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Health and Productivity of Commuter Railroad Employees Involved in Critical Incidents

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FTA Report No. 0019
Federal Transit Administration

PREPARED BY

Patrick Sherry, Ph.D.
National Center for Intermodal Transportation
University of Denver

U.S. Department of Transportation
Federal Transit Administration

COVER PHOTO

Edwin Adilson Rodriguez, Federal Transit Administration

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Patrick Sherry, Ph.D.
National Center for Intermodal Transportation
University of Denver
2400 S. Gaylord Street
Denver, CO 80208

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Metric Conversion Table

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
		NOTE: volumes greater than 1000 L shall be shown in m^3		
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C

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13. ABSTRACT

The effects of accidents—termed Critical Incidents—on the health and productivity of rail transit workers have not been fully investigated. Anecdotal evidence suggests lasting effects of these incidents. Surveys were obtained from 363 commuter railroad operating employees from 3 different U.S. locations regarding their involvement in Critical Incidents (CIs) such as grade crossing accidents, striking trespassers, and others, achieving a 78.6% response rate among urban workers. The survey assessed general psychological state, health, and perceived work productivity. Nearly half of all rail transit operators (43.6%) reported involvement in a CI during their careers and, of those, nearly half (48%) reported involvement in more than one incident. A total of 12.1% of those in CIs scored in the clinical range on a standard measure of post-traumatic stress disorder (PTSD). The odds of scoring in the clinical range on the PTSD measures were approximately 6 to 1 for those involved in a CI. Persons involved in CIs reported significantly higher levels of intrusive thoughts, heightened emotional arousal, and sleep disturbances. Persons involved in CIs subsequently reported more physical health difficulties and were twice as likely to report depression and miss significantly more work days (2.96) than those not involved in CIs (1.5).

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FOREWORD

The research completed under Federal Transit Administration Cooperative Agreement CO-26-7010-00 has resulted in the identification of the current prevalence rate of rail transit employees' involvement in Critical Incidents (CIs). Results indicate that nearly half of those surveyed reported involvement in CIs and that a significant number of those reported symptoms of distress following the incident. Additional results point to the greater likelihood of absenteeism and decreased confidence in overall work performance following involvement in CIs. The report concludes with several recommendations for informing both management and labor of the risks involved in rail transit operations work.

EXECUTIVE SUMMARY

Increasing recognition of the need for high-quality transit service to improve transportation and reduce congestion has fueled growing demand for new rail services throughout the United States. Rail systems have contributed to the revitalization of many major American cities, from New York to San Francisco and Washington, D.C. In 2008–2009, several rail transit systems reported a number of train-to-train collisions that resulted in 9 fatalities and 130 injuries and millions of dollars in property losses. During the same time period, three transit maintenance workers were struck and killed by trains while engaged in maintenance activity on the tracks. The effects of these tragic incidents on the health and productivity of rail transit workers has not been investigated. However, anecdotal evidence suggests that there are lasting effects of these incidents on persons employed in the industry. Surveys were obtained from 363 commuter railroad operating employees from 3 different locations throughout the eastern and western United States regarding their involvement in Critical Incidents (CIs), such as the striking of trespassers and others. The survey also assessed their general psychological state, health, and perceived work productivity. The predominantly male sample (85.7%) had an average age of 45.3 years. The response rate for the urban rail transit operator sample was 78.6 percent. Findings from the analysis of results were as follows:

- Nearly half of all rail transit operators (43.6%) are likely to be in involved in a CI at some point in their work career.
- Of those, nearly half (48%) reported involvement in more than one incident.
- A total of 47.9 percent of those involved in CIs felt that the individuals involved had made a deliberate suicide attempt.
- A total of 12.1 percent of those who experienced CIs exceeded the conservative cut-off on a standard measure of post-traumatic stress disorder (PTSD), a higher percentage than what has been found in the general population of 3.6 percent for men and 9.7 percent for women.
- The odds of developing PTSD after having been involved in a CI are approximately 6 to 1, as compared to those who had not.
- Persons who reported feeling frightened or afraid during the CI event were 5.2 times more likely to report clinically significant levels of PTSD symptoms.
- Persons involved in CIs were also found to have significantly higher levels of unwanted intrusive thoughts of the incident, heightened emotional arousal, and sleep disturbances.
- The odds of reporting severe depression were twice as high for those involved in CIs than those who were not.
- Persons involved in CIs subsequently reported more physical health difficulties than those who had not.
- Persons involved in CIs reported significantly more missed days of work than those who were not involved in CIs (2.96 days versus 1.5 days).

SECTION 1

Introduction

Every day, railroad workers are exposed to a number of conditions that involve the likelihood of exposure to critical incidents (CIs). These incidents may include accidents, near misses, collisions with other vehicles, personal injury, or contact with unauthorized individuals or equipment in the right-of-way of the train.

A recent report published by the Federal Transit Administration (FTA) (2009) indicated that the rail transit industry provided service for more than 18.5 billion passenger miles, which represented a substantial increase over 2007. During 2008 calendar year, 992 accidents were reported consistent with federal reporting guidelines. These accidents resulted in 37 fatalities and 677 injuries. In comparison to the previous year, accidents increased by 61 percent, fatalities by 5 percent, and injuries by 25 percent. The situation is of concern to public officials. Congressman James Oberstar (D-MN) (2007) stated:

> The Department of Transportation predicts that rail traffic will more than double over the next 20 years. That increase, coupled with the fact that there are far fewer workers having to meet more demands on the railways than ever before, will only exacerbate the situation. While there is both good and bad news in these statistics, the picture that emerges is clear that there is a considerable number of accidents that occur each year.

The focus of this report is to examine the effects of involvement in accidents on the health and productivity of the rail transit operator. Looking at the overall safety trends and the number of accidents and injuries that occurred over the course of the past few years, there is considerable opportunity for an individual to be exposed either to an accident, injury, or fatality. In an FTA 2009 report (FTA 2009), results of the six-year trend in accidents and incidents are reported. The trends pose substantial risk of exposure for persons involved in the railroad industry.

It should be noted that FTA does not use the same criteria for safety data for commuter rail as does the Federal Railroad Administration (FRA). FTA used the following criteria for reporting accidents, which were designated in the 2009 report:

SSO Accident Reporting Thresholds (49 CFR Part 659.33)

(1) A fatality at the scene; or where an individual is confirmed dead within thirty (30) days of a rail transit-related incident;

(2) Injuries requiring immediate medical attention away from the scene for two or more individuals;

(3) Property damage to rail transit vehicles, non-rail transit vehicles, other rail transit property or facilities and non-transit property that equals or exceeds $25,000;

(4) An evacuation due to life safety reasons;

(5) A collision at a grade crossing;

(6) A main-line derailment;

(7) A collision with an individual on a rail right-of-way; or

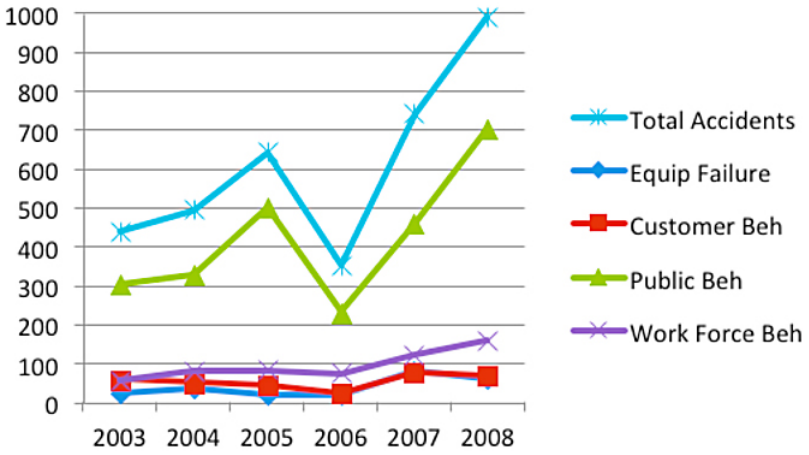
(8) A collision between a rail transit vehicle and a second rail transit vehicle, or a rail transit non-revenue vehicle.

Table 1-1 *10-Year Commuter Railroad Safety Trends*

Category	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	% Change from Last Year	% Change from 1996
TOTAL ACCIDENTS/ INCIDENTS	2,314	2,210	1,959	2,032	2,023	2,128	1,912	1,918	1,818	1,796	-1.08	-22.39
Total fatalities	75	93	62	61	74	99	92	66	74	81	9.46	8.00
Total injuries	2,299	2,045	1,816	1,891	1,900	1,978	1,797	1,804	1,650	1,849	12.06	-19.57
Employee-on-duty deaths	5	3	2	2	0	2	3	2	3	1	-66.67	-80.00
Employee-on-duty injuries	1,620	1,402	1,259	1,260	1,280	1,308	1,163	1,097	968	958	-0.79	-40.86
Trespasser deaths, not at												
highway-rail grade crossings	46	68	42	45	58	68	60	40	42	40	-4.44	-13.04
TRAIN ACCIDENTS	100	85	89	77	105	127	137	147	149	113	-46.75	13.00
Train accident fatalities	14	1	0	1	2	0	3	0	0	13	1,300.00	-7.14
Train accident injuries	122	11	6	4	21	47	110	83	36	232	4,900.00	90.16
Collisions	11	11	15	8	8	10	10	7	9	5	-50.00	-54.55
Train accidents on main line	66	48	63	49	74	86	83	92	94	80	-28.57	21.21
Incidents at public crossings	78	62	54	71	68	85	86	86	96	93	-4.23	19.23
OTHER ACCIDENTS/ INCIDENTS	2,132	2,059	1,812	1,880	1,849	1,912	1,681	1,681	1,569	1,588	1.01	-25.52
Other incidents fatalities	47	75	46	48	59	73	66	45	49	45	-8.33	-4.26
Other incidents injuries	2,119	2,016	1,795	1,862	1,811	1,859	1,631	1,642	1,533	1,554	1.13	-26.66

Figure 1-1

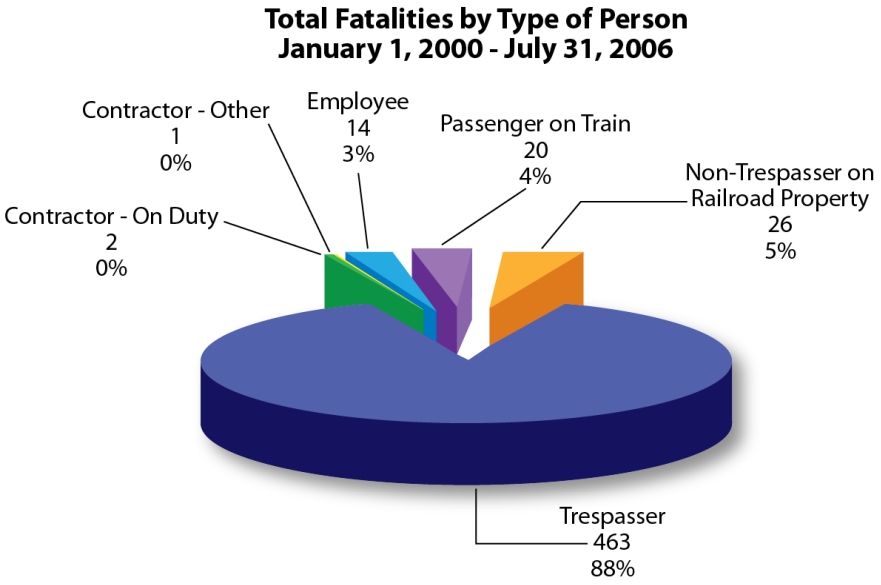
Railroad accident and injury rates, 2003–2008



In addition to the overall trends shown in Figure 1-1, the categories of individuals involved in fatal accidents show that of the total (463), the majority (88%) were unauthorized trespassers.

Figure 1-2

Fatalities by type for FTA-funded commuter railroads



Exposure to these types of events is considered a significant or critical event or incident. In fact, the recent Rail Safety Improvement Act (RSIA, 2008) identified Critical Incidents, called CIs in the railroad industry, as an important safety concern and legislated mandatory time off if requested and the development of CI stress reduction plans stress plans to alleviate the effects of these incidents.

While these incidents are fairly well documented, the risk of exposure for railroad employees is not easy to quantify. In the freight industry, according to statistics released by FRA in 2006, there were 2,908 highway-rail accidents, in which there were 362 fatalities and 999 injuries. In 2006, grade crossing fatalities increased by 1.4 percent, to 362, and trespass fatalities—the number one cause of all rail-related deaths—increased by 14.5 percent, to 530. These events can be very traumatic to the railroad employees involved. Extrapolating from these numbers, at least 3,782 railroad employees were involved in CIs in which a serious threat of injury or harm either to self or others may have occurred. At least 362 railroad employees were exposed to fatalities, and nearly 1,000 were exposed to injuries. Thus, a large number of freight railroad employees were exposed to potentially traumatic incidents in 2006 alone.

According to data provided by the Association of American Railroads (AAR 2009), approximately 67,632 people worked in transportation, train, and engine (TY&E) service for the railroad industry. Using that estimate, about 4.1 percent of TY&E railroad employees in 2007 were possibly exposed to traumatic incidents.

Looking over the last 10 years of data, the average number of highway-rail accidents was 3,261. If we assume that none of the railroad employees were involved in repeat highway-rail accidents, then 32,610 TY&E railroad employees—almost half of the entire work force—could have been exposed to traumatic incidents over a 10-year period. Following similar logic with the commuter railroads using the data provided in Figure 1-1, we could expect an average of 610 accidents per year with a total of 3,665 accidents over the last 6 years. Thus, at the very least, on average, about 600 persons were exposed to a CI annually. Assuming that the entire commuter rail workforce is in the neighborhood of 6,000–7,000 employees, then about half of the commuter and light rail workforce could have been exposed to a CI over the past 6 years. These numbers are only speculative, but suggest that there may be a reasonable risk of exposure over the course of an employee's career in the commuter rail industry.

Effects of Involvement in Critical Incidents

Psychological Effects

The effects of exposure to traumatic events in the rail industry have not been extensively studied. Anecdotal evidence provided by seasoned railroad personnel describes the numerous emotional reactions that railroad employees experience in relation to involvement with these events.

