The Health and Safety Effects of Accidents on Intermodal Transportation Workers: A Study of Psychological Health Concerns and Depression of Operating Employees Involved in Critical Incidents

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Executive Summary

Surveys of 1420 intermodal transportation workers operating railroad equipment including mechanical and train yard and engine crafts from seven different locations throughout the western and eastern United States with various measures designed to assess their attitudes towards work and their general psychological mood were conducted over a three year period. An average response rate of 81.3% was obtained from the surveys. For persons were asked if they had been involved in a "traumatic event at work" or "near miss" or if there was "another person inured as a result of a work related incident" then a significant correlation was obtained ($r = .204$, $p < .002$, $N=238$), ($r = .205$, $p < .001$, $N=275$) and ($r = .159$, $p < .009$, $N=271$) respectively. Number of fatalities, proximity of persons killed, or working as a train operator were also significant. Results indicate that railroad workers in general reported levels of depression higher than would be expected in the general population. In the present study 11.9% of respondents reported moderate or greater levels of depression as measured by the Beck Depression Inventory which is larger than the 7.06% 12-month prevalence rate reported by Compton (2006) and 6.7% rate reported for the prevalence of Major Depressive Disorder (MDD) obtained by Kessler et. al. (2005) in the NCS Replication study of depression in the general population. Point prevalence, or current prevalence, has been estimated to be 5% to 9% for women and 2% to 3% for men. Using the BDI cutoff score of (18) recommended by Steer Brown, Beck and Sanderson (2001) as a conservative indicator, the present sample was found to have 16.7% of respondents meeting the criteria suggestive of major depressive episode. **Thus, this rate is 2.49 times higher than what was found by Kessler in the NCS-R.** A very small percentage of respondents (less than 1%) reported self-injurious thoughts. The predominantly male sample (97.3%) as a whole had an average age of 43.5 and a mode of 52. However, depression was significantly correlated with younger ages. Depression was also associated with involvement in critical incidents at work and being injured or observing others being injured at work. In addition, significant correlations between depression and decreased concentration, tiredness, sleepiness and lower perceived levels of working safely were also obtained. Limitations of the study include use of self-report measures with an occupationally functioning sample, small sample size, and lack of structured interview corroboration of presence of depressive symptomology. Implications of the results are the possibility that depression may be under diagnosed in male populations and may also have a negative impact on safety and work performance. Recommendations discussed include the need for the development of better screening procedures, increased employee and organizational awareness of signs, need for the development of training programs for supervisory personnel for the identification of signs, symptoms and risks associated with depression in the workplace.

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Introduction

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 has promoted studies which have estimated the cost of untreated depression in the workplace to be in the billions of dollars. (Kessler & Frank, 1997; Wang, et al., 2006).

A recent study by Wang et al (2003) found that depression was significantly associated with quantity, quality and overall work performance, absenteeism (in hours off) and critical incidents which consisted of accidents, injuries or special success or failures. Specifically, depression was associated with approximately 188 days absent per 100 workers. Similarly, depression was associated with 8.9 excess negative critical incidents (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.

Definition of Depression

Hippocrates (460-377 BC) identified melancholia as a condition and postulated that it was caused by an excess of black bile. Depression was first identified by Aristotle as melancholia. Modern conceptualizations of depression were first described by Kreapelin 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 (DSM). He wrote a chapter on manic depressive illness in his "Textbook of Psychiatry" (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 is characterized by the following symptoms:

> A. Five (or more) of the following symptoms have been present during the same 2-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 please see the DSM-IV (APA, 1994)

Prevalence of Depression

Estimates of the prevalence of depression in the population come from two large national surveys (Regier et al., 1993b; Kessler et al., 1994). These studies suggest that approximately 6.2% will experience a mood disorder at some point in their lifetime. Approximately, 6.5% will experience major depression and 1.6% 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% to 25% for women and 5% to 12 % for men. Point prevalence, or current prevalence, was estimated to be 5% to 9% for women and 2% to 3% for men. Major Depressive Disorder current has been defined as having a major depressive episode during the previous 12 months.

Kessler in (1994) estimated the 12-month prevalence of major depressive episode using the DSM-III-R diagnostic criteria as 7.7% for male and 12.9% for females and a total prevalence rate of 10.3%. This represents an 8.6% prevalence rate for Major Depressive Disorder (MDD).

Twelve Month Prevalence

		N	Measure	Any Mood Disorder	MDD	Dysthymia
Weisman (1991)	1991	18 571			3.0	
Regier (1993)	1993					
Kessler (1994)*	1994	8098	DSM-III-R	11.3	8,6	2.5%
Narrow (2002)	2002			7.5	6.4	1.8
WHO (2004)	2004	60,463		9.6%		
Kessler (2005)	2005	9282	DSM-IV	9.5%	6.6	1.5%
Hasin (2005)	2005	43093	DSM-IV		5.28	
Compton (2006)*	2006	42,000			7.06%	

* Studied major depressive episode in last 12 months.

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. Results of the studies showed that the likelihood of having any disorder in the previous 12 months varied from 4.3% in Shanghai to 26.4% in the US. Twelve month prevalence of mood disorders in the US was found to be 9.6% (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 18+ and older 9,282 participants were interviewed using the WHO Composite International Diagnostic Interview (CIDI). Twelve-month prevalence estimates were anxiety, 18.1%; mood, 9.5%; impulse control, 8.9%; substance, 3.8%; and any disorder, 26.2%. Of 12-month cases, 22.3% were classified as serious; 37.3%, moderate; and 40.4%, mild. Fifty-five percent carried only a single diagnosis; 22%, 2 diagnoses; and 23%, 3 or more diagnoses. These incidence rates are similar to those obtained in the WHO (2004) study.

Hasin, et al. (2005) reported that the 12-month MDD prevalence rate was 5.28% for the total population and 3.56% for males and 6.87% for females.

Another large scale study (Compton, 2006) looked at the prevalence of a major depressive episode 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 that the rate of past-year major depressive episodes was 7.06%. The previous twelve 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% of persons who met the criteria for a concurrent substance abuse disorder. Furthermore, a prevalence rate of 17.46% for depression with comorbid substance abuse was found for those aged 18-29 as compared to a 12.36% rate for those persons 45 years of age and older.

Some shrinkage in the 12-month prevalence estimates have been attributed to the change in the diagnostic criteria which were used since the 1994 study. Primarily, the addition of the so-called clinical significance criteria, which assessed whether the person was distressed or that their work performance was affected by the symptoms they suffered, was considered a major factor in obtaining different prevalence rates.

Costs of Depression

Wang et al (2004) studied a sample of 105 reservations agents and 181 customer service agents over a seven day period. Respondents were given pagers and asked to provide data at 5 times each day. Results of these analyses identified seven medical conditions that were analyzable. These seven conditions were as follows: 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 that a total of 1.1% of the workers met the criteria for bipolar disorder (I or II) in the previous 12 months and 6.4% met the criteria for major depressive disorder. Bipolar disorder was associated with 65.5 and major depressive disorder was associated with 27.2 lost workdays. Using average estimates for wages the study suggests that $4426 dollars 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 dollars of salary equivalent lost-days in productivity.

Purpose

The present study was designed to provide an initial estimate of the prevalence of depression in a sample of intermodal transportation workers employed primarily in the railroad industry.

Methodology

Participants

The study participants were obtained from various locations across the eastern and western United States. Individuals were approached as they came on duty at their workstations and terminals and invited to participate in a survey of attitudes and health effects associated with railroad work. Research assistants were trained counselors with at least a Masters 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.

