



Contents lists available at ScienceDirect

## Journal of Transport &amp; Health

journal homepage: [www.elsevier.com/locate/jth](http://www.elsevier.com/locate/jth)

## Road safety and heavy goods vehicle driving in LMICs: Qualitative evidence from Nepal

Anish Khadka<sup>a,\*</sup>, Preeti Gautam<sup>a</sup>, Elisha Joshi<sup>a</sup>, Paul Pilkington<sup>b</sup>, John Parkin<sup>c</sup>, Sunil Kumar Joshi<sup>a</sup>, Julie Mytton<sup>b</sup><sup>a</sup> Nepal Injury Research Centre, Kathmandu Medical College Public Limited, Bhaktapur, Nepal<sup>b</sup> Centre for Public Health and Wellbeing, Faculty of Health and Applied Sciences, University of the West of England, Bristol, UK<sup>c</sup> Centre for Transport and Society, Faculty of Environment and Technology, University of the West of England, Bristol, UK

## ARTICLE INFO

## Keywords:

Heavy goods vehicle drivers  
Transportation association  
Road risk  
Qualitative  
Safety culture  
Nepal

## ABSTRACT

**Background:** Heavy goods vehicle drivers are an influential driving population in Nepal, with over 90% of goods in the country are transported by road. Due to the time spent on the road, drivers have long periods of exposure to the risk of crash involvement. The study explores the perceptions and experiences of heavy goods vehicle drivers and representatives from their professional association regarding road danger.

**Methods:** We conducted semi-structured interviews with fifteen heavy goods vehicle drivers regularly driving on the East-West highway of Makwanpur District, Nepal. A focus group was conducted with eleven members from a major transportation entrepreneur's association in Nepal. The focus group and interviews were audio-recorded, transcribed, translated, and analyzed using thematic analysis.

**Results:** Four themes were developed- assumptions of blame; perceptions of safety culture in the trucking industry; influence of road infrastructure; and behaviours of road users. The road and traffic environment, enforcement, and the safety culture in the heavy vehicle industry not only influenced the attitudes of the road users towards traffic safety but also legitimized and encouraged behaviours that affect safety. General and industry-related road safety improvements suggested by participants included: making provision for heavy good vehicles parking areas, separating the highway with a median strip, improving crash investigation capacity, conducting road safety awareness and training programs, strictly enforcing the speed limit and laws about driving under the influence of alcohol/drugs, and formulating strategies to create a safe, supportive working environment in the heavy vehicle industry.

**Conclusion:** Heavy goods vehicle drivers and members of the professional association can provide rich information regarding the barriers and facilitators of road risk in Nepal. Their perceptions and opinions can contribute to devising interventions at individual, societal, organizational, and governmental levels, and inform efforts to develop a positive safety culture within the heavy vehicle transport industry.

\* Corresponding author. P O Box 21266, Duwakot, Bhaktapur, Nepal.

E-mail address: [anishkhadka04@yahoo.com](mailto:anishkhadka04@yahoo.com) (A. Khadka).<https://doi.org/10.1016/j.jth.2021.101247>

Received 14 March 2021; Received in revised form 4 August 2021; Accepted 1 September 2021

Available online 6 September 2021

2214-1405/© 2021 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

Heavy goods vehicle (HGV) driving in Low and Middle-Income Countries (LMICs) is characterized by high demands on drivers (for example, continuous vigilance and decision-making on and off the road) but low job control (for example, subjected to external demands of employers, customers, and the driving environment) (Danna and Griffin, 1999). The strenuous nature of the job makes the driving of HGVs (hereafter referred to as trucks) one of the most fatality-prone occupations (McCall and Horwitz, 2005). With human factors relating to driver errors considered to have the greatest influence on the occurrence of crashes (Özkan et al., 2006; Sayed et al., 1995), the emphasis has been on driver training and education (Malkin et al., 2021). Multiple factors and conditions, including truck drivers' health and wellness, also influence their safety at work (Crizzle et al., 2017; Morrow and Crum, 2004). These factors arise due to both lifestyle practices and the working environment. Studies show that many truck drivers reportedly misuse drugs or alcohol, have a poor diet and sleeping pattern, and seldom exercise (Crouch et al., 1993; Krueger, 2007; Moreno et al., 2006; Olson et al., 2016). A driver behaviour questionnaire conducted among truck drivers in Egypt found that driver fatigue, sleep deprivation, and drug driving were associated with truck crashes (Elshamly et al., 2017). Associations between drug use and fatigue (Davey and Richards, 2004) and trip-based payments (Williamson et al., 2000) have been reported among truck drivers in Australia. Mittal et al. (2018) conducted a driver behaviour questionnaire among truck drivers in India and found the majority (85%) of the drivers to be the sole earners in the family, and the financial pressure motivated them to drive longer hours to earn more incentives. This highlights that adverse driving behaviours could be influenced by the demands of the work and the interplay of personal, professional, and environmental factors.

Huang et al. (2013) report that truck drivers face multiple pressures such as delivering goods on time, limited rest time, traffic regulation including speed limits, maintaining their vehicles, and adverse weather conditions. McCart et al. (2000) surveyed 593 truck drivers in the US and found occupational factors such as adverse work schedules, long working hours, and night-time driving to be a predictor of falling asleep behind the wheel. Past studies report that truck drivers perceive that physical and mental stress is induced by unsupportive workplace environments, financial pressures, worry about their families whilst away from home, and inadequate road infrastructure (Karimi Moonaghi et al., 2015; Ranjbar et al., 2016; Shattell et al., 2010). This not only adversely affects their driving performance but also prompts them to engage in unsafe driving. In a survey of 250 truck drivers in Tanzania, Kircher and Andersson (2013) reported dissatisfaction and the encouragement of aberrant driving behaviours arising from employers' lack of respect towards the drivers, low salaries, and corrupt police officers. Sullman et al. (2017) surveyed 339 company-employed truck drivers in New Zealand and found aberrant driving behaviour to be associated with drivers' perception of the safety climate (i.e., organization safety ethics) in the workplace. This literature highlights that driving behaviours linked to crashes are influenced by multiple factors, and suggests commercial drivers' experiences and understanding of road crashes could help unravel this complexity and indicate opportunities for intervention to prevent crashes.

