MONASH University

Work-related driver safety:

A multi-level investigation

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Abstract

By the year 2030, road traffic injuries are predicted to be the fifth leading cause of mortality globally. In Australia, more than 30% of motor vehicles are registered for work-related purposes and an estimated 33% of work-related fatalities occur while driving. Similarly, employees commuting or travelling as part of their work represent approximately 40% of worker fatalities and half of all road deaths across the European Union. These statistics highlight the need for a reform in prevention approaches in this safety critical domain.

Much road safety research in light vehicle fleets has focused on the road user or individual as the precursor in understanding crashes. This is reflected in interventions primarily focused on individual compliance with safe driving practices (e.g., driver training, incentive schemes, and group based discussions). Despite road traffic injury being the leading cause of work-related death in Australia, many organisations do not understand their role in creating a safe work environment. This project addressed gaps in research and practice by investigating the landscape of risk management in workplace road safety in Australia and the broader organisational practices that support and constrain safe driver behaviour.

The overall aim of this PhD was to identify the organisational determinants of safe driver behaviour. This was achieved through a mixed methods program of research. The PhD comprised four components. First, a new approach to managing work-related road traffic injury was presented in the form of a novel health investment framework. The framework provided a holistic interpretation of the complex interactions within and across organisational levels influencing workplace road safety and aimed to promote the development of interventions that consider the role of all organisational members (i.e., senior management, supervisors and individual fleet drivers) in improving safety. Second, the landscape of workplace road safety risk management in Australia was explored. This research highlighted a lack of maturity in workplace road safety risk management practices in Australia. The

results provide baseline data for organisations to enable the identification of strengths and limitations in their existing approaches to fleet safety management. Third, this program of research explored the HR practices that support and constrain safe driver behaviour. The results demonstrated that some management practices (selection, communication and job and work design) predispose drivers to unsafe driving practices, while others (i.e., remuneration) support safe driving behaviour but only when safety is valued and prioritised. The final study explored how a system of human resource practices (i.e., High Performance Workplace Systems) moderated the relationship between attitudes and safety behaviour. This study demonstrated that strong attitudes towards safe driving mitigated the negative influence of high investment in HPWS. Investment in HPWS negatively influenced safety behaviour in the work-related driver context, even when drivers had a positive attitude towards safe driving.

Overall, this program of research demonstrated that safe driving is influenced by factors at multiple levels within the workplace including senior level managers, supervisors and individual fleet drivers. The conclusions made from this program of research also highlight the role of other actors, beyond the workplace context, in supporting safe driver behaviour, including workplace safety regulators. Thus, to ensure the safety of employees driving vehicles, a reform in prevention approaches is needed to incorporate a systems perspective in interventions.

The results from this program of research support the need for better integration of workplace road safety within Health and Safety systems including, risk management practices and operational activities (i.e., Human Resource management). This goal could be achieved through various activities such as, reviewing the roles and responsibilities of those involved in the safety management of drivers (i.e., supervisors) and vehicles (i.e., fleet managers), establishing a national guideline for risk management in light vehicle fleets across Australia and capturing data on purpose of journey data following a road crash to enable better understanding of the magnitude of the problem and accurate allocation of

resources to prevention efforts. This program of research provides valuable insight into the determinants of safe driving behaviour and an opportunity to advocate for system reform in preventive approaches to workplace road safety in Australia and internationally.

Publications arising from this thesis

Warmerdam, A., Newnam, S., Sheppard D., Griffin, M., & Stevenson, M. (2017). A new approach to managing work-related road traffic injury: The development of a health investment framework. *Traffic Injury Prevention,* DOI: 10.1080/15389588.2017.1288289

Warmerdam, A., Newnam, S., Sheppard D., Griffin, M., & Stevenson, M. (2017). Workplace road safety risk management: An investigation into Australian practices. *Accident Analyis & Prevention, 98,64-73*. DOI: 10.1016/j.aap.2016.09.014

Newnam, S., **Warmerdam, A.,** Sheppard, D., Griffin, M., & Stevenson, M. (2017). Do management practices support or constrain safe driving behaviour? A multi-level investigation in a sample of occupational drivers, *Accident Analysis & Prevention, 102, 101-109.* DOI: 10.1016/j.aap.2017.02.007

Warmerdam, A., Newnam, S., Sheppard D., Wang, Y., Griffin, M., & Stevenson, M. High Performance Workplace Systems' influence on safety attitudes and occupational driver behaviour. *Submitted to Safety Science.*

Conference presentations arising from this thesis

Safety Culture from the Regulator's Perspective, April 2016: Melbourne, Australia.

Road Safety on Five Continents, May 2016: Rio de Janeiro, Brazil.

Traffic and Transport Psychology, August 2016: Brisbane, Australia.

Australasian Road Safety Conference, September 2016: Canberra, Australia.

Association for the Advancement of Automotive Medicine, September, 2016: Hawaii, USA.

National Safety Council, October: California, USA.

Presentations for Industry & Industry Engagement

Australasian Fleet Management Association, April, 2015: Melbourne, Australia.

MiX Telematics webinar presentation, May 2016.

AFMA Professional Development Forum, May 2016: Melbourne, Australia.

Research Translation Workshop 1, April 2016: Melbourne, Australia.

ALC Supply Chain Safety & Compliance Summit, August 2016: Melbourne, Australia.

Research Translation Workshop 2, September 2016: Melbourne, Australia.

Department of Education and Training, April 2017: Melbourne, Australia.

Media & Awards

Best student paper conference award: Safety Culture from the Regulator's Perspective.

Safety at Work blog https://safetyatworkblog.com/2016/05/18/free-safety-conference-was-more-valuable-than-many-other-more-expensive-ones/

The Age newspaper http://www.theage.com.au/smallbusiness/franchising/workinprogress/theroadtollareemployerstoblame20170119gtum13.html

Regional student research prize (Victoria and Tasmania), Australian Road Research Board.

Best paper with implications for improving workplace road safety, Australasian College of Road Safety Conference.

Travel stipend, Association for the Advancement of Automotive Medicine

Thought leadership paper, Chain of Responsibility Advisor Magazine

Thought leadership paper, Australasian Fleet Management Association

Safety at Work blog https://safetyatworkblog.com/2017/03/16/safe-driving-affected-by-leadership/

Best student paper award, Monash University

Thesis including published works General Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

The thesis includes three original articles published in a peer reviewed journal and one submitted publication. The core theme of the thesis was work-related road traffic injury. The ideas, development and writing up of all the papers in the thesis were the principal responsibility of myself, the student, working within the Monash University Accident Research Centre under the supervision of Dr. Sharon Newnam, Dr. Dianne Sheppard and Prof. Mark Stevenson. The inclusion of co-authors reflects the fact that the work came from active collaboration between researchers and acknowledges input into team-based research. In the case of chapters 2, 3, 4 and 5 my contribution to the work involved the following:

Thesis Chapter	Publication title	Publication status	Student contribution
2	A new approach to managing work-related road traffic injury: The development of a health investment framework	Published in Traffic Injury Prevention	70%
3	Workplace road safety risk management: An investigation into Australian practices.	Published in Accident, Analysis & Prevention	70%
4	Do management practices support or	Published in Accident,	50%

	constrain safe driving behaviour? A multi-level investigation in a sample of occupational drivers	Analysis & Prevention	
5	High Performance Workplace Systems' influence on safety attitudes and occupational driver behaviour	Submitted to Safety Science	60%

This research was supported by a NHRMC grant. Out of the scope of this PhD was estimating the prevalence of work-related road traffic injury. The PhD was focused on developing conceptual thinking in the area.

I have not renumbered sections of submitted or published articles in order to generate a consistent presentation within the thesis. The reference style used was as per the specifications of the Journal to which the relevant article has been submitted or published. A list of references relevant to each article is presented at the conclusion of each of these articles as per the requirements of the publisher.

Student signature: [redacted] **Date:** 9 May 2017

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the student's and co-authors' contributions to this work. In instances where I am not the responsible author I have consulted with the responsible author to agree on the respective contributions of the authors.

Main Supervisor signature: [redacted] **Date:** 9 May 2017

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I'd like to express my gratitude to my panel members, in particular Richard Tay who attended all of my milestones and Jennie Oxley and Judith Charlton for chairing these sessions.

As the recipient of the Peter Vulcan Scholarship, I would like to acknowledge the support of the Monash University Accident Research Foundation. This scholarship allowed devotion of my time to finalising my thesis. Thank you also to the administrators in the centre, Julie Suker and Sam Bailey, for countless cab charges and chats. Thank you to Vero Insurance and WorkSafe Victoria for your assistance with recruitment efforts.

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Abbreviations

ANCAP	Australasian new car assessment program
ANZSIC	Australian and New Zealand standard industrial classification
CFA	Confirmatory factor analysis
CFI	Comparative fit index
HPWS	High performance workplace systems
KPI	Key performance indicator
LMX	Leader-member exchange
NRSPP	National road safety partnership program
OHS	Occupational health and safety
RMSEA	Root mean square error of approximation
TLI	Tucker-Lewis index
VWA	Victorian work authority
WHO	World health organisation
WHS	Workplace health and safety

Chapter 1 Introduction

1.0 About this chapter

The first chapter of this PhD thesis sets the scene by outlining background on the topic of occupational safety. The literature relevant to workplace road safety has been discussed in detail in each paper submitted as part of this PhD. This chapter will commence with an overview of the extent of the problem in workplace road safety.

Every year the lives of almost 1.24 million people are lost as a result of a road traffic crash. Furthermore, between 20 to 50 million people suffer non-fatal injuries, with many incurring a disability as a result of their injury (WHO, 2015). Work-related drivers have been identified as a vulnerable road safety population as more than 30% of registered motor vehicles in Australia are work-related vehicles (Haworth, Tingvall, & Kowadlo, 2000). In the state of New South Wales fleet vehicles comprise up to 5.3 fatalities per 100,000 registered fleet vehicles (generally referred to as light vehicles < 4.5 tonnes; Stuckey, LaMontagne, Glass, & Sim, 2010). This public health issue affects employees and organisations worldwide, an estimated 26% of work fatalities in the USA were deaths of vehicle occupants in road traffic crashes (US Bureau of Labor Statistics, 2016; excluding pedestrian workers struck by vehicles in traffic).

1.1 Narrative literature review

1.1.1 Individual compliance with safe driving practices

Much work-related road safety research has focused on the road user or individual as the critical mechanism in understanding crashes. This has been reflected in interventions that primarily focus on individual compliance with safe driving practices (e.g., driver training, incentive schemes, and group based discussions). Much of the research has also focused on individual-driver predictors of safety outcomes, including attitudes, behaviour, and perceptions of safety (see Newnam & Watson, 2011 for a review). This approach has been shown to improve safety performance. For example, Gregerson et al., (1996) used this

approach and reduced driver crash rates. Similarly, a social psychological discussion methodology was reported by Salminen (2008) to reduce traffic-related accidents by 72% over an eight year period. Past research has found support for interventions focused on group discussion, feedback and goal setting in gaining an understanding of the driving context and improving driver behaviour (Newnam, Lewis, & Warmerdam, 2014).

One area of light vehicle fleets that has received research attention is the use of fleet vehicle monitoring systems. There is evidence that industry is adopting fleet vehicle driver monitoring systems in the management of occupational drivers (Warmerdam, Newnam, Griffin, Sheppard, & Stevenson, 2017). Telematics devices have been shown to be effective in reducing unsafe driving behaviour such as speeding (Newnam et al., 2014). Yet, there is a need to understand and manage the human element of work-related driving. For example, there is evidence that intentions to speed are also impacted by behaviours beyond the workplace such as the normative influence of friends and family (Newnam, Watson, & Murray, 2004). A significant portion of this research assumes human error is the primary cause of crashes (Larsson, Dekker, & Tingvall, 2010; Reason, Manstead, Stradling, Baxter, & Campbell, 1990) and views the driver in isolation, rather than individuals as members within a system that is characterised by its social interaction among team members and across organisational levels. There have also been significant efforts to better understand factors influencing safe driving in the heavily vehicle industry with many authors calling for a safe systems approach (Newnam & Goode, 2015). Although some research has examined the individual and organisational behavioural determinants of work-related road safety, none has examined this issue using a multi-level approach.

1.1.2 Organisational climate research

Organisational climate and organisational culture are conceptual representations of the ways that employees draw meaning from and make sense of their work environments (Barbera, 2014). The terms are often used interchangeably but are conceptually distinct.

Climate research has focused on employees' shared meanings of policies, procedures, and practices in so much that these behaviours are rewarded, expected and supported in their work environment (Schneider, Parkington, & Buxton, 1980). This is distinct from culture, which speaks to organisational ideologies, values and norms.

Historically, research into an organisation's climate emerged from an interest in the psychological life space people inhabited at work i.e., the social and behavioural attitudes of people in response to leadership practices. The early literature used the terms 'social climate' and 'social atmosphere' to describe what is now known as climate research (see Lewin, Lippitt, & White, 1939). Organisational climate research over the past 50 years has been separated into two streams of focus: psychological or individual climate, and organisational or unit / workgroup climate (Barbera, 2014). This research has also distinguished between the multiple climates that exist within an organisation, namely, innovation, service and safety climates. The focus of this research is on the safety climate. Safety climate informs an employee about the extent to which safety is valued and prioritised in that organisation (Griffin & Neal, 2000). This definition is based on a shared perception with organisational members about the relative importance of safety at work when compared to organisational productivity and efficiency. As organisational members come to understand the organisation's priorities, they develop an understanding of which behaviours are rewarded, expected and supported based on feedback from supervisors and senior management (Zohar & Luria, 2005). Given the often misaligned nature of organisational written policies and enacted practice at the supervisory level (i.e., supervisory discretion), it is sometimes difficult for employees to have a clear understanding of management's commitment to employee protection and safety. The differences in safety management practices have, thus, been suggested as a major contributing factor to the heterogeneity in safety climate perceptions at the work group level. These differences in safety management practices are due, in part, to the leadership-climate relationship.

The leadership-climate relationship has been explained as a 'social learning process' whereby one's experiences and observations, written documents, training courses or other formal or publicly available communications are constantly being interpreted by the employee (Dragoni, 2005). It has been suggested that work group leaders create their own interpretation of policy and procedure and shape the climate of a group and the quality of the relationship with their subordinates (Newnam, Griffin, & Mason, 2008). Research suggests that this cross-level process exists within the psychological construct of safety climate; thus, this can be conceptualised and analysed over multiple organisational levels, involving leader-subordinate interactions (Griffin & Hu, 2013; Zohar, 2000; Zohar & Luria, 2005). This program of research focuses specifically on the multi-level nature of organisational safety climate. While interactions happening within an organisational level impact employee perceptions of how safety is valued and prioritised within an organisation, the interactions across organisational levels also play a role. Previous research has proposed that senior management is concerned with policy making and the establishment of procedures, while the workgroup supervisors implement this knowledge in a discretionary manner (Zohar, 2000; Zohar & Luria, 2005). For example, supervisors are often entrusted to disseminate information from senior management to workgroups, thereby having discretion as the 'gatekeeper' of this information (Newnam et al., 2008). Therefore, while policy from senior management may affect the employee across organisational levels, the discretionary implementation of that policy through supervisory practice will influence employee perceptions within an organisational level i.e., workgroup. This interpretation is important, as a subordinates' perception of safety climate is crucial in terms of its influence on their compliance with safety procedures, safety motivation (Neal & Griffin, 2006), and their likelihood of carrying out activities that minimise the risk of injury to themselves and their workgroup (Colley, Lincolne, & Neal, 2013). Perceptions of the level of investment given to employee safety, health and wellbeing is largely influenced by the social environment of the workplace.