In order 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 available. Thus, all members of the available workforce were invited to participate as they reported for duty during an approximate 48 to 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 1.

Table 1. Locations and Sample Sizes.[1]

Location	N	Depression Measures	BDI	CESD	GHQ*	Response Rate
1. Western - Mechanical TYE	281	275	X			82.6%
2. Rocky Mountain - Mechanical	160	157	X			94.1%
3. South West - TYE	283	282			x	79.5%
4. Rocky Mountain – TYE	55	55		x		74.3%
5. Midwest - TY & E	181	180			x	70.7%
6. NW US - TY&E Employees	193	186	X			89.4%
7. Rail Transit - North East US	298			x		78.6%
Total	1420					81.3%

*Single Item from GHQ scales.

Samples were obtained from several different regions of the country from at least two major carriers. All but one of the samples consisted of employees of freight railroads. The exact locations are not described in order to protect the identities of the collaborating organizations.

Interestingly, the age distribution of the group is bimodal with (M=43.5, Mdn=45, Md=52, SD=11.07). The average number of years worked is 13. However, 40% of employees have worked less than six years, another 27% have worked six to 15 years, and the remainder

[1] BDI – Beck Depression Inventory
CES-D – Center foe Epidemiological Studies Depression Scale
GHQ – General Health Questionnaire

working more than 16 years with a mode occurring at 30 to 32 years. This presents an interesting set of demographics when trying to generalize to the entire population.

Table 2. Demographic Characteristics of Freight Samples

Gender		
Male	1062	97.3%
Female	30	2.7%
Not reported	61	
	1153	
Race		
Asian	19	1.8%
African American	47	4.4%
Native American	12	1.1%
Hispanic	106	9.9%
White	859	80.4%
Other	24	2.3%
Not reported	86	
Age		
20 to 30	159	15.0%
30 to 40	287	27.2%
40 to 50	253	23.9%
50 to 60	328	31.0%
Over 60	30	2.8%
Not reported	96	
	1153	

Table 3. Demographic Characteristics of Transit Sample

Gender		
Male	207	85%
Female	37	15%
Not reported	54	
	298	
Race		
Asian	9	4%
African American	105	44%
Native American	3	1%
Hispanic	37	16%
White	69	29%
Other	13	6%
Not reported	62	
	298	
Age		
20 to 30	21	9%
30 to 40	41	18%
40 to 50	93	41%
50 to 60	69	30%
Over 60	4	2%
Not reported	70	
	298	

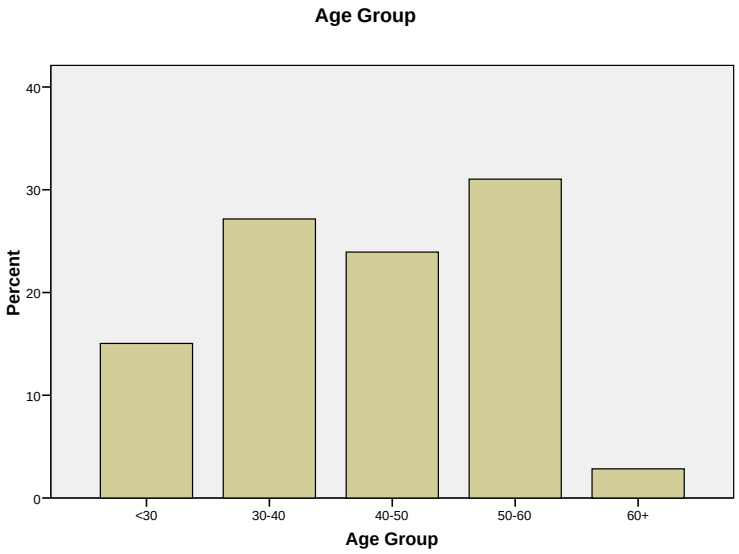


Figure 1. Age Group Distribution for Freight Sample

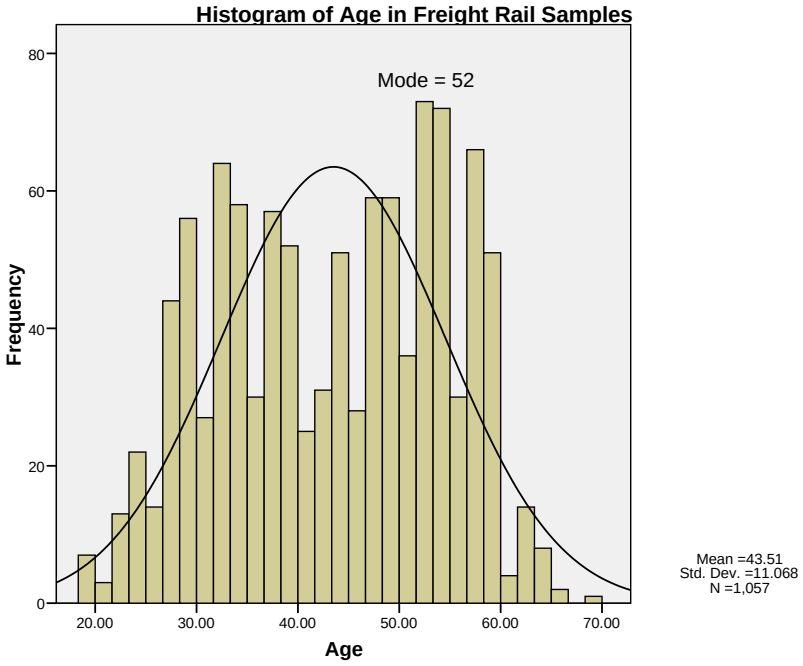


Figure 2. Age Distribution for Freight Sample

Figure 3. Age Group Distribution for Transit Sample

Measures

CESD

Center for Epidemiological Studies Depression Scale (CES-D) (Radloff, 1977). The CES-D 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 BDI, Zung 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. CESD scores of 16 to 26 are considered indicative of mild depression and scores of 27 or more indicative of major depression (Zich et al. 1990, Ensel 1986). Zich, Attkisson & Greenfield (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 cutoffs have been successfully used in studies by Ensel 1986; Zich, Attkisson et al. 1990; Logsdon, McBride et al. 1994; Geisser, Roth et al. 1997.

A study by Pandya, Metz and Patten (2005) with Multiple Sclerosis patients found that a cutoff score of >16 resulted in the correct identification of 74.5% of patients who were DSM-IV diagnosable with a Major Depressive Episode (MDE). The chart below (permission pending) shows that a cutoff score of >=28 will result in the correct classification of more than 85% of persons reporting an MDE. Consequently, using a cutoff score of 28 was selected for this study to determine the extent to which the CES-D detected MDE.

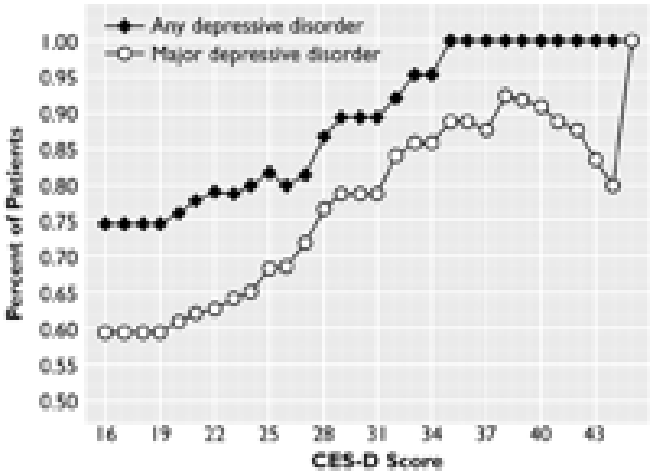


Figure 4. Depression and CESD.

