

# Firefighters, Critical Incidents, and Drinking to Cope: The Adequacy of Unit-Level Performance Resources as a Source of Vulnerability and Protection

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The authors investigated the moderating role of unit-level performance resources on the distress-mediated relationship between the intensity of involvement in workplace critical incidents and problematic drinking behavior (i.e., drinking to cope). Building on recent developments in hierarchical linear modeling, the authors tested a cross-level, moderated-mediation model using data from 1,481 firefighters in 144 companies. The findings indicate that (a) there is a significant, distress-mediated association between intensity of involvement in such incidents and drinking to cope, which varies by company (i.e., unit), and (b) the adequacy of unit-level performance resources explains much of this cross-unit variance and attenuates both individual-level mediation stages (i.e., intensity of involvement in critical incidents → distress, and distress → drinking to cope). Implications regarding the role of unit resources adequacy as a vulnerability factor in stressor–strain relations are discussed.

*Keywords:* trauma, stress, problem drinking, performance resources, first responders

The comorbidity of involvement in critical incidents—events that are overwhelming, dangerous either to oneself or to significant others, and sufficiently unusual so as to potentially overwhelm the individual’s ability to cope (Monnier, Cameron, Hobfoll, & Gribble, 2002; Paton & Smith, 1996)—and drinking behavior has been demonstrated in numerous studies (see Jacobsen, Southwick, & Kosten, 2001; Stewart, Pihl, Conrod, & Dongier, 1998, for

recent reviews), with a number of studies suggesting a relatively high prevalence of comorbidity among emergency service workers, such as firefighters (Del Ben, Scotti, Chen, & Fortson, 2006; McFarlane, 1998). Indeed, in the shadow of the megaterrorist attack on New York City’s Twin Towers and the Pentagon on September 11, 2001 (i.e., 9/11), front-page news stories regarding traumatic firefighter drinking and comorbidity have become commonplace (e.g., Van Derbeken, 2005), as have reports of the aggravating effect that inadequate equipment (e.g., radios) and other performance-related resources might have on first responders’ ability not only to perform their job but—just as important—to cope with inherent work-based stressors (Jackson, Baker, Ridgely, Bartis, & Linn, 2004; New York City Fire Department, 2002). Beyond recognizing that resource-inadequate task environments may tax regulation capacity (i.e., limit one’s capacity for task completion), thus potentially making work more stressful (Akerboom & Maes, 2006, p. 23; Frese & Zapf, 1994), researchers have begun to suggest that such contextual (i.e., unit-level) conditions may also limit the sense of self-efficacy and control that employees feel they have in coping with high-demand situations, thus potentially exacerbating the effects of other work-related stressors on individual well-being (Jex & Bliese, 1999). Nevertheless, few studies have examined the cross-level (Klein, Dansereau, & Hall, 1994) moderating effect that such factors might have on individual-level stressor–strain relations, no less the relationship between the intensity of involvement in work-based critical incidents and employee drinking behavior.

This is unfortunate for a number of reasons. First, from an organizational and public policy perspective, given that the misuse of alcohol has the potential to impair cognitive and behavioral

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performance and thus pose workplace productivity problems and safety risks (Frone, 2006), the identification and amelioration of work-related factors that potentially moderate the incident-related onset and/or exacerbation of employee drinking problems may ultimately enhance operational efficiency and effectiveness (Bacharach, Bamberger, & Sonnenstuhl, 2002). This may be particularly relevant for first-responder organizations, such as fire departments, not only because of the potentially high cost of human error in such jobs but also because of the high prevalence of problem drinking among first-responder workforces (i.e., 30% among firefighters, or approximately double that of the population as a whole; Murphy, Beaton, Pike, & Johnson, 1999). Second, from an employee health and well-being perspective, a focus on strictly individual-level factors moderating the link between stressors and drinking is liable to result in conclusions that have the largely individual-level implications (e.g., training in stress coping) that workers, managers, and policy makers often find impractical and/or of limited utility (Bliese & Jex, 2002). In contrast, insights into the organizational factors that potentially moderate the link between critical incident involvement and psychopathology might facilitate the adoption of organizational policies and practices that are likely to have a broader and more robust impact on the mental health risks faced by first responders. Finally, from a research perspective, the failure to take into account group-level and/or organizational-level variables that have the potential to directly influence individual strain or moderate individual-level stressor-strain relationships increases the risk that investigators will commit either the “psychologicistic fallacy” (i.e., assuming that individual-level outcomes can be explained exclusively in terms of individual-level characteristics or perceptions) or the “atomistic fallacy” (i.e., assuming that individual-level results imply the nature of relationships among similar variables at higher levels of analysis; Diez-Roux, 1998).

In this context, using first responders as an empirical referent, we sought to examine the extent to which a particular task environment factor, namely the quality and availability of performance-related resources at the unit level (what we refer to as *unit-level resources adequacy*) might moderate the link between the intensity of involvement in work-related critical incidents (herein referred to as *intensity*) and drinking to cope (herein referred to as *drinking*)—an important form of alcohol misuse and precursor of alcohol abuse and dependence (Carpenter & Husin, 1999; Todd et al., 2005). In particular, given that the link between intensity and drinking has been demonstrated to be at least partially mediated by postincident distress (see Stewart et al., 1998, for a review), we sought to shed light on just how resources adequacy might moderate the intensity–drinking relationship—that is, by moderating the link between intensity and distress, the link between distress and drinking, or possibly both stages of the distress-mediated intensity–drinking relationship. We opted to focus on unit-level resources adequacy as a moderator of the intensity–drinking relationship in the context of (a) the cognitive appraisal notion (Karasek & Theorell, 1990; Lazarus & Folkman, 1984) that individual-level stressor–strain relations are likely to be attenuated to the extent that the broader task environment provides employees with greater control over their work process and (b) recent research suggesting the need to broaden this notion of control to incorporate a wide range of resources used by employees to manage the uncertainties inherent in their work (Demerouti,

Bakker, Nachreiner, & Schaufeli, 2001; Schaufeli & Bakker, 2004, p. 296).

### Exposure, Distress, and Comorbidity Among Emergency Service Workers

Traumatic distress may arise when an individual is confronted with threatened death or serious injury and when, as a result, the individual experiences intense fear, horror, or helplessness (American Psychiatric Association, 1994). Traumatic distress severity depends on the degree to which such traumatization results in the emergence of a cluster of characteristic psychophysiological symptoms, including intrusive recollections of the event (e.g., nightmares) and increased arousal (e.g., exaggerated startle response; American Psychiatric Association, 1994; Flannery, 1999). To date, a number of studies have examined the prevalence of risky drinking behavior among individuals employed in those occupations characterized by routine and regular exposure to critical incidents. These studies typically have reported rates of traumatic distress of between 10% and 20% of those workers exposed to a particular critical incident (Del Ben, Scotti, Chen, & Fortson, 2006; Hodgins, Creamer, & Bell, 2001), with a substantial portion of those experiencing distress also reporting the emergence or exacerbation of risky drinking behavior (e.g., McFarlane, 1998; Sims & Sims, 1998). Moreover, such studies have suggested that the cumulative impact of multiple events in a given period of time may be more critical to the development of distress than exposure to any single event (Bamberger, 2005; Del Ben et al., 2006).

Researchers have offered a number of physiological and cognitive explanations for the apparent link between incident exposure and problematic drinking behaviors. For example, from a physiological perspective, Volpicelli, Balaraman, Hahn, Wallace, and Bux (1999) suggested that the link between exposure and drinking may be endorphin related. Their findings suggest that individuals who experience a traumatic event often experience a biochemical response of an endorphin release, which helps to numb the physical and emotional pain of the trauma. However, as the numbing effects of the endorphin release subside over time, individuals may experience a withdrawal, with some turning to alcohol as a means by which to cope (i.e., replace the endorphin-based numbing effect).

Survivors' need to self-medicate is also a key element in more cognitive explanations of the exposure–drinking relationship (Jacobsen et al., 2001). According to cognitive or information-processing models (Brewin & Holmes, 2003), until a critical incident “can be assimilated and integrated into existing schematic representations (regarding one’s safety and invulnerability), it is stored in active memory, and the psychological elements of the event may continue to produce intrusive and emotionally upsetting recollections” (Creamer, Burgess, & Pattison, 1992, p. 452) as well as a variety of other distress symptoms, such as increased arousal (e.g., overreaction to situations, agitation; American Psychiatric Association, 1994). For example, individuals experiencing postincident intrusive reactions often report difficulty winding down and sleep-related problems as well as problems with concentration (Nishith, Resick, & Mueser, 2001). As noted above, a number of researchers have claimed that because some individuals may seek to “medicate” such postexposure distress, they are at increased risk

of abusing alcohol or becoming alcohol dependent (Stewart et al., 1998).

