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Drug use disorders and post-traumatic stress disorder over 25 adult years: Role of psychopathology in relational networks

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Abstract

Background—In traumatized populations, drug use disorders and post-traumatic stress disorder (PTSD) persist for many years. Relational factors that mediate this persistence have rarely been systematically examined. Our aim is to examine the relative effects of psychopathology in familial and non-familial networks on the persistence of both disorders over adulthood.

Method—We utilized longitudinal data from an epidemiologically ascertained sample of male Vietnam veterans (n = 642). Measures included DSM-IV drug use disorders, other psychiatric disorders, network problem history and time-varying marital and employment characteristics. Longitudinal measures of veterans' psychopathology and social functioning were retrospectively obtained for each year over a 25 year period. We used generalized estimating equations (GEE) to estimate the relative effects of network problems on veteran's drug use disorders and PTSD after adjusting for covariates.

Results—Veterans' mean age was 47 years in 1996. Prevalence of illicit drug disorders declined from 29.8% in 1972 to 8.3 % in 1996, but PTSD remained at 11.7% from 13.2% in 1972. While 17.0% of veterans reported a familial drug use problem, 24.9% reported a non-familial drug use problem. In full GEE models, a non-familial drug problem was a significant predictor of illicit drug use disorders over 25 years (OR = 2.21, CI=1.59-3.09), while both familial depression (OR = 1.69, CI = 1.07-2.68) and non-familial drinking problem (OR=1.66, CI=1.08-2.54) were significant predictors of PTSD over 25 years.

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Conclusions—Familial and non-familial problems in networks differentially affect the persistence of drug use disorders and PTSD in traumatized male adults.

Keywords

Familial and non-familial networks; drug disorder; post-traumatic stress disorder; veterans

1. INTRODUCTION

Drug abuse and addiction decline with age, particularly in middle adulthood. This is in part due to maturation but also altered environmental exposure (e.g., Chassin et al., 2004; Chen and Kandel, 1995). However, drug use disorders remain protracted in traumatized populations when there is additional co-occurring psychopathology (Price et al., 2004). Post-traumatic stress disorder (PTSD) appears to prolong illicit drug disorders in traumatized populations (Lacoursie et al., 1980; Breslau, 2009; Cottler et al., 1992). Both prolonged drug use disorders and PTSD are linked to familial vulnerability and heightened non-familial risks (Najavits et al., 1998). To our knowledge, no study has examined the relative effects of familial and non-familial risks with illicit drug disorders and PTSD in middle adulthood. Discerning the relative influence, and subsequently obtaining more precise information, will help to devise interventions specific to middle adulthood. Such knowledge is important because evidence suggests baby boomers continue to use drugs as they age (Colliver et al., 2006).

There is a long tradition of family studies of substance use disorders. Evidence strongly suggests vulnerability to substance abuse runs in families (Luthar and Rounsaville, 1993; Merikangas et al., 1998) and across multiple generations (e.g., Luthar and Rounsaville, 1993). Familial risks may be specific or non-specific to proband's psychopathology. Merikangas et al. (1998) noted separate factors specific to drug abuse (e.g., parental concordance for drug abuse) from non-specific family environments (e.g., any family psychopathology). More recently, McCutcheon et al. (2012) reported links between maternal depression and alcoholism only in the presence of a comorbid internalizing disorder. In their study, sibling drug use was significantly associated with alcoholism with or without comorbid internalizing and externalizing disorders. A number of studies have also implicated family history of substance use disorder as a significant risk for protracting proband's substance use disorder (Maddux and Desmond, 1989; Pickens et al., 2001; Sher, 1991). The evidence is greater for alcohol than for illicit drug use disorder (Merikangas et al., 1998). Despite decades of research on familial history of psychopathology, there still is a dearth of studies on illicit drug disorders encompassing middle adulthood years.

