Profiling contextual factors which influence safety in heavy vehicle industries

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Abstract
A significant proportion of worker fatalities within Australia result from truck-related incidents. Truck drivers face a number of health and safety concerns. Safety culture, viewed here as the beliefs, attitudes and values shared by an organisation's workers, which interact with their surrounding context to influence behaviour, may provide a valuable lens for exploring safety-related behaviours in heavy vehicle operations. To date no major research has examined safety culture within heavy vehicle industries. As safety culture provides a means to interpret experiences and generate behaviour, safety culture research should be conducted with an awareness of the context surrounding safety. The current research sought to examine previous health and safety research regarding heavy vehicle operations to profile contextual factors which influence health and safety. A review of 104 peer-reviewed papers was conducted. Findings of these papers were then thematically analysed. A number of behaviours and scenarios linked with crashes and non-crash injuries were identified, along with a selection of health outcomes. Contextual factors which were found to influence these outcomes were explored. These factors were found to originate from government departments, transport organisations, customers and the road and work environment. The identified factors may provide points of interaction, whereby culture may influence health and safety outcomes.

Keywords: Safety culture; Organisational safety; Safety climate; Heavy vehicle; Truck; Profiling contextual factors which influence safety in heavy vehicle industries

1 Introduction

In the 10 year period from 2003 to 2012, 30% (n = 787) of all worker fatalities in Australia resulted from truck-related incidents (Safe Work Australia, 2014). Though approximately three quarters of these fatalities occurred on public roads, 15% occurred during loading and unloading, and 7% during maintenance. During the 10 year period, a further 298 bystanders were killed, including drivers or passengers of vehicles (not including the truck driver), and pedestrians. In addition to fatalities, a high number of truck drivers are injured as a result of crashes or other workplace incidents. Injury compensation data from Queensland revealed that between 2008 and 2009 the transport and storage sector received 2718 accepted injury claims, at a rate of 21.7 per 1,000 workers (Queensland Workplace Health and Safety Board,

2010). This rate was second only to the manufacturing industry and approximately 50% higher than the all-industry average. Furthermore, the Australian heavy vehicle industry has been identified as having high rates of many other health concerns including poor mental health, obesity, arthritis and rheumatism, lung diseases, and heart and intestinal problems (The Work Outcome Research Cost-Benefit (WORC) Project, 2008). There is a clear need to advance our understanding of health and safety within this industry and identify approaches for intervention.

Safety culture has been the focus of much research in recent years, and may provide a valuable lens with which to examine heavy vehicle operations. There are many definitions and approaches to safety culture, often reflecting, in part, the background of researchers (see reviews by Choudhry et al., 2007; Edwards et al., 2013; Guldenmund, 2000). Safety culture is often simply referred to as "the way we do things around here" (Guldenmund, 2000). Whilst this phrase was first applied to corporate cultures, as separate to safety, the phrase has gained popularity in safety culture research. This is perhaps due to the fact that the phrase shows safety culture as something that is highly abstract and implicit, yet provides members of an organisation with an intrinsic sense of what ought to be done. Given the high level of worker autonomy in heavy vehicle operations (Arboleda et al., 2003), it appears important to understand the factors which contribute to a driver's understanding of what ought to be done.

In terms of the content of safety culture, there are two main approaches in the literature, one which emphasises shared psychological constructs, and the other which emphasises behaviour and organisational structures and systems (Nævestad, 2009). In a recent review of the safety culture literature, Edwards et al. (2013) argued that the differing approaches to safety culture could be better viewed as multiple components of a single construct. Safety culture was then defined as "the assembly of underlying assumptions, beliefs, values, and attitudes shared by members of an organisation, which interact with an organisation's structures and systems and the broader contextual setting to result in those external, readily-visible, practices that influence safety" (p.77). When viewed as a single construct, safety culture holds promise as a framework to understand health and safety within heavy vehicle operations. Safety culture could provide an understanding of the average psychological factors associated with heavy vehicle safety, as well as the context which interacts with this culture to influence behaviour. Research may then provide insight for the design of interventions that are congruaent with the beliefs and values of the workforce (Edwards et al., 2013; Guldenmund, 2010b).

To date there has been no major research examining safety culture within heavy vehicle industries. There is, however, some research examining safety climate. Huang et al. (2013) developed a safety climate survey for lone workers, using truck drivers as an exemplar. Following testing, it was found that proactive practices, driver safety priority, and supervisory care promotion were dimensions of organisational level safety climate, while safety promotion, delivery limits, and cell phone disapproval were safety climate dimensions at a group level.

Detailing the differences between safety climate and culture are beyond the scope of the present manuscript, however, it is important to note that safety culture and climate are related, yet different concepts (Huang et al., 2013). Safety climate has been described as the aggregate perception of workers regarding the priority placed on safety by the organisation (Huang et al., 2013; Zohar, 2010). Neal and Griffin (2002) state that safety climate "refers to perceptions of policies, procedures, and practices relating to safety in the workplace" (p.67). As these perceptions may be influenced by shared beliefs, attitudes and values, safety climate can be viewed as a culturally-influenced measure of the organisational context. Further, when examining the factors used by Huang et al. (2013) it can be seen that they largely centre on the perceived attitude and actions of management, and give little attention to deeper shared beliefs, attitudes and values of the workers themselves.

Other research, which did not aim to explore safety culture or climate, has identified a number of safety-relevant beliefs, attitudes or values that were common among samples of heavy vehicle drivers. These have included a tendency to view others as less safe than oneself (Baas et al., 2000; Friswell and Williamson, 2010; Walton, 1999), prioritising road safety over other forms of safety (Friswell and Williamson, 2010; Shibuya et al., 2010), attitudes towards the effectiveness of enforcement and regulations (Douglas and Swartz, 2009; Snyder, 2012), conflict between profit and risk taking (Helmkamp et al., 2004; Summala and Pihlman, 1993), attitudes towards receiving feedback (Huang et al., 2005, 2008; Roetting et al., 2003; Zhang et al., 2006), valuing personal experience over rules (Snyder, 2012), valuing working hard and getting the job done (Snyder, 2012), and desiring to fit in with the 'trucking image' (Davey et al., 2007).

Prior to exploring culture, it is important to gain an insight into the context within which a culture is located. As stated by Schein (1992) behaviour is not solely the product of culture but is also the result of contextual variables. Further, it could be argued that culture only gains meaning towards behaviour when it meets with specific contextual or situational factors, serving as a stimulus for action. This is congruent with one definition of culture put forward by Guldenmund (2010a) who stated that culture is used by a group to "interpret experience and generate behaviour that distinguishes them from other groups or categories of people" (p.1472). It is important to consider what contextual or situational factors may provide experiences to be interpreted through culture.

From the first use of the phrase safety culture, in regards to the Chernobyl disaster, it was reported that a lack of safety culture, both within the Chernobyl plant and at a national level, contributed to the incident (INSAG-1, 1986, as updated in INSAG-7, International Nuclear Safety Advisory Group, 1992). Thus, it is evident that broader contextual influences, even on a national scale, are relevant to the safety culture framework. In Edwards et al. (2013) definition of safety culture provided above, this was highlighted by indicating that both organisational structures and systems, as well as "the broader contextual setting" interact with culture. To truly understand the influence culture has on safety, it is important to gain an

understanding of the context surrounding workers, an organisation and even an industry.

Within the broader safety culture literature, contextual factors have almost exclusively been investigated at an organisational level. These have included organisational management systems, policies and procedures, job design, work pressures, training, employee involvement in decision making and perceptions and attitudes regarding the work environment (Arboleda et al., 2003; Choudhry et al., 2007; Cox and Cheyne, 2000; Grote, 2008; Håvold, 2010; O'Toole, 2002; Parker et al., 2006). Though broader contextual factors are beginning to be explored in the related field of traffic safety culture (for examples, see Edwards et al., 2014; Girasek, 2011; Nævestad and Bjornskau, 2012; Ward et al., 2010; Wiegmann et al., 2007; Williams and Haworth, 2007), little safety culture research in workplace settings has sought to examine these factors, or how they may interact with culture to influence safety.

The absence of safety culture research does not mean that there is no information on the cultural context surrounding heavy vehicle operations. A significant amount of research has sought to examine external influences on safety without using a safety culture framework. In order to lay a foundation for future exploration of safety culture within heavy vehicle industries, it is beneficial to profile external factors identified in past heavy vehicle research as relevant to health and safety outcomes (crash, injury, and illness) or safety-related behaviours. The present research consists of a review of the heavy vehicle health and safety literature seeking to profile health and safety behaviours and outcomes (as a mechanism through which contextual factors may influence safety) as well as contextual factors shown to influence these behaviours, or outcomes directly.

2 Method

In order to access as much of the existing literature on heavy vehicle safety as possible, a thorough search was conducted using a number of databases including EBSCOhost, Emerald, INFORMIT, Proquest and Sciencedirect. The following search phrases were used (or the equivalent for a given database):

(“heavy vehicle” OR “heavy goods vehicle” OR “large goods vehicle” OR “truck” OR “lorry”) AND (“health” OR “safety” OR “accident” OR “injury” OR “crash”)

A number of approaches were used to limit the number of records returned. Firstly, in order to exclude articles with only passing reference to the search terms, the terms were limited to search only the title, abstract, and keywords. Additionally~~;~~, though there is a significant degree of grey literature surrounding heavy vehicle safety; the search was limited to peer-reviewed journal articles or peer-reviewed conference papers in order to maximise the quality of papers reviewed. Each article was assessed for eligibility based upon the two focuses of the current review. That is~~;~~, the research was required to demonstrate behaviours that influence health and safety in heavy vehicle operations; or contextual factors that influence behaviours or outcomes (crashes, injuries, illness etc.). This screening eliminated a number of

articles with a primary focus on other road users; the environmental impacts of heavy vehicle traffic; and the effect of truck emissions on the general public. Finally~~;~~, a number of articles from low to middle income nations, which focussed on HIV and sexual risk behaviours~~;~~ were also excluded. Whilst each of these eliminated topics are an important field of research; they were deemed outside the scope of the current research. Findings within the included articles were thematically analysed~~;~~, in order to develop categories and themes of relevant factors.