Evidence supporting such a mediating role of psychological distress in the trauma–problem drinking relationship stems from a number of sources, including the National Comorbidity Survey (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995), which found the occurrence of such symptoms more likely to precede than to follow the development of drinking problems; a study of combat survivors by Bremner, Southwick, Darnell, and Charney (1996), which found substance abuse problems to develop subsequent to the emergence of incident-related distress symptomatology; and Stewart, Conrod, Pihl, and Dongier's (1999) community-based research, which found arousal-related distress symptoms (e.g., inability to relax) to play a particularly instrumental role in mediating the trauma–drinking relationship. Although none of these studies focused on employees experiencing a critical incident in the context of their work role per se, the framing of alcohol as a means by which to cope with critical incident–related distress is consistent with conventional models of work-related risk factors and employee problem drinking, many of which posit that some negative affect or emotional state, such as stress, mediates the relationship between a given workplace stressor and problematic drinking behaviors (Bacharach et al., 2002; Frone, 1999). Consequently, we posit the following:

*Hypothesis 1:* The severity of distress symptomatology will mediate the positive relationship between the intensity of recent involvement in workplace critical incidents and current drinking to cope.

#### *Context-Based Variation in Distress-Related Processes*

However, as Frone (1999, p. 286) noted, empirical support for direct-effect and even mediated models of occupational stress and employee drinking is mixed, since certain stressors may be less salient for some workers than others and since, even when the stressor is salient and results in distress, workers may not necessarily view drinking as a useful means by which to cope. That is, while some adults may, indeed, turn to alcohol as a means by which to cope with the distress generated by workplace stressors, most tend to rely on other coping behaviors (e.g., talking to friends or relatives, exercising, or addressing the problem source), viewing these other mechanisms as offering similar, if not greater, relief with fewer negative side effects. Thus, Frone (1999) suggested that while the predictive validity of mediated stress–drinking models is superior to that of simple direct-effect models, moderated-mediation models, which take both vulnerability and protective factors into account, are likely to offer the greatest degree of predictive validity. Such models go beyond explaining how stressors such as critical incidents are associated with alcohol use by also specifying the conditions under which such stressors are more (i.e., vulnerability factors) or less (i.e., protective factors) likely to have such effects.

Similarly, implicit in both physiological and psychological models of trauma is the recognition that not all individuals are likely to be similarly affected by a common critical incident experience and that individual-level genetic (Villareal & King, 2004), personality (Stewart et al., 1998), and experiential (e.g., Brewin, Andrews, & Valentine, 2000) factors may serve as pro-

TECTIVE or vulnerability factors, moderating posttraumatic distress processes. Thus, for example, empirical studies testing such moderated-mediation models have focused on the role of individual-level vulnerability factors, such as positive alcohol expectancies (Cooper, Russell, & Frone, 1990), tension-reduction expectancies (Frone, Russell, & Cooper, 1993), and avoidance-coping tendencies (Grunberg, Moore, Anderson-Connolly, & Greenberg, 1999).

Although such conditions are far less studied than individual-differences moderators of posttraumatic distress processes, several researchers have suggested that contextual conditions may also moderate posttraumatic distress processes (Brewin et al., 2000; Emsley, Seedat, & Stein, 2003). Indeed, the notion that the broader social context should be considered as a possible moderator of occupational stress processes is gaining increasing recognition in the organizational health psychology literature, with a number of researchers suggesting that the failure to consider contextual factors in stress-related models may increase the risk of biased standard error estimates and statistical inferences. As Bliese and Jex (2002, p. 267) noted, absent the consideration of contextual influences, such biasing is likely, since stress data are typically collected from individuals nested within groups and since individuals' strain- and stress-related perceptions may be at least partially a function of the group to which these individuals belong. That is, the social context, by shaping or characterizing social interaction, may play a significant role both in influencing the degree to which a particular type of incident is interpreted as traumatic (Festinger, 1954) and in affecting "how individuals respond to stressors" (Bliese & Jex, 2002, p. 267). Consistent with such a notion, empirical findings suggest that the individual-level relationship between a given stressor and psychological strain may not be consistent across social units. For example, military studies have demonstrated that unit cohesion (Shils & Janowitz, 1948) and other protective contextual factors, such as collective efficacy, leadership climate, and consensus about leadership (Bliese & Britt, 2001; Jex & Bliese, 1999), may also attenuate the link between work stressors and individual strain. Generalizing from such findings to the relationship between work-based intensity and drinking, we therefore propose the following:

*Hypothesis 2:* The association between the intensity of recent involvement in workplace critical incidents and current drinking to cope will vary significantly across work units.

#### *Explaining the Cross-Unit Variance in Distress Processes: Unit-Level Resource Adequacy*

If the association between intensity and drinking does indeed vary across work units, what might be a salient dimension along which these work units vary that might explain these differential incident-related effects? Drawing from both (a) cognitive and appraisal-based (Karasek & Theorell, 1990; Lazarus & Folkman, 1984) and (b) resource-based (Hobfoll, 2002) models of stress, we propose that the adequacy of performance resources—the apparatus, tools, support services, information, and infrastructure that are directly brought to bear by job incumbents as they seek to carry out their specified tasks and/or meet task objectives (Bacharach & Bamberger, 1995)—may serve as one factor in incumbents' task environment moderating the individual-level, distress-mediated

association between intensity and DTS in the context of a cross-level process (Klein et al., 1994) and therefore play an important role in explaining these differential effects. After describing what we mean by *unit-level resources adequacy*, we explain how this construct may exert cross-level moderating effects on the intensity–distress and distress–drinking stages of the distress-mediated, individual-level relationship between intensity and drinking.

As noted by Bacharach and Bamberger (1995), the adequacy of performance resources varies as a function of both availability (i.e., how quickly and easily a worker can mobilize enough of the given resource necessary for successful task completion) and quality (i.e., the degree to which the resource consistently and reliability meets standards, fits the use to which it is supposed to be applied, and is readily understandable to those who are expected to use it). While the adequacy of performance resources may vary from one job to the next (and even between two individuals performing the same job), the adequacy of certain performance resources used in common by all members of a given work unit (e.g., computing resources from a common computer network or assistance from the information technology help desk) may be viewed as varying at the unit level rather than at the position or individual level. As such, particularly in those work contexts, such as firefighting, in which nearly all unit members share a common set of performance resources (apparatus, radios, etc.), the adequacy of performance resources at the unit level, rather than at the position or individual level, is likely to play a role in explaining the cross-unit variation in the association between individual intensity and drinking.

### Cross-Level Effects on the Intensity–Distress Relationship

From a cognitive perspective (Karasek & Theorell, 1990; Lazarus & Folkman, 1984), unit-level resource adequacy may, as shown in Figure 1, moderate individual responses to intensity in that resources often play a central role in determining the degree to which employees are able to exert control over their work environment in general and over their job tasks in particular (Bacharach & Bamberger, 1995). Indeed, as noted by Demerouti et al. (2001), “when the external environment lacks resources, individ-

uals cannot cope with the negative influences of environmental demands (like high workload), and they cannot obtain their goals” (p. 501). Particularly among individuals who are consistently facing high-demand situations characteristic of critical incidents, the ability to access needed resources in a timely manner should provide unit members with an enhanced sense of individual and collective self-efficacy, not to mention a heightened sense of mastery over one’s job, general work environment, and the risks inherent in both (Gist & Mitchell, 1992). In addition, consistent with the job demands and control theory (Karasek & Theorell, 1990), research suggests that such positive control-related self-perceptions often attenuate the generally detrimental impact of occupational stressors on well-being (Jex & Bliese, 1999, p. 349). Moreover, consistent with the cognitive-processing model (Brewin & Holmes, 2003), an enhanced sense of mastery is likely to facilitate the assimilation and integration of critical incidents into existing cognitive schemas (particularly those regarding one’s safety and invulnerability), thus reducing the severity and duration of arousal-type distress symptoms (Creamer et al., 1992). Finally, any resource-based constraint on employees’ ability to effectively perform their job and/or reduce the risks inherent in the performance of job-related task may demand that employees compensate by maintaining a heightened state of arousal and hypervigilance on the job, thus serving as an additional source of distress-related symptomology (Jex & Bliese, 1999).