Studies of familial risk for PTSD tend to be more recent. Connor and Davidson (2006) found that 45% to 74% of the cases of PTSD in the studies they reviewed had a family history of the disorder. The specific nature of familial effects is complicated by heterogeneity in the expression of PTSD. There is also evidence that familial trauma increases vulnerability to the disorder (Yehuda et al., 2001; Solomon et al., 1988). However, longitudinal studies including both illicit drug use disorders and PTSD are rare, especially those encompassing middle adulthood years. Further, no study to our knowledge included a number of familial problem phenotypes to examine cross-phenotype or phenotype-specific effects on proband's illicit drug disorder and PTSD simultaneously. Little is known about their effects during middle adulthood, which may shed light on prevention and intervention target areas, such as implementation of a short screening in primary care.

Substance related problems in friends and spouses also affect drug use disorders and PTSD. Numerous developmental studies document peer clustering of drug use where both

assortative mating and socialization play a role in proband's drug use (e.g., Oetting and Beauvais, 1987; Stein et al., 1987). Some evidence exists for person-to-person or "horizontal" transmission of PTSD through non-familial networks in adulthood (McCubbin and Figley, 1983). A few studies have documented secondary traumatization and PTSD symptoms in spouses or partners of service members who returned from war (Maloney, 1988; McCubbin and Figley, 1983; Dirkzwager et al., 2005). These studies are nonetheless limited because of a lack of longitudinal assessment, inability to differentiate non-familial from familial network effects and a lack of diagnostic measures of both drug use disorders and PTSD.

Familial and non-familial studies also face challenges to appropriately characterize a wide variety of both familial and non-familial relationships. Studies involving familial networks have included one or both parents (e.g., Luthar and Sexton, 2007) or siblings (e.g., Luthar and Rounsaville, 1993). Studies including both over many years in middle adulthood are less common. Non-familial networks include friends (e.g., McCutcheon et al., 2012) but few studies include spouses. Thus, it is difficult to arrive at conclusive evidence for the relative importance of particular relationships that are associated with proband's psychopathology.

To fill these gaps, the aims of the current study are to: (1) separate substance abuse and psychiatric problems in familial (father, mother, siblings) versus non-familial (spouses, friends) networks; (2) examine the association of substance abuse and psychiatric problems in specific relational networks with proband's drug dependence or abuse (DDA) and PTSD over adult years, while accounting for demographic characteristics, social functioning and other co-occurring disorders; and, (3) assess the overall relative effects of familial and non-familial problems on proband's DDA and PTSD.

2. METHODS

2.1. Participants

The data were gathered as part of a series of long-term follow-up studies on combat veterans deployed to Southeast Asia. The original studies included a total of 1,227 servicemen. Army servicemen (pay grades E1–E9), who had positive urine tests (drug positive status at baseline) for opiates, amphetamines, or barbiturates at the time of their departure from Vietnam in September 1971, comprised half of the original veteran sample; the other half of veterans were drawn from the entire roster of September 1971 returnees (drug-negative status). Further details are described elsewhere (Robins 1974; Robins and Helzer, 1975; Price et al., 2001). All aspects of the series of follow-up studies involving this cohort were approved by the appropriate Institutional Review Boards. The current study utilized data from the Wave 3 follow-up conducted in 1996–1997 which retained over 80% of surviving and located sample members (Price et al., 2004). Analyses used the veteran sample only (n = 642).

2.2. Outcomes

Annual measures of DSM-IV drug dependence or abuse (DDA)—Survey questions in 1996–1997 were used to compute annual DDA measures for each year from 1972 to 1996, according to the diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders, 4th ed. (DSM-IV; APA, 1994). Respondents who reported illicit drug use five times or more since 1972 were asked to respond to each DSM-IV dependence or abuse symptom and verify the years in which they experienced each symptom for each of the following drug classes: sedatives, stimulants, marijuana, cocaine, opiates, PCP, hallucinogens, and inhalants. Based on symptoms endorsed for each year, it was determined whether subjects met DSM-IV drug dependence or abuse criteria in each year from 1972

until 1996. In this study, DDA diagnoses across all classes of drugs were combined to code the presence or absence of dependence, abuse or both for each year.