3 Results

A total of 104 peer-reviewed articles met the selection criteria. These articles covered a broad range of topics, which could be categorised as relating to on-road crashes, non-crash injuries or health outcomes (see Table 1). Additionally, a small selection of papers, classified as miscellaneous, discussed potentially relevant information regarding contextual variables, yet did not explore the means by which they were relevant to safety.

Table 1 Breakdown of reviewed articles according to category of investigation

Category of papers	Number of articles
Crash outcomes	78
Injury outcomes	15
Health outcomes	11
Miscellaneous papers	3
Total	107[**a]

[a]Exceeds eligible articles (*N* = 104) due to multiple classification of single articles.

3.1 Health and safety-related behaviours and outcomes

For contextual factors to be relevant to safety, they must be seen to influence safety outcomes (crashes, injuries, illnesses etc.). Further, within a cultural framework, it is important to consider worker behaviours that are generated in part through context and culture. Thus it is necessary to understand the safety outcomes and behaviours present in the literature. A significant portion of the papers included in this review related to the occurrence and severity of crashes, or examined factors known to influence crash-related injuries and fatalities.

The principal behaviours which were identified within the literature as relevant to heavy vehicle crashes included driving whilst fatigued, driving whilst under the influence of drugs or alcohol, speeding, seatbelt non-use, and driving errors and violations. Each of these behaviours was found to increase the likelihood and severity of injuries as well as to be involved in fatal heavy vehicle crashes. With the exception of seatbelt non-use, each of these behaviours was also seen to either cause crashes or increase the likelihood of a crash occurring (see Table 2).

Table 2 Relevance of driving behaviours to safety in the reviewed literature.

	Driving whilst fatigued	Drug use	Speeding	Seatbelt non-use	Driving errors and violations
Causes or increases risk of crash	(Carter et al., 2003; Hanowski et al., 2007)	(Golob et al., 1987)	(Golob et al., 1987; McKnight and Bahouth, 2009)	–	(Golob et al., 1987; Hanowski et al., 2005; McKnight and Bahouth, 2009; Sullman et al., 2002)

	Driving whilst fatigued	Drug use	Speeding	Seatbelt non-use	Driving errors and violations
Increases injury severity or likelihood	(Chen and Chen, 2011)	(Zhu and Srinivasan, 2011)	(~~F.~~ Chen and Chen, 2011)	(Bunn et al., 2012)	(Chen and Chen, 2011)
Involved in fatal crashes	(Brodie et al., 2009; Häkkänen and Summala, 2001)	(Brodie et al., 2009)	(Brodie et al., 2009)	(Brodie et al., 2009)	(Häkkänen and Summala, 2001)

In addition to the general importance of each of these behaviours, a number of findings specific to individual behaviours were present. For example, driving whilst fatigued has been shown to be directly linked with the number of hours driven (McCartt et al., 2000), and truck drivers have been seen to have low levels of seatbelt use (Cook et al., 2008; Kim and Yamashita, 2007). There has been a significant degree of research related to the level of drug use within truck drivers, along with comparisons to the general population in the nation of study (Gjerde et al., 2012; Labat et al., 2008; Leyton et al., 2012; Mabbott and Hartley, 1999; Khan et al., 2012; Silva et al., 2003). There have been mixed findings, demonstrating that drug use patterns differ by nation and jurisdiction, with some studies showing truck drivers to have higher drug use than the population average, while others showed lower levels of use.

In addition to crashes, heavy vehicle drivers experience a range of other injuries, referred to here as non-crash injuries. Within the available literature, few specific behaviours were identified as relevant to non-crash injuries. A number of studies investigated these injuries, identifying incident scenarios, mechanisms of injury and physical forces associated with tasks. At a broad level these scenarios and mechanisms included slips, trips and falls, overexertion, locomotor disorders, and striking/crushing. These incidents typically occurred during loading/unloading, exiting/entering or ascending/descending from the vehicle or trailer and overexertion from lifting (Jones et al., 2011; Lincoln et al., 2004; Robb and Mansfield, 2007; Shibuya et al., 2010). Slips, trips and falls have been demonstrated to be responsible for a significant number of heavy vehicle driver injuries (~~D.~~ Jones and Switzer-McIntyre, 2003; Lincoln et al., 2004; Shibuya et al., 2010). Impact forces and risk of slips, trips and falls may be associated with use of steps and hand rails (Fathallah and Cotnam, 2000; Fathallah et al., 2000) and facing away from the vehicle when exiting (Patenaude et al., 2001). These findings represent the only specific behaviours shown to be related to non-driving injuries in the examined literature. Research has also shown a high prevalence of lesions of the ulnar nerve, invertebral disk disorders, carpal tunnel syndrome, synovitis and bursitis in heavy vehicle drivers (Jensen et al., 2008). As this last form of injury is likely the result of long-term strain, it may be difficult to directly tie specific behaviours, and therefore culture, to these outcomes.

A small number of papers were identified which focussed on health outcomes for heavy vehicle drivers. The health outcomes included cancers, respiratory diseases, obesity and related diseases, and common illnesses. Truck drivers have been identified as at high risk of stomach, lung and prostate cancer (Balarajan and

McDowall, 1988; Jakobsson et al., 1997; Jarvholm and Silverman, 2003), as well as bronchitis, emphysema and asthma (Balarajan and McDowall, 1988). Truck drivers also have high rates of heart disease (Robinson and Burnett, 2005) and lifestyle-related diseases, particularly those linked with calorie intake (Dahl et al., 2009). Finally, truck drivers have high levels of serum lipids, associated with stress, which are known to have multiple adverse health impacts (Jovanović et al., 2008), and the need for recovery after work has been linked with subsequent sick days (de Croon et al., 2003). Receiving health care, as well as healthy eating and exercise were present as behaviours that relate to these outcomes. However, as many illnesses can be influenced by environmental or contextual factors, rather than specific behaviours, the majority of findings discussed contextual factors. For example, though smoking was argued to account for a significant degree of heart disease and lung cancer (Robinson and Burnett, 2005), research has shown that after accounting for smoking, truck drivers are still at risk of lung cancer from exhaust fumes (Jakobsson et al., 1997; Jarvholm and Silverman, 2003).

After identifying behaviours and outcomes in the literature, it is now possible to examine contextual factors and determine their relevance to safety. Specifically, factors that influence either the previously identified behaviours or safety outcomes may be relevant points of interaction with culture. Put the other way, if contextual factors have not been shown to be linked with safety behaviours and outcomes, it is unlikely that they have an interaction with culture which is meaningful toward safety. The remainder of identified findings relate to contextual influences on these behaviour and outcomes.

3.2 Contextual factors associated with health and safety in heavy vehicle industries

There were a number of articles which identified contextual factors related to health and safety outcome likelihood and severity, or risky behaviours. Prior to exploring these, it is important to note ~~that~~ that there are a broad number of factors which influence health and safety outcomes and that individual articles can provide information on multiple factors. Given the number of factors identified within many articles, examining each article individually would result in significant overlap and duplication of findings. Thus, this discussion aggregates articles by findings. Through thematic analysis, the contextual factors identified in the literature were categorised as relating to government departments, transport organisations, customers, and the road and work environment. Each of these contextual factors provides the setting in which cultural beliefs, attitudes and values may exert influence over behaviour. As these factors are specifically relevant to safety, they provide points of interaction with culture that should be investigated to better understand how culture and context influence safety.

3.2.1 Government departments

The literature surrounding government departments predominantly focussed on the role of policies and enforcement. Whilst some examples of enforcement have obvious effects, others are less clear. Chen (2008) assessed crash rates in US trucking firms, comparing organisations which were subjected to a compliance review to those

never reviewed. In the US, compliance reviews are conducted by an external body, assessing the policies and practices of companies with high crash rates. As a result of compliance reviews, organisations may be required to undertake a number of measures in order to avoid being banned from operating. It was found that companies subjected to a review showed significant steady declines in crash rates a number of years following review. From this example, both the threat of punishment and provided direction for change may have influenced safety.

A number of articles examined the effect of specific policies on crash rates. As policies differ via jurisdiction, the specific policies identified are not necessarily relevant outside the jurisdiction of study. Further, whilst many jurisdictions may have policies related to similar concepts, the precise content of these policies and their effects may vary. For example, though not specifying the mechanisms by which safety may be influenced, Kuncyté et al. (2003) analysed government legislation surrounding training and evaluation requirements between Canada, the Netherlands, Sweden and the United States. In Sweden there was an emphasis on accreditation for all trainers, while in the Netherlands, emphasis was placed on examining the results of training. However, in Canada and the US, training is considered the responsibility of the organisation. It was argued that these differences in policies led to lower quality training in the US and Canada.

Other specific policies identified included those related to truck length, speed and lane restrictions, conspicuity measures, and random drug testing. These policies have been demonstrated to have different impacts on safety, some influencing number of crashes, others injuries or fatalities per crash, and one having no benefit (see Table 3). Further, a large amount of research has surrounded driving whilst fatigued, often targeted at maximum work hours.

Table 3 Government policies and their influence on crash outcomes.

Policies	Reduce crashes	No benefit	Reduce injuries/fatalities per crash
Lower speed for all vehicles	(Neeley and Richardson, 2009)	–	–
Differential speed (trucks lower)	–	(Garber et al., 2006; Neeley and Richardson, 2009)	–
Lanes restrictions	–	–	(Fontaine, 2008)
Lane restrictions + differential speed	(Korkut et al., 2010)	–	–
Random drug testing	(Swena and Gaines, 1999)	–	–
Shorter truck lengths	–	–	(Neeley and Richardson, 2009)
Conspicuity measures	(Sullivan and Flannagan, 2012)	–	–

Significant research was conducted surrounding the 2004 change in US hours of service regulations which included changing the maximum work hours from 10 to 11. Despite the final hour holding higher risk than the first hour of driving, there has been no significant difference identified in risk between the 10th and 11th hours

(Hanowski et al., 2009; Park and Jovanis, 2010). McCartt et al. (2008) did find that drivers had an increase in rest and sleep time, and similar violation levels, yet fell asleep at the wheel more.