Thomas, Jones, Scarinci, Mehan, & Brantley (2001) studied a sample of low-income women attending public primary care clinics (n = 179, ages 20-77) who completed the CES-D and the Diagnostic Interview Schedule for the DSM-IV (DIS-IV). The results showed that a cutoff score of 16 and above yielded a sensitivity of .95 and specificity of .70 in predicting Major Depressive Disorder (MDD). However, over two-thirds of those who screened positive

did not meet criteria for MDD (positive predictive value = .28). The authors concluded that the standard cut-score was valid but that a score of 34 yielded a higher specificity (.95) and over 50 percent of the patients who screened positive had a MDD (positive predictive value = .53).

Beck Depression Inventory (BDI-II)

Beck Depression Inventory, version 2 (BDI-II) Beck, Steer et al. 1996. The BDI and BDI-II are perhaps the most popular self-report instruments used to assess depression in research studies and clinical practice. The BDI-II was developed to incorporate the revised diagnostic criteria for depressive disorders listed in the DSM-IV (APA. 1994). It is a 21-item scale, requesting information on depressive symptoms over the last two weeks, with possible scores ranging from 0 to 63 (higher values correspond to higher levels of depressive symptomatology). Beck et al. (1996) suggest that scores be interpreted in ranges: not depressed (0-13); mild depression (14-19); moderate depression (20-28); and severe depression (29-63). Similarly, a study by Ball & Steer (2003) found that in a sample of 200 outpatients half of whom were diagnosed with recurrent Major Depressive Disorder (MDD) and half who were diagnosed with Dysthymic Disorder the mean BDI-II scores were significantly different. In addition, Kumar, Rissmiller Steer and Beck (2006) determined that for a sample of 120 outpatients diagnosed with bipolar disorder that significant differences on the BDI-II were found for persons with depressed episodes (M=34.1, sd=13.2) and mixed episodes (M=25.9, sd=13.6), and manic episodes (M=11.7, sd=7.8, $p<.001$). A study by Kogan, Kabacoff, Hersen and van Hasselt (1994) using the Beck Depression inventory found that clinical cut-offs of 22 on the BDI successfully diagnosed 68% of those patients with a major depressive episode (MDD).

A study by Steer, Brown, Beck and Sanderson (2001) found that for a sample of outpatients who were diagnosed with a major depressive episode (MDE) that the mean BDI-II scores were: 18 for mild (N=35), 27 for moderate (N=144), and 34 for severe (N=81) depression.

Shafer (2006) reviewed the four main measures of depression in a meta-analysis and concluded that the specific depression symptom factors measured by each test were relatively robust and consistent with factor structures identified in the literature. The author concluded that three general factors emerged including: a general Depression Severity factor, a smaller Somatic Symptoms factor and an even smaller Positive Affect factor that was found in two of the four measures.

Geisser Roth (1997) compared the psychometric properties of the CESD and the BDI. Discriminant function analysis revealed an optimal cut-off score of 21 for the BDI and 27 for the CES-D. Overall hit rates at these cut-offs for the two questionnaires were comparable, while the CES-D had somewhat better sensitivity (81.8% vs. 68.2%). Conversely, the BDI had slightly better specificity (78.4% vs. 72.7%).

Single Item Measures

Several studies have been conducted that have attempted to shorten the BDI and the CESD 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. 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. A Likert response format (1= to a little or no degree to 5 = to a very great degree) was used to be consistent with the other items in the survey. To compare the results to previous studies employing the GHQ a binary or dichotomous response format was derived by recoding the responses into either a no = 0, for responses 1,2,3 on the Likert scale or yes = 1, responses 4 and 5, to permit comparisons with other published data.

Results

Prevalence of Depression

BDI

Depression scores were calculated for the various samples using either the Beck Depression Inventory or the CES-D. We began the study with the CES-D which was widely accepted for epidemiological purposes, however, we decided that a measure that was more clinical in nature might be useful for decision making purposes. The BDI is considered the best self-report clinical measure of depression from a clinical perspective and has been used in numerous studies. The BDI has been shown to have a high degree of validity and also highly correlated with other self-report measures of depression including the Zung, the CESD, and the MMPI. The BDI was administered, along with a number of other measures, to a sample of the 617 railroad employees from several different locations in the western United States. A total of 94 railroad employees at two locations completed the CESD. A third sample, of 267 transit rail workers who completed the CESD was also obtained.

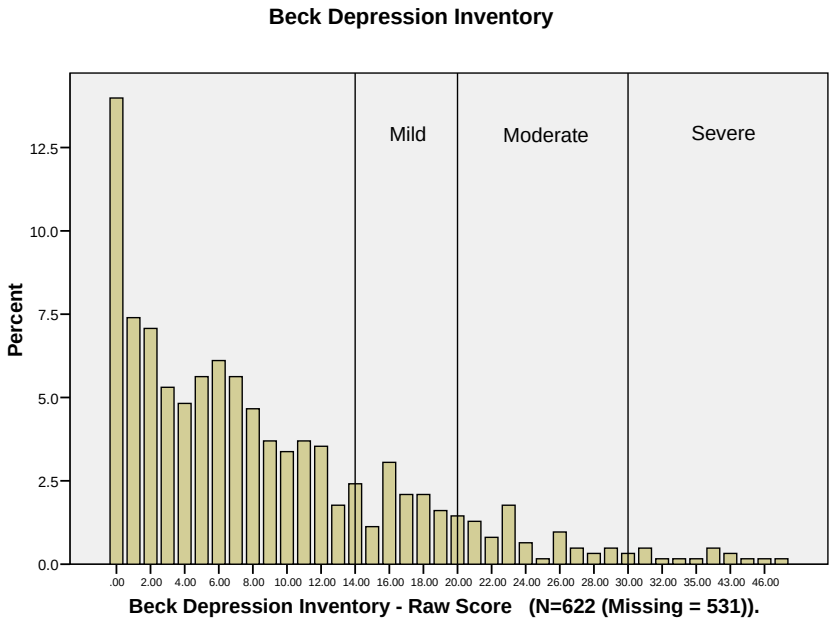
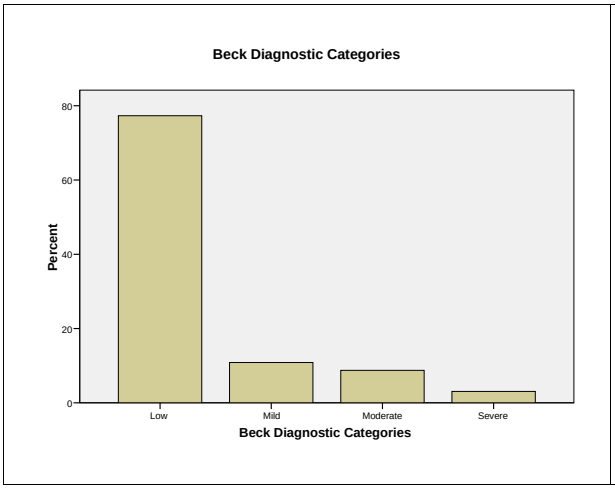


Figure 5. Frequency Distribution of BDI Scores in Total Sample (N=622).

In Figure 5 the histogram of respondents per each BDI value is presented. The following graph and table were complied using the recommended cutoffs (Steer, Brown, Beck and Sanderson, 2001; Beck et al.;1996) from the validation studies of the BDI. The respondents can be classified into mild, moderate and severely depressed categories. The categories depict a population in which a significant portion of the respondents reported levels of depression at or above the traditional cut-offs recommended.