Alternatively, a cross-level moderating effect of inadequate unit-level performance resources on the individual intensity–distress relationship may also be posited on the basis of resource ecology theory (Hobfoll, 1989). Focusing on personal (as opposed to unit or organizational) resources and defining personal resources as “those entities that either are centrally valued in their own right (e.g., self-esteem, close attachments) or act as a means to obtain centrally valued ends (e.g., time, energy)” (Hobfoll, 2002, p. 307), conservation of resources theory suggests that the linkage between individual-level intensity and distress is likely to vary according to the degree to which the intensity of each critical incident places a draw on personal resources (Hobfoll, 1988, 1989). Moreover, a key corollary of conservation of resources theory is that those with fewer personal resource stocks are highly

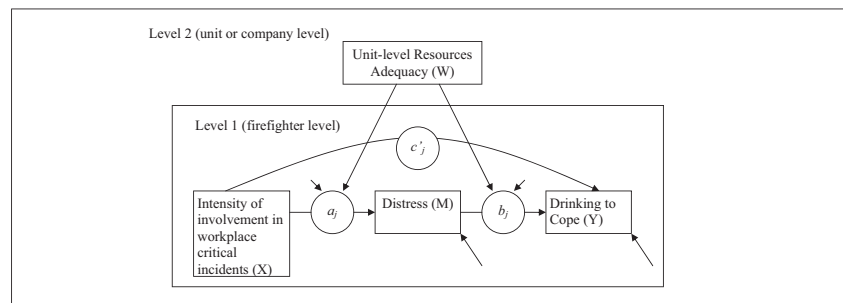


Figure 1. Moderated lower-level mediation model of intensity of involvement in workplace critical incidents ( $X$ ) on drinking to cope ( $Y$ ). The two frames indicate the two levels of sampling: Level 1, the firefighter level, and Level 2, the unit level. The arrows with circles represent random effects, and arrows without circles represent fixed effects. Arrows not originating from variables indicate residuals. The arrows from  $W$  to circles represent the moderation of the causal effects tested in our model at the third stage.  $a_j$  and  $c'_j$  are the regression slopes of  $M$  and  $Y$  on the individual-level covariate  $X$  for group  $j$ , and  $b_j$  is the regression slope of  $Y$  on  $M$  for group  $j$ .

vulnerable to resource loss, with initial losses not only placing them at increased risk of further losses but also resulting in increasingly less efficient patterns of resource utilization, increasingly rapid rates of resource depletion (i.e., loss spirals), and, ultimately, personal resource impoverishment and psychological distress (Hobfoll, 2002; Holahan, Moos, Holahan, & Cronkite, 1999). Because employees tend to compensate for unit-level resource inadequacies by investing more of their own personal resources, such as time and energy, to meet performance requirements (Bacharach & Bamberger, 1995, p. 90), sustained resource inadequacy at the unit level has the potential to generate personal resource depletion processes and, ultimately, the development of distress symptoms (Monnier et al., 2002).

While, to date, research regarding the impact of performance resource adequacy on the link between stressors and distress has been limited (Westman, Hobfoll, Chen, Davidson, & Laski, 2005), a number of studies have provided indirect support for such a proposition. For example, Freedy, Hobfoll, and Ribbe (1994) found that nurses involved in an intervention program aimed at enhancing resources reported significant reductions in psychological distress relative to those in a control group. Similarly, Westman et al. (2005, p. 210) reported that 2 months after the introduction of a new organizational information system, individuals who participated in a 4-hr training session (emphasizing, e.g., how the system operated and its advantages to the user) prior to the introduction of the new system experienced no increase in burnout and no decline in job satisfaction, whereas those in the control group experienced a "remarkable" increase in burnout and decline in satisfaction. In this sense, consistent with the cross-level effects suggested on the basis of cognitive theories, these findings suggest that when higher quality performance resources (e.g., apparatus, communication and safety equipment, training) are more readily available to workers, employees exposed to critical incidents may be better positioned to use their own personal resources more efficiently and therefore experience some degree of protection from the detrimental mental health consequences of incident exposure, while those employed in units characterized by less adequate performance resources may be more vulnerable to postincident distress. Consequently, we posit the following:

*Hypothesis 3:* The generally positive, individual-level association between intensity and distress will be attenuated as a function of unit-level resource adequacy.

#### *Cross-Level Effects on the Distress–Drinking Relationship*

Similarly, unit-level resource adequacy may have a cross-level moderation effect on the individual-level relationship between postincident distress and drinking (see Figure 1). From a cognitive perspective, to the extent that unit-level resource adequacy enhances members' sense of self-efficacy (Gist & Mitchell, 1992) as well as their perceptions of the expected utility of engaging in activities aimed at reducing distress-related risks in the future, members of such units may be more likely to adopt problem-based distress-coping strategies (e.g., reviewing critical incident operating procedures to reduce distress risks) as an alternative to avoidance-based distress coping (e.g., drinking). In contrast, because members of more resource-inadequate units may tend to assume that almost any solution will have limited practical feasi-

bility, they may be quicker to dismiss such problem-focused coping strategies, opting for avoidance-based alternatives, such as drinking, instead. Furthermore, research on help seeking suggests that an enhanced sense of self-efficacy facilitates help seeking (Nadler, Maler, & Freidman, 1984), with such behavior resulting in the more timely and effective management of posttraumatic distress and the avoidance or early amelioration of any secondary psychopathology, such as drinking (Sonnenstuhl, 1996). In contrast, situational constraints on performance (such as those imposed by unit-level resource inadequacy) can contribute to a general sense of learned helplessness (Mikulincer & Nizan, 1988), a potentially important impediment to timely and effective help seeking (Nadler et al., 1984). Thus, to the extent that they may be better positioned to resolve distress-related problems at an earlier stage than individuals in units characterized by inadequate performance resources, it is likely that among those employed in units characterized by more adequate unit-level performance resources, the association between distress symptomology and drinking will be more attenuated.

Alternatively, assuming that, as noted above, employees are often forced to draw more heavily on their own personal resources in order to compensate for unit-level resource inadequacies, a similar prediction may also be made on the basis of conservation of resources theory. This need to consistently draw from one's personal resources in the face of unit-level resource inadequacy may be problematic not only in that it can lead to psychological distress but also in that as individuals deplete personal resources, they may become increasingly hesitant to cope with such distress on the basis of more "costly" problem-focused strategies, opting instead for coping strategies viewed as, at least in the short run, resource conserving—such as those involving physical or psychological withdrawal, such as drinking (Lee & Ashforth, 1996; Wright & Cropanzano, 1998). To the extent that individuals employed in work units that have more adequate unit-level resources are likely to deplete personal resources at a slower rate than those employed in less resource-munificent units, we expect individuals in such resource-munificent units to be more likely to adopt those modes of coping (e.g., problem focused) that, while more costly (in terms of such personal resources as time and energy) in the short term, tend to be more effective and less detrimental to well-being in the long run than those focused on avoidance or withdrawal (e.g., drinking).

Thus, drawing from both cognitive and resource ecology perspectives, we posit the following:

*Hypothesis 4:* The generally positive individual-level association between distress and current drinking will be attenuated as a function of unit-level performance resource adequacy.

## Method

### *Sample*

In order to test our hypotheses, we analyzed data collected from a sample of New York City firefighters. These data were collected in early 2003 on the basis of a self-report questionnaire distributed to all members of a stratified random sample of 144 (out of a total of 346) engine and ladder companies. Using the New York City Fire Department's three-category system to differentiate between

more and less active firehouses, we randomly sampled an equal number of the firehouses from each of these three categories (i.e., 48 each from the highly active, moderately active, and relatively inactive categories) for inclusion in the study.

Surveys were distributed by union shop stewards and returned by respondents directly to us by prepaid mail. Of the 2,502 questionnaires distributed, 1,653 were returned (response rate of 66%). All respondents were informed that the general purpose of the survey was to examine the link between workplace conditions and employee well-being and that questionnaires were to be completed anonymously in order to guarantee confidentiality.

We included in our analysis only those firefighters ( $n = 1,600$ ) who specified the company to which they belonged. Given the limited number of women in our sample ( $n = 10$ ), we included only individuals who responded to the gender question ( $n = 1,590$ ) and indicated that they were male ( $n = 1,580$ ). Additionally, following both Rulke and Galaskiewicz (2000) and Bunderson (2003) and in order to ensure the reliability of the unit-level assessed independent variables, we only included firefighters from the 101 companies with at least five respondents ( $n = 1,401$ ). Thus, in the average company included in our sample, 14 of the 20 to 25 company members responded to the survey, for a mean company-level response rate of over 60%. There were no significant differences along any of the individual-level variables of theoretical interest (i.e., intensity of exposure, incident-related distress, drinking to cope) between those individuals dropped from the sample for any of the reasons specified above and those retained. Respondents ranged in age from 21 years to over 60 years, with a mean age of 33.

### Measures

**Dependent variable.** Drinking to cope was measured with a five-item measure based on Cooper, Russell, and George (1988) and relating to current drinking behaviors. Respondents were asked to indicate how often they drank for a variety of reasons, including (a) "to forget your worries," (b) "to feel more self-confident," (c) "to relieve boredom," and (d) "to cheer you up when you're in a bad mood." Response categories ranged from 1 (*never*) to 4 (*almost always*). Cronbach's alpha was .91.