In Australia, a review of driving hours legislation has been recommended by coroners (Brodie et al., 2010), indicating that driving hours enforcement have had insufficient effectiveness to date. However, it is questionable whether this is a fault in the policy. Hall and Mukherjee (2008) found that in the US, at most a further 3–5% reduction could be achieved by reductions in maximum driving hours. It was argued that to achieve this would require 100% enforcement. This may highlight a key point of interaction between culture and policies, specifically, whether drivers will comply with laws. Within New Zealand, as many as 33% of drivers exceeded regulated hours, and only 69% comply with regulated rest between shifts (Baas et al., 2000). As many external factors, such as sleep quality, can have an effect on fatigue, compliance itself may even be insufficient to prevent fatigue-related incidents. Snyder (2012) demonstrated that through 'working the system,' US drivers are able to legally drive long hours while fatigued in order to meet deadlines after delays. Thus it is important to consider how culture may produce unsafe compliance.

3.2.2 The organisation and health and safety

Throughout the literature a number of organisational factors were identified which influence health and safety. These factors can be broadly categorised as general organisational factors, employee management, and management practices. With regards to general organisational factors research has shown that the type of goods carried, distance travelled, firm size and type, past safety record, and vehicle types each have an influence on safety. Each of these factors except vehicle type used, have been linked with hours of service (Cantor et al., 2009), and all except firm type and past safety record have been shown to be related to crash risk (Monaco and Redmon, 2012; Moses and Savage, 1994; Stein and Jones, 1988). Furthermore, carrying specific types of goods has been associated with injury severity from crashes (Chen and Chen, 2011), and short-distance light truck drivers have shown different causes for fatigue than long-distance heavy truck drivers (Friswell and Williamson, 2013). There may be underlying variables which contribute to the influence of these factors on safety, and further research is needed to determine whether they may interact with cultural variables to influence safety.

Employee management approaches, shown to be associated with health and safety outcomes, included employment type, and payment and retainment. There were mixed findings associated with employment type and safety. Though some research has shown that owner operators and subcontractors have higher crash and injury rates (Birdsey et al., 2010; Mayhew and Quinlan, 2006), other research has suggested reduced rates (Monaco and Redmon, 2012). Some of this discrepancy may be related to incident reporting levels depending on whether the contractor owns their vehicle. Informal employment has also been linked with obstructive sleep apnoea (Lemos et al., 2009) and there have been differing levels of injury claims among permanent and part-time or casual drivers (Williamson et al., 2009). The

manner in which drivers are paid is also important to safety. Drivers who are paid by distance may be more likely to engage in unsafe practices (Snyder, 2012). Further, high turnover rates, which are partially influenced by payment and changes in pay (Rodríguez et al., 2006), have been linked with higher crash rates (Staplin and Gish, 2005). There may be specific subcultures related to employment form and payment, and these factors may also interact with the culture of drivers to influence safety-related behaviours.

Finally, there were a number of management practices associated with safety in heavy vehicle industries. These management practices included training, management support and pressure, scheduling, policies, and monitoring and enforcement. Many of these factors are common within the safety culture literature and as such will only be briefly summarised here (see Table A1 in the appendix for a detailed listing of findings). Training has been suggested as a means to reduce technical driving errors (Hanowski et al., 2007), and voluntary attendance linked with reduced fatigue (Crum and Morrow, 2002). Thus driver's attitudes towards training may be relevant to developing effective training to reduce injuries.

There is a significant level of management pressure in some heavy vehicle industries (Sabbagh-Ehrlich et al., 2005), which has been associated with fatigue, drug and alcohol use, calorie intake and injury levels and recovery (Buxton et al., 2009; de Croon et al., 2002; Friswell and Williamson, 2010; Mir et al., 2012; Morrow and Crum, 2004; Shattell et al., 2010; Swartz and Douglas, 2009; Williamson et al., 2009). One specific means by which pressure is exerted is through scheduling. Arduous schedules have been associated with fatigue and breaking hours of service legislation (Baulk and Fletcher, 2011; Beilock, 1995; Braeckman al., 2011; Charlton and Baas, 2001; Crum and Morrow, 2002; de Croon et al., 2002; de Pinho et al., 2006; Maldonado et al., 2002; McCartt et al., 2000; Perttula et al., 2011; Sabbagh-Ehrlich et al., 2005; Soccolich et al., 2013; Stein and Jones, 1988). The way through which this pressure influences drivers is in need of further examination. However, it is likely that the beliefs, attitudes and values of drivers may interact with management pressure to determine how a driver will respond and the course of action taken.

Lastly, there are a number of policies used by companies as well as differing approaches to monitor compliance and punish breaches. Some companies will exceed government policy requirements to ensure safety (Sullivan and Flannagan, 2012). High performance safety companies have been shown to use screening criteria for new employees, conduct regular, and early, training, and reward safe behaviour (Mejza et al., 2003). A number of papers focussed on specific policies surrounding loading and unloading, the use of two-up driving and incident reporting. Similarly to government policies, these policies may provide a point of interaction with which culture may influence compliance and resultant safety.

3.2.3 Customers and health and safety

There was little direct reference to customers within the included literature. Further, where customers were mentioned, research rarely included actual measures

or dependant variables that related to customers, instead indicating a role without direct evidence. It is, however, important to note that customers may influence the policies and decisions of organisations. For example, schedulers have been found to, at times, be more influenced by revenue than fatigue-related concerns (Braver et al., 1999). Thus the influence of organisations may partially stem from customers. Additionally, Kemp et al. (2013) collected qualitative and quantitative data from 435 truck drivers in the US and found that many drivers experienced time pressures, which typically stemmed from customer delays. Snyder (2012) provided an account of one such instance, in which customer delays led a driver to drive whilst fatigued in order to reach a deadline. In other industries customers may have a less significant role in safety, reducing the degree of attention customers have received in safety culture literature. However, customers appear to be an important contextual influence on safety within heavy vehicle industries. Again, it is important to further explore the role of customers in heavy vehicle operations, and specifically to examine how the beliefs, attitudes and values of drivers may interact with customer policies and practices.

3.2.4 Road and work environment and crash outcomes

As drivers spend the majority of their time on the road, the road environment is important for heavy vehicle safety. The literature identified a number of road environment factors which influence safety, including (1) other vehicles; (2) environmental conditions such as the time of day and weather patterns; and (3) road design and condition related to public and private roads as well as on road facilities.

Other vehicles are viewed by truck drivers as presenting the greatest threat to productivity and safety (Cherry and Adelakun, 2012) and have been found to be at fault in between 81 and 84% of crashes between heavy vehicles and other vehicles (Björnstig et al., 2008; Häkkänen and Summala, 2001). With regards to environmental conditions, inclement weather has been associated with crash severity and likelihood (Chen and Chen, 2011; Häkkänen and Summala, 2001; Young and Liesman, 2007). The time of day has also been shown to be linked with the likelihood of crashes (Blower et al., 1993), and night-time crashes have been associated with greater levels of truck driver culpability (Bunn et al., 2009). Whilst night-time crashes may be partially caused by glare (Ranney et al., 2000), the main issue which has been associated with driving at different times of the day is fatigue (Crum and Morrow, 2002; Gander et al., 2006; Heaton et al., 2008; McCartt et al., 2000).

There were a number of factors associated with road design which influence safety. The specific findings can be found in Table A2 in the appendix, however, it is worth noting a few key points. At a general level, different sectors of road have been linked with differing crash patterns (Golob and Recker, 1987). Specific factors such as shoulder and lane width, posted speed limit, traffic signals, visibility and rest location availability have seen significant attention. Further, research has demonstrated that private road design can impact not only crashes but also musculoskeletal injuries through vibrations. Finally, the availability of health care facilities on the road has been implicated as a factor associated with lower health

care, thus impacting the general health of truck drivers who conduct long-distance travel.

Heavy vehicle organisations can limit night-time driving, however, road design factors are generally beyond the control of the industry. As regular roadway usage is common to relatively few industries (e.g. transport and emergency services), and the safety culture literature has emphasised organisational factors, it is not surprising that the road environment has eluded prior safety culture literature. Given the majority of people will use some form of roadway when commuting to and from work, it is important for research to examine the relationship between these factors and other safety culture factors both at an organisational and worker level.

A significant degree of literature focussed on work environment factors which the organisation is able to exert some control over. Specifically, these factors included: (1) vehicle design and maintenance such as mechanical faults, the physical properties of the vehicle, technologies, ergonomic factors, and emissions; (2) passengers, and; (3) cargo-related factors. Cargo-related factors have already been discussed under general organisational factors. In the case of passengers, there was only one study, which indicated that the presence of passengers was protective against crashes for older drivers (Bunn et al., 2009).

There were a large number of vehicle design and maintenance-related factors (see Table A2). These generally included mechanical faults, physical properties of the vehicle, vehicle technologies, ergonomics and vehicle emissions. Generally, mechanical faults have been found to be associated with an increased risk of crashes and higher culpability rates (Blower et al., 2010; Häkkänen and Summala, 2001; Jones and Stein, 1989). Physical properties of the vehicle, both those which are common across heavy vehicles and those specific to heavy vehicle types, have been associated with the likelihood of crashes and injury severity (e.g. Braver et al., 1998; Hanowski et al., 2005).

