The Major Issues of Drugs, Alcohol and Fatigue in Heavy Vehicle Safety

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Abstract

The VIFM Australian Fatality study shows that, 4.1% of drivers killed over a 10-year period, tested positive to stimulants. However, 23% of truck drivers tested positive and these drivers were at a very high accident risk, similar to car drivers with a blood alcohol level of 0.1 to 0.15 BAC.

Since deaths associated with heavy vehicles make up 20% of the road toll this is a major public safety issue. These deaths could be significantly reduced by introducing low cost, non-invasive, saliva testing for truck drivers, linked to effective financial penalties for those who test positive. Truck drivers use stimulants for occupational reasons and this behaviour is relatively easily changed compared to addictive or recreational drug driving use. Powernaps are a drug free alternative to reduce sleep related fatigue accident risk and there are safer drugs than stimulants.

Drivers with sleep disordered breathing have an increased risk of an accident and heavy vehicle drivers are over represented in sleep disorder studies. There is evidence that sixteen percent of heavy vehicle drivers have both sleep disordered breathing and symptoms of excessive daytime sleepiness, both of which can be successfully treated to reduce accident risk.

A major program involving 15,000 Victorian heavy vehicle drivers is using a low cost method to identify drivers with an elevated crash risk and provide treatment options and education. This program will also provide risk assessments for cardiovascular health and diabetes. Night driving is associated with a high accident risk and these drivers should be the focus of an education program based on sleep science, as 24/7 will increase in importance as the predicted 75% increase in heavy vehicle traffic occurs.

Introduction

The Truck Safety Benchmarking Study (Haworth et al, March 2002) has identified that Australia has the highest proportion of single vehicle fatal crashes, and the NRTC documents explaining the need for a heavy vehicle safety strategy state that heavy vehicle deaths and serious injuries have begun to rise over the past few years. It is also stated that heavy vehicle traffic is expected to increase 75% in the period to 2010. Whilst the Benchmarking Study presents seven recommendations to improve truck safety in Australia, it does not consider the major issue of drug related deaths; both truck drivers killed who test positive to stimulant drugs and other road users who die in heavy vehicle accidents where truck drivers have used stimulant drugs.

Drug use by truck drivers is an issue of major public concern because as the Benchmarking report states, “In most fatal crashes involving a truck it is not the truck occupant who is killed (occupants of the other vehicles being the most common group)”. Deaths associated with heavy vehicles make up 20% of the road toll.

High Accident Risk and High Incidence for Stimulant Positive Truck Driver Fatalities
The very high accident risk associated with truck drivers who use stimulant drugs has been highlighted in a recent 10 year national fatality study (Drummer, May 2002), which found that truck drivers who tested positive to stimulants had an accident risk similar to car drivers who test positive to a blood alcohol level of 0.10 to 0.15. These levels of alcohol represent gross impairment.

This major study by the Victorian Institute of Forensic Medicine was conducted on 3398 fatally injured drivers to assess the effect of alcohol and drug use on crash risk. Crashes investigated were from three Australian states (Victoria, New South Wales and Western Australia). A method of responsibility analysis was used that had previously been validated for alcohol. Logistic regression was used to examine the effect of key attributes such as age, gender, and type of crash and drug use.

Overall 4.1 % of drivers were using stimulants, but 23 % of truck drivers were using stimulants. The study found that the majority of these truck drivers were culpable. The odds ratio of all drivers using stimulants was 2.3, but this increased to 8.8 in truck drivers. This report also lists other studies, which found a high rate of aberrant driving for amphetamine users, particularly in the acute intoxication phase and in the rebound fatigue phase.

In terms of accident risk, 90.6% of drivers who tested positive to stimulants were judged to be fully or partly responsible for their death. The Therapeutic and Toxic Drug Concentrations guidelines show that 41% of these drivers had stimulant drug levels which could be considered toxic. In addition to the sleep rebound fatigue impairment, these drivers would also be impaired by the toxic effects of the stimulants, particularly those drivers who had used illicit methamphetamines.

Alcohol and Stimulant Positive Truck Driver Fatalities
Overall 13.6% of truck drivers killed tested positive to alcohol, and 12.2% were both positive to alcohol and responsible for their death.

