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Occupational Stressors, Stress Responses, and Alcohol Consumption Among Professional Firefighters: A Prospective, Longitudinal Analysis

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This dual-site longitudinal prospective study monitored and measured change in self-reported occupational stressors, emotional trauma, symptoms of stress, and alcohol consumption in urban firefighters. Study participants were 188 firefighters employed by two urban fire departments. The results showed that of 19 occupational stressors examined, only 5 (26%) changed significantly over time, and of those 5, only two—job skill concerns and concerns regarding reduction in force and benefits—decreased, reflecting less bothersome subjective ratings. Of the 12 measures of posttraumatic and other symptoms of stress, 9 (75%) increased significantly over time and none decreased significantly, whereas alcohol consumption was stable over time. Job stressors, trauma caseness, and stress response symptoms at baseline were strongly and significantly associated with the same measures at the two-year follow-up. The implications of the findings for prevention and remediation of stress disorders in fire service personnel are considered. It can be concluded that the stressful nature of urban firefighting is significantly associated with negative health outcomes, including the potential overreliance on alcohol use.

KEY WORDS: professional urban firefighting; occupational stressors and stress responses; stress responses of urban firefighters.

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INTRODUCTION

Professional firefighting consistently ranks as one of the most dangerous and stressful occupations in the United States. As recently as 1995, the incidence of job-related injuries among the nation's firefighters was approximately 4.5 times higher than for workers in private industry (IAFF, 1995). Similarly, firefighters ranked fourth in the number of occupational fatalities (per 100,000 employees) among U.S. workers (Leigh, 1988; U.S. Bureau of Labor Statistics, 1995). National household surveys estimate that 65% of all firefighters consume alcohol, which is similar to the general population (Parker & Harford, 1992). Based on other epidemiological data, only about 5% of firefighters indulge in heavy alcohol use—that is, drinking five or more drinks on five or more occasions in the past 30 days (Hoffmann, Brittingham, & Larson, 1996). However, other studies have shown higher rates of consumption as well as problem drinking in firefighter samples (Boxer & Wild, 1993; Corneil, 1995; McFarlane, 1998).

Despite these morbidity and mortality data, research involving firefighter occupational stress (with the exception of critical incident stress) and its adverse health consequences was not initiated until 1985 (IAFF, 1995). Only one prior study, employing a cross-sectional design, examined the occupational stressors, stress responses, and their relationships to alcohol use in professional firefighters (Boxer & Wild, 1993). The purpose of this study was to replicate and extend the findings of Boxer and Wild using a contemporaneous sample of U.S. urban fire service personnel.

The Work Environment of Firefighters

The organization of fire departments. A relatively unique organizational aspect of firefighting includes the 24-hour shift, which is often sleep-disrupted, characterized by uncertainty and potential danger, and is sometimes uneventful and boring. Shift work, even of short duration, has been shown to adversely affect job performance, sleep patterns, and social and family life (Monk, 1990; Tepas & Carvalhais, 1990).

Most fire departments in the United States and other countries have rigid, paramilitary administrative structures with a "chain of command" that can make some forms of communication difficult. Yet teamwork and communication are essential for the success of both emergency medical service (EMS) calls and fire suppression. Fillmore (1992) noted that social drinking among colleagues is higher among worker groups whose jobs require teamwork.

Job stress in the fire service. Exposure to trauma is repetitive and frequent, which may increase the risk of posttraumatic stress disorder (PTSD) in this

worker group. Prevalence rates of PTSD in firefighters range from 16% to 50% (Beaton & Murphy, 1993; Corneil, 1995; McFarlane, 1998). Other job stressors include job skill concerns, concerns regarding job security, wages, and benefits, conflicts with coworkers, as well as conflicts between firefighters and their officers (Beaton & Murphy, 1993; Herbeson, Rando, & Plante, 1984). The *high-demand/low-control* nature of firefighting is referred to by Karasek *et al.* (1988) as a potentially "deadly" high-strain occupational combination, increasing the risk of cardiovascular disease, including higher prevalence of myocardial infarction.