There has been a rapid expansion of the road network in Nepal. Road transportation is considered crucial to regional economic growth and reduced social inequalities (Asian Development Bank, 2013). With improved mobility and access, there has also been a significant increase in the number of road traffic crashes (RTCs). In 2016, the RTC fatality rate in Nepal was estimated at 15.9/100,000 population (World Health Organization, 2018). Despite committing to meet the Sustainable Development Goals on road safety (SDG target 3.6), Nepal has made negligible progress; Police records suggest that road fatalities between 2013 and 2019 increased at an annual rate of 7.6%, from 1816 to 2789 (Traffic Directorate, Nepal Police). With over 90% of goods in Nepal transported by road, truck drivers can be considered an influential driving population. The majority of crashes on Nepalese highways recorded by the police involve commercial vehicles such as trucks, and report driver-related errors such as driving under the influence of alcohol or drugs and speeding as some of the most common causes of the crash (Choulagai et al., 2015; Karkee and Lee, 2016). The large size and weight of the trucks also pose a danger to other vehicles, passengers, and vulnerable road users (Elshamly et al., 2017).

Despite being a key stakeholder on road safety and existing police data suggesting truck drivers as a high-risk group for crash involvement, it is unclear how professionals working in the trucking industry in Nepal experience and perceive the causes and nature of road dangers. This study was designed to address this knowledge gap.

## 2. Methods

### 2.1. Study design

A qualitative study design was used to explore the complex processes and contexts surrounding road crashes by seeking the views of those with direct experience of the issues (Holmes et al., 2019). Two methods were adopted to enable a comprehensive understanding of the subject. Semi-structured interviews were used with truck drivers because their personal experiences and perceptions were likely to vary depending on the sector of the industry they work in (construction, long-distance, etc.), and the nature of their work (i.e., mostly on the road) meant it was challenging to bring them together as a group. A focus group was used to explore the views of people who have influence over the nature of the industry. This methodology allows the sharing and interchange of thoughts and ideas, identifying deeper insights, and allowing a lot of information exchange in a short period of time.

### 2.2. Setting and participants

The study location, Hetauda, is an industrial city in the Makwanpur District of Southern Nepal and is located at the intersection of the East-West highway (Nepal's main domestic and international trade corridor) and the Tribhuvan highway (connecting Kathmandu to the Indian border). Hetauda includes both urban and rural roads (therefore including different road environments), and, in common

with many districts in Nepal, the Makwanpur region has three different geographical terrains (i.e., hills, mountains, and plains) each with different influences on crash risks.

We recruited truck drivers for the interviews as they passed through Hetauda on the East-West highway. In the absence of formal trucking stops, truck drivers use informal locations with roadside settlements along the highway, where they eat, rest, repair vehicles, load/unload goods, and wait for consignments. We recruited the interviewees at Thanabharyang, a popular informal truck stop location that offered hotels, general stores, vehicle repair services, and a truck weighing station.

A convenience sampling method was adopted to recruit truck drivers meeting the study inclusion criteria i.e., at least one year's truck driving experience (to ensure that study participants have spent some time behind-the-wheel to draw on in their interview). The first author approached potential participants at Thanabharyang and explained to them the purpose of the research.

The participants for the focus group discussion were purposively sampled from a major transportation entrepreneur's association in Nepal, whose members would be likely to have experience of the safety challenges and opportunities faced by the trucking industry. Transportation entrepreneur's associations are quasi-regulatory agencies. Vehicle owners form the membership of such associations, which are often route-based, and partly autonomous. They have the power to enforce supply restrictions and pricing in the routes they represent (Poudel, 2015). For the focus group, the use of purposeful sampling was to select participants with diverse roles and occupying different hierarchical positions in the association. We approached an executive member of the association, and this person assisted in recruiting members of the management committee to form the focus group.

### 2.3. Data collection

Interviews were conducted at locations to suit the participants' convenience such as vehicle repair workshops, and inside parked trucks while ensuring that no other person was present nearby to hear the conversation. The focus group was conducted by two researchers (first and third author) supported by a note-keeper, and took place in the office of the transport association. A topic guide (see online supplementary file) was used to facilitate the interviews and focus group. Topics included participants' demographics and driving history, opinions regarding road safety within the trucking industry, perceptions of the causes of road traffic injuries (RTIs), and barriers and facilitators to road danger reduction. For the focus group, an additional topic was included on the roles, responsibilities, and activities of the transport association in relation to RTIs and road dangers. The topic guide was informed by the study objectives and a review of relevant literature. All the interviews and the focus group were conducted in the participant's native language i.e. Nepali and audio-recorded after obtaining written consent.

### 2.4. Data analysis

The audio recordings were transcribed verbatim in Nepali, de-identified, and translated into English by an independent translator. Translation enabled analysis by an international team and use of NVivo 12.0 software for thematic analysis, as described by Braun and Clarke (2013). The first and second authors coded half the interview transcripts each, while for the focus group, each independently coded the transcript. A combined inductive/deductive approach was used to code the data that was driven by both searching for patterns in the raw data as well as the researcher's analytic pre-conceptions (Nowell et al., 2017). The process involved identifying phrases or sentences in the transcripts that were relevant to the research question, and attaching codes describing their content (Cassell and Symon, 2004). After coding a few transcripts independently, the codes of the two researchers were compared for consistency (i.e., whether or not the coders form similar codes). Coding differences were resolved through discussion before agreeing on the coding frame (O'Connor and Joffe, 2020). The coding frame, was then systematically applied to the remaining transcripts while iteratively revising the coding frame as new codes emerged. Similar codes were grouped into potential themes, and discussed with the wider team to develop the final themes. As the coding was conducted by researchers from different disciplines and with different professional backgrounds (engineering and public health), it helped us to interpret the qualitative data from diverse perspectives, enhancing the depth, credibility, and reliability of the analysis.

**Table 1**

Profile of participants in the interviews and focus group.

Characteristics of Participants		Interviews, n (%)**	Focus group, n (%)
Total number of participants		15 (100%)	11 (100%)
Age (in years)	24–44	11 (73%)	5 (46%)
	45–60	4 (27%)	6 (54%)
Education	Little or no formal education	1 (7%)	0 (0%)
	Primary (Class 1–7)	6 (40%)	1 (9%)
	Secondary (Class 8–10)	6 (40%)	5 (46%)
	Higher secondary (Class 11 & 12)	1 (7%)	3 (27%)
	University	1 (7%)	2 (18%)
Driving experience (in years)	2–10	4 (27%)	*
	11–20	6 (40%)	*
	21–30	5 (33%)	*

\*Focus group participants were not asked about their driving experience. \*\* Interview percentages may not add to 100 due to rounding.

