Psychological Trauma in the Workplace: Variation of Incident Severity among Industry Settings and between Recurring *vs* Isolated Incidents

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Abstract

Background: Psychologically traumatic workplace events (known as critical incidents) occur within various work environments, with workgroups in certain industries vulnerable to multiple incidents. With the increasing prevalence of incidents in the USA, incident response is a growing practice area within occupational medicine, industrial psychology, occupational social work and other occupational health professions.

Objective: To analyze a measure of incident severity based on level of disruption to the workplace and explore whether incident severity varied among different industry settings or between workgroups experiencing multiple *vs* single traumatic incidents.

Methods: Administrative data mining was employed to examine practice data from a workplace trauma response unit in the USA. Bivariate analyses were conducted to test whether scores from an instrument measuring incident severity level varied among industry settings or between workgroups impacted by multiple *vs* isolated events.

Results: Incident severity level differed among various industry settings. Banks, retail stores and fast food restaurants accounted for the most severe incidents, while industrial and manufacturing sites reported less severe incidents. Workgroups experiencing multiple incidents reported more severe incidents than workgroups experiencing a single incident.

Conclusion: Occupational health practitioners should be alert to industry differences in several areas: pre-incident resiliency training, the content of business recovery plans, assessing worker characteristics, strategies to assist continuous operations and assisting workgroups impacted by multiple or severe incidents.

Keywords: Workplace; Workplace violence; Occupational injuries; Psychology, industrial

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Introduction

Globally, psychologically traumatic events, such as industrial accidents, explosions, mass shootings, terrorism, and natural disasters occur with unfortunate regularity. While similar incidents have occurred throughout history, widespread and instantaneous media coverage results in high visibility, raising awareness about psychological trauma as a consequence. In recent years, there

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have occurred several devastating natural disasters (Typhoon Haiyan, Philippines, 2013; Super Storm Sandy, USA, 2012; Indonesia's Tsunami, 2004), tragic gun violence in schools (Sandy Hook Elementary School, USA, 2012; Kauhajoki and Tuusula, Finland, 2008 and 2007), deadly industrial disasters (DuPont's toxic chemical's leak in La Porte, Texas, USA, 2014; West Fertilizer Company's explosion, West, Texas, USA, 2013; Amuay refinery explosion in Punto Fijo, Venezuela, 2012; Deepwater Horizon oil rig explosion in the Gulf of Mexico, 2010) and brutal acts of terrorism (Kunming train station stabbings, China 2014; Boston Marathon bombing, USA, 2013). As is evident from these examples, traumatic incidents frequently occur within workplaces globally. Workplaces within the USA however, are particularly vulnerable. To explore differences among industry settings and their experience with critical incidents in the USA, this observational study analyzes critical incident practice data generated in a high volume incident response unit.

The article documents the prevalence of workplace incidents within the USA, identifies common employee traumatic stress symptoms and shows how subsequent work performance impairments can be understood as manifestations of traumatic stress. It next reviews pre-incident and post-incident strategies to mitigate the impact of events on workers and the organization. It then profiles a prominent critical incident response unit, outlining its scope of practice, and describing its extensive database of critical incident records, which serve as the data set for an observational study. Employing the methodology of administrative data mining, data are tested for whether incident severity level (a measure of disruption to organizations), differed significantly among various industry settings, and for whether incident severity was greater for workgroups experiencing multiple traumatic incidents than for those who were exposed to a single event. The article closes with implications for occupational health practitioners and recommendations for continued research.

Prevalence of Workplace Trauma in the USA

The USA Bureau of Labor Statistics reports the occurrence of over 5000 workplace fatalities annually and in 2008 noted workplace suicides rose 28% over the previous year. In one year alone there were 4.6 million serious workplace injuries.[1] The US Occupational Safety and Health Administration cited homicide as a leading cause of workplace death, especially for women.[2] Among mass shootings within the USA between 2000 and 2013, over 50% occurred in the workplace.[3] Federal Bureau of Investigation (FBI) data reveal there are over 5000 bank robberies annually.[4] As work-

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TAKE-HOME MESSAGE

- For settings with a high frequency of incidents or those prone to more severe events it is especially important to emphasize pre-incident preventive measures, including resiliency training for workers and to ensure the human resource components of crisis recovery plans include specific strategies to reduce the emotional and psychological impact of events.