In 23.5% of these—alcohol and responsible deaths—the drivers also tested positive to stimulants.

In terms of accident risk, the percentage of drivers who tested positive to alcohol levels greater than 0.05% was 8.6% and the percentage of drivers who were severely impaired, which is indicated by a BAC of greater than 0.1BAC, was 6.4%

Cannabis and Stimulant Positive Truck Driver Fatalities
As stated above 23% of truck driver fatalities test positive to stimulants and 15% of these stimulant positive drivers also tested positive to cannabis.

Overall 2.1% of drives tested positive to cannabinoids alone.

Thus the cannabis positives both as the sole drug and in combination with stimulants represented 5.7% of the truck driver deaths.

Action to Reduce Deaths Associated with Stimulant Use
Perhaps the most significant issue is that these deaths could be significantly reduced by introducing low cost, non-invasive, saliva testing for truck drivers, linked to effective financial penalties for those who test positive.

Whilst drug-driving behaviour is very difficult to change for drug addicts, and is also difficult to change for recreational drug users, truck drivers who use stimulant drugs, do so for occupational reasons.

Occupational drug driving behaviour should be relatively easily changed, given a significant financial penalty. Given the low cost of the implementation of this countermeasure its potential benefit cost ratio is very high, particularly when compared to the other solutions offered in the Benchmarking report.

The saliva plasma ratio for stimulants is relatively high and saliva testing used with gas chromatography/mass spectrometry analysis is 100% accurate.

A road safety countermeasure system, which involved saliva collection by the police at the roadside, using any one of several available saliva collection devices, would involve minimum delays to the driver. For example, it takes on average only one and a half minutes to collect the required saliva (using the current cozart rapidscan device once it is placed in the mouth). The driver would then be allowed to proceed on the journey. Overnight laboratory analysis of the sample by evidentiary standard 100% accurate GC/MS would then be used to establish the presence of illicit stimulant drugs. Positive tests would attract significant financial penalties for both driver and truck owner.

This countermeasure is similar to the speed camera approach, where drivers are targeted at specific locations and they receive notification of an offence some short time after the offence. This approach has been successful in terms of both speed reduction and cost effectiveness.

It is more appropriate to model a road safety countermeasure for stimulant drugs on this speed camera strategy, than on the far more expensive Random Breath Test approach. The above countermeasure does use police to collect the saliva sample but this could be done by other methods.

Alternatives to stimulant use

There are safer alternatives than stimulants available to truck drivers to reduce fatigue and accident risk when working long hours, or when working at nights. The safest alternative is to use preventative powernaps, which require only short 15 to 20 min sleep opportunities. A recent report by Professor Hartley (Hartley, L August 2002) presents guidelines for companies to incorporate napping policies within their operations. Preventative powernaps offer not only accident reduction benefits but also significant health and quality of life benefits for drivers.

Other alternatives for drivers involve the use of legal alerting drugs like caffeine or the use of a new class of alerting drugs, which are claimed to specifically, and chemically control sleepiness by targeting the specific receptors associated with wakefulness in the brain. The most studied of these new generation drugs is modafinil. Whereas stimulant use is associated with addiction, psychosis, disturbed sleep and agitation these drugs are claimed to increase wakefulness without these adverse effects.

These drugs once proven and available could be considered as a safer alternative to stimulant drug use. However any driver based countermeasure that does not involve sleep increases the potential for sleep rebound and microsleep attack

Drivers are very reluctant to stop driving and take a powernap as shown by the results of the Austin Hospital studies, which are described below. Employers are also reluctant to pay drivers to sleep on the job and because of these factors drivers could be tempted to use these alternative drugs, before the appropriate studies are completed.

Stimulants, Microsleeps and Impairment due to Sleep Related Fatigue

Truck drivers use stimulants to combat fatigue, which can be due to long hours of work, inadequate quality sleep (short term or long term) or sleep disorders. The Truck Safety Benchmarking Study (Haworth et al, March 2002) states that Australia has the highest proportion of single vehicle fatal crashes, which are often used as a surrogate measure of fatigue.

The high accident risk associated with stimulants, for the majority of truck drivers is considered to be related to “sleep rebound”, which involves the onset of microsleeps as the alerting effects of the stimulant drugs decrease.