There were a number of specific vehicle technologies, which have also been investigated under test conditions or computer modelling and shown to have potential benefits. These included rearward video (Lee et al., 2010), forward collision warning (Rakha et al., 2010), and speed limiters (Saccomanno et al., 2009). Ergonomic factors, such as seat design and trailer tarping mechanisms have also been indicated to influence the risk of non-crash injuries in both real world and test condition examination (Marshall and Wells, 2011; Robb and Mansfield, 2007). Finally, vehicle emissions have been linked with the likelihood of lung cancer (e.g. Steenland et al., 1990).

Each of these work environment factors represent contextual influences which can, and perhaps should, be controlled by the organisation. Further, depending on the beliefs, attitudes and values of an organisation's drivers, many of these factors may have differing influences on safety. Along with the modification of the work environment by organisations, it is important to recognise that some of the above factors may represent an artefact of culture, or a point at which culture may interact

with context. For instance, mechanical faults may be caused by a lack of correct maintenance checks. The failure to conduct such checks may result from beliefs, attitudes and values surrounding the inspection of vehicles. However, other factors, such as those linked with specific vehicle types may also be associated with differential subcultures. For example, the culture of long-combination vehicle drivers may differ from those of smaller heavy vehicles. The relationship between these factors and culture should be further investigated.

4 Discussion

The current research sought to review the heavy vehicle health and safety literature to profile health and safety behaviours and outcomes (as a means by which contextual factors may influence safety) and contextual factors shown to influence these behaviours or outcomes. After reviewing 104 peer-reviewed articles, a broad range of factors were identified.

Health and safety within heavy vehicle operations can be generally categorised as crashes, non-driving injuries and health outcomes. Within the accessed literature, a number of crash-related behaviours have been identified for heavy vehicles. These primarily include driving whilst fatigued, driving under the influence of drugs and alcohol, speeding, seatbelt non-use, and general driving errors and violations. Each of these behaviours have been extensively researched in the broader traffic safety literature, and within the heavy vehicle research have been demonstrated to either increase the risk or severity of crashes.

Regarding non-driving injuries, a number of mechanisms or scenarios of injury were identified. These included slips, trips and falls, overexertion, locomotor disorders, and striking/crushing incidents. Though each of these scenarios may be caused by a large cluster of behaviours, the literature has largely focussed on broader mechanisms and prevalence of injuries, rather than behaviours. This is concerning, as without knowing the specific behaviours that drivers should avoid or engage in, it is difficult to manage these incidents or understand them from a cultural perspective. From the papers reviewed it is evident that a large number of non-driving injuries occur during loading and unloading, through poor lifting and potentially standing location in the case of striking/crushing injuries. Another key activity during which injuries appear to occur is when entering and exiting the vehicle or trailer. Whilst research has demonstrated that facing the vehicle and using the correct steps and hand rails reduces impact forces, there is little evidence surrounding the prevalence of injuries tied directly to these behaviours. Further research is required to understand which behaviours present the highest risk of non-driving injury to heavy vehicle drivers.

With regards to health outcomes, prior research has demonstrated high levels of lung cancer and respiratory diseases, diet and exercise-related diseases, as well as those related to stress. From the research reviewed, it appears that promotion of healthy lifestyle choices, such as quitting smoking, healthy eating and exercising, could reduce these outcomes. Furthermore, teaching drivers to better handle work stress, through relaxation and coping mechanisms, may have an impact on the level

of stress-related disorders. Though there was relatively little emphasis on specific behaviours related to health outcomes, these health issues are not restricted to heavy vehicle drivers. Prevalence-focussed studies provide an understanding of how to use prior health knowledge to improve health within this industry. Thus, using the reviewed papers alongside an examination of literature surrounding these problems would enable a better understanding of health within heavy vehicle operations. An investigation of the culture of heavy vehicle drivers may then provide information about how to best communicate health messages to drivers.

Within the current research, the purpose of identifying these health and safety outcomes and behaviours was to define targets that contextual factors should influence. There are many external influences on heavy vehicle operations which have been examined. These factors are important for future research, and intervention, using a cultural framework to understand and improve health and safety in heavy vehicle operations. Within the accessed literature, management practices such as training, support and pressure, scheduling, policies, monitoring and enforcement, as well as factors related to employment and payment, align well with previously examined safety culture factors (see Guldenmund, 2007). Additional organisational factors that were identified within the literature included more general organisational characteristics, such as type of goods and distance of journeys, firm size and type, previous safety record and types of vehicles used. Some of these factors may have a direct influence over safety, however, organisations with similarities in these characteristics may also be more likely to have similar safety cultures and performance. This could in part stem from historical factors surrounding certain subsections of the industry, as well as similar challenges that may be faced. It is important to consider such factors, where relevant, to understand how they may interact with the beliefs, attitudes and values of workers.

As discussed in Section 1, despite the indication that a safety culture perspective should include national level variables (INSAG-1, 1986, as updated in INSAG-7, International Nuclear Safety Advisory Group, 1992), little research has sought to do so when examining safety culture. This is surprising given the degree of research in broader health and safety, particularly within the reviewed literature, which has examined factors outside the workplace.

Within the reviewed literature, it was found that government departments, customers and the road environment are important in heavy vehicle operations. Though specific legislations differ between jurisdictions, it was seen that government departments have an influence over health and safety through education and enforcement. The majority of government-focussed research examined specific legislations. These included behaviour-related laws, such as those for speed, lane use, roadside drug testing and driving/work hours, as well as vehicle-related laws such as those for vehicle length and conspicuity. Though it received less direct attention within the literature, customers were also seen to be relevant to health and safety, through influencing organisations and causing delays or time pressures. Finally, the road and work environment consisted of a broad range of factors including other

vehicles, environmental conditions, road condition and design, vehicle design and maintenance, the presence of passengers, and cargo-related factors. At a surface level, these factors may appear to have little to do with safety culture as it has traditionally been applied. While there is a need to explore broader contextual factors when investigating safety culture, there is also a need to ensure that safety culture does not become a meaningless umbrella term for all things health and safety. However, when using a conceptualisation of safety culture akin to that presented by Edwards et al. (2013) or the interpretive framework discussed by Nævestad (2009), it is important to recognise these influences, and explore how the underlying culture of an organisation, work group or industry may interact with these contextual factors. Each of the identified factors may provide a point of interaction, whereby culture may influence safety. Further, it is commonly argued that the deepest levels of culture are difficult to directly measure (Guldenmund, 2000; Schein, 1990). As each of the identified factors has been shown to be relevant for safety or safety-related behaviours, they also provide useful starting points for deciphering the culture and how it influences safety.

5 Conclusion

The Australian heavy vehicle industry, like other heavy vehicle industries around the world, is faced with significant health and safety issues. The concept of safety culture could provide a useful framework for understanding and improving safety. While little prior safety culture research has been conducted within heavy vehicle operations, there has been a significant degree of research exploring contextual factors which influence health and safety. The present research sought to profile these factors, along with the behaviours, and health and safety outcomes which they influence. A number of factors were identified which may provide a framework for future research seeking to explore health and safety within heavy vehicle industries. These factors, when present within specific heavy vehicle operations, represent a broader cultural context within which the beliefs, attitudes and values shared by a workforce exist. Thus, the identified factors may provide points of interaction with culture, and may further serve as a starting place for exploring safety culture.

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Appendix A

See Table A1

Table A1 Organisational management practices in the reviewed literature.

Organisational factor	Finding	Location	Articles
Training	Training could reduce proportion of incidents caused by technical driving errors.	Virginia, USA	(Hanowski et al., 2007)
	Voluntary training attendance is associated with reduced perceived fatigue.	United States	(Crum and Morrow, 2002)
Management support and pressure	Supportive (vs. demanding) management reduces intentions to commit unsafe acts in owner operators, and reduces fatigue.	Holland, United States	(de Croon et al., 2002; Morrow and Crum, 2004; Swartz and Douglas, 2009)
	41.9% of port truck drivers report that their employee forces them to drive over hours.	Israel	(Sabbagh-Ehrlich et al., 2005)
	Time pressure and disrespectful treatment by managers, and work stress correlated with drug and alcohol use.	Pakistan, United States	(Mir et al., 2012; Shattell et al., 2010)
	Organisational pressure associated with injuries.	Australia	(Friswell and Williamson, 2010)
	Work-life conflict associated with worsening injuries over time.	Australia	(Williamson et al., 2009)
	Job strain, working high hours and lack of supervisor support, and job satisfaction, associated with higher intake of sugary foods through reduced sleep.	United States	(Buxton et al., 2009)
Scheduling	More arduous schedules, night-time driving, delivery window size, inability to choose break times, and higher work/time-off ratio, associated with fatigue.	Brazil, Finland, Holland, New Zealand, South Africa, United States	(Charlton and Baas, 2001; Crum and Morrow, 2002; de Croon et al., 2002; de Pinho et al., 2006; Maldonado et al., 2002; McCartt et al., 2000; Perttula et al., 2011; Soccolich et al., 2013; Stein and Jones, 1988)
	Some driver's schedules require driving outside of hours of service regulations.	Florida, USA; Israel	(Beilock, 1995; Sabbagh-Ehrlich et al., 2005)
	Heavy schedules associated with poor sleep quality.	Belgium	(Braeckman et al., 2011)
	Sleeping away from home increases perceived fatigue.	Australia	(Baulk and Fletcher, 2011)
	Schedulers influenced by revenue more than hours of service when accepting jobs, and use potentially inaccurate estimates of travel time.	Tenessee, USA	(Braver et al., 1999)
Policies, and monitoring and enforcement	High performance safety companies apply screening criteria for new employees, emphasise pre and during employment training, conduct a wide variety of training and testing, and	United States	(Mejza et al., 2003)

Organisational factor	Finding	Location	Articles
	reward safe behaviour.		
	Policies regarding amount of unloading and loading influence fatigue and related incidents.	South Africa, United States	(Crum and Morrow, 2002; Maldonado et al., 2002; Soccolich et al., 2013)
	Time spent loading associated with worsening injuries.	Australia	(Williamson et al., 2009)
	Recommend policies for unloading and loading, and personal protective equipment.	Denmark	(Shibuya et al., 2010)
	Use of two-up driving (two drivers alternating between sleeping and driving) reduces sleep quality.	South Africa	(Maldonado et al., 2002)
	Some company policies may positively exceed regulations.	United States	(Sullivan and Flannagan, 2012)
	Under reporting of incidents associated with higher crash rates.	United States	(Moses and Savage, 1994)

Table A2 Road and vehicle environment factors in reviewed literature.