BDI Category	Frequency	Percent	Cumulative Percent
None	477	77.3	77.3
Mild	67	10.9	88.2
Moderate	54	8.8	96.9
Severe	19	3.1	100.0
Total	617	100.0	

Figure 6. Beck Diagnostic Categories

As can be seen from Figure 6, after removing missing data, 77.3% percent were classified as not reporting any depression, 10.9% indicated mild depression, 8.8% moderate depression, and

3.1% severe depression. Looking at the results from a cumulative perspective then, **about 22.7% of the population reported mild or greater levels of depression,** 11.9% reported moderate or greater, and 3.1% reported severe to extreme levels of depression. The finding of 11.8% moderate or greater, is larger than the 7.06% 12-month prevalence rate reported by Compton (2006) and 6.7% for Major Depressive Disorder (MDD) reported by Kessler et. al. (2005) in the NCS Replication study.

Table 4. Major Depression Likely

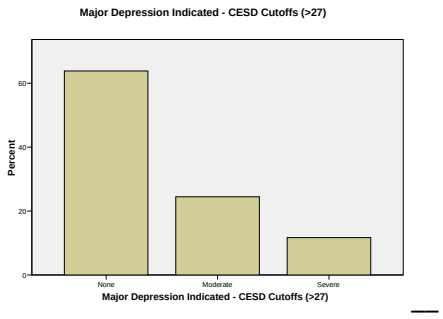
	Frequency	Percent	Cumulative Percent
No Depression	518	83.3	83.3
Major Depression Episode Likely	104	16.7	100.0
Total	622	100.0	

As noted above several authors (Steer, Brown, Beck and Sanderson, 2001; Beck et al.; 1996), have reported that a BDI cutoff of 16 or greater can successfully identify a large group of patients with major depressive episode. Arnou et. al. (2001) evaluated the usefulness of the BDI-II in a primary medical care setting recommended that BDI scores above 18 be used to identify the presence of MDD. Using the score of 18 correctly classified 92% of the patients in the sample (sensitivity = 94 and specificity = 92) Therefore, simply using this cutoff (BDI=18) as a conservative estimate, seen in Table **4**, the present sample was found to have 16.7% of respondents meeting the criteria suggestive of major depressive episode. **Thus, this rate is 2.49 times higher than what was found by Kessler in the NCS-R.** In general the results suggest, using various cutoffs, that there is a higher prevalence of current depression in this population than that found by Kessler et al. Using a two sample t-test for proportions we find that there is a very large difference between the present findings (16.7%) and that of the Compton et al findings (7.06%) ($t=9.23$, $df=42620$, $p<.0001$).

CESD

Results of the analysis of the CESD revealed that approximately 63.8% of the sample was below and 36.2% above the cutoff of 16 recommended by the CESD for identification of depression. Using the more conservative cutoffs recommended by (Pandya, Metz and Patten, 2005) we find that 88.3 percent were below 28 and that 11.7% were above In other words this would suggest that the CESD was able to identify approximately 11.7% of the sample as likely meeting the criteria for MDE. The 95% confidence interval for this score would be 11.7± 6.5% which is to say that we are 95% certain that the true population proportion falls into the range from 5.2% to 18.2%. As noted above (Pandya, Metz and Patten, 2005) this cutoff score was associated with the correct identification of over 85% of persons who were diagnosed with MDE. Using a two sample t-test for proportions we find that there is not a statistically significant difference between the present findings (11.7%) and that of the Compton et al findings (7.06%) for the total population ($t=1.53$, $df=42620$, $p<.ns$). However,, if we compare the two results for the males from the Compton study (4.88%) we find a statistically significant difference between the two samples ($t=2.88$, $df=42620$, $p<.002$). Given the smaller sample (N=94) and the larger confidence interval some error might be present in this estimate

and that only N=94 freight railroad employees completed the CESD we can not be as confident of this estimate as we can with the BDI. Nevertheless, it is statistically higher than we would have expected for the general population.



CESD Category	Frequency	Percent	Cumulative Percent
None (<16)	60	63.8	63.8
Moderate (16-27)	23	24.5	88.3
Severe (=>28)	11	11.7	100.00
Total	94		

Figure 7. CESD Diagnostic Categories

Interestingly, some studies have suggested that the positively worded items may be tapping a different factor than depression and recommend using a shortened version of the CES-D sans the four positive items. The flatter distribution of scores is reflected in the figure below and can be compared to the negatively skewed distribution of the BDI shown in Figure 2.

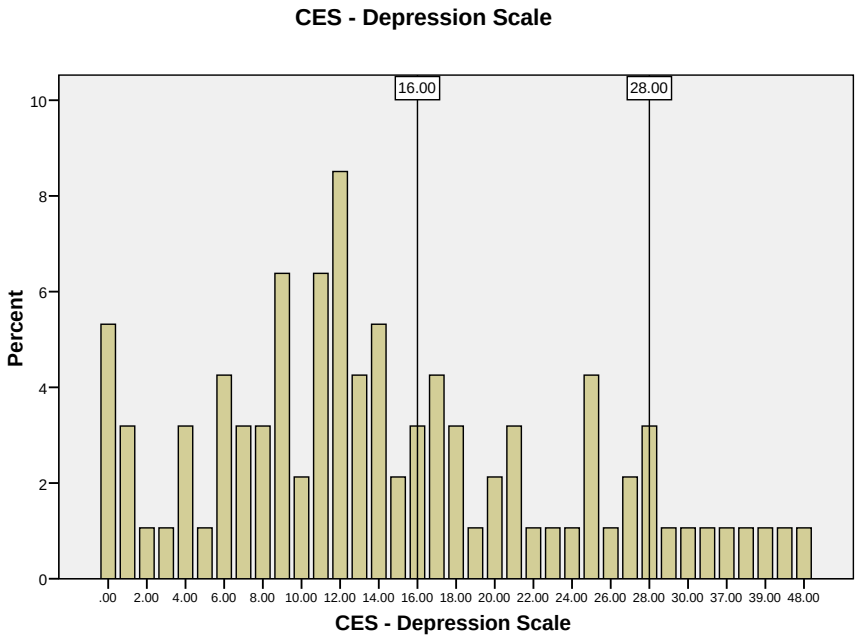


Figure 8. Range of Scores on CESD.

Results suggest then that if we take the most conservative view that a little over 11.7% of the sample is suffering from depression that would be diagnosable by clinicians. Since all of the persons surveyed were in fact working it seems likely that they would not meet the most stringent criteria of DSM-IV diagnosis such that they were not functional. However, clearly a large portion of the population is experiencing and reporting considerable amounts of depression.

In a separate sample of N=298 rail transit workers, who have a very different schedule than the typical freight railroad employees, the CESD was administered. The frequency distribution for the 278 respondents that completed the CESD revealed that with the cut scores recommended above that there was a total of 20.9% were above the cutoff of 16 and that only 5.4% were at 28 or above. These results were not statistically significantly different from the Compton findings for either the total or the male prevalence rates. Thus, the rail transit sample does not appear to have the same level of mood disturbance as the freight sample.