**Independent variables.** Intensity of involvement in workplace critical incidents was assessed with Monnier et al.'s (2002) Critical Incident Inventory (CII), a measure specifically developed to assess incident exposure among firefighters and emergency service personnel. The CII asks respondents to indicate the number of incidents they were exposed to that had particular characteristics in a recent period (in the current case, 4 months, to capture the seasonal variation in the nature of the incidents handled). The scale includes 24 incident characteristics, such as "incident involving suicide or attempted suicide" and "incident involving 1 or 2 fatalities." With response options running from 0 (*none*) to 7 (*seven or more incidents*) and the total score for intensity of involvement generated as the sum of the total item-specific scores, the possible range for this measure runs from 0 to 168. Although, as noted by Monnier et al. (2002, p. 17), the validity of incident lists is determined by their comprehensiveness rather than by their internal reliability, we found the CII to have an acceptable level of internal reliability ( $\alpha = .73$ ).

Distress was measured on the basis of the seven-item Stress subscale of the Depression, Anxiety and Stress Scale (DASS-21; Antony, Bieling, Cox, Enns, & Swinson, 1998). Like the longer version of the DASS on which it is based, the DASS-21 has been found to effectively distinguish between features of depression, psychological tension and agitation, and psychophysiological arousal and to have excellent internal consistency, temporal stability, and concurrent validity (Antony et al., 1998). We operationalized distress on the basis of the stress dimension items of this scale because these items most closely tap the psychophysiological, arousal-related distress symptoms noted earlier and identified by Stewart et al. (1998) to serve as the primary mediators of the trauma–drinking relationship. Study participants were asked the degree to which each of seven statements (e.g., "I found it difficult to relax," "I felt that I was rather touchy," "I tended to over-react to situations") applied to them over the past week. The response options ranged from 0 (*did not apply to me at all*) to 3 (*applied to me most of the time*). Cronbach's alpha for this measure was .92.

**Moderating variable.** Although the level of origin for unit-level resource adequacy was the individual, our theory called for the examination of this construct as a distal characteristic of the fire company (i.e., work unit)—that is, as a unit-level (or Level 2) variable. At the individual level, resource adequacy was assessed on the basis of a five-item measure incorporating, as suggested by Bacharach and Bamberger (1995), both material and conditional resources. Specific items were generated on the basis of the analysis presented in the report of New York City Fire Department (2002) on the department's response to the attack on the World Trade Center as well as on the basis of interviews conducted with firefighters, officers, and union leaders (see Bacharach et al., 2004). These interviews focused on the identification of those resources that interviewees deemed likely to impact their efficacy on the job. More specifically, we asked interviewees to identify those resources that they felt they needed in order to carry out their job in a safe and effective manner.

The resulting measure incorporated three items relating to material resources used (a) for firehouse duties and nonemergency duties (i.e., maintenance and repair materials and equipment, such as spare parts and cleaning supplies, tools), (b) for duties in the field (e.g., hose straps, spanners, lighting, utility cords, radios), and (c) to ensure firefighter safety both in the firehouse and in the field (e.g., gloves, goggles, hearing protection, safety harnesses, respiratory protection). It also included two conditional resource items having to do with training and preparedness for (a) routine field assignments (e.g., fires and other routine emergencies) and (b) mass-casualty or terror-related incidents (including those involving toxic or radioactive materials). Consistent with the conceptual framework developed by Bacharach and Bamberger (1995), firefighters rated each of these three sets of resources on a 7-point rating scale, first in terms of availability (1 = *rarely available*, 7 = *always available*) and then in terms of quality (1 = *low*, 7 = *high*). At the individual level, reliability for both resource measures was moderate (Cronbach's  $\alpha$ s = .79 and .81 for availability and quality, respectively).

Individual-level availability and quality scores were then each aggregated to the company (unit) level on the basis of the company mean. Next, consistent with the conceptual framework developed by Bacharach and Bamberger (1995) and discussed earlier, we calculated unit-level resource adequacy as the product of unit-level

resource availability and unit-level resource quality. Although, as a global unit property (Kozlowski & Klein, 2000) of each fire company, one need not demonstrate consensus among the resource perceptions of work-unit members in order to establish the construct validity of the aggregate variable, in the case of both availability and quality, we nevertheless found a satisfactory level of agreement (mean  $r_{WGS} = .70$  and  $.69$  for availability and quality, respectively), suggesting that despite its framing as a “fuzzy composition process variable” (Bliese, 2000, p. 375), company members held relatively similar perceptions regarding the adequacy of unit-level resources. While sharedness need not necessarily be demonstrated in such variables, as Bliese (2000) noted, “because groups need to have reliably different mean values on the construct if one hopes to detect emergent relationships, estimating group-mean reliability— $ICC_2$ —is always important” (p. 375). Although  $ICC_2$ s for availability and quality (.27 in both cases) were slightly below conventional levels for all groups regardless of size, for the 92% of groups for which we had more than seven observations,  $ICC_2$  was substantially higher (.37 in both cases) and consistent with values reported in other studies (e.g., Chen, 2005; Erdogan, Liden, & Kraimer, 2006). Moreover, Bliese (personal correspondence, March 2006) noted that, particularly when influenced by small group size, “lower values may be justified if, despite relatively unreliable group means, one still detects emergent effects.”

*Control variables.* In testing the hypotheses noted above, we controlled for a variety of respondent demographic attributes, including marital status, ethnicity, and education level. Furthermore, because the correlation between intensity and drinking may be a function of critical incident experiences outside of work, we also controlled for the number of incidents respondents experienced while off duty during the previous year in which they were injured severely enough to require medical attention. Additionally, because individual experience and personality may influence firefighters’ resilience and distress-related coping, we included in our models variables tapping both factors, namely seniority (measured in terms of years employed as a firefighter) and locus of control (measured on the basis of Valecha and Ostrom’s, 1974, 11-item scale; Cronbach’s  $\alpha = .68$ ). Furthermore, given that both the cognitive and the resource-based stress perspectives recognize social support as a potentially powerful buffer of stressor–strain relations, in testing our hypotheses we controlled for the effects of perceived peer and supervisor support. Both of these variables were assessed on the basis of Caplan, Cobb, French, Harrison, and Pinneau’s (1975) 4-item Social Support Scale, completed once for peers and again for supervisors (Cronbach’s  $\alpha$ s =  $.84$  and  $.82$  for peers and supervisors, respectively).

Finally, because many of the firefighters employed by the New York City Fire Department in 2003 (when our data were collected) were involved in one way or another in the events of 9/11, we deemed it necessary to control for firefighters’ intensity of involvement in 9/11. We did so on the basis of a variation of Monnier et al.’s (2002) CII. In this case, however, we adapted the measure to reflect the varying nature of involvement in a single incident on a single day, namely the World Trade Center attacks on 9/11, similar to the approach used in the Diagnostic Interview Schedule (Robbins, Helzer, Cottler, & Goldring, 1989). Drawing from qualitative data collected on the basis of interviews with over a dozen 9/11 veteran firefighters, we adapted the 19 relevant CII

items (of the original 24) to reflect the varying modes of involvement in specifically the 9/11 incident. Respondents replied either “yes” (1) or “no” (0) as to whether each of the 19 statements accurately portrayed their experience in the 9/11 incident, with the scale score (ranging from 0 to 19) generated on the basis of the summed scores. In order for this measure to also capture whether the person was on site on that day, those who did not arrive at the site on the actual day received a score of zero on this measure. We limited our examination of intensity to the actual day of 9/11 itself, given that the nature of the event and the relative lack of survivors to be searched for or rescued in the days following the actual event were characterized by a largely invariant degree of involvement intensity.

### Analytical Procedure

Given that all respondents belonged to one of 101 different companies and that we proposed that the individual-level (i.e., Level 1) distress ( $M$ )-mediated association between intensity ( $X$ ) and drinking ( $Y$ ) would be moderated by a unit-level measure of resources adequacy ( $W$ ), we applied the “moderated lower-level mediation” approach of Bauer, Preacher, and Gil (2006) to test our hypotheses. Although it may be possible to test such a proposition using Baron and Kenny’s (1986) mediation assessment framework, Preacher and Hayes (2004, p. 719) have noted the shortcomings of such an approach. They suggest a more powerful strategy for testing mediation that requires that the following two conditions be met: (a) There will be an effect to be mediated, and (b) the indirect effect will be statistically significant in the direction predicted by the hypothesis. We followed this strategy and combined it with the “moderated multi-level mediation” approach of Bauer et al. (2006).