## 2.5. Ethical consideration

A letter of permission to conduct the study was obtained from Hetauda Municipality, Makwanpur. Ethical approval was obtained from the Kathmandu Medical College Institutional Review Committee (Ref: 310,620,191) and the Health and Applied Sciences Faculty Research Ethics Committee of the University of West of England (HAS.19.04.173).

## 3. Results

### 3.1. Participant characteristics

We approached twenty truck drivers as potential interviewees, and fifteen agreed to participate. Reasons for non-participation included being busy with repair works and waiting for a phone call. The focus group included eleven members from the transportation entrepreneur's association. The interviews and focus group were conducted in August 2019. All participants were male (as typical of this profession), with a diverse range of educational backgrounds and driving experience (Table 1). Most truck driver participants had either primary or secondary level education, as seen in other studies with this professional group (New ERA (2009)). Unusually, one truck driver participant had higher secondary education, and one had a university degree. Education levels were higher amongst the professional association participants, reflecting the wider range of occupational roles involved. Interview participants included drivers of tankers, box trucks, articulated trucks, and tippers. Focus group participants' roles included crash management and legal assistance, supporting insurance claims, and vehicle finance support.

The findings from both interviews and focus group are presented in four themes: (1) Assumptions of blame, (2) Perceptions of safety culture in the trucking industry, (3) Influence of road infrastructure, and (4) Behaviours of road users. Table 2 provides a summary of themes, sub-themes, and their descriptions. For each theme, we report the participants' perceptions of potential crash issues and the opportunities and actions suggested by them to reduce road crashes and injuries.

### 3.2. Assumptions of blame

Both interview and focus group participants consistently suggested it was common for the driver of larger vehicles, such as trucks, to be blamed by the police for crashes, even when they were not at fault, and seldom was there a thorough crash investigation. Several interviewees perceived that this negatively influenced the behaviours of other road users; the drivers of smaller vehicles and pedestrians were aware they were unlikely to be charged even when they were at fault. This was believed to increase crash risk and also subjected truck drivers to financial burdens arising from crash claims. To tackle this, truck drivers reported that transport associations

**Table 2**  
Summary of themes, sub-themes, and descriptions of the codes.

Themes	Sub-themes	Descriptions of the codes
<b>Assumptions of blame</b>	–	<ul style="list-style-type: none"> <li>• Larger vehicles blamed for crashes</li> <li>• Inadequate crash investigation</li> <li>• Outpouring of general public's anger on vehicle and driver following a crash</li> <li>• Financial burden from crash claims</li> <li>• Driver 'blind spots' aggravated by other road users' unpredictable behaviour</li> </ul>
<b>Perceptions of safety culture in the trucking industry</b>	Informal training	<ul style="list-style-type: none"> <li>• Last resort occupation for individuals with limited education</li> <li>• Driver training by apprenticeship</li> </ul>
	Monetary incentives	<ul style="list-style-type: none"> <li>• Low wages</li> <li>• Trip-based payment arrangements</li> <li>• Pressure from owner-operators to prioritize revenue over safety</li> <li>• Vehicle overloading practices</li> <li>• Weak feelings of responsibility for the vehicle among hired drivers</li> </ul>
	Use of drugs & alcohol	<ul style="list-style-type: none"> <li>• Prevalence of drugs &amp; alcohol use among drivers and helpers</li> <li>• Insufficient enforcement and breathalyzer testing</li> </ul>
<b>Influence of road infrastructure</b>	Road condition	<ul style="list-style-type: none"> <li>• Multiple potholes</li> <li>• Lack of road maintenance</li> </ul>
	Narrow roads with mixed traffic Parking facilities	<ul style="list-style-type: none"> <li>• All road users sharing the same road space</li> <li>• Inadequate transport infrastructure</li> <li>• Roadside parking practices</li> </ul>
<b>Behaviours of road users</b>	–	<ul style="list-style-type: none"> <li>• All road users are in a hurry</li> <li>• Young and inexperienced drivers</li> <li>• Lack of knowledge of traffic rules</li> <li>• Inadequate driver training</li> <li>• Bribery used to obtain a driving licence</li> </ul>

had been set up to safeguard the interests of truck owners/drivers, with their roles reportedly primarily limited to providing administrative and financial crash assistance.

“... if a cycle hits a motorcycle then, it is not the mistake of the cycle and the motorcycle is blamed. If the motorcycle collides with a car then the car is blamed not the motorcycle. Similarly, if the car collides with large vehicles then large vehicles are blamed ... The main thing is if the actual culprit could be held accountable for paying compensation then accidents would reduce significantly.” (P13, driver interview, aged 26)

Several participants spoke of truck drivers and the transport associations being unfairly treated by police and local people, and felt they were regarded as easy targets to blame and fine. Truck drivers described instances where people were aggressive to drivers after a crash, sometimes prompting them to run away from the scene, even if there was someone injured. They felt they were at a greater risk of prolonged police custody or imprisonment, even without a proper crash investigation.

“... after a crash, local people blame and try to kill or hit the driver, and burn the vehicle. Tipper driver, truck driver or even car driver, whoever he/she is ... no one is bothered how it happened, whether it happened knowingly or unknowingly or was it due to the road.” (P15, driver interview, aged 40)

Many participants blamed pedestrians and small vehicle drivers' unpredictable behaviours for the crashes and reported how the blind spots inherent in large vehicles make it difficult for truck drivers to deal with such unpredictable behaviours. This increased pressure on the truck drivers and made them feel vulnerable. Both focus group and interview participants emphasized the need for protocols for crash investigation and training for investigators to ensure that the real 'culprit' or the actual cause(s) of the crash is found.

“We are stressed wherever we travel in our vehicle. We are afraid if someone will come from behind, side, or front, and hit us.” (P4, driver interview, aged 46)

### 3.3. Perceptions of safety culture in the trucking industry

#### 3.3.1. Informal training

Some of the interview and focus group participants noted the trucking sectors' failure to attract individuals with education beyond secondary level and associated this with crashes. They felt that society viewed trucking as a low-level, last resort occupation, suitable for people with limited education. Participants cited limited formal school-based education to be a factor influencing safety awareness and unsafe behaviours.

