, was linked to wife's mental distress but not to the husband's battering behaviors.

Hence, the present study examined the joint effects of drinking frequency, drinking quantity, and the hyperarousal feature of PTSD on marital abuse and violence. We generally hypothesized an exacerbation effect such that high levels of husband's current alcohol consumption coupled with more severe hyperarousal symptomatology would be associated with the expression of more husband-to-wife aggressive tendencies. Because we used a dual conceptualization of alcohol consumption, drinking frequency and drinking quantity, treated as separate dimensions, we were able to examine their possible differential and interactive influences and thereby arrive at potentially more precise and meaningful explanations for marital aggression. A specific research question was as follows: Are there particular patterns of drinking, frequently but not to excess vs. excessively on a given occasion, that are more or less likely to exacerbate the association between hyperarousal and violence?

Method

Sample

Our sample consisted of 376 male veterans who served in the Vietnam War sometime between 1964 and 1975 and their female spouses or partners. All were participants in the National Vietnam Veterans Readjustment Study (NVVRS; Kulka et al., 1990a, 1990b), a large-scale, nationally representative survey whose primary purpose was to document the long-term effects of the Vietnam war-zone experience, especially the current and lifetime prevalence rates of PTSD in the population of Vietnam veterans. Of an original sample of 1,200 male veterans, a subsample of veterans and their partners was selected; the response rate for partners was 80%. This subsample included all dyads from the larger group with a PTSD-positive veteran, according to a critical cut-point score of 89 on the Mississippi Scale for Combat-Related PTSD (Keane, Caddell, & Taylor, 1988). Also, the subsample included veterans who did not appear to have the disorder but reported high levels of combat exposure as assessed by Kulka et al.'s (1990a, 1990b) factor-analytically derived war-zone exposure index or displayed high levels of nonspecific distress as assessed by the demoralization scale of the Psychiatric Epidemiology Research Inventory (Dohrenwend, 1982). To enhance dispersion or score variability while maintaining a focus on high-risk family units, the subsample also included a group of dyads with veterans who did not meet any of the above criteria. Data from veterans were collected in extensive, face-to-face household interviews that lasted approximately 5 h and inquired about numerous variables related to the veteran's premilitary, military, and postmilitary life. Data from their partners were obtained in 1-h sessions emphasizing the partner's perspective on marital and family relationships, including interaction problems and family violence. (See Jordan et al., 1992, for further details on this sample).

The NVVRS and the data it produced are very well-suited for this study of marital abuse and violence. As noted above, partners of veterans with a high probability of current PTSD or nonspecific distress were oversampled, relative to the distribution in the larger group of male veteran NVVRS participants. Almost 33% of the veterans in these families scored above the cut-point for PTSD, and 51% scored in the medium to high range on the measure of nonspecific distress. The veterans in this family subsample also had relatively high rates of alcohol abuse, with a lifetime prevalence rate of 42% and a current rate of 15%, as assessed by the Diagnostic Interview Schedule (Robins, Helzer, Croughan, & Ratcliff, 1981). In addition, the NVVRS was an influential study that scrupulously attended to the diversity of the sample and incorporated a sampling design that oversampled for minorities in the main study. Subsequently and toward this end, the racial or ethnic identity of participants in the partner interview subsample roughly mirrored that of the main study and was distributed as follows: African American, 24%; Hispanic, 29%; and White/other, 47%. Finally, response rates for the family participants were high, with no appreciable differences between those who participated and those who did not (see Kulka et al., 1990a, Appendix A, pp. 16–18).

Measures

Alcohol use. The frequency and quantity of veteran's current alcohol use was assessed using questions from the Diagnostic Interview Schedule (Robins et al., 1981) that asked the veteran about his consumption of beer, wine, and liquor separately, a method that has been recommended by recent research (Feunekes, van't Veer, van Staveren, & Kok, 1999; Serdula, Mokdad, Byers, & Siegel, 1999). Questions about *drinking frequency* were accompanied by an 8-point scale, with the following response options: *never in the past 12 months*; *once or twice in the past 12 months*; *3–11 days in the past 12 months*; *1–3 times/month*; *1–2 days/week*; *3–4 days/week*; *5–6 days/week*; *about every day*. To obtain a more precise estimate of drinking frequency, responses were transformed using the median value of each response option (e.g., *once or twice in the past 12 months* = 1.5 days/year divided by 52 weeks/year = .029; *3–4 days/week* = 3.5; *about every day* = 7). Responses for each of the three beverages were then summed to give a total drinking frequency score, reflecting total number of drinking occasions per week. *Drinking quantity* was obtained in a similar fashion. Veterans were asked to report the number of drinks they typically consumed in a single occasion for beer, wine, and liquor, separately, over the last 12 months. Responses were then averaged over the three beverages, giving a composite score indicating the average quantity of alcohol imbibed per occasion.