In addition to safety climate, this PhD will also explore employee perceptions of the level of organisational investment given to safety, health and wellbeing (Karelina & DeVries, 2011). Mutual concern for health and wellbeing of team members creates a safe work environment (Mearns, Hope, Ford, & Tetrick, 2010). When work group members develop this consensus about how the work environment places emphasis on safety, this perception – by extension – creates a climate where safety can be conceptualised as an investment in health. Investment in health and well-being of employees by an organisation is, in part, a human resource management activity. Workers reciprocate high quality relationships in a manner consistent with the type of safety behaviour valued in their work environment (Hofmann, Morgeson, & Gerras, 2003). This research suggests that a social environment that promotes safety, health and wellbeing between staff members facilitates and encourages safe working practices. That is, leaders who are able to effectively convey a high health investment are likely to have workers who perceive that their safety, health and wellbeing is prioritised relative to productivity and efficiency.

1.1.3 Role of supervisors and senior management

Much has been learned in recent years about the organisational characteristics that influence safety behaviours. For example, the quality of management practices within organisations have been linked to reduced injury rates (Zacharatos et al. 2005). However, there is a paucity of literature exploring the role of management practices in relation to work-related driving safety. This can be attributed, in part, to challenges inherent in conducting research on work-related driving determinants within the organisational context.

Management of safety in the work-related driving setting has characteristics that distinguish it from the management of other organisational safety activities. Unlike the traditional workplace context, the work-task (i.e., driving) is conducted outside the physical boundaries of the workplace; thus, direct employer or supervisory control is limited. This poses a managerial challenge as there is generally limited opportunity to observe employee

behaviour and provide timely feedback. Managerial responsibilities are further complicated in organisations where driving activities fall outside typical line management responsibilities and are often managed by a person who is not part of the same management structure (e.g., fleet manager; Newnam et al. 2008). This is often seen in occupations such as sales representatives, community nurses, and delivery personnel where driving is considered secondary to the primary work role (Lynn and Lockwood 1998).

Despite these managerial challenges, research has identified that the workgroup supervisor plays a critical role in creating a context in which safety is valued and prioritised within their teams (Newnam et al. 2008). For example, Newnam et al. (2012) found that drivers whose supervisor engages in more frequent safety-related discussions reported safer driving behaviour. This finding suggests that supervisors play a key role in creating a workplace climate in which safety is valued and prioritised; however, research is yet to identify the supervisory skills or specific actions that facilitate change in safety practices at the driver level.

There is also limited research that fully articulates the role of senior-level management in creating a safe work environment. There is research that suggests that risk management initiatives, including crash databases designed to identify trends in crashes, recruitment, selection methods and induction programs, are important elements within senior-management responsibilities in driver safety (e.g., Cheyne et al. 1998). Although there is limited evidence to support any one risk management initiative, it is well recognised that senior-level management (e.g., directors) commitment is critical to achieving successful implementation of these types of safety systems and improved safety outcomes (e.g., Cheyne et al. 1998; Lingard & Rowlinson 1997; Williamson et al. 1996). These findings suggest that leader's actions have the potential of developing synergy between human and organisational capabilities, ultimately supporting the development of self-sustaining safety systems (Griffin & Talati 2014). However, research is yet to articulate the human resource management practices most effective in creating a safe driving system.

In summary, there is an emerging trend that identifies actions of the leader, including their indirect influence on driver performance through self-sustaining safety systems, are a key element in achieving a reduction in work-related road traffic injury. However, the literature provides little guidance regarding the mechanisms and how each of these sub-systems interacts in achieving a safe driving environment.

This PhD investigates management practices that have been found to support performance-based activities in the organisation, namely High Performance Workplace Systems (HPWS). HPWS practices have been defined as distinct but interconnected human resource management practices that are designed to maximise individual employee contributions. There is research that demonstrates a relationship between HPWS and occupational safety (Zacharatos et al., 2005). The PhD explores a range of HPWS that are capable of supporting or constraining safe driver behaviour. Although the research to date suggests the positive impact of HPWS on productivity and, more importantly, safety performance, these practices have yet to be investigated within the unique context of workplace road safety.

1.2 PhD Aims

The overall aim of this PhD is to identify the organisational determinants of safe driver behaviour. The PhD comprises four studies that aim to identify the factors at, and across, multiple levels within the workplace including senior level managers, supervisors and individual fleet drivers' roles in supporting safe driving behaviour. Safety climate was assessed through both self-report of individual perceptions (i.e., established scales) and organisational practices allowing investigation of the landscape of risk management practices in workplace road safety and investment in human resource management practices. The objectives for this PhD were completed alongside a larger research project.

The PhD objectives include the conceptualisation of a new approach to managing work-related road safety which facilitates interpretation of the complex interactions within and across organisational levels. This approach forms the basis for understanding the landscape

of workplace road safety risk management in Australia and the human resource management practices that support and constrain safe driver behaviour. This in-depth understanding aims to promote the development of interventions that consider the role of all organisational members in improving safe driving practices. In addition, the research examines how these multi-level influences interact with personal factors like driver attitudes to impact on driver behaviour.

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Chapter 1 discussed safety climate literature as it relates to the landscape of workplace road safety in Australia. As research into light vehicle fleets has focused on the road user or individual as the precursor in understanding crashes, interventions have primarily focused on individual compliance with safe driving practices (e.g., driver training, incentive schemes, and group based discussions).This is due, in part, to a lack of understanding of the roles of organisational members in creating a safe work environment.

Chapter 2 presents the health investment framework developed as the first component of this research project. The health investment framework provides a holistic interpretation of the complex interactions within and across organisational levels influencing work-related road traffic injury. This framework aims to promote the development of targeted interventions and future research to address an area identified as an important public health concern. The health investment framework also sets the stage conceptually for the program of research that follows and acts as a way to conceptualise the multi-level relationships that influence safe driving. Health investment (i.e., practices that are specifically intended to improve employee health) are articulated through HPWS. The reason is that high-level decisions that affect health and safety may come from completely different parts of an organisation.
The conceptual framework is presented in a journal article, entitled, "A new approach to managing work-related road traffic injury: The development of a health investment framework". It has been published in Traffic Injury Prevention.

Chapter Two

Monash University

Declaration for Thesis Chapter 2

Warmerdam, A., Newnam, S., Sheppard D., Griffin, M., & Stevenson, M. (2017). A new approach to managing work-related road traffic injury: The development of a health investment framework. *Traffic Injury Prevention, 18*(6), 631-635.

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Declaration by candidate

In the case of Chapter 2 (i.e., paper one), the nature and extent of my contribution to the work involved the following:

Nature of the contribution	Extent of the contribution (%)
Principal author responsible for the concept and design of theory and writing up the manuscript	70

The following co-authors contributed to the work:

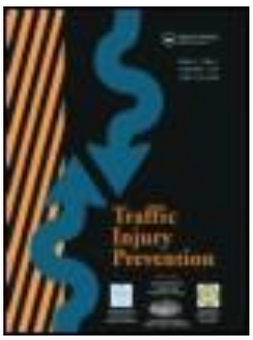
Name	Nature of the contribution	Extent of the contribution (%)
Dr. Sharon Newnam	Contributed to the concept and design of the study, and critically reviewed the manuscript	10
Dr. Dianne Sheppard	Contributed to the concept and design of the study, and critically reviewed the manuscript	10
Prof. Mark Griffin	Contributed to the manuscript diagram	5

Prof. Mark Stevenson	Critically reviewed the manuscript	5

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the candidate's and co-authors' contributions to this work.

Student signature: [redacted] **Date:** 9 May 2017

Main Supervisor signature: [redacted] **Date:** 9 May 2017



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A new approach to managing work-related road traffic injury: The development of a health investment framework

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ABSTRACT

Objective Statistics indicate that employees commuting or travelling as part of their work are over-represented in workplace injury and death. Despite this, many organisations are unaware of the factors within their organisations that are likely to influence potential reductions in work-related road traffic injury.

Methods This paper presents a multi-level conceptual framework that identifies health investment as the central feature in reducing work-related road traffic injury. Within this framework, we explore factors operating at the individual-driver, workgroup-supervisor and organisational-senior management levels that create a mutually reinforcing system of safety.

Results The health investment framework identifies key factors at the senior manager, supervisor and driver levels to cultivating a safe working environment. These factors are High

Performance Workplace Systems, Leader-member exchange and autonomy, trust and empowerment respectively. The framework demonstrates the important interactions between these factors and how they create a self-sustaining organisational safety system.

Conclusions The framework aims to provide insight into the future development of interventions that are strategically aligned with the organisation and target elements that facilitate and enhance driver safety, and ultimately reduce work-related road traffic injury and death.

Keywords

driver safety; driver behaviour, work-related drivers; health investment framework; multi-level approaches to safety.

ACCEPTED MANUSCRIPT

By the year 2030, road traffic injuries are predicted to be the fifth leading cause of mortality, globally (WHO 2013). Employees commuting or travelling as part of their work represent approximately 40% of worker fatalities and half (50%) of all road deaths across the European Union (European Commission 2009) Similar figures have been reported in Australia, with an estimated 33% of work-related fatalities occurring while driving (Driscoll et al. 2005). Limited research has explored the role of organisational behaviour within a multi-level model. Understanding the impact of organisational behaviour is critical to addressing the interactions between organisational and system members.

Despite the over-representation of work-related road traffic fatalities, there is limited understanding of the organisational determinants of work-related road traffic injury and deaths, particularly in light-vehicle fleets (Newnam et al. 2014) Although some research has examined the individual and organisational behavioural determinants of work-related road safety, (see Newnam and Watson 2011 for a review), none has examined this issue using a multi-level approach. One area of light vehicle fleets that has received research attention is the use of fleet vehicle monitoring systems. There is evidence that industry is adopting fleet vehicle driver monitoring systems in the management of occupational drivers (Warmerdam et al. 2017). Telematics devices have been shown to be effective in reducing unsafe driving behaviour such as speeding (Newnam et al. 2014). Yet, there is a need to understand and manage the human element of work-related driving. For example, there is evidence that intentions to speed are also impacted by behaviours beyond the workplace such as the normative influence of friends and family (Newnam et al. 2004). There have also been significant efforts to better understand

factors influencing safe driving in the heavily vehicle industry with many authors calling for a safe systems approach (Newnam and Goode 2015).

The safe systems approach to road safety explores individual system components and their complex interactions (e.g., Griffin & Talati 2014; Newnam & Goode, 2015; Levenson 2002). Within this approach, organisational behaviour has received very limited attention. This presents a significant gap in the literature considering that more than 30% of registered motor vehicles are being driven for work-related purposes (Driscoll et al. 2005) and that 80% of road traffic crashes has been attributed to human error (Larsson et al. 2010).

Introduction

Much research has focused on the road user or individual as the critical mechanism in understanding crashes. This is reflected in interventions that focus on individual compliance with safe driving practices (e.g., driver training, incentive schemes and group-based discussions). Research has also focused on individual-driver predictors of safety outcomes, including attitudes, behaviour, and perceptions of safety (see Newnam & Watson 2011 for a review). Much of the research assumes human error as the primary cause of crashes (Larsson et al. 2010; Reason et al. 1990) and views the driver in isolation, rather than individuals as members within a system; a system characterised by its social interaction among team members and across organisational levels.

Behaviour modification programs, run by an externally appointed safety officers, have received strong support in previous research. Individual-based discussion groups, individual or group feedback, and goal setting exercises are the dominant approaches currently used in industry (Newnam & Watson, 2011).

Whilst individual driver determinants play an important role in reducing road traffic injury, a safe work environment depends not only on driver compliance but on all individuals, at various organisational levels, anticipating threats to safety, showing concern for the safety of others, and contributing to safety improvements in the organisation (Newnam et al. 2014). Much has been learned in recent years about the organisational characteristics that influence safety behaviours. For example, the quality of management practices within organisations have been linked to reduced injury rates (Zacharatos et al. 2005). However, there is a paucity of literature exploring the role of management practices in relation to work-related driving safety. This can be attributed, in part, to challenges inherent in conducting research on work-related driving determinants within the organisational context. Management of safety in the work-related driving setting has characteristics that distinguish it from the management of other organisational safety activities. Unlike the traditional workplace context, the work-task (i.e., driving) is conducted outside the physical boundaries of the workplace; thus, direct employer or supervisory control is limited. This poses a managerial challenge as there is generally limited opportunity to observe employee behaviour and provide timely feedback. Managerial responsibilities are further complicated in organisations where driving activities fall outside typical line management responsibilities and are often managed by a person who is not part of the same management structure (e.g., fleet manager; Newnam et al. 2008). This is often seen in occupations such as sales representatives, community nurses, and delivery personnel where driving is considered secondary to the primary work role (Lynn and Lockwood 1998).

Despite these managerial challenges, research has identified that the workgroup supervisor plays a critical role in creating a context in which safety is valued and prioritised

within their teams (Newnam et al. 2008). For example, Newnam et al. (2012) found that drivers whose supervisor engages in more frequent safety-related discussions reported safer driving behaviour. This finding suggests that supervisors play a key role in creating a workplace climate in which safety is valued and prioritised; however, research is yet to identify the supervisory skills or specific actions that facilitate change in safety practices at the driver level.

There is also limited research that fully articulates the role of senior-level management in creating a safe work environment. There is research that suggests that risk management initiatives, including crash databases designed to identify trends in crashes, recruitment, selection methods and induction programs, are important elements within senior-management responsibilities in driver safety (e.g., Cheyne et al. 1998). Although there is limited evidence to support any one risk management initiative, it is well recognised that senior-level management (e.g., directors) commitment is critical to achieving successful implementation of these types of safety systems and improved safety outcomes (e.g., Cheyne et al. 1998; Lingard & Rowlinson 1997; Williamson et al. 1996; Zohar 1980). These findings suggest that leader's actions have the potential of developing synergy between human and organisational capabilities, ultimately supporting the development of self-sustaining safety systems (Griffin & Talati 2014). However, research is yet to articulate the human resource management practices most effective in creating a safe driving system.

In summary, there is an emerging trend that identifies actions of the leader, including their indirect influence on driver performance through self-sustaining safety systems, are a key element in achieving a reduction in work-related road traffic injury. However, the literature provides little guidance regarding the mechanisms and how each of these sub-systems interacts

in achieving a safe driving environment. We propose therefore, to explore this issue using a multi-level approach to understanding the determinants of work-related road traffic injury.