“Especially in this transportation sector ... very few people are educated ... if one drops out from his study and does not get any job, then he becomes an assistant of a driver. He learns a little bit of driving from there and starts to think that he has perfected his driving skills ... The lack of education and awareness are also the reasons for the increase in crashes.” (P10, focus group, aged 41)

Individuals entering the trucking profession were reported to usually work as an apprentice first, before becoming drivers. Most apprentices are trained informally; observing, receiving instruction, and assisting drivers to manage vehicle blind spots. With improved, newer, vehicles, a few participants suggested apprentices could learn the basics of vehicle operation more quickly, but potentially miss out on other important driving skills compared with previous longer apprenticeships. One interview participant alleged that current formal driving training imparted inadequate driving skills, as the training is limited and conducted in an enclosed space that does not resemble actual traffic conditions. He felt drivers trained this way were the ones who commit mistakes.

“The things learned from training centers are 90% wrong. It is because the drivers receive limited knowledge that is available at the training center ... in training centers, one needs to learn within a small piece of land. Let me take an example of a bike; the teaching is limited to riding on a straight line, a gradient (slope), and then turnings. That's it. They will not be able to understand how to drive on the highway.” (P1, driver interview, aged 50)

Focus group participants identified budgetary issues as hindering the transport association in conducting regular awareness and training programs for the member drivers. Both the interview and focus group participants emphasized the need for greater collaboration between the transport association and local government in sensitizing drivers to safe driving practices and awareness of traffic rules.

#### 3.3.2. Monetary incentives

Low wages coupled with trip-based payments were considered to motivate some drivers to engage in unsafe driving behaviours, such as speeding and inappropriate overtaking. Focus group and interview participants alleged that this was particularly true for tipper trucks, which typically make multiple short trips in a day. Interview participants reported that the drivers need to earn enough for themselves and the vehicle owner, and this further adds to the mental stress of finding the next load or completing enough daily trips.

“Some drivers get more money for more trips. They tend to drive that way due to these personal benefits associated with speeding ... In a way, there is an obligation to undertake more trips as you won't earn much for just one trip. Usually, construction contractors do it, they lure drivers with a trip allowance.” (P11, focus group, aged 41)

Some drivers felt that vehicle owners do not care about drivers' physical and mental health, or the road conditions, demanding more trips, and increasing the likelihood of crashes. The practice of overloading was felt to risk both vehicle safety and damage the road surface. A few drivers alleged that overloading practices prevailed because weighing stations may be owned by transport

associations who had no incentive to enforce appropriate loads, and also the enforcement system that allowed the ‘culprits’ to escape with a low fine.

“The vehicle owner should make a safe environment by guiding the driver on how to drive, telling him the benefits of driving in such a way. But, instead, they say, ‘How much money did you save and bring? How much money did you save on the truck’. They shout saying ‘the other vehicle made this much money while you made only this much’. They give mental pressure to the drivers.” (P5, driver interview, aged 42)

Several interviewees perceived that some drivers, particularly those who do not own the vehicle, take more risks, such as taking long breaks then speeding to make up time. This increased the possibility of breakdowns and crashes, and this may be due to lack of liability for damages incurred to vehicles. Interview participants had differing views as to whether poor vehicle maintenance was the fault of the driver, or the owner. Both drivers and owners were reported to prioritize additional trips and hence earnings over safety. Poor road conditions were blamed for increasing operating and maintenance costs. All participants perceived that poorly maintained vehicles could lead to failures resulting in crashes, but most opted for having maintenance undertaken only after a problem was noticed, rather than proactively.

“If it is our own vehicle then we don’t drive rashly. I think it’s because we need to bear all the costs as well as risks when we own the vehicle. But when it is driven by a hired driver, they have a feeling that both costs, as well as risks, will be borne by the owner, and if anything happens to the vehicle, he will find another vehicle.” (P8, driver interview, aged 35)

Both interview and focus group participants suggested that both the driver and owner should be equally responsible for practicing and promoting safe driving and working environments. One interview participant suggested the provision for periodic vehicle roadworthiness inspection at the time of road permit renewal could help ensure that vehicles are maintained.

### 3.3.3. Use of drugs & alcohol

Most participants reported that anti-drink driving campaigns and breathalyzer testing had been successful in discouraging drunk driving. However, participants were concerned that drivers and apprentices had changed to using drugs. In contrast, some argued that the enforcement of drink-driving laws was weak due to inadequate random roadside breath testing on the highway, and drunk driving was still prevalent. Participants emphasized the need for drug testing and harsh consequences such as a driving disqualification.

“At present, there are strict rules on drink and drive ... Due to these reasons, the drivers as well as their apprentice have now resorted to weeds or other drugs, and drive their vehicles aggressively.” (P14, driver interview, aged 46)

## 3.4. Influence of road infrastructure

### 3.4.1. Road condition

Participants mentioned that poor road conditions, such as potholes, have both direct impacts (e.g., crashes while avoiding potholes), as well as indirect impacts (e.g., vehicle damage). Potholes were perceived to be more dangerous during the rainy season, because their depth is not apparent when water-filled, and they are more difficult to spot.

“Many roads are being black-topped but they get damaged within 1–2 months. Vehicles also come at high speeds and stop suddenly at the potholes. They lose control and accidents occur ... During the rainy season, potholes are water-filled and are not visible.” (P6, driver interview, aged 35)

Both interview and focus group participants blamed the authorities for poor quality road construction, long delays during road works, and negligence in road maintenance. They complained about poor planning and supervision of roadworks. Participants believed that prioritizing road maintenance and strict supervision of contractors’ work would help improve safety.

### 3.4.2. Narrow roads with mixed traffic

All the participants perceived that the highway system had failed to keep pace with increasing traffic volumes, with many narrow and congested roads. Such problems were worsened by vehicles sharing the road space with animals, and inadequate separation between types of road user such as motorists, pedestrians, and cyclists. Several participants suggested the government should control increasing vehicle ownership, limit vehicle speeds, and widen highways.

“... the government is constructing roads considering past traffic volumes. In the past, there were very few vehicles but now the number has highly increased ... I think, if there would be a different track for pedestrians, bus/truck, motorbike, and bicycle, then the accidents will be minimized.” (P9, driver interview, aged 40)

### 3.4.3. Parking facilities

Several interview participants reported that the lack of designated parking places meant they were forced to park their trucks on the roadside. They spoke of visibility problems for pedestrians and approaching vehicles created by roadside parking, and the resulting increase in crash risks.

“It is due to the lack of parking spaces, the vehicles are kept in this way ... Actually, we should stop in the parking areas only. But what can we do? The government has not constructed it, we park our vehicle wherever we find an open space.” (P10, driver interview, aged 60)

In the absence of parking facilities and rest areas, and high temperatures during the day inside the cab, some drivers reported

difficulty in sleeping during daytime planned rests, resulting in falling asleep behind the wheel at night. Participants suggested the need for more parking facilities, rest areas, and the regulation of the use of roadsides in built-up areas.