A driver who suffers lose of alertness, due to being awake for a considerable period or due to significant sleep debt, can regain mental vigilance by using a stimulant drug. This allows the driver to continue being awake, but the need for sleep continues to increase and becomes a more powerful internal force. Initially, after taking the drug, this internal sleep drive is counteracted by the chemical alerting effects of the stimulant drug.

As the driver continues to remain awake, the body metabolizes the drug, and its alerting effects are reduced. However, the driver’s basic need for sleep continues to significantly increase and produces impaired information processing and “microsleeps”.

At a fatigue conference in Melbourne in July this year, Professor Dinges explained that neuroscan imaging has shown that the major sleep related fatigue impairment effects in the brain occur in the thalamus (which is important in receiving visual and audio information from the bodies sensory systems) and the prefrontal cortex and inferior parietal cortex (which are the "executive" function parts of the brain). Accordingly, although the fatigued driver is not asleep, the driver is impaired and the essential information necessary for safe driving is not being appropriately received or processed by the brain.

In this state the driver is also not aware of microsleeps, in which the eyes are closed and the brain may enter sleep as measured by EEG. A recent, but limited study by the Austin Hospital (Howard, M, August 2002) indicated that sober drug free truck drivers, when fatigued, do not recognize the signs of microsleeps until they are experiencing approximately 50secs per hour of microsleeps.

This project examined the driving of 15 TWU professional drivers in a laboratory driving simulator over a 24h period and measured objective psychomotor vigilance performance; subjective vigilance performance; subjective ability to drive and physiological measures of sleep related fatigue and microsleeps. Drivers stated that they would continue driving to complete a short journey, during 75% of sessions when 50 to 100 seconds per hour of microsleeps were present.

When more than 100 s/hr of microsleeps were present no drivers stated that they would continue driving. Drivers stated that they would continue driving to complete a long journey, during 50% of sessions when 50 to 100 s/hr of microsleeps were present. Although the numbers involved in this study were small, the drivers were professional drivers, selected at random and currently employed in the industry. This study indicates that efforts should be made to educate drivers of the key signs of microsleeps and to provide them with strategies to reduce the associated accident risk.

High Accident Risk and High Incidence of Sleep Disordered Breathing in Truck Drivers

The benchmarking study also does not consider the important issue of driving sleep disorders, which again contribute significantly, to increased fatigue accident risk. A national project "Prevalence of Sleep Disordered Breathing in Victorian Road Transport Drivers, commenced in September 1999". The purpose of this project was to investigate the prevalence of sleep disordered breathing in Victorian professional heavy vehicle drivers. Studies (Howard, M, August 2002) have shown that sleep disordered breathing is associated with more than twice the risk of being involved in an accident. The project examined the sleep disorders of 100 randomly selected professional heavy vehicle drivers using full overnight polysomnography to measure sleep disordered breathing.

The results showed that fifty-nine percent of truck drivers had some evidence of sleep-disordered breathing on sleep studies (respiratory disturbance index over five) compared to 26% of men in a study of the Australian male population. Eighteen percent of Victorian truck drivers had moderate to severe sleep disordered breathing on their sleep study and these drivers were significantly sleepier than other drivers.

Sixteen percent of drivers had at least mild sleep disordered breathing on their sleep study in association with symptoms of excessive daytime sleepiness. In comparison in the study of the Australian male population 3-12% of subjects had symptoms of excessive sleepiness in association with sleep disordered breathing on their sleep study.

Ten percent of subjects who have taken part in the study have proceeded to treatment for sleep disordered breathing. Such treatment reduces the risk of accidents by at least 50%.

The Victorian – Tasmanian branch of the Transport Workers Union has acted on the above information and has started a major program, which will examine 15,000 heavy vehicle drivers and will identify and treat those who have an elevated crash risk due to sleep disorders. This program uses a low cost method to identify high accident risk drivers and will provide education and treatment options. The program will also provide risk assessments for cardiovascular health (heart attack and stroke) and diabetes, and education on these issues for drivers.

This is the type of action program that the industry needs to support in order to reduce the very high road toll associated with heavy vehicles.