A Multi-level Framework of Work-related Driving Safety

Stuckey et al. (2007) developed a framework for developing occupational health and safety (OHS) theory in an organisational light vehicle context using a model that included a comprehensive mix of organisational (e.g., work arrangements, vehicle ownership) and environmental (e.g., road design elements, road safety legislation) factors. The framework covered five levels of potential determinants of crash, injury and fatality, including locus of injury, physical work environments (immediate and external), organisational environment, and policy environment. Wallington et al. (2014) also adopted a systems approach to describe a case study designed to reduce work-related driving costs and collisions. In doing this, the authors adapted the Haddon Matrix to systematically categorise safety initiatives across five components, including management culture and leadership (e.g., business case, risk analysis), journey management (e.g., risk assessment, reducing need to travel), people (e.g., induction process, policy and handbook), vehicle (e.g., safety features, specification) and society/community (e.g., engagement with research community, marketing program). This case study described reduced crash involvement over a period of greater than 10 years; concluding that risk management and risk mitigation were strong contributors to the reduction in crash involvement.

While these studies provide a comprehensive illustration of the organisational and environmental factors influencing work-related driving safety, these models do not consider the behavioural mechanisms facilitating change in driver behaviour; this presents a limitation in the existing literature considering that health investment is considered a function of reciprocity

(Mearns et al. 2010) and these types of systems are characterised by social interactions across and between levels. This article describes a multi-level framework characterised by a focus on health investment. At the forefront of this framework, we consider High Performance Workplace Systems (HPWS).

A HEALTH INVESTMENT FRAMEWORK

HPWS are distinct but interconnected human resource management practices that are designed to improve workplace competence, attitudes and motivation through increased employee empowerment, information flow and autonomy (Zacharatos et al. 2005; Posthuma et al. 2013). Maximising individual employee contributions through the strategic alignment of organisational goals and human resource practices has been well established as a method of increasing the intensity of workplace inputs (e.g., commitment and motivation) and outputs (i.e., increased performance and reduced turnover) (Combs et al. 2006). Although limited research has explored the role of HPWS in the safety context (with the exception of Zacharotas), a plethora of research has focused on the direct link between HPWS and productivity (see Posthuma et al. 2013 for a review). For example, past research has provided support for the relationship between productivity and HPWS practice including, selection (e.g., Michie & Sheehan 2005) communication (e.g., Gibson et al. 2007; Gittell et al. 2010) and performance management (e.g., Zhang & Li 2009)

Beyond improving productivity, HPWSs also create an enriched workplace environment, through empowering workers to make change and enhance their own capabilities (Posthuma et al. 2013). Research has demonstrated an indirect link between greater productivity and HPWS through increased employee empowerment, information flow and autonomy (Posthuma et al.

2013; Combs et al. 2006). This research suggests that HPWS plays a direct and indirect role in creating a positive and productive workplace.

As mentioned previously, HPWS has been explored in facilitating change in safety performance. Zacharotas et al. (2005) found that trust mediated the relationship between HPWS and occupational safety, such that, the greater an employee trusted in management, the greater their safety performance (i.e., personal-safety orientation measured through safety knowledge, motivation, compliance, and initiative); and the lower their safety incidents including first aid treatments and 'near misses'. Chuang & Liao (2010) also found that a climate that demonstrates concern for employees, mediated the relationship between HPWS (or High Performance Workplace Practices) and employee helping behaviour.

This research suggests that implicit communication of priorities is given to employee health and well-being and, by extension, concern for safety (see Mearns et al. 2010). Using this lens to research the capabilities of HPWS delineates it from traditional research approaches that are based on control oriented organisational practices (Aït Razouk 2011). Through synergistically aligning HPWS with organisational strategies, it transforms the employee from a mere worker into an active collaborator in achieving organisational goals (Buller & McEvoy 2012; Subramony 2009); which in the safety context translates into practices that contribute to a safe working environment. To this end, we argue that HPWS can be conceptualised as an investment in employee health and wellbeing.

In our framework, we present a direct link between HPWS and high quality relationships between supervisors and senior level management. We argue that the quality of the relationship between supervisors and senior level management is characterised by the degree of alignment

between supervisors' interpretation of the safety policies and procedures and the safety goals instituted by senior level management (Zohar 2002). Articulating this link presents an important addition to the health investment framework as alignment in beliefs regarding concern for employee well-being informs role-behaviour expectancies and organisational performance (Podsakoff et al. 2003), which in our framework translates into more effective supervisory safety practices. Evidence to support this link has been well demonstrated, through the concept of reciprocity.

Reciprocity refers to conditions whereby there is a mutually gratifying pattern of exchanging goods and services (Gouldner 1960). An illustration of reciprocity is an organisation providing services perceived as discretionary which could inspire reciprocating behaviour in the form of employee compliance with organisational procedures. In the safety context, reciprocation is a process whereby workers feel mutual concern for the health and wellbeing of team members and that this creates a safe work environment (Mearns et al. 2010). In support of this argument, research has demonstrated that workers reciprocate high quality relationships in a manner consistent with the type of safety behaviour valued in their work environment (Hofmann et al. 2003).

This paper operationalises reciprocity through the quality of the relationship between a leader and their workers i.e., reciprocity occurs in high quality relationships. Leader-member exchange, or LMX, describes the dyadic relationship between supervisors and workers; a leader develops an exchange with their workers and the quality of the exchange influences cross level change effects. In our framework, we describe the role of the LMX in creating trust, empowerment and autonomy at the driver-level. There is some evidence to support this

argument. Hofmann and Morgeson (1999) found that employees who perceived a high quality relationship with their manager (high quality LMX) were more likely to raise safety concerns and were more committed to safety at their workplace. Hofmann and colleagues (2003) also found that LMX influenced how employees define their roles with relation to organisational safety, such that employees with high quality relationships with their managers were more likely to perceive safety as part of their job responsibility, resulting in greater safety participation or safety citizenship behaviour.

At the individual-driver level, our framework identifies a relationship between *trust, autonomy, and empowerment* and driver capability. Trust in management has been found to improve commitment to the organisation (Kim & Wright 2011). Zacharotas and colleagues (2005) found that employees view trustworthiness of management as indicative of the organisation's commitment to them and that this perception, informed safety performance. Griffin and Talati (2014) have also identified that trust can lead to an environment where employees feel comfortable reporting and discussing their errors Empowerment is the functional capacity of teams to improve safety systems (e.g., proactively solve safety problems) and optimise the way that safety systems serve to enhance safety (Griffin & Talati, 2014). For example, Hechanova-alampay et al. (2001) found that teams that were more empowered performed safety behaviours more frequently and had better safety records. Finally, job *autonomy* is characterised by a sense of accountability and proactive involvement in decision making. Parker and Turner (2001) found that job autonomy (and communication) were positively associated with safe working practices. In summary, our framework describes a direct

relationship between trust, empowerment and autonomy and driver capacity; with driver capability being characteristics through safety values, attitudes, driving behaviour.

Figure 1 presents the multi-level health investment framework. This framework describes the multidimensional nature in the safety management of work-related road traffic injury. The framework identifies the three levels (individual-driver, workgroup-supervisor and organisational-senior management) within an organisation that contribute to creating a safe driving environment. The framework also describes the factors relevant at each level of the organisation, and how they can aid in understanding the behavioural determinants of work-related road traffic injury.

DISCUSSION

This paper presents a multi-level framework, characterised through its focus on health investment, in understanding work-related road traffic injury. The framework extends traditional approaches to behavioural management which are focused on driver compliance and considers actions of supervisors and senior level management and their contribution to creating a safe work environment. There are three key features that characterise this framework. First, through the implementation of HPWS, senior-level management cultivate an enriched workplace environment that promotes high quality exchange relationships. Second, high quality leader-member exchange relationships play a pivotal role in enhancing trust, empowerment and autonomy at the individual-driver level. Third, trust, empowerment and autonomy enhance driver capability, and work-related road traffic injury. Each of these conceptual links are focused on creating an investment in health throughout the organisation. However, these relationships are not likely to be mutually exclusive. This framework also considers the direct relationship

between factors operating at each level and work-related road traffic injury. For example, it is possible that the quality of the LMX will have a direct relationship with safe driving behaviour (Newnam et al. 2012). Overall, the essence of this framework is captured in a systems approach which explores factors operating within each subsystem as a contributor in creating a safe driving environment.

The information gained from this framework will provide insight into the future development of interventions that are well aligned in the organisation and target elements that facilitate and reduce work-related road traffic injury and death. These interventions will be part of a systems-based framework with identified actions necessary by senior management which can be integrated into training programs and practical systems for implementation in at different levels of the organisation. A defining feature of the framework is that it is built on the assumption of a 'self-sustaining' system, whereby members are intrinsically motivated toward safety and management and have the skills to build reciprocal relationships that reinforce practices that create a safe driving environment.

From a methodological perspective, the framework has the potential to overcome limitations in past work-related road safety research. Almost all research in the area of organisations and work-related road traffic injury has been undertaken within single organisations. A limitation of these studies is that it is unknown if the identified safety factors within each individual organisation can be generalised to other organisations; particularly organisations with differing business activity and size. Furthermore, it is unknown whether the business activities operating within particular organisations or industries predispose drivers to safe / unsafe driving conditions. For example, it is possible that individuals within organisations

in which driving is the core business (e.g., transport ancillaries) are exposed to a 'culture' of safety associated with the driving task in contrast to organisations where driving is secondary to the individuals' core responsibility (e.g., in-home nursing care). Thus, this framework aims to encourage future research that not only examines the organisational determinants of work-related road traffic injury, but importantly takes account of the core business activity of the organisations. One limitation of this framework is that it is less able to be generalised to smaller enterprises such as sole traders or partnerships which do not consist of multiple organisational levels.

Practical Applications

Our health investment framework provides a holistic interpretation of the complex interactions within and across organisational levels influencing work-related road traffic injury. This framework aims to promote the development of targeted interventions and future research to address an area identified as an important public health concern.

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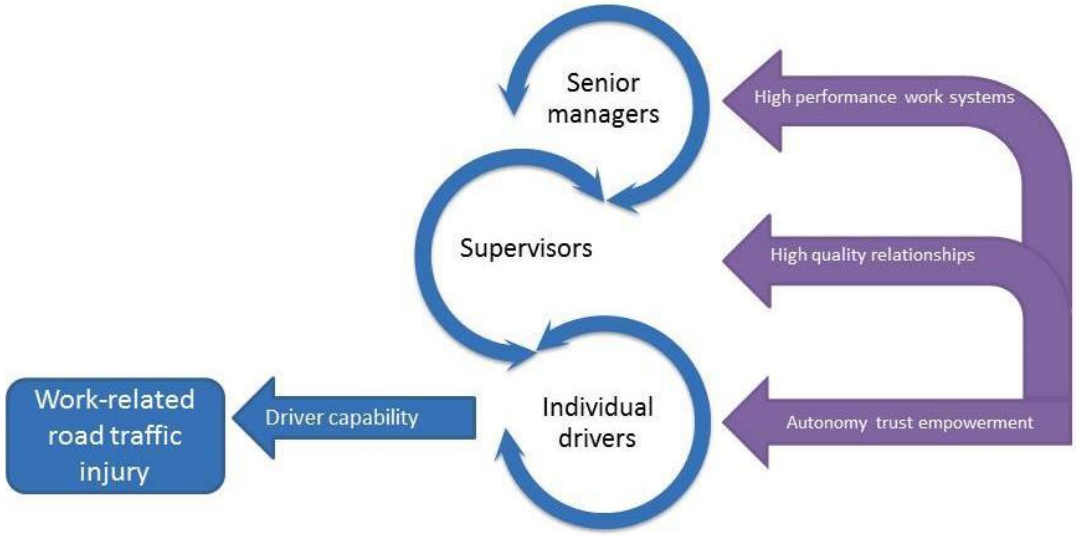

Figure 1: Work-related road traffic injury: A health investment framework.

Chapter 2 contains the conceptual framework for this program of research which forms the foundation for the following studies presented. The research cited in the second chapter suggests that when implicit communication tells employees that priority is given to health and well-being, that, by extension, this communicates concern for safety. Thus, aligning HPWS with organisational strategies may contribute to a safer working environment. Investigation into the role of HPWS in improving safety, in the work-related driving context, will bridge a gap in the literature. However, as there is limited research into senior management's role, first this program of research will develop understanding of more traditional mechanisms.

Chapter 3 presents the qualitative benchmarking study. The aim of this paper was to explore the current landscape of risk management practices. This study highlighted a lack of maturity in risk management in workplace road safety. The results identified multiple areas for improvement, including ensuring management commitment to safety, standardisation and formalisation of organisational policies impacting drivers and the need for systems to evaluate practices that are implemented. This research fits within the overall aim of the PhD by demonstrating the importance of safety being integrated across business units. The findings from the qualitative benchmarking study are presented in a journal article entitled, "Workplace road safety risk management: An investigation into Australian practices". It has been published in Accident Analysis and Prevention.

Chapter Three

Monash University

Declaration for Thesis Chapter 3

Warmerdam, A., Newnam, S., Sheppard D., Griffin, M., & Stevenson, M. (2017). Workplace road safety risk management: An investigation into Australian practices. *Accident Analysis & Prevention, 98, 64-73*. DOI: 10.1016/j.aap.2016.09.014

Declaration by candidate

In the case of Chapter 3 (i.e., paper two), the nature and extent of my contribution to the work involved the following:

Nature of the contribution	Extent of the contribution (%)
Principal author responsible for the concept, design, data collection, interpretation of results and writing up the manuscript	70

The following co-authors contributed to the work:

Name	Nature of the contribution	Extent of the contribution (%)
Dr. Sharon Newnam	Contributed to the concept and design of the study, and critically reviewed the manuscript	10
Dr. Dianne Sheppard	Contributed to the concept and design of the study, and critically reviewed the manuscript	10
Prof. Mark Griffin	Critically reviewed the manuscript	5

Prof. Mark Stevenson	Critically reviewed the manuscript	5

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the candidate's and co-authors' contributions to this work.

Student signature: [redacted] **Date:** 9 May 2017

Main Supervisor signature: [redacted] **Date:** 9 May 2017

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Workplace road safety risk management: An investigation into Australian practices

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a b s t r a c t

In Australia, more than 30% of the traffic volume can be attributed to work-related vehicles. Although work-related driver safety has been given increasing attention in the scientific literature, it is uncertain how well this knowledge has been translated into practice in industry. It is also unclear how current practice in industry can inform scientific knowledge. The aim of the research was to use a benchmarking tool developed by the National Road Safety Partnership Program to assess industry maturity in relation to risk management practices. A total of 83 managers from a range of small, medium and large organisations were recruited through the Victorian Work Authority. Semi-structured interviews aimed at eliciting information on current organisational practices, as well as policy and procedures around work-related driving were conducted and the data mapped onto the benchmarking tool. Overall, the results demonstrated varying levels of maturity of risk management practices across organisations, highlighting the need to build accountability within organisations, improve communication practices, improve journey management, reduce vehicle-related risk, improve driver competency through an effective workplace road safety management program and review organisational incident and infringement management. The findings of the study have important implications for industry and highlight the need to review current risk management practices.