Factor		Findings	Location	Articles
Road design and conditions	Public roads	Different highway sections associated with different crash patterns.	California, USA	(Golob and Recker, 1987)
		Number of highway access points, and narrower lanes and shoulders linked with increased crash risk.	India	(Sharma and Landge, 2012)
		Posted speed limit associated with truck driver at-fault rates.	Kentucky, USA	(Bunn et al., 2009)
		Coroners recommendations following fatal crashes commonly target signage, speed limits, safety barriers, and lighting/visibility.	Australia	(Brodie et al., 2010)
		Traffic light signalling patterns influence crash rate.	Australia	(Archer and Young, 2009)
		Availability of rest locations associated with fatigue and related outcomes.	Israel; United States	(Crum and Morrow, 2002; Morrow and Crum, 2004; Sabbagh-Ehrlich et al., 2005; Snyder, 2012)
		Inclination when unloading and loading increases risk of crushing from brake failure.	Denmark	(Shibuya et al., 2010)
	Private roads	Site access road and roadway-associated vibrations contribute to injuries.	Australia	(Friswell and Williamson, 2010)
		Duration and intensity of vibration associated with lower back pain.	Italy, Sweden, Netherlands, United Kingdom	(Bovenzi et al., 2006; Robb and Mansfield, 2007)
		Vibrations in mining trucks can exceed international standards.	Canada	(Kumar, 2004)
	Facilities	Difficulties accessing health care	United States	(Staško and Neale, 2007)

Factor		Findings	Location	Articles
		on the road.		
Work environment				
Vehicle design and maintenance	Mechanical faults	Tyre defects associated with increased crash severity.	United States	(Chen and Chen, 2011)
		Technical faults common in truck driver at-fault crashes.	Finland; United States	(Häkkänen and Summala, 2001)
		Brake and steering defects increase crash likelihood.	Washington, USA	(Blower et al., 2010; Jones and Stein, 1989)
	Physical properties	Under ride evident in 63% of fatal crashes.	Indiana, USA	(Braver et al., 1998)
		14.3% of critical incidents caused by physical properties of vehicle (related to weight, size and centre of gravity).	United States	(Hanowski et al., 2005)
		Longer vehicles have fewer crashes per kilometre travelled.*[a]	Canada	(Regehr et al., 2009)
		Double trailer trucks more likely to crash than single trailer trucks.*[a]	Washington, USA	(Stein and Jones, 1988)
		Greater mass associated with increased risk of running through red lights.	Australia	(Archer and Young, 2009)
	Technologies	Rear-view video improves stopping in reversing situations.	Controlled tests	(Lee et al., 2010)
		Forward collision warnings could reduce rear end crashes in the United States.		(Rakha et al., 2010)
		Speed limiters set to 105 km/h could reduce crash rates in Canada.	Computer modelling	(Saccomanno et al., 2009)
	Ergonomics	Step-van design reduces risk of slipping when exiting regardless of hand rail use.	Controlled test	(Fathallah et al., 2000)
		Manual tarping trailers associated with increased risk of falls and overexertion.	Controlled Ttest	(Marshall and Wells, 2011)
		Seat design influences back pain and repetitive strain injuries.	United Kingdom	(Robb and Mansfield, 2007)
	Emissions	Lung cancer associated with vehicle exhaust exposure.	Sweden; United States	(Garshick et al., 2008; Jakobsson et al., 1997)
		More specifically, lung cancer associated with diesel exhaust.	United States	(Steenland et al., 1990)

[a]Discrepant findings may be related to jurisdictional differences and clustering of multiple vehicles as 'long vehicles'.

References

Arboleda A., Morrow P.C., Crum M.R. and Shelley Ii M.C., Management practices as antecedents of safety culture within the trucking industry: Similarities and differences by hierarchical level, J. Saf. Res. 34, 2003, 189–197, http://dx.doi.org/10.1016/S0022-4375(02)00071-3.

Archer J. and Young W., Signal treatments to reduce heavy vehicle crash-risk at metropolitan highway intersections, Accid. Anal. Prev. 41 (3), 2009, 404–411, http://dx.doi.org/10.1016/j.aap.2008.12.015.

Baas P.H., Charlton S.G. and Bastin G.T., Survey of New Zealand truck driver fatigue and fitness for duty, Transp. Res. Part F: Traf. Psychol. Behav. 3 (4), 2000, 185–193, http://dx.doi.org/10.1016/S1369-8478(01)00003-1.

Balarajan R. and McDowall M.E., Professional drivers in London: a mortality study, Br. J. Ind. Med. 45 (7), 1988, 483–486, 0.1136/oem.45.7.483.

Baulk S. and Fletcher A., At home and away: Measuring the sleep of Australian truck drivers, In: Paper presented at the Managing Fatigue in Transportation, Resources and Health International Conference (8th), Fremantle Western Australia, Australia2012, (2012–2013).

Beilock R., Schedule-induced hours-of-service and speed limit violations among tractor-trailer drivers, Accid. Anal. Prev. 27 (1), 1995, 33–42, http://dx.doi.org/10.1016/0001-4575(94)00042-K.

Birdsey J., Alterman T., Li J., Petersen M.R. and Sestito J., Mortality among members of a truck driver trade association, AAOHN J. 58 (11), 2010, 473–480, http://dx.doi.org/10.3928/08910162-20101018-01.

Björnstig U., Björnstig J. and Eriksson A., Passenger car collision fatalities–With special emphasis on collisions with heavy vehicles, Accid. Anal. Prev. 40 (1), 2008, 158–166, http://dx.doi.org/10.1016/j.aap.2007.05.003.

Blower D., Campbell K.L. and Green P.E., Accident rates for heavy truck-tractors in Michigan, Accid. Anal. Prev. 25 (3), 1993, 307–321, http://dx.doi.org/10.1016/0001-4575(93)90025-R.

Blower D., Green P. and Matteson A., Condition of trucks and truck crash involvement, Transport. Res. Rec. J. Transp. Res. Board 2194 (1), 2010, 21–28, http://dx.doi.org/10.3141/2194-03.

Bovenzi M., Rui F., Negro C., D'Agostin F., Angotzi G., Bianchi S. and Stacchini , An epidemiological study of low back pain in professional drivers, J. Sound Vibration 298 (3), 2006, 514–539, http://dx.doi.org/10.1016/j.jsv.2006.06.001.

Braeckman L., Verpraet R., Van Risseghem M., Pevernagie D. and De Bacquer D., Prevalence and correlates of poor sleep quality and daytime sleepiness in Belgian truck drivers, Chronobiol. Int.: J. Biol. Med. Rhythm Res. 2, 2011, 126–134, http://dx.doi.org/10.3109/07420528.2010.540363.

Braver E.R., Mitter E.L., Lund A.K., Cammisa M.X., Powell M.R. and Early N., A photograph-based study of the incidence of fatal truck underride crashes in Indiana, Accid. Anal. Prev. 30 (2), 1998, 235–243, http://dx.doi.org/10.1016/S0001-4575(97)00079-1.

Braver E.R., Preusser C.W. and Ulmer R.G., How long-haul motor carriers determine truck driver work schedules: the role of shipper demands, J. Saf. Res. 30 (3), 1999, 193–204, http://dx.doi.org/10.1016/S0022-4375(99)00014-6.

Brodie L., Bugeja L. and Ibrahim J., Coroners' recommendations following fatal heavy vehicle crash investigations, Aust. N. Z. J. Public Health 34 (2), 2010, 136–141, http://dx.doi.org/10.1111/j. 1753-6405.2010.00497.x.

Brodie L., Bugeja L. and Ibrahim J.E., Heavy vehicle driver fatalities: learning's from fatal road crash investigations in Victoria, Accid. Anal. Prevention 41 (3), 2009, 557–564, http://dx.doi.org/10.1016/j.aap.2009.02.005.

Bunn, T. L., Slavova, S., Robertson, M., 2012. Motor vehicle injuries among semi truck drivers and sleeper berth passengers, J. Saf. Res. (0). doi: 10.1016/j.jsr.2012.09.003.

Bunn T.L., Yu L., Slavova S. and Bathke A., The effects of semi truck driver age and gender and the presence of passengers on collisions with other vehicles, Traf. Inj. Prev. 10 (3), 2009, 266–272, http://dx.doi.org/10.1080/15389580902857622.

Buxton O.M., Quintiliani L.M., Yang M.H., Ebbeling C.B., Stoddard A.M., Pereira L.K. and Sorensen G., Association of sleep adequacy with more healthful food choices and positive workplace experiences among motor freight workers, Am. J. Public Health 99 (S3), 2009, S636–S643, http://dx.doi.org/10.2105/AJPH.2008.158501.

Cantor et al., 2009 D.E. Cantor, T.M. Corsi and C.M. Grimm, Do electronic logbooks contribute to motor carrier safety performance?, J. Bus. Logist. 1, 2009, 203–222, http://dx.doi.org/10.1002/j.2158-1592.2009.tb00105.x.

Carter N., Ulfberg J., Nyström B. and Edling C., Sleep debt, sleepiness and accidents among males in the general population and male professional drivers, Accid. Anal. Prev. 35 (4), 2003, 613–617, http://dx.doi.org/10.1016/S0001-4575(02)00033-7.

Charlton S.G. and Baas P.H., Fatigue, work-rest cycles, and psychomotor performance of New Zealand truck drivers, N. Z. J. Psychol. 30 (1), 2001, 32.