The Accident Risk of Night Driving

The benchmarking study identifies night driving as factor and recommends more studies to quantify and compare risks and, "If night-time fatal crash risks are substantially higher than daytime risks…reduce amount of truck travel at night, or improve the fatigue management of night time travel"

There are already many studies (Fatigue Expert Group, February 2001), which clearly document the increased risk of night driving for drivers. The increased accident risk is due to circadian rhythms, reduced visibility at night and reduced opportunity for drivers driving at night to have quality sleep.

The human body has evolved over millions of years to have a chemistry that produces sleepiness in the brain at night and wakefulness during the day. Studies show that this chemistry is very robust and persists even when drivers work successive nights. Drivers who work nights are not only are fighting the natural chemistry of evolution which produces sleepiness, but also face the difficulties of trying to make up sleep during the day when the brain is being alerted by endogenous stimulants. This markedly reduces the quality of the daytime sleep. These factors can result in significant sleep debt for night drivers and this is an additional factor increasing fatigue accident risk.

However overseas trends have shown that road capacity can be effectively increased by working through the night and given the 75% predicted increase in heavy vehicle traffic by 2010, it can be anticipated that our transport industry will continue to use the 24/7 mode of operation despite the increased accident risk associated with night driving.

There is a need to take action and accordingly drivers who work nights should be encouraged to take "powernaps" and actions to promote this should be started, without waiting for more studies.

Conclusions & Key Recommendations

In summary, the benchmarking study has highlighted that 20% of the road toll is associated with heavy vehicle accidents and deaths and serious injuries have begun to rise. Since heavy vehicle traffic is expected to increase by 75% in the period to 2010, urgent action is needed. The Benchmarking study makes 7 recommendations for improving truck safety in Australia but does not include 2 of the major issues. These issues are firstly stimulant use by truck drivers, which is associated with very high accident risk, and secondly driver sleep disorders, which also significantly increase accident, risk.

Action to reduce the road toll associated with both these issues can be taken now, and a low cost targeted enforcement program involving saliva testing for heavy vehicle drivers at night on the major freight highways would have a significant effect in reducing stimulant use if it was linked to strong financial penalties for both the driver and the owner. Occupational drug use is relatively easily addressed in terms of effective behaviour change and drivers should be encouraged to use the drug free alternative of powernaps to reduce fatigue accident risk. The other 'less safe' option of switching from potentially harmful stimulant drugs to the new 'safer' drugs does not address the issue of cumulative sleep rebound.

The TWU has shown that the issues associated with sleep disorders in truck drivers can be tackled by a high benefit cost ratio health program and this should be extended to a national approach. Such a program has the advantages of not only reducing fatigue accidents but also improving driver health in other areas such as heart attack stroke and diabetes.

References

- Dinges, D. (July 2002). 'Shiftwork and Fatigue Presentation', Victoria – Tasmania Branch Transport Workers Union Port Melbourne Australia.
- Drummer, O. (May 2002). Report to Vicroads – May 1, 2002, *Fatal Driver Study 1990-1999*, Victorian Institute of Forensic Medicine, Southbank, Australia.
- Fatigue Expert Group. (February 2001). *Fatigue Expert Group: Regulatory Approach to Fatigue in Drivers of Heavy Vehicles in Australia and New Zealand*, ISBN 0 642 54478 6, National Road Transport Commission Law Courts Victoria, Australia pp.32–35.
- Hartley, L. Buxton, S. Sully, M. Krueger, G. (August 2002). Report to VicRoads on *Guidelines for using Napping to Prevent Commercial Vehicle Driver Fatigue*, VicRoads, Kew, Australia.
- Haworth, N. Vulcan, P. Sweatman, P. (March 2002). 'Truck Safety Benchmarking Study', National Road Transport Commission, Melbourne, Australia.
- Howard, M. Pierce, R. (August 2002). Vicroads Research And Development Project Final Report, *The Temporal Nature Of Fatigue Related To Road Crashes*, Project No 761, Report No IR/2002/02, VicRoads, Kew, Australia.
- Howard, M. Pierce, R. (August 2002). Vicroads Research And Development Project Final Report *Sleep Disorders – Heavy Vehicle Drivers*, Project No 763, Report No IR/2002/01, VicRoads, Kew, Australia.

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