1. Introduction

According to the World Health Organisation (WHO) 1.3 million people die annually as a result of road traffic accidents, which equates to more than 3000 deaths each day, globally. The economic consequences of motor vehicle crashes have been estimated to fall between 1% and 3% of the respective GNP of the world countries, reaching a total of over $500 billion annually (WHO, 2013).

In Australia, more than 30% of the traffic volume can be attributed to work-related vehicles. There is also evidence to suggest an over representation of injury when comparing work-related drivers with non-work-related drivers (Newnam et al., 2002). In terms of fatalities, work-related road traffic crashes are the leading cause of occupational death, with this figure estimated to be 33% of all work-related fatalities (Driscoll et al., 2005). In the Australian state of New South Wales, there are up to 5.3 fatalities per 100,000 registered fleet vehicles (generally referred to as light vehicles < 4.5 t; Haworth et al., 2000; Stuckey et al., 2010). This trend is not limited to Australian roads with work-related road traffic deaths estimated to account for 22% of work fatalities in the USA and 16% in New Zealand (Driscoll et al., 2005). Considering the social and financial implications of work-related road traffic crashes, there is an urgency to investigate the maturity of risk management in workplace road safety. Although work-related driver safety has been given some attention in the scientific literature, it is uncertain how well this knowledge has been translated to industry. This is due to two reasons. First, workplace road safety has not been well integrated within Occupational Health and Safety (OHS) system

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(Newnam et al., 2002, 2012). The work vehicle is now considered to be part of the workplace; however, there has been significant lag in the acknowledgement of this, particularly in light vehicle fleets (Newnam and Watson, 2011). Second, there is a lack of understanding regarding what constitutes 'best practice' in risk management. With the exception of a few case studies (e.g., Wallington et al., 2014) that describe effective fleet safety programs, there is limited research to guide practitioners in the establishment of best practice. The lack of evidence suggests that a deductive approach to risk management is unlikely to be effective in reducing workplace road safety death and injury; rather, an inductive process, whereby, industry practice guides scientific knowledge needs to be considered. To this end, this study focuses on exploring risk management through the lens of current benchmarking practices.

1.1. Benchmarking

"Benchmarking is a business excellence tool for finding, adapting and implementing outstanding practices". (Mooren, 2015, pp. 5). This process has received attention within Australia (Mooren, 2015) and internationally (European Union, 2010; Adminaite et al., 2015; Aeron-Thomas et al., 2002). Despite this, limited consensus of the practices that constitute effectiveness of a best practice criterion. An evidence-based approach provides greater predictive and explanatory utility as it aids in understanding the underlying mechanisms contributing to an organisation's success or failure in benchmarking (Watson, 2004). Building an evidence-based framework for benchmarking will not only result in increased implementation rates of effective safety practices in industry (Chen et al., 2016; Mooren et al., 2012), it also has the potential to improve the quality of decision making and therefore consensus, among researchers and practitioners.

Consistent with this thinking, there has been a recent move towards developing an evidence-based benchmarking tool in Australia by the National Road Safety Partnership Program (NRSPP). The NRSPP is an initiative that constitutes a network of organisations and academics working together to develop a positive road safety culture in Australia (Carslake and Van Dam, 2014). One of the core aims of this initiative was the development of a national fleet benchmarking tool. The first stage of the tool has been completed, which involved the development of an evidence-based framework to better illustrate best practice.

The NRSPP program tool was designed to allow organisations to measure their safety performance against a series of lead and lag indicators, and was developed and informed by the recommendations of the 'World Report on road traffic injury prevention and commission for global road safety' as set out by the World Health Organisation (Arboleda et al., 2003). The WHO report introduced 'five pillars' of road safety, with each pillar representing a set of activities that are recommended to be implemented at a national level. The approach aligns with existing road safety frameworks such as Safe, Vision Zero and Sustainable Safety, and maps out five pillars to guide national road safety plans and activities: building road safety management capacity; improving the safety of road infrastructure and broader transport networks; further developing the safety of vehicles; improving the behaviour of road users; and improving post-crash care (see Fig. 1). The current definitions set out by the WHO are detailed in Table 1. The results are categorised under each of the five pillars.

2. Research aim

The NRSPP framework provides an ideal benchmarking tool to examine the alignment between current practice and 'best practice' in workplace road safety risk management. The aim of the study was to map the current landscape of risk management in workplace road safety against the NRSPP benchmarking tool thereby, guiding practitioners in the development and implementation of risk management practices along with identifying opportunities for the improving current workplace road safety management.

3. Methods

3.1. Participants

A total of 83 organisations were recruited through the Victorian Work Authority (VWA), with recruitment also extending to organisations in metropolitan Sydney, New South Wales. The organisations ranged in size, from microbusiness (N = 1, 1%), small (N = 2, 2.5%), medium (N = 19, 23%) large (N = 8, 10%) to enterprise (N = 53, 64%). Table 2 presents a summary of industry type, as classified by the Australian and New Zealand Standard Industry Classification (ANZSIC).

A representative within the Occupational Health and Safety (OHS) and/or fleet management division of each organisation was approached to participate in a face-to-face interview. Job roles ranged from OHS managers, to fleet managers and quality managers (see Table 3). The majority of participants were male 61%

Table 1
World Health Organisation Definitions of the Five Pillars of Road Safety.

Pillar	Description	Definition
1	Road safety management	Adhere to and/or fully implement UN legal instruments and encourage the creation of regional road safety instruments. Encourage the creation of multi-sectoral partnerships and designation of lead agencies with the capacity to develop and lead the delivery of national road safety strategies, plans and targets, underpinned by the data collection and evidential research to assess countermeasure design and monitor implementation and effectiveness.
2	Safer roads and mobility	Raise the inherent safety and protective quality of road networks for the benefit of all road users, especially the most vulnerable (e.g. pedestrians, bicyclists and motorcyclists). This will be achieved through the implementation of various road infrastructure agreements under the UN framework, road infrastructure assessment and improved safety-conscious planning, design, construction and operation of roads.
3	Safer vehicles	Encourage universal deployment of improved vehicle safety technologies for both passive and active safety through a combination of harmonization of relevant global standards, consumer information schemes and incentives to accelerate the uptake of new technologies.
4	Safer road users	Develop comprehensive programs to improve road user behaviour. Sustained or increased enforcement of laws and standards, combined with public awareness/education to increase seat-belt and helmet wearing rates, and to reduce drink-driving, speed and other risk factors.
5	Post-crash response	Increase responsiveness to post-crash emergencies and improve the ability of health and other systems to provide appropriate emergency treatment and longer term rehabilitation for crash victims.

Source: (WHO, 2013).

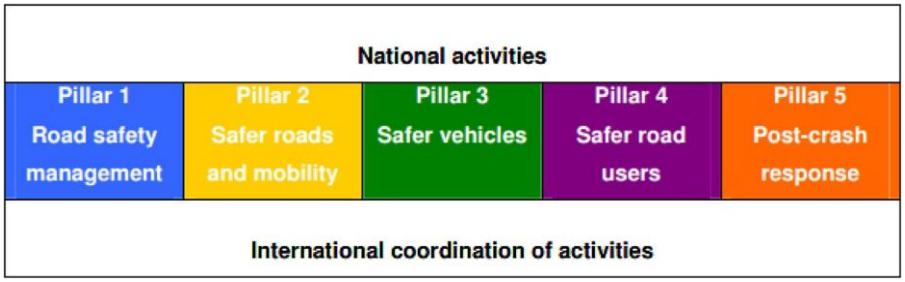

Fig. 1. Five Pillars of Road Safety (WHO, 2013).

Table 2
Frequency and percentage of industry type of the sample (n = 83 organisations).

Industry Type	N	%
Agriculture, Forestry and Fishing	2	2.5
Mining	0	0
Manufacturing	2	2.5
Electricity, Gas, Water and Waste Services	5	6
Construction	4	5
Wholesale Trade	4	5
Retail Trade	3	3.5
Accommodation and Food Services	0	0
Transport, Postal and Warehousing	3	3.5
Information Media and Telecommunications	4	5
Financial and Insurance Services	0	0
Rental, Hiring and Real Estate Services	0	0
Professional, Scientific and Technical Services	1	1
Administrative and Support Services	3	3.5
Public Administration and Safety	11	13
Education and Training	4	5
Health Care and Social Assistance	26	31.5
Arts and Recreation Services	0	0
Other Services	11	13

Note: Modal industry type was Health Care and Social Assistance.

Table 3
Job Title Categories within the Sample.

Job title category	N
Occupational health and safety manager	16
Environment, health and safety manager	12
Safety and risk manager	11
General manager	11
Fleet manager	6
Human resources manager	5
Finance manager	4
Director/Managing Director	4
Administrative/Support manager	4
Workers compensation manager	3
Quality manager	2
Other	3

with a mean age of 47.5 years (ranging in age from 35 to 55 years). There was an average organisational tenure of 7.75 years (range 0.5–35 years) and an average of five years in their current organisational role. Ninety-three percent of respondents were full time and the remaining part-time.

3.2. Procedure

This study was conducted as part of a larger safety project designed to identify the organisational determinants of work-related road traffic injury. Eligible organisations were identified by the VWA. The VWA provided a list of organisations where at least one of their employees had sustained a work-related road traffic injury as a result of a motor vehicle crash between July 2010 and end of May 2014.[1] Exclusion criteria included (i) types of vehicles as the primary 'agency of injury' including taxi, bus, tram, train, motorbikes, trucks, emergency service vehicles, other machinery driving/operating (ii) claims that listed a fatality (iii) organisations with head offices not in Victoria or NSW metropolitan regions (iv) fleet sizes of <5 vehicles (v) fleets primarily consisting of heavy vehicles (truck and buses), and (vi) driving schools or driver training schools (n = 111, 16%). Fig. 2 presents a flow chart of the recruitment process. Further fleet composition information is provided in Table 4 below.

Semi-structured questions were designed to elicited information on current organisational practices, as well as policy and procedures around work-related driving and how they were being implemented. Participants were asked a series of questions to assess the existence of practices (eg., licence checks), policies (eg., journey management) and procedures (eg., review of policy practices). Questions were also designed to 'probe' the level of maturity in the implementation of practices, policies and procedures. For example, if a participant identified that policy reviews existed, the interviewer asked questions such as 'how frequently are policies reviewed?' and 'are policy updates communicated to staff, if yes, how do staff acknowledge their understanding?' This process ensured both the standardisation of the interview process and an assessment of the variability in maturity across organisations."

3.3. Measures

Development of the interview schedule was based on a review of road safety risk management practices in Australia (Newnam and Watson, 2011) and internationally (European Union, 2010; Aeron-Thomas et al., 2002). The interview schedule also aligns well with international benchmarking efforts. The interview items underwent a two stage review process; the first stage involving content validation with experts in the field approached to review the items regarding clarity, appropriateness, and acceptability in the context of the interview respondents; the second stage involved a check for interpretability and fluency. The final interview schedule is presented in Table5.

3.4. Data analysis

The interviews were transcribed and coded using NVIVO10. The coding process involved the development of an initial coding list. This list was developed, in part, based on the categories of interview questions. The data were then analysed using thematic analysis. Themes, patterns and insights were documented, as well as identifying data that were unique or contradictory. This approach allowed new themes to emerge and, when necessary, triggered refinement of original themes (Bazeley, 2009; Pratt, 2009). For example, when

[1] These claims were limited to those above the minimum threshold of $680 and >10 work days lost.

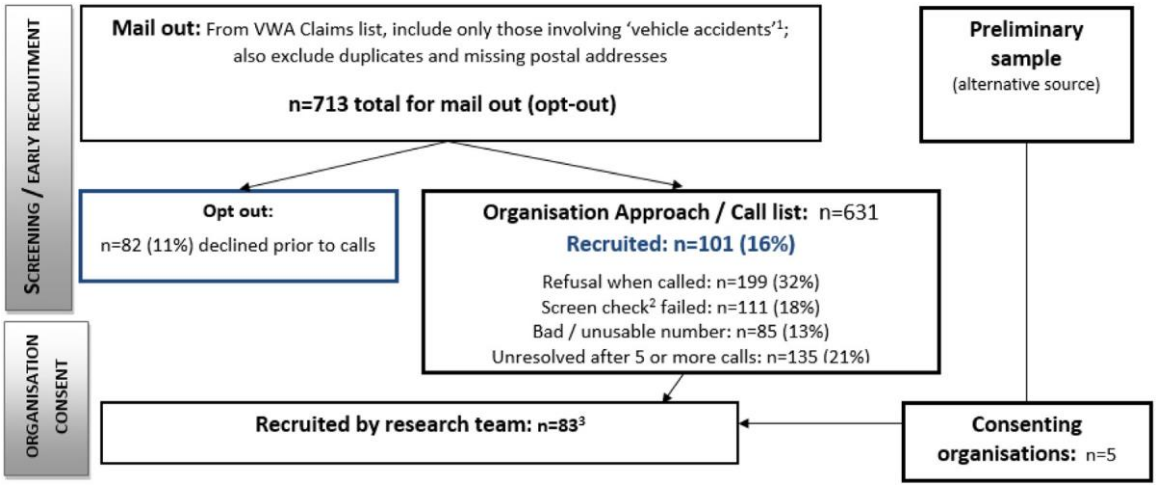

Fig. 2. Schematic representation of the recruitment process.

Table 4
Characteristics of fleets included in the sample of organisations.

	N	%
Vehicle Ownership Status		
Personally-owned, non-salary sacrificed	127	14
Personally-owned, salary sacrificed	31	4
Company owned/fleet	742	82
Full Personal use of Vehicle		
Yes	495	55
No	416	45
Top 5 Most Popular Vehicle Makes		
Toyota	268	23
Ford	184	16
Holden	108	9.5
Hyundai	102	9
Mitsubishi	41	4

Note: $N = 11$ missing values from vehicle ownership status, valid% are reported.

Table 5
Open ended questions or example probes used during interviews.

Category	Example question or probe
Crash system database	Does your organisation have a crash system database?
Selection and recruitment	Can you please talk me through recruiting and selecting new employees that have a driving role?
Induction and training	Can you please talk me through the induction process for new employees that have a driving role?
Procurement and maintenance of vehicles	During the procurement process, what do you look for in a car?
Work-life balance	Does your organisation have policies to help employees balance work and home life?

asked about work-life balance, many respondents made comment on practices, that allowed them to drive home to their families following long distance trips. Based on this information, fatigue management was identified as a theme. As themes and sub-themes were identified, consensus among team members was obtained through group discussions (Sofaer, 2002). Interrater reliability was established with a second member of the research team coding 10% of the transcripts. This validation exercise resulted in 97% agreement, with full consensus reached through discussion with the research team. The themes are discussed in a de-identified format to preserve anonymity of both respondents and participating organisations.