- Since support groups and other interventions vary in their effectiveness based on differing worker needs, preferences and cultures, awareness of the types of employees exposed (professionals, skilled labor, industrial workers, store clerks, *etc*) allows occupational health practitioners to modify approaches accordingly.

- Occupational health practitioners should routinely screen for a positive workgroup history for multiple incidents and determine whether interventions typically provided for single incidents need modification, such as incorporating a workgroup's previous exposure and experience into discussions or recommending the workgroup be observed over a longer period of time to ensure ongoing recovery.

place trauma becomes more prevalent and disruptive to work environments it becomes increasingly relevant to occupational health professionals assisting workers and affected organizations with post-incident recovery. When occurring within the workplace, traumatic events are referred to as "critical incidents."[5-12] Correspondingly, the field of practice responding to workplace incidents is referred to as "critical incident response." While historically this field evolved out of crisis intervention theory and workplace strategies to reduce general occupational stress, it is distinct. In contrast to various stress management interventions implemented to address routine and chronic stressors inherent in all work organizations, critical incident response specifically addresses unexpected and acute reactions to critical incidents.

Chronic and Acute Workplace Stressors

Chronic sources of work stress cited in the literature include time pressures, high or low demand tasks,[13] low levels of worker autonomy and organizational instability.[14] Murphy offers several work characteristics that contribute to stress, including job factors (long work hours, rapid pace of work) and role factors (high levels of responsibility, multiple tasks, role overload, role ambiguity).[15] Other examples include conflicts between employees and between employees and managers.[16] Graen cites as a stressor the tedious nature of some tasks.[17] Colligan and Higgins note that workplace atmospheres that are predominantly critical or disrespectful contribute to chronic stress as well.[16] In addition to daily work-related stressors, there occur periodic, large-scale, organizational-level stressors such as bankruptcies, reorganizations, lay-offs, mergers, acquisitions or plant closings. To address chronic job stressors inherent in any work organization, employers rely on various management strategies, including specialized training to in-

crease managers' understanding of worker stress response, various work accommodations, stress management training and establishing an overall worker-focused, supportive environment.[18,19] Support for large scale organizational change takes the form of training for managers on responding to employee reactions, support groups for employees and making available resources needed to navigate changes such as job re-training or outplacement services to seek alternate employment. Many employers maintain formal employee assistance programs that provide a range of services to increase worker health, improve productivity, ameliorate routine work stress and reduce the impact of organizational change.[20-23] Where routine occupational stressors contribute to chronic and usually moderate levels of stress, unpredictable critical incidents tend to generate acute stress, with significant repercussions for workers and their employers.

Impact of Traumatic Stress on Workers and Work Organizations

Workers exposed to a critical incident frequently experience emotional, cognitive and behavioral symptoms that compromise occupational functioning. Symptoms include restlessness, insomnia, anxiety, detachment, intrusive images, poor concentration, social withdrawal or hypervigilance.

Within any given workgroup, approximately 15% of workers will exhibit symptom clusters of sufficient severity and duration to meet criteria for a diagnosis of acute stress disorder (ASD) or post-traumatic stress disorder (PTSD),[24,25] with the majority displaying sub-clinical, normal stress responses. Even normal symptoms however, can emerge in the workplace as absenteeism, poor presenteeism (present at work, but in a highly distracted state), task avoidance, increased conflicts, accidents or loss of motivation. Employees

may socially isolate themselves as a means of avoiding talking about the incident. Anxiety, fear, sadness and dissociative symptoms impair cognitive functioning and work skills. Arousal symptoms create difficulties with sleep, resulting in poor concentration, irritability with co-workers and tardiness or absenteeism. Due to workplace reminders of the event, an employee may become distressed merely at the thought of entering the workplace.[26] To the employer, the worker may appear distracted or unmotivated. If not addressed such symptoms are disruptive to operations through sick leave, missed deadlines, compromised work quality, worker conflicts and declining productivity. The employer is also at risk financially for increased disability claims, worker compensation claims, increased health and mental health claims or legal liability.[27] Due to the operational and financial risks of traumatic stress symptoms many employers develop and maintain pre-incident and post-incident procedures to mitigate risks and guide the organization through an event.