The psychological impacts of involvement in traumatic railway accidents has been written about since as early as 1882, which described so-called "Railway Spine" or the occurrence of numerous physical ailments without an apparent physical cause. Harrington (2003), a scholar specializing in the history of railroad at the University of York, England, wrote an article summarizing the literature and early writings:

> The railway accident as an agent of traumatic experience occupies an important place in the history of mid- and late-nineteenth-century medical and medico-legal discourses over trauma and traumatic disorder. In fact it can be argued that systematic medical theorization about psychological trauma in the modern west commenced with the responses of mid-Victorian medical practitioners to the so-called "Railway Spine" condition, which was characterized by the manifestation of a variety of physical disorders in otherwise healthy and apparently uninjured railway accident victims. The investigation of this condition led many nineteenth-century surgeons to examine the role of psychological factors—variously referred to as "fright," "terror," or "emotional shock"—in provoking physical disorders, some thirty years before Freud and Breuer considered the matter in *Studies on Hysteria*, and half a century before the advent of shell shock among the soldiers of the First World War brought a general recognition of the reality of the "psycho-neuroses. (Harrington 2003)

These reports laid the groundwork for the subsequent development of the term "shell-shock" and, later, the more modern term "post-traumatic stress disorder" (PTSD).

A small body of work regarding the response of railway personnel to CIs such as pedestrian suicide and persons being struck by trains has been reported. For example, Cocks (1989), addressing railway suicide, stated that, "The mental distress of the train drivers has been compared to the post-traumatic stress syndrome suffered by Vietnam veterans" (p. 96). In Stockholm, Theorell et al. (1992) followed 40 subway train drivers for a year after a "person under train" (PUT) incident to determine driver reactions. Sick leave was substantially greater for those drivers involved in a CI, as compared to other drivers. Additionally, driver absences were greater when the victim had suffered severe injury or death as compared to minor injuries.

Another study conducted with the Swedish and Norwegian State Railways (Karlehagen et al. 1993) was designed to study the acute and longer-term responses of 101 train drivers involved in PUT incidents. Drivers were assessed at three separate times: within a few days after the incident, at one month, and at one year. During Time 1 measurement (within a few days of the incident), drivers reported moderate to high distress as measured by the Impact of Event Scale (IES) and the General Health Questionnaire (GHQ-28). Of the symptoms reported, distressing intrusive visual images were experienced most often. The authors stated that the "… relative dominance of intrusive symptoms … is basically the same finding as seen in disaster studies …" of acute stress responses (Karlehagen et al. 1993, 804). At the Time 2 (one-month follow-up), a significant reduction in distress was documented, and the same was true for the Time 3 (one-year follow-up). However, of the sample, 10 percent continued to report distress that infringed upon the quality of their life in a subjectively significant way. The researchers did not attempt to explain these findings further.

Vatshelle and Moen (1997) found that a large sample of Norwegian locomotive engineers who had not experienced a CI had better present health. Among those who had been involved in a CI, a correlation was found between recalled psychological distress and present health problems. In the U.S., Napper (1998) found that 75 percent of locomotive engineers had experienced a CI, while Margiotta (2000) found a significant correlation between the locomotive engineers who had experienced a CI and the development of Acute Stress Disorder (ASD).

Sherry and Philbrick (2003) reviewed the existing literature and concluded that a significant number of life-threatening events and occurrences were prevalent in the transportation industry. Their review showed that survivors of transportation accidents anywhere from 13–23 percent of survivors of transportation accidents could develop "severe short and long-term symptoms of psychological distress" (144).

A study by Cothereau et al. (2004) surveyed 202 French train drivers immediately following a PUT accident and 186 who had not been involved in an incident. Drivers were assessed at three months as well as one, two, and three years later. The GHQ-28 and several other questionnaires were used to assess symptoms. In the exposed group, after three months, the prevalence of post-traumatic stress was 4 percent, which was significantly higher than that observed for the drivers who had not experienced an incident. However, all of these differences disappeared within a year. Interestingly, the authors noted that drivers who were allowed to drive alone after an incident were more likely to develop symptoms. In all, more than 95 percent of study participants had no short-, medium-, or long-term impairment of their occupational fitness. Using the same data set, Limosin et al. (2006) determined that 15 days after the event, PUT drivers reported more ASDs than control drivers. However, these differences were absent three months as well as one year later.

Sherry and Fazio (2006) administered the PTSD Checklist (PCL-C) to 188 out of 283 (66%) locomotive engineers and conductors who worked in a specific Midwestern location of a large freight rail transportation company. In addition to the PCL-C, the participants also completed the Shiftwork Index, which includes measures of family and supervisor support as well as job satisfaction and stress following involvement in train/auto collisions. Results of the assessment revealed that 64.3 percent of the respondents reported involvement in a grade crossing or trespasser incident, with an average of 3.4 incidents per respondent. Using the most conservative cut-off criteria on the PCL-C of a score greater than 2 on 3 of the major symptom clusters, 34 percent of respondents met the criteria for PTSD using the PCL-C. Using the most conservative cut-off (Blanchard and Hickling 1997), 16 percent met the criteria of presumptive PTSD.

Finally, Yuma et al. (2006) conducted a study of 639 Korean railroad employees who were mailed a survey regarding their reactions to PUT events. The questionnaire consisted of a number of regularly-used instruments including the Impact of Events Scale (IES), and an impressive response rate of 79.9 percent was obtained. The authors concluded that those persons who had experienced PUT events reported more negative physical and psychological symptoms than those who did not.

These studies suggest that there may be some serious psychological consequences to being involved in the types of accidents and injuries that are not uncommon in the railroad industry. Based on these reports, anywhere from 10–16 percent of persons who have been exposed to railroad related incidents may report considerable distress for some time following the event.

PTSD

DSM-IV-TR Criteria for PTSD. In 2000, the American Psychiatric Association revised the PTSD diagnostic criteria in the fourth edition of its *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)* (APA 2000). The diagnostic criteria (A–F) are specified below.

Diagnostic criteria for PTSD include a history of exposure to a traumatic event meeting two criteria and symptoms from each of three symptom clusters: intrusive recollections, avoidant/numbing symptoms, and hyper-arousal symptoms. A fifth criterion concerns duration of symptoms, and a sixth assesses functioning.

Criterion A: Stressor

The person has been exposed to a traumatic event in which both of the following have been present:

1) The person has experienced, witnessed, or been confronted with an event or events that involve actual or threatened death or serious injury, or a threat to the physical integrity of oneself or others.
2) The person's response involved intense fear, helplessness, or horror. Note: In children, it may be expressed instead by disorganized or agitated behavior.

Criterion B: Intrusive Recollection

The traumatic event is persistently re-experienced in at least one of the following ways:

1) Recurrent and intrusive distressing recollections of the event, including images, thoughts, or perceptions. Note: In young children, repetitive play may occur in which themes or aspects of the trauma are expressed.
2) Recurrent distressing dreams of the event. Note: In children, there may be frightening dreams without recognizable content.
3) Acting or feeling as if the traumatic event were recurring (includes a sense of reliving the experience, illusions, hallucinations, and dissociative flashback episodes, including those that occur upon awakening or when intoxicated). Note: In children, trauma-specific reenactment may occur.
4) Intense psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event.
5) Physiologic reactivity upon exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event.

Criterion C: Avoidant/Numbing

Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (not present before the trauma), as indicated by at least three of the following:

1) Efforts to avoid thoughts, feelings, or conversations associated with the trauma.

2) Efforts to avoid activities, places, or people that arouse recollections of the trauma.
3) Inability to recall an important aspect of the trauma.
4) Markedly diminished interest or participation in significant activities.
5) Feeling of detachment or estrangement from others.
6) Restricted range of affect (e.g., unable to have loving feelings).
7) Sense of foreshortened future (e.g., does not expect to have a career, marriage, children, or a normal life span).

Criterion D: Hyper-Arousal

Persistent symptoms of increasing arousal (not present before the trauma), indicated by at least two of the following:

1) Difficulty falling or staying asleep.
2) Irritability or outbursts of anger.
3) Difficulty concentrating.
4) Hyper-vigilance.
5) Exaggerated startle response.

Criterion E: Duration

Duration of the disturbance (symptoms in B, C, and D) is more than one month.

Criterion F: Functional Significance

The disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functioning. Acute—if duration of symptoms is less than three months. Chronic—if duration of symptoms is three months or more.

Prevalence of PTSD. The term used to describe the extent to which a specific disorder occurs in the population over a period of time is called prevalence. Similarly, the proportion of the population that has a given disorder at a specific time is also termed prevalence. Typically, we refer to the lifetime or past-year prevalence of a specific disorder to indicate the relative likelihood of its occurrence. Prevalence is the proportion of people in a population that have a given disorder at a given time and is usually expressed as the number of cases per 100 in the population (Beaglehole et al. 1993). This ratio represents the existing cases of a disorder in a population or group. Prevalence estimates can be influenced by many factors, including the duration of the disorder and the number of occurrences or outbreaks. Estimates can differ by demographic factors such as age, gender, and location. It is important to qualify prevalence estimates with the

time at which they were measured, as prevalence estimates can shift over time. Similarly, when interpreting prevalence estimates, it is important to keep in mind that prevalence is dynamic—it can change over people, places, and time.

Often, prevalence is discussed in terms of lifetime prevalence. Other times, statistics will be given on current prevalence of PTSD in a given time frame, usually one year.

Helzer et al. (1987) reported on the prevalence of PTSD as part of an epidemiologic survey of 2,493 participants from the general population. The prevalence of a history of PTSD was 1 percent in the total population, about 3.5 percent in civilians exposed to physical attack and in Vietnam veterans who were not wounded, and 20 percent in veterans wounded in Vietnam. PTSD was associated with a variety of other adult psychiatric disorders. Although some symptoms of PTSD, such as hyper-alertness and sleep disturbances, occurred commonly in the general population, the full syndrome, as defined by the *Diagnostic and Statistical Manual of Mental Disorders, Third Edition*, was common only among veterans wounded in Vietnam.

More recent studies have also been conducted. To assess the prevalence of a wide variety of psychiatric disorders, a national study was conducted in 2001 and 2003 based on in-depth interviews of a nationally-representative sample of 9,282 adults ages 18 years and older. This study, the National Comorbidity Study-Replication (NCS-R), estimated the lifetime prevalence of PTSD to be 6.8 percent and past-year PTSD prevalence at 3.5 percent (Kessler et al. 2005).The study further determined that lifetime prevalence of PTSD among men as 3.6 percent and women as 9.7 percent. The 12-month prevalence was 1.8 percent among men and 5.2 percent among women (National Comorbidity Survey 2005).

Table 1-2

PTSD Prevalence Studies

Study	Year	N	Lifetime %
Helzer	1987	2,493	1.0
Kessler	1995	8,098	7.8
Blanchard & Hickling	1996		16
Kessler	2005	9,282	6.8
Bronner	2009		3.8

These results are similar to those reported earlier by Kessler et al. (1995) in their large-scale interview study of 8,098 adults ages 15–54 years. They estimated lifetime prevalence at 7.8 percent in the general population, with women (10.4%) being twice as likely as men (5%) to have PTSD at some point in their lives.

PTSD among returning combat veterans was studied by Tanielian and Jaycox (2008), who found that the prevalence of current PTSD among veterans returning from the conflict in Iraq and Afghanistan was 13.8 percent.

Depression

Another possible consequence of exposure to traumatic incidents or events may be some symptoms of depression. Many factors are thought to influence the occurrence of depression, such as genetic predisposition, biological factors, imbalances of neurotransmitters, and the like. However, it is also thought that the interaction between characteristics of the individual and the occurrence of stressors and stressful life events may trigger depressive symptoms in some individuals.

Depression is a disorder recognized by the American Psychiatric Association (APA 1994). Recently, concerns about the lack of recognition of the prevalence and effects of depression have promoted studies that have estimated the cost of untreated depression in the workplace to be in the billions of dollars (Kessler and Frank 1997; Wang et al. 2006).

Definition of Depression. Hippocrates (460–377 BC) identified melancholia as a condition and postulated that it was caused by an excess of black bile (Jackson 1990). Depression was first identified by Aristotle as melancholia. Modern conceptualizations of depression were first described by Kreapelin (as cited in Jackson 1990) and included reference to the term "manic depressive." His system of classification of the psychiatric illness of the time formed the conceptual basis of what has now become the *Diagnostic and Statistical Manual of Mental Disorders* (APA 2000). Kraeplin (19139) wrote a chapter on manic depressive illness in his T*extbook of Psychiatry for Students and Physicians (Psychiatrie. Ein Lehrbuch fur Studierende und Urzte)* (1913). However, modern conceptualizations of depression have differentiated the two terms into depressive disorders and bi-polar disorders.

Symptoms of Depression. A Major Depressive Episode (MDE) is characterized by the following symptoms:

A. Five (or more) of the following symptoms have been present during the same two-week period and represent a change from previous functioning; at least one of the symptoms is either (1) depressed mood or (2) loss of interest or pleasure.

   1) Depressed mood most of the day, nearly every day, as indicated by either subjective report (e.g., feels sad or empty) or observation made by others (e.g., appears tearful). Note: In children and adolescents, can be irritable mood.

   2) Markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day (as indicated by either subjective account or observation made by others)

   3) Significant weight loss when not dieting or weight gain (e.g., a change of more than 5% of body weight in a month), or decrease or increase in appetite nearly every day. Note: In children, consider failure to make expected weight gains.

4) Insomnia or hypersomnia nearly every day.
5) Psychomotor agitation or retardation nearly every day (observable by others, not merely subjective feelings of restlessness or being slowed down).
6) Fatigue or loss of energy nearly every day.
7) Feelings of worthlessness or excessive or inappropriate guilt (which may be delusional) nearly every day (not merely self-reproach or guilt about being sick).
8) Diminished ability to think or concentrate, or indecisiveness, nearly every day (either by subjective account or as observed by others).
9) Recurrent thoughts of death (not just fear of dying), recurrent suicidal ideation without a specific plan, or a suicide attempt or a specific plan for committing suicide.

B. The symptoms do not meet criteria for a Mixed Episode.

C. The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.

D. The symptoms are not due to the direct physiological effects of a substance (e.g., a drug of abuse, a medication) or a general medical condition (e.g., hypothyroidism).

E. The symptoms are not better accounted for by Bereavement, i.e., after the loss of a loved one, the symptoms persist for longer than 2 months or are characterized by marked functional impairment, morbid preoccupation with worthlessness, suicidal ideation, psychotic symptoms, or psychomotor retardation.

For more detail on symptoms, see the *DSM-IV* (APA 2000).

Prevalence of Depression. Estimates of the prevalence of depression in the population come from two large national surveys (Regier et al. 1993; Kessler et al. 1994). These studies suggest that approximately 6.2 percent will experience a mood disorder at some point in their lifetime, approximately 6.5 percent will experience major depression, and 1.6 percent will experience dysthymia (depressed mood that lasts for an extended period of time). According to the *DSM-IV* (APA 1994), the lifetime risk for major depressive disorder in community samples has ranged from 10–25 percent for women and 5–12 percent for men. Point prevalence, or current prevalence, was estimated to be 5–9 percent for women and 2–3 percent for men. Major depressive disorder currently has been defined as having a Major Depressive Episode during the previous 12 months.