Annual measures of DSM-IV post-traumatic stress disorder (PTSD)—Annual PTSD diagnosis based on the DSM-IV criteria was obtained as follows. First, respondents were asked to recall major psychological traumas (accidents, fires, assaults, witnessing acts of violence, life threatening situations, deaths of loved one, or natural disasters). They were then asked to identify the most severe traumatic event for the period before 1972 and for the period after 1972. Presence of DSM-IV PTSD symptoms was obtained for each of the two most traumatic events. Next, the time from the trauma to onset of each symptom cluster and the duration since the onset was also obtained. Thus a respondent was considered positive for PTSD in a given year if he met three symptom criteria in that year and the lifetime DSM-IV impairment criteria, which combined the diagnosis for pre-1972 and post-1972 most traumatic event.

2.3. Substance abuse and psychiatric problems in familial and non-familial networks

Figure 1 schematically shows how types of relational networks are categorized into familial and non-familial networks which are in turn used as predictors of longitudinal measures of DDA and PTSD, along with fixed and time-variant covariates (right section). Substance abuse and psychiatric problems of parents, siblings and spouses were obtained from the family history module in the 1996-1997 survey based on a list of family members enumerated in an earlier module. Each respondent was asked to indicate the presence or absence of an alcohol problem among parents, siblings and spouses starting with the question, “As far as you know, have any of these family members drunk so much that it became a problem?” The presence of a drug use problem in these networks was assessed by the question, “Have any of these family members ever had a problem with drugs including abusing prescriptions?” The presence or absence of a depression problem in these networks was assessed by the question, “Have any of these family members ever suffered from depression, that is, they felt so low for a period of weeks or months that they hardly ate or couldn’t work or do whatever they usually did?” Family history of PTSD was not asked because the diagnostic construct was established in 1980, thus the validity of off-spring’s (veteran’s) report of his parental PTSD was judged questionable.

Substance abuse problems in friend networks were assessed in the social network module. First, a gateway question asked the proband to recall all friends “that have been important to you at any time since 1972.” This question was then followed by a more specific question which asked the proband to choose the four most important persons over the past 20 years. Once names of these four friends were obtained, follow-up questions asked the respondent if each of these four individuals had a “*drinking problem*” or used “*illicit drugs regularly*.” Friends’ depression was not asked in this module, thus was not included in the subsequent analyses.

Substance abuse or psychiatric problems reported for mother, father or full siblings were combined in the familial networks category; reported problems in the spouse and friend networks were combined in the non-familial category. Six dichotomous network problem measures were used in summary statistics: drinking problem, drug problem and depression for familial and non-familial network categories.

2.4. Covariates

Demographic information included race, age and education. Race (African-American versus others), continuous age measure (in 1996) and high school education (yes or no high school education) were included as demographic covariates. Annual measures of marital status

(married or not) and employment status (any employment or no employment in a given year) for each year from 1972 to 1996 were included. Veteran's drug urinalysis result in 1971 constituted the baseline drug sampling status. Individual's own co-occurring psychopathologies are likely confounding factors (e.g., Lin et al., 1996; Merikangas et al., 1998). We included annual measures of alcohol dependence or abuse, major depression, and adult antisocial personality, which are based on the DSM-IV criteria covering 1972 to 1996. The computation of annual measures of alcohol dependence or abuse was similar to that of drug abuse or dependence. Annual major depression and adult antisocial personality were computed using the onset and recency timing reported for each DSM-IV symptom because we found in a pretest phase that annual recalls of each symptom for these pathologies were less reliable than those for illicit drug and alcohol dependence and abuse.