“Sometimes we have to travel during very hot weather. Due to this reason, mostly it is not possible to travel in the afternoon and the driver cannot fall asleep. And when they travel at night, the driver falls asleep behind the wheels and result in accidents” (P7, driver interview, aged 36)

### 3.5. Behaviours of road users

The participants perceived that all road users (pedestrians, passengers, and drivers) seem to be in a hurry and this resulted in enhanced crash risk. Examples given included passengers pressurizing bus drivers to reach their destinations quickly. They also reported road closures and congestion causing delays, and hence the need to ‘make up time’. Both interview and focus group participants reported observing speeding, inappropriate overtaking, and cutting across lanes. They mostly blamed motorcyclists for such behaviours, with their youth and inexperience cited as the reason. They argued that bribery to obtain a driving license had also led to an increase in the number of drivers on the road with inadequate or no driver training and driving skills.

“Despite low visibility, passengers sometimes tend to pressurize the driver to drive ... They apply pressure saying, “I have to reach by this time because I have to return tomorrow or I have to finish this work.” ... There is a compulsion to drivers ... As soon as the passengers sit on their seats, they start asking the driver, “Will we reach by this time?” (P1, driver interview, aged 50)

Both interview and focus group participants thought that pedestrians pay inadequate attention to oncoming vehicles while crossing the road and while walking on the road, which poses a threat to themselves and other road users. Local buses and powered three-wheelers were reported to stop abruptly in the middle of the road to let passengers board or alight, without considering vehicles behind. Pedestrians were also reported to cross the road suddenly and without looking, when catching or alighting from a bus. They suggested that the provision of bus stops should be made on the highway and be strictly enforced.

“Most people using public vehicles cross the road from the place wherever the vehicle stops. Thinking that, “As the vehicle is stopped, I will quickly cross the road”, they abruptly cross the road while another vehicle is about to overtake the stopped vehicle.” (P5, driver interview, aged 42)

A few interview participants expressed concern that highway authorities failed to provide adequate safety infrastructure, such as footways and pedestrian crossings, and that this hindered pedestrians in practicing safe road use.

“There aren’t adequate facilities for pedestrians. I blame the government for this. Where should they walk? There are no footways” (P1, driver interview, aged 50)

In contrast, several interview and focus group participants noted that, even at places where pedestrian infrastructure is available, it is either used inappropriately or not used at all. Participants linked these issues to the lack of knowledge of traffic rules. Participants suggested that improved road safety could be achieved through traffic awareness programs for rural communities, road safety education in schools, strict speed enforcement, and the establishment of a dedicated road safety agency.

“While returning home from school, some students walk haphazardly on the highway covering half of the roadway and holding each other’s hand ... It might be due to lack of awareness regarding road safety rules and regulations.” (P1, focus group, aged 62)

## 4. Discussion

The aim of the study was to explore the factors that truck drivers and representatives from their professional association perceive as contributing to road dangers in the Makwanpur District of Nepal. Diverse factors including those related to the road environment, road user behaviour, traffic law enforcement practices, and the truck industry were identified.

All participants perceived the growing transportation supply-demand gap as an important cause of road crashes. Similar observations in Taiwan were reported by [Keng \(2005\)](#), where the increase in motor vehicle numbers without corresponding road expansion and improvement led to an increase in crash frequency. In many LMICs, non-motorized and motorized road users (of varying sizes, speeds, acceleration, and braking characteristics) compete for limited road space ([Mohan, 2002](#)). Our participants suggest that heterogeneous traffic poses particular challenges for heavy vehicles. They noted the problems of truck blind spots and low maneuverability, and raised concerns about other road users following too closely and passing dangerously. [Moridpour et al. \(2015\)](#) suggest such road user behaviors could result due to the psychological effect that heavy vehicles impose on other road users. This suggests that supporting road users in Nepal to safely share the road with heavy vehicles may be helpful. Road authorities in the United States promote dedicated truck lanes (DTL) to overcome the safety and mobility issues associated with the mixing of dissimilar vehicle types on highways ([Bucklew, 2011](#)). The feasibility of DTL on major trade corridors in Nepal could be explored.

[Chen et al. \(2021\)](#) surveyed 1265 long-haul truck drivers in the USA and found more than 90% reported that constructing truck stops was important to improving truck driver safety. Despite the Vehicle and Transport Management Act (1993) in Nepal mandating rest-periods every 4 h, the inter-urban highways largely lack lay-over facilities. Drivers reported parking at the roadside, despite knowing this increases crash risks. Lack of investment in parking areas may have resulted from limited finances and poor collaboration between road agencies together with negligible involvement with the trucking sector in road infrastructure planning. Truck drivers perceived their treatment by police during roadside checks and following a crash to be unfair. They expressed frustration and stress at



being blamed for crashes without proper investigation of the cause, and felt it adversely influenced their driving behaviour. Similar instances have been reported by [Raynor and Mirzoev \(2014\)](#), with drivers in Kenya reporting to have low incentives to obey traffic regulations when being treated as scapegoats. The practice of blaming the driver of the largest vehicle is not uncommon in LMICs ([Heydari et al., 2019](#)). These findings suggest a need for improved objective crash investigation and devising measures to promote fair and effective policing practices.

The trucking sector in most LMICs is largely fragmented and informal, with minimal barriers to entry and ways of working being determined by associations and unions ([Kent, 2009](#)). Our findings suggest the Nepalese trucking sector is no different and comparable with India where small-sized operators have low profit margins, offer low remuneration, and compromise on safety ([Roy et al., 2016](#)). We found management practices such as the adoption of trip-based payment systems and adverse scheduling to be prevalent. Such practices, along with the drivers' financial aspirations driven by their poor economic conditions legitimized and encouraged speeding, inappropriate overtaking, and fatigued driving. These findings are similar to those reported by [Dotse et al. \(2019\)](#) among commercial drivers in Ghana.

The study participants raised safety concerns regarding impaired driving among their peers due to alcohol and drug use. In our study, it was not clear whether drug and/or alcohol misuse among drivers was a consequence of the working environment or a lifestyle choice. Truck drivers in Pakistan reported reduced fatigue, mental peace, and dependence as reasons for drug and alcohol use among commercial heavy vehicle drivers ([Mir et al., 2012](#)). The low socio-economic status, unsupportive working environment, long work schedules, and job dissatisfaction may contribute to the substance misuse reported among Nepalese truck drivers. In Nepal, drink-driving is prohibited by law and strictly enforced through random roadside breath tests, however, there exist no laws against drugged driving ([World Bank, 2020](#)). Our participants reported that many truck drivers changed to taking drugs not detectable using breathalyzers. The lack of drug testing and limited sobriety checks has limited the effectiveness of the implementation of drink-drive laws in Nepal. Reduction of impaired driving in Nepal may require measures to be devised to address the socio-economic factors driving such behaviours.