Hyperarousal. As previously noted, the cluster of PTSD symptoms commonly referred to as hyperarousal reflects sleep and concentration difficulties, hypervigilance, and hindered emotional control (APA, 1994, p. 428). Hyperarousal

has been validated as a distinct feature of PTSD in a number of confirmatory factor-analytic studies (e.g., King & King, 1994; King, Leskin, King, & Weathers, 1999; Lauterbach, Vrana, King, & King, 1997; Sack, Seeley, & Clarke, 1997; Vreven, Gudanowski, King, & King, 1995). Our measure of hyperarousal consisted of 8 items from the Mississippi Scale for Combat-Related PTSD (Keane et al., 1988), self-reported by the veteran, each assessed with a 5-point Likert-type response format. Examples of hyperarousal items are "I have trouble concentrating on tasks" and "I lose my cool and explode over minor everyday things." Item scores were averaged to give a total scale score, with an alpha of .81 in our sample. This eight-item measure of hyperarousal was used as a primary indicator of the disorder in a series of prior studies of PTSD etiology (King, King, Foy, Keane, & Fairbank, 1999).

Marital abuse and violence. For this study, we used the Conflict Tactics Scale (CTS; Straus, 1979), which has been shown to be a reliable and valid self-report measure of marital discord and violence (Arias & Beach, 1987; Straus, 1979) and has been used in numerous empirical studies (e.g., Byrne & Riggs, 1996; Dutton, 1995; Gondolf & Foster, 1991; Jordan et al., 1992). Its items ask for the frequency (in the last year) of different strategies used to resolve marital disputes, including acts of partner-to-partner violence. For our measure of *physical violence*, we used 8 CTS items that inquire about the husband's physical battering of his spouse in the past year, as reported by the spouse. Sample items are: "threw something at [you]", "pushed, grabbed, or shoved [you]", and "used a knife or gun." Each item reflected a 7-point Likert-type scale of choices ranging from 0 (*never*) to 6 (*more than 20 times*), with a total scale score that was a sum of the item scores. The scale had an alpha of .90 in our sample. Six items were used to assess the frequency of various acts of *psychological abuse*, defined by Straus (1979) as "the use of verbal and nonverbal acts which symbolically hurt the other, or the use of threats to hurt the other" (p. 77). Again, the measure was administered to the female partner, who reported on the behaviors of the husband. Example items are "insulted or swore at [you]" and "threw or smashed or hit or kicked something." The items were accompanied by the same 7-point response scale used for the physical violence items, summed to give a total scale score. The psychological abuse scale had an alpha of .84. The CTS has been criticized on several accounts, in particular for its failure to consider the context in which abusive or violent acts take place. Critics claim that the result is an overestimate of female-perpetrated acts (see Straus, 1990, Straus, 1997, and Straus, 1999, for discussions of this issue). In the present study, however, we focused only on male-perpetrated abuse and violence, which to our knowledge has not been linked to bias in measurement using the CTS.

Analyses

Descriptive statistics and zero-order or bivariate correlations among all variables were computed. Two hierarchical linear regression analyses then were

conducted, one for each of the outcomes: physical violence and psychological abuse. At the first step of each regression analysis, drinking frequency, drinking quantity, and hyperarousal were entered to assess the independent contributions of these variables to the variance accounted for in the outcomes. Two additional steps were included to explore the possible interactive influences of alcohol use and hyperarousal. In the second step, product terms representing all two-way interactions among the three variables were entered (Drinking Frequency × Hyperarousal, Drinking Quantity × Hyperarousal, and Drinking Frequency × Drinking Quantity). Finally, to determine whether the joint effects of drinking frequency, drinking quantity, and hyperarousal interact (a three-way interaction) to uniquely predict the outcome over and above their independent main effects and two-way interactions, a product term of Drinking Frequency × Drinking Quantity × Hyperarousal was entered into each regression equation in the third step.