2.5. Statistical Analysis

We used the generalized estimating equation (GEE; Liang and Zeger, 1986) to estimate the degree of associations between substance abuse and psychiatric problems of relational networks with the longitudinal outcome measures of DDA and PTSD. GEE framework estimates the probability of an outcome as a function of predictor variables using population averaged models (Pickens et al., 2001). GEE accounts for correlations of outcome measures over multiple years; models are considered robust even when correlation structures are misspecified (Ghisletta and Spini, 2004). GEE is suitable for time-dependent covariates, which in our case included PTSD for the DDA outcome, illicit drug use disorder for the PTSD outcome, and alcohol dependence or abuse, major depression and two social functioning variables (marital status and employment) for both DDA and PTSD outcomes. Using SAS 9.2, we specified first-order autoregressive correction of each outcome variable (Smith and Smith, 2006). For dichotomous outcomes, interpretation of GEE estimates for covariates is similar to that of logistic regressions (Ghisletta and Spini, 2004). Odds ratios and 95% confidence intervals of network problem predictors were estimated from GEE separately for DAD and PTSD outcomes. Dichotomized network predictors at the veteran level that were significant in covariate unadjusted models were included in full covariate adjusted GEE models.

3. Results

3.1. Sample characteristics

The sample was predominantly Caucasian (72.2%) and 38.5% were drawn from the drug-positive sample. As shown in Table 1, average age was 46.7 in 1996; educational attainment measured as high school or above improved from 61.8% in 1972 to 79.2% in 1996; married veterans increased from 48.9% in 1972 to 71.1% in 1996. Employment status remained similar between these years: having 80.5% and 77.7% of veterans reported having a job in 1972 and 1996, respectively

The original samples were weighted on the probability of selection into a particular sample, but weights were not used in the current study (see Price et al., 2004). The un-weighted prevalence of substance use and psychiatric disorders declined over 25 years, except for major depression. The largest declines in prevalence were seen for drug dependence or abuse (29.8% in 1972 to 8.3% in 1996) and alcohol dependence or abuse (30.6% in 1972 to 16.1% in 1996). PTSD rate changed little over 25 years (13.2% in 1972 to 11.7% in 1996).

3.2. Reported rates of drinking, drug use problems and depression in familial and non-familial networks

Reported rates were computed separately for veterans as unit of analysis and for each network size as denominator (Table 2). Rates of positive response ranged from 0.3% of

veterans reporting drug use problem in their fathers to as much as 22.1% of veterans reporting drug use problems among their friends. Only 10.4% of the friend network reportedly had a drug use problem, suggesting that some veterans were associated with more than one friend having a drug use problem. Drinking and drug use problems in the non-familial networks were more prevalent than those in the familial networks. Reporting of depression was highest for siblings: 14.6% of veterans reported siblings experienced depression. This amounts to 5.7% of the total siblings elicited; thus a small number of veterans reported more than one sibling who had experienced depression.

3.3. Associations of problems in each type of relational networks with DDA and PTSD

Although unadjusted odds ratios for drinking and drug use problems of specific relationships on DDA are all significant except for spouse's drinking, controlling for other covariates resulted in significant adjusted odds ratios only for sibling drug use problem (OR = 1.63, CI = 1.08-2.45), spouse drug problem (OR = 2.10, CI = 1.12-3.95), and friend drug problem (OR = 2.09, CI = 1.47-2.96) (Table 3a). Friend's drinking problem (OR = 1.83, CI = 1.18-2.83) and sibling's depression (OR = 2.37, OR = 1.45-3.83) remain significant predictors of proband PTSD in the covariate adjusted model (Table 3b).

3.4. Associations of problems in summary familial and non-familial networks with DDA and PTSD

As in the relation-specific GEE models, drinking and drug use problems in both familial and non-familial networks were significantly associated with veterans' DDA. However, in the covariate-adjusted models, only drug use problems in the non-familial networks remained significantly associated with veteran's DDA (OR = 2.21, CI = 1.59-3.09; Table 4a). For PTSD, both depression in the family networks (OR = 1.69, CI = 1.07-2.68) and drinking problem in the non-familial networks (OR = 1.66, CI = 1.08-2.54) remained significant after adjusting for covariates (Table 4b).