Change in firefighter duties. An important change in job tasks of urban firefighters over the past two decades has been their increasing involvement in life-threatening medical emergencies. In some areas of the country, urban firefighters currently respond to medical emergencies about 60–80% of the time on most shifts. Thus, fire-based emergency medical service (EMS) has dramatically increased for most urban firefighters while responses to fire suppression incidents have leveled off. The job skills and work performance required for both emergency medical service tasks and fire suppression are highly demanding and characterized by time urgency, accurate decision making, threats of injury and/or death to self and others, witnessing deaths and injuries, and conveying news of tragedy to next of kin and friends of victims. Studies of emergency room physicians (Hughes, Brandenburg, & Baldwin, 1992) and nurses (Trinkoff & Storr, 1998) have shown that alcohol use was higher in emergency, critical care, and oncology than in other medical or nursing specialties. These findings suggest that alcohol use in the fire service may be increasing as firefighters are required to function as emergency medical technicians (EMTs).

Changes in fire service demographics. Another major change in the fire service over the past 10–20 years has been the impact of diversity. More women and persons from varying ethnic backgrounds have initiated careers in what was once an almost exclusively white male occupation. Both genders in male-dominated occupations are 1.5 times more likely to drink than workers in non-male-dominated occupations (Kraft, Blum, Martin, & Roman, 1993).

Extraorganizational factors. Because of extended periods of off-duty time and modest compensation, it has been estimated that 25% to 50% of professional fire service personnel are employed part-time at second jobs (Beaton & Murphy, 1993; Mitchell & Bray, 1990). Another factor receiving increasing study is "spillover" stress (Eckenrode & Gore, 1990). Finding and maintaining a balance between their work and family responsibilities has not been directly studied in firefighters to date, but one could easily envision spillover from their jobs because of the long hours firefighters must work as well as the inherent dangers and emotional turmoil involved in rendering emergency medical services. On the other hand, family support is also presumably important for firefighters, given the stressful nature of their jobs. Previous studies have estab-

lished significant buffering effects of social support on job dissatisfaction, job stress, and health outcomes in firefighters and other occupational groups (Beaton, Murphy, Pike, & Corneil, 1997; Berkman & Symes, 1979; Broadhead *et. al.*, 1983). Divorce rates are said to be elevated in rescue workers, but very little systematic data have been collected to date (Dunning & Silva, 1980).

Health Outcomes

Stress-related disorders are the physiological, cognitive, psychological, and behavioral manifestations of an acute or chronic nature, some of which have previously been documented to occur at elevated prevalence rates in emergency service workers (Mitchell & Bray, 1990; Beaton, Murphy, Pike, & Jarrett, 1995; Corneil, 1995). Stress-related signs and symptoms are outcomes of considerable concern because they may interfere with job performance, impact the length of employment, impair health status following retirement, and also because they may impose high economic costs on employers and employees alike. Data show that approximately 8% of firefighter job disabilities reported in the United States in 1991 were due to mental distress (IAFF, 1995). An unknown fraction of this distress is traumatic stress, coined "secondary traumatic stress" (Figley, 1995), which is commonly found among emergency workers and other caregivers. Trauma symptoms, including secondary traumatic stress symptomatology, are manifested by intrusion, avoidance, and hypervigilance (American Psychiatric Association, 1994; Beaton & Murphy, 1995).

Substance use and abuse has been associated with certain stress-related disorders, including PTSD, with the self-medication hypothesis suggested as a major causal pathway (Chilcoat & Breslau, 1998; Mitchell & Bray, 1990). Apparently, Boxer and Wild (1993) have been the only investigators to assess alcohol use as a potential stress-reduction strategy in fire service personnel. Boxer and Wild reported that 29% of their sample of urban U.S. firefighters met or exceeded the screening scores on the Michigan Alcoholism Screening Test (MAST) (Selzer, 1971), which is suggestive of alcohol abuse and/or dependence.

Poor health practices, such as inadequate diet, insufficient exercise, and smoking, may also heighten risk for disease in any worker group including fire personnel (Ullman & Siegel, 1996; U.S. Department of Agriculture, 1992; USDHHS, 1990, 1996; Wiley & Camacho, 1980). Finally, health status and illness prevalence have consistently been associated with demographic factors such as age, gender, marital status, education, income, and employment (Berkman, & Symes, 1979; Ullman & Siegel, 1996).