Pre-Incident Strategies: Crisis Response Plans and Resiliency Training

Pre-incident planning results in recovery strategies variously known as business continuity plans, operational contingency plans, disaster recovery plans, crisis mitigation strategies, *etc*. While the comprehensiveness of recovery plans vary, they normally cover steps to quickly establish a command center, address financial impacts, restore facilities, re-establish communications, protect data integrity, replace technology and manage human resources. While the human resource component typically involves procedures to ensure worker's physical safety, restore performance and regain productivity, they vary in the extent to which they include strategies to reduce the emotional and psychological impacts of events. A comprehensive human resource plan will detail psychological support strategies to be taken within each of four phases of response—the pre-incident phase, the emergency phase, the post-impact phase, and the restoration phase. An important element of pre-incident preparation, the provision of resiliency training, has been found to facilitate adaptive responses post-incident.[28,29] For employees, the content of resiliency training typically includes psycho-educational information about the relative risks of various types of incidents, common stress responses, appropriate self-care measures, signs of traumatic stress, and the availability of resources for assistance. For managers, training additionally covers how to identify stress symptoms in workers and reviews constructive ways to approach performance issues in the aftermath of an event.[30] Preventive resiliency training within settings known to be at risk for traumatic experiences receives a good deal of attention.[31-33] The US Army recently reported positive results of a resiliency training program designed to reduce PTSD symptoms among soldiers.[34,35]

Employers seeking to reduce the impact of workplace traumatic stress[36-38] provide resiliency training and include psychological support procedures in their recovery plans. Additionally, to facilitate recovery following an incident major employers in the USA also rely on a specialized approach known as "critical incident response."[27,39,40]

Post-Incident Critical Incident Response

Critical incident response is an approach designed to facilitate the recovery of workers and managers and to stabilize the organization. As a stabilization strategy, it includes various components, incident assessment, consultation to managers, post-incident response planning, delivery of on-site interventions (group sessions and individual counseling) and follow-up observations. These wide range of services

are delivered by occupational health professionals including workplace physicians and nurses, industrial psychologists, occupational social workers, employee assistance staff and employees of other health-related disciplines. Frequently, the overall response is coordinated by specially trained critical incident response units or teams, operating within various industries, government agencies, community organizations, law enforcement, emergency services, unions, airlines, banks and schools.[5,41] These units may be staffed by employees internally or they may be independent organizations contracting with multiple employers to provide critical incident services as needed. The unit serving as the setting for this study is an independent, external program.

Research Setting: A Critical Incident Response Unit

The research setting was an external critical incident response unit, one of the largest in the USA and operated by Magellan Health Services. The unit served over 1400 client organizations with over 43 million residents (one out of every six individuals) eligible for its services. Between 2006 and 2008 the unit responded to more than 3000 critical incidents annually. Since beginning operations in 1995 the unit collected extensive data on over 60 000 workplace incidents. Two characteristics therefore position this unit as an appropriate setting for an observational, exploratory study—its large volume of requests for assistance and its extensive database. Specifically, the data represent an opportunity to explore variation of incident severity level among different industry settings and between multiple *vs* single incidents.

Gaps in the Literature and Research Objective

While critical incident response seeks to support both the recovery of individual employees emotionally and the recovery of organizations functionally, research oriented towards treating individual traumatic symptoms dominates the literature.[26,31,36,42-48] Correspondingly, the trauma assessment literature predominantly reflects scales designed to screen individuals for risk factors and varying levels of post-traumatic symptoms.[49-57] This research contributes to less prevalent literature on measures of incident characteristics disruptive on the organizational level. Additionally, while critical incident response units collect massive amounts of practice information, there are few published studies capitalizing on potential discoveries within their data. Building on previous studies analyzing this unique database,[58-60] this research explored variation in the severity level of incidents occurring within different industry settings and tested whether incident severity level differed within workgroups experiencing repetitive incidents *vs* a single incident.