4. DISCUSSION

4.1. Summary of findings

In this study, we used twenty-five year follow-up data of a Vietnam veteran cohort with a history of opiate addiction and heavy drinking to examine the role of psychopathology in familial and non-familial networks on veterans' long-term trajectory of drug dependence or abuse (DDA) and PTSD. To summarize: (1) In this sample of veterans, we found considerable drinking and drug use problems both in siblings and peers (important friends in our study). Based on network member endorsement, many veterans had multiple network members with drug or drinking problems. (2) Drug use problems in peers were significantly associated with veteran's drug dependence or abuse over the 25 year period even after controlling for demographics, social functioning, and veteran's other psychopathology. Furthermore, siblings and spouses' drug use problems were significantly associated with the DDA outcome in the covariate-adjusted model. However, parental substance use problems did not remain significant predictors. On the other hand, sibling depression and friend's drinking problem were significantly associated with PTSD over 25 years; this effect was seen even after controlling for the veteran's own time-varying depression and alcohol dependence or abuse. (3) When specific relational types were combined to categories of familial and non-familial networks, we found that drug use problems in the non-familial networks were the strongest and only significant predictor of drug dependence and abuse over 25 years when controlling for other cofounders. Familial depression and non-familial drinking problems were significant predictors of PTSD over 25 years. However, the level of association was not as strong as the non-familial drug use problem with drug dependence or abuse (more than two-fold risk with a drug using non-familial network member).

4.2. Implications

Our study is novel in that it addresses the important connections between familial and non-familial network psychopathology and chronicity of drug use disorders and PTSD in a veteran population. Overall, our study underscores the important role of psychiatric problems in personal networks on protracted drug use disorders and PTSD in traumatized populations. Network effects appear both familial and non-familial: specific relational types are differentially associated with drug dependence or abuse and PTSD over the course of these disorders in adulthood. Familial problem effects, notably sibling depression, were observed only for veteran's PTSD. This may suggest a "phenotype non-specific" familial effect within line of the internalizing-externalizing distinction reported by several others (e.g., McCutcheon, 2012). This finding contrasts with the effects of network drug use problems on drug use disorders.

The associations of non-familial network problems with both disorders have practical and policy implications. Our findings point to the merit of including a short substance use and mental health inventory of select members of a patient's non-familial networks when treating dual diagnosis patients. Because non-familial networks present a malleable area for intervention and are available in the "current time frame" (Friedman, 2004), our finding is significant in underscoring the relative importance of siblings, spouses and friends' substance abuse and mental health problems in adulthood, over and above patient's family history and own psychopathology. Although we did not specifically assess the extent of impact of the familial and non-familial networks on the duration of drug dependence or abuse and PTSD, combined effects from relational networks on prolonging both disorders may be considerable. To reduce the length of two common chronic disorders in a traumatized population, future research is warranted to determine if the course of disease can be limited by interventions at the level of the social networks.

The importance of a short screener with reasonable discriminating ability for PTSD in military primary care has been emphasized (see Gore et al., 2008) and used successfully in military collaborative care for PTSD and depression (Engel et al., 2008). Our finding of the significant association of familial depression with veterans' chronic PTSD suggests that a short screener in primary care should be extended to include a family history of depression as well as measures of psychopathology in the patient's close social networks. Given our result of non-familial association of alcohol problems in networks with veteran's PTSD, such a screener should include alcohol use behaviors.

Illicit drug use and abuse prevention such as described above for the collaborative primary care initiative may still be beyond the scope of the current U.S. military, due to legal ramifications of disclosure of illicit activities. The recently released Institute of Medicine report points out the military's over reliance on drug testing which limits the military's ability to address evolving patterns of drug and alcohol use over time (Institute of Medicine, 2012). Our study results are consistent with a few of the Institute of Medicine's key recommendations such as implementation of evidence-based prevention programs and joint planning with the leadership of the Veterans Health Administration to address the issues of access to care for the reserve component personnel (Institute of Medicine, 2012) as well as their families. If prevention policies and implementations such as a primary care screener and collaborative care had been in place when Vietnam veterans highly exposed to military combat and illicit drugs came home, chronicity of their PTSD and drug use disorders may have been shortened.