In summary, very few longitudinal studies of firefighter health have been conducted. Thus, it is unclear how long-term repetitive exposure to dangerous

and sometimes life-threatening situations along with other existing occupational and spillover stressors might adversely affect the mental and physical health of firefighters. Biological, cognitive-behavioral, and social mechanisms as well as demographic factors appear to be potential systemic linkages between occupational stressors, acute responses, and long-term adverse health outcomes. One purpose of the current study was to replicate and extend the investigation conducted by Boxer and Wild in the mid-1980s with urban firefighters that was published in 1993. The specific aims were to (1) identify the self-reported occupational stressors among firefighters at baseline and two years later; (2) identify the self-reported posttraumatic and other symptoms of stress, as well as alcohol use/abuse among firefighters over this same two-year time frame; (3) examine differences between participating fire departments and stability versus change of their occupational stressors and stress-related outcomes over time; (4) determine the associations among the study variables at baseline and assess their ability to predict outcomes two years later.

METHOD

Subjects and Sampling

The sample was drawn from two urban fire departments in a Pacific Northwest state. Department #1 consisted of 55 participants (36% of the firefighters and paramedics assigned to the department), and Department #2 consisted of 133 participants (33% of the department). Recruitment procedures were in accordance with university human subjects guidelines. Participants were selected from a prospective longitudinal study of firefighter occupational stressors and stress-related symptoms funded by the National Institute for Occupational Safety and Health (NIOSH) and the Centers for Disease Control (CDC). The 188 study participants selected for the analyses completed surveys at both baseline and at the two-year follow-up. The sample was predominantly male (93%), Caucasian (89%), whose mean age was 38 years (*S.D.* = 7.7). The majority of the participants were married (73%) and well educated, with a mean of 14.3 years (*S.D.* = 1.76) of formal schooling. At baseline, the fire service participants, on average, had been with their respective departments 10.4 years (*S.D.* = 8.6), 72% were considered "line" firefighters and paramedics (as opposed to officers), and 32% reported being employed at one or more off-shift second jobs for an average of 48 hours per month. Compared with an additional 100 participants who completed surveys at *either* baseline or at the two-year follow-up but for whom longitudinal data were not available, the longitudinal sample was significantly younger ($t = 3.37$, $p = < .05$), had significantly fewer years in the department ($t = 4.01$, $p = < .05$), had fewer officers

($\chi^2 = 5.85$, $p = < .05$), and had significantly more years of schooling ($t = 2.03$, $p = < .05$). The study sample demographics were, however, similar to Boxer and Wild's (1993) sample in terms of age, marital status, and years of schooling. However, the Boxer and Wild sample was more ethnically diverse (76% vs. 89% Caucasian), was reportedly more likely to hold an additional part-time job (58% vs. 32%), worked more hours per week at their second jobs (a mean of 21 vs. 12), and reported more career longevity with their respective fire departments (13.8 vs. 10.4 years of service).

Instruments

Sources of occupational stress. Occupational stressors were measured by the Sources of Occupational Stress instrument (SOOS) (Beaton & Murphy, 1993). The SOOS is a 57-item questionnaire developed by the first and second authors to assess the types and intensity of job-related stressors to which firefighters are commonly exposed. Respondents identified job stressors experienced in their past 10 shifts worked and were then instructed to indicate how "bothered" they were (by each job-related stressor experienced) by making a slash on a 0–100 visual analog scale (VAS) line that provided three anchors: 0 = not at all bothered, 50 = somewhat bothered, and 100 = extremely bothered. "Bothered" was defined in the instructions as "frustrated, annoyed, or irritated." If a particular SOOS item had not occurred within the past 10 shifts, participants were asked to check a nonapplicable column. Examples of SOOS items are threats to safety, thoughts about past runs that have been particularly upsetting, concerns about not knowing the latest technology, and telling families that their relatives had died or were injured. A total SOOS score can be obtained by summation of scores from all 57 SOOS items. Items marked nonapplicable were handled in subsequent analysis by assigning them a zero value.

Internal consistency reliability of the SOOS for the current sample was $\alpha = .96$. Construct validity was assessed in preliminary analyses with firefighter/EMTs ($n = 1{,}773$) and firefighter/paramedics ($n = 253$). Paired t-test results using Bonferroni's correction revealed no statistically significant differences in the sources of occupational stress between these two closely aligned occupational subsamples. A principal component factor analysis revealed 14 orthogonal factors with eigenvalues greater than 1.0. The 14 SOOS factors accounted for 66.3% of the total variance of the SOOS instrument (Beaton & Murphy, 1993). The 14 SOOS factors are shown in Table 1. Two of the 14 factors, financial concerns and second job stress, are shown in Table 1 as extra-occupational stressor variables.