Table 5. Major Depression Likely – CESD Transit Sample

CESD Category	Frequency	Percent	Cumulative Percent
None (<16)	220	79.1	79.1
Moderate (16-27)	43	15.5	94.5
Severe (=>28)	15	5.4	100.
Total	278		

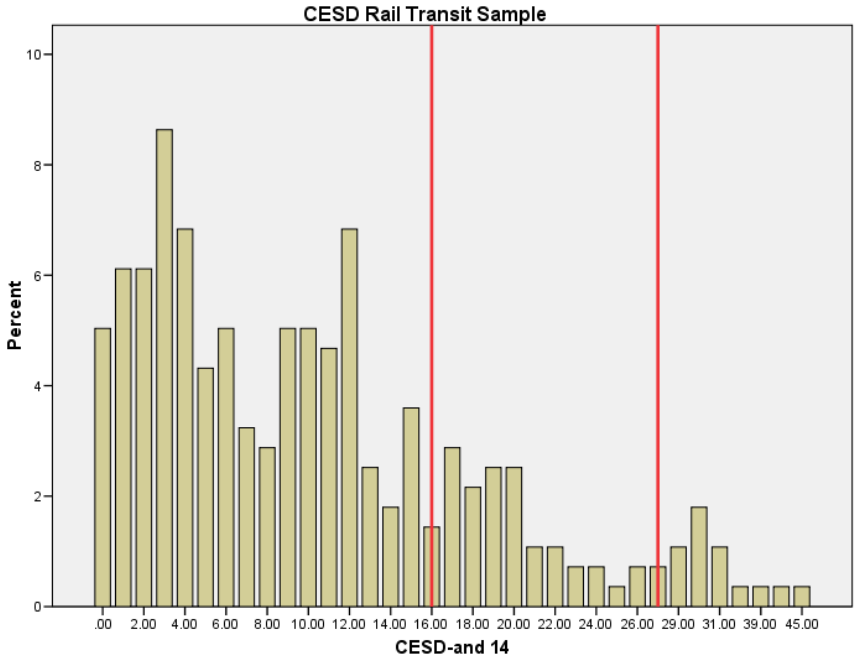


Figure 9. CESD in Rail Transit Sample.

CESD Short Form

A more recent study by Irwin et al 1999 looked at the utilization of a short form of the CESD and provided specificity and sensitivity analyses for the various cutoffs. In a sample of 40 depressed patients 39 were correctly identified using a cutoff score of >= 4. Sensitivity, Specificity and Positive Predictive Value were 97%, 84%, and 85% respectively.

Using the =>4 point cutoff on the recalculated 10 item CESD -Short Form it can be seen from the following chart that more than half would meet the criteria for having a depressive disorder.

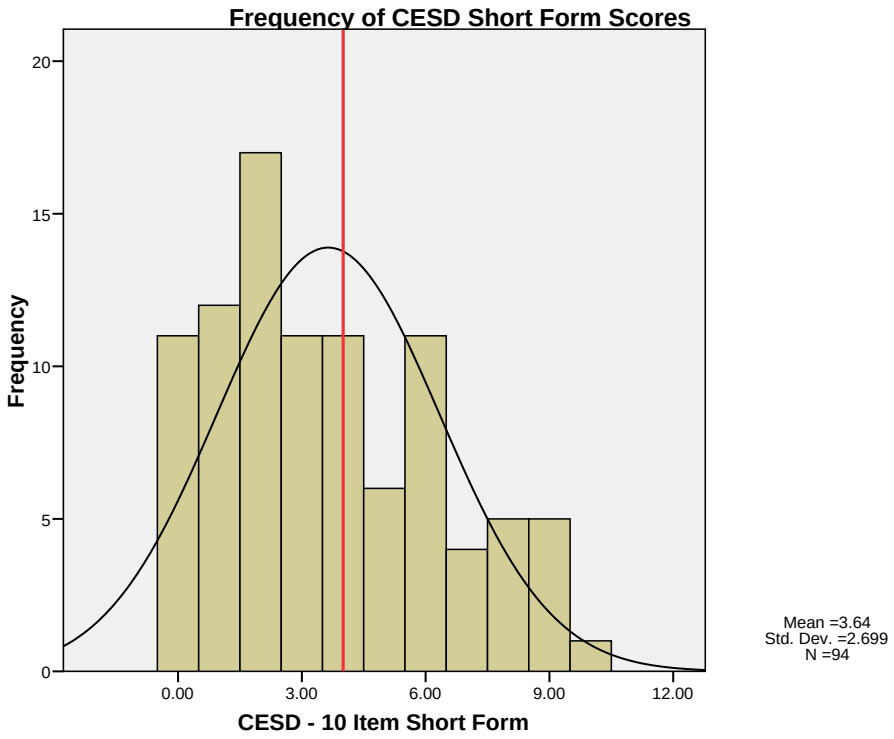


Figure 10. Range of Scores on CESD Short Form.

Table 6. Frequency Distribution for CESD - 10 Item Short Form

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	11	1.1	11.7	11.7
	1.00	12	1.3	12.8	24.5
	2.00	17	1.8	18.1	42.6
	3.00	11	1.1	11.7	54.3
	4.00	11	1.1	11.7	66.0
	5.00	6	.6	6.4	72.3
	6.00	11	1.1	11.7	84.0
	7.00	4	.4	4.3	88.3
	8.00	5	.5	5.3	93.6
	9.00	5	.5	5.3	98.9
	10.00	1	.1	1.1	100.0
	Total	94	9.8	100.0	
Missing	System	866	90.2		
Total		960	100.0		

This table indicated that 34% of the sample would fall into the clinical range. Again, this is statistically significant and larger than what was found in the Compton study (t=10.145, df =42092, p <.0001).

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) which 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 2 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 $\geq$3) had a sensitivity of 83% and specificity of 92% 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 from the previously collected GHQ. In addition, it may be possible 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 various surveys used in our studies with the greatest number of respondents to determine the distribution of scores and to whether the distribution was similar to that obtained by the more robust measures.

Table 7. To what extent have you been feeling unhappy and depressed?

	Frequency	Percent	Valid Percent	Cumulative Percent
Little or no degree	179	38.58%	39.00%	39.00%
Slight degree	106	22.84%	23.09%	62.09%
Moderate degree	101	21.77%	22.00%	84.10%
Considerable degree	46	9.91%	10.02%	94.12%
Very great degree	27	5.82%	5.88%	100.00%
Total	459	98.92%	100.00%	
Missing	5	1.08%		
Total	464	1		

Results of our 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 37.9% reporting moderate or greater symptoms of depression. (See Table 7.) Or, more conservatively, 15.9% experiencing symptoms to a considerable degree or greater, and finally 8.4% reporting a very great degree, which is roughly in line with the estimates obtained with the BDI reported in Figure 5 above. Thus, our measures are relatively consistent in suggesting that a substantial portion of the railroad population studied is experiencing moderate to severe degrees of depression.

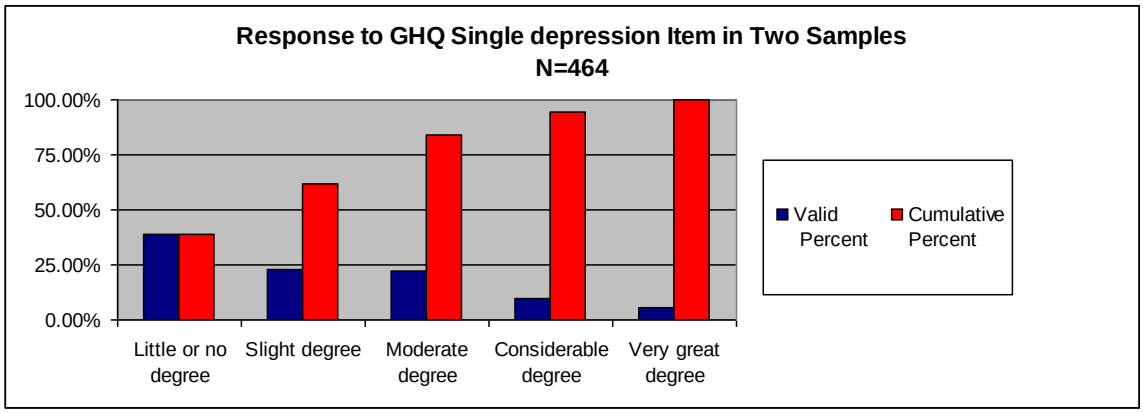


Figure 11. GHQ Single item Scores on feeling depressed.