Chen F. and Chen S., Injury severities of truck drivers in single- and multi-vehicle accidents on rural highways, Accid. Anal. Prev. 43 (5), 2011, 1677–1688, http://dx.doi.org/10.1016/j.aap.2011.03.026.

Chen G.X., Impact of federal compliance reviews of trucking companies in reducing highway truck crashes, Accid. Anal. Prev. 40 (1), 2008, 238–245, http://dx.doi.org/10.1016/j.aap.2007.06.002.

Cherry C.R. and Adelakun A.A., Truck driver perceptions and preferences: congestion and conflict, managed lanes, and tolls, Transp. Policy 24 (0), 2012, 1–9, http://dx.doi.org/10.1016/j.tranpol.2012.07.012.

Choudhry R.M., Fang D. and Mohamed S., The nature of safety culture: a survey of the state of the art, Saf. Sci. 45, 2007, 993–1012, http://dx.doi.org/10.1016/j.ssci.2006.09.003.

Cook L.J., Hoggins J.L. and Olson L.M., Observed seatbelt usage among drivers of heavy commercial vehicles in Utah, Accid. Anal. Prev. 40 (4), 2008, 1300–1304, http://dx.doi.org/10.1016/j.aap.2008.01.012.

Cox S.J. and Cheyne A.J.T., Assessing safety culture in offshore environments, Saf. Sci. 34, 2000, 111–129, http://dx.doi.org/10.1016/S0925-7535(00)00009-6.

Crum M.R. and Morrow P.C., The influence of carrier scheduling practices on truck driver fatigue, Transp. J. 42, 2002, 20–41.

Dahl S., Kaerlev L., Jensen A., Tüchsen F., Hannerz H., Nielsen P.S. and Olsen J., Hospitalization for lifestyle related diseases in long haul drivers compared with other truck drivers and the working population at large, Work 33 (3), 2009, 345–353, http://dx.doi.org/10.3233/WOR-2009-0882.

Davey J., Richards N. and Freeman J., Fatigue and beyond: patterns of and motivations for illicit drug use among long-haul truck drivers, Traf. Inj. Prev. 8 (3), 2007, 253–259, http://dx.doi.org/10.1080/15389580601186034.

de Croon E.M., Blonk R.W.B., de Zwart B.C.H., Frings-Dresen M.H.W. and Broersen J.P.J., Job stress, fatigue, and job dissatisfaction in Dutch lorry drivers: towards an occupation specific model of job demands and control, Occup. Environ. Med. 59 (6), 2002, 356–361, http://dx.doi.org/10.1136/oem.59.6.356.

de Croon E.M., Sluiter J.K. and Frings-Dresen M.H.W., Need for recovery after work predicts sickness absence: a 2-year prospective cohort study in truck drivers, J. Psychosom. Res. 55 (4), 2003, 331–339, http://dx.doi.org/10.1016/S0022-3999(02)00630-X.

de Pinho R.S.N., da Silva-Júnior F.P., Bastos J.P.C., Maia W.S., de Mello M.T., de Bruin V.M.S. and de Bruin P.F.C., Hypersomnolence and accidents in truck drivers: a cross-sectional study, Chronobiol. Int.: J. Biol. Med. Rhythm Res. 23 (5), 2006, 963–971, http://dx.doi.org/10.1080/07420520600920759.

Douglas and Swartz, 2009 M.A. Douglas and S.M. Swartz, A multi-dimensional construct of commercial motor vehicle operators' attitudes toward safety regulations, Int. J. Logist. Manage. 20 (2), 2009, 278–293, http://dx.doi.org/10.1108/09574090910981341.

Edwards J., Davey J. and Armstrong K., Returning to the roots of culture: a review and re-conceptualisation of safety culture, Saf. Sci. 55, 2013, 70–80, http://dx.doi.org/10.1016/j.ssci.2013.01.004.

Edwards J., Freeman J., Soole D. and Watson B., A framework for conceptualising traffic safety culture, Transp. Res. Part F: Traf. Psychol. Behav. 0, 2014, (in press) http://dx.doi.org/10.1016/j.trf.2014.03.002.

Fathallah F.A. and Cotnam J.P., Maximum forces sustained during various methods of exiting commercial tractors, trailers and trucks, Appl. Ergon. 31 (1), 2000, 25–33, http://dx.doi.org/10.1016/S0003-6870(99)00020-4.

Fathallah F.A., Grönqvist R. and Cotnam J.P., Estimated slip potential on icy surfaces during various methods of exiting commercial tractors, trailers, and trucks, Safe. Sci. 36 (2), 2000, 69–81, http://dx.doi.org/10.1016/S0925-7535(00)00016-3.

Fontaine M., Effect of truck lane restrictions on four-lane freeways in mountainous areas, Transp. Res. Rec.: J. Transp. Res. Board 2078 (1), 2008, 135–142, http://dx.doi.org/10.3141/2078-18.

Friswell R. and Williamson A., Work characteristics associated with injury among light/short-haul transport drivers, Accid. Anal. Prev. 42 (6), 2010, 2068–2074, http://dx.doi.org/10.1016/j.aap.2010.06.019.

Friswell R. and Williamson A., Comparison of the fatigue experiences of short haul light and long distance heavy vehicle drivers, Saf. Sci. 57 (0), 2013, 203–213, http://dx.doi.org/10.1016/j.ssci.2013.02.014.

Gander P.H., Marshall N.S., James I. and Quesne L.L., Investigating driver fatigue in truck crashes: trial of a systematic methodology, Transp. Res. Part F: Traf. Psychol. Behav. 9 (1), 2006, 65–76, http://dx.doi.org/10.1016/j.trf.2005.09.001.

Garber N., Miller J.C., Sun X. and Yuan B., Safety impacts of differential speed limits for trucks and passenger cars on rural interstate highways: a modified empirical bayes approach, J. Transp. Eng. 132, 2006, 19–29, http://dx.doi.org/10.1061/(ASCE)0733-947X(2006)132:1(19).

Garshick E., Laden F., Hart J.E., Rosner B., Davis M.E., Eisen E.A. and Smith T.J., Lung cancer and vehicle exhaust in trucking industry workers, Environ. Health Perspect. 116 (10), 2008, 1327–1332, http://dx.doi.org/10.1289/ehp.11293.

Girasek D.C., Towards operationalising and measuring the traffic safety culture construct, Int. J. Inj. Control Saf. Promot. 19, 2011, 37–46, http://dx.doi.org/10.1080/17457300.2011.603147.

Gjerde H., Christophersen A., Normann P., Pettersen B., Sabaredzovic A., Samuelsen S. and Morland J., Analysis of alcohol and drugs in oral fluid from truck drivers in Norway, Traf. Inj. Prev. 13 (1), 2012, 43–48, http://dx.doi.org/10.1080/15389588.2011.627957.

Golob T.F. and Recker W.W., An analysis of truck-involved freeway accidents using log-linear modeling, J. Saf. Res. 18 (3), 1987, 121–136, http://dx.doi.org/10.1016/0022-4375(87)90003-X.

Golob T.F., Recker W.W. and Leonard J.D., An analysis of the severity and incident duration of truck-involved freeway accidents, Accid. Anal. Prev. 19 (5), 1987, 375–395, http://dx.doi.org/10.1016/0001-4575(87) 90023-6.

Grote G., Diagnosis of safety culture: a replication and extension towards assessing "safe" organizational change processes, Saf. Sci. 46, 2008, 450–460, http://dx.doi.org/10.1016/j.ssci.2007.05.005.

Guldenmund F.W., The nature of safety culture: a review of theory and research, Saf. Sci. 34, 2000, 215–257, http://dx.doi.org/10.1016/S0925-7535(00)14-X.

Guldenmund F.W., The use of questionnaires in safety culture research –A– an evaluation, Saf. Sci. 45, 2007, 723–743, http://dx.doi.org/10.1016/j.ssci.2007.04.006.

Guldenmund F.W., (Mis) understanding safety culture and its relationship to safety management, Risk Anal. 30 (10), 2010a, 1466–1480, http://dx.doi.org/10.1111/j.1539-6924.2010.01452.x.

Guldenmund F.W., Understanding and Exploring Safety Culture, 2010b, Technical University of Delft; Oisterwijk.

Häkkänen H. and Summala H., Fatal traffic accidents among trailer truck drivers and accident causes as viewed by other truck drivers, Accid. Anal. Prev. 33 (2), 2001, 187–196, http://dx.doi.org/10.1016/S0001-4575(00)00030-0.

Hall R.W. and Mukherjee A., Bounds on effectiveness of driver hours-of-service regulations for freight motor carriers, Transp. Res. Part E: Logist. Transp. Rev. 44 (2), 2008, 298–312, http://dx.doi.org/10.1016/j.tre.2007.07.007.

Hanowski R.J., Hickman J.S., Olson R.L. and Bocanegra J., Evaluating the 2003 revised hours-of-service regulations for truck drivers: the impact of time-on-task on critical incident risk, Accid. Anal. Prev. 41 (2), 2009, 268–275, http://dx.doi.org/10.1016/j.aap.2008.11.007.

Hanowski R.J., Hickman J.S., Wierwille W.W. and Keisler A., A descriptive analysis of light vehicle–heavy vehicle interactions using in situ driving data, Accid. Anal. Prev. 39 (1), 2007, 169–179, http://dx.doi.org/10.1016/j.aap.2006.06.016.

Hanowski R.J., Perez M.A. and Dingus T.A., Driver distraction in long-haul truck drivers, Transp. Res. Part F: Traf. Psychol. Behav. 8 (6), 2005, 441–458, http://dx.doi.org/10.1016/j.trf.2005.08.001.

Håvold J.I., Safety culture and safety management aboard tankers, Reliab. Eng. Syst. Saf. 95, 2010, 511–519, http://dx.doi.org/10.1016/j.ress.2010.01.002.