Social support and network conflict. Satisfaction with social support at home and at work was also measured by a 100-point visual analog scale rated

as follows: 0 = completely dissatisfied, 50 = somewhat satisfied, and 100 = completely satisfied. For the network degree of conflict measures, comparably anchored VAS ratings of appraised conflict (at work and at home) were as follows: 0 = little or no conflict, 50 = some conflict, and 100 = frequent, intense conflict. (See Beaton *et al.*, 1997, for reliability and validity of the social support and network measures with fire personnel.)

Symptoms of stress. Stress responses of the fire service personnel were measured by the Symptoms of Stress Inventory (SOS) (Beaton, Egan, Kegan, & Morrison, 1991). The SOS is a 94-item self-report with 10 content-derived subscales: peripheral/cutaneous, cardiovascular, muscle tension, neurologic, depression, anxiety, anger, nervous habit patterns, gastrointestinal distress, and cognitive disorganization. Respondents were asked which stress-related symptoms they experienced in the past week and how frequently they had experienced the symptom (0 = never to 4 = very frequently). Examples of SOS items are rapid breathing, difficulty concentrating, and migraine headaches. The instrument has adequate interitem and test-retest reliability and validity (Beaton *et al.*, 1991, 1995). Both total SOS and SOS subscale scores were calculated. The total SOS Cronbach's alpha for the current study sample was .97.

Posttrauma symptomatology. Posttrauma symptoms and caseness criteria for PTSD were measured with the 15-item Impact of Event Scale (IES) (Horowitz, Wilner, & Alvarez, 1979). Sample IES items are "I thought about it when I didn't mean to"; "I made an effort to avoid talking about it." The IES yields a total score as well as intrusion and avoidance subscale scores. A total IES score of $\geq$26 was the established PTSD caseness criterion employed in this and prior investigations (Corneil, 1995). Cronbach's alpha for the current study was .95.

Alcohol consumption and problem drinking. Alcohol consumption was measured by 19 items (6 subscales) that were part of the Health Screening Survey (HSS) (Fleming & Barry, 1991). Quantity and frequency of alcohol consumption was measured by asking participants to report the number of standard drinks consumed per week. Included within the HSS is the 4-item CAGE questionnaire (Mayfield, McLeod, & Hall, 1974). Two or more "yes" responses on the 4-item CAGE suggests alcohol abuse or dependence. A "problem drinking" caseness criterion was based on criteria suggested by Fleming and Barry: a positive response to one or more of the six alcohol-related HSS subscales. The HSS has shown evidence of validity, reliability, and sensitivity in identifying problem drinking and alcoholism (Fleming & Barry, 1991). The number of drinks per week, self-reported drinking problems, and alcohol caseness were significantly correlated and relatively stable (with certain exceptions) over time for the current study sample (see Tables 3 and 4). Cronbach's alpha for the CAGE section of HSS with the current study sample was .76.

Background Information. Individual and occupational data were obtained via a background form that consisted of items asking for age, gender, marital

status, ethnicity, current job title, years of education, number of years as a firefighter, length of time assigned to one's current department, number of hours per month employed at a second job, and self-reported estimations of the proportions of their medical emergencies and fire suppression activities within the prior month on duty.

RESULTS

Occupational Stressors, Stability Versus Change Over Time, and Fire Department Differences

Table 1 shows the means, standard deviations, change scores, *t*-values, and associated significance levels for occupational stressors reported by firefighters at baseline and at the two-year follow-up assessment. The total SOOS score

Table 1. Means, Standard Deviations, and Paired *t* Values Showing Change/Stability Over Time for the Occupational Stressor Variables