4. Results

Existing work-practices have been presented under each of the five pillars, including: road safety management, safer roads and mobility, safe vehicles, safe road users and post-crash response. Overall, the results showed varying levels of maturity in the existence and implementation of risk management practices in workplace road safety.

4.1. Pillar one: road safety management

Road safety management was focused on building accountability and responsibility within the organisation and how this information was communicated to staff. Variation in organisational size didn't seem to impact the results of pillar one i.e., larger organisations didn't perform better or worse than smaller organisations. The following will further articulate this definition.

4.1.1. Accountability

In the majority of organisations, there was no clear understanding of who was responsible or accountable for road safety management. One manager described their confusion: "Is it the employer? Is it their responsibility?"

Often this was the result of organisations viewing driving as a secondary job role. For example a nurse was considered a health care professional and not a work-related driver, such that, all aspects of the perceived primary role from recruitment to training reflected this distinction. As stated by one retail trade manager: "...we don't have specific driving roles, as in *that* is the person's job."

Three reasons emerged in the data that provided some justification for the ambiguity in the roles and responsibilities of individuals in the safety management of drivers. First, driving was considered the responsibility of the individual driver, rather than an organisation-level issue. One manager of a community service organisation stated: "You like to think that they are law abiding adults and quite clearly if there are infringements or issues, the staff are very accountable".

Second, there was a level of complexity reflected in the physical context of work-related driving. That is, work-related driving is a remote task, which is unique in that there is limited opportu-

Table 6
Characteristics of organisations based on frequency of policy reviews.

Frequent policy reviews	Infrequent policy reviews
Senior management commitment	Lack of policy enforcement
Experience of fleet manager	Lack of accountability (ie., no dedicated staff)
OHS committee meetings	Lack of employee engagement in OHS
Incident reporting and data analysis	Irrelevant and/or out-of-date policies

nity for managers to supervise the performance of their staff. To illustrate this issue, one manager in a community service organisation discussed this difficulty, stating: "Enforcement is an interesting concept when there's no one there to supervise people".

Third, a lack of senior management (i.e., CEO level) support was seen as a barrier in most organisations. For example, one health care organisation manager expressed their frustration at the CEO not supporting safety initiatives: "When the CEO says, 'oh they don't have to do the audits this month'. . . I just don't think that's good enough."

4.1.2. Key performance indicators and policy reviews

The types of issues discussed included KPIs, policy reviews and communication practices. A small number of participants discussed the existence of KPI indicators such as having a valid drivers' licence or demerit points. For example, the manager of a large telecommunications provider described how they tied these KPIs to upward mobility: ". . .there are KPIs that the driver's manager has to check every six months, just to make sure that the driver still holds a valid licence, and hasn't lost it through demerit points or anything like that. It's actually the driver's responsibility to provide that information either as print out or mailing form from the relevant government body."

Overall, the data showed that it was uncommon for driving performance to be included as a KPI for staff or for it to be considered during assessment for promotion. However, this finding should not be surprising considering that, as discussed above, driving was considered as a secondary task in most organisations

Policy reviews were also discussed as a road management strategy. Some organisations did bi-annual or annual reviews and others had not reviewed such policies in many years. A trigger observed for policy reviews was a new leader or manager driving organisation change. One manager commented: "There is a draft version of the policy which is where the CEO's come back from leave which includes a new section which requires drivers of company vehicles to inform us if their licence is suspended or cancelled. . ." Another manager discussed a recent change in CEO: "[name removed] who was the CEO prior to [name removed] starting, he spent a lot of time on that. And he went out to sites and visited and saw what we had and then changed it. So it's been a big change in driving safety".

To better understand enabling and inhibiting factors of policy reviews an analysis of organisational characteristics based on the frequency of policy reviews is presented in Table 6. As the interviews were semi-structured, not managers interviewed discussed policy reviews. From the organisations that did disclose details of policy reviews, this was found to be a bi-annual or annual process. Hence a timeframe of frequent (<1 per year) and infrequent (>1 per year) was used to identify the discriminating factors. Each factor outlined in the table below was identified by a minimum of three (3) organisations as a contributing factor to having completed or not completed a policy review. This table shows that safety leadership, shared accountability (i.e., OHS meetings) and technology contributed to more frequent policy reviews. The reasons cited for less frequent reviews included a lack of accountability (by an individual or shared) and a lack of human resources to manage the review process.

Table 7
Formal communication mechanism listed by channel or type and the method of delivery explained.

Channel	Method of Delivery
Face-to-face	Toolbox talks, Kick-off (daily agenda) meetings, and OH&S committee meetings
Hardcopy	Flyers, mail, affixed to payslips
Hardcopy & Electronic	Newsletter, notice boards i.e., RSS feeds
Electronic	Intranet including systems such as WIKI, website, emails, memos i.e., safety alerts, in-vehicle telematics, incident reporting system e.g., RiskMan, Mango
Telecommunications	SMS, two way radios, telephone

4.1.3. Road safety communication

The majority of organisations discussed the existence of formal communication strategies. Table 7 below outlines the communication mechanisms for safety-related messages participants discussed during the interviews. As can be seen, multiple channels and methods of delivery were employed by organisations, with the greatest number of specific delivery methods via the electronic channel. The frequency of communication ranged from daily, weekly, fortnightly, monthly, to annually. One site supervisor stated ". . .the guys who drive for us are spoken to literally every load before they go out. So there's communication going on literally all the time."

Communication was primarily reactive, i.e. driven by incidents or events evoking a post-incident learning. For example, if something happened or an organisation was seeing a lot of parking fines, they would make communication relevant to parking fines. In the majority of organisations, the dissemination of communication was driven by a top-down approach. To illustrate, in many organisations senior management scheduled meetings and supervisors were briefed on the meeting outcomes, such as a policy change, and supervisors were subsequently tasked with disseminating this information 'downward' to drivers. This was particularly true of medium sized organisations which placed strong emphasis on the role of supervisors. In most organisations, it was uncommon for information from meetings or reports to be given directly to drivers. One manager explained: ". . .it would be made through the supervisors. And they would do it during a team meeting or an ad-hoc team meeting." The data showed there was greater group consensus and discussion related to safety in smaller organisations; this finding likely reflects the capacity to coordinate discussion among smaller as opposed to larger groups of employees.

4.2. Pillar two: safer roads and mobility

Safer roads and mobility reflected how organisations manage risk when staff drive for work-related purposes, particularly in regards to fatigue management, driving conditions and points of contact. Overall, there was large variability in journey management across industry type. This variability appeared to be influenced by an organisations' core business activity and the driving environment.

In regards to core business activity, it was found that organisations employing drivers as part of their core business activity (e.g., courier services) had greater documentation around journey management, including fatigue restrictions, temporal driving guidelines, points of contact and expectations in regarding to the safety management of drivers. For example, one manager described their approach to decreasing exposure by improving journey management: "They all do planning, they know where they need to go

in advance to all of their site inspections and things like that. So they would be working and I'd certainly be working with them to say okay there's no point driving from here, all the way over to the other side and back again. You'd obviously cluster your jobs you know for that day or this week to this region and that type of thing as well".

In contrast, organisations that viewed driving as a 'secondary' function of an employee's day were given little or no documentation regarding journey management and staff were generally expected to manage their own workload and day-to-day trips. This was well illustrated by a quote from one manager: "I'd see it [journey management] as more ad-hoc driving than a fundamental part of their role." This was also true of more senior staff who were given greater autonomy. This variability across industry type was particularly evident in approaches to fatigue management, points of contact including technology use, and driving or environmental conditions.

4.2.1. Fatigue management

The data showed that the majority of organisations did not have a formal policy on fatigue management. This finding was not surprising considering that light vehicle fleets have not been subjected to the same regulations in relation to fatigue management as the commercial vehicle industry (i.e., trucks; Adams-Guppy and Guppy, 2003; Arboleda et al., 2003). In the majority of organisations fatigue management was considered to be at the discretion of the workgroup manager. That is, where formal policy was not provided, arrangements such as staying overnight would be made on a case-by-case basis whereby the driver would need to directly report symptoms of fatigue to a supervisor. An electrical and water services organisation illustrates this issue: ". . .it's only really by them discussing it [fatigue] with their manager. . . If they want to, obviously if they need to be home for something we would say okay but make sure you stop and take regular breaks or maybe catch the train or look at other options to get yourself there."

4.2.2. Driving environments

The data showed that journey management was more targeted within organisations which had staff driving in potentially extreme environmental conditions, such as rural areas. In these situations, senior management had greater involvement and responsibility in risk management, for example, preparing for the drive by carrying water and food, sun protection, the use of safe road networks, two way radios, global positioning systems (GPS) and buddy systems. A community service organisation manager stated: ". . .we don't encourage people to be driving alone anyway so there's a second person. But it doesn't help you if you've got a second person if you're stuck in the fringe or in the middle of a desert and there are no other drivers going past. So yeah there are some real challenges for us."

4.2.3. Points of contact and technology

The data showed that when management were more involved in journey management, this generally included setting up points of contact. Technology, in particular, was shown to impact the management of journeys and the points of contact. For example, some organisations used SMS warning systems, particularly for bush fire prone areas. These systems sent a fleet wide SMS advising of the dangerous route to avoid. One manager also discussed a belt worn by staff: "So when they get to a site they push this 'I'm okay' button which sends an SMS back to their manager including GPS co-ordinates and there's an SOS button. And then when leaving the site, they message as well. . ."

4.3. Pillar three: safe vehicle

Practices within this pillar related to procurement and maintenance practices designed to reduce vehicle-related risk. Three themes were identified under this pillar including: ANCAP safety rating was the most widely used and accepted vehicle safety and procurement criterion; Manufacturer's specifications' was the most widely used maintenance practice, and; Vehicle turnover was becoming less frequent across industry types.

4.3.1. ANCAP rating key criteria in industry

In the majority of organisations, the ANCAP rating was the most widely used and accepted safety criterion for vehicle procurement. All organisations required a four or five star rating, most requiring five star, with the exception of one organisation which allowed commercial vehicles to be three star rated (i.e., tool of trade utes). One manager stated: "Five star and we have got contracts and they won't accept anything less than five star. So we're governed by that." This aligns well with European benchmarking findings which identify wide use of EuroCAP.

Although safety, as measured by the ANCAP rating was considered of primary importance, cost of the vehicle was also a key consideration. One manager stated: "I presume safety would be the number one and/or cost." Additional procurement criteria that were represented in multiple interviews included size, economy, environmental efficiency (i.e., emissions), ergonomics, office location (i.e., rural versus metro), country of manufacture, Bluetooth, staff perspectives, recommendations from a fleet provider, organisational client needs or requests (i.e., security companies or mining companies) and 'fitness for purpose'.

4.3.2. Vehicle turnover

As mentioned previously, cost was a significant consideration in vehicle procurement and turnover. The majority of organisations cited that they were keeping their vehicles for longer periods of time, with transitions ranging from 2 to 3 year periods to up to 4–5 years. The manager of an educational institution concludes: "[vehicle turnover] used to be based on the policy, we replaced the cars every 3 years. . . we're not observing that at the moment, we're basically replacing things when we need to replace them. . .we've got a couple of 4 year old Corollas they've got 60,000kms on them. They're in perfect condition, there's nothing wrong with them, and we're not going to replace them." In fact, some specialist vehicles such as tool of trade vehicles or buses were kept for up to 12 years. Instances where additional modifications were made to a vehicle (e.g., additional shelving or custom cargo holds) meant that the vehicle was more likely to be owned than leased and generally kept for longer before turning over due to capital investment and resale value. The manager of an agriculture, forestry and fishing organisation said: ". . .so a hybrid vehicle is great for branding, terrible from the bank balance side of things. So why get a Toyota Camry hybrid when you can get 3 Kia's for the same price? That's the reality."

4.3.3. Maintenance of vehicles

The majority of participants stated that maintenance of the vehicle was completed to 'manufacturer specifications'. In only a few organisations, it was stated that the drivers were held accountable for servicing; this occurred more frequently when drivers had dedicated vehicles (i.e., as opposed to pooled fleet vehicle). There was a lack of consensus among organisations as to who should be responsible for vehicle maintenance process e.g., recording completed services. In one interview, two managers had a conversation with each other regarding responsibility in the maintenance of vehicles:

I: "and who enforces the servicing of vehicles. . . who check's that it's been done?"

R1: "um, I don't think we do?"

R2: "well *you do*!"

It was also noted that there appeared to be greater rates of servicing documentation and compliance in organisations that used technology to assist in risk management. A good example of this was the use of a web based application that would send reminders when services were due. This finding aligns with the previous discussion relating to a lack of consensus around responsibility for road safety management (pillar one). Additionally, fleet managers or officers often cited the positive benefits of such electronic systems such as reduced workload.

4.4. Pillar four: safe road users

Practices within this pillar focused on driver accountability, including licencing as a competency, driver history, induction, recruitment and driver behaviour and training.

4.4.1. Licencing

The majority of participants stated that potential drivers would be asked whether they had a licence during the recruitment process. However, the verification process was highly varied. For example, in some organisations, there was no process to verify a licence, while other organisations maintained licence status, expiry and points in an electronic system which would notify via email when renewals were due or points were low. One manager discussed the renewal process in his organisation: "So it's up to the individual if they renew it [their licence], to drop it in [to the office]. But generally they [the drivers] don't, so yeah."

There was also a large degree of variability in the auditing of licencing. For example, one manager stated: "Audited. No. Required to provide updates. Yes. It's up to the employee to notify their managers and then move it up the hierarchy to say, 'Look I've got X amount of points and I've got this.' So the onus is on the driver to notify of any changes."

Other pre-employment checks conducted by organisations included health checks i.e., vision tests, in-vehicle competency assessments, and drug and alcohol screening. While the former were not very common, police checks were common (however, this may have been due to the number of community service organisations recruited). Depending on the role e.g., delivery driver, there may have been physicality requirements, for example, fitness or height requirements.

4.4.2. Driving history

The majority of organisations did not ask about a candidate's driving history. In fact, in some cases there was an intentional aversion to questions related to a previous driving behaviour for reasons around talent scarcity. One manager commented: ". . .it's hard enough in this industry to attract the right people as it is so that's sort of. . . if we were more strenuous we'd just probably be more stringent and it would just make it difficult to get the right people."

The issue of perceived discrimination and being an equal opportunity employer was also considered an important factor in the recruitment of drivers. For example, two managers' comments were: ". . .but then you think if they've got their licence then there's things they have to be able to do to get that licence. And that's hazard perception. And then are we just doubling up on that? Because you wouldn't get your licence without doing those hazard perceptions and. . . I know. It's like, well, where do we stop and that starts? Are we the police?. It's about finding that balance, I think, and also not being discriminatory as well because it's quite important that we don't discriminate. You know it's legislated and so we have to be quite careful." The second manager of an education institution stated: ". . .you can't necessarily discriminate against putting someone in that position because they don't have a driver's licence. Because it's not really a core requirement."