The first step of our analysis was therefore to show that there is a relationship between intensity ( $X$ ) and drinking ( $Y$ ). Because respondents were nested within units, we fitted a random intercept and slope model in order to allow for a different effect of the predictor ( $X$ ) on the outcome ( $Y$ ) across the units. This model can be formulated as follows:

$$Y_{ij} = d_{0j} + p_1 P_{1ij} + \dots + p_k P_{kij} + c_j X_{ij} + e_{ij}, \quad (1)$$

where  $Y_{ij}$  is the observed value of outcome  $Y$  (individual level drinking) for observation  $i$  nested within group  $j$ ,  $d_{0j}$  is the intercept for group  $j$ ,  $p_1$ – $p_k$  are the population regression slopes of the outcome  $Y$  on individual-level background covariates  $P_1$ – $P_k$ ,  $c_j$  is the regression slope of outcome  $Y$  on the individual-level covariate  $X$  for group  $j$ , and  $e_{ij}$  is a residual term.

In order to initiate mediation analysis we first had to demonstrate an average effect between intensity ( $X$ ) and drinking ( $Y$ ), or in other words, that the expected value of  $c_j$ , designated as  $c$ , is significant. Assuming that  $c$  is significant, the significance of the variance of  $c_j$ , designated as  $\sigma_{c_j}^2$ , is a necessary condition for initiating a moderated mediation analysis, since it demonstrates that the effect of the  $X$  predictor on  $Y$  differs significantly across the Level 2 units.

Next, we analyzed the indirect effect of intensity ( $X$ ) on drinking ( $Y$ ) through distress ( $M$ ; all three assessed at the individual level; see the inner frame diagram of Figure 1). At this stage, two steps were involved: (a) testing the significance of the indirect effect from  $X$  to  $Y$  through  $M$ , in order to complete the mediation

assessment, and (b) estimating the variability of the indirect effect over Level 2 units, in order to establish the need for moderation at Level 2.

Because respondents were nested in units, in assessing the statistical significance of the mean indirect effect (the first step noted above), we once again fitted a random intercept and slope model, in order to allow for different effects across the Level 2 units. Using the notation of Bauer et al. (2006), we can specify the lower level mediation model as follows:

$$M_{ij} = d_{Mj} + p_{M1} P_{1ij} + \dots + p_{Mk} P_{kij} + a_j X_{ij} + e_{Mij}. \quad (2)$$

$$Y_{ij} = d_{Yj} + p_{Y1} P_{1ij} + \dots + p_{Yk} P_{kij} + b_j M_{ij} + c'_j X_{ij} + e_{Yij}. \quad (3)$$

$M_{ij}$ ,  $Y_{ij}$ ,  $P_{1ij}$ – $P_{kij}$ , and  $X_{ij}$  are the observed values of  $M$ ,  $Y$ ,  $P_1$ – $P_k$ , and  $X$  for observation  $i$  nested within group  $j$ . The terms  $d_{Mj}$  and  $d_{Yj}$  are the intercepts for group  $j$  for  $M$  and  $Y$ , respectively.  $p_{M1}$ – $p_{Mk}$  and  $p_{Y1}$ – $p_{Yk}$  are the population regression slopes of the outcomes  $M$  and  $Y$  on individual-level background covariates  $P_1$ – $P_k$ ,  $a_j$  and  $c'_j$  are the regression slopes of  $M$  and  $Y$  on the individual-level covariate  $X$  for group  $j$ ,  $b_j$  is the regression slope of  $Y$  on  $M$  for group  $j$ , and  $e_{Mij}$  and  $e_{Yij}$  are the residuals for  $M$  and  $Y$ , respectively. Accordingly, the  $c'_j$  coefficient is the direct effect of  $X$  on  $Y$  within group  $j$ , and  $a_j b_j$  is the indirect effect of  $X$  on  $Y$  within group  $j$ . Then, defining  $E(a_j) = a$ ,  $E(b_j) = b$ , and  $Covariance(a_j, b_j) = \sigma_{a_j b_j}$ , we tested the significance of the mean indirect effect, specified by Bauer et al. (2006, p. 147) as

$$E(a_j b_j) = ab + \sigma_{a_j b_j}. \quad (4)$$

Defining  $Var(a_j) = \sigma_{a_j}^2$  and  $Var(b_j) = \sigma_{b_j}^2$ , on the basis of Bauer et al. (2006, p. 147), we assessed the variability of the indirect effect (the second step noted above), as  $Var(a_j b_j) = b^2 \sigma_{a_j}^2 + a^2 \sigma_{b_j}^2 + \sigma_{a_j}^2 \sigma_{b_j}^2 + 2ab \sigma_{a_j b_j} + \sigma_{a_j b_j}^2$ . This variance quantifies the variability of the indirect effect at the unit level. One should not confuse this variance with the variance of the estimator of  $E(a_j b_j)$ , which we used to test the significance of  $E(a_j b_j)$ . A more meaningful measure for the variability of the indirect effect is the coefficient of variation (CV), which is defined as the ratio of the standard deviation (square root of the variance) to the expected value. A high value of CV implies high variability of the indirect effect at Level 2, which may suggest that a Level 2 moderator should be considered. In addition to the CV, we also examined the variability of the direct and indirect effects components by assessing the significance of  $\sigma_{c'_j}^2$ ,  $\sigma_{a_j}^2$ , and  $\sigma_{b_j}^2$ . The two models above (for  $M$  and  $Y$ ) were estimated simultaneously with a slightly modified version of Bauer et al.'s (2006) IndTest.sas SAS macro.

Assuming a significant expected indirect effect is found and that the variances of  $a_j$  and  $b_j$  are significant, there is sufficient justification for testing the unit-level moderation effect by unit resources adequacy ( $W$ ) on the indirect effect of  $X$  on  $Y$ . To do this, following the strategy suggested by Bauer et al. (2006, p. 153), we conducted a moderated multilevel moderation analysis, examining whether and how the unit resources ( $W$ ) moderated the paths  $X \rightarrow M$  and  $M \rightarrow Y$  and the indirect effect of  $X$  on  $Y$  through  $M$  (see Figure 1). The moderated multilevel model had the same equations as above:

$$M_{ij} = d_{Mj} + p_{M1} P_{1ij} + \dots + p_{Mk} P_{kij} + a_j X_{ij} + e_{Mij}. \quad (5)$$

$$Y_{ij} = d_{Yj} + p_{Y1} P_{1ij} + \dots + p_{Yk} P_{kij} + b_j M_{ij} + c'_j X_{ij} + e_{Yij}. \quad (6)$$

However, if we assume that  $\sigma_{a_j}^2$  and  $\sigma_{b_j}^2$  are significant, we may express  $a_j$  and  $b_j$  as a linear function of  $W$ . When we followed Bauer et al.'s (2006) suggestion to include  $W$  as a predictor of the random intercept as well as the random slope in the same equation, the equations for the random coefficients were as follows:

$$d_{Mj} = \gamma_{dM0} + \gamma_{dM1} W_j + u_{dMj}. \quad (7)$$

$$a_j = \gamma_{a0} + \gamma_{a1} W_j + u_{aj}. \quad (8)$$

$$d_{Yj} = \gamma_{dY0} + \gamma_{dY1} W_j + u_{dYj}. \quad (9)$$

$$b_j = \gamma_{b0} + \gamma_{b1} W_j + u_{bj}. \quad (10)$$

$$c'_j = \gamma_{c'0} + u_{c'j}. \quad (11)$$

Substituting the random coefficients in the equations for  $Y$  and  $M$  and expanding them, we model the following:

$$M_{ij} = \gamma_{dM0} + p_{M1} P_{1ij} + \dots + p_{Mk} P_{kij} + \gamma_{a0} X_{ij} + \gamma_{dM1} W_j + \gamma_{a1} W_j \times X_{ij} + u_{dMj} + u_{aj} X_{ij} + e_{Mij}. \quad (12)$$

$$Y_{ij} = \gamma_{dY0} + p_{Y1} P_{1ij} + \dots + p_{Yk} P_{kij} + \gamma_{c'0} X_{ij} + \gamma_{b0} M_{ij} + \gamma_{dY1} W_j + \gamma_{b1} W_j \times M_{ij} + u_{dYj} + u_{bj} M_{ij} + u_{c'j} X_{ij} + e_{Yij}. \quad (13)$$

Again, the two models above (for  $M$  and  $Y$ ) were estimated simultaneously, via SAS Mixed procedure. According to Bauer et al. (2006, p. 154), the conditional expected value of the indirect effect of  $X$  on  $Y$  is:

$$E(a_j b_j | W_j = w) = (\gamma_{a0} + \gamma_{a1} w)(\gamma_{b0} + \gamma_{b1} w) + \sigma_{u_{aj}, u_{bj}}.$$

Hence, to test for the existence of the moderation of the indirect effect, we tested the significance of  $\gamma_{a1}$  and  $\gamma_{b1}$ . If  $\gamma_{a1}$  were significant, there would be evidence of a moderating effect of  $W$  on the link between  $X$  and  $M$ . If  $\gamma_{b1}$  were significant, there would be evidence of a moderating effect of  $W$  on the link between  $M$  and  $Y$ .