Kessler (1994) estimated the 12-month prevalence of Major Depressive Episode using the DSM-III-R diagnostic criteria as 7.7 percent for males and 12.9 percent

for females and a total prevalence rate of 10.3 percent. This represents an 8.6 percent prevalence rate for major depressive disorder.

12-Month Prevalence. In 2004, the World Health Organization (WHO) published the results of its global survey of prevalence of mental disorders, which covered 60,463 adults from 14 countries in Asia, Africa, the Americas, Europe, and the Middle East (WHO 2008). Results of the studies showed that the likelihood of having any disorder in the previous 12 months varied from 4.3 percent in Shanghai to 26.4 percent in the U.S. Twelve-month prevalence of mood disorders in the U.S. was found to be 9.6 percent (a 95% CI was 8.8–10.4%).

Kessler et al. (2005) replicated the National Comorbidity Study and looked at the 12-month prevalence of mental disorders. In a nationally representative sample of adults ages 18+, 9,282 participants were interviewed using the WHO Composite International Diagnostic Interview (CIDI). Twelve-month prevalence estimates were anxiety, 18.1 percent; mood, 9.5 percent; impulse control, 8.9 percent; substance, 3.8 percent; and any disorder, 26.2 percent. Of 12-month cases, 22.3 percent were classified as serious, 37.3 percent as moderate, and 40.4 percent as mild. A total of 55 percent carried only a single diagnosis, 22 percent carried 2 diagnoses, and 23 percent carried 3 or more diagnoses. These incidence rates are similar to those obtained in the WHO 2004 study. The same year, Hasin et al. (2005) reported that the 12-month MDD prevalence rate was 5.28 percent for the total population, 3.56 percent for males, and 6.87 percent for females.

Another large-scale study (Compton 2006) looked at the prevalence of an MDE in the past year using the DSM-IV definitions of depression that require the presence of a clinically-significant level of depression, namely, impairment in work or social relations. The results of this survey showed that for a nationwide cross-sectional survey of 42,000 adults, the rate of past-year Major Depressive Episodes was 7.06 percent. The previous 12-month prevalence rate reported for 2001–2002 was 4.88 for men and 9.06 for women. Interestingly, episodes of major depression were noted among 15.06 percent of persons who met the criteria for a concurrent substance abuse disorder. Furthermore, a prevalence rate of 17.46 percent for depression with comorbid substance abuse was found for those ages 18–29 as compared to a 12.36 percent rate for those persons 45 years of age and older.

Some shrinkage in the 12-month prevalence estimates has been attributed to the change in the diagnostic criteria used since the 1994 study. Primarily, the addition of the so-called "clinical significance criteria" assessed whether the person was distressed or that their work performance was affected by the symptoms they suffered.

Table 1-3
12-Month Prevalence of MDD

Study	N	Measure	Any Mood Disorder	MDD	Dysthymia
Weisman (1991)	18,571			3.0	
Kessler (1994)*	8,098	*DSM-III-R*	11.3	8,6	2.5
Narrow (2002)			7.5	6.4	1.8
WHO (2004)	60,463		9.6		
Kessler (2005)	9,282	*DSM-IV*	9.5	6.6	1.5
Hasin (2005)	43,093	*DSM-IV*		5.28	
Compton (2006)*	42,000			7.06	

* Studied Major Depressive Episode in last 12 months.

Costs of Depression. The effects of depression on workplace behavior have recently received additional attention. A study by Wang et al. (2003) found that depression was significantly associated with quantity, quality, and overall work performance, absenteeism (in hours off), and CIs that consisted of accidents, injuries, or special success or failures. Specifically, depression was associated with approximately 188 days absent per 100 workers, in excess of what the typical worker would produce. Similarly, depression was associated with 8.9 excess negative CIs (e.g., accidents) as compared to 14.7 for customer service representatives and 4.0 for executives. These and other data point to the need to look more closely at the effects of depression on work performance in the railroad industry.

Wang et al. (2004) studied a sample of 105 reservations agents and 181 customer service agents over a 7-day period. Respondents were given pagers and asked to provide data at five times each day. Results of these analyses identified seven medical conditions that were analyzable. Significant reductions in work performance were obtained for persons who had depression. These results indicate that work performance decrements and absenteeism were calculated to be the equivalent of 2.3 lost work days or absences per month.

Kessler et al. (2006) examined the data from the National Comorbidity Study Replication and found that, with a sample of 3,378 workers, a total of 1.1 percent of the workers met the criteria for bipolar disorder (I or II) in the previous 12 months and 6.4 percent met the criteria for major depressive disorder. Bipolar disorder was associated with 65.5 lost workdays, and major depressive disorder was associated with 27.2 lost workdays. Using average estimates for wages, the study suggests that $4,426 per year per worker can be associated with the effects of major depression. These calculations can be extended nationally to an estimate of 225 million days per year at a cost of $36.6 billion of salary equivalent lost days in productivity.

Health Effects

The psychological effects of reactions to traumatic events have been discussed above. However, the question that also must be asked is whether these events also create other effects, such as having an impact on health or productivity.

At one level, there is some evidence that supports the idea that involvement in a trauma may affect health. For example, Boscarino (2008) examined the prevalence of heart disease and PTSD in more than 4,000 Vietnam veterans. He found that the more the severe the diagnosis of PTSD, the greater the likelihood of cardiovascular involvement.

PTSD has been consistently associated with a greater likelihood of cardiovascular morbidity. In a recent study, Boscarino (2008) used electrocardiogram (ECG) findings to compare the cardiovascular function of Vietnam veterans with PTSD to the cardiovascular function of veterans without PTSD. After controlling for risk factors such as alcohol consumption, weight, current substance abuse, and smoking, in addition to controlling for current medication use, PTSD was found to be associated with nonspecific ECG abnormalities, atrioventricular conduction defects, and infarctions. Because the PTSD group in this study included only those veterans with severe PTSD, it is important to interpret it with caution.

A study by Kibler, Joshi, and Ma (2009) found significant correlations between PTSD and depression and hypertension. A study of Croatians by Kulenović, Kučukalić, and Maleč (2008) with combat-related PTSD found a significantly higher level of cholesterol, LBL, and HDL in patients with PTSD than a group of control patients. The authors concluded that chronic PTSD is associated with dyslipidemia, leading to an increased risk of coronary artery disease.

Metabolic syndrome is composed of a cluster of clinical signs including obesity, high blood pressure, and insulin resistance and is also associated with cardiovascular disease. Researchers studied a group of male and female veterans presenting for screening and treatment within the PTSD programs at the Cincinnati Veterans Affairs Medical Center (Heppner 2009). The sample was primarily male (92%) and Caucasian (76%), with an average age of 52 years. A majority of the sample was U.S. Army veterans (71%), and close to 70 percent were Vietnam veterans. Clinical data indicate that more than half (55%) of these veterans had moderate to severe levels of PTSD, and 64 percent met criteria for MDD. About 40 percent of the veterans met criteria for metabolic syndrome. Taking age, gender, depression, and substance abuse into consideration, they found that those with a higher degree of PTSD were more likely to meet the diagnostic criteria for metabolic syndrome. In addition, the rate of metabolic syndrome was higher among those with PTSD (34%) than in those with MDD (29%). For those with both PTSD and MDD, 46 percent met criteria for metabolic syndrome.

Spitzer et al. (2009) examined the medical histories of 3,171 adults living in the community. They were administered the PTSD module of the Structured Clinical Interview for *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition* (APA 2000) and were assigned to three groups:

no trauma (n = 1440); trauma, but no PTSD (n = 1669); and trauma with subsequent PTSD (n = 62). Results indicated that persons with a history of had higher odds ratios (ORs) for angina pectoris and heart failure (OR = 1.2; 95% Confidence Interval [CI] = 1.1-1.3), stroke (OR = 1.2; 95 CI = 1.0-1.5), bronchitis, asthma, renal disease, and polyarthritis (ORs between 1.1 and 1.3) compared with non-traumatized participants. The PTSD positive subsample had increased ORs for angina (OR = 2.4; 95% CI = 1.3-4.5), heart failure (OR = 3.4; 95% CI = 1.9-6.0), bronchitis, asthma, liver, and peripheral arterial disease (ORs, range = 2.5-3.1). The authors concluded that their findings suggest a strong association between PTSD and cardiovascular and pulmonary diseases.

Cohen et al. (2009) investigated the relationship between PTSD and cardiovascular disease in a cohort of 1,022 men and women with coronary heart disease. Nine percent of the study participants were diagnosed with current PTSD and were more likely to report at least mild symptom burden (57% vs. 36%), mild physical limitation (59% vs. 44%), and mildly diminished quality of life (62% vs. 35%) (all P < or = .001). When adjusted for cardiovascular risk factors and objective measures of cardiac function, PTSD was associated with greater symptom burden (OR= 1.9; CI= 1.2-2.9; P < .004), greater physical limitation (OR= 2.2; CI= 1.4-3.6; p< .001), and poor quality of life (OR= 2.5; CI= 1.6-3.9; p< .001). The authors surmised that for patients with heart disease, PTSD is more strongly associated with patient-reported cardiovascular health status than objective measures of cardiac function.

Taken together, these findings suggest a need to gather additional information about the extent to which commuter railroad workers are exposed to CIs. In addition, it should be determined what, if any, are the physical and/or psychological health consequences of exposure to a CI and what, if any, are the effects of exposure on the health and safety of commuter railroad employees.

SECTION 2

Methodology

Participants

Study participants were commuter railroad workers in various locations across the United States. Because there were adequate resources available, all employees at a particular location who were eligible to work were invited to participate in the study.

Table 2-1

Survey Locations and Sample Sizes

Location	N	Response Rate
West Coast	30	51.7%
East Coast	72	48.3%
Urban	293	78.6%

All individuals who reported for duty at a specific location were approached as they came on duty at their workstations and terminals and were invited to participate in a survey of attitudes and health effects associated with railroad work. Research assistants were trained counselors with at least a master's degree in psychology and training in dealing with psychological and emotional concerns. A consent form, approved by the University of Denver Institutional Review Board, was presented and explained. All participants were informed that their participation was voluntary and that they could discontinue participation in the survey at any time. Confidentiality was also offered due to the fact that the survey was covered by the Certificate of Confidentiality granted by the National Institute of Health.

To ensure that a representative sample was obtained, researchers made every effort to contact all employees who reported to work during the two- or three-day period. Thus, all members of the available workforce were invited to participate as they reported for duty during the 36–72 hour period. This ensured that persons were not embarrassed or singled out. In addition, this procedure was used to increase response rate and sample size. Demographic and descriptive characteristics of the respondents are presented in Table 2-2.

Table 2-2

Demographic Characteristics of Sample

Characteristic	N	%
Gender		
Male	270	85.7
Female	45	14.3
Not reported	55	
Total	370	
Race		
White	76	24.8
Asian	9	2.9
Black	109	35.5
Native American	8	2.6
Hispanic	91	29.6
Other	14	4.6
Not reported	63	
Marital Status		
Single	70	22.4
Married	182	58.1
Divorced	29	9.3
In a relationship	32	10.2
Not reported	50	
Education		
Average years	13.6	
Median	13.0	
Mode	12.0	
SD	1.7	
Minimum	10.0	
Maximum	20.00	

Samples were obtained from several different regions of the country from at least two major carriers. The exact locations are not described in order to protect the identities of the collaborating organizations. A concerted effort was made to obtain participation from another west coast railroad and a Midwest railroad. However, efforts were unsuccessful due to concerns that layoffs, as a result of significant downturn in the economy, and potential litigation would expose employees to unnecessary psychological distress and discomfort.

Interestingly, the age distribution of the group was bimodal with (M=45.3, Median=46, Mode=48, SD=48). The average number of years worked was 14.8. However, 34 percent of employees had worked less than 10 years, 54 percent had worked 16 years or less, and 32 percent had worked 20 years or more. This presents an interesting set of demographics when trying to generalize to the entire population.

Table 2-3

Additional Descriptive Statistics

Characteristic	N	%
Craft		
Train operator	143	46.9
Conductor	162	53.1
Other	1	0.3
Not reported	61	
Length of Time with Company (yrs)		
Average	14.8	
Median	15.0	
Mode	11.0	
SD	9.6	
Minimum	0.42	
Maximum	37.0	

Measures

Involvement in Critical Incidents

Respondents were administered a series of questions designed to assess their involvement in CIs. These were defined as an event such as "a grade crossing accident, a trespasser incident, a personal injury, or an assault." Respondents were asked to indicate whether they had been involved in an incident (Yes or No), how many incidents, whether a person was killed, whether the person was a trespasser or unauthorized person, whether the incident involved a suicide, whether the person attempted to assault or threaten the employee, and whether the employee was frightened by the incident. Respondents were also asked to provide a list of events and a brief description of the date and the incident itself.

An additional series of questions was also asked to determine what occurred after the incident, including who the employee talked to (e.g., supervisors, peers, physicians, medical personnel, etc.) and whether those experiences were helpful.

Post-traumatic Symptom Disorder Checklist (PCL-C)

Respondents completed the PTSD-Checklist for Civilians (Weathers et al. 1996), a 17-item instrument designed to determine the extent to which a person reported various psychological symptoms of stress following an incident. The items were based on the DSM-IV criteria for PTSD. Respondents were asked to indicate the extent to which they have been "bothered" by each symptom during the previous month using a 5-point Likert scale, with 1 = "Not at all" and 5 = "Extremely." Some scoring systems use the "rule of 3," in which a score of 3 is necessary for the presence of a symptom to be significant. Wilson and Keane (1997) endorse the PCL-C as a "… time and cost efficient [tool] in the multi-method assessment process" (275). The instrument reportedly has "… good sensitivity (0.82) and specificity 0(.83), and is positively correlated with standard

measures of PTSD…." (275). Time to complete this scale typically ranges from 5–7 minutes. Weathers (1999) examined the reliability and validity of the instrument in comparison to the Clinician Administered PTSD Scale (CAPS) and found it had adequate reliability and validity.

One of the problems with the PCL-C is the lack of agreed-upon cut-off scores to diagnose PTSD across populations. Different cut-off scores have been suggested, from 44 and 45 to as high as 50 for combat veterans, rape survivors, and firefighters, respectively (Ruggerio et al. 2003). In general, the greater the total PCL-C score, the greater the likelihood the individual is experiencing significant psychological distress, if not full-blown PTSD. Therefore, the total PCL-C score in many ways is a good indicator of psychological adjustment to a traumatic event. While support for the diagnostic utility of the PCL-C is inconsistent across populations, the measure offers valuable clinical information regarding the number and intensity of PTSD-related symptoms experienced by individuals exposed to various types of trauma. Due to the sensitive nature of the topic, the importance of correctly identifying the percent of persons possibly affected by involvement in CIs and the possible unintended consequences of overestimating the effects of involvement in CIs, a cut-off of 44 was selected.