4.4.3. Recruitment and induction

For the bulk of organisations, the recruitment process was the same, regardless of whether the person drove for work or not. That is, very few organisations had a dedicated recruitment process for the driving role. For example, one manager stated: ". . .the only things we would do differently is just state in their position description that the role would involve driving and/or a lot of offsite work. I guess which would imply driving." Following recruitment, the majority of organisations completed some form of site induction. However, there was variability across organisations, particularly as a result of the core business activity of that organisation. In some cases, there were procedures to induct staff on issues such as servicing, maintenance, accident procedure, authorised drivers, and logs, while in other organisations there was no formal induction process. In one organisation, the manager was unaware of any policy: "I don't know, I would say I suspect not, although you would hope that there's some kind of explanation of practice to them, before they start driving. I suspect now, I suspect that if somebody's got a valid driving licence, I presume that's okay." Another manager was also unsure: "Yeah so I had to check this one with our finance staff who actually manage the fleet vehicles and they said that they don't do anything specifically."

In the majority of organisations, there was no vehicle induction. One reason for this appeared to be reflected in the perception that if the person had a licence, they could drive a car; thus, vehicle induction was not considered necessary and that this process could be perceived as 'babying' or 'preaching' to adults. For example, one manager stated: "Without then creating the problem of telling someone that's driven a car like that a million times before, they own one. You don't want to go to the extent of babying everyone because as soon as you start babying and go oh look I know how to drive and all that".

In those organisations which did have a vehicle induction, this process was undertaken at the discretion of the supervisor or fleet manager: ". . .on the induction checklist there are certain policies that are highlighted that we expect that they will read. Again, depending on the area, sometimes it is just asking them to do it, and hoping that they've done it."

4.4.4. Driver behaviour and training

In the majority of organisations, it was assumed that staff would 'follow the road rules' as they were deemed as competent drivers, according to the regulatory authority. One manager stated: "So we assume by having their licence they have the competency to drive a vehicle safely."

Only a few organisations employed external driver training programs. Reasons for the lack of training were cost, lack of information (e.g., effectiveness of different training programs, types of training programs), logistics (i.e., time-management, decentralised companies) and lack of senior management support. These issues were highlighted in the following discussions with managers: "One company suggested, that they do observational training. But with 200 fleet drivers it's just not practical to try to. . . from a cost perspective and also from a logistics. . . we're in a bit of a quandary with training. It's just hard, yeah." The second managers' comment: "They are not always cheap but at the end of the day you want a quality program so I think it is good because overall it can assess the needs, implement some actions. One thing that we don't do is look at the follow up about the effectiveness of those programs." A very strong trend toward online training or e-learning modules was found in the sample. Senior management and supervisor support for training were

often cited as important. For example: "It's left up to discretion of that cost centre manager."

4.5. Pillar five: post-crash response

Practices within this pillar included policy and processes following an incident including reporting, investigation and infringements. Overall, the data revealed that incident reporting was being completed in the majority of organisations; however, training to accurately report an incident was limited.

4.5.1. Incident reporting

The majority of organisations had some type of incident reporting system. These systems included information about the driver, vehicle, who was at fault, location, and other vehicles involved. Some organisations also recorded crash cause, task, time of day and near misses. In particular, online systems (e.g., risk management software or spreadsheets) were frequently used, for example, Riskman, Mango or Excel. Only a small number of organisations stated that reporting was completed exclusively by their insurance company.

The data showed that the majority of organisations completed monthly reporting from incident databases, mostly in the form of trend analyses. Organisations disclosed that they produced reports with varying frequencies including weekly, quarterly or annually. These reports were generally discussed at management meetings or OH&S committee meetings and only in a few cases were the reports given to a senior manager or the CEO of the organisation for review and feedback.

Training employees how to report incidents was limited. However, if a new system had been implemented staff were generally trained on how to use that system. It was evident that there was significant underreporting, due in part to a lack of training. One manager described the difficulties around incident management: "Because sometimes people aren't sure. 'Do I report that? Is that an incident?"

4.5.2. Infringement management

The majority of organisations recorded infringements. However, there was a lack of oversight in the management of these incidents. For example, in most organisations infringements were sent directly to a financial or administrative office and never seen by fleet managers or supervisors. One manager commented: "...if there was someone that was constantly infringing and we were concerned, then we'd talk to them...there's nothing formal in policy." There were exceptions, for example, in one organisation the driver received a personal letter signed from the CEO. Another organisation gave infringement notices to supervisors rather than staff directly, this practice reportedly resulted in a 50% reduction in the number of infringements received. There was a distinction by organisational size, such that, smaller organisations in the sample tended to track infringements very closely and mostly deal with the rule violator directly.

4.5.3. Incident investigation

Incident investigation tended to be reserved for 'serious' incidents such those involving personal injury and/or asset damage. A small proportion of organisations conducted incident investigations (e.g., root cause analysis) internally while many seemed to rely on insurance investigators or reports. Organisations and insurers were primarily interested in at fault collisions.

5. Discussion

The aim of the paper was to define and map current industry work-related driver practices against the NRSPP benchmarking tool. As part of this process we sought to identify the maturity of organisations, focusing on their policies and practices in risk management and the depth of development and implementation of these practices. The strength of this study was that it offered significant insight into the risk management practices in a range of small, medium to large organisations. Overall, we identified a number of risk management practices that aligned with the NRSPP benchmarking tool. A key finding was the capacity of smaller organisations to communicate more directly and with less latency than larger organisations. Albeit, larger organisations were better utilising technologies, but there was limited evidence to suggest the integration of the data from the technology into driver safety management practices. Several other key findings were identified within each pillar.

Pillar one findings suggested opportunities for improvement, particularly in relation to the clarity of the employees' roles and responsibilities, a lack of safety performance indicators, and communication practices. There was evidence to suggest ambiguity in role definitions of management including accountability and responsibilities regarding driver safety. One reason for this was because driving was considered a secondary job task. This is consistent with previous research that has found that driving is seen as a secondary task in the work-related driver field (Lynn and Lockwood, 1998). A second reason for this finding was that drivers were primarily seen as accountable for their own safety and that management commitment to safety initiatives was low. There was also evidence to suggest a lack of formal roles and responsibilities in the safety management of drivers and commitment to the consistent implementation and evaluation of initiatives. Previous research has demonstrated that shared ownership for driver safety between management and drivers was associated with better safety outcomes (Banks et al., 2010). These findings suggest a need for improved role clarity in organisations and clear communication of accountability within the role. This aligns with previous research which demonstrated greater role clarity positively influenced individual safety behaviour (Neal et al., 2000).

In regards to safety performance indicators, a key finding of the research was that driving performance was generally excluded from assessments for promotion, including KPIs. This finding suggests that supervisors and senior managers who have been promoted without criteria for safety performance may not consider safety a priority within their organisation; thus, safety practices are less likely to be embedded within the work role. Given that past research has established a relationship between the extent to which safety is embedded within daily practices of supervisors and safety outcomes, including performance (Neal and Griffin, 2006) and injury rates (Zohar, 2002), this finding suggests a need for organisations to include a criteria for safety performance in performance appraisals for upward mobility.

This study identified opportunities for improvement in communication practices in workplace safety. For example, it was found that some organisations do not engage in face-to-face meetings regarding safety. Previous research has demonstrated that drivers, whose supervisor engages in more frequent safety-related discussions, reported safer driving behaviour (Newnam et al., 2012). Thus, organisations must ensure that safety policy and procedure are understood, and risks and safety-related messages are accessible across organisational levels using a range of formal communication methods.

Pillar two results suggested there were opportunities for greater development of maturity in safer roads and mobility. There was evidence to suggest that organisations were adopting technology for journey management, particularly large sized organisations who most likely had the budget. However, there was limited evidence to suggest that organisations were integrating these systems in their reporting processes, as well as a lack of evidence

to suggest evaluation of their effectiveness. The results also suggested that the vast majority of organisations did not monitor their employee's daily road trips, including duration; this included the oversight of fatigue management. The exception to this finding was organisations which employed individuals to drive in rural setting or where the organisation's need for efficiency (i.e., couriers) demanded planning and oversight. These findings suggest that journey management in all driving conditions is an avenue to improve workplace road safety management programs.

Although the findings were mixed, Pillar 3 (safer vehicles) showed the strongest evidence to support the existence of risk management practices in workplace safety. In particular, there was evidence regarding the widespread use of ANCAP rating systems and increased technology use to manage vehicle maintenance. The safety benefits of a five star crash tested vehicle have been consistently demonstrated (ANCAP, 2016). The results also identified a strong trend toward organisations using technology to manage vehicle maintenance. The organisations using electronic systems to manage vehicle maintenance reported greater compliance with vehicle maintenance than organisations in which there was no system in place (or those in which the driver was given primary responsibility). This finding suggests that using technology to manage vehicle maintenance activities may improve safety through increased compliance.

In contrast, opportunities for improvement were identified within this pillar. While some organisations reported conducting risk assessments to determine individual driver's vehicle needs e.g., modifications based on a driver's height, there was also evidence to suggest that organisations had decreased the frequency of vehicle turnover rates, stating financial concerns as the reason for this decision. In support, a report from Curtin-Monash Accident Research Centre (C-MARC, 2013) demonstrated that across private, government and corporate fleets the vehicle age distributions showed an increasing modal age; an average age of six years for private fleets, two years for government and one year for corporate fleets. Of these three fleet types, private fleets had the worst crashworthiness rating, reflecting their higher average age. The safety implications of this practice need to be investigated further. One potential avenue may be analysing existing data such as the used car ratings system.

The results also suggest opportunity for improvement in the safety practices within Pillar 4 (safer road users). This conclusion was based on the finding that the majority of organisations had not implemented practices in relation to staff induction and training. This finding appeared to be partly driven by the perception that competency could be determined by drivers holding a current, valid licence. The perception that a driver's licence represented a blanket competency for drivers appeared to influence organisational investment in external training providers, such that, many believed that training was an unnecessary cost. Recruitment, induction and training have been identified as key elements of an effective workplace road safety program (Newnam and Watson, 2009); thus, the findings of this study suggest that organisations have opportunity to further improve the safety management of work-related drivers in this area.

The results showed opportunity for improvement in incident reporting and investigation (Pillar 5). Identifying that few organisations had implemented incident reporting and incident response practices related to driving incidents. Of particular concern was that many organisations could not define a workplace road safety incident and the threshold for reporting. The safety issue associated with this lack of knowledge is that it is possible there is under or incorrect reporting in organisations.

Furthermore, for those organisations with incident reporting practices in the area of work-related driving, there was a tendency towards using technology i.e., electronic incident reporting. Although these systems have the potential of standardising the process, there was a lack of evidence to suggest that the data collected were been used for the purposes of safety management; rather, the information was used for targeting repeat offenders for disciplinary action or reporting for insurance purposes. There was also limited evidence to suggest that there was adequate training provided on the utility of these systems. These findings suggest that there is limited opportunity for organisations to learn from these incidents to improve safety (Jacobsson et al., 2012).

Another opportunity for improvement related to the management of infringement notices. This study found that infringements were typically sent to an administration department in the organisation, as opposed to the person accountable for the safety of the driver (i.e., supervisor or safety manager). This finding presents a potential opportunity for improvement as the supervisor of a driver has been to play a critical role in managing the safety of drivers (Newnam et al., 2012). Although anecdotal, one organisation in this study found that by sending infringement notices to supervisors rather than drivers themselves resulted in a 50% decrease in the number of infringements received. Furthermore, a medium sized organisation reported a 64% drop in infringements and 34% reduction in accidents through building greater accountability.

5.1. Practical implications

This study has provided a unique insight into the landscape of workplace road safety management in Australia. The results highlighted the need for a review of current risk management strategies as well as an opportunity to explore the development of new initiatives that target a reduction of death and injury in this safety critical domain. Three themes emerged in this study.

First, there was a lack of management commitment to safety. The results identified a lack of standardised and implemented practices related to journey management (i.e., fatigue), road users (e.g., training, induction to the vehicle) and post-crash response (i.e., incident reporting). To minimise the risk of work-related driver injury, formalisation of policy and procedure is required by organisations, particularly in regards to roles and responsibilities of supervisors in the safety management of drivers (i.e., Newnam et al., 2012; Newnam and Oxley, 2016).

Second, this study related to risk management practices in licencing requirements. The commonly held perception was that licenced drivers are competent to drive without additional training or instruction is twofold. Firstly, it reveals a need for systems to validate (e.g., manual versus automatic) and maintain (e.g., expiry dates) licences and manage infringement notices (i.e., ensure a licence is not invalid due to demerit point accumulation). Secondly, it requires organisations examine the requirements of a driver's role which may extend beyond holding a current, valid licence. In order for that organisation to provide training for that specific role requirement e.g., driving with a trailer is isn't covered during a drivers licence test but may be required of a work-related driver.

Third, there was a reliance on the use of technology in the context of fleet maintenance, incident reporting and communication practices. This includes the growing number of organisations using telematics as a risk management strategy (Newnam et al., 2014). While it must be acknowledged that technology plays a prominent role in the future management of safety within this context – particularly in regards to addressing the challenge of the 'visibility' of driving performance – there was evidence to suggest that the data were not being used to optimise safety through learning (particularly through incident reporting and investigation practices). There is strong evidence to suggest that human interaction, particularly the interaction and communication between supervisors and drivers, plays a key role in driver safety outcomes (Newnam et al., 2002, 2012).

As such, to optimise the safety benefits of this technology organisations need to consider methods of integrating data produced by technology into the daily safety management practices of supervisors. With consideration to these implications for industry, it should be recognised that the methods of recruitment and sampling used in this study may have introduced some bias, such that, an organisation with some interest in the safety management of work-related drivers would be more likely to participate than an organisation without any concern for safety practices. Without this bias, we may have seen lower maturity with respect to safety practices in this context.

Two limitations of this study needs to be addressed. First, we were unable to recruit organisations with no reported injuries in the sample time period. Including these organisations would have allowed a comparison of risk management practices between organisations with reported injuries. A second limitation relates to the representativeness of this sample. The majority of organisations that participated in this study were health care and social assistance organisations (eg., allied health employees, community nurses). It is possible that the bias in industry category may reflect the culture of the industry. That is, organisations whose operational activities are oriented towards the concern for others health and wellbeing). Thus, this context which may have contributed to a more positive reflection of the landscape of risk management in workplace road safety. Future research could overcome this limitation by using a stratified sampling approach.

6. Conclusion

This study is the first to explore the landscape of workplace road safety risk management in Australia; thus, the findings are unique in that they provide insight into the safety practices in an industry that has received limited academic attention. This research reinforces how workplace driver safety is not well integrated with organisational OH&S and the specific areas highlighted for attention include (i) accountability (ii) journey management (iii) vehicle procurement and maintenance (iv) licencing and driving history (v) recruitment and induction (vi) driver behaviour and training (vii) incident reporting and investigation and (viii) infringement management. The findings highlight that Australian organisations need to place greater emphasis on risk management practices in the workplace with respect to road safety. The results not only guide practitioners in the development and implementation of an effective fleet safety program, but they provide baseline data for assessing change in workplace road safety in Australia. That is, the data used from this study could be used to develop a survey that assesses maturity in risk management practices over time.

