



Executive Summary

Psychiatric Disorders and Commercial Motor Vehicle Driver Safety

Presented to

The Federal Motor Carrier Safety Administration

August 29, 2008

Prepared for



MANILA Consulting Group, Inc.

1420 Beverly Road, Suite 220

McLean, VA 22101

Prepared by



ECRI Institute

5200 Butler Pike

Plymouth Meeting, PA 19462

Evidence reports are sent to the Federal Motor Carrier Safety Administration's (FMCSA) Medical Review Board (MRB) and Medical Expert Panels (MEP). MRB and MEP make recommendations on medical topics of concern to the FMCSA.

The FMCSA will consider all MRB and MEP recommendations; however, all proposed changes to current standards and guidance (guidelines) will be subject to public notice and comment and relevant rule-making processes.

Policy Statement

This report was prepared by ECRI Institute under subcontract to MANILA Consulting Group, Inc., which holds prime GS-10F-0177N/DTMC75-06-F-00039 with the Department of Transportation's Federal Motor Carrier Safety Administration. ECRI Institute is an independent, nonprofit health services research agency and a Collaborating Center for Health Technology Assessment of the World Health Organization. ECRI Institute has been designated an Evidence-based Practice Center by the United States Agency for Healthcare Research and Quality. ECRI Institute's mission is to provide information and technical assistance to the healthcare community worldwide to support safe and cost-effective patient care. The results of ECRI Institute's research and experience are available through its publications, information systems, databases, technical assistance programs, laboratory services, seminars, and fellowships. The purpose of this evidence report is to provide information regarding the current state of knowledge on this topic. It is not intended as instruction for medical practice or for making decisions regarding individual patients.

Authorship

Stephen Tregear, DPhil (Manila Consulting Group)

Marie Tiller, PhD (ECRI Insititute)

Nicholas Price (ECRI Institute)

Executive Summary

Purpose of Evidence Report

Of all occupations in the United States, trucking industry workers experience the third highest fatality rate, accounting for 12% of all worker deaths. About two-thirds of fatally injured truck workers were involved in highway crashes. According to statistics from the U.S. Department of Transportation, there were 4,932 fatal crashes involving a large truck in 2005 for a total of 5,212 fatalities. In addition, there were 137,144 nonfatal crashes; 59,405 of these crashes resulted in an injury to at least one individual (for a total of 89,681 injuries).

The purpose of this evidence report is to summarize the available data pertaining to the relationship between a number of psychiatric disorders and commercial motor vehicle (CMV) driver safety. Driving is a complicated psychomotor performance that depends on fine coordination between the sensory and motor systems. It is influenced by factors such as arousal, perception, learning, memory, attention, concentration, emotion, reflex speed, time estimation, auditory and visual functions, decision making, and personality. Complex feedback systems interact to produce the appropriate coordinated behavioral response. Anything that interferes with any of these factors to a significant degree may impair driving ability. Psychiatric illnesses may affect thinking, mood, and/or perception, resulting in a wide range of types and degrees of cognitive impairment. Insight is critical for drivers to drive within their limitations and to know how and when these limitations change. Poor insight in patients with psychiatric illness may be evidenced by noncompliance with treatment, trivializing their role in a crash, or repeated involuntary admissions to hospital (often as a result of discontinuing prescribed medication).

To meet the aims of the evidence report, we addressed the following three key questions:

Key Question 1: Are individuals with a psychiatric disorder at an increased risk for motor vehicle crash? If so, are there specific psychiatric disorders that present a particularly high risk?

Key Question 2: Are individuals using psychotherapeutics for a psychiatric disorder at an increased risk for crash when compared to comparable individuals who are not using psychotherapeutics?

Key Question 3: What traits associated with personality disorders are associated with reductions in motor vehicle driver safety?

Thus, the primary aims of this report are to examine the relationship between psychiatric disorders and driver safety and to examine the impact of psychopharmacotherapy on driver safety.

Identification of Evidence Bases

Separate evidence bases for each of the key questions addressed by this evidence report were identified using a process consisting of a comprehensive search of the literature, examination of abstracts of identified studies in order to determine which articles would be retrieved, and the selection of the actual articles that would be included in each evidence base.