Materials and Methods

Administrative Data Collection

Administrative data mining was employed to examine data produced by a single critical incident response unit. Critical incident response services are initiated by requests for assistance from site managers, medical directors, human resource professionals, union representatives or other organizational officials. Calls to the unit are routed to an intake team. During intake assessment, staff gathers details about the incident, workgroup history and composition, and identifies needs and expectations. They assess the severity of the incident using a scale measuring disruption to the workplace, categorize the industry setting in which the incident occurred, determine whether the affected workgroup experi-

enced a previous traumatic incident and enter the information into a computerized Microsoft® Access® database.

Measurement of Incident Severity Level: CrISIS-R

Within the field of trauma psychology, there is a proliferation of clinical assessment tools that facilitate screening for risk factors for traumatic stress and for measuring varying levels of individual PTSD symptoms.[49-57] Collectively, they are classified as "impact of event scales."[57] While within some US practice settings it is feasible to employ individualized scales, within the frequently chaotic post-incident workplace environment, administration is generally not feasible. In order to meet employer demands for an immediate on-site response, there are neither the time nor the resources to administer individual scales. As an alternative to a clinical measure based on post-traumatic symptoms disruptive to individuals (a symptom severity scale), the unit in the study developed a measurement of incident characteristics disruptive to organizations as measured by an incident severity scale—the Critical Incident Severity Index Scale-Revised (CrISIS-R). The instrument is quickly and easily administered during intake by telephone and it proved practical and usable within the unit's high volume incident environment.

CrISIS-R includes six five-point Likert scale indices, each corresponding to an incident characteristic—portion of employees involved in the incident, number of workers with direct *vs* indirect exposure, level of perceived threat, level of violence, impact on productivity, and extent of media exposure. Their combined ratings comprise an overall CrISIS-R score with a maximum of 30 points. Reliability testing showed the scale to have a Cronbach's α of 0.7. Further details on scale development, administration and reliability are reported previously.[59] Staff administers the scale for each incident at intake. Scores are grouped into five incident severity categories ranging in impact from "low" to "catastrophic."

Industry Settings and Critical Incidents

While any US industry setting is vulnerable to experiencing a critical incident, several occupational groups are at high risk.[61] Heavy equipment industries and industrial settings (oil and gas, mining, construction, manufacturing) experience drilling disasters, mining accidents, explosions, industrial fires, and biochemical accidents. Financial and commercial sectors (banks, retail stores) risk exposing tellers and store clerks to criminal acts such as robberies, assaults, hostage taking and homicides. Nurses and doctors in health settings and social workers, child welfare and public assistance workers endure threats or injury and witness deaths. Workers in educational settings (teachers, administrators) experience shootings and emergency service employees (fire, police, ambulance staff) are vulnerable to traumatic rescue and recovery operations.[61]

Based on the North American Industry Classification System,[62] upon intake the unit assigns each client organization an industry classification code. The database houses the following general industry groupings—public administration, utilities, finance (including banks and insurance companies); professional settings (including scientific and technical industries); real estate (including rental and leasing); travel and leisure (hotels, restaurants, arts, entertainment and recreation); health and education (medical, educational and social services); manufacturing (including industrial, construction, mining and chemical industries) and wholesale and retail trade (fast food restaurants, department stores, *etc*).

In addition to the unit observing how frequently critical incidents occurred with-

in each of these work settings, staff also noted that some settings were susceptible to recurring or multiple incidents.

Multiple Critical Incidents

Documenting the impact of multiple traumatic events on individual functioning, trauma researchers found that repetitive incidents increase risk for severe stress symptoms.[63-65] Schauer, *et al*, reported a building block effect, which is a dosage to response influence from a cumulative, additive effect that predicts for more severe traumatic stress symptoms.[66] While the portion of US residents experiencing at least one traumatic event in their lifetime ranges from 50% to 66%,[67-69] many experience multiple traumatic events, evidenced by estimates that 17% of men and 13% of women have experienced more than three traumatic incidents.[70]

Within the US workplace, employees in certain industries are more or less susceptible to multiple incidents depending on a variety of factors, including geographical location and level of site security. For example, worksites in the coastal Southeast USA are vulnerable to seasonal natural disasters such as hurricanes. Those in western states are susceptible to recurring wild fires and those located in low-lying areas are in danger of frequent flooding. While employers in these locations prepare for such natural events, they cannot prevent their recurrence. To prevent recurring criminal acts such as robberies or shootings, organizations implement a high level of site security, the level of which is a function of whether a setting is public facing, such as retail stores, social and medical services and government offices, or non-public facing, such as factories, refineries, utilities and other secure worksites. Organizations serving the public need to allow open access by non-employees and are therefore vulnerable to recurring robberies or shootings. In contrast, industrial

sites and factories closed to the public are more secure against criminal acts.