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Chapter 3 discussed how employers have traditionally focused on risk management practices to manage the behaviour of drivers. Despite this, chapter 3 demonstrated how greater maturity is still required to support safety in the workplace. Relying on risk management is limited in that risk management alone cannot control for the range of factors influencing safe driver behaviour. Thus, Chapter 4 explores the individual human resource management practices that support and constrain safety behaviour in organisations. The results demonstrated that some management practices (selection, communication and job and work design) predispose drivers to unsafe driving practices, while others (i.e., remuneration) support safe driving behaviour but only when safety is valued and prioritised. The findings from multi-level modelling study are presented in a journal article entitled, "Do management practices support or constrain safe driving behaviour? A multi-level investigation in a sample of occupational drivers". It has been published in Accident Analysis and Prevention.

Chapter Four

Monash University

Declaration for Thesis Chapter 4

Newnam, S., **Warmerdam, A.,** Sheppard, D., Griffin, M., & Stevenson, M. (2017). Do management practices support or constrain safe driving behaviour? A multi-level investigation in a sample of occupational drivers, *Accident Analysis & Prevention, 102, 101-109.* DOI: 10.1016/j.aap.2017.02.007

Declaration by candidate

In the case of Chapter 4 (i.e., paper three), this paper was part of the larger NHMRC project which was conceptualised by the CI team, the nature and extent of my contribution to the work involved the following:

Nature of the contribution	Extent of the contribution (%)
Second author responsible for the data collection, data analysis, interpretation and writing up of results, and contributing to discussion and recommendations	50

The following co-authors contributed to the work:

Name	Nature of the contribution	Extent of the contribution (%)
Dr. Sharon Newnam	Contributed to the concept and design of the study, and wrote sections of the manuscript	30
Dr. Dianne Sheppard	Contributed to the concept and design of the study, and critically reviewed the manuscript	10

Prof. Mark Griffin	Critically reviewed the manuscript	5
Prof. Mark Stevenson	Critically reviewed the manuscript	5

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the candidate's and co-authors' contributions to this work.

Student signature: [redacted] **Date:** 9 May 2017

Main Supervisor signature: [redacted] **Date:** 9 May 2017

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Do management practices support or constrain safe driving behaviour? A multi-level investigation in a sample of occupational drivers

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It has been estimated that one-third of all work-related deaths occur while driving for work-related purposes. Despite this, many organisations are unaware of the practices, beyond those that identify and control the impact of unforeseen events (i.e., risk management), that predispose drivers to risk. This study addresses the issue by identifying the management practices operationalised as, High Performance Workplace Systems (HPWS) that influence safe driver behaviour. The study also explores the value given to safety by senior level management as a moderator of the relationship between HPWS practices and driver behaviour. Each factor was tested within a two level hierarchical model consisting of 911 drivers, nested within 161 supervisors and 83 organisations. The findings highight that under conditions of high investment in job and work design, communication and selection practices, drivers reported poorer driving behaviour. An interaction effect also demonstrated that under conditions of high investment in remuneration, drivers reported safer behaviour, but only when they perceived that managers valued and prioritised safety. The findings challenge current thinking in the management of workplace road safety.

1. Introduction

Road traffic injury is the leading cause of work-related death in Australia. It has been estimated that one-third of all work-related deaths occur while driving for work purposes (Driscoll et al., 2005). This emerging public health issue is not unique to Australia, with work-related road traffic deaths estimated to account for 22% of work fatalities in the United States and 16% in New Zealand (Driscoll et al., 2005). Despite this, many organisations employing individuals to drive a vehicle as part of their work are unaware of the factors that may act to reduce work-related road traffic injury and deaths.

Research has demonstrated the relationship between a positive safety climate and safer driving behaviour. Although this knowledge has advanced preventive activities (eg., cultural change programs; Newnam et al., 2012), safety goals can conflict with other organisational imperatives such as profitability. Both goals are important but can make competing demands upon limited resources (Rasmussen, 1997). It is not clear how organisational practices that enhance overall performance relate to the driving safety of employees. On the one hand, management practices that improve performance might have a positive impact on employee work safety (Zacharatos et al., 2005). On the other hand, employee driving activities are often poorly integrated with other work practices (Newnam et al., 2008), so investment in better work practices might create competing demands with safer driving.

The current study investigates management practices that have been found to support performance-based activities in the organisation, namely High Performance Workplace Systems (HPWS). HPWS practices have been defined as distinct but interconnected human resource management practices that are designed to maximise individual employee contributions. This study aimed to address this issue by exploring a range of HPWS that are capable of supporting or constraining safe driver behaviour. This study also explored how drivers' perceptions of the value and priority given to safety plays a role in creating safe driving practices.

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1.1. Importance of the organisational context

Better understanding of the organisational factors influencing a safe working environment is critical to our ability to reduce work-related road traffic injury and deaths. In recent years, a growing body of research has emerged demonstrating that leadership is a key factor in supporting organisational performance and that effective safety leadership has a positive influence on supporting safe performance, and the prevention of incidents and injuries in high-risk industries (Donovan et al., 2016). For example, the quality of management practices within organisations have been linked to reduced injury rates (Zacharatos et al., 2005). However, these processes might not apply in a context where performance (ie., driving activities) falls outside typical line-management responsibilities and are often supervised by a person (e.g., a fleet manager) who is not part of the same management structure associated with other work roles. That is, fleet managers are traditionally employed to manage the risk associated with the asset (ie., the vehicle), not the behaviour of the personnel operating the asset (Newnam et al., 2008; Warmerdam et al., 2017).

There is evidence that in order to achieve reductions in work-related road traffic injury, it is necessary to focus beyond an individual's compliance with safety procedures (Newnam et al., 2012; Stuckey et al., 2007; Wills et al., 2009). Stuckey et al. (2007) proposed a systems framework for light vehicles in the workplace with five potential determinants of crash, injury and fatality. These elements, located at different levels within the systems framework included locus of injury, physical work environments (immediate and external), organisational environment, and the policy environment. Research has supported this model by showing that behaviour within this environment is strongly influenced by a system of inter-linked contexts operating at multiple levels within the organisation. For example, it has been demonstrated that drivers' perceptions of the value and priority given to safe driving by their supervisors predicts crashes (Newnam et al., 2008). The frequency of exchange of safety-related information between supervisors and their drivers has also been found to predict safe driver behaviour (Newnam et al., 2012). This research supports Stuckey's model by showing that leadership within the workgroup context contributes to creating a safe driving environment.

Research is yet to demonstrate the impact of leadership at the senior-management or organisational level. This context is characterised by the promulgation of policies, procedures and practices designed to guide role-behaviour expectancies at all levels within an organisation. The paucity of research exploring organisational-level influences on workplace road safety may, in part, be attributed to the challenges inherent in managing behaviour in the workplace road safety context. In addition to the structural characteristics that distinguish this context from the management of other organisational safety activities, the work-task (i.e., driving) is conducted outside the physical boundaries of the workplace; thus, direct employer or supervisory control is limited (Huang et al., 2013; Newnam et al., 2012). This separation poses a managerial challenge in creating policies, procedures and practices that are both relevant and specific to the driving task.

Despite the challenge of systematically linking OHS improvement to the driving task, there is some evidence to suggest that senior management commitment to safety is critical in creating a safe driving environment (Newnam et al., 2002; Wills et al., 2006). For example, Darby et al. (2009) examined the effectiveness of an online fleet driver assessment program to identify, target, and reduce occupational road safety risk. These findings are important because they establish that senior-level management are capable of creating an environment that supports safe driving. However, the types of management practices, independent of risk management, that both shape and constrain safe driving behaviour are yet to be determined. This is an important question to consider given the conflict that can exist between productivity and safety within the workplace.

Table 1
The Nine HPWS practices explored.

Practice	Definition
Remuneration	Direct rewards and payments that employees receive.
Job and work design	Elements of the work-role task, relationships between tasks, and the organisational structure.
Development	Competency training required to complete work-role tasks and future work-role tasks.
Selection	Selection of applicants, both from within and external to the organisation.
Job Security	Level of confidence in retaining employment.
Communication	Formal information sharing programs.
Performance Appraisal	Measuring and improving individual performance for all employees across the organisation.
Promotion	Opportunities and methods to move up to higher level positions within the organisation.
Retention	Identifying and taking steps (i.e., modifying traditional workplace practices) to address the reasons for voluntary turnover.

1.2. High performance workplace systems

This study, therefore, explored the role of HPWS practices in influencing safe driver behaviour. Types of HPWS practices previously explored in the literature include selection (e.g., Michie and Sheehan, 2005), communication (e.g., Gibson et al., 2007; Gittell et al., 2010) and performance management (e.g., Zhang and Li, 2009). Much attention has focused on the role of HPWS practices in increasing the intensity of workplace inputs (e.g., commitment and motivation) and maximising outputs (i.e., increased performance and reduced turnover) (Combs et al., 2006). There is also research that demonstrates a relationship between HPWS and occupational safety (Zacharatos et al., 2005). Although the research to date suggests the positive impact of HPWS on productivity and, more importantly, safety performance, these practices have yet to be investigated within the unique context of workplace road safety.

The key study objective was to identify and understand the management practices that support or constrain safe driver behaviour. There is some research that suggests that joining together individual complimentary practices into configurations or 'bundles' create superior synergistic effects, whereby certain practices reinforce and support one another (Posthuma et al., 2013). There is, however, limited consensus regarding the number, terminology, and specific bundling of these practices that promote organisational efficiency (Sun et al., 2007). For this reason, this study will explore the independent relationships between nine HPWS practices and work-related driver behaviour. These practices are described in Table 1. These practices were identified based on a review of the HPWS literature (Posthuma et al., 2013) and were selected as relevant to the workplace road safety context.

1.3. Safety climate in the work environment

Much research has demonstrated that workers' perception of the value and priority given to safety (ie. safety climate) is a determinant of safe working performance (eg., Zohar, 2000; Griffin and Neal, 2000). These findings have also been extended to the work-

place road safety setting, with research showing relationships with safe driving behaviour (Newnam et al., 2012; Wills et al., 2009) and crashes (Newnam et al., 2008). These finding have important practical implications as they suggest that an organisation's safety climate can positively influence safe driving behaviour, regardless of the managerial challenges inherent in supervising individuals that work outside the physical boundaries of the workplace.

Research has established that perceptions of safety climate are influenced by the level of investment in HPWS and that safety climate mediates the relationship between HPWS and the frequency of safety incidents (Zacharatos et al., 2005). Although not yet investigated, the relationship between HPWS and safety climate on an organisation's safety performance is also likely to be supported in the workplace road safety context. However, in contrast to the research conducted by Zacharatos et al. this relationship is likely to be different given the lack of integration of OHS within the safety role. That is, HPWS is less likely to have a direct relationship with driver behaviour. This is because the design of HPWS are less likely to be aligned to safety goals related to driving given that driving is frequently not well integrated within the broader Occupational Health and Safety (OHS) system (Newnam and Watson, 2011).

Rather, the relationship between HPWS and driver behaviour is likely to be influenced by goals that encompass safety in the role of a driver. That is, drivers' perceptions of the safety climate. Given that research has established that an organisation's safety climate is context dependent, an employees' perception of the safety climate is likely to influence the strength of the relationship between HPWS and driver behaviour. That is, the organisation's safety climate is likely to indirectly influence the relationship between HPWS and safe driving behaviour. Thus, we propose that the safety climate will moderate the relationship between HPWS practices and safe driver behaviour.

2. Methods

2.1. Procedure and participants

This research was awarded ethical clearance from the host university. A four-staged recruitment process was facilitated by a state-based compensation regulatory body in Australia. First, organisations were recruited from a list of work-related injury claims relating to motor vehicle crashes received by the regulatory body between July 2010 and end of May 2014. A screening process excluded claims from the following categories: vehicle types *such as* the primary 'agency of injury' including taxi, bus, tram, train, motorbikes, trucks, emergency service vehicles, other machinery driving/operating; organisations with fleet sizes of <5 vehicles; those with fleets primarily consisting of heavy vehicles (trucks, buses, trains), and; driving schools or driver training schools. Following the selection process, eligible organisations were contacted by the regulatory body to seek their agreement to be contacted by the research team.

The organisations that were selected represented over thirteen industry categories, based on the Australia and New Zealand Standard Industry Classification (ANZSIC). Organisations from the healthcare and social assistance industry (n = 26) represented the greatest proportion of the sample, followed by organisations classified under public administration (n = 11). The second stage of recruitment involved the research team approaching consenting organisations to participate in the study, by identifying a relevant senior manager to participate in a survey.

This stage resulted in the recruitment of 83 senior managers within OHS or fleet management divisions. All managers had a strong understanding of the implementation of the workplace practices and the relevance of these practices to safety. The majority of respondents were male (61%) with a mean age of 47.5 years (SD = 8.72, Range = 28 to 67 years). There was an average organisational tenure of eight years and an average of five years in their current role.

The third stage involved the recruitment of individuals who drove for work purposes to participate in a telephone interview. This stage was facilitated through senior-level managers, who were asked to select a random sample of individuals that drive for work purposes within their organisations. Following their consent to participate in the research, drivers contact details were sent to the research team. An occupational driver was defined as an employee who drove at least once per week for occupational purposes (Newnam and Watson, 2011). The sample consisted of 911 drivers who were employed in a range of roles such as nurses, plumbers, construction workers, sales representatives, couriers, and security guards. The majority were male (58.5%) with an average of 45 years (SD = 11.07, Range = 20 to 73 years) and drove an average of 191 km/week for work-related purposes (SD = 1608.38, Range = 2 to 2000 km/week).

The final stage involved the recruitment of supervisors. Supervisors were defined as those responsible for the daily management of occupational drivers (Newnam et al., 2012). Recruitment was conducted by asking drivers to identify their supervisor or team leader. This process was also facilitated by senior level managers who sent emails to all supervisors in the organisation stating that they may be contacted by a member of the research team. Emails with an embedded link to an online questionnaire were sent to supervisors, resulting in recruitment of 161 supervisors. The majority of participants were male (59%) with a mean age of 47 years (SD = 9.34, Range = 26 to 67 years), an average organisational tenure of 8.86 years and an average of six years in their current organisational role. Supervisors represented 37 of the 83 organisations recruited for the study and supervised an average of 11 drivers (SD = 17.92, Range = 1 to 125).

The final sample consisted of 911 drivers nested within 161 workgroups and 83 organisations. There were an average of 24 drivers within each organisation (Range = 1 to 87) and 5.65 drivers within each supervisory workgroup (Range = 1 to 13). Matching the three samples within a multi-level structure resulted in 37 sets of complete three level data.