	Baseline		2-year follow-up			
Occupational stressor variables	M	S.D.	M	S.D.	Change scores	*t*
Perceived job stress (TOT SOOS)	19.29	13.95	19.63	13.41	−.35	−.40
SOOS subscales						
Sleep disturbance	40.07	29.38	43.43	28.46	−3.36	−1.72
Job skill concerns	25.49	21.00	21.76	19.35	3.73	2.64*[b]
Recall/past critical incident	17.32	19.68	16.29	16.63	1.03	.75
Management/labor conflict	15.43	17.68	17.47	19.41	−2.04	−1.40[b]
Personal safety concerns	21.97	22.07	20.50	19.21	1.46	.99
Conflict with coworkers	19.71	20.29	19.27	20.12	.45	.26
Substandard equipment	19.40	23.44	19.73	24.35	−.33	−.16
Concerns regarding reduction in force & benefits	14.48	24.23	9.38	17.70	5.11	2.94*[b]
Convey tragedy	12.85	21.22	14.22	20.40	−1.36	−.76
Job tedium	9.75	14.00	10.16	15.22	−.41	−.37
Discrimination	11.01	20.19	9.38	17.30	1.63	1.16
Conflict at work	22.30	20.92	22.76	21.40	−.45	−.24
Extraoccupational stressor variables						
Financial concerns	17.11	19.23	19.86	20.29	−2.76	−2.02*[a]
Second Job stress	9.16	13.50	9.62	12.71	−.46	−.41
Conflict at home	26.68	23.05	26.70	24.86	−.02	−.01
Social support/work	65.88	21.91	60.76	22.20	5.12	3.10*[a]
Social support/home	72.24	23.58	64.86	23.10	7.37	4.39*
Poor health habits	24.76	23.93	27.95	23.27	−3.17	1.78

Note: *$p < .05$. A negative change score implies an increase in the variable over time.
[a]Significant for Fire Department #1 only.
[b]Significant for Fire Department #2 only.

results are shown first in Table 1, followed by the factor-analytic SOOS subscale and extraorganizational factors. Of the 19 variables measured, significant changes over time were noted for only 5 out of 19 occupational and extraorganizational factors. Job skill concerns and concerns regarding reductions in force and benefits were significantly lower at the two-year follow-up assessment (Time 2) compared to baseline scores, but only among the firefighter sample in Department #2. Financial concerns increased significantly over the two-year measurement period and perceived social support both at work and at home decreased significantly over time. However, the reported increase in financial concerns and the decline in perceptions of social support at work were significant only among participants in Department #1. Thus, only perceptions of an extraorganizational decline in at-home social support were documented for both participating department samples.

Posttrauma Caseness, Stress Symptoms, and Alcohol Measures: Stability Versus Change Over Time and Fire Department Differences

Table 2 shows the means, standard deviations, change scores, *t*-values and associated *p*-value significances reported by firefighters two years apart on

Table 2. Means, Standard Deviations, and Tests of Significance Showing Change/Stability Over Time for the Trauma, Stress Symptomatology, and Alcohol Consumption Variables

Health variables	Baseline M/P	Baseline S.D.	2-year follow-up M/P	2-year follow-up S.D.	Change scores	t/χ^2
Trauma Indicator						
PTSD caseness	26.5%	—	22.2%	—	—	1.13
Symptoms of stress						
Perceived overall stress	.70	.49	.81	.54	−.11	−3.54*
Peripheral manif./stress	.53	.60	.64	.62	−.11	−2.38*[a]
Cardiopul. manif./stress	.59	.51	.69	.58	−.10	−2.83*[a]
Neurologic. manif./stress	.19	.36	.25	.39	−.06	−2.29*
Gastrointest. manif./stress	.65	.64	.76	.62	−.11	−2.71*[a]
Muscle tension	.99	.84	1.13	.87	−.15	−2.38*[a]
Habit patterns	1.04	.70	1.14	.72	−.10	−2.85*
Depression	.71	.68	.75	.76	−.05	−1.01
Anxiety	.49	.45	.56	.47	−.07	−2.41*[a]
Emotional irritability	.85	.74	.99	.83	−.15	−2.74*[b]
Cognitive disorganization	.62	.58	.66	.63	−.04	−1.15
Alcohol consumption measures						
Drinks per week	5.84	7.27	5.85	7.94	−.01	−.02
"Caseness" for alcoholism	36.2%	—	29.70%	—	—	1.86
Self-reported drink. problem	10.3%	—	8.10%	—	—	.65

Note: $^*p < .05$. A negative change score implies an increase in the variable over time.
[a]Significant for Fire Department #1 only.
[b]Significant for Fire Department #2 only.