Vietnam combat veterans are a part of the baby boomer generation whose members continue to use drugs as they age at a higher rate than similar age cohorts in earlier years (Colliver et al., 2006 Substance Abuse and Mental Health Services Administration, 2010). Treatment

and counseling services of their continuing substance abuse, including illicit drug use or prescription drug misuse rely on the health care systems in the communities they live, unless they are eligible and willing to be under the VA's care. Because geriatric substance abuse has been overlooked until recently, screening and identification of such individuals is most important. Primary care sector may be the best setting for screening because of increased need for seeing physicians for their age related physical problems (Center for Substance Abuse Treatment, 2012). Although the current available screening questions are limited to patients themselves (Center for Substance Abuse Treatment, 2012), our study suggests merit in incorporating a few screening questions about spouses and perhaps, even friends. Novel methods which include social networks (see for e.g., Facebook based suicide prevention for veterans, Himel-Nielson, 2012) could also be used to provide resources for symptom recognition and access to counseling.

4.3. Limitations

First, the sample was limited to male combat veterans. Thus, generalization to a wider population is limited. Using a veteran cohort in their middle age years, we had the unique opportunity to observe the life course of PTSD as well as DDA, which would not be possible in non-veteran populations. Applicability of our findings to the current returnees from Iraq and Afghanistan also requires caution since many differences exist between the Vietnam War and current conflicts, including substance use patterns (Institute of Medicine, 2012) and trauma characteristics (Friedman, 2004). Second, familial and non-familial effects were included as fixed effects and a causal association between network problems and chronicity of two disorders cannot be concluded. The association of substance abuse problems in the non-familial networks could be a result of assortative mating or homophily. A truly prospective longitudinal design would be needed to further elucidate the key causal explanatory effects of non-familial networks which impact chronicity of drug use disorders and PTSD. Third, although survey instrument development included extensive pre-testing with use of a life-chart recall method, timing information based on retrospective recall of 25 years may have included considerable recall errors. It should be noted, however, that previous studies using this cohort produced distinctively different trajectories of psychiatric phenotypes (e. g., Price et al., 2004). Alcohol dependence trajectory patterns replicated earlier findings from another large cohort of Vietnam era veterans (Jacob et al., 2010). Fourth, proband's recall of parental substance abuse and psychiatric problems may not be as good as recall on siblings, spouse and friends, with whom relationship duration is likely closer to the time of interview. As a result, parent effects on both DDA and PTSD may be underestimated.

Finally, while the assessment of familial networks is relatively complete, assessment of the friend network is far from complete because it was limited to a maximum of four names. Even though close ties were captured in this method, other, more distant relationships may have been missed in our assessment. Furthermore, our assessment did not include friend's depression. It is possible that if friends' depression had been included in our model, this variable may have showed a significant effect on veteran's outcomes, particularly PTSD. Friends' depression may reduce the effect of familial depression on PTSD (see Benazon and Coyne, 2000 study of depression in spouses). A second possibility is that friends' depression may significantly affect the relationship between friends' alcohol problems and veterans' PTSD, in which case the associations between friends' alcohol problems and veterans' PTSD may no longer be significant. A third possibility is that friends' depression may have no role on veteran's PTSD as individuals with chronic depression continuing into middle adulthood are less likely to report significant personal networks (see for e.g., Golden et al., 2009 study among community-dwelling elderly). These remain mere speculations and need to be addressed in future research.