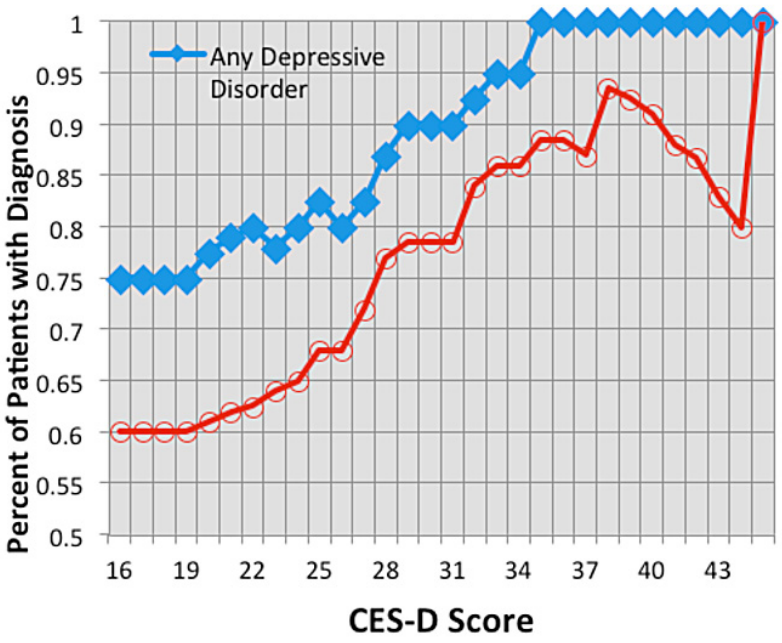
CES-D

The CES-D (Center for Epidemiological Studies Depression Scale) (Radloff 1977) is a 20-item self-report scale designed to assess depressed mood during the past week using a 4-point Likert-type response scale ranging from 0 = "Not at all" to 3 = "Most of the time." The CES-D was developed by including items from the Beck Depression Inventory (BDI) (Beck et. al. 1996), the Zung Depression Scale, and other previously-validated depression measures. It has also been validated with cardiac patients (Penninx et al. 2001) and older populations (Zich et al. 1990) and has good test-retest reliability (Ensel 1986). Scores range from 0 to 60, with higher scores indicating more symptoms of depression. CES-D scores of 16–26 are considered indicative of mild depression, and scores of 27 or more are indicative of major depression (Zich et al. 1990; Ensel 1986). Zich et al. (1990) found a cut-off score of 27 more useful for screening medical patients for depression than the usual cut-off score of 16. The cut-offs have been successfully used in studies by Ensel (1986), Zich et al. (1990), Logsdon et al. (1994), and Geisser et al. (1997).

A study by Pandya, Metz, and Patten (2005) with MS patients found that a cut-off score of >16 resulted in the correct identification of 74.5 percent of patients who were *DSM-IV* diagnosable with an MDE. Figure 2-1 shows that a cut-off score of >=28 will result in the correct classification of more than 85 percent of persons reporting an MDE. Consequently, using a cut-off score of 28 was selected for this study to determine the extent to which the CES-D detected MDE.

Figure 2-1

Depression and CES-D



Single-Item Measures of Depression

Several studies have been conducted that have attempted to shorten the BDI and the CES-D even further. More recently, there have been several published reports of attempts to use single-item measures as screening tools in various setting to facilitate additional screening and early identification of depressive conditions. For example, one item from the General Health Questionnaire (GHQ-12) (Goldberg 1972) specifically asks for information about depression. The GHQ-12 has been used to assess levels of depression, anxiety, sleep disturbance, and happiness in the general population. One item was taken from the GHQ-12 and reformatted for use with the railroad population. For the present study, one item from the CES-D scale was selected as the single-item indicator of depression. This item simply asked respondents, "To what extent have you been feeling sad or depressed?" and was rated on a 4-point Likert response format, where 0 = "Not at all" and 3 = "Very often."

Epworth Sleepiness Scale

The Epworth Sleepiness Scale (ESS) (Johns 1993) has been used extensively to assess levels of daytime sleepiness. In addition to the presence of psychological symptoms such as depression and stress, one of the consequences of exposure to traumatic incidents can be sleep disturbances. According to Gander et al. (2005), "It is accepted as reliable, internally consistent, and externally validated by comparisons with the clinical 'gold standard' sleepiness measure" (249). This questionnaire requires a respondent to rate the degree to which he or she is likely to fall asleep in eight different situations (e.g., sitting and talking to someone) using a 4-point Likert scale, where 0 = "No chance of dozing" and 3 = "High chance of dozing."

Johns (1991) reported that the mean and standard deviation for a group of 30 normal sleepers was 5.9±2.2, with a range 2 to 10. In addition, the ESS total scores were significantly different between normal and the diagnostic groups such that patients with obstructive sleep apnea, narcolepsy, and hypersomnia produced ESS total scores of 11.7±4.6, 17.5±3.5, and 17.9±3.1, respectively. A score ranging between 1 and 6 indicates that a respondent is getting enough sleep, a score of 7–8 is average, and scores of 10 and above are considered high enough that additional assessment or diagnostic study may be warranted. Thus, a score of 9 and below is considered in the normal range because it falls within two standard deviations from the mean of the group on whom the instrument was normed. A score between 10 and 13 is considered borderline, and a score of 14 or greater is considered to be in the clinical range.

Johns (1993) reported that ESS scores are significantly correlated with the Multiple Sleep Latency Test (MSLT), a behavioral measure of sleepiness ($r = -0.51$, $n = 27$, $p<0.01$). In addition, factor analysis has shown that the ESS is a unitary scale with high internal consistency (Cronbach's alpha = 0.88) and good test-retest reliability over a period of five months in normal subjects ($r = 0.82$, $n = 87$, $p<0.001$).

Recently, a study by Shen (2006) indicated that the average ESS score in a sample of 489 adult workers was 9.6±4.6 for a group of 145 people who never worked shift work and 9.5±4.5 for a group that worked more than three shifts per week. Another study by Hossain et al. (2005) reported that a sample of 93 individuals diagnosed with sleep apneas had an ESS score of 9.8±5.6. A previous study by Hossain et al. (2003) found that individuals scoring less than or equal to 8 were in the normal range and that scores >= 11 indicated hypersomnolence.

A study by Bloch et al. (1999) reported the mean ESS score and standard deviation for a sample of 159 German normals and 174 patients with various sleep disorders. The mean score for the normals was 5.7 ± 3.0, while for sleep-disordered patients it was 13.0 ± 5.1, which was significantly different from the normal group ($p<.0001$). Cronbach internal consistency scores for the measure were = 0.60 in normals and 0.83 in patients. In another study by Parker (2003), there was little relationship found between scores on the ESS that were normal and the MSLT. Thus, low scores are inconclusive, and the ESS alone cannot be used to rule out OSA. Overall, however, the data support the use of the ESS as a screening device for further assessment of sleep-related disorders.

The ESS has been used to assess sleepiness and performance in such areas as academic performance, driver simulation exercises, and the effects of fatigue on resident-physicians' professional lives and well-being. While high scores on the ESS have not been shown to be correlated with academic GPA in a population of college students (Howell, Jahrig, and Powell 2004), a study with high school students (Shin et al. 2003) and medical students (Rodrigues et al. 2002) revealed

that high scores on the ESS were significantly correlated with a decline in academic performance. A study on driving performance in narcoleptic subjects revealed a non-significant correlation between scores on the ESS and driving performance (Kotterba et al. 2004). However, a study using the York Driving Simulator with a population of healthy young adult females showed that objective and self-reported sleepiness measures were equally effective in predicting driving ability, such that high ESS scores were correlated with driving impairment (Alloway 2002). Similarly, high scores on the ESS (84% of participants scored in the clinical range) have been subjectively correlated with reduced participation in personal activities and have impacted the ability to perform work in a study of resident-physicians (Papp et al. 2004). In some cases, then, high scores on the ESS are correlated with declines in performance.

Koffel and Watson (2009) examined sleep complaints, depression, and anxiety in samples of college students, older adults, and psychiatric patients. A factor analysis revealed that sleep complaints could be reduced to two main dimensions: Insomnia and Lassitude. Both factors were significantly related to symptoms and diagnoses of depression and anxiety. However, the Lassitude factor was more strongly related to symptoms of depression and anxiety than Insomnia. In addition, Lassitude showed specificity to measures and diagnoses of depression compared with anxiety disorders. Interestingly, the authors reported that the average response of college students (N=349) to the ESS was 8.99 (sd=3.67) and to the PSQI was 6.36 (sd=3.23), and the average response to the PCL-C was 28.61 (sd=10.61). The average response of the adults to the ESS was 7.79 (sd=4.37) and to the PSQU was 6.51 (sd=4.01).

Alcohol and Substance Abuse Measures

The CAGE Questionnaire (Ewing 1984) was developed in the 1980s as a short interviewer-administered test to screen for alcoholism and problem drinking. The CAGE questionnaire, a mnemonic for attempts to cut down on drinking, annoyance with criticisms about drinking, guilt about drinking, and using alcohol as an eye-opener, is a self-report screening instrument for use in screening outpatients and those in research studies. Two or more positive answers are believed to indicate covert problem drinking. Although the CAGE and the MAST (Michigan Alcohol Screening Test) are able to detect severe forms of alcohol disorders, i.e., ICD-10 diagnoses of harmful (consumption that has caused damage to health) or dependent drinking, these screening tools do not identify those with hazardous use of alcohol. Hazardous drinking is alcohol consumption that confers risk of physical or psychological harm.

The CAGE, which can be self-administered or conducted by a clinician, poses four overt yes-no questions and requires approximately one minute to complete. Bush (2007) used the CAGE to screen 518 patients in a community hospital. Using a cut-off score of 2 (in this case, meaning 2 “yes” answers), the

investigators found that the test correctly identified 75 percent of alcoholics (sensitivity) and 96 percent of non-alcoholics (specificity). Dhalla and Kopec (2007) completed a review of 19 articles evaluating the effectives of the CAGE. Results indicated that the CAGE has shown high test-retest reliability (0.80–0.95) and adequate correlations (0.48–0.70) with other screening instruments. The authors conclude that it is a valid instrument for use in the detection of alcohol abuse and dependence in medical and surgical inpatients, ambulatory medical patients, and psychiatric inpatients (average sensitivity 0.71, specificity 0.90). Its performance in primary care patients has been varied—it has not performed well in white women, prenatal women, and college students. Furthermore, it is not an appropriate screening test for less severe forms of drinking. Thus, users should be aware of its limitations when interpreting the results. A positive screen should be followed by a proper diagnostic evaluation using standard clinical criteria.

Liskow et al. (1995) used the CAGE questionnaire in detecting alcohol dependence at a Veterans Affairs hospital. Approximately 1,667 attending the walk-in clinic were asked several questions relating to whether they were current drinkers or were seeking alcohol treatment and whether they had been hospitalized for treatment of alcoholism. Comparing CAGE results to those of a diagnostic interview using DSM III-R revealed a prevalence rate for alcoholism of 22 percent in this clinic population. The CAGE scale, when used with one or more "yes" responses indicating a positive response, achieved a sensitivity of 86 percent and specificity of 93 percent when using the diagnostic interview as the criterion standard. These studies suggest that the CAGE items are useful in identifying individuals who may be dealing with alcohol abuse problems. (Note: Unfortunately, insufficient data were obtained to warrant any analyses using this measure.)

Work Performance Questionnaire

The World Health Organization (WHO) Health and Work Performance Questionnaire (HPQ) was used as a standard measure of work performance and absenteeism. The survey was designed to measure absenteeism (missed days of work) and performance while at work (transformed to lost workday equivalents) and responses are scored to generate a summary measure of overall lost workdays in the month before the instrument is completed. Scoring of the instrument was modified to be consistent with the railroad environment and to use a simple number of days worked index. For the present study, a combined absenteeism–productivity index was developed by taking the product of the two.

Hilton et al. (2009) studied 1,324 heavy load truck drivers in Australia. They found high levels of psychological distress in full-time employees (4.5% per month) that were indicated by the presence of difficulties with attention, concentration, motivation, decision-making, visual-motor control, and psychomotor reaction times. Correlations between the WHO HPQ and depression, anxiety, and stress

were not significantly associated with driver absenteeism rates or self-rated driving performance. However, severe depression (1.5% of drivers) and very severe depression (1.8% of drivers) was associated with an increased odds ratio (OR=4.5 and 5.0, respectively) for being involved in an accident or near miss in the past 28 days.

The validity of the HPQ has been supported by a study conducted by Kessler and Wang (2006), who reported the accuracy of the questionnaire work performance assessment document's strong relationship of questionnaire measures with independently-validated payroll records and supervisor evaluations of job performance.

A recent review by Bonde (2008) found 16 studies with a combined sample of 63,000 employees. The studies included validated scales that were used to measure perceived psychosocial stressors. Major depression was defined by clinical criteria in seven studies and by symptom scales in another seven. The follow-up period ranged from 1 to 13 years. While the prevalence of depressive disorder varied substantially, the adjusted relative risk for onset of a Major Depressive Episode according to job stressors ranged from 0.5 to 1.5 in 44 of 61 reported associations with various psychosocial factor dimensions. Associations were strongest and most consistent for job strain, defined as high demand and low decision latitude among men. Most studies shared common limitations such as lack of independent measures of exposure and outcome and potential confounding. Although a meta-analysis would technically be possible, heterogeneity across studies evidenced by variation in the prevalence of depression made this unfeasible.

A prospective study by Adler et al. (2006) determined that the relationship between work characteristics and depression is complex. Although symptom remission is associated with improved job performance, deficits continue to be seen in workplace performance. At baseline and each follow-up, the depression group had significantly greater difficulties in managing mental-interpersonal, time, and output job tasks. Improvements in job performance were predicted by symptom severity. However, the job performance of even the "clinically improved" subset of depressed patients remained consistently worse than the control groups. The study by Adler compared job performance of depressed workers with that of healthy subjects and also with a sample of workers with rheumatoid arthritis. The investigators found that several aspects of everyday job performance were affected by depression. They concluded that as symptoms of depression decrease, job performance improves, but that they continue to have job performance deficits and are less productive than healthy subjects than those coping with rheumatoid arthritis. Treatment seems to have some benefit but performance deficits remain.