## Results

Means, standard deviations, and correlations among the variables are displayed in Table 1. As can be seen in this table, the distribution of scores on drinking were, as expected, skewed to the right, with the mean level of drinking being 1.49 ( $SD = 0.50$ , range = 1 to 3.8). The distribution of scores on the distress and intensity measures were also skewed to the right, with a mean of 0.80 ( $SD = 0.68$ ) and scores ranging from 0 to 3.0 for distress and a mean of 17.35 ( $SD = 12.45$ ) and scores ranging from 0 to 78.0 for intensity. The results in Table 1 also indicate that there were no problems of multicollinearity except between the two individual- and unit-level resource variables ( $rs = .82$  and  $.73$ , respectively).

Results of the multilevel analyses are presented in Table 2. As noted above, in order to demonstrate support for Hypothesis 1 (specifying that distress would mediate the relationship between intensity and drinking), two conditions must be met. As shown in Model 1 of Table 2, the first condition was met in that the coefficient for intensity ( $c$ ) was positive and significant ( $c = 0.008$ ,  $p < .001$ ). The results presented in the columns under Model 2 in Table 1 show evidence that the second condition was met (i.e., the indirect effect was statistically significant and in the

Table 1  
Correlations, Means, and Standard Deviations of Variables

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Drink to cope	1.49	0.50	—																
2. Distress	0.80	0.68	.39	—															
3. Intensity of involvement in workplace critical incidents	17.35	12.45	.23	.27	—														
4. Married	0.68	0.47	-.09	.06	-.03	—													
5. Ethnicity	0.11	0.31	-.04	-.08	-.06	-.02	—												
6. Education	4.49	1.39	-.03	.01	.02	-.15	-.02	—											
7. No. off-duty incidents with injuries in past year	0.22	0.60	.09	.14	.24	-.02	.04	.04	—										
8. Involvement intensity in 9/11	4.43	4.16	.11	.20	.26	.12	-.02	-.10	.03	—									
9. Peer support	3.59	0.52	-.06	-.17	.01	-.03	-.06	-.01	-.01	-.08	—								
10. Supervisor support	3.26	0.64	-.11	-.23	-.01	.00	-.06	-.02	-.02	-.07	.64	—							
11. Locus of control	1.70	0.21	-.25	-.25	-.11	-.03	.00	-.02	-.03	-.13	.12	.14	—						
12. Seniority	8.50	6.66	.02	.09	.03	.33	-.06	-.24	.01	.18	-.07	-.02	-.09	—					
13. Unit-level resource adequacy	15.50	2.77	-.03	.01	-.04	-.02	.05	-.02	.01	.01	-.01	.04	.01	-.05	—				
14. Unit-level resource availability	4.02	0.36	-.03	.02	-.05	-.02	.03	-.01	.01	-.01	.00	.04	.01	-.03	.95	—			
15. Unit-level resource quality	3.83	0.38	-.04	.00	-.04	-.01	.05	-.03	.00	.01	-.01	.05	.02	-.04	.95	.82	—		
16. Individual-level resource availability	4.01	1.12	-.06	-.18	-.20	-.10	.05	-.01	-.02	-.16	.14	.18	.10	-.14	.30	.31	.26	—	
17. Individual-level resource quality	3.81	1.14	-.08	-.18	-.19	-.06	.03	.01	-.03	-.14	.11	.18	.11	-.11	.31	.27	.32	.73	—

Note. Unless otherwise noted, all variables were assessed at the individual level. Correlations between individual-level and unit-level variables, as well as among unit-level variables, were all estimated at the individual level ( $n = 1,152$ ), with each individual receiving the mean value for his company for each unit-level variable. 9/11 = September 11, 2001 terrorist attacks. For  $r_s > .06, p < .05$ . For  $r_s > .09, p < .01$ . For  $r_s > .12, p < .0001$ .

hypothesized direction). Although the  $X \rightarrow M$  and  $M \rightarrow Y$  models were calculated simultaneously, for the sake of clarity, we present their results separately in the table. These results indicate (a) a positive association between intensity ( $X$ ) and distress ( $M$ ;  $a = 0.01, p < .001$ ), (b) a positive association between distress ( $M$ ) and drinking ( $Y$ ;  $b = 0.20, p < .001$ ), and, most important, (c) a positive (as hypothesized) and significant expected indirect effect: estimated  $E(ab_j) = 0.003 (p < .001; SE = 0.0008; \text{Monte Carlo confidence interval} = 0.002, 0.005; \alpha = .05)$ . This indirect effect accounted for approximately one third of the total intensity–drinking effect: estimated  $E(ab_j + c_j) = 0.009 (p < .001; SE = 0.002; \text{Monte Carlo confidence interval} = 0.006, 0.012; \alpha = .05)$ .

The results of Model 1 also indicate support for Hypothesis 2, which specified that the intensity–drinking association would vary significantly across work units (a necessary condition for initiating a moderated mediation analysis). Specifically, the results indicate that, as hypothesized, the variance of the Level 2 slopes or  $c_j$  was significant ( $\sigma_{c_j}^2 = 0.00004, p < .05$ ).

In order to test Hypotheses 3 and 4 (positing a Level 2 moderation of the Level 1, distress-mediated association between intensity and drinking), the analytic strategy noted above called for us to next test the variability of the indirect effect over Level 2 units. More specifically, recognizing the significance of  $\sigma_{c_j}^2$  shown above, we sought to confirm that the variability of the total effect over Level 2 units was, in fact, manifested in the distress-mediated

path between intensity ( $X$ ) and drinking ( $Y$ ; i.e., in terms of the variability of the indirect effect over Level 2 units). As shown under the columns labeled *Model 2* in Table 2, the estimated variance of  $ab_j = 0.001$ , and the CV of  $ab_j = 4.25$ . The source of variability in  $\sigma_{c_j}^2$  is given at the bottom of the columns for this model in terms of the estimates for  $\sigma_{aj}^2, \sigma_{bj}^2$ , and  $\sigma_{c_j}^2$ . These results indicate that the variability of the total effect emerged only from the two elements of the indirect effect, namely intensity–distress ( $\sigma_{aj}^2 = 0.0008, p < .05$ ) and distress–drinking ( $\sigma_{bj}^2 = 0.04, p < .01$ ), with the variability of the direct effect ( $\sigma_{c_j}^2$ ) being statistically insignificant.

Evidence that unit-level resource adequacy indeed explained much of this variance and significantly attenuated both the relationship between intensity ( $X$ ) and distress ( $M$ ) and the relationship between distress ( $M$ ) and drinking ( $Y$ ; consistent with Hypotheses 3 and 4, respectively) is provided under the columns labeled *Model 3* in Table 2. As in the case of Model 2, the  $X \rightarrow M$  and  $M \rightarrow Y$  models were calculated simultaneously, with their results displayed separately for the sake of clarity. These results indicate that, as hypothesized, unit-level resource adequacy significantly attenuated both the association between intensity ( $X$ ) and distress ( $M$ ;  $\gamma_{a1} = -0.002, p < .01$ ) and the association between distress ( $M$ ) and drinking ( $Y$ ;  $\gamma_{b1} = -0.02, p < .05$ ). Further evidence that these effects were consistent with those hypothesized is provided on the basis of the interaction plots shown in Figure 2. The fact

Table 2  
Results of Mixed Model Analysis of the Cross-Level Moderated Mediations Model