Truck drivers work in a highly complex and dynamic environment, where they must independently take spontaneous and informed decisions to keep safe ([Douglas and Swartz, 2016](#)). It is therefore, crucial that novice drivers are adequately prepared to manage road crash risks. Canada and India have legislated a minimum education qualification of 10th (Commercial Motor Vehicle Safety Act, 1986) and 8th standard (Central Motor Vehicle Rule, 1989) respectively. In Nepal, which is facing a surge in labour migration abroad ([Mishra and Kunwar, 2020](#)), introducing formal education qualification requirements for obtaining a truck driving licence now could lead to the loss of skilled drivers that could, in turn, have a detrimental impact on safety. Besides, the effectiveness of minimum education levels reducing risky driving is unclear ([Dash et al., 2021](#); [Mahajan et al., 2019](#)). Formal driver training has been shown to have a beneficial impact on road safety ([Malkin et al., 2021](#)). Most truck drivers in our study received their training informally, as an apprentice, gaining basic driving skills by observing the driver. Though aberrant driving behaviour could be passed on through informal training ([Teye-Kwadjio et al., 2013](#)), our study participants favoured experiential on-the-job learning and perceived the training provided by driving training schools to lack effective transfer of the necessary driving skills. In Nepal, driving training schools are operated by the private sector, are poorly regulated, and there are no standards for how they should operate. The training offered focuses on imparting theoretical knowledge and driving skills that are necessary to pass the practical driving test comprising off-road assessment of the ability to perform slow-speed manoeuvres. There is no assessment of drivers' ability to drive in traffic on-road. A similar driving training approach in India is reported to induce a false sense of confidence among novice drivers ([Pillai and Ray, 2015](#)). Standardised training and a driver licensing system that assesses both off-road and on-road driving skills could help ensure commercial vehicle drivers have the necessary skills and establish a safer driving culture in the country.

Our study highlights that both industry and non-industry stakeholders play a significant role in shaping the safety culture in the trucking industry as well influencing the wider road safety culture in Nepal. Transforming safety cultures is challenging, but has been achieved in the construction industry, through continuous improvements in regulations and safety-related activity ([Misnan and Mohammed, 2007](#)). An agency to lead on a multi-sectoral systems-based approach to road safety, would assist in this regard.

#### 4.1. Strengths and limitations

We believe this is the first qualitative study to explore the perspectives of truck drivers and transport association members about road dangers on the highways in Nepal. Rich information was obtained from participants with diverse educational qualifications, ages, and job categories. Whilst participants appeared open about their views, there is a risk their answers were affected by social desirability bias. The study was conducted in one location. Commercial drivers' experiences may vary by location; for example, between urban areas (greater traffic volumes and mix of road users) and rural areas (with hillier terrains and different infrastructure requirements). [Nordfjærn et al. \(2011\)](#) found variation in traffic risk perception and sensitivities in a cross-cultural study in high-income and low-income countries. They suggested the variation was linked with differences in the exposure to hazardous road traffic. We may have found different predominating perceptions had we sampled across different locations. Further, the study engaged only one transport association, and other similar associations may have different views. A larger sample in our study may have provided additional information.

#### 4.2. Implications

The findings of the study have the potential to be of interest to highway planners and designers, occupational health and safety legislators, traffic enforcers, driving schools, licencing authorities, and truck industry stakeholders in Nepal and other LMICs. This



research suggests a need to strengthen the safety culture among private drivers, professional drivers, and non-motorized road users through road infrastructure investments as well as legislative, regulatory, and organizational reforms. Further research could involve interviewing other types of commercial drivers such as bus drivers, to compare and contrast their perspectives on road danger. In addition, ethnographic research may provide insights to place the reported perceptions in context.

## 5. Conclusion

This study explored the perspectives of truck drivers and their professional association members regarding road dangers on highways in Nepal. Despite truck drivers having the safety cushion of large vehicles, they perceived themselves as vulnerable to crashes and their consequences due to a perceived lack of safety culture in the trucking industry and the attitude of law enforcers and the public towards them. Poor road infrastructure and facilities, weak enforcement, inadequate awareness and training, work environment and stresses influence road users' behaviours and increase crash risks. The changes needed to improve road safety require a holistic approach that addresses issues across the sector including drivers, owners, driving instructors, contractors, legislators, enforcement, and government agencies.

## CRedit author statement

Anish Khadka: Conceptualization, Methodology, Resources, Investigation, Formal analysis, Visualization, Writing – Original Draft, Writing- Review and Editing, Project administration. Preeti Gautam: Formal analysis, Writing- Original Draft. Elisha Joshi: Investigation, Writing- Original Draft. Paul Pilkington: Conceptualization, Methodology, Supervision, Writing- Review & Editing. John Parkin: Conceptualization, Methodology, Supervision, Writing- Review & Editing. Sunil Kumar Joshi: Funding acquisition, Supervision, Writing- Review & Editing. Julie Mytton: Funding acquisition, Conceptualization, Methodology, Supervision, Writing- Review & Editing.

## Financial disclosure

This research was funded by the National Institute for Health Research (NIHR) (Project ref 16/137/49) using UK aid from the UK Government to support global health research. The views expressed in this publication are those of the authors and not necessarily those of the NIHR or the UK Department of Health and Social Care.

## Acknowledgment

We acknowledge the contributions of all participants and the input to the study of the wider research team at the Nepal Injury Research Centre at Kathmandu Medical College and the University of the West of England, Bristol. We are grateful to the Makwanpur Municipality for approving the fieldwork for the study, and staff at Mother and Infant Research Activities (MIRA) for their support in recruiting note-taker/transcriber/translator.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jth.2021.101247>.