Table 8. Single item measure of depression in freight and transit rail samples.

How often have you felt depressed? (Transit)

	Frequency	Percent	Valid Percent	Cumulative Percent
Rarely	186	62.4	68.6	68.6
Some	52	17.4	19.2	87.8
Occasionally	24	8.1	8.9	96.7
Most	9	3.0	3.3	100.0
Total	271	90.9	100.0	
Missing	27	9.1		
Total	298	100.0		

How often have you felt depressed? (Freight)

	Frequency	Percent	Valid Percent	Cumulative Percent
Rarely	58	5.0	61.7	61.7
Some	23	2.0	24.5	86.2
Occasionally	9	.8	9.6	95.7
Most	4	.3	4.3	100.0
Total	94	8.2	100.0	
Missing	1059	91.8		
Total	1153	100.0		

Examining the CESD for the single item that measures depression directly for both the freight and the transit rail samples there is a remarkable similarity in the extent to which the

participants reported feeling depressed. As can be seen in Table 8 a little over 4% of the freight sample felt depressed most of the time as did 3.3% of the Transit sample.

Relationships with Other Variables

There were a number of correlates of the BDI. One of the first things that we needed to determine is whether there was any correlation between the BDI and some of the key demographic variables.

Age

There are some misconceptions about the relationship between age and depression with some thinking that depression increases with age. However, some studies have shown a declining correlation between age and depression. Lawton, Kleban, and Dean (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, Jorm, Korten, Jacomb, Christensen, and Rodgers (1998) sampled 2725 persons aged 18 to under 80 and found that symptoms of depression declined with age in both men and women. Lewinshohn (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. Similarly for MDE and dysthymia the percentages were 5.2 and 2.7 for young and older and for dysthymia 1.7 and 1.6.

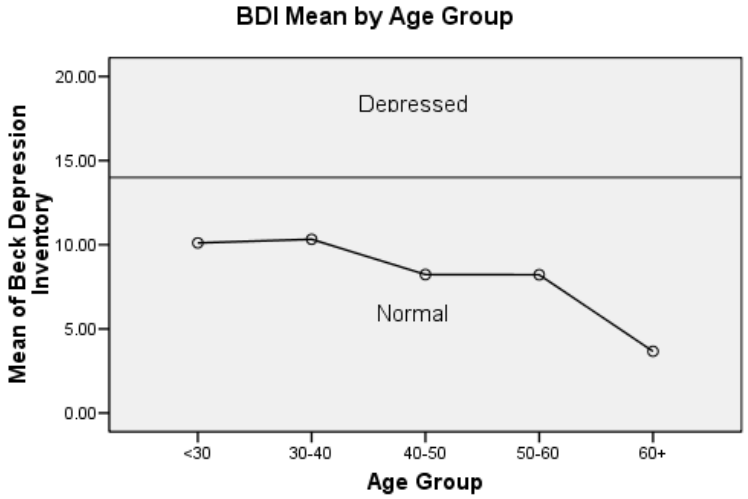


Figure 12. Beck Depression Scores by Age Group for Rail Sample.

In the present study the correlation between the BDI and age was significant (r =-.133, p<..002, N=560) and supported the notion that younger ages generally report more depression. As can be seen in Figure 12, the BDI measure of depression declined gradually with age. In addition, BDI was below clinical cutoffs (cutoff = 14) on the average for all five age groups. Similarly, for the CESD the correlations between age and depression were non-significant in both the Freight and the Transit samples.

Suicide

Suicide has been identified as the eleventh leading cause of death in the U.S. Suicide was the eighth leading cause of death for males and the sixteenth leading cause of death for females in 2004. The overall rate was 10.9 suicide deaths per 100,000 people. (CDC, 2007)_ Major risk factors include: depression and other mental disorders, or a substance-abuse disorder (often in combination with other mental disorders) In addition, 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. Oujendo (2004) cited early 50 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.http://www.nimh.nih.gov/health/publications/suicide-in-the-us-statistics-and-prevention/index.shtml - Moscicki-Epi#Moscicki-Epi (Moscicki, 2001)

Suicidal thoughts often accompany depression. In fact, epidemiological data suggest that between 59 and 87% of suicide victims suffered from major depression and that almost 15% eventually committed suicide. Male gender, previous suicide attempt(s), comorbid 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 preventative 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 the identification and recognition of, 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, 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.

Results from the suicidal ideation item of the BDI provide interesting data. For example, Item #9 asks respondents to indicate the extent to which they are experiencing suicidal thoughts. As seen in the table below 93.3 percent of respondents were not experiencing any thoughts of killing themselves. However, a relatively small number, 0.5% indicated that they would if they had the chance. While this is a small percent, in a group of 20,000 operating employees 100 people could be actively considering taking their own life. Interestingly, men tend to be more likely to engage in active and violent means of completing suicide than do women who are more likely to use a passive means such as taking pills.

Table 9. Suicidal thoughts or wishes

	Frequency	Percent	Valid Percent	Cumulative Percent
I don't have any thoughts of killing myself	575	49.9	93.3	93.3
I have thoughts of killing myself, but I would not carry	38	3.3	6.2	99.5
I would kill myself if I had the chance	3	.3	.5	100.0
Total	616	53.4	100.0	
Missing	537	46.6		
Total	1153	100.0		

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 Knorring, 1997; Teri, 1982), adolescent psychiatric outpatients (Steer et al., 1998), and adolescent psychiatric inpatients (Ivarsson et al., 1998; Larsson and Ivarsson, 1998). .

Suicidal ideation has been associated with subsequent suicidal acts by both Kessler (1999) and Oquendo (2004). In fact Oquendo (2004) the presence of suicidal ideation and high levels of depression as measured by the BDI were found to increase the risk of suicide attempts by a factor of 2.96. Interestingly, the severity of depression has not been shown to be a significant predictor of suicide attempts in comparison to level of pessimism and other factors.

For non patient 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% 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.

Concentration

Another one of the key constructs of depression is ability to concentrate. Examining the BDI items more carefully we see that item #19 is specifically related to depression and the frequency of response is presented below. As can be seen, 33% of respondents indicated that

they could not concentrate as well as they used to and in fact a combined total of 5.7% report more severe concentration difficulties ("can't keep my mind on anything" and "can't concentrate on anything"). Such difficulties could present some challenges in the operational environment.

Table 10. BDI - Concentration Difficulty

		Frequency	Percent	Valid Percent	Cumulative Percent
	I can concentrate as well as ever	414	35.9	67.0	67.0
	Can't concentrate as well	169	14.7	27.3	94.3
	It's very hard to keep my mind on anything	30	2.6	4.9	99.2
	Can't concentrate on anything	5	.4	.8	100.0
	Total	618	53.6	100.0	
	Missing	535	46.4		
Total		1153	100.0		

A similar item on the CESD "Had trouble keeping my mind on what I was doing" reveals that about 3.2 percent of the freight rail sample had "trouble" MOST of the time while in the transit rail sample only 1.8 percent had similar reports.