Due to the importance of determining whether a workgroup is exposed to multiple incidents, at intake staff inquire of callers whether the currently affected workgroup experienced a previous traumatic incident. Workgroups with an incident within the last 12 months with at least some members present for the previous incident are recorded as multiple incidents.

Statistical Analysis

From the unit's records entered during 2006–2008, data for the three variables were extracted—CrISIS-R scores, industry settings, and whether the workgroup experienced multiple incidents. To test the potential association of settings or multiple incidents with CrISIS-R scores, bivariate analyses were conducted using ANOVA for industry setting and *Student's t* test for multiple *vs* singular incidents. A p value <0.05 was considered statistically significant.

Results

Over the three-year period (2006–2008), there were 5181 incidents in the unit's records. Figure 1 displays the number of incidents and sample scores' distribution.
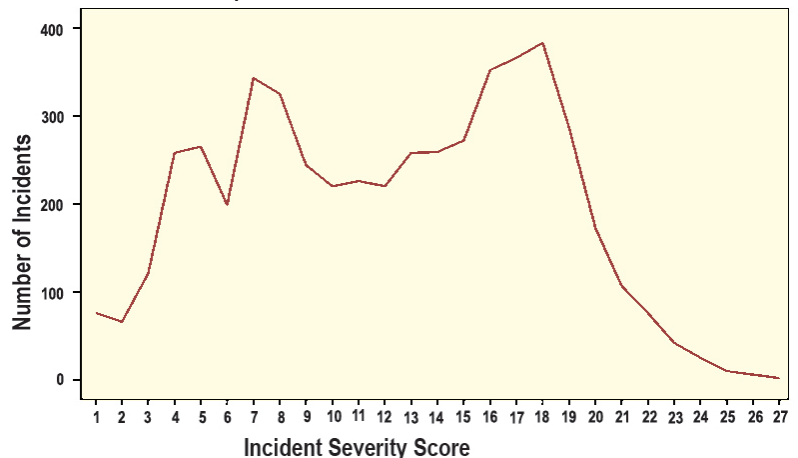

Figure 1: Distribution of CrISIS-R scores (2006–2008)

Table 1: Distribution of CrISIS-R scores by severity category (2006–2008)

Level of impact	Scores range	Frequency (%)
Catastrophic	25 to 30	18 (0.3)
Severe	19 to 24	710 (13.7)
Moderate	13 to 18	1890 (36.5)
Mild	7 to 12	1578 (30.5)
Low	0 to 6	985 (19.0)
Total incidents		**5181 (100.0)**

The sample scores had a median of 13.0 (range 26.0, SD 5.6) (Fig 1). Severity categories, score ranges and distribution of incident scores are presented in Table 1. The incident frequency of incidents stratified by industry is shown in Table 2. The mean CrISIS-R score was 12.2, indicating most incidents are of "mild" to "moderate" severity. Table 3 presents the frequency of multiple and single incidents over the three-year period.

Type of industry had a significant (p<0.001) effect on the incident severity level and accounted for 23% (η^2 0.235) of the variance observed in the severity score (Table 4).

The mean incident severity score was significantly (p<0.001) lower in workgroups who experienced a single (n=3539) than those with multiple traumatic incidents (n=848) (12.30 [SD 5.57] *vs* 13.68 [SD 5.42]).

Discussion

We found that CrISIS-R score is significantly higher in certain types of industry and for workgroups who experienced multiple incidents. The observance of high CrISIS-R scores for finance, trade settings and real estate is consistent with a key characteristic of these settings. As public facing environments, they have less restrictive security than non-public facing environ-

ments, such as industrial and manufacturing sites, resulting in greater exposure to criminal acts. Due to involving weapons, assaults, injuries or fatalities, criminal acts tend to score high on the CrISIS-R scale.[59] Confirming this differential exposure to criminal acts, the sample shows that among all criminal acts (n=1950), a high concentration (n=1775, 91.0%) occurred within these settings while only 9.0% (n=175) occurred within manufacturing, industrial, utilities and other settings.