Kessler et al. (2006) reported that mood disorders are common among workers and can cause substantial problems with workplace performance. From scores on the WHO Comprehensive International Diagnostic Interview (CIDI), investigators identified individuals who met the diagnostic criteria for MDE or bipolar disorder. Among these individuals, they identified a subgroup of individuals who were employed at least 20 hours per week. Among these employed individuals, they found annual prevalence of 6.4 percent and 1.1 percent for MDE and bipolar disorder, respectively. These individuals were asked to report their absences from work as well as assess their performance at work on a scale in which 100 represents fully-effective work performance and 0 represents no productive work. The study estimated that MDE was associated with 8.7 days absent and 18.2 days of lost productivity per year at a cost of $4,426 per person annually. Absenteeism and presenteeism for workers with mood disorders is substantial, according to this well-designed study. Of course, those out of work completely are presumed to be even more impaired and costly.

SECTION 3

Results

Prevalence of Traumatic Events in the Work Place

In response to the single-item query as to whether the respondent had been involved in a CI at work, 158 out of 370 respondents (43.6%) indicated that they had experienced some sort of CI with either a trespasser or another vehicle at some point in their work career. The results, therefore, are indicative of the presence of current symptoms in relation to a previous event of uncertain proximity.

Table 3-1

Prevalence of Critical Incidents—Been Involved in a Critical Incident?

	Frequency	%	% with Missing Excluded	Cumulative %
No	204	55.1	56.4	56.4
Yes	158	42.7	43.6	100.0
Total	362	97.8	100.0	
Missing (System)	8	2.2		
Total	*370*	*100.0*		

Interestingly, for those who reported a CI, more than 48 percent report having more than one incident. Incidents reported can be broken down into two or three categories. The majority of persons who are the victims in these types of events are classified as trespassers or unauthorized persons. Of the 146 incidents reported, 89 percent were identified as involving trespassers. Apparently, there are some inconsistencies among law enforcement agencies in terms of how these incidents are categorized. In some cases, there may be a clear-cut suicide attempt, and in others the victim's intent may be harder to ascertain.

Table 3-2

How Many Critical Incidents?

# Incidents	Frequency	%	% with Missing Excluded	Cumulative %
1	71	19%	48%	48%
2	35	9%	24%	72%
3	28	8%	19%	91%
4	4	1%	3%	93%
5	10	3%	7%	100%
Total	148	40%	100%	
Missing	222	60%		
Total	*370*	*100.00*		

There is some inconsistency between these tables due to the fact that some people will answer differently to the different questions.

Similarly, of those persons who were unauthorized, more than 47 percent (see Table 3-3) were identified as likely suicide attempters or completers. Again, this is a subjective interpretation from the railroad employee respondent who is completing the questionnaire. While this may be open to interpretation, the fact that the extent to which the employee perceives the event as having been a suicide may contribute to the degree of distress that the railroad employee may experience

Table 3-3 *Trespasser or Deliberate Suicide?*

Trespasser or Suicide?	Frequency	%	% with Missing Excluded	Cumulative %
No	52	14.1	37.1	37.1
Yes	67	18.1	47.9	85.0
Don't Know	21	5.7	15.0	100.0
Total	140	37.8	100.0	
Missing	230	62.2		
Total	*370*	*100.0*		

A total of 18.5 percent of respondents indicated that the CI they experienced involved some sort of weapon. For those incidents resulting in fatalities, a little more than one-third reported two or more fatalities.

Table 3-4 *Number of Fatalities*

Number of Fatalities	Frequency	%	% with Missing Excluded	Cumulative %
0.00	1	0.3	1.4	1.4
1.00	44	11.9	62.0	63.4
2.00	19	5.1	26.8	90.1
3.00	4	1.1	5.6	95.8
5.00	2	0.5	2.8	98.6
6.00	1	0.3	1.4	100.0
Total	71	19.2	100.0	
Missing	299	80.8		
Total	*370*	*100.0*		

The resultant psychological and physical consequences of involvement in a traumatic event are of interest in this study. Results indicated that of those involved in CIs, as shown in Table 3-5, 29.3 percent reported feeling afraid or frightened either during or after the incident occurred. This is an important consideration in that the occurrence of intense emotional reactions immediately after the occurrence of a CI occurs may be an indicator of subsequent disturbance. At the very least, the occurrence of these symptoms may also serve to create a screening question or technique that might be better used to identify those who are in need of additional follow-up.

Table 3-5 *Frightened or Concerned for Safety*

Frightened or Concerned for Safety?	Frequency	%	% with Missing Excluded	Cumulative %
No	99	26.8	70.7	70.7
Yes	41	11.1	29.3	100.0
Total	140	37.8	100.0	
Missing	230	62.2		
Total	*370*	*100.0*		

Furthermore, of those involved in CIs, 37.3 percent reported that they had received automatic time off after the incident, and the amount of time off ranged from 0 to 150 days. The median amount of time off was 3.0 days, and the mode was also 3.0 days off (see Table 3-6).

Table 3-6

Number of Days Taken Off

# Days Off	Frequency	%	% with Missing Excluded	Cumulative %
0.00	1	0.3	2.0	2.0
1.00	3	0.8	6.0	8.0
2.00	2	0.5	4.0	12.0
3.00	28	7.6	56.0	68.0
4.00	2	0.5	4.0	72.0
5.00	9	2.4	18.0	90.0
25.00	1	0.3	2.0	92.0
30.00	1	0.3	2.0	94.0
60.00	1	0.3	2.0	96.0
90.00	1	0.3	2.0	98.0
150.00	1	0.3	2.0	100.0
Total	50	13.5	100.0	
Missing	320	86.5		
Total	*370*	*100.0*		

Interestingly, engineers reported a few more incidents (66.3%) of involvement in CIs than conductors (33.6%). The relative risk of engineers/train operators being involved in CIs is thus slightly higher for engineers. However, this difference is not statistically significant (CI = 0.346, 2.821).

Table 3-7

Number of Engineers and Conductors Involved in CIs

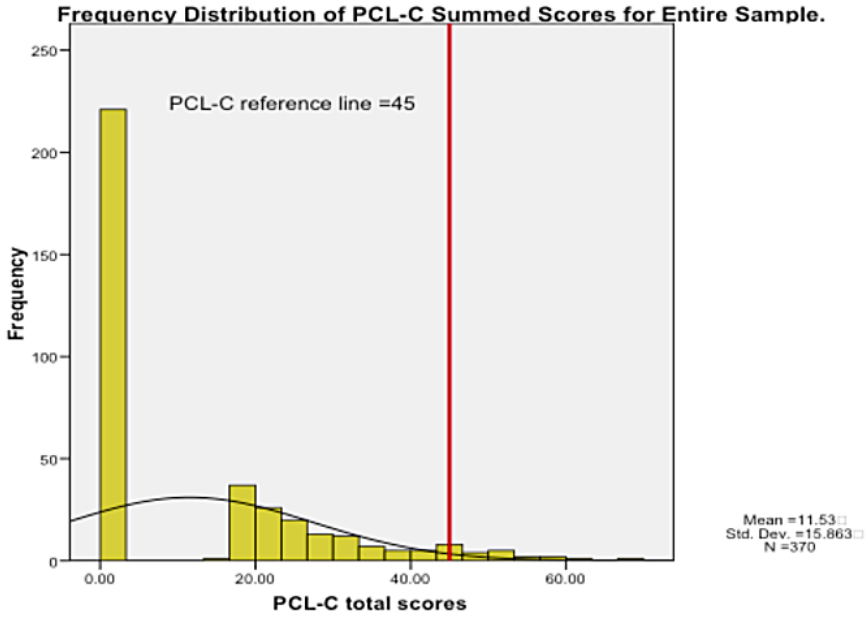
Been Involved in a CI?	Engineer	Conductor	Total
No	6	12	18
Yes	41	81	122
Total	*47*	*93*	*140*

Psychological Consequences of Involvement in CIs

What are the psychological consequences of being involved in a commuter rail CI? We assessed the extent to which individuals reported experiencing psychological symptoms as a result of or subsequent to involvement in a CI as defined above. Using the PCL-C (Weathers 1999), respondents were asked to indicate the symptoms and reactions they experienced following their exposure to CIs. Of the 370 respondents, 149 completed the PCL-C and obtained a score. The distribution of the scores is provided in Figure 3-1. As can be seen, those persons who did not complete the PCL-C were assigned a score of 0 to reflect the fact that some people in the sample did not report any psychological symptoms in response to their involvement in a CI.

Figure 3-1

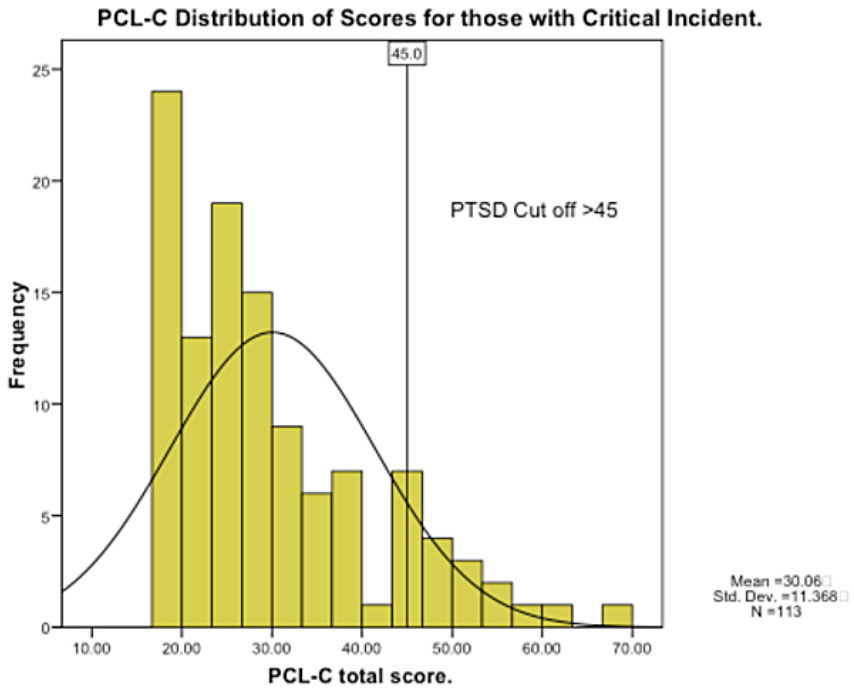
Distribution of PCL-C scores for entire sample



As can be seen from Figure 3-2, 59.7 percent of the respondents did not complete the PCL-C, which is a little higher than the 56.4 percent who indicated that they were not involved in a CI such as a Grade Crossing/ Trespasser Incident (GCA/T); not completing the PCL-C indicates that they did not feel that they were involved in a CI, which was true for about 40 percent of the sample. Please note that those scoring above the suggested clinical cut-off of 45 (indicated by the vertical line) were significantly more likely to meet the clinical diagnostics criteria for PTSD.

Figure 3-2

Distribution of PCL-C scores for those involved in Critical Incident



Examining only those PCL-Cs that were considered to be valid in that the respondent indicated involvement in a CI (i.e., GCA/T and also completed the PCL-C) resulted in useable data from 30 percent of the total sample. Results of the analysis of the PCL-C scale suggest that using a cut-off of greater than 44 as the threshold results in about 12.1 percent of those who experienced a CI as meeting or exceeding the suggestive PTSD cut-off.

Figure 3-8

Involvement in Critical Incident and PTSD (Cut-off >44)

Been involved in a Critical/T Incident?	Below PTSD Threshold	Above PTSD Threshold	Total
No	200	4	204
Yes	141	17	158
Total	*341*	*21*	*362*

Odds ratio = 6.03 CI=(1.986, 18.298), Chi Square = 12.61, p<.001

Recall that, as mentioned above, 29.3 percent reported feeling afraid or frightened either during or after the incident occurred. Interestingly, for those persons who reported feeling frightened or concerned as a result of being in a CI, the odds of meeting or exceeding the cut-off criteria were 5.28, which is 5 times more likely to report than those not indicating such emotional reactions. In other words, the ability to effectively predict the likelihood that a person will report a significant number of PTSD symptoms is greatly enhanced if they report significant levels of fear and likely anxiety as well. These results are statistically significant (X^2=9.2, df=1, p<.005).

Table 3-9

Report Being Frightened and Meeting PCL-C PTSD Cutoff (>44)

Frightened or Concerned for Your Own Safety?	Below PTSD Threshold	Above PTSD Threshold	Total
No	94	5	99
Yes	32	9	41
Total	*126*	*14*	*140*

Odds ratio = 5.28; CI= (1.65, 16.94), Chi-Square = 9.2, p<.005

Additional Symptoms and Involvement in CIs

Table 3-10 shows the correlation between the items on the PCL-C, involvement in CIs, presence of fatalities in the CI, and the number of incidents and the scores on the individual items of the PCL-C. The greater the number, the stronger the relationship between the item and the criteria. For example, the correlation of 0.385 reported in column 2 row 1 of Table 3-10 indicates that there is a strong relationship between reporting or experiencing involvement in a CI and the occurrence of repeated memories. The asterisks following the number indicate that the results are statistically significant and not likely to occur simply by chance. The PCL-C comprises 17 items that correspond with the 17 symptoms needed to make the diagnosis of PTSD from the DSM-IV-TR. As noted earlier, a diagnosis is made if clusters of symptoms are present. The table also indicates that the main symptoms that are reported by the persons completing this questionnaire were from Criteria B–Intrusive Recollection and Criteria D–Arousal. Significant correlations were obtained between CI involvement and repeated memories, distressing dreams, feeling that it was happening again, and upsetting reminders. Additionally, respondents reported having trouble sleeping, being angry or irritable, being jumpy or easily startled, and hyper-vigilance. Note that Criteria C–Avoidance was not significant, yet we did find higher levels of absenteeism for those reporting CIs.

Table 3-10 *Correlation Matrix for PCL-C, CES-D, and Involvement in CIs*

PCL Items	Been Involved in a CI?	Fatalities	How Many Incidents?
Repeated memories	0.385**	0.113	0.131
Distressing dreams	0.197*	0.072	-0.012
Happening again	0.225**	0.059	0.078
Very upset over reminders	0.216**	0.022	0.042
Physical reactions	0.143	-0.057	0.038
Avoid thinking	0.132	-0.048	-0.038
Avoid activities	-0.049	-0.133	0.096
Trouble remembering	-0.105	-0.200*	0.018
Loss of interest	0.141	-0.164	0.074
Distant	0.099	-0.102	0.012
Emotionally numb	0.172*	-0.057	0.016
Future cut short	0.115	-0.150	0.027
Trouble sleeping	0.221**	0.068	0.213*
Irritable or angry	0.206*	-0.101	0.169
Difficulty concentrating	0.098	0.027	-0.002
Super alert or vigilant	0.248**	-0.100	0.043
Jumpy or easily startled	0.221**	-0.029	0.124
PCL-C Total Score	0.260**	-0.057	0.096
CES-D Total Score	0.231**	-0.073	0.068

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)

The main conclusion one can draw from these correlations and statistics is that individuals involved in CIs are likely to report statistically-higher levels of intrusive memories, distressing dreams, feeling like the incident is happening again, and becoming upset over simple, commonplace reminders of the event. Thus, they will be bothered by the memories and images of the events that may be triggered by any reminder of the event (e.g., a train engine or a signal crossing). In addition, persons involved in CIs will also be more likely to report more difficulty sleeping, emotional numbness, becoming hyper alert, being jumpy or easily startled, and becoming angry and irritable more often. Note that the number of incidents is also related to increased sleeping difficulty. Finally, they will score higher on the PCL-C and also the measure of depression.