4.4. Conclusion

Drug use problems in siblings, friends and spouses are contributing factors that are associated with prolonging drug use disorders into middle adulthood for men with a history of trauma and substance abuse. Such associations are independent of their own PTSD and other psychopathology as well as other family history of substance abuse and psychopathology. Even for middle adulthood years, a brief assessment of non-familial network characteristics may provide opportunities for intervention for individuals suffering from dual drug abuse and PTSD.

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Figure 1.

Psychopathology in relational networks and veteran's own psychopathology affecting drug dependence or abuse (DDA) and post-traumatic stress disorder (PTSD).

Table 1

Demographics, social functioning, and prevalence of psychiatric disorders in 1972 and 1996.

Measures	Category or criteria	Veterans interviewed in 1996-1997 (n = 642)	
		Estimates in 1972 ^{a,b}	Estimates in 1996 ^{a,b}
Age (Means (SD))		24.23 (3.39)	46.71 (3.30)
Education (%)	At least high school	61.84	79.19
Marital status (%)	Married	48.89	71.11
Employment status (%)	Employed	80.50	77.66
Illicit drug abuse or dependence (%) ^c	DSM-IV	29.75	8.26
Post-traumatic stress disorder (%) ^c	DSM-IV	13.24	11.68
Alcohol abuse or dependence (%) ^c	DSM-IV	30.63	16.09
Major depression (%) ^c	DSM-IV	4.98	6.39
Adult antisocial personality (%)	DSM-IV	12.99	3.58

^aPercentages are unweighted.^bThe number of missing cases varied from 0 to 13 across variables.^cImpairment criteria were assessed for lifetime basis and applied to annual diagnostic measures.

Table 2

Rates of drinking problem, drug use problem, and depression in the relational networks reported by veterans.

Relation type	% of veterans reported problem in network				% of total network members positive for problem			
	Veteran (n)	Drinking problem	Drug use problem	Depression	Network (n)	Drinking problem	Drug use problem	Depression
In father ^a	642	9.81	0.31	2.80	642	9.81	0.31	2.80
In mother ^a	642	2.18	1.71	6.85	642	2.18	1.71	6.85
In sibling ^b	642	15.73	21.03	14.64	2028	8.40	6.40	5.70
Familial total	642	25.23	16.97	22.11	3312	7.90	4.25	3.50
In spouse ^c	642	4.21	4.36	10.12	949	3.50	2.90	7.16
In friend ^d	642	29.6	22.12	NA	2328	12.37	10.39	NA
Non-familial total	642	32.08	24.92	NA	3277	10.49	8.40	NA

NA = Question not asked. Totals for familial and non-familial networks for depression therefore are not reported.

^aThe parent who raised the veteran. Only one "mother" and one "father" were allowed.

^bOnly full siblings were included in the denominator.

^cUp to four spouses were listed based on the question on the number of marriages, which was used as the denominator.

^dUp to four friends were listed based on the question on the most important people endorsed, which was used as the denominator.

Table 3

Associations of drinking, drug use and depression problems in relational networks with veteran's drug dependence or abuse and post traumatic stress disorder: Odds ratios estimated separately for each relational type.