Fatigue

Problems sleeping and fatigue are symptoms that are strongly associated with a diagnosis of depression. Due to the safety sensitive nature of the railroad operating environment fatigue could contribute to the occurrence of accidents.

Table 11. Fatigue indicators – Sleeping Changes reported by freight rail respondents.

	Frequency	Valid Percent
No changes in sleeping	248	40.6
Sleep more	159	26.0
Sleep less	137	22.4
Sleep a lot more than usual	29	4.7
Sleep a lot less than usual	28	4.6
Sleep most of the day	2	.3
I wake up 1-2 hours early and can't get back to sleep	8	1.3
Total	611	100.0

Table 12. Fatigue indicators – Tiredness reported by freight rail respondents.

Tiredness or Fatigue

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No more tired than usual	310	26.9	50.2	50.2
	Tired more easily	242	21.0	39.2	89.3
	Too tired to do a lot of the things I used to	51	4.4	8.3	97.6
	Too tired to so most things	15	1.3	2.4	100.0
	Total	618	53.6	100.0	
Missing	System	535	46.4		
Total		1153	100.0		

Two items from the BDI specifically reference fatigue and from the frequency distribution we can see that slightly over 10% of the respondents indicate that they are "too tired to do a lot of the things I used to" and "Too tired to do most things". Furthermore, about 22.4% indicated that they "slept less"; 4.6% reported "sleep less than usual" and 1.1% reported waking and being unable to get back to sleep.

For the N=434 respondents who completed both the BDI and the Epworth in the freight rail sample the correlation between the two scales was statistically significant (r=.315, p<.001). Clearly, there is a moderate and positive relationship between the amount or level of depressed affect or mood and the amount of sleepiness that is reported

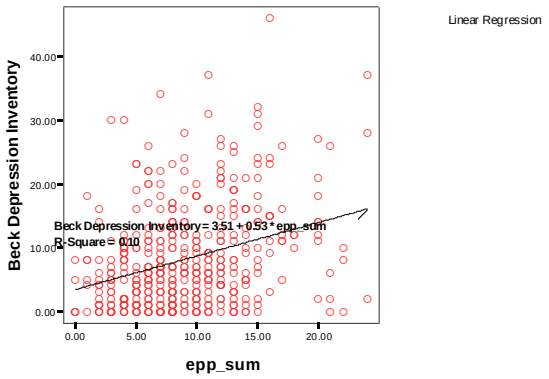


Figure 13. Scattergram for BDI and Epworth.

fatigue reported in this particular sample. Moreover, **the relative risk of reporting high levels of fatigue when also reporting depression is 2.49,** meaning that there is almost two and half times the risk of reporting very high levels of fatigue when also experiencing depression.

Results for the CESD in the transit rail sample also show a similar picture. Respondents who completed the CESD and the Epworth produced a significant positive correlation (r = .240, p <.001, N= 275). In effect, the greater the depression the greater the self-reported sleepiness and vice versa.

Injuries

There is a small but significant relationship between the number of injuries an individual reported and the level of depression. In particular there was a significant correlation between the BDI and number of injuries (r = .09, p<. 01) for the N=432 individuals who completed both the BDI and the number of injuries question. The correlation between the CESD and number of injuries reported was also significant (r=.232, p<.04, N=54) but based on fewer respondents in the freight sample. The correlation between injuries and depression using the CESD in the transit rail sample was also significant (r= 246, p <.001, N=236).

Safety at Work

There is statistically significant correlation between scores on the BDI and self-reported perceptions of being safe at work. For this particular study a scale was devised which asked respondents several questions about their overall safety at work. The scale was comprised of items such as "is your work behavior as safe as you would like it to be" and others responded to on a five point Likert type response scale.

For the sample of rail transit workers (N=274) a significant negative correlation was obtain such that the higher the level of depression the greater the likelihood that respondents would indicate that their level of work performance was poor (r=-.258, p<.001). Similarly, they also reported that their overall job performance was lower (r= -.246, p <.001) and that they did not work as carefully (r =-. 181, p<.003). An overall index of work safety and performance constructed out of five items (Cronbach's Alpha = .794) was also significantly negatively correlated with depression (r = -.193, p < .002).

Results indicate that higher levels of depression were associated with lower levels of perceived ability to work safely at work. (r=-140, p<.013)

Absenteeism

In order to assess the potential impact of depression on work performance the correlations between the various depression measures and an index of absenteeism were calculated. For the Transit rail sample a statistically significant correlation was obtained between a four item measure of absenteeism (alpha=.79) and the CESD (r=.164, p<.007, N=270). However, the four item index was not reliable for the Freight rail sample. Instead significant correlations were obtained between single item measures of absenteeism. Significant correlations were obtained in the freight rail sample between the Beck Depression inventory and an item "In the past FOUR weeks how many days did you miss an entre work day because of problems with your physical or mental health?" (r=.166, p < .028, N=175) and also with "In the past four weeks how many days did you miss part of a work day because of problems with your physical or mental health?" (r= .193, p < .011, N =171).

Critical Incidents

For persons who reported that they were involved in a traumatic incident at work in the Transit rail sample the results are somewhat confusing. In the first place, if asked if they were involved in a 12-9 (train hitting a pedestrian) there was no significant relationship between the CESD and the occurrence of such an event. Nor was there any relationship between the number of incidents or whether there was a fatality. However, when respondents were asked if they were involved in a "traumatic event at work" or "near miss" or if there was "another person inured as a result of a work related incident" then a significant correlation was obtained ($r = .204$, $p < .002$, $N=238$), ($r = .205$, $p < .001$, $N=275$) and ($r = .159$, $p < .009$, $N=271$) respectively. Number of fatalities, proximity of persons killed, or working as a train operator were significant.

Examining the data from the freight rail sample a number of important findings were obtained. Significant correlations were found between

	CESD	BDI
Involvement in a GA or Trespasser Incident	.003	.068
Was a person killed?	-.066	-.007
Was a person injured	.312	.184*
Injured as a result of involvement in a traumatic	-.320*	
GCA involving heavy equipment		.217*

Relative Contribution of Risk Factors to Occurrence of Depression

In order to complete the analyses of the various factors that were correlated with the various measures of depression a regression analysis was run. Regression enables the simultaneous examination of the contribution to the variance in the occurrence of a dependent variable.

Results of the regression analysis reveal that the best combination of predictors of the Beck Depression Inventory was: level of perceived stress, inability to discuss person feelings with others. Other variables such as: exposure to critical incidents, age, education, marital status, craft, number of incidents involved in and number of fatalities did not contribute significantly when these other variables were include in the question.