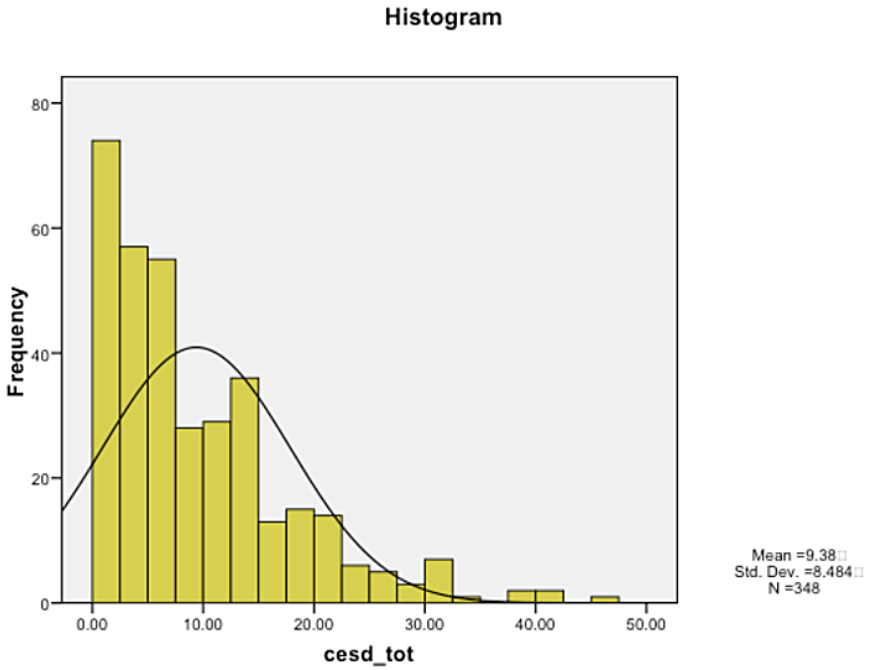
Involvement in Critical Incidents and Depression

Implicit in the overall pattern of symptoms is a disturbance in mood. For the most part, the mood reaction or disorder that is produced as a result of an involvement in traumatic events has been mainly termed an anxiety disorder. However, considerable research has also suggested the presence of depressed mood following involvement in CIs as well. For all practical purposes,

depression is a health consequence—a mental health consequence. Mental health disorders are covered by health insurance. Consequently, in this study we included a measure of depression (CES-D) along with the other measures in the study to determine the presence of depression. As can be seen from Table 3-10, the results indicate that persons who have been involved in CIs are also likely to score higher on the depression scale (CES-D). The number of respondents reporting the range of depression scores on the CES-D is shown in Figure 3-3.

Figure 3-3

Number of respondents by score on CES-D measure



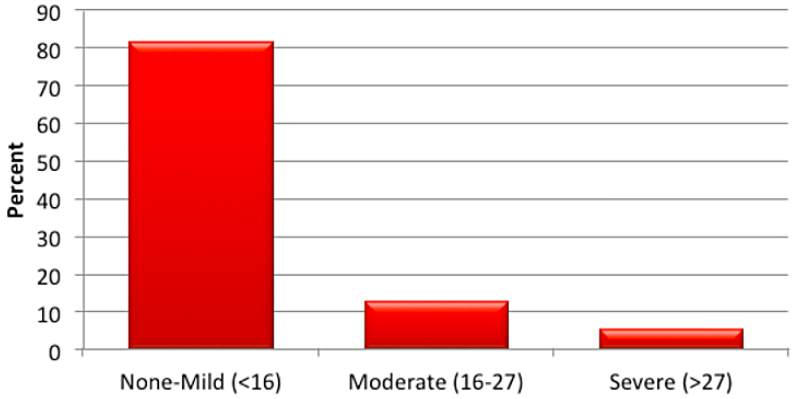
Results of the analysis of the CES-D revealed that approximately 81.9 percent of the sample was below and 18.1 percent above the cut-off of 16 recommended by the CES-D for identification of depression. Using the more conservative cut-offs recommended by Pandya, Metz and Patten (2005), we find that 95.4 percent were below 28 and 4.6 percent were above. In other words, this would suggest that the CES-D was able to identify approximately 4.6 percent of the sample as likely meeting the criteria for MDE. The 95% confidence interval for this score would be 4.6± 2.23 percent, which is to say that we are 95% certain that the true population proportion falls into the range from 2.37 percent to 6.83 percent. As noted above, this cut-off score was associated with the correct identification of more than 85 percent of persons who were diagnosed with MDE. Using a two-sample t-test for proportions, we find that there is a statistically-significant difference between the present findings (4.6%) and that of the Compton et al. (2006) findings (7.06%) for the total population ($z=1.53$, $df=42620$, $p<.05$). However, if we compare the two results for the males from the Compton study (4.88%), we

find no significant difference between the two samples (z=0.044, df=42620, p<ns).Thus, the present sample seems a little lower in depression, lower than that of the general population but not significantly different for the general male population.

In relation to CIs, the results indicate that persons involved in CIs are statistically more likely to report high levels of depression (r=.190, p<.001) and that those who are "assaulted with a weapon" have an even higher likelihood of reporting depression (r=.390, p<.001). Overall, the odds of developing or reporting statistically-significant and severe levels of depression are 2.03 to 1 (OR=2.03, CI=1.17, 3.52), which is statistically significant (X^2=6.49, df=1,342, p<.008) after having been involved in a CI.

Figure 3-4

Depression levels of rail transit sample



CES-D Category	Frequency	%	Cumulative %
None - Mild (<16)	284	81.6	81.6
Moderate (16-27)	45	12.9	94.5
Severe (=>28)	19	5.5	100.00
Total	*348*		

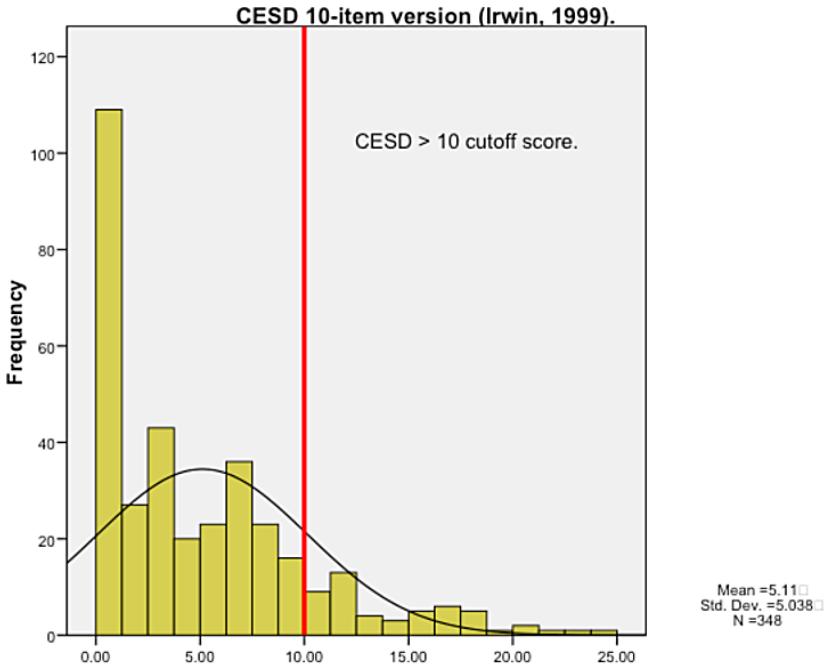
CES-D Short Form

A more recent study by Irwin et al. (1999) looked at the utilization of a short form of the CES-D and provided specificity and sensitivity analyses for the various cut-offs. In a sample of 40 depressed patients, 39 were correctly identified when using a cut-off score of >= 4. Sensitivity, Specificity and Positive Predictive Value were 97, 84 and 85 percent, respectively.

A more recent study by Lee and Chokkanathan (2007) with older Chinese adults living in Singapore reported a 10-item scale mean of 5.43 and, using a cut-off score of 10, reported that the rates of depressive symptoms for the entire sample, males, and females were 11.2, 12.2, and 10.0, respectively.

Figure 3-5

Range of scores and cut-offs for single-item measure of depression



Using the ≥10 point cut-off on the recalculated 10-item CES-D Short Form, it can be seen from Figure 3-5 that more than half would meet the criteria for having a depressive disorder.

As can be seen from Figure 3-6, the 10-item scale results in a similar distribution, with 14.7 percent falling above the cut-off of 10.

These data are included in the report for the purpose of illustrating the fact that a short version of the CES-D scale could be used as a screening device in the field and still be successful in identifying problems with depression among transit operators.

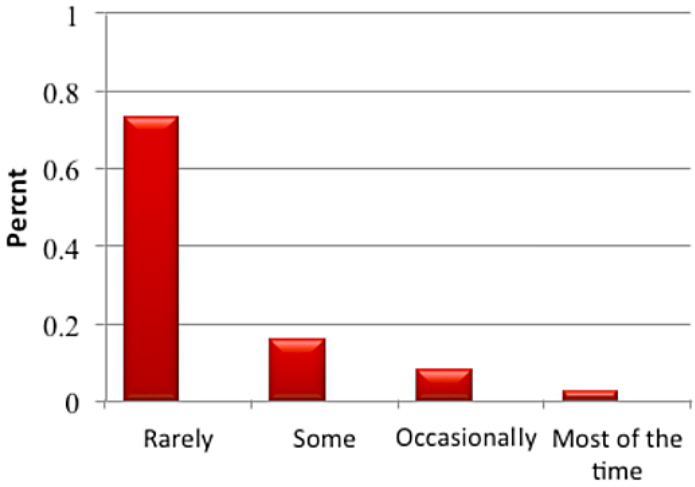
Single-Item Measures of Depression

Some authors have suggested that a single-item measure of depression can be used as a screening tool for the assessment of depression. Short instruments have been studied by Whooley et al. (1997). The 9-item Patient Health Questionnaire (PHQ-9) was found to have good sensitivity (88%) and specificity (88%) for major depression when compared with a diagnostic interview conducted by a mental health professional using SCID by Spitzer (1999). Kroenke et al. (1999) tested the validity of two items (depressed mood and anhedonia over the past two weeks) of the PHQ (PHQ-2) in a population of community primary care and obstetrics-gynecology patients and found that a score of 3 or higher (PHQ-2 ≥3) had a sensitivity of 83 percent and specificity of 92 percent compared with a diagnostic interview by a mental health professional. Williams et al. (1999) reported that the sensitivity

and specificity for a single question ("Have you felt depressed or sad much of the time in the past year?") approached that of the CES-D (85% vs. 88% and 66% vs. 75%, respectively) when compared to the findings of a diagnostic interview. Finally, Corson et al. (2004) demonstrated the effectiveness of a single-item screen in a VA population that showed a specificity of 78 and sensitivity of 88. Based on these findings, it was decided that useful information for the study of a railroad population might be gleaned from the examination of the single-item data to identify very simple and cost-effective methods for screening the population to determine the presence of depression. Based on this notion, a single item was selected from the CES-D to determine the distribution of scores and whether the distribution was similar to that obtained by the more robust measures.

Figure 3-6

Response to single-item measure of depression



Results of the analyses revealed that a single item—"Have you been feeling unhappy and depressed?"—resulted in an estimate of the prevalence of depression in the sample of approximately 10.8 percent reporting moderate or greater symptoms of depression (see Table 3-11), which is roughly in line with the estimates reported in Figure 3-6. Thus, our measures are relatively consistent in suggesting that a substantial portion of the transit railroad population studied is experiencing moderate to severe degrees of depression. Again, these data illustrate the possible use of a short practical screening measure for use with transit operators. Administering this question with other routine health services and health fairs could be useful in identifying persons in need of additional consultation or treatment. It could also be used as part of a follow-up interview after the fact for those involved in CIs.

Table 3-11

Results of Single-Item Measure of Depression

	Frequency	%	% with Missing Excluded	Cumulative %
Rarely	250	67.6	73.3	73.3
Some	54	14.6	15.8	89.1
Occasionally	28	7.6	8.2	97.4
Most of the time	9	2.4	2.6	100.0
Total	341	92.2	100.0	
Missing	29	7.8		
Total	*370*	*100.0*		

Depression and CIs

Taken together, these results suggest that involvement in CIs is significantly related to the reporting of depressive symptoms subsequent to the incident. In fact, there is a statistically-significant association between involvement in a CI and scoring in the clinically depressed range on the CES-D (X^2 = 6.49, df=1,342, p<.008) with an OR = 2.03, CI= (1.17, 3.52). Thus, the odds of developing depression are two times greater for those involved in a CI than for those who are not.

Table 3-12

Odds of Developing Depression after Involvement in a CI (Cut-off >28)

Been Involved in a CI?	Mild Depression	Clinical Depression	Total
No	189	4	193
Yes	137	12	149
Total	*326*	*16*	*342*

Health-Related Consequences of Involvement in Critical Incidents

To assess the impact of the involvement in CIs, a set of analyses was conducted designed to determine the probability of health consequences as a result of involvement in Critical Incidents. The results of the analysis of the HPQ (see Table 3-13) revealed that involvement in CIs resulted in statistically-significantly greater self-reports of physical health difficulties interfering with work and other activities. In addition, persons involved in CIs were more likely to indicate that their physical health was likely to contribute to their accomplishing less, (t=2.54, p<.05) limiting their activity (t=2.60, p<.05), and reporting greater levels of pain (t-3.72, p<.001). These results suggest that involvement in CIs in the railroad does affect the physical health and related activities of railroad employees. Future research may be needed to ascertain the specific effects on particular diagnoses such as heart disease, hypertension, sleep disturbances, and obesity.