measures of stress symptomatology, PTSD caseness, and alcohol use/abuse. Posttrauma caseness criterion data are followed by the total SOS score and SOS subscore data, and finally alcohol consumption outcome measures are shown. Of the 15 measured health outcomes, statistically significant increases were noted for 11. There was no significant change in the proportion of study participants reaching PTSD "caseness" based on IES scores over time. However, of the stress symptoms measured, only depression and cognitive disorganization SOS subscale scores remained statistically unchanged. All of the other stress symptom subscale scores and the SOS total score increased significantly over the two-year measurement period. As Table 2 indicates, most of the significant SOS changes were due to changes reported only by participants from Department #1 (except for the emotional irritability subscale, which increased only in Department #2 participants). Only habit patterns and neurologic SOS symptoms increased across departments. Both self-reported drinking problems and caseness for alcoholism criteria decreased over time; however, decreases did not reach statistical significance.

Associations Among Demographics, Occupational Stressors, Trauma, Health Outcomes and Alcohol Consumption at Baseline

Table 3 shows the results of Pearson product moment correlations generated for the sample of 188 firefighters at baseline. Demographic variables overall showed weak ($r = .22$) though often statistically significant relationships with outcome variables. As would be expected, age and years in the department were highly correlated ($r = .74$; $p < .05$). Job stressors were strongly correlated with both PTSD caseness and measured stress response indicators (r ranged from .53 to .68; $p < .05$). Similarly, all three drinking measures are intercorrelated (r's = .34 to .56; $p < .05$); however, the occupational, posttrauma, stress symptom, and alcohol use measures showed weak to modest correlations ($r = .06$ to .68, $p < .05$).

Associations Among Demographic, Occupational Stressors, Trauma, Health Outcomes and Alcohol Consumption at Baseline and at Two Year Follow-up

As shown in Table 4, job stressors, posttrauma caseness, and stress response symptoms at Time 1 significantly predicted participants' scores on these same measures (i.e., test-retest reliability) at Time 2 (two-year follow-up) and were generally the most strongly associated of all variables across time. Job stressors, the number of drinks per week, self-reported drinking problems, and

Table 3. Pearson Product Moment Correlations Among Demographics, Occupational Stressors, Trauma, Symptoms of Stress, and Alcohol Use for Professional Firefighters at Baseline

Variables	1	2	3	4	5	6	7	8	9	10
1. Age		.18*	.35*	.74*	.11	.18*	.09	.20*	.19*	.18*
2. Marital status			.08	.15*	−.02	−.03	−.04	−.22*	.08	−.19*
3. Supervisory rank				.35*	.16*	.15*	.18*	.16*	.11	.15*
4. Years in the department					.15*	.11	.14	.05	.09	.17*
5. Job stressors						.53*	.68*	.23*	.18*	.12
6. Trauma caseness							.58*	.06	.21*	.18*
7. Symptoms of stress								.17*	.09	.19*
8. Reported # of drinks per week									.35*	.34*
9. Self-reported drinking problem										.56*
10. Alcohol "caseness"										

Note: $*p < .05$. Data shown were provided by 188 participants who provided data at both baseline and two years postbaseline.

Table 4. Pearson Product Moment Correlations Among Occupational Stressors, Trauma, Symptoms of Stress, and Alcohol use for Professional Firefighters by Time Comparisons

Baseline ↓ / 2-year follow-up → Variables	1	2	3	4	5	6
1. Job stressors	.63*	.41*	.45*	.17*	.28*	.19*
2. Trauma caseness	.44*	.46*	.38*	−.004	.17*	.13
3. Symptoms of stress	.56*	.45*	.74*	.12	.15	.15
4. Reported # of drinks per week	.15*	.24*	.18*	.70*	.48*	.31*
5. Self-reported drinking problem	.10	.32*	.04	.25*	.35*	.26*
6. Alcohol "caseness"	.11	.24*	.13	.26*	.29*	.46*

Note: $*p < .05$. Data shown were provided by 188 respondents who provided data at baseline and at two-year follow-up. Shaded region shows test-retest correlations.

alcohol caseness at Time 1 significantly predicted these same associations at Time 2 paralleling those found at Time 1. However, Time 1 reported number of drinks per week was more strongly associated with problem drinking and alcohol caseness at Time 2 than with these same measures at Time 1.