A total of seven electronic databases (MEDLINE, PubMed (preMEDLINE), EMBASE, PsycINFO, CINAHL, TRIS, the Cochrane Library) were searched (through January 28, 2008). In addition, we

examined the reference lists of all obtained articles with the aim of identifying relevant articles not identified by our electronic searches. Hand searches of the “gray literature” were also performed. Admission of an article into an evidence base was determined by formal retrieval and inclusion criteria that were determined *a priori*.

Grading the Strength of Evidence

Our assessment of the quality of the evidence took into account not only the quality of the individual studies that compose the evidence base for each key question; we also considered the interplay between the quality, quantity, robustness, and consistency of the overall body of evidence.

Analytic Methods

The set of analytic techniques used in this evidence report was extensive. Random-effects meta-analyses were used to pool data from different studies. Differences in the findings of studies (heterogeneity) were identified using the Q-statistic and I^2 . Sensitivity analyses, aimed at testing the robustness of our findings, included the use of cumulative random-effects meta-analysis.

Presentation of Findings

In presenting our findings, we made a clear distinction between qualitative and quantitative conclusions and we assigned a separate “strength-of-evidence” rating to each conclusion format. The strength-of-evidence ratings assigned to these different types of conclusion are defined in Table 1.

Table 1. Strength-of-Evidence Ratings for Qualitative and Quantitative Conclusions

Strength of Evidence	Interpretation
Qualitative Conclusion	
Strong	Evidence supporting the qualitative conclusion is convincing. It is highly unlikely that new evidence will lead to a change in this conclusion.
Moderate	Evidence supporting the qualitative conclusion is somewhat convincing. There is a small chance that new evidence will overturn or strengthen our conclusion. ECRI Institute recommends regular monitoring of the relevant literature for moderate-strength conclusions.
Minimally Acceptable	Although some evidence exists to support the qualitative conclusion, this evidence is tentative and perishable. There is a reasonable chance that new evidence will either overturn or strengthen our conclusions. ECRI Institute recommends frequent monitoring of the relevant literature.
Insufficient	Although some evidence exists, the evidence is insufficient to warrant drawing an evidence-based conclusion. ECRI Institute recommends frequent monitoring of the relevant literature.
Quantitative Conclusion (Stability of Effect-size Estimate)	
High	The estimate of treatment effect in the conclusion is stable. It is highly unlikely that the magnitude of this estimate will change substantially as a result of the publication of new evidence.
Moderate	The estimate of treatment effect the conclusion is somewhat stable. There is a small chance that the magnitude of this estimate will change substantially as a result of the publication of new evidence. ECRI Institute recommends regular monitoring of the relevant literature.
Low	The estimate of treatment effect included in the conclusion is likely to be unstable. There is a reasonable chance that the magnitude of this estimate will change substantially as a result of the publication of new evidence. ECRI Institute recommends frequent monitoring of the relevant literature.
Unstable	Estimates of the treatment effect are too unstable to allow a quantitative conclusion to be drawn at this time. ECRI Institute recommends frequent monitoring of the relevant literature.

Evidence-based Conclusions

The findings of our analysis of the best available data addressing each of the questions asked by the Federal Motor Carrier Safety Administration are presented below.

Key Question 1: Are individuals with a psychiatric disorder at an increased risk for motor vehicle crash? If so, are there specific psychiatric disorders that present a particularly high risk?

- **The evidence concerning crash risk for drivers with psychiatric disorders is inconclusive. The possibility of an increased risk of crash for some drivers with psychiatric disorders cannot be ruled out (Strength of Evidence: Minimally Acceptable).**

Our searches identified eight direct crash risk studies with a total of 1,931 individuals with psychiatric disorders. The quality assessment was low for six studies and moderate for two studies. None of the study participants were specifically identified as CMV drivers, so the generalizability of findings to the CMV driver population is unclear.

The findings of seven studies could be combined in a quantitative analysis. Pooling of the data from these studies found no statistically significant difference in crash risk between drivers with psychiatric disorders and drivers without psychiatric disorders. However, the possibility of an increased crash risk for some drivers with psychiatric disorders could not be ruled out. We note that the patient populations enrolled in these studies were unlikely to have included individuals with severe symptoms who would be more likely to have impaired driving ability.