Heaton K., Browning S. and Anderson D., Identifying variables that predict falling asleep at the wheel among long-haul truck drivers, AAOHN J. 56 (9), 2008, 379–385, http://dx.doi.org/10.3928/08910162-20080901-05.

Helmkamp J.C., Bell J.L., Lundshom W.J., Ramprasod J. and Haque A., Assessing safety awareness and knowledge and behavioral change among West Virginia loggers, Inj. Prev. 10 (4), 2004, 233–238, http://dx.doi.org/10.1136/ip.2003.005033.

Huang Y.-H., Rau P.-L.P., Zhang B. and Roetting M., Chinese truck drivers' attitudes toward feedback by technology: a quantitative approach, Accid. Anal. Prev. 40 (4), 2008, 1553–1562, http://dx.doi.org/10.1016/j.aap.2008.04.001.

Huang Y.-H., Roetting M., McDevitt J.R., Melton D. and Smith G.S., Feedback by technology: attitudes and opinions of truck drivers, ~~ortation Research~~Transp. Res. Part F: Traffic Psychol. Behav. 8 (4-5), 2005, 277–297, http://dx.doi.org/10.1016/j.trf.2005.04.005.

Huang et al., 2013 Y.-H. Huang, D. Zohar, M. Robertson, A. Garabet, J. Lee and A. Murphy, Development and validation of safety climate scales for lone workers using truck drivers as exemplar, Transp. Res. Part F: Traffic Psychol. Behav. 17, 2013, 5, http://dx.doi.org/10.1016/j.trf.2012.08.011.

International Nuclear Safety Advisory Group, 1992 International Nuclear Safety Advisory Group, The Chernobyl Accident: Updating of INSAG-1, 75-INSAG-7 Safety Series, 1992, International Atomic Energy Agency; Vienna.

Jakobsson R., Gustavsson P. and Lundberg I., Increased risk of lung cancer among male professional drivers in urban but not rural areas of Sweden, Occup. Environ. Med. 54 (3), 1997, 189–193, http://dx.doi.org/10.1136/oem.54.3.189.

Jarvholm B. and Silverman D., Lung cancer in heavy equipment operators and truck drivers with diesel exhaust exposure in the construction industry, Occup. Environ. Med. 60 (7), 2003, http://dx.doi.org/10.1136/oem.60.7.516, 516–516.

Jensen A., Kaerlev L., Tüchsen F., Hannerz H., Dahl S., Nielsen P.S. and Olsen J., Locomotor diseases among male long-haul truck drivers and other professional drivers, Int. Arch. Occup. Environ. Health 81 (7), 2008, 821–827, http://dx.doi.org/10.1007/s00420-007-0270-4.

Jones C.B., Ibrahim J.E. and Ozanne-Smith J., Work-related non-crash heavy vehicle driver fatalities in Australia, 2000–9, Inj. Prev. 17 (4), 2011, 271–274, http://dx.doi.org/10.1136/ip.2010.030783.

Jones D. and Switzer-McIntyre S., Falls from trucks: a descriptive study based on a workers compensation database, Work 20 (3), 2003, 179–184.

Jones I.S. and Stein H.S., Defective equipment and tractor-trailer crash involvement, Accid. Anal. Prev. 21 (5), 1989, 469–481, http://dx.doi.org/10.1016/0001-4575(89)90007-9.

Jovanović J., Stefanović V., Stanković D.N., Bogdanović D., Kocić B., Jovanović M. and Jovanović J., Serum lipids and glucose disturbances at professional drivers exposed to occupational stressors, Cent. Euro. J. Public Health 16 (2), 2008, 54–58.

Kemp E., Kopp S.W. and Kemp E., Six days on the road: will I make it home safely tonight? Examining attitudes toward commercial transportation regulation and safety, Int. J. Logist. Manage. 24 (2), 2013, 210–229, http://dx.doi.org/10.1108/IJLM-08-2012-0080.

Kim K. and Yamashita E.Y., Attitudes of commercial motor vehicle drivers towards safety belts, Accid. Anal. Prev. 39 (6), 2007, 1097–1106, http://dx.doi.org/10.1016/j.aap.2007.02.007.

Korkut M., Ishak S. and Wolshon B., Freeway truck lane restriction and differential speed limits: crash analysis and traffic characteristics, Transp. Res. Rec. 2194, 2010, 11–20.

Kumar S., Vibration in operating heavy haul trucks in overburden mining, Appl. Ergon. 35 (6), 2004, 509–520, http://dx.doi.org/10.1016/j.apergo.2004.06.009.

Kuncyté R., Laberge-Nadeau C., Crainic T.G. and Read J.A., Organisation of truck-driver training for the transportation of dangerous goods in Europe and North America, Accid. Anal. Prev. 35 (2), 2003, 191–200, http://dx.doi.org/10.1016/S0001-4575(01)00103-8.

Labat L., Fontaine B., Delzenne C., Doublet A., Marek M.C., Tellier D. and Frimat P., Prevalence of psychoactive substances in truck drivers in the Nord-Pas-de-Calais region (France), Forensic Sci. Int. 174 (2-3), 2008, 90–94, http://dx.doi.org/10.1016/j.forsciint.2007.03.004.

-Lee et al., 2010 C. Lee, A. Kourtellis, P.-S. Lin and P. Hsu, Rearview video system as countermeasure for trucks' backing crashes, Transp. Res. Rec.: J. Transp. Res Board 2194 (1), 2010, 55–63, http://dx.doi.org/10.3141/2194-07.

Lemos L.C., Marqueze E.C., Sachi F., Lorenzi-Filho G. and Moreno C.R.D., Obstructive sleep apnea syndrome in truck drivers, J. Brasileiro De Pneumologia: Publicaç ão Oficial Da Sociedade Brasileira De Pneumologia E Tisilogia 35 (6), 2009, 500–506, http://dx.doi.org/10.1590/S1806-37132009000600002.

Leyton V., Sinagawa D.M., Oliveira K.C.B.G., Schmitz W., Andreuccetti G., De Martini B.S. and Munoz D.R., Amphetamine, cocaine and cannabinoids use among truck drivers on the roads in the State of Sao Paulo, Brazil, Forensic Sci. Int. 215 (1–3), 2012, 25–27, http://dx.doi.org/10.1016/j.forsciint.2011.03.032.

Lincoln et al., 2004 A.E. Lincoln, G.S. Sorock, T.K. Courtney, H.M. Wellman, G.S. Smith and P.J. Amoroso, Using narrative text and coded data to develop hazard scenarios for occupational injury interventions, Inj. Prev. 4, 2004, 249–254.

Mabbott N.A. and Hartley L.R., Patterns of stimulant drug use on Western Australian heavy transport routes, Transp. Res. Part F: Traffic Psychol. Behav. 2 (2), 1999, 115–130, http://dx.doi.org/10.1016/S1369-8478(99)00012-1.

Maldonado C.C., Mitchell D., Taylor S.R. and Driver H.S., Sleep, work schedules and accident risk in South African long-haul truck drivers, South Afr. J. Sci. 98 (7/8), 2002, 319–324.

Marshall J. and Wells R., Evaluating the physical demands of three tarping systems for flatbed transport trailers, Work 39 (2), 2011, 125–140, http://dx.doi.org/10.3233/WOR-2011-1159.

Mayhew C. and Quinlan M., Economic pressure, multi-tiered subcontracting and occupational health and safety in Australian long-haul trucking, Employee Relat. 28 (3), 2006, 212–229, http://dx.doi.org/10.1108/01425450610661216.

McCartt A.T., Hellinga L.A. and Solomon M.G., Work schedules of long-distance truck drivers before and after 2004 hours-of-service rule change, Traffic Inj. Prev. 9 (3), 2008, 201–210, http://dx.doi.org/10.1080/15389580802040287.

McCartt A.T., Rohrbaugh J.W., Hammer M.C. and Fuller S.Z., Factors associated with falling asleep at the wheel among long-distance truck drivers, Accid. Anal. Prev. 32 (4), 2000, 493–504, http://dx.doi.org/10.1016/S0001-4575(99)00067-6.

McKnight A.J. and Bahouth G.T., Analysis of large truck rollover crashes, Traffic Inj. Prev. 10 (5), 2009, 421–426, http://dx.doi.org/10.1080/15389580903135291.

Mejza M.C., Barnard R.E., Corsi T.M. and Keane T., Driver management practices of motor carriers with high compliance and safety performance, Transp. J. 42 (4), 2003, 16–29.

Mir M.U., Khan I., Ahmed B. and Abdul Razzak J., Alcohol and marijuana use while driving: an unexpected crash risk in Pakistani commercial drivers: a cross-sectional survey, BMC Public Health 12, 2012, http://dx.doi.org/10.1186/1471-2458-12-145, 145–145.

Monaco K. and Redmon B., Does contracting with owner operators lead to worse safety outcomes for US motor carriers? Evidence from the Motor Carrier Management Information System, Accid. Anal. Prev. 45 (0), 2012, 654–659, http://dx.doi.org/10.1016/j.aap.2011.09.036.

Morrow P.C. and Crum M.R., Antecedents of fatigue, close calls, and crashes among commercial motor-vehicle drivers, J. Saf. Res. 35 (1), 2004, 59–69, http://dx.doi.org/10.1016/j.jsr.2003.07.004.

Moses L.N. and Savage I., The effect of firm characteristics on truck accidents, Accid. Anal. Prev. 26 (2), 1994, 173–179, http://dx.doi.org/10.1016/0001-4575(94)90087-6.

Nævestad T., Mapping research on high-risk organisations: ~~A~~arguments for a sociotechnical understanding of safety culture, J. Contingencies Crisis Manage. 7, 2009, 126–136, http://dx.doi.org/10.1111/j. 1468-5973.2009.00573.x.