Results

Descriptive statistics and bivariate correlations are displayed in Table 1. There was a high prevalence of marital abuse and violence in this sample: In total, 315 men (84%) were reported to have engaged in at least one act of psychological abuse toward their spouse in the last year. The scores on this CTS subscale ranged from 0 (for a minority of the respondents) to 36, with more than 40% scoring above the mean of 8.75. For the physical violence subscale, 80 men (21%) were reported to have committed one or more acts of physical violence against their spouse or partner in the last year. The scores on this CTS subscale were much more positively skewed and ranged from 0 to 47, with more than 16% scoring above the mean of 1.40. The two outcomes were moderately correlated, as those men who psychologically abused their partners were more likely to engage in acts of physical violence. The two alcohol measures were likewise moderately related to one another.

Bivariate correlations revealed different relationships between the separate components of alcohol use and the marital abuse and violence outcomes. Of the two drinking characteristics, only drinking quantity was significantly related to both physical violence and psychological abuse. Drinking frequency was significantly

Table 1. Descriptive Statistics and Bivariate Correlations for All Study Variables

Variable	*M*	Median	*SD*	1	2	3	4	5
1. Drinking frequency	2.51	0.94	3.36	—	.40**	.11*	.08	.13*
2. Drinking quantity	1.97	1.67	2.16		—	.30**	.23**	.35**
3. Hyperarousal	2.14	2.00	0.74			—	.30**	.27*
4. Psychological abuse	8.75	6.00	8.23				—	.55**
5. Physical violence	1.40	0.00	4.64					—

*$p < .05$. **$p < .01$.

Table 2. Summary of Hierarchical Regression Analysis for Variables Predicting Physical Violence ($N = 373$)

Variable	B	$SE\ B$	β
Step 1			
Drinking frequency	−0.01	0.07	−.01
Drinking quantity	0.64	0.12	.30**
Hyperarousal	1.15	0.32	.18**
Step 2			
Drinking frequency	−0.06	0.22	−.04
Drinking quantity	−0.09	0.41	−.04
Hyperarousal	1.22	0.44	.19**
Drinking Frequency × Hyperarousal	−0.13	0.10	−.24
Drinking Quantity × Hyperarousal	0.08	0.14	.13
Drinking Frequency × Drinking Quantity	0.12	0.02	.49**
Step 3			
Drinking frequency	0.40	0.29	.29
Drinking quantity	0.54	0.48	.25
Hyperarousal	1.71	0.48	.27**
Drinking Frequency × Hyperarousal	−0.30	0.12	−.57*
Drinking Quantity × Hyperarousal	−0.15	0.17	−.23
Drinking Frequency × Drinking Quantity	−0.05	0.07	−.22
Drinking Frequency × Drinking Quantity × Hyperarousal	0.06	0.03	.78*

Note. $R^2 = .15$ for Step 1; $\Delta R^2 = .07$ for Step 2 ($p < .01$); $\Delta R^2 = .01$ for Step 3 ($p < .05$).
$^*p < .05$. $^{**}p < .01$.

associated only with physical violence and at a level considerably below the corresponding association between drinking quantity and physical violence. Hyperarousal was significantly associated with both physical violence and psychological abuse, as well as with both measures of alcohol use, albeit more modestly with drinking frequency.

The results of the regression analysis when physical violence was the dependent variable are summarized in Table 2. At Step 1, both drinking quantity and hyperarousal had significant independent main effects, suggesting that heavier drinking per occasion and greater hyperarousal symptomatology are associated with higher levels of physical violence. Drinking frequency was not independently related to physical violence. In addition to these main effects, there were several significant interactions among the variables, most notably the three-way interaction among drinking frequency, drinking quantity, and hyperarousal. To assist in interpreting this significant three-way interaction, we developed equations for the regression of physical violence on hyperarousal for four different combinations of the drinking frequency and drinking quantity variables: low frequency/low quantity, high frequency/low quantity, low frequency/high quantity, and high frequency/high quantity (see Cohen & Cohen, 1983, for computational details). High frequency and quantity values were defined as the mean plus 1 standard deviation, and low frequency and quantity values were defined as the mean minus 1/2 standard deviation. These values were selected so that the resulting regression equations