DISCUSSION

This study extended the only prior investigation of occupational stressors, posttrauma, other stress symptoms, and alcohol consumption among urban firefighters (Boxer & Wild, 1993). The findings of the current longitudinal study showed statistically significant changes in 5 of 19 (26%) occupational stressors measured. Statistically significant positive changes (decreases in perceived work stressors over time) were noted in terms of fewer job skill concerns and fewer concerns about reduction in force and benefits. Negative changes (increases in the appraisal of each stressor) were noted for 14 of 19 (74%) of the job stressors examined, with 3 reaching statistical significance, namely financial concerns and less social support both at work and at home. However, none of these changes were of a magnitude (±.5 S.D.) considered to be clinically significant. Nonetheless, the findings reported here support previous reports suggesting that firefighting is a very stressful occupation with numerous sources of occupational stress (Beaton & Murphy, 1993, 1995; Boxer & Wild, 1993; IAFF, 1995; Karasek *et al.*, 1988; Leigh, 1988; Monk, 1990; Corneil, Beaton, Murphy, Johnson, & Pike, 1999). Occupational stressors and stress reactions were asso-

ciated in this investigation, a finding that differed from that reported by Boxer and Wild (1993).

It is not clear whether the statistically significant changes noted in Table 1 represented random fluctuations or some actual changes in measured variables. The fact that more than 5% of the variables (nearly 25%) were significantly different at baseline and the two-year follow-up would argue against random perturbations. Another argument against mere random variability was the observation that for some of the variables changes occurred in only one department. While most of the changes on the SOOS measure were in the direction of increasing distress over the two-year time period, two of the five changes were in the direction of *less* distress, arguing against some progressive and consistent test taking bias such as negative affectivity.

It is difficult to explain the rather dramatic decline in perceived social support at home between the baseline and two-year follow-up assessments. While it is worth noting that perceptions of at-work social support also declined during this same time frame, they did so for only the department involved in labor-management strife. Thus, it is possible that the decline in perceptions of social support at home reflected a spillover effect from perceived job dissatisfaction and increased sources of stress. It is possible that a perceived decrease in social support at home is "safer" than a decrease in social support at work given the life-and-death responsibility and heavy reliance upon teamwork. Thus, displacement of conflict at work may be shifted onto significant others who respond by being less supportive (Beaton *et al.*, 1997; Eckenrode & Gore, 1990).

PTSD/trauma caseness did not change significantly in the participants between Time 1 and Time 2. However, several symptoms of stress increased and reported problems with alcohol decreased. Statistically significant increases were noted on 11 of 15 (79%) of the outcome variables measured. This finding demonstrates the potential midrange negative effects of firefighter occupational stressors on health and well-being, but the statistically significant changes between Time 1 and Time 2 were modest and may not be clinically significant for the entire sample. However, a clinically significant finding is that 20% of the firefighter sample met DSM-IV criteria for PTSD at both Time 1 and Time 2 (APA, 1994). The incidence of stress-related disorders was not only high at baseline; it was higher on many SOS scales than community norms and did not decline over the two-year surveillance period (see Beaton *et al.*, 1993, 1995). Although the prevalence of alcohol caseness declined significantly from baseline to the two-year measurement assessment, it was still nearly 30% at follow-up and approximately the same rate reported by Boxer and Wild (1993). The elevated levels of stress symptoms and possible alcohol problems could affect length of employment, health status following retirement, and, ultimately, health care costs of urban fire service personnel.

Study participants identified stressors in all three realms of occupational strain measured: the job per se, the organization of work, and extraorganizational factors. Evidence for spillover was reflected by reports of significant decreases in perceived social support at home over the two-year monitoring period. Significant correlations were identified in the firefighter study participants among work stressors, symptoms of stress, and alcohol problems.

The differences between the two urban fire departments that comprise the sample were not anticipated nor predicted. The decreases in job skill concerns may have reflected increased access to training opportunities available in a larger department (Department #2). The smaller of the two departments (Department #1) was involved in a protracted union-management renegotiation of their contract with the administration for most of the time between the baseline and two-year follow-up, which may help to explain the significant increases observed in stress symptomatology in participants in Department #1 but not Department #2, with only a few exceptions.

Some rival hypotheses for the present findings are the study design, that is, the conduct of research in naturalistic settings, and various measurement issues. The two samples from the participating urban fire departments differed by locale, department size, and types of services provided. The larger urban department (#2) of the two might have posed unique work requirements, that is, more emergency runs, more violence, and perhaps more personal safety concerns. Heightened organizational strain, protracted contract negotiations, and a spate of contested grievances may have contributed to increases in stress symptomatology by firefighters in Department #1. Thus, the generalizability of our findings is limited. Reasons for drinking were not measured in this study, which may have been an important omission. Some previously conducted studies have noted that job stressors alone are not related to alcohol abuse. Rather, "escapist" reasons for drinking may mediate the relationship between job stress and alcohol consumption (Cooper *et al.*, 1990; Greenberg & Grunberg, 1995).