Workgroups with recurring incidents also tended to experience more severe incidents. The observance of high CrISIS-R scores for multiple incidents is consistent with the type of recurring incidents in the sample. Among 848 recurring incidents, 52.1% (n=442) were criminal acts with high CrISIS-R scores.

These results have several implications for occupational health practitioners. Those supporting workers and organizations following traumatic workplace events should be alert to industry differences in several areas: the extent of an organization's pre-incident resiliency training, the comprehensiveness of their crisis recovery planning, the types of worker populations affected, whether the environment is continuously operational and vulnerability to multiple or more severe incidents.

Since pre-incident resiliency training facilitates adaptive responses,[28,29] it is a recommended preventive measure, especially for organizations vulnerable to severe or multiple incidents, such as public facing settings (finance and retail trade). Compared to other industries in the sample, these industries were more vulnerable to four types of risk. They experienced more traumatic incidents than other settings. They accounted for the majority of workgroups with multiple incidents. They were more susceptible to criminal acts and they tended to experience more severe incidents. However, the critical incident

response unit observed finance settings (banks) tended to emphasize resiliency training more than retail trade organizations (department stores, fast food restaurants). To manage the inevitability of robberies, finance settings not only implemented training for employees regarding security procedures,[30] they also routinely provided resiliency training. Given banks' high frequency of robberies and their need to quickly restore worker performance, it is not surprising such preventive strategies are widely implemented. Conversely, retail trade settings rarely conducted resiliency training. A possible explanation could be the nature of their workforce. Typically employing a large portion of part-time, transient sales clerks, fast food workers, *etc*, trade settings may judge the investment is not justified. However, since retail trade settings are similarly vulnerable to severe and multiple incidents, where practitioners find preventive strategies absent, they should discuss their value in reducing the impact of future events. A partial resolution could be conducting training only with more stable employees such as store managers. Better preparing managers to support resiliency among their employees still contributes significantly to post-incident recovery.

As noted, organizations' recovery plans differ in general by their level of comprehensiveness and in particular, by the extent to which they address emotional and behavioral impacts. During event intake, understanding a setting's crisis recovery plan informs practitioners about the setting's readiness to respond and the range of strategies available to be implemented. Practitioners consulting with settings with incomplete plans should emphasize their value for managing a response to future events.

Since critical incident approaches effective for certain types of employees may be less effective with other types,[71] awareness

Table 2: Incident frequency by industry setting (2006–2008)

	Frequency (%)
Finance	2055 (39.7)
Wholesale and retail trade	985 (19.0)
Manufacturing	558 (10.8)
Health and education	301 (5.8)
Other services	286 (5.5)
Professional	269 (5.2)
Travel and leisure	253 (4.9)
Public administration	230 (4.4)
Utilities	177 (3.4)
Real estate	67 (1.3)
Total incidents	**5181 (100.0)**

of the demographics and characteristics of workers affected informs occupational health practice. An important element of incident assessment is therefore to determine the types of workers exposed (professionals, skilled labor, health care staff, educators, industrial workers, office staff, tellers, retail store clerks, food service workers, *etc*). Identifying populations to be assisted allows for tailoring support services, group discussions or other interventions to suit needs, cultures and preferences.

Work settings also vary in their ability to accommodate worker time off to participate in post-incident support services

Table 3: Incident frequency by multiple *vs* single incidents (2006–2008)

	Frequency	%	Valid %
Single incident	3539	68.3	80.7
Multiple incidents	848	16.4	19.3
Valid total	4387	—	—
Missing	794	15.3	—
Total incidents	**5181**	**100.0**	**100.0**

Table 4: Mean (SD) incident severity score.