(a) Drug dependence or abuse (DDA)					
Relation type	Unadjusted odds ratios (CI)			Adjusted odds ratios (CI) ^a	
	Problems in networks			Problems in networks	
	Drinking	Drug use	Depression	Drinking	Drug use Depression
Father	1.97 (1.31, 2.95) ***	2.84 (0.29, 27.01)	1.39 (0.68, 2.83)	1.33 (0.83, 2.12)	# #
Mother	4.14 (1.85, 9.26) ***	2.63 (1.02, 6.77) *	1.62 (0.95, 2.76)	2.33 (0.96, 5.65)	1.39 (0.33, 5.84) 0.86 (0.41, 1.80)
Sibling	1.72 (1.24, 2.39) **	2.29 (1.61, 3.24) ***	1.36 (0.90, 2.05)	0.97 (0.65, 1.45)	1.63 (1.08, 2.45) * #
Spouse	1.67 (0.89, 3.12)	3.70 (2.21, 6.20) ***	1.25 (0.80, 1.97)	#	2.10 (1.12, 3.95) * #
Friend	2.49 (1.84, 3.35) ***	3.08 (2.26, 4.21) ***	NA	1.34 (0.96, 1.87)	2.09 (1.47, 2.96) *** NA
(b) Post-traumatic stress disorder (PTSD)					
Relation type	Unadjusted odds ratios (CI)			Adjusted odds ratios (CI) ^a	
	Problems in networks			Problems in networks	
	Drinking	Drug use	Depression	Drinking	Drug use Depression
Father	1.95 (1.09, 3.49) **	##	1.09 (0.37, 3.24)	1.42 (0.79, 2.54)	# #
Mother	1.32 (0.38, 4.49)	0.63 (0.15, 2.55)	0.97 (0.46, 2.06)	#	# #
Sibling	1.44 (0.90, 2.29)	1.04 (0.59, 1.76)	2.18 (1.34, 3.56) **	#	# 2.37 (1.45, 3.83) ***
Spouse	0.75 (0.32, 1.73)	0.91 (0.37, 2.23)	1.43 (0.82, 2.48)	#	# #
Friend	2.03 (1.34, 3.07) ***	1.23 (0.78, 1.93)	NA	1.83 (1.18, 2.83) **	# NA

Bolded texts are statistically significant odds ratios

* $p < .05$

** $p < .01$

*** $p < .001$. CI = confidence interval.

= non-significant in unadjusted models and dropped from estimation for adjusted models.

= failed to converge due to a low prevalence.

^a Odds ratios were adjusted for sampling status, education, race, marital status, employment status, veteran's alcohol dependence or abuse, major depression, and adult antisocial personality. For models for DDA, veteran's post-traumatic stress disorder was also included; and for models for PTSD, veteran's drug dependence or abuse was included.

Table 4

Associations of drinking, drug use and depression problems in relational networks with veteran's drug dependence or abuse and post-traumatic stress disorder: Odds ratios estimated for combined familial and non-familial networks.

(a) Drug dependence or abuse (DDA)						
Summary relation type	Unadjusted odds ratios (CI)			Adjusted odds ratios (CI) ^a		
	Problems in networks			Problems in networks		
	Drinking	Drug use	Depression	Drinking	Drug use	Depression
Familial	1.92 (1.41, 2.60) ***	2.23 (1.58, 3.14) ***	1.40 (0.99, 1.97)	1.23 (0.86, 1.77)	1.43 (0.94, 2.15)	0.95 (0.65, 1.40)
Non-familial	2.49 (1.85, 3.36) ***	3.35 (2.48, 4.53) ***	1.25 (0.80, 1.96)	1.34 (0.97, 1.85)	2.21 (1.59, 3.09) ***	#
(b) Post-traumatic stress disorder (PTSD)						
Summary relation type	Unadjusted odds ratios (CI)			Adjusted odds ratios (CI) ^a		
	Problems in networks			Problems in networks		
	Drinking	Drug use	Depression	Drinking	Drug use	Depression
Familial	1.48 (0.96, 2.26)	0.97 (0.57, 1.67)	1.64 (1.05, 2.56) [*]	#	#	1.69 (1.07, 2.68) [*]
Non-familial	1.89 (1.26, 2.85) **	1.18 (0.76, 1.84)	1.43 (0.82, 2.48)	1.66 (1.08, 2.54) [*]	#	#

Bolded texts are statistically significant odds ratios

* $p < .05$

** $p < .01$

*** $p < .001$

CI = confidence interval.

= non-significant in unadjusted models and dropped from estimation for adjusted models.

^a Odds ratios were adjusted for sampling status, education, race, marital status, employment status, veteran's alcohol dependence or abuse, major depression, and adult antisocial personality. For models for DDA, veteran's post-traumatic stress disorder was also included; and for models for PTSD, veteran's drug dependence or abuse was included.