A strength of this investigation was the longitudinal design. Data were collected exactly two years apart, controlling for seasonal variations. However, the study sample of 188 firefighters is relatively small and comprised fewer than 50% of the potential sample of all personnel in both participating departments. Therefore, the findings may not be representative of urban firefighters' experiences in the northwest United States or even these two departments. All the measures used in this investigation were part of a larger ongoing study and were obtained by valid self-report and reliable measures. Timing of the data collection might also account for the results obtained. Baseline and two years later were selected for the current report. However, data were collected three times between baseline and two years, which may have contributed to familiarity with questionnaire items and may have resulted in some individuals reacting differently to the items (e.g., test-taking reactivity). Finally, measuring

change over time presents a host of other methodological problems, such as historical changes and regression toward the mean. Paired *t*-tests may not be the most sensitive analytic strategy, and finally one must be careful to differentiate between statistically and clinically significant change.

Implications for Occupational Health Clinicians

There are important clinical implications of the findings. Consistent with recommendations made by the IAFF and fire service management, prevention and remedial intervention strategies for stress-related disorders require that both individuals and organizational policy be assessed (IAFF, 1997). Our findings and those of others (Boxer & Wild, 1993; Corneil, 1995; Mitchell & Bray, 1990) suggest that internal fire department communication can be further improved. First-line officers, second-line officers, and battalion fire chiefs and others might benefit from leadership and management skills training. Certain individual firefighters may benefit from assessment and treatment for depression, anxiety, and/or hypertension, backaches, and headaches—all stress-related disorders. Various modalities might be helpful in both preventive and remediation efforts including relaxation and biofeedback. Referral and counseling interventions for excessive alcohol consumption may also be desirable for some individuals.

Future Research Directions

We recommend two approaches for the next generation of studies examining stress-induced drinking. First, employment in the fire service can best be viewed as a process that needs to be studied over time. Occupational "wear and tear" factors are not well understood. Future studies need to include measures of personality attributes, job characteristics, and the work environment, including work culture, in the same study sample. Second, existing theoretical models need to be tested and new ones advanced. For example, the work stress hypothesis suggests that various workplace conditions, such as boring tasks and work overload, cause distress, which is relieved by substance use; however, little empirical support has been found for this model unless reasons for drinking are included as mediators between job stress and substance use outcomes (Cooper, Russell, & Frone, 1990; Greenberg & Grunberg, 1995). New models need to be developed for gender differences in response to work stress. The social control model holds that deviant drinking is promoted by the absence of clear, unambiguous workplace policies (Roman & Trice, 1970; Bennett & Lehman, 1996). Substance use policies may be entirely lacking or ambiguous in the fire service.

Finally, the work culture perspective posits that administrative and occupational subcultures establish norms for substance use (Ames & Janes, 1992; Bennett & Lehman, 1998). These perspectives need to be included in future research endeavors with fire service personnel.

CONCLUSION

The study findings confirm the stressful nature of urban firefighting and the apparently elevated prevalences of numerous negative health outcomes including posttrauma symptomatology, other symptoms of stress, as well as a possible overreliance on alcohol. The findings were consistent with a cumulative impact of stress responses following fire service occupational stressors. Most of the measures of sources and symptoms of occupational stress were quite elevated and relatively stable between the baseline and two-year follow-up assessment. No statistically significant decreases in distress on any of the employed stress-related health outcome measures were documented. These results were confirmed by the second set of correlational analyses showing that job stressors, posttrauma caseness, and stress response symptoms at Time 1 significantly correlated with these same measures among study participants at Time 2. Similarly, the number of drinks per week, self-reported drinking problems, and alcohol caseness at Time 1 were significantly associated with these same indices at Time 2, two years later. These longitudinal correlations suggest these stress-related health symptoms are enduring, chronic problems for urban fire service personnel. The results have implications for preventive and remedial interventions for fire departments, firefighters as individuals, and firefighting as a high-strain occupational group.

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