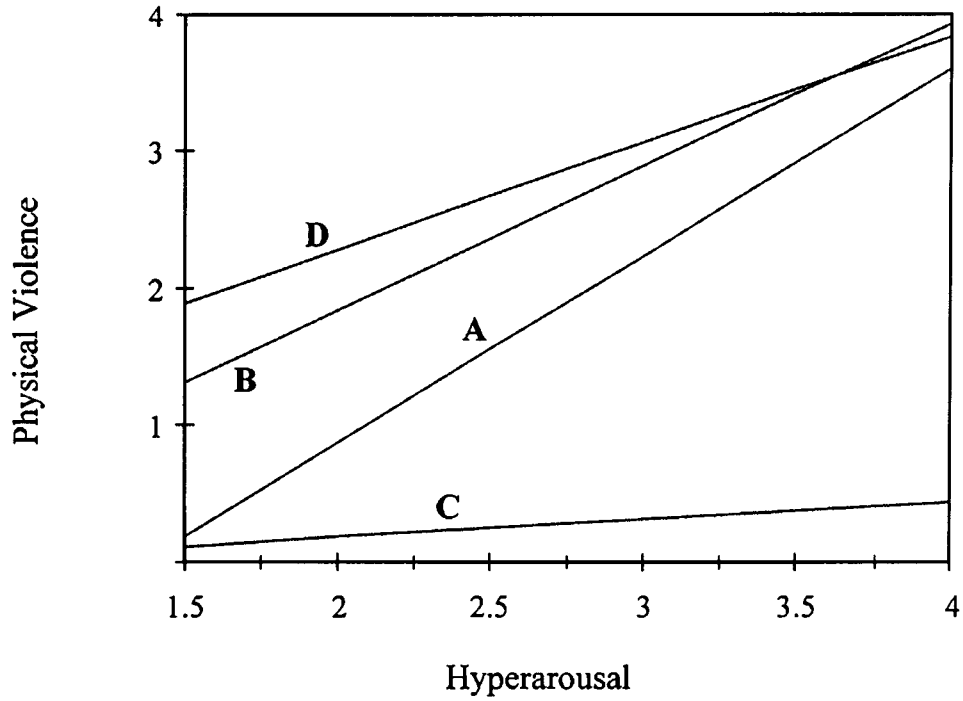

Fig. 1. Relationship between self-reported Mississippi Scale hyperarousal and CTS physical violence reported by the partner, as a function of drinking frequency and drinking quantity. A: low frequency/low quantity; B: low frequency/high quantity; C: high frequency/low quantity; D: high frequency/high quantity.

for each drinking profile would depict relationships reflecting real (nonnegative) values for all variables.

Figure 1 displays the resulting associations between hyperarousal and physical violence for the different drinking profiles. Consistent with the previously noted main effect, drinking quantity appears to play a role in physical violence. That is, at even low levels of hyperarousal, the two high quantity conditions (low frequency/high quantity and high frequency/high quantity) appear to produce more physical violence than the two low quantity conditions (low frequency/low quantity and high frequency/low quantity). This is well represented by the intercepts on the vertical axis, where the low quantity conditions approach a zero score on physical violence. Also, across the full range of the hyperarousal dimension, the two regression lines for the high quantity conditions reflect more physical violence than the regression lines for the low quantity conditions.

For psychological abuse, there were fewer significant findings (see Table 3). Although the same main effects were observed at Step 1 for drinking quantity and hyperarousal, neither the two-way interactions nor the three-way interactions were significant at the step in which they were entered into the equation. However, the

Table 3. Summary of Hierarchical Regression Analysis for Variables Predicting Psychological Abuse ($N = 372$)

Variable	B	$SE\ B$	β
Step 1			
Drinking frequency	−0.04	0.13	−.02
Drinking quantity	0.63	0.22	.17**
Hyperarousal	2.69	0.58	.24**
Step 2			
Drinking frequency	0.33	0.41	.14
Drinking quantity	−0.19	0.76	−.05
Hyperarousal	2.82	0.82	.25**
Drinking Frequency × Hyperarousal	−0.23	0.18	−.24
Drinking Quantity × Hyperarousal	0.21	0.25	.19
Drinking Frequency × Drinking Quantity	0.05	0.04	.13
Step 3			
Drinking frequency	0.99	0.54	.40†
Drinking quantity	0.71	0.90	.19
Hyperarousal	3.51	0.90	.32**
Drinking Frequency × Hyperarousal	−0.48	0.23	−.51*
Drinking Quantity × Hyperarousal	−0.12	0.31	−.11
Drinking Frequency × Drinking Quantity	−0.19	0.14	−.44
Drinking Frequency × Drinking Quantity × Hyperarousal	0.08	0.05	.64†