Variable	Total effect $X \rightarrow Y$ (Model 1)		Multilevel mediation model (Model 2)				Multilevel moderated mediation model (Model 3)			
	Estimate	SE	$X \rightarrow M$		$M \rightarrow Y$		$X \rightarrow M$		$M \rightarrow Y$	
Intercept	$d$ 1.55	0.03	$d_M$ -0.06	0.04	$d_Y$ 1.57***	0.03	$\gamma_{dm0}$ -0.06	0.04	$\gamma_{dy0}$ 1.57	0.03***
Marital status	-0.10***	0.03	0.08*	0.04	-0.11***	0.03	0.08*	0.04	-0.11***	0.03
Ethnicity	-0.05	0.05	-0.17**	0.05	-0.02	0.04	-0.16**	0.05	-0.02	0.04
Education	-0.02	0.01	0.01	0.01	-0.02*	0.01	0.01	0.01	-0.02*	0.01
No. incidents received treatment	0.04	0.02	0.11***	0.03	0.004	0.02	0.11***	0.03	0.004	0.02
Involvement in 9/11	0.005	0.004	0.01**	0.004	0.003	0.003	0.01**	0.004	0.003	0.003
Peer support	0.04	0.04	-0.04	0.04	0.02	0.03	-0.04	0.04	0.02	0.03
Supervisor support	-0.09**	0.03	-0.20***	0.04	-0.03	0.03	-0.20***	0.04	-0.03	0.03
Locus of control	-0.54***	0.07	-0.50***	0.09	-0.44***	0.07	-0.50***	0.09	-0.44***	0.07
Tenure	0.001	0.002	0.003	0.003	-0.0005	0.002	0.004	0.003	-0.001	0.002
Intensity of involvement in workplace critical incidents ( $X$ )	$c$ 0.008***	0.002	$a$ 0.01***	0.002	$c'$ 0.006***	0.001	$\gamma_{a0}$ 0.01***	0.002	$\gamma_{c'0}$ 0.006***	0.001
Distress ( $M$ )					$b$ 0.20***	0.03			$\gamma_{b0}$ 0.21***	0.03
Resources <sup>a</sup> ( $W$ )							$\gamma_{dm1}$ 0.001	0.007	$\gamma_{dy1}$ -0.008	0.005
Resources <sup>a</sup> $\times$ Intensity ( $W \times X$ )							$\gamma_{a1}$ -0.002**	0.0006		
Resources <sup>a</sup> $\times$ Distress ( $W \times M$ )									$\gamma_{b1}$ -.02*	.009
Variance of Level 2 intercepts	$\sigma_{dj}^2$ .001	.003	$\sigma_{dMj}^2$ .003	.004	$\sigma_{dYj}^2$ .002	.003	$\sigma_{u_{dm}}^2$ .003	.004	$\sigma_{u_{dyj}}^2$ .002	.003
Variance of Level 2 slopes	$\sigma_{c'j}^2$ .00004*	.00003	$\sigma_{aj}^2$ .00008*	.00004	$\sigma_{bj}^2$ .04**	.01	$\sigma_{u_{aj}}^2$ .00005	.00004	$\sigma_{u_{bj}}^2$ .03**	.01
					$\sigma_{c'j}^2$ .00002	.00002			$\sigma_{u_{c'j}}^2$ .00002	.00002
					Estimated var ( $ab_j$ ) = 0.001			Contrast for testing $\gamma_{a1}$ and $\gamma_{b1}$		
					CV ( $ab_j$ ) = 4.25			simultaneously:		
					$E(ab_j) = 0.003$ ***			P[F(2,85.1) > 6.89] = 0.0017		

Note.  $n = 1,186$ . All other variables were analyzed at the individual (Level 1) level.  $X$  = intensity of involvement in workplace critical incidents;  $Y$  = drinking to cope;  $M$  = distress;  $W$  = unit resource climate; 9/11 = September 11, 2001 terrorist attacks.  
<sup>a</sup> Unit-level (Level 2) variable.  
 \*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

that, with respect to both stages of the indirect effect, the positive standard deviation curve was relatively flat, while the negative standard deviation curve was quite steep, suggests that the impact of unit-level resources on the individual-level intensity–drinking relationship was felt primarily when unit-level resources were at below-mean levels of adequacy. This was, in fact, confirmed on the basis of Bauer et al.’s (2006) tests of the expected value of the indirect effect of  $X$  (intensity) on  $Y$  (drinking) at varying levels of  $W$  (unit-level resources), in which we found that while at mean levels of resource adequacy the expected effect of intensity on drinking was 0.003 ( $p < .001$ ), at one standard deviation above the mean level of unit resources adequacy, the expected effect of intensity on drinking was 0.001 ( $ns$ ), and at one standard deviation below the mean level of unit resources adequacy, the expected effect of intensity on drinking was 0.004 ( $p < .001$ ). The latter estimate suggests that the indirect effect of intensity on drinking via distress was 33% stronger among members of units with a level of unit-level resources adequacy one standard deviation lower than the mean than it was among members of units whose unit level of resources adequacy was at the mean. Furthermore, while, as noted at the bottom of this column, a contrast analysis indicated that both

cross-level moderation elements played a significant role in explaining the individual-level, distress-mediated relationship between intensity and drinking,  $F(2, 85.1) = 6.89, p < .01$ , inspection of the remaining variability in the Level 2 slopes indicated that, with the inclusion of  $\gamma_{a1}$  and  $\gamma_{b1}$  in these models, the unexplained variability of the Level 2 slopes became statistically insignificant with regard to the intensity–distress path ( $\sigma_{u_{aj}}^2 = 0.00, ns$ ) but was only reduced in magnitude with regard to the distress–drinking path ( $\sigma_{u_{bj}}^2 = 0.03, p < .01$ ). Finally, a comparison of the proportion of variance explained (calculated on the basis of Xu, 2003, p. 3530) in the moderated mediation model ( $R^2 = .28$ ) versus an unshown model containing only the control variables and random intercept ( $R^2 = .11$ ) indicated that 155% more variance in drinking was explained when the distress-mediated and resource-moderated effects of intensity were taken into account. It should be noted, however, that most of this increase stemmed from the inclusion of intensity and distress in the model ( $R^2 = .27$  for a model including intensity and distress but excluding the unit-level resources moderator). Still, the additional variance explained with the inclusion of the unit-level moderator was statistically significant ( $p < .01$ ), with this moderator explaining approxi-

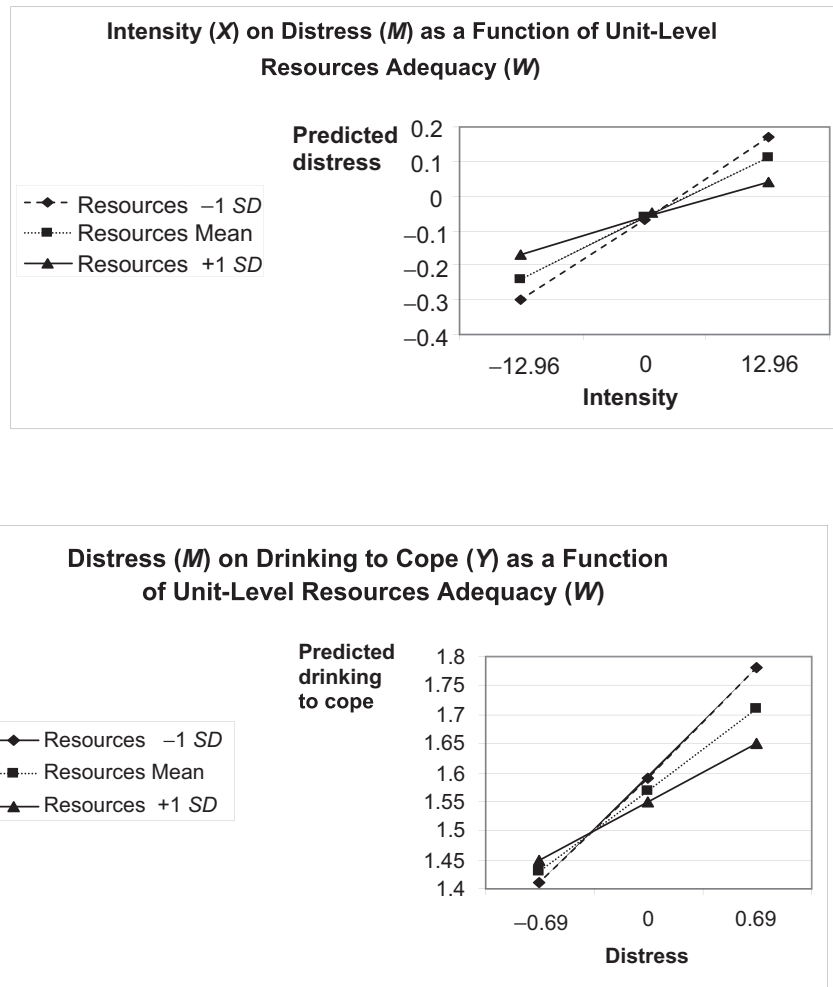


Figure 2. Plots of the cross-level moderation of the Level 1, distress-mediated effect of intensity of involvement in workplace critical incidents on drinking to cope by unit-level resources adequacy. The top panel shows the effects of intensity (X) on distress (M) as a function of unit-level resources adequacy (W); the bottom panel shows the effects of intensity (X) on drinking to cope (Y) as a function of unit-level resources adequacy (W).

mately 4% more of the variance in drinking than that explained by the mediation model alone (i.e., .28 is approximately 4% greater than .27).

### Discussion

At their most basic level, the findings presented replicate those of earlier studies in that they confirm a link between the intensity of firefighters' involvement in critical incidents and drinking to cope and in that they indicate that this link was mediated by distress. However, beyond replicating earlier findings, the results of our study imply that the vulnerability of employees to the adverse effects of incident involvement on well-being and problematic drinking is not necessarily consistent across work units and that unit-level differences in the adequacy of performance resources may explain at least some of this cross-unit variability in comorbidity processes. More specifically, our results suggest that unit members' psychological responses to critical incident involvement may depend on the adequacy of unit-level resources, with

members of units with less adequate resources being more vulnerable to distress and distress-related sequelae, such as drinking to cope, than members of units with more adequate resources. As noted above, the strength of the distress-mediated linkage between the intensity of critical incident involvement and drinking to cope was 33% greater among members of units characterized by one standard deviation less of unit-resources adequacy than the mean than it was among members of units characterized by the mean level of unit-resources adequacy.