Subgroup Analyses: Specific Psychiatric Disorders and Crash Risk

- **Psychotic Disorders: Currently available evidence does not suggest an increased crash risk for individuals with psychotic disorders compared to individuals without these disorders, but an increased crash risk cannot be ruled out (Strength of Evidence: Minimally Acceptable).**
- **Mood Disorders: Although evidence suggests the possibility that individuals with mood disorders are at an increased risk for a motor vehicle crash compared with drivers who do not have mood disorders, more evidence is needed to reach a firm conclusion.**
- **Anxiety Disorders: A paucity of evidence prevents us from being able to draw an evidence-based conclusion about the effects of anxiety disorders on the risk of motor vehicle crash.**
- **Personality Disorders: Due to inconsistencies in the available evidence, we are precluded from drawing an evidence-based conclusion pertaining to the strength of the relationship between personality disorders and crash risk at this time.**

Our searches identified four studies with a total of 332 individuals with psychotic disorders, three studies with a total of 377 individuals with mood disorders, one study with 95 individuals with anxiety disorders, and three studies with 217 individuals with personality disorders. The median quality assessment for each subgroup analysis was low. Even when pooling of data was possible, none of these analyses found a statistically significant increase in crash risk for any of the four types of disorders compared to patients

without psychiatric disorders. However, the possibility of increased crash risk could not be ruled out in any of these subgroup analyses.

Key Question 2: Are individuals using psychotherapeutics for a psychiatric disorder at an increased risk for crash when compared to comparable individuals who are not using psychotherapeutics?

Analysis 1: Benzodiazepine Use and Crash Risk

- **Benzodiazepine use is associated with an increased risk for a motor vehicle crash (Strength of Evidence: Moderate).**
 - Benzodiazepine anxiolytic use is associated with an increased risk for a motor vehicle crash (Strength of Evidence: Minimally Acceptable).
 - Crash risk may be greater during the first week of an index prescription of benzodiazepines (Strength of Evidence: Minimally Acceptable).
 - Crash risk may be greater among benzodiazepine users ≤ 40 years of age (Strength of Evidence: Minimally Acceptable).

Our searches identified nine direct crash risk studies with a total of approximately 235,000 individuals using benzodiazepines. The average quality of these studies was moderate. None of the study participants were specifically identified as CMV drivers, so the generalizability of the findings to the CMV driver population is unclear. The findings of the nine studies were inconsistent. However, pooling of the data from each study found elevated odds of crash associated with benzodiazepine use. This finding was statistically significant and robust.

Because benzodiazepine anxiolytics are more likely to be used than hypnotics in patients with psychiatric disorders, we performed a subgroup analysis of five studies that presented separate crash data for users of anxiolytics. The pooled data analysis found that the odds of crash were significantly increased in users of benzodiazepine anxiolytics.

Further analysis to identify factors that may lead to increased risk for benzodiazepine users identified timing of exposure and patient age as potential risk factors. Two studies found the highest risk of crash to occur during the first week of the index prescription, and two studies found that crash risk was higher in benzodiazepine users ≤ 40 years of age.

Analysis 2: Antipsychotic Use and Crash Risk

- **The evidence concerning crash risk associated with antipsychotic use is inconclusive. The possibility of an increased crash risk associated with antipsychotic use cannot be ruled out.**

One study addressed the potential association between antipsychotic drugs and crash risk. This study found no excess risk of crash associated with antipsychotic agents within two weeks or four weeks of the index prescription. As this is a single moderate-quality study and the 95% confidence intervals around the effect estimates do not rule out the possibility of increased risk, more evidence is needed to confirm these findings.

Analysis 3: Antidepressant Use and Crash Risk

- **The evidence concerning crash risk associated with antidepressant use is inconclusive. The possibility of an increased crash risk associated with antidepressant use (particularly tricyclic antidepressant [TCA] use) cannot be ruled out (Strength of Evidence: Minimally Acceptable).**

Our searches identified seven direct crash risk studies with an unknown number of individuals using antidepressants—the number is not reportable because the raw data needed to calculate the total study population using antidepressants was not reported in all studies. Because these are seven of the nine studies identified under benzodiazepines, the generalizability issues and quality assessments are described in the earlier summary.