	Number of incidents	Mean (SD) CrISIS score
Finance	2055	15.44 (4.72)
Wholesale and retail trade	985	11.34 (5.41)
Real estate	67	11.33 (5.00)
Utilities	177	10.97 (5.58)
Public administration	230	10.67 (4.99)
Travel and leisure	253	9.56 (4.99)
Health and education	301	9.37 (4.44)
Manufacturing	558	9.11 (4.95)
Professional	269	9.08 (5.12)
Other services	286	NA
Total	**5181**	**12.22 (5.64)**

and to recover from an incident. Environments that need to maintain continuous operation (various 24-hour operations) or remain open for public access (banks, retail stores) may not be able to shut down for any length of time. To best assist such sites, occupational health practitioners should incorporate distinctive setting features into incident response planning. Important considerations include how quickly workers have to resume duties, whether reserve employees are available from other branches or divisions as temporary replacements and the extent to which employees are eligible for time-off with pay. Where necessary, practitioners should schedule support services outside of work shifts and be versed in briefer techniques for delivering support groups.[6]

Since severe incidents and recurring traumatic events pose greater risks for worker stress and organizational disruption, intake staff encountering workgroups experiencing multiple or severe incidents should consider unique challenges they present. During incident response planning, it should be determined whether

worker and organizational needs following such events differ from those following singular or less severe incidents. Typical support strategies such as a single group session covering symptoms and constructive recovery activities may not adequately support employees and organizations following multiple or severe incidents. Specialized, more intensive or a series of individual or group support sessions may be indicated. For multiple incidents, it is important to acknowledge the workgroup's previous exposure and to incorporate their prior experience into discussions. Additionally, multiple and severe incidents warrant emphasizing observation of the workgroup over time to ensure ongoing recovery and if needed, delivering additional services.

This study has some limitations. Findings and conclusions generated from a US-based study are not generalizable to other countries. Additionally, sample-specific results from administrative data mining for one incident response unit are not applicable to other settings. Conclusions based on observational statistics must be viewed cautiously. Bivariate analyses conducted on large samples have an increased likelihood of producing statistically significant results, and significant findings do not support a causal relationship. Furthermore, an anticipated limitation of studies employing administrative data mining is that data intended for program administration may not be structured optimally for research. For example, while a low percentage (15%) of records were missing data for whether an event represented a single vs recurring incident, there is some potential for non-response bias. In addition, while the CrISIS-R scale's Cronbach's α of 0.7 was considered adequate for an exploratory study, it needs continued refinement to achieve a desired 0.9 level of reliability. Finally, analyses of pre-existing administrative data are by definition retro-

spective, precluding randomization within a controlled design, which constrains generalization.

Consistent with the objective of an observational investigation, this study generated several directions for further research. Given the inability to generalize from administrative data mining studies and the limitation on making causal inferences based on bivariate associations, prospective and randomized research needs to confirm findings of relationships between incident severity level, industry setting or multiple incidents.

Given that only part of the variance in CrISIS-R scores was explained by setting and multiple incidents and the potential for an interactive effect between industry settings, multiple incidents and other variables multivariate analysis is indicated. For example, a logistic regression would produce a predictive model indicating how much, or whether, each variable contributes to variations in CrISIS-R score, and whether other variables intervene between industry setting and CrISIS-R score. Further research could confirm whether comprehensive incident response plans with well-developed psychological support components increase worker resistance to symptoms of traumatic stress or whether organizations experience less disruption to operations.

Critical incidents occur within the context of pre-existing work and organizational stressors. Further studies can examine whether there is reciprocal impact, where a critical incident exacerbates existing organizational stressors or where existing stressors exacerbate critical incident effects. For example, in an environment where workers routinely experience high stress levels due to work demands, overload or labor-management conflict, research could explore whether worker's traumatic stress symptoms post-incident are greater than within environments without such chronic stressors, and reciprocally, whether the effect of a critical incident exacerbates such pre-existing stressors.

While data available in this study indicate CrISIS-R scores varied among industry categories, they do not provide any insight into the independent influence of specific characteristics of settings, apart from the industry category. Setting characteristics include nature of work, types of employees, organizational culture, site security, work environment and many other variables. As an alternative to researching classifications based on general industry categories (finance, trade setting, manufacturing, *etc*), research based on various setting characteristics could examine relationships between characteristics and outcomes for workers and organizations. For example, research could explore which types of workers respond best to certain approaches and interventions, matching different employee groups to interventions and adapting incident response plans accordingly.

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Conflicts of Interest: At the time of the study, the author, currently an independent organizational consultant, was employed by the organization in which the critical incident response unit operated.

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