Both cognitive-processing and resource ecology theories may provide important insights into why and how unit-level performance resources adequacy moderates individual-level, distress-mediated comorbidity processes. As for why such resources may explain why some individuals exposed to critical incidents experience distress (the first element of the indirect path between intensity and drinking), while others do not, consistent with the cognitive-processing theory, it may be that more adequate unit-level resources provide unit members with an enhanced sense of

self-efficacy and mastery. In turn, this enhanced sense of self-efficacy may serve to both (a) attenuate adverse effects of occupational stressors on well-being (Jex & Bliese, 1999) and (b) facilitate the assimilation and integration of critical incidents into existing cognitive schemas (particularly those regarding one's safety and invulnerability), thus reducing the severity and duration of arousal-type distress symptoms (Creamer et al., 1992). Similarly, consistent with the resource ecology perspective, resources adequacy may have a cross-level attenuating effect on the individual intensity–distress relationship, in that members of more resource-munificent units may find it less necessary to draw from personal resource stocks in order to meet performance demands and, as such, may be less vulnerable to resource loss, loss spirals, and resource depletion, conditions that often manifest themselves in the form of distress-related sequelae (Hobfoll, 2002).

As for why such resources may explain the variance in the association between distress and drinking to cope (the second element of the indirect path between intensity and drinking), consistent with both cognitive-processing and resource ecology theories, it may be that unit-level resources adequacy plays an important role in determining the subjective expected utility of problem-focused versus avoidance-focused modes of coping with distress (such as drinking to cope). From a cognitive perspective, unit-level resource adequacy might influence perceptions of helplessness, as well as the relative expected utility of, for example, engaging in activities aimed at reducing distress-related risks in the future as opposed to simply attempting to “escape” from the felt distress in the immediate term. Similarly, from a resource perspective, it may be that among those who, because of limited unit-level resources, are forced to draw on their own personal resources to ensure task performance, there is a natural tendency to reject more resource-costly, problem-focused strategies and to opt instead for coping strategies viewed as resource conserving, such as those involving physical or psychological withdrawal (Hobfoll, 2002) such as drinking to cope.

It is interesting that pattern of findings presented above suggests that while the adequacy of unit-level performance resources moderated both stages of the indirect, distress-mediated path between intensity and drinking, it accounted for essentially all of the unit-level variance in the first stage, intensity–distress, but for only a portion of the unit-level variance in the second stage, distress–drinking. Such a finding is consistent with the literature on workplace drinking cultures (Bacharach et al., 2002), which suggests that the relationship between many of the more widely studied organizational risk factors (e.g., stress, alienation) and drinking behavior may be contingent on unit-level permissive drinking norms. Although we collected data on unit-level permissive drinking norms in the current study, we failed to find a sufficient level of agreement along the various agreement indexes to justify unit-level aggregation. Still, this may be a fruitful direction for future cross-level moderation research.

No less interesting are the results of our tests of the expected value of the indirect effect of intensity on drinking at varying levels of unit-level resources adequacy. These findings indicate that, at a single standard deviation from the mean, above-mean resources adequacy had no significant attenuation effect, while below-mean resources adequacy (i.e., inadequacy) did. While it may be that at a difference of two standard deviations from the mean, for example, greater adequacy does attenuate the indirect

effect of intensity on drinking, these results nevertheless suggest that the adequacy of unit-level performance resources may serve as more of a vulnerability factor than a protective factor. That is, while greater or above-mean resources adequacy may do little to attenuate distress-mediated comorbidity, below-mean unit resources or relative inadequacy may greatly increase the severity of firefighters' risk of comorbidity.

Taken as a whole, our findings suggest that the adequacy of unit-level performance resources may have effects well beyond those suggested by Bacharach and Bamberger (1995). That is, beyond simply serving as a situational constraint with a direct impact on individual task performance (as posited by Bacharach and Bamberger, 1995), inadequate unit-level performance resources may increase workers' vulnerability to job-based strain and distress while limiting workers' interest and/or ability to cope with such strain and distress in a nondysfunctional manner. Thus, from a theoretical perspective, the results of our study contribute to the occupational stress literature by suggesting that context-based resource factors may play an important role in determining the amplitude of individual-level stressor–strain relations in general, and distress-mediated comorbidity processes in particular, and suggesting just how these moderating effects may manifest themselves.

However, our results may also be viewed as making an important contribution by laying the theoretical and methodological groundwork for further analyses of other unit-level factors that potentially moderate individual-level stressor–strain relations and comorbidity processes, such as support (Bacharach, Bamberger, & Feigin-Vashdi, 2005) and control (van Yperen & Snijders, 2000) climates. Indeed, as noted by van Yperen and Snijders (2000), while the job demands, control, and support (JDCS) model (Karasek & Thorell, 1990) was initially framed around the buffering effect of control and support as environmental factors, it has almost always been tested on the basis of the respondent's own personal perception of such factors. In this context, our findings suggest that one reason for the rather inconsistent support for the JDCS model may be that, to the extent that such buffering effects may have more to do with different conditions between work groups than with different conditions between individuals within work groups, they are more difficult to pick up when buffering models are examined via individual perceptions in the context of individual-level analyses. By applying the theoretical framework and methodological approach demonstrated above to test control and support climate buffers of individual-level stressor–strain relations, researchers may be able to more fully maximize the explanatory potential of cognitive appraisal stress–strain models, such as JDCS theory.

Finally, from a practical perspective, our results suggest that policy makers and practitioners concerned with first-responder comorbidity take into account that organizational factors may play a significant role in moderating the emergence and/or exacerbation of first-responder drinking problems. While, given the nature of the job, it may not be possible to fully prevent exposure to those types of incidents that often initiate or exacerbate comorbidity processes, our findings indicate that practitioners may do well by beginning to identify those organizational-level vulnerability factors, such as the adequacy of unit-level performance resources, over which they do have control. However, while, as suggested above, the current study

focuses on unit-level resources adequacy as a potential cross-level moderator of individual-level comorbidity processes, other cross-level moderators should be investigated, such as unit-level drinking norms, support (Bacharach et al., 2005), and control (van Yperen & Snijders, 2000). In addition, practitioners might want to further investigate the level at which unit-level performance resources actually do begin to serve as significant buffers of stressor-strain (or protective factors) relations and not just as important vulnerability-reduction factors.

### Limitations and Future Research

In addition to the avenues for future research noted above, several limitations of our study may also offer additional research opportunities. First, given that our survey was conducted among New York City firefighters 18 months following the 9/11 incident, the findings reported above might have been confounded by firefighter distress associated with that event. Although we controlled for the intensity of involvement in 9/11, other aspects of 9/11 and its aftermath might, nevertheless, have confounded our results. In addition, our inability—because of data limitations—to control for other individual and unit characteristics that were unrelated to 9/11 but suggested above as potentially influencing the link between critical incidents and drinking to cope might have also confounded our results. Some of these variables include (at the individual level) positive alcohol expectations, tension reduction expectancies, avoidance coping tendencies, and (at the unit level) company activity level.

Second, despite the assessment of resources adequacy at the fire company (i.e., unit) level, given that all data were collected on the basis of self-report questionnaires and that behavioral data were collected retrospectively, it is likely that some of the reported associations may have been inflated as a function of common method variance and/or retrospective bias. For example, it may be that those reporting a high level of distress tended to retrospectively overestimate their level of involvement in critical incidents. In the future, researchers may wish to try to replicate our findings using longitudinal designs in order to reduce the risk of such bias. However, such researchers should also beware that the collection of longitudinal data regarding such stigmatized problems as alcohol misuse is often problematic in that such designs tend to require the collection of data in a nonanonymous manner, leading to the potential replacement of common method bias by response bias (Bacharach et al., 2002).

Finally, given the nonlongitudinal nature of our analysis, the possibility of inverse causation remains. Although we were careful to temporally operationalize our measures to be consistent with previous comorbidity research (i.e., intensity over the past 4 months, distress over the past week, and current drinking to cope), the risk of temporal overlap, particularly with regard to distress and drinking to cope, remains. While researchers may, in theory, attempt to more precisely capture the causal relations among intensity, distress, and drinking by controlling for earlier, baseline measures of these same variables, given the problems with longitudinal alcohol research noted above, this may be easier said than done. Despite these limitations, we believe that our findings provide important insights for researchers concerned with the poten-

tial moderating role of the broader task environment in moderating individual-level stressor-strain relations.

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