Note. $R^2 = .11$ for Step 1; $\Delta R^2 = .01$ for Step 2 ($p = .38$); $\Delta R^2 = .01$ for Step 3 ($p < .07$).
† $p < .07$. * $p < .05$. ** $p < .01$.

three-way interaction of Drinking Frequency × Drinking Quantity × Hyperarousal approached significance ($p < .07$). When it was added at Step 3, the test statistic for the two-way interaction between drinking frequency and hyperarousal moved into the significance range, a consequence of the multicollinearity among the interaction terms.

Discussion

This study examined associations among two dimensions of alcohol consumption (drinking frequency and drinking quantity), a defining symptom cluster of PTSD (hyperarousal), and two forms of marital aggression (psychological abuse and physical violence) using a sample of Vietnam veterans and their partners. The strongest bivariate predictors of the abuse and violence outcomes were drinking quantity and hyperarousal, and both predictors uniquely contributed to each of the outcomes in separate multiple regression analyses. When physical violence was the dependent variable—and to a marginal degree when psychological abuse was the dependent variable—these partial relationships were qualified by a three-way (Drinking Frequency × Drinking Quantity × Hyperarousal) interaction.

Consistent with prior research (Barnett & Fagan, 1993; Neff et al., 1995), we found drinking frequency and drinking quantity were differentially related to

marital aggression. Drinking quantity was significantly associated with both physical violence and psychological abuse, even when controlling for drinking frequency and hyperarousal symptomatology, whereas drinking frequency was not a significant independent predictor of either type of aggression. Thus, though moderately correlated, these two approaches to assessing alcohol consumption appear to index somewhat different phenomena, with drinking quantity having seemingly more serious implications for marital discord. Regardless of whether drinking behavior is frequent or infrequent, the quantity of alcohol consumed on a typical occasion is related to both physical violence and psychological abuse: the greater the quantity, the more marital aggression. This differentiation between drinking frequency and drinking quantity offers a possible explanation for the mixed evidence provided by earlier studies (e.g., Hutchinson, 1999; Kaufman Kantor & Straus, 1987; Leonard et al., 1985) investigating the association between some composite or total drinking score and violent behavior in intimate relationships. In fact, it argues that the disaggregation of the total into its components of frequency and quantity may provide a more precise understanding of their roles in marital abuse and violence.

More intriguing is that the joint effect of these two drinking variables (their product term), in the presence of their individual components (their main effects), actually moderated or qualified the relationship between hyperarousal and marital aggression. That is, the significant three-way interaction for the physical violence dependent variable suggests that the relationship between hyperarousal and this outcome differs as a function of various combinations of the drinking frequency and drinking quantity variables. Though drinking frequency had no main effect, its salience in interaction with drinking quantity and hyperarousal emerges in Fig. 1. There, one can see that the strongest relationship (the steepest slope) between hyperarousal and physical violence is for the low frequency/low quantity condition, and the weakest relationship (the flattest slope) is for the high frequency/low quantity condition. It appears that when alcohol use is at a minimum (low frequency/low quantity), hyperarousal exhibits the strongest relationship to husband-to-wife violence. On the other hand, frequent consumption of alcohol, but at low quantities on any given occasion, might have a mitigating effect, such that the hyperarousal–physical-violence relationship is neutralized. In other words, more frequent drinking in small doses does not appear to provoke physical violence among those experiencing hyperarousal symptoms.

The pattern of relationships when psychological abuse was the dependent variable paralleled the pattern for physical violence, with the exception that the three-way interaction only approached significance. The explanation for this different result for the three-way interaction may lie in the relatively higher prevalence of psychological abuse. Psychological partner abuse was far more common than physical battering: as mentioned earlier, the vast majority of our sample (84%) reported engaging in psychological abuse. Consequently, it is likely not as much

a function of alcohol consumption and hyperarousal, but probably related to yet other individual difference characteristics of the veteran or partner.