## Declaration of competing InterestCOI

NONE

## References

- Asian Development Bank, 2013. South asia subregional economic cooperation (SASEC) road connectivity Project: road transport sector assessment (summary). <https://www.adb.org/projects/documents/nep-sasec-road-connectivity-project-rpp>.
- Braun, V., Clarke, V., 2013. *Successful Qualitative Research: A Practical Guide for Beginners*. Sage.
- Bucklew, K.J., 2011. Improving freight roadway transportation with dedicated truck lanes: opportunities and issues. *Transport. J.* 50 (4), 431–445. <https://doi.org/10.5325/transportationj.50.4.0431>.
- Cassell, C., Symon, G., 2004. *Essential Guide to Qualitative Methods in Organizational Research*. Sage.
- Chen, G.X., Sieber, W.K., Collins, J.W., Hitchcock, E.M., Lincoln, J.E., Pratt, S.G., Sweeney, M.H., 2021. Truck driver reported unrealistically tight delivery schedules linked to their opinions of maximum speed limits and hours-of-service rules and their compliance with these safety laws and regulations. *Saf. Sci.* 133, 105003. <https://doi.org/10.1016/j.ssci.2020.105003>.
- Choulagai, B., Ling, H., Sharma, P., Mishra, S., Ahmed, M., Chand, P., 2015. Epidemiology of road traffic accidents in Nepal: data review and qualitative analysis. *SM J Public Health Epidemiology* 1 (3), 1014.
- Crizzle, A.M., Bigelow, P., Adams, D., Gooderham, S., Myers, A.M., Thiffault, P., 2017. Health and wellness of long-haul truck and bus drivers: a systematic literature review and directions for future research. *J. Transp. Health.* 7, 90–109. <https://doi.org/10.1016/j.jth.2017.05.359>.
- Crouch, D.J., Birky, M.M., Gust, S.W., Rollins, D., Walsh, J.M., Moulden, J., Quinlan, K., Beckel, R., 1993. The prevalence of drugs and alcohol in fatally injured truck drivers. *J. Forensic Sci.* 38 (6), 1342–1353. <https://doi.org/10.1520/JFS13538J>.