The findings of six of the seven studies could be combined to obtain a summary estimate of the relative odds of crash associated with antidepressant use. Pooling of the data from these studies found that the odds of crash was not significantly different for drivers using antidepressants compared to drivers not using antidepressants. However, there was a trend toward elevated risk associated with antidepressants, and the wide confidence interval around the summary estimate means that the possibility of increased crash risk cannot be ruled out. The same finding was shown for a subgroup meta-analysis of studies that separately reported data on TCA use.

Key Question 3: What traits associated with personality disorders are associated with reductions in motor vehicle driver safety?

- **The evidence suggests that individuals with traits associated with personality disorders are at an increased risk for a motor vehicle crash compared to comparable drivers who do not have traits associated with personality disorders. These traits include aggression, hostility, impulsivity, disregard for law (i.e., attitude toward traffic law violations), and various psychological symptoms. However, inconsistencies in the methodologies of the included studies preclude us from drawing an evidence-based conclusion pertaining to the strength of the relationship between traits associated with personality disorders and crash risk at this time.**

Our searches identified 21 direct crash risk studies with a total study population of 164,539 individuals, 512 of whom were CMV drivers. The quality assessment of 14 of the included studies was low; the quality assessment of the remaining 7 studies was moderate. Methodological limitations of these studies include the lack of uniformity in the definition of the traits, behaviors, and outcomes as well as the use of scales that may not have been age or gender appropriate. Since most of the studies did not include CMV drivers, the generalizability of the findings to the CMV driver population is unclear.

Because the studies used a number of different scales and methodologies to measure the traits and behaviors and the outcome measures could not be assumed to be uniform, we were precluded from combining them for quantitative analysis. Instead, we have provided a qualitative summary of the findings.

Overall, the studies suggest that traits such as aggression, hostility, impulsivity, disregard for laws (i.e., attitude toward traffic law violations), and various psychological symptoms are associated with an increase in crash risk. The same can be said of behaviors such as risky driving and violation of traffic

laws. In turn, behaviors such as risky driving are associated with aggression, impulsivity, and psychological symptoms such as anxiety, depression, and psychosis. Violation of traffic laws is associated with risky driving and aggression. Table 2 provides a quick summary of the associations between factors and outcomes.

Table 2. Associations between Factors and Outcomes for Key Question 3

	Aggression	Hostility	Impulsivity	Attitude toward Traffic Law Violations	Psychological Symptoms*	Behaviors	
						Risky Driving	Violations of Traffic Law(s)
Crash							
Risky Driving		NA				—	
Violations of Traffic Laws		NA	NA	NA	NA		—
Aggression	—	NA	NA	NA			

 Factor has a negative impact on this outcome such that crash risk is increased.

* Psychological symptoms include anxiety, paranoid ideation, depression, psychosis, personality disorder, irritability, negativism, and antisocial tendencies.

NA: Not applicable. (This factor was not examined in relationship to the outcome of interest.)

Overall Summary

This report did not find conclusive evidence of an association between increased crash risk and any of four classes of psychiatric disorders (psychotic disorders, mood disorders, anxiety disorders, and personality disorders). However, given the limitations of the available studies and the likelihood that patients with severe symptoms would not be driving and thus would not be enrolled, the possibility of increased crash risk for some patients with psychiatric disorders cannot be ruled out. In contrast, the evidence was sufficient to show an association between use of at least one class of psychotherapeutic medications (benzodiazepines) and increased crash risk. This association held in a subgroup analysis of benzodiazepine anxiolytics that are likely to be used by patients with anxiety disorders. Further evidence suggested that the risk of crash was highest during the first week of index treatment and that benzodiazepine users aged <40 years were at higher risk than other age groups. The evidence was unclear about whether any type of antipsychotic or antidepressant was associated with increased crash risk. The available evidence also suggested an association between certain traits of patients with personality disorders (including aggression, hostility, impulsivity, disregard for law, and various psychological symptoms) and increased crash risk.