At the outset of this study, we hoped to determine how particular aspects of alcohol use (drinking frequency and drinking quantity) and PTSD (hyperarousal symptomatology) might be implicated in the manifestation of marital abuse and violence in our sample of Vietnam veterans and their partners. We think the obtained associations argue for future attention by both clinicians and researchers to the complex interplay of these several dimensions. Obviously, there is the expected positive association between hyperarousal symptoms and husband-to-wife physical violence, and this association is compounded when excessive quantities of alcohol are reportedly consumed on a typical drinking occasion. These results are consistent with an exacerbation effect. Yet, the frequency of consumption of alcohol gives additional unique information. Specifically, it appears that frequent consumption of alcohol in low quantities, even under conditions of high arousal, does not portend husband-to-wife violence. Of course, there may be an unmeasured variable operating to account for this outcome, such that the same mechanism that enables one to limit consumption on a single occasion also controls violent expression of internal arousal states.

A limitation of this study is that the overall effect sizes are small, which suggests that there are more powerful factors related to or accounting for psychological abuse and physical violence in these couples, factors other than drinking frequency, drinking quantity, and hyperarousal. Just above, we mentioned the possibility of an unmeasured third variable indexing an internal control mechanism. There are certainly other features of the husband's and wife's background, mental health, or relationship quality that may be strongly implicated in the expression of abuse and violence. These might include exposure to domestic violence in the husband's family of origin or an ingrained pattern of general antisocial and coercive behavior. In addition, there are external pressures related to the socioeconomic environment surrounding the family unit that may be contributing factors to marital abuse and violence: financial distress and depressed living conditions. Nonetheless, the distinction between drinking frequency and drinking quantity explored in this study appears to be meaningful and should be incorporated into future studies of substance use and domestic violence among trauma victims.

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References

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

Arias, I., & Beach, S. R. H. (1987). Validity of self-reports of marital violence. *Journal of Family Violence, 2,* 139–149.

Barnett, O. W., & Fagan, R. W. (1993). Alcohol use in male spouse abusers and their female partners. *Journal of Family Violence, 8,* 1–25.

Blanchard, E. B., Kolb, L. C., Pallmeyer, T. P., & Gerardi, R. J. (1982). A psychophysiological study of post traumatic stress disorder in Vietnam veterans. *Psychiatric Quarterly, 54,* 220–229.

Byrne, C. A., & Riggs, D. S. (1996). The cycle of trauma: Relationship aggression in male Vietnam veterans with symptoms of posttraumatic stress disorder. *Violence and Victims, 11,* 213–225.

Carlson, B. E. (1984). Children's observations of interparental violence. In A. R. Roberts (Ed.), *Battered women and their families* (pp. 147–167). New York: Springer.

Carroll, E. M., Rueger, D. B., Foy, D. W., & Donahoe, C. P. (1985). Vietnam combat veterans with posttraumatic stress disorder: Analysis of marital and cohabiting adjustment. *Journal of Abnormal Psychology, 94,* 329–337.

Cohen, J., & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Coleman, K. H., Weinman, M. L., & Hsi, B. P. (1980). Factors affecting conjugal violence. *The Journal of Psychology, 105,* 197–202.

Dohrenwend, B. P. (1982). *Psychiatric Epidemiology Research Interview (PERI).* New York: Columbia University, Social Psychiatry, Research Unit.

Dutton, D. G. (1995). Trauma symptoms and PTSD-like profiles in perpetrators of intimate abuse. *Journal of Traumatic Stress, 8,* 299–316.

Feunekes, G. I. J., van't Veer, P., van Staveren, W. A., & Kok, F. J. (1999). Alcohol intake assessment: The sober facts. *American Journal of Epidemiology, 150,* 105–112.

Finkelhor, D., & Dziuba-Leatherman, J. (1994). Victimization of children. *American Psychologist, 49,* 173–183.

Gerardi, R. J., Keane, T. M., Cahoon, B. J., & Klauminzer, G. W. (1994). An in vivo assessment of physiological arousal in posttraumatic stress disorder. *Journal of Abnormal Psychology, 103,* 825–827.

Gondolf, E. W., & Foster, R. A. (1991). Wife assault among VA alcohol rehabilitation patients. *Hospital and Community Psychiatry, 42,* 74–79.

Goodman, L. A., Koss, M. P., Fitzgerald, L. F., Russo, N. F., & Keita, G. P. (1993). Male violence against women: Current research and future directions. *American Psychologist, 48,* 1054–1058.