Table 3-13 *Effects of Involvement in CIs on Health-Related Activities*

	CI	N	Mean	Std Dev	t	df	P<	Mean Diff
Total Health Concerns (HPQ)	No	187	10.43	1.71	2.76	331	0.006*	0.544
	Yes	146	9.88	1.87				
Total number of post-traumatic stress symptoms	No	204	4.27	10.44	(12.05)	360	0.00*	(17.21)
	Yes	15	21.48	16.60				
Have you experienced physical reactions?	No	36	1.31	0.62	(1.75)	147	0.08*	(0.30)
	Yes	113	1.60	0.95				
Have you had trouble sleeping?	No	36	1.28	0.74	(2.73)	146	0.01*	(0.59)
	Yes	112	1.87	1.22				
Health problems limited amount of work you do?	No	193	3.29	1.31	(.19)	334	0.85	(.03)
	Yes	143	3.32	1.08				
In general, your health is good?	No	179	2.43	0.84	0.77	320	0.44	0.07
	Yes	143	2.36	0.88				
Has physical health caused you to accomplish less?	No	179	2.43	0.84	2.54	330	0.01*	0.28
	Yes	143	2.36	0.88				
Physical health has limited your work or activities?	No	187	4.46	0.93	2.60	329	0.01*	0.28
	Yes	144	4.18	1.02				
Pain interfered with your normal work?	No	175	1.51	0.88	(3.72)	304	0.01*	(0.42)
	Yes	131	1.92	1.07				
Physical health interfered with your social activities?	No	185	1.56	0.95	(1.07)	327	0.29	(0.11)
	Yes	144	1.67	0.89				
Missed work due to physical or mental health?	No	204	0.01	0.10	(1.50)	360	0.14	(0.02)
	Yes	158	0.03	0.18				

Note: CI=Critical Incident; N= Number of respondents; StdDev=Standard Deviation; t=T-Test; df=degrees of Freedom; p< = significance level; Mean Diff = absolute difference of the group means.

Job Performance and Critical Incidents

Examining the work performance and productivity in the persons involved in CIs was performed using the WHO scale work performance items. Significant differences between exposed and unexposed samples were obtained in terms of number of total days off. However, no differences in self-reported performance were obtained. The results of the analysis of the Job Performance measures are presented in Table 3-14. As can be seen, there are a few measures that reflect the effects of involvement in a Critical Incident on the various ratings of job performance.

Table 3-14 *Job Performance and Critical Incidents*

	CI	N	Mean	Std Dev	t	df	P<	Mean Diff
Absenteeism Score (WHO-A)	No	197	6.61	9.37	(1.94)	344	0.05*	(3.02)
	Yes	149	9.63	19.00				
How many entire work DAYS did you miss for any reason?	No	192	1.50	3.40	(3.54)	336	0.001*	(1.46)
	Yes	146	2.96	4.17				
Job Performance Score (WHO-P)	No	196	15.87	5.82	(0.32)	342	0.75	(0.18)
	Yes	148	16.05	4.20				
Are you as productive as you would like to be?	No	201	3.67	1.16	1.36	355	0.18	0.17
	Yes	156	3.51	1.12				
Job performance past 4 weeks?	No	195	3.21	1.26	(0.82)	338	0.41	(0.11)
	Yes	145	3.31	1.04				
Concentration past 4 weeks?	No	194	3.02	1.38	(1.29)	339	0.20	(0.18)
	Yes	147	3.19	1.02				
Overall job PERFORMANCE in past 4 weeks?	No	186	8.73	1.14	0.44	322	0.66	0.06
	Yes	138	8.68	1.15				
Is your work behavior as safe as you would like it?	No	202	3.78	1.18	0.86	356	0.39	0.11
	Yes	156	3.67	1.16				
Confidence in effectiveness after having a CI?	No	199	3.52	1.18	(3.16)	348	0.001*	(0.38)
	Yes	151	3.91	1.06				
Confidence in working safely after having a CI?	No	196	3.65	1.22	(2.64)	344	0.01*	(0.33)
	Yes	150	3.98	1.03				
Intention to quit	No	200	1.83	1.33	(1.65)	354	0.10	(0.24)
	Yes	156	2.07	1.41				

Note: CI=Critical Incident; N= Number of respondents; StdDev=Standard Deviation; t=T-Test; df=degrees of Freedom; p< = significance level; Mean Diff = absolute difference of the group means.

Absenteeism

One simple measure of job performance is simply being present. As can be seen from Table 3-14, the WHO Absenteeism measure was significantly higher for those who had experienced a CI than for those who had not. When this measure was dichotomized to reflect either greater than or less than two days off, a significant chi-square was obtained for missing a part of a day for any reason (X^2=6.131, df=1, p<.01), with an OR=2.65, CI=(1.19, 5.88). Similarly, a significant chi-square was obtained for missing an entire day of work for any reason (X^2=15.81, df=1, p<.001), with an OR=2.65, CI=(1.65, 4.54). Thus, the odds of being absent from work following exposure to traumatic events is significant and likely more than 2.6 times as great as those persons who do not experience similar traumatic events at work.

These results have implications for the transit operator work performance. Overall, the data suggest that those person involved in CIs are 2.6 times as

likely to miss work following the CI. If showing up for work is considered a measure of work performance (and most experts agree that it is), then these data convincingly show the effects of CIs on work performance. Workers who have experienced or been involved in a CI are less likely to be able to work.

Work Performance

Table 3-14 also depicts the comparison of persons involved in CIs on several measures of work performance with those who have not been involved in CIs. Looking first at the overall composite measure of performance WHO-P, we can see that results of the t-test comparisons were not significant. An inspection of some of the items that make up the WHO-P did not reveal any additional significant findings. In fact, the only measures that were significantly affected by involvement in CIs was the degree of confidence in working effectively ($t=-3.16$, $p<.001$) or working safely ($t=-2.64$, $p<.01$) that a respondent felt after being involved in a CI. One finding did approach significant, namely, Intention to quit ($t=-1.65$, $df=354$, $p<.10$). Overall, these results suggest that there is a significant difference between persons involved in CIs and those who have not been involved such that those involved in CIs have higher levels of absenteeism, lower levels of confidence in working effectively and safely, and some thoughts of quitting the job.

Relationships with Other Variables

There were a number of other correlates of CIs and the PCL-C. The following sections describe the correlation between these and other variables of interest.

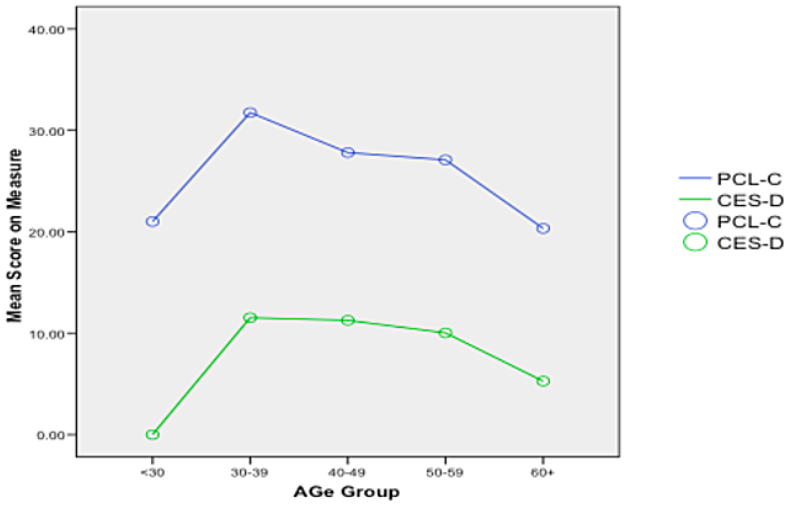
Age

The relationship between age and depression has been investigated in some studies. Given that the average age of the sample was 40+, further analyses were conducted to determine whether any relationships existed. Some studies have shown a declining correlation between age and depression. Lawton et al. (1993) found few age differences in self-reported affective symptoms in three separate cohorts of young (18–20), middle aged (31–59), and elderly (60+) persons. Depression was more often found in younger respondents and least frequent among older adults. Henderson et al. (1998) sampled 2,725 persons ages 18 to under 80 and found that symptoms of depression declined with age in both men and women. Lewinsohn (2001), in a sample of older adults, found no significant correlation between CES-D scores and age as well as no difference between males and females on the CES-D. Kessler (2006), in a study of the prevalence of depression in a work sample, found that the odds of being diagnosed with depression in the last 12 months were 4.3, 3.8, 2.2, and 1.0 for age groups from 18–29, 30–44, 45–59, and 60+, respectively. Narrow et al. (2002), using the clinical significance criteria as an additional feature with which to analyze the prevalence of depression in two large-scale studies, found that the prevalence of any mood disorder was 5.7 and 3.4 for the 18–54 vs. the 54+

age groups, respectively. Similarly, for MDE and dysthymia, the percentages were 5.2 for young and 2.7 for older and, for dysthymia, 1.7 and 1.6.

Figure 3-7

PCL-C and CES-D scores by age group



In the present study, the correlation between the both the PCL-C and CES-D and age was not significant. In addition, there were no significant differences between either the PCL-C or CES-D by age group.

Suicide

Suicide is recognized by the National Institutes of Mental Health (NIMH) as the 11th leading cause of death in the U.S. and a major public health crisis. Suicide was the 8th leading cause of death for males and the 16th for females in 2004. Car accidents account for 669,000 deaths per year, and suicide accounts for 499,000 deaths per year in developed countries worldwide. The overall rate in the U.S. was 10.9 suicide deaths per 100,000 people (CDC 2007). In 2007, the most recent year for which statistics are available, 34,598 Americans died by suicide—about 11 suicides per 100,000 people—according to the Centers for Disease Control and Prevention. We know from the Substance Abuse and Mental Health Services Administration's (SAMHSA's) National Survey on Drug Use and Health (NSDUH) that in 2008, about 3.7 percent of people had serious thoughts of suicide, and about 1 percent actually made suicide plans. Clearly, suicide is a health problem worldwide.

Over the past decade, the overall rate of suicide has not declined, although there have been slight decreases in the young and in older adults, offset by a compensatory increase in suicide for people between ages 24 and 65. Major risk factors include depression and other mental disorders or a substance-abuse disorder (often in combination with other mental disorders). In addition to these are stressful life events in combination with other risk factors such as depression, prior suicide attempt, family history of mental disorder or

substance abuse, family history of suicide, family violence, firearms in the home, incarceration, exposure to the suicidal behavior of others, such as family members, peers, or media figures. Oquendo (2004) cited early studies that identified risk factors for suicidal acts, which included previous suicide attempt, ongoing major depression, alcohol or other substance use disorder, hopelessness, separation or loss, anger, and suicidal ideation. She also concluded that the three most powerful predictors of future suicidal acts were a history of suicide attempt, subjective rating of the severity of depression, and cigarette smoking, each of which had an additive effect on future risk. Pessimism and aggression/impulsivity both were significantly and additively related to subsequent suicidal acts. More than 90 percent of people who die by suicide have these risk factors (Moscicki 2001).

Suicidal thoughts often accompany depression. In fact, epidemiological data suggest that between 59 and 87 percent of suicide victims suffered from major depression and that almost 15 percent eventually committed suicide. Male gender, previous suicide attempt(s), co-morbid mental disorders, adverse life situations, acute psycho-social stressors also constitute significant risk factors for suicide (Gonda 2007). According the CDC, males take their lives almost four times the rate of females (CDC 2008).

Promoting suicide prevention is thought to be one of the more important public health preventive activities. In addition, Gonda (2007) cited studies that reported that most suicide victims had asked for professional help just before committing suicide and were either misdiagnosed or undertreated. Thus, the importance of training and education in identification and recognition for health and medical professionals is essential. The importance of early identification and appropriate responses of managerial and supervisory personnel in the railroad industry is also an important first line of defense. The proper use of medical assistance and the reduction of pessimism and increasing the reasons for living are also extremely important preventative factors that may be enhanced through the appropriate training and education of managerial and supervisory personnel. Social support and behavioral counseling are extremely important in reducing mortality.

Some studies have examined the predictive utility of a single item of depression with depression patients in studies of high school students and adolescents in the community (Larsson et al. 1991; Lewinsohn et al, 1993, 1994; Olsson and von Knorrin, 1997; Ter, 1982), adolescent psychiatric outpatients (Steer et al. 1998), and adolescent psychiatric inpatients (Ivarsson et al. 1998; Larsson and Ivarsson 1998). For nonpatient adolescents, the odds ratio for past suicide attempts was 3.9 when the BDI item was endorsed (OR=3.9) (Lewinsohn et al. 1993). In high school students in Sweden, 27 percent of adolescents with a high score on the suicide item had made a previous suicide attempt (Larsson et al. 1991). Finally, the BDI suicidal ideation item predicted both future suicide

attempts (OR=6.9) and future depressive episodes (OR=2.1) (Lewinsohn et al. 1994) for community-based adolescents. In the present study, there is no suicidal item. However, several items do reflect the severity of depression and may suggest a need for further investigation or consultation.

There was no suicidal ideation item on the CES-D in the present study. However, one item asked respondents whether they felt optimistic about the future. This item was recoded to reflect a pessimistic outlook consistent with the scoring of the other items. As seen in Table 3-15, 84.3 percent of respondents were only occasionally, some, or rarely pessimistic about the future. A modest number, 15.7 percent, indicated that they were pessimistic about the future most of the time. This does not necessarily indicate or even suggest suicidal ideation. But it does indicate that a not insignificant number of people appear to have a rather grim outlook. More study of this particular phenomenon would appear to be warranted.

Table 3-15

*Feel Pessimistic about the Future?**

	Frequency	%	% with Missing Excluded	Cumulative %
Rarely	146	39.5	42.6	42.6
Some	83	22.4	24.2	66.8
Occasionally	60	16.2	17.5	84.3
Most of the time	54	14.6	15.7	100.0
Total	343	92.7	100.0	
Missing (System)	27	7.3		
Total	*370*	*100.0*		

*Note: This is reverse scored from the "hopeful" item.

Concentration

Another one of the key constructs of depression is ability to concentrate. One item on the CES-D addresses this area: "Had trouble keeping my mind on what I was doing." A frequency distribution of the responses to this item (shown in Table 3-16) reveals that only 1.5 percent of the respondents had difficulty most of the time with this issue. There was a small but significant relationship between involvement in a CI and reporting difficulty concentrating ($r= 0.125$, $p<.02$).