- Danna, K., Griffin, R.W., 1999. Health and well-being in the workplace: a review and synthesis of the literature. *J. Manag.* 25 (3), 357–384. <https://doi.org/10.1177/014920639902500305>.
- Dash, D.P., Sethi, N., Dash, A.K., 2021. Education, human error, and road crash risk: an empirical investigation in the Indian states. *J. Publ. Aff.* 21 (1), e2163. <https://doi.org/10.1002/pa.2163>.
- Davey, J.D., Richards, N.L., 2004. Illicit drug use and driving by Australian long haul truck drivers: reform starts with rehabilitation. In: *17th International Conference on Alcohol Drugs and Traffic Safety*, p. T2004.
- Dotse, J., Nicolson, R., Rowe, R., 2019. Behavioral influences on driver crash risks in Ghana: a qualitative study of commercial passenger drivers. *Traffic Inj. Prev.* 20 (2), 134–139. <https://doi.org/10.1080/15389588.2018.1556792>.
- Douglas, M., Swartz, S., 2016. Truck driver safety: an evolutionary research approach. *Transport. J.* 55 (3), 258–281. <https://doi.org/10.5325/transportationj.55.3.0258>.
- Elshamly, A.F., El-Hakim, R.A., Afify, H.A., 2017. Factors affecting accidents risks among truck drivers in Egypt. *MATEC Web of Conferences*; 2017: EDP Sciences 124 (4), 04009. <https://doi.org/10.1051/mateconf/201712404009>.
- Heydari, S., Hickford, A., McIlroy, R., Turner, J., Bachani, A.M., 2019. Road safety in low-income countries: state of knowledge and future directions. *Sustainability* 11 (22), 6249. <https://doi.org/10.3390/su11226249>.
- Holmes, B.D., Haglund, K., Beyer, K.M., Cassidy, L.D., 2019. Qualitative methods of road traffic crash research in low-and middle-income countries: a review. *Int. J. Inj. Contr. Saf. Promot.* 26 (2), 194–199. <https://doi.org/10.1080/17457300.2018.1535512>.
- Huang, Y-h, Zohar, D., Robertson, M.M., Garabet, A., Lee, J., Murphy, L.A., 2013. Development and validation of safety climate scales for lone workers using truck drivers as exemplar. *Transport. Res. F Traffic Psychol. Behav.* 17, 5–19. <https://doi.org/10.1016/j.trf.2012.08.011>.
- Karimi Moonaghi, H., Ranjbar, H., Heydari, A., Scurlock-Evans, L., 2015. Truck drivers' experiences and perspectives regarding factors influencing traffic accidents: a qualitative study. *Workplace Health & Saf.* 63 (8), 342–349. <https://doi.org/10.1177/2165079915576934>.
- Karkee, R., Lee, A.H., 2016. Epidemiology of road traffic injuries in Nepal, 2001–2013: systematic review and secondary data analysis. *BMJ open* 6 (4), e010757. <https://doi.org/10.1136/bmjopen-2015-010757>.
- Keng, S.-H., 2005. Helmet use and motorcycle fatalities in Taiwan. *Accid. Anal. Prev.* 37 (2), 349–355. <https://doi.org/10.1016/j.aap.2004.09.006>.
- Kent, P.L., 2009. *Freight Transport for Development Toolkit: Road Freight*. The World Bank.
- Kircher, K., Andersson, J., 2013. Truck drivers' opinion on road safety in Tanzania—a questionnaire study. *Traffic Inj. Prev.* 14 (1), 103–111. <https://doi.org/10.1080/15389588.2012.671982>.
- Krueger, G.P., 2007. Health and wellness programs for commercial drivers. *Transp. Res. Board.* 15.
- Mahajan, K., Velaga, N.R., Kumar, A., Choudhary, A., Choudhary, P., 2019. Effects of driver work-rest patterns, lifestyle and payment incentives on long-haul truck driver sleepiness. *Transport. Res. F Traffic Psychol. Behav.* 60, 366–382. <https://doi.org/10.1016/j.trf.2018.10.028>.
- Malkin, J., Crizzle, A.M., Zello, G., Bigelow, P., Shubair, M., 2021. Long-haul truck driver training does not meet driver needs in Canada. *Saf Health Work* 12 (1), 35–41. <https://doi.org/10.1016/j.shaw.2020.09.001>.
- McCall, B.P., Horwitz, I.B., 2005. Occupational vehicular accident claims: a workers' compensation analysis of Oregon truck drivers 1990–1997. *Accid. Anal. Prev.* 37 (4), 767–774. <https://doi.org/10.1016/j.aap.2005.03.018>.
- McCart, A.T., Rohrbaugh, J.W., Hammer, M.C., Fuller, S.Z., 2000. Factors associated with falling asleep at the wheel among long-distance truck drivers. *Accid. Anal. Prev.* 32 (4), 493–504. [https://doi.org/10.1016/S0001-4575\(99\)00067-6](https://doi.org/10.1016/S0001-4575(99)00067-6).
- Mir, M.U., Khan, I., Ahmed, B., Razzak, J.A., 2012. Alcohol and marijuana use while driving—an unexpected crash risk in Pakistani commercial drivers: a cross-sectional survey. *BMC Publ. Health* 12 (1), 1–7. <https://doi.org/10.1186/1471-2458-12-145>.
- Mishra, M., Kunwar, L.S., 2020. Overview of foreign labour migration in Nepal. *Patan Pragya* 7 (1), 123–134.
- Misran, M.S., Mohammed, A.H., 2007. Development of safety culture in the construction industry: a conceptual framework. In: *Procs 23rd Annual ARCOM Conference. Association of Researchers in Construction Management*, Belfast, UK, pp. 3–5.
- Mittal, N., Udayakumar, P.D., Raghuram, G., Bajaj, N., 2018. The endemic issue of truck driver shortage—a comparative study between India and the United States. *Res. Transport. Econ.* 71, 76–84. <https://doi.org/10.1016/j.retrec.2018.06.005>.
- Mohan, D., 2002. Road safety in less-motorized environments: future concerns. *Int. J. Epidemiol.* 31 (3), 527–532. <https://doi.org/10.1093/ije/31.3.527>.
- Moreno, C., Louzada, F., Teixeira, L.R., Borges, F., Lorenzi-Filho, G., 2006. Short sleep is associated with obesity among truck drivers. *Chronobiol. Int.* 23 (6), 1295–1303. <https://doi.org/10.1080/07420520601089521>.
- Moridpour, S., Mazloumi, E., Mesbah, M., 2015. Impact of heavy vehicles on surrounding traffic characteristics. *J. Adv. Transport.* 49 (4), 535–552. <https://doi.org/10.1002/atr.1286>.
- Morrow, P.C., Crum, M.R., 2004. Antecedents of fatigue, close calls, and crashes among commercial motor-vehicle drivers. *J. Saf. Res.* 35 (1), 59–69. <https://doi.org/10.1016/j.jsr.2003.07.004>.
- New ERA, 2009. *Integrated Biological and Behavioral Surveillance Survey (Ibbs) Among Truckers in 22 Terai Highway Districts of Nepal*. Family Health International/Nepal.
- Nordfjærn, T., Jørgensen, S., Rundmo, T., 2011. A cross-cultural comparison of road traffic risk perceptions, attitudes towards traffic safety and driver behaviour. *J. Risk* 14 (6), 657–684. <https://doi.org/10.1080/13669877.2010.547259>.
- Nowell, L.S., Norris, J.M., White, D.E., Moules, N.J., 2017. Thematic analysis: striving to meet the trustworthiness criteria. *Int. J. Qual. Methods* 16 (1). <https://doi.org/10.1177/1609406917733847>, 1609406917733847.
- O'Connor, C., Joffe, H., 2020. Intercode reliability in qualitative research: debates and practical guidelines. *Int. J. Qual. Methods* 19. <https://doi.org/10.1177/1609406919899220>.
- Olson, R., Thompson, S.V., Wipfli, B., Hanson, G., Elliot, D.L., Anger, W.K., Bodner, T., Hammer, L.B., Hohn, E., Perrin, N.A., 2016. Sleep, dietary, and exercise behavioral clusters among truck drivers with obesity: implications for interventions. *J. Occup. Environ. Med.* 58 (3), 314. <https://doi.org/10.1097/JOM.0000000000000650>.
- Özkan, T., Lajunen, T., Chliaoutakis, J.E., Parker, D., Summala, H., 2006. Cross-cultural differences in driving skills: a comparison of six countries. *Accid. Anal. Prev.* 38 (5), 1011–1018. <https://doi.org/10.1016/j.aap.2006.04.006>.
- Pillai, S., Ray, G.G., 2015. Systems perspective in road safety—an improvement of novice driver training in India. In: *Proceedings 19th Triennial Congress of the IEA*; 2015: Citeseer.
- Poudel, B., 2015. Structure of Nepal's Trucking Industry: Results from a Nationwide Survey. Crown. [https://doi.org/10.12774/eod\\_cr.january2015.poudelb](https://doi.org/10.12774/eod_cr.january2015.poudelb).
- Ranjbar, H., Moonaghi, H.K., Heydari, A., Mazlom, S.R., Scurlock-Evans, L., Assadi, S.N., 2016. Road life perspectives and experiences among Iranian truck drivers: a qualitative study. *Acta Fac. Med. Naissensis* 33 (2), 109–118. <https://doi.org/10.1515/afmna-2016-0012>.
- Raynor, N.J., Mirzoev, T., 2014. Understanding road safety in Kenya: views of matatu drivers. *Int. Health* 6 (3), 242–248. <https://doi.org/10.1093/inthealth/ihu034>.
- Roy, D., Raghuram, G., Jain, R., Tripathi, S., Sharda, K., 2016. *Trucking Business Management: Cases and Concepts*. McGraw-Hill Education.
- Sayed, T., Abdelwahab, W., Navin, F., 1995. Identifying accident-prone locations using fuzzy pattern recognition. *J. Transport. Eng.* 121 (4), 352–358.
- Shattell, M., Apostolopoulos, Y., Sönmez, S., Griffin, M., 2010. Occupational stressors and the mental health of truckers. *Issues Ment. Health Nurs* 31 (9), 561–568. <https://doi.org/10.3109/01612840.2010.488783>.
- Sullman, M.J., Stephens, A.N., Pajo, K., 2017. Transport company safety climate—the impact on truck driver behavior and crash involvement. *Traffic Inj. Prev.* 18 (3), 306–311. <https://doi.org/10.1080/15389588.2016.1199865>.
- Teye-Kwadjo, E., Knizek, B.L., Rundmo, T., 2013. Attitudinal and motivational aspects of aberrant driving in a West African country. *Tidsskr Nor Psykologforening* 50, 451–461.

- Williamson, A., Feyer, A., Friswell, R., Saduri, S., 2000. Driver Fatigue: A Survey of Professional Heavy Drivers in Australia. draft report prepared for the National Road Transport Commission, Melbourne.
- World Bank, 2020. Delivering Road Safety in Nepal: Leadership Priorities and Initiatives to 2030.
- World Health Organization, 2018. Global Status Report on Road Safety 2018: Summary.