Graham, K., Leonard, K. E., Room, R., Wild, T. C., Pihl, R. O., Bois, C., & Single, E. (1998). Current directions in research on understanding and preventing intoxicated aggression. *Addiction, 93,* 659–676.

Graham, K., & Schmidt, G. (1999). Alcohol use and psychosocial well-being among older adults. *Journal of Studies on Alcohol, 60,* 345–351.

Hotaling, G. T., & Sugarman, D. B. (1986). An analysis of risk markers in husband to wife violence: The current state of knowledge. *Violence and Victims, 1,* 101–124.

Hutchinson, I. W. (1999). Alcohol, fear, and woman abuse. *Sex Roles, 40,* 893–920.

Jordan, B. K., Marmar, C. R., Fairbank, J. A., Schlenger, W. E., Kulka, R. A., Hough, R. L., & Weiss, D. S. (1992). Problems in families of male Vietnam veterans with posttraumatic stress disorder. *Journal of Consulting and Clinical Psychology, 60,* 916–926.

Karney, B. R., & Bradbury, T. N. (1995). The longitudinal course of marital quality and stability: A review of theory, methods, and research. *Psychological Bulletin, 118,* 3–34.

Kaufman Kantor, G., & Straus, M. A. (1987). The "Drunken Bum" theory of wife beating. *Social Problems, 34,* 213–230.

Kaufman Kantor, G., & Straus, M. A. (1989). Substance abuse as a precipitant of wife abuse victimizations. *American Journal of Drug and Alcohol Abuse, 15,* 173–189.

Keane, T. M., Caddell, J. M., & Taylor, K. L. (1988). Mississippi Scale for Combat-Related Posttraumatic Stress Disorder: Three studies in reliability and validity. *Journal of Consulting and Clinical Psychology, 56,* 85–90.

Keane, T. M., & Wolfe, J. (1990). Comorbidity in post-traumatic stress disorder: An analysis of community and clinical studies. *Journal of Applied Social Psychology, 20,* 1776–1788.

King, L. A., & King, D. W. (1994). Latent structure of the Mississippi Scale for Combat-Related Post-Traumatic Stress Disorder: Exploratory and higher-order confirmatory factor analyses. *Assessment, 1,* 275–291.

King, L. A., & King, D. W. (2000). *Male-perpetrated domestic violence: Testing a series of multifactorial family models.* Final report to the National Institute of Justice (Grant 98-WT-VX-OC31).

King, D. W., King, L. A., Foy, D. W., Keane, T. M., & Fairbank, J. A. (1999). Posttraumatic stress disorder in a national sample of female and male Vietnam veterans: Risk factors, war-zone stressors, and resilience-recovery variables. *Journal of Abnormal Psychology, 108,* 164–170.

King, D. W., Leskin, G. A., King, L. A., & Weathers, F. W. (1998). Confirmatory factor analysis of the Clinician-Administered PTSD Scale: Evidence for the dimensionality of posttraumatic stress disorder. *Psychological Assessment, 10,* 90–96.

Kulka, R. A., Schlenger, W. E., Fairbank, J. A., Hough, R. L., Jordan, B. K., Marmar, C. R., & Weiss, D. S. (1990a). *The National Vietnam Veterans Readjustment Study: Tables of findings and technical appendices.* New York: Brunner/Mazel.

Kulka, R. A., Schlenger, W. E., Fairbank, J. A., Hough, R. L., Jordan, B. K., Marmar, C. R., & Weiss, D. S. (1990b). *Trauma and the Vietnam War generation: Report of findings from the National Vietnam Veterans Readjustment Study.* New York: Brunner/Mazel.

Lauterbach, D., Vrana, S., King, D. W., & King, L. A. (1997). Psychometric properties of the Civilian Version of the Mississippi PTSD Scale. *Journal of Traumatic Stress, 10,* 499–513.

Leonard, K. E., & Blane, H. T. (1992). Alcohol and marital aggression in a national sample of young men. *Journal of Interpersonal Violence, 7,* 19–30.

Leonard, K. E., Bromet, E. J., Parkinson, D. K., Day, N. L., & Ryan, C. M. (1985). Patterns of alcohol use and physically aggressive behavior in men. *Journal of Studies on Alcohol, 46,* 279–282.