Nævestad T. and Bjornskau T., How can the safety culture perspective be applied to road traffic?, Transp. Rev. 32, 2012, 139–154, http://dx.doi.org/10.1080/01441647.2011.628131.

Neal A. and Griffin M.A., Safety climate and safety behaviour, Aust. J. of Manage. 27, 2002, 67–75, http://dx.doi.org/10.1177/031289620202701S08.

Neeley G.W. and Richardson M., Jr., The effect of state regulations on truck-crash fatalities, Am. J. Public Health 99 (3), 2009, 408–415, http://dx.doi.org/10.2105/ajph.2008.136952.

O'Toole M., The relationship between employees' perceptions of safety and organizational culture, J. Saf. Res. 33, 2002, 231–243, http://dx.doi.org/10.1016/S0022-4375(02)00014-2.

Park S.-W. and Jovanis P., Hours of service and truck crash risk: findings from three National U.S. carriers during 2004, Transp. Res. Rec. (2194), 2010, 3–10, http://dx.doi.org/10.3141/2194-01.

Parker D., Lawrie M. and Hudson P., A framework for understanding the development of organisational safety culture, Saf. Sci. 44, 2006, 551–562, http://dx.doi.org/10.1016/j.ssci.2005.10.004.

Patenaude S., Marchand D., Samperi S. and Bélanger M., The effect of the descent technique and truck cabin layout on the landing impact forces, Appl. Ergon. 32 (6), 2001, 573–582, http://dx.doi.org/10.1016/S0003-6870(01)00032-1.

Perttula P., Ojala T. and Kuosma E., Factors in the fatigue of heavy vehicle drivers, Psychol. Rep. 108 (2), 2011, 507–514, http://dx.doi.org/10.2466/06.13.22.pr0.108.2.

Queensland Workplace Health and Safety Board, Statistical Update: Report 3 – August 2010, 2010, Queensland Workplace Health and Safety; Brisbane.

Rakha H., Fitch G., Arafeh M., Blanco M. and Hanowski R., Evaluation of safety benefits from a heavy-vehicle forward collision warning system, Transp. Res. Rec.: J. Transp. Res. Board 2194 (-1), 2010, 44–54, http://dx.doi.org/10.3141/2194-06.

Ranney T.A., Simmons L.A. and Masalonis A.J., The immediate effects of glare and electrochromic glare-reducing mirrors in simulated truck driving, Human Factors 42 (2), 2000, 337–347, http://dx.doi.org/10.1518/001872000779656453.

Regehr J.D., Montufar J. and Rempel G., Safety performance of longer combination vehicles relative to other articulated trucks, Can. J. Civil Eng. 36 (1), 2009, 40–49, http://dx.doi.org/10.1139/l08-109.

Robb M.J.M. and Mansfield N.J., Self-reported musculoskeletal problems amongst professional truck drivers, Ergonomics 50 (6), 2007, 814–827, http://dx.doi.org/10.1080/00140130701220341.

Robinson C.F. and Burnett C.A., Truck drivers and heart disease in the United States, Am. J. Ind. Med. 47 (2), 2005, 113–119, http://dx.doi.org/10.1002/ajim.20126.

Rodríguez D.A., Targa F. and Belzer M.H., Pay incentives and truck driver safety: a case study, Ind. Labor Relat. Rev. 59 (2), 2006, 205–225.

Roetting M., Huang Y.-H., McDevitt J.R. and Melton D., When technology tells you how you drive– – Truck drivers' attitudes towards feedback by technology, Transp. Res. Part F: Traffic Psychol. Behav. 6 (4), 2003, 275–287, http://dx.doi.org/10.1016/j.trf.2003.09.001.

Sabbagh-Ehrlich S., Friedman L. and Richter E.D., Working conditions and fatigue in professional truck drivers at Israeli ports, Inj. Prev. 11 (2), 2005, 110–114, http://dx.doi.org/10.1136/ip.2004.007682.

Saccomanno F., Cunto D., Hellinga B., Philp C. and Thiffault P., Safety implications of mandated truck speed limiters on freeways, Transp. Res. Rec. 2096, 2009, 65–75, http://dx.doi.org/10.3141/2096-09.

Safe Work Australia, (2014). Work-related fatalities involving trucks, Australia, 2003 to 2012. Canberra, ACT, Australia.

Schein E.H., Organizational culture, Am. Psychol. 45, 1990, 109–119, http://dx.doi.org/10.1037/0003-066x.45.2.109.

Schein E.H., Organizational Culture and Leadership, 3rd ed., 1992, Jossey-Bass; San Francisco.

Sharma A.K. and Landge V.S., Zero inflated negative binomial for modelling heavy vehicle crash rate on indian rural highway, Int. J. Adv. Eng. Technol. 5 (2), 2012, 292–301.

Shattell M., Apostolopoulos Y., Sönmez S. and Griffin M., Occupational stressors and the mental health of truckers, Issues Mental Health Nursing 31 (9), 2010, 561–568, http://dx.doi.org/10.3109/01612840.2010.488783.

Shibuya H., Cleal B. and Kines P., Hazard scenarios of truck drivers' occupational accidents on and around trucks during loading and unloading, Accid. Anal. Prev. 42, 2010, 19–29, http://dx.doi.org/10.1016/j.aap.2009.06.026.

Silva O.A., Greve J.M.D., Yonamine M. and Leyton V., Drug use by truck drivers in brazil, Drugs: Edu., Prev. Policy 10 (2), 2003, 135, http://dx.doi.org/10.1080/0968763021000057727.

Snyder B.H., Dignity and the professionalized body: truck driving in the age of instant gratification, Hedgehog Rev. 14 (3), 2012, 8–20.

Soccolich S.A., Blanco M., Hanowski R.J., Olson R.L., Morgan J.F., Guo F. and Wu S.-C., An analysis of driving and working hour on commercial motor vehicle driver safety using naturalistic data collection, Accid. Anal. Prev. 58, 2013, 249–258, http://dx.doi.org/10.1016/j.aap.2012.06.024.

Staplin L. and Gish K.W., Job change rate as a crash predictor for interstate truck drivers, Accid. Anal. Prev. 37 (6), 2005, 1035–1039, http://dx.doi.org/10.1016/j.aap.2005.06.001.

Staško J.C. and Neale A.V., Health care risks and access within the community of Michigan over-the-road truckers, Work: J. Prev., Assess. Rehabil. 29 (3), 2007, 205–211.

Steenland N.K., Silverman D.T. and Hornung R.W., Case-control study of lung cancer and truck driving in the Teamsters Union, Am. J. Public Health 80 (6), 1990, 670–674, http://dx.doi.org/10.2105/AJPH.80.6.670.

Stein H.S. and Jones I.S., Crash involvement of large trucks by configuration: a case-control study, Am. J. Public Health 78 (5), 1988, 491–498, http://dx.doi.org/10.2105/AJPH.78.5.491.

Sullivan J.M. and Flannagan M.J., Heavy trucks, conspicuity treatment, and the decline of collision risk in darkness, J. Saf. Res. 43 (3), 2012, 157–161, http://dx.doi.org/10.1016/j.jsr.2012.05.005.

Sullman M.J.M., Meadows M.L. and Pajo K.B., Aberrant driving behaviours amongst New Zealand truck drivers, Transp. Res. Part F: Traffic Psychol. Behav. 5 (3), 2002, 217–232, http://dx.doi.org/10.1016/S1369-8478(02)00019-0.

Summala H. and Pihlman M., Activating a safety message from truck drivers~~' memory: A~~' memory: an experiment in a work zone, Saf. Sci. 16 (5–6), 1993, 675–687.

Swartz S.M. and Douglas M.A., The independence of independents: Influences on commercial driver intentions to commit unsafe acts, Transp. J. 48 (1), 2009, 23–41.

Swena, D.- D., Gaines Jr, W., 1999. Effect of random drug screening on fatal commercial truck accident rates. Int. J. Drug Test., 2.

The Work Outcome Research Cost-Benefit (WORC) Project, Report: Health Survey of the Nsw Transport Industry, 2008, Australian Rotary Health Research Fund; Paramatta.

Walton D., Examining the self-enhancement bias: Professional truck drivers' perceptions of speed, safety, skill and consideration, Transp. Res. Part F: Traffic Psychol. Behav. 2 (2), 1999, 91–113, http://dx.doi.org/10.1016/S1369-8478(99)00010-8.

Ward N.J., Linkenbach J., Keller S.N. and Otto J., White Paper on Traffic Safety Culture White papers for: Towards zero deaths: A national strategy on highway safety, 2010, Western Transport Institute, College of Engineering Montana state University; Montana.

Williams A.F. and Haworth N., Overcoming barriers to creating a well-functioning safety culture: a comparison of Australia and the United States, Improving traffic safety culture in the United States – The journey forward, 2007, AAA; Washington DC, 77–92.

Williamson A., Bohle P., Quinlan M. and Kennedy D., Short trips and long days: safety and health in short-haul trucking, Ind. Labor Relations Rev. 62 (3), 2009, 415–429.

Young R.K. and Liesman J., Estimating the relationship between measured wind speed and overturning truck crashes using a binary logit model, Accid. Anal. Prev. 39 (3), 2007, 574–580, http://dx.doi.org/10.1016/j.aap.2006.10.002.

Zhang B., Huang Y.-H., Rau P.-L.P., Roetting M. and Liu C., A study of Chinese truck drivers' attitudes toward feedback by technology, Saf. Sci. 44 (8), 2006, 747–752, http://dx.doi.org/10.1016/j.ssci.2006.03.005.

Zhu X. and Srinivasan S., Modeling occupant-level injury severity: An application to large-truck crashes, Accid. Anal. Prev. 43 (4), 2011, 1427–1437, http://dx.doi.org/10.1016/j.aap.2011.02.021.

Zohar D., Thirty years of safety climate research: Reflections and future directions, Accid. Anal. Prev. 42, 2010, 1517–1522, http://dx.doi.org/10.1016/j.aap.2009.12.019.