Discussion

Prevalence

Results of this study suggest that the railroad employees may have a slightly higher prevalence of depressive symptoms than that of the general population. Using the Beck Depression inventory, persons sampled were found to have a statistically higher level of depression symptoms than those reported in the literature. Using the suggested cutoff scores that have been associated with the successful identification of Major Depressive Disorder (MDE) the BDI identified 16.7% of the freight rail sample as being likely to meet the criteria for MDE the corresponding confidence interval is ± 2.93% which is to say that we are 95% certain that the true population proportion falls into the range from 13.79% to 19.65%. Put another way, at this confidence level and this sample size, there will be a one-in-twenty chance that the true population proportion will fall outside the calculated range. This is significantly higher than published prevalence rates for depressive symptomology than that experienced by the general population. The first question that comes to mind is whether the results are consistent with other findings. As noted in the introduction we have found that in other large scale studies of depression there is a finding, primarily using structured interviews as a means to diagnose the presence of depression, that the best estimate for the prevalence of depression in the last 12 months comes from the Kessler study which estimates that there is about 6.5% depression. The most recent epidemiological study by Compton found that 7.06% of the population suffered from MDD during the previous 12 months. Compared to these large scale studies the finding of 16.7% using fairly conservative criteria is quite large and raises concerns about the health and safety of the freight railroad operating population. **Thus, this rate is 2.49 times higher than what was found by Kessler in the NCS-R.** In general the results suggest, using various cutoffs, that there is a higher prevalence of current depression in this population than that found by Kessler et al. (2005) or Compton (2006). Using a two sample t-test for proportions we find that there is a very large difference between the present findings (16.7%) and that of the Compton et al findings (7.06%) ($t=9.23$, $df=42620$, $p<.0001$). This was also supported by the CESD in the freight sample but not the transit rail samples.

Age

The fact that the average age of the freight rail workers in the present sample was 43.51 with a mode of 52 suggests that on the average the population of rail workers is generally a little older. The second mode occurred around 32 years and as can be seen the age distribution is roughly bimodal (see Figure 2) above and below 40 with a somewhat greater number of employees 60.2 percent of the employees were in the over 40 age group. The fact that there are higher levels of depression for the freight rail sample, given the preponderance of employees over 40, is unexpected since other studies have suggested that the prevalence of depression declines with age. The fact that we see even higher levels is somewhat disconcerting and raises questions as to why and how this might be occurring. There are no clear cut indications as to the reasons for these differences. However, Figure 10 does suggest that there are higher elevations of depression among the younger age groups, which is consistent with the literature.

Concentration

Results of the analyses indicate that 33% of respondents might not be able to concentrate as well as they used to and in fact a combined total of 5.7% report more severe concentration difficulties ("can't keep my mind on anything" and "can't concentrate on anything"). Such difficulties could present some challenges in the operational environment.

This is an important finding in that, while most people generally associate depression with feelings of sadness and low self-worth they usually don't make the association with concentration. In the rail operating environment concentration, in the face of numerous routine, but high risk or high stakes tasks, can be catastrophic.

The present findings point to the need to increase awareness of the potential health and safety risks associated with depression that manifest in the form concentration deficits possibly attributable to depression and other medical conditions. In other work we have documented the important to concentration as a key component of successfully completing switching operations in a yard setting.

At the very least, then, depression may contribute to lack of concentration which may in turn impact operational safety.

Fatigue

As is well known, depression is often marked by severe disturbances in sleep. These can manifest as either an inability to sleep, an inability to wake, or premature awakening. Results from the inventories suggest the presence of sleep disturbances in a considerable portion of the sample. Wherein, 26% reported sleeping more and 22.4% reported sleeping less. In addition, the present results also showed a significant correlation between scores on the BDI and the Epworth sleepiness scale ($r=.315$, $p<.001$). The correlation was significant, but only moderate in magnitude suggesting that the two scales are measuring phenomena that are not strongly associated with each other. Nevertheless, based on the frequency distribution and crosstabulation analyses in the present sample **the relative risk of reporting high levels of fatigue when also reporting depression is 2.49,** meaning that there is almost two and half times the risk of reporting very high levels of fatigue when also experiencing depression. These findings were present, to a lesser degree in the transit sample as well.

Again, it is impossible to attribute causality from these data. We can merely state that that there is a statistically significant association between fatigue and depression. It may be caused by the depressive symptomatology or it could just as easily be the result o fatigue resulting from the nature of railroad work. It could also be none of these and the result of as yet still undefined or undetermined variable. Clearly, more research is needed to help identify these factors.

Safety at Work and Injuries and Critical Incidents

The results of the study also revealed some small but statistically significant relationships between self-reported injuries, involvement in critical incidents and perceived safety at work and depression. It is noteworthy that involvement in various critical incidents such as grade crossing and trespasser fatalities or injuries to co-workers was also associated with a greater likelihood to report high levels of depression. These events appear to carry with them significant psychological consequences that affect the individual in spite of the fact that there are no physical consequences. The psychological consequences may have an indirect effect on subsequent worker safety and performance not to mention personal distress and fatigue. The finding of feeling less likely to feel that "work behavior is safe" seems consistent with the finding that persons who are depressed would feel more vulnerable due to lower levels of concentration, lowered self-esteem, and pessimism. There may be some potential for lower levels of concentration as noted above. All things considered, these results suggest that there is a lowered perception of perceived safety which may be affected by a lack of concentration, reduced motivation, pessimism and the like. Whether there are in fact more injuries among employees who experience depression remains to be seen. Clearly, a prospective study that would follow a random sample of employees over a specific period of time is needed to be able to determine the relationship in a predictive sense between the depression and safety is needed.

The finding that persons with injuries also report higher levels of depression is not surprising. Medical patients, persons undergoing surgery, patients with some illness etc all report higher levels of depression. Accordingly, it is not surprising that one of the consequences of being injured at work might also be depression.

The importance of these findings however relate to the fact that persons with who have been injured in the workplace may also experience the feelings of depression and the associated decreases in attention, pessimistic outlook, potential for suicidal ideation, and feelings of fatigue all of which may contribute to a loss of attention and the possibility of self-injurious behavior that may have subsequent negative consequences in the workplace. These effects are of course in addition to the person feelings of discomfort and anxiety associated with the condition itself. The bottom line is that any event or activity in the workplace that causes or exacerbates depression creates a condition which can in turn have additional negative consequences in the workplace.

Implications

The implications of these findings are that additional attention should probably 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 the employees as a significant cost to doing business. However, the findings that involvement in critical incidents, injuries and associated with trauma that affects co-workers can create a set of emotions and attitudinal consequences which

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 measures used were self-report which provide 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 has to do with the fact that the population studies were all gainfully employed and were surveyed when they reported for duty. Despite the adequate response rate (81.3%) 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.

The sample size upon which the various instruments were administered varies from around six hundred to less. While we had a large sample size additional respondents all completing the same instrument are needed to achieve the highest possible levels of statistical significance.

The use of a structured interview forma 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.

Recommendations

1. **Increase screening.** The finding that the level of MDE is possibly 2.5 times higher than would be expected in the general population is a concern. While there are a number of factors that may contribute to this finding there is still a need to explore it. If there are 20,000 operating employees there may be as many as 200 people who have serious suicidal ideation and would "kill themselves if they had the chance."
2. **Supervisor training.** The high rates of depression in the sample suggest that it may be beneficial to provide supervisors with additional training regarding how to identify depression and what types of responses are helpful and what type of resources are available to assist in the diagnosis and treatment of depression. 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 EAP or make a referral, from what we know about depression in the males, they would be more likely to respond to someone they know. Therefore a supervi**sor or a trusted coll**eague might be more likely to be effective.
3. **Regulations.** If the numbers are correct, and if there is a sense that these are indeed safety sensitive position, it may be necessary to require that individuals **will have a yearly p**hysical that shall also include an assessment of depression.

4. **Public Awareness and Education.** A campaign to alert people to the issues facing employees
5. **Safety and Depression.** Given high levels of depression found in this study employers may also wish to consider the potential impact of depression on safety on operations in the work place. The results how significant correlations between depression safety and concentration. Consequently, employers may wish to more closely monitor levels of depression in their workforce by require. Additional screen, awareness campaigns, publication of National Depression Awareness Week could be a significant first step. Later, more aggressive screening could be done.

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