Table 3-16

Trouble Keeping My Mind on What I Was Doing

	Frequency	%	Valid %	Cumulative %
Rarely	249	67.3	72.6	72.6
Some	52	14.1	15.2	87.8
Occasionally	37	10.0	10.8	98.5
Most of the time	5	1.4	1.5	100.0
Total	343	92.7	100.0	
Missing (System)	27	7.3		
Total	*370*	*100.0*		

Fatigue

Sleep disturbance and sleepiness or fatigue are associated with both depression and PTSD. These symptoms could be related to the operational effectiveness of railroad employees. Fatigue is widely recognized as a factor contributing to the safety of rail operations. Persons involved in CIs did not report significantly higher levels of sleepiness as measured by the Epworth Sleepiness Scale (ESS). Persons who were involved in CIs did report statistically significantly higher levels of PTSD symptoms ($F=10.647$, $df=1,347$, $p<.001$) and depression ($F=19,085$, $df=1,340$, $p<.001$). However, the association between sleepiness and depression was stronger in persons who had been involved in a CI than those who had not ($r=0.321$ vs. $r=0.279$, both $p<.001$). Furthermore, persons involved in a CI reported that they had significantly more trouble sleeping ($F=7.473$, $df=1,146$, $p<.007$) and that their sleep was significantly more restless ($F=7.931$, $df=1,338$, $p<.005$) than those who had not.

Moreover, the odds of reporting high levels of fatigue and sleepiness when also reporting depression is 3.23 (OR=3.23, CI= 1.8, 5.7), meaning that there is 3.23 times the risk of reporting very high levels of fatigue when also experiencing depression.

Figure 3-8

Complaints of sleep disturbance for those involved in a CI

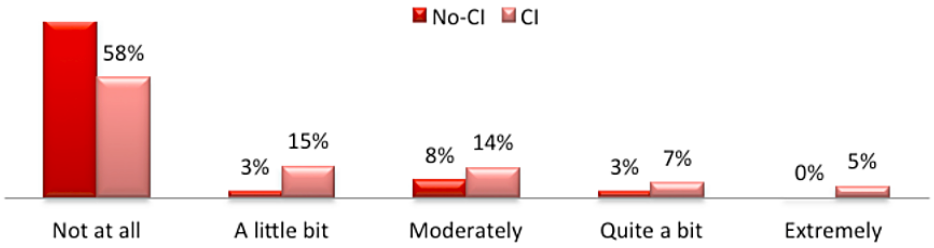
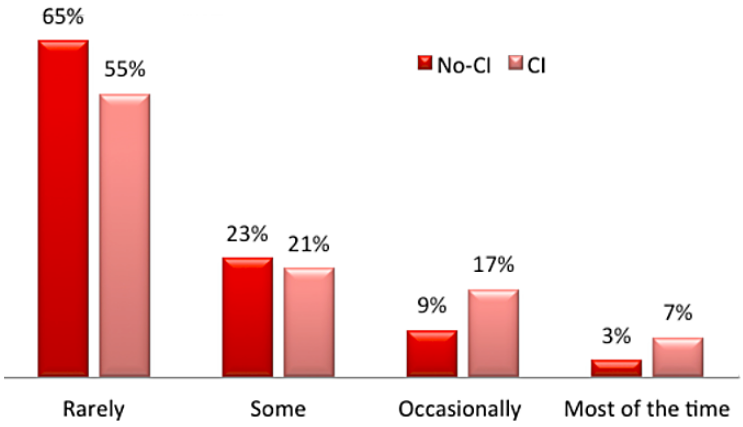


Figure 3-9

Complaints of restless sleep for those involved in a CI



SECTION 4

Discussion

Exposure to Critical Incidents

Results of these analyses suggest that individuals in the commuter rail industry have a strong likelihood (43.6%) of being exposed to a CI of some sort. The most likely CI reported appears to be a suicide by an unauthorized person or trespasser (48%). In addition, the typical commuter railroad employee will likely also be exposed to more than one event in his or her career.

Consequences of Exposure to Critical Incidents

Results of this study suggest that the typical commuter railroad employee that is exposed to a CI will experience some physical and psychological reactions as a result of the event. Previous research suggests that there may be some association with cardiovascular disease. The present study design did not permit the identification of specific diseases. It was found however, that respondents reported that their social and work activities were significantly affected by their physical health reactions subsequent to involvement in CIs. The results of the present study also suggest that there are relationships between involvement in CIs and physical symptoms but these are as yet nonspecific. The more detailed studies investigating the occurrence of diagnoses that correspond with PTSD provide some suggestive evidence.

Psychological consequences of the effects of exposure to CIs were found in the present study. Significantly higher levels of post-traumatic stress symptoms and depression were identified in the current sample of respondents. With respect to depression, respondents were two times more likely to report symptoms of severe depression if they had been involved in a CI than those who had no involvement. The overall level of severe depression in the entire sample was about the same as the findings for the general population. However, there was a significant increased risk associated with exposure to CIs such that those persons were twice as likely to report severe depression.

With respect to the PTSD symptoms that have been typically associated with exposure to traumatic events, the findings are more dramatic. Specifically, using the more conservative cut-offs, the present study determined that a little over 12 percent of the respondents exceeded the criteria and reported a degree of symptom severity associated with a formal diagnosis of clinical PTSD. While a more in-depth assessment would be needed to determine the actual presence of the disorder, the levels are sufficiently elevated to suggest a high probability of presence of the disorder. Moreover, the odds ratio associated with being

involved in a CI was 6.03, with a corresponding statistically-significant result as well. This ratio suggests that CIs are very powerful in triggering PTSD symptoms.

The specific symptoms associated with involvement in CIs appear to be those of intrusive thoughts and emotional arousal. The items in the symptom clusters were significantly associated with the occurrence of a CI. Interestingly, the avoidance items were not significantly associated, perhaps due to the fact that the nature of railroad work requires a continual exposure to the equipment and locations. Unlike some other occupations in which people are able to avoid the situations that have created the event, in the railroad industry one's livelihood is dependent upon continued exposure to the equipment and locations.

It should be noted that there was a significant increase in the risk of obtaining an elevated PCL-C score if the person reported feeling frightened or afraid following the event. This is an important finding in that it provides additional screening information that can be used to help identify persons who might develop more severe reactions to the event. It is possible that persons responding to the event might be sensitized to the presence of these symptoms and make appropriate follow-up referrals.

In addition to the psychological symptoms, there were indications that health effects were greater for those who had been involved in CIs. These health effects were non-specific and, due to the study design, enable us to determine only that those involved in CIs appear to have a feeling that their health is interfering with their work and social activities. Additional research will be needed to determine what specific diagnostic consequences may occur.

Results indicate that there is a greater degree of disturbed sleep in those who have been exposed to CIs. The results of the study indicate a significantly greater number of complaints about sleep and restlessness. These symptoms suggest that sleep is disrupted and disturbed. While this may affect the person on an acute basis, the results of the scores on the Epworth Sleepiness Scale suggest that chronic sleepiness is not the result. These findings are consistent with the notion that PTSD is a disturbance of the ability to regulate arousal. Persons reporting involvement in CIs were more likely to endorse the emotional arousal items of the PCL-C. Thus, the effects of CI exposure may be more episodic and acute than sustained. This may make it more difficult to treat and mitigate due to the intermittent occurrence of the symptoms. Additional thought will be needed on how to best manage these symptoms.

Last, the results suggest that productivity is affected in several ways. First, there is almost a twofold increase in the numbers of days absent from work for those who have been involved in a CI. This is surprising, on one level, since the avoidance items from the PCL-C were not endorsed. However, it

is not surprising in that avoidance of stress-provoking stimuli is associated with a diagnosis of PTSD. In other words, due to the nature of the work and the effects of work-related traumatic events, the person is not able to avoid the stressful reminders of the traumatic event when he or she goes to work. Hence, he/she must avoid work. The negative consequences of this for the employer are self-evident.

Overall perceptions of job performance were not significantly different for those involved or not involved with CIs. However, there were significant differences of perceptions of confidence and efficacy with respect to performing the work. It appears that as a result of exposure to CIs, persons are less confident of their ability to handle the work. The implications of this are unclear. Persons may be less decisive and less confident when making decisions in the workplace. Again, more research about the implications of these findings is needed.

SECTION 5

Conclusion

Results of this study reveal that 43.6 percent of commuter railroad employees reported involvement in a CI. Almost half of those involved reported experiencing more than one event. Persons exposed to CIs were significantly more likely to report experiencing severe depression and to also meet the criteria for PTSD. Some evidence for a greater interference in work and social activities as a result of being involved in CIs was also found. Significantly more complaints regarding disturbed and restless sleep were also found. Finally, persons who were exposed to CIs reported twice the number of days of work missed and significantly lower self-confidence in completing work-related tasks.

Implications

The implications of these findings are that additional attention should be given to the detection and prevention of depression in the workplace. For the most part, it would seem that these findings would be a bit of a surprise to most people who generally do not view the psychological health of employees as a significant cost of doing business. However, the findings that involvement in CIs, injuries, and being associated with trauma that affects co-workers can create a set of emotions and attitudinal consequences that can affect the ability of workers to concentrate, attend to their tasks, and experience a satisfying quality of life.

Limitations

There are several limitations of the present study. The most important is the fact that the primary measure used was self-reporting, which provided respondents with the opportunity to self-rate their own subjective experience. These self-ratings have the limitation of being open to bias. In addition, the respondents self-selected in responding to the questionnaires.

Another limitation is the fact that all of the population studied were gainfully employed and were surveyed when they reported for duty. Despite the adequate response rate (85.3%), it may be the case that this sample might not meet the DSM criteria of "clinically significant distress or impairment in social, occupational or other important areas of function," as required for a *DSM-IV* diagnosis of Major Depressive Episode. It may be the case that persons who were most affected by their involvement with CIs either have left the workplace or did not participate in the study.

The sample size upon which the various instruments were administered varied. While there was a large sample size, additional respondents all completing the same instrument are needed to achieve the highest possible levels of statistical

significance. A larger sample size was planned and could have been obtained; however, social and financial considerations prevented the acquisition of a larger sample size.

Issues with respect to the actual time frame in which a CI occurred may have affected the outcome. For example, some incidents could have been relatively recent, while others may have been some time ago. The study design requested a timeline and dates for CIs, but the compliance with these requests was spotty. Future studies should address this shortcoming more directly.

The use of a structured interview format to assess the presence of diagnosable symptoms would also have provided greater certainty and confidence in the results. Several structured interviews are available based on the *DSM-IV-TR* criteria.

SECTION 6

Recommendations

Based on the findings of this study, the following recommendations are made.

Educate employees and management.

The present study provides substantial evidence that persons in the commuter rail transportation industry will experience one or more CIs. These incidents may have some negative physical and psychological effects upon a significant portion of those exposed. Care should be taken to inform both employees and managers of the possible consequences. Moreover, it should be noted that the causal linkages between exposure and symptom formation are not known. All that is known at this point is that exposure has some risks. Therefore, managers and employees alike should exercise caution when making statements as to the etiology of these symptoms.

Provide preventive education and responsible follow-up.

Not all individuals will develop symptoms following exposure to CIs. Nevertheless, the possibility does exist and should be planned for. Appropriate education and prevention programs and materials may need to be distributed to both employees and managers. Furthermore, health care professionals, first responders, and railroad management and railroad labor officials may need to be informed of the possible risks associated with exposure and types of responses and treatment available to those involved.

Increase screening for persons involved in CIs.

As previously noted, not all respondents will develop symptoms following involvement in a CI. The results of this study suggest that those who have been involved and exposed to CIs will develop symptoms. Person exposed to CIs will most likely develop symptoms from clusters A and D. Additionally, persons exposed to CIs will likely also develop a significant level of depression. These findings indicate that the level of depression following involvement in CI is significant. Persons who have been exposed to a CI may need additional assistance to address depression and its associated consequences. In particular, persons who are exposed to a CI who have also experienced other significant stressors may be at risk for more severe depression. Consequently, assessing for level of distress and depression following CI involvement is recommended.

Provide supervisor training.

Again, given the fact that almost half of rail transit employees will be exposed to a CI and that those exposed are more likely to develop psychological distress, health problems that interfere with their work and social activities, and higher levels of absenteeism from work, supervisors in the workplace

need training to recognize the signs and symptoms of distress following CIs. Rail transit supervisors will benefit from being able to recognize the negative effects of exposure to CIs and may be in the position to make an appropriate referral. In addition to symptoms of stress, intrusive thoughts, arousal, and the like, one area of concern, not previously addressed, may be how to identify and recognize the existence of depression. Supervisors, for example, could be attuned to the fact that persons who have been involved in CIs are more likely to request time off. Policies regarding availability may need to be addressed in this regard. Supervisors may need to learn to be more able to respond to individuals when they suspect depression. While the natural tendency might be to call on an employee assistance program or make a referral, males are more likely to respond to someone they know. Therefore, a supervisor or a trusted colleague might be more likely to be effective.

Consider developing workplace regulations related to medical exams.

Results of this study suggest that many people are involved in CIs and that the consequences of CIs may have longstanding effects on interpersonal functioning and long-term health and work productivity. Due to the retrospective nature of this study and the lack of data on the physical and mental consequences of such involvement, it may be the case that symptoms of PTSD and depression will develop not just immediately after the event but also at some later point in time. Thus, it may be prudent to require that individuals undergo routine medical exams to review the development of symptoms subsequent to involvement in a CI. It may be necessary to require that individuals have a yearly physical that would also include an assessment of depression and PTSD. It may be the case, especially with these types of events, that since the symptoms appear to be persistent and last over time, longer-term follow up is needed.

Address workplace fatigue.

Clearly, there are relationships between involvement in a CI and sleep disturbance. Given Congress's recent focus on changing the hours of service and the ongoing desire to address fatigue, not to mention the fact that there is a mounting body of evidence supporting the relationship between fatigue and human-factor-caused accidents, it should be noted that CIs are an additional risk factor contributing to disturbed sleep and possibly to work-related fatigue. At the very least, these facts should be incorporated into fatigue training programs to alert employees so they can include them into their planning.

Provide management training on identifying depression.

In addition to intrusive thoughts and emotional arousal that may contribute to distraction when operating equipment, there is also the risk of depression. Given the traditional nature of the transportation workplace, dealing with depression is a very sensitive issue. Nevertheless, the risk, though small, is there and is exacerbated by involvement in CIs. Again, alerting rail and labor

management to the signs and symptoms of depression would be prudent as a precautionary measure. Depression is associated with increased sensitivity to pain, lethargy, fatigue, and suicide. These could become contributing factors to accidents and incidents in day-to-day railroad operations.

ACRONYMS

CAGE	Alcohol Use Questionnaire
CES-D	Center for Epidemiological Studies Depression Scale
CI	Critical Incident
DSM-IV	Diagnostic Statistical Manual of Mental Disorders
ESS	Epworth Sleepiness Scale
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GCA/T	Grade Crossing or Trespasser Incident
HPQ	Health Performance Questionnaire
MSLT	Multiple Sleep Latency Test
OSA	Obstructive Sleep Apnea
PCL-C	Post-traumatic Check List – Civilian Version
PUT	Person Under Train
RSIA	Rail Safety Improvement Act
WHO	World Health Organization
WHO-A	World Health Organization Absenteeism Score
WHO-P	World Health Organization Work Performance Scale

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