Malloy, P. F., Fairbank, J. A., & Keane, T. M. (1983). Validation of a multimethod assessment of posttraumatic stress disorders in Vietnam veterans. *Journal of Consulting and Clinical Psychology, 51,* 488–494.

Murdoch, D., Pihl, R. O., & Ross, D. (1990). Alcohol and crimes of violence: Present issues. *The International Journal of the Addictions, 25,* 1065–1081.

Neff, J. A., Holamon, B., & Schluter, T. D. (1995). Spousal violence among Anglos, Blacks, and Mexican Americans: The role of demographic variables, psychosocial predictors, and alcohol consumption. *Journal of Family Violence, 10,* 1–21.

Orr, S. P., Pitman, R. K., Lasko, N. B., & Herz, L. R. (1993). Psychophysiological assessment of posttraumatic stress disorder imagery in World War II and Korean combat veterans. *Journal of Abnormal Psychology, 102,* 152–159.

Pallmeyer, T. P., Blanchard, E. B., & Kolb, L. C. (1986). The psychophysiology of combat-induced post-traumatic stress disorder in Vietnam veterans. *Behavioral Research and Therapy, 24,* 645–652.

Pihl, R. O., Peterson, J. B., & Lau, M. A. (1993). A biosocial model of the alcohol–aggression relationship. *Journal of Studies on Alcohol, 11* (Suppl.), 128–139.

Pitman, R. K., Orr, S. P., Forgue, D. F., de Jong, J. B., & Claiborn, J. M. (1987). Psychophysiologic assessment of posttraumatic stress disorder imagery in Vietnam combat veterans. *Archives of General Psychiatry, 44,* 970–975.

Rehm, J., Ashley, M. J., & Dubois, G. (1997). Alcohol and health: Individual and population perspectives. *Addiction, 92* (Suppl. 1), 109–115.

Robins, L. N., Helzer, J. E., Croughan, J., & Ratcliff, K. S. (1981). National Institute of Mental Health Diagnostic Interview Schedule: Its history, characteristics and validity. *Archives of General Psychiatry, 38,* 381–389.

Sack, W. H., Seeley, J. R., & Clarke, G. N. (1997). Does PTSD transcend cultural barriers? A study from the Khmer Adolescent Refugee Project. *Journal of the American Academy of Child and Adolescent Psychiatry, 36,* 49–54.

Schafer, J., Caetano, R., & Clark, C. L. (1998). Rates of intimate partner violence in the United States. *American Journal of Public Health, 88,* 1702–1704.

Serdula, M. K., Mokdad, A. H., Byers, T., & Siegel, P. Z. (1999). Assessing alcohol consumption: Beverage-specific versus grouped-beverage questions. *Journal of Studies on Alcohol, 6,* 99–102.

Stewart, S. H. (1996). Alcohol abuse in individuals exposed to trauma: A critical review. *Psychological Bulletin, 120,* 83–112.

Straus, M. A. (1979). Measuring intrafamily conflict and violence: The Conflict Tactics (CT) Scales. *Journal of Marriage and the Family, 41,* 75–88.

Straus, M. A. (1990). The Conflict Tactics Scales and its critics: An evaluation and new data on validity and reliability. In M. A. Straus & R. I. Gelles (Eds.), *Physical violence in American families: Risk factors and adaptations to violence in 8,145 families* (pp. 49–73). New Brunswick, NJ: Transaction.

Straus, M. A. (1997). Physical assaults by women partners: A major social problem. In M. R. Walsh (Ed.), *Women, men, and gender: Ongoing debates* (pp. 210–221). New Haven, CT: Yale University Press.

Straus, M. A. (1999). The controversy over domestic violence by women: A methodological, theoretical, and sociology of science analysis. In X. B. Arriaga & S. Oskamp (Eds.), *Violence in intimate relationships* (pp. 17–44). Thousand Oaks, CA: Sage.

Straus, M. A., & Gelles, R. J. (1992). How violent are American families? Estimates from the National Family Violence Resurvey and other studies. In M. A. Straus & R. J. Gelles (Eds.), *Physical violence in American families* (pp. 95–112). New Brunswick, NJ: Transaction.

Vreven, D. L., Gudanowski, D. M., King, L. A., & King, D. W. (1995). The Civilian Version of the Mississippi PTSD Scale: A psychometric evaluation. *Journal of Traumatic Stress, 8,* 91–109.