2.2. Measures

2.2.1. High performance workplace systems

The HPWS model consisted of nine individual practices, where each practice comprised three items within the manager and supervisor surveys. Questions were prefixed with the statement "In thinking about the organisation that you work for. . .". Items were measured on a five-point Likert scale, ranging from *strongly disagree* (1) to *strongly agree* (5). All items are listed in Table 2, below.

2.2.2. Perceived senior management safety values (ie., safety climate)

Driver's perceptions of their senior manager's safety values were assessed using the safety values items from Newnam et al. (2008). Three items made up this measure and were reworded to correspond with perceptions of senior management. An example item is "Senior level management place a strong emphasis on motor vehicle safety." Items were measured on a five-point Likert scale, ranging from *strongly disagree* (1) to *strongly agree* (5).

2.2.3. Occupational driver behaviour scale

The dependent variable was a self-reported driver measure of safety performance consisting of 12 items measuring speeding, rule violations, inattention and tiredness while driving (Newnam and Watson, 2011). Questions were prefixed with "During a typical

Table 2
Factor loadings for items based on a nine factor solution.

HPWS Items	1	2	3	4	5	6	7	8	9
Paying above average wages is a priority	0.704								
considered important (e.g., incentive plans or bonuses)	0.777								
Encouraging a long-term employment focus through remuneration practices is considered important	0.938								
Fostering involvement in decision-making at all levels of this organisation is a priority		0.814							
Great effort is put in to providing employees with meaningful jobs (i.e., challenging, fulfilling etc)		0.900							
Ensuring that employees have autonomy (i.e. opportunities to decide how to do their work) is a priority		0.829							
Encouraging participation in staff development and/or training (e.g., driving skills, health and safety, IT skills) is considered important			0.788						
Developing the skills employees need to perform their job is considered a priority			0.885						
Great effort is put in to ensuring that staff development helps employees to improve performance			0.914						
Selecting the right person for a job is considered an important HR function				0.762					
Hiring selectivity is considered a priority				0.797					
Great effort is put in to selecting employees (e.g., use of tests, interviews, etc)				0.865					
Formal information sharing programs e.g., newsletters, employee input suggestion scheme, are considered important					0.742				
Great effort is put in to communicating the results of employee surveys across the organisation					0.771				
Communicating information about how well the organisation is performing is considered important					0.856				
Providing employees with clear career paths is a priority						0.853			
Great effort is put in to providing employees with opportunities for upward mobility						0.868			
Considerable importance is placed on ensuring that employees feel that they have a positive future in this organisation						0.889			
Considerable importance is placed on ensuring that performance appraisals are standardised and documented							0.865		
Regular performance appraisals are considered a priority							0.892		
Great effort is put in to ensuring that all employees are clear about the standards used to evaluate job performance							0.886		
Providing job security to employees is a priority in this organisation								0.785	
Considerable importance is placed on finding a suitable position elsewhere in the organisation								0.717	
If an employee loses his/her job, great effort is put in to supporting and encouraging employees to stay in their job for as long as they want to								0.911	
Modifying workplace practices to meet the needs of all employees, e.g. offering flexible work schedules, is considered important									0.752
Great effort is put in to reducing work demands through providing work-life balance practices, e.g. variations in standard work week									0.874
Providing health and wellness programs, e.g. stress reduction programs, to all employees is considered a priority									0.636

0. Remuneration, 2. Job & work design, 3. Development, 4. Selection, 5. Job security, 6. Communication, 7. Performance appraisal, 8. Promotion, 9. Retention.

week when you drive for work purposes, how often do you. . .” An example speeding item is “Deliberately exceed the speed limit on a residential road.” Items were measured on a five-point Likert scale, ranging from *rarely or never* (1) to *very often* (5). As the scale measures frequency of engagement in a particular behaviour, lower scores indicate safer driving practices.

2.2.4. Control measures

Age, gender and the number of kilometres driven were included as control variables in this study. Kilometres per week was used to control for exposure to risk in the traffic environment (Newnam et al., 2008; Newnam et al., 2012). Gender and age were also included as control measures as they have been shown to be predictors of a number of driving behaviours (for example, Newnam et al., 2008).

2.3. Analysis overview

The research questions were analysed using multi-level modelling. Nine models were developed to examine the relationships between the HPWS practices and driver behaviour, as well as safety values as a moderator. For all models, the drivers were nested within a two-level multilevel model, where supervisors' and senior managers' scores on the HPWS scales represented Level 2 data. The ratio of between-group variance to total variance provided support for aggregating supervisor scores on the HPWS to Level 2 (ICC = 0.123).

The psychometric properties of the HPWS were assessed through a confirmatory factor analysis (CFA). The goodness of fit statistics used to evaluate the CFA included the root mean square error of approximation (RMSEA; Steiger, 1990), the comparative fit index (CFI), and the Tucker-Lewis index (TLI; Hu and Bentler, 1999). Item reliabilities for all scales were also assessed (see Table 3).

3. Results

3.1. Confirmatory factor analysis

Psychometric properties of the HPWS item factors were assessed using confirmatory factor analysis. The confirmatory factor analysis provided a good fit to the data x^2 (288, $N = 911$) = 429.795, $p < 0.05$, CFI = 0.968, TLI = 0.961, RMSEA = 0.05. The factor loadings are reported in Table 2. All hypothesised loadings were statistically significant.

Table 3
Means, Standard Deviations, (Reliabilities) and Correlations between Constructs.

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Age (years)	45	11.0	–													
2. Gender (% male)	58.5	–	−0.11**	–												
3. Behaviour	1.76	0.44	−0.13***	−0.01	(0.707)											
4. KM driven	4.31	3.70	−0.04	−0.30***	0.11**	–										
5. Remuneration	3.07	0.77	0.02	−0.20***	0.08*	0.30***	(0.851)									
6. Design	3.60	0.66	0.10**	−0.08*	0.11**	0.05	0.04	(0.913)								
7. Development	3.87	0.63	0.05	−0.20***	0.13***	0.22***	0.43***	0.40***	(0.921)							
8. Selection	4.04	0.70	0.04	−0.02	0.13***	−0.02	0.32***	0.36***	0.51***	(0.833)						
9. Communication	4.19	0.69	0.14***	−0.05	0.11**	0.07*	0.12***	0.39***	0.50***	0.44***	(0.849)					
10. Promotion	3.18	0.75	0.06	−0.15***	0.06	0.21***	0.59***	0.47***	0.42***	0.16***	0.31***	(0.910)				
11. Appraisal	3.91	0.75	0.08*	−0.17***	0.09*	0.25***	0.42***	0.17***	0.47***	0.35***	0.66***	0.50***	(0.900)			
12. Job Security	3.63	0.66	0.08*	−0.17***	0.05	0.17***	0.29***	0.43***	0.23***	0.09**	0.28***	0.54***	0.27***	(0.869)		
13. Retention	3.56	0.70	0.17***	−0.04	0.03	−0.07*	0.01	0.63***	0.02	−0.01	0.36***	0.54***	0.20***	0.43***	(0.838)	
14. Safety values	4.12	0.83	0.05	−0.13***	−0.18***	0.08*	0.03	−0.04	0.09**	−0.04	0.002	−0.08*	−0.03	−0.03	−0.11**	(0.891)

Note: Supervisor responses to High Performance Workplace Practices have been aggregated into Senior Management level in the table.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

3.2. Descriptive data

Means, standard deviations, correlations and reliabilities for each variable measured in the analyses are reported in Table 3. The bi-variate correlations highlight two issues. First, the HPWS practices were only moderately correlated, which suggests these practices may have different effects on driver behaviour; thus, supporting examination of the independent relationships between these practices and driver behaviour. Driver behaviour was significantly (< 0.05) correlated with age (r =–0.13) and kilometres driven (r = 0.11), as well as remuneration (r = 0.08), job and work design (r = 0.11), selection (r = 0.13), communication (r = 0.11), development (r = 0.13), performance appraisal (r = 0.09) and safety values (r =–0.18). While the bivariate correlations offer initial support for the research questions, they do not take into account the nested data structure. As such, multi-level modelling was used to assess the relationship between factors.

3.3. Multi-level modelling

Nine models were developed to investigate the relationships between HPWS practices and driver behaviour. The multi-level modelling was undertaken using Mplus software. The equation is shown below, where HPWS represents a select practice in each model i.e., remuneration. For all analyses, at level one of each model, kilometres driven, age and gender were included as control variables. The equation is depicted as:

$$Level1: \textbf{Driverbehaviourij} = \beta 0j + \beta 1(\textbf{kilometresdriven}) + \beta 2(\textbf{age}) + \beta 3(\textbf{gender}) \beta 4j(\textbf{safetyvalues}) + rij$$

$$Level2: \beta oj = \gamma 00 + \gamma 01(\textbf{HPWSpracticesk}) + R0j,$$

$$B4j = \gamma 40 + \gamma 41(\textbf{HPWSpracticesk}) + R4j$$

The results of the models are shown in Table 4. The results showed significant direct effects for job and work design, communication and selection. These effects indicated that under high conditions of investment in these practices, drivers reported poorer driving behaviour. No other significant main effects were identified. There was also one significant interaction effect. The remuneration model revealed an interaction, which suggested a relationship between the level of investment in remuneration practices and driver's safety perceptions on driver behaviour. An analysis of the simple slopes revealed that this relationship was significant under conditions of high perceptions of safety values ($p < 0.05$). This is demonstrated graphically in Fig. 1. Consistent with previous research kilometres driven and age were significant predictors in most models.

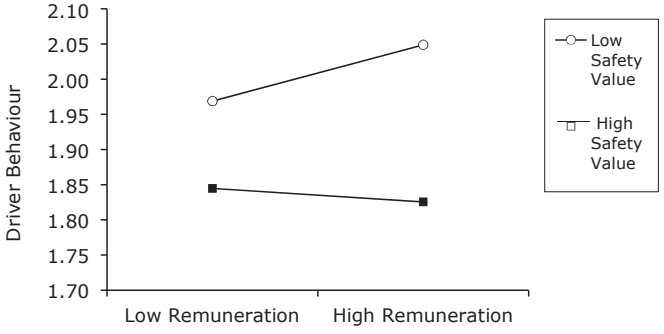

Fig. 1. The interaction term between safety values and investment in remuneration.

4. Discussion

This study explored the relationship between HPWS practices and driver behaviour, and the role of safety climate in moderating these relationships. This study provides unique contribution to the research literature for two reasons. It is the first study to consider workplace road safety within the broader OHS context by exploring the management practices that support and constrain safe driving behaviour. Second, it is the first study to explore the determinants of safe driver behaviour within a multi-level, nested, structure, considering the role of management practices across multiple organisations with differing business activities.

The results for HPWS both contradict and extend previous research. The results showed significant relationships between driver behaviour and several HPWS practices, including job and work design, selection and communication. These results indicated that higher investment in these practices was associated with poorer driver behaviour. Given that past research has demonstrated a positive relationship between HPWS and occupational safety (Zacharatos et al., 2005), these results are somewhat surprising. However, important insights are gained from this unexpected finding in relation to the significant moderation effect of remuneration, and the current management practices regarding workplace road safety in Australia (and internationally). These two points are elaborated next.

Table 4
Results of Multilevel Modelling Analysis for HPWS Practices.

	Driver Behaviour *N = 911*		
Level and Variable (Step 5)	Estimate	*SE*	Ratio
Remuneration model			
Level 1			
KM	0.012*	0.005	2.674
Age	−0.005*	0.002	−2.911
Gender	−0.018	0.028	−0.648
Level 2			
Remuneration practices (**k**)	0.024	0.030	0.793
Cross-level interaction			
Safety-Value Perceptions	−0.052*	0.024	−2.180
Variance Components			
Within-organisation (L1) variance	0.184***	0.011	17.144
Intercept (L2) variance	0.005	0.003	1.793
Slope (L2) variance	0.000	0.004	0.091
Number of estimated parameters	10		
Job & work design model			
Level 1			
KM	0.012*	0.005	2.592
Age	−0.005*	0.002	−2.927
Gender	−0.009	0.026	−0.363
Level 2			
Job & work design practices (**k**)	0.057*	0.028	2.013
Cross-level interaction			
Safety-Value Perceptions	0.012	0.031	0.391
Variance Components			
Within-organisation (L1) variance	0.183***	0.011	16.795
Intercept (L2) variance	0.003	0.002	1.573
Slope (L2) variance	0.006	0.011	0.510
Number of estimated parameters	10		
Development model			
Level 1			
KM	0.011*	0.005	2.279
Age	−0.005*	0.002	−2.918
Gender	−0.004	0.030	−0.137
Level 2			
Development practices (**k**)	0.067	0.038	1.776
Cross-level interaction			
Safety-Value Perceptions	−0.021	0.034	−0.636
Variance Components			
Within-organisation (L1) variance	0.183***	0.011	16.801
Intercept (L2) variance	0.003	0.002	1.288
Slope (L2) variance	0.006	0.013	0.441
Number of estimated parameters	10		
Selection model			
Level 1			
KM	0.012*	0.005	2.739
Age	−0.005*	0.002	−2.906
Gender	−0.008	0.025	−0.314
Level 2			
Selection practices (**k**)	0.067*	0.028	2.410
Cross-level interaction			
Safety-Value Perceptions	−0.025	0.052	−0.468
Variance Components			
Within-organisation (L1) variance	0.184***	0.012	15.712
Intercept (L2) variance	0.003	0.002	1.668
Slope (L2) variance	0.004	0.016	0.250
Number of estimated parameters	10		
Communication model			
Level 1			
KM	0.011*	0.005	2.403
Age	−0.005*	0.002	−3.070
Gender	−0.011	0.026	−0.407
Level 2			
Communication practices (**k**)	0.064*	0.025	2.597
Cross-level interaction			
Safety-Value Perceptions	−0.011	0.031	−0.341

Table 4 (*Continued*)

Level and Variable (Step 5)	Driver Behaviour *N = 911*		
	Estimate	*SE*	Ratio
Variance Components			
Within-organisation (L1) variance	0.183***	0.011	16.482
Intercept (L2) variance	0.003	0.003	1.121
Slope (L2) variance	0.006	0.013	0.427
Number of estimated parameters	10		
Promotion model			
Level 1			
KM	0.012*	0.005	2.576
Age	−0.005*	0.002	−2.889
Gender	−0.017	0.028	−0.601
Level 2			
Promotion practices (**k**)	0.013	0.029	0.462
Cross-level interaction			
Safety-Value Perceptions	−0.016	0.040	−0.395
Variance Components			
Within-organisation (L1) variance	0.183***	0.011	16.923
Intercept (L2) variance	0.005	0.003	1.602
Slope (L2) variance	0.005	0.011	0.509
Number of estimated parameters	10		
Job security model			
Level 1			
KM	0.012*	0.005	2.517
Age	−0.005	0.002	−2.912
Gender	−0.016	0.027	−0.607
Level 2			
Job security practices (**k**)	0.022	0.018	1.227
Cross-level interaction			
Safety-Value Perceptions	−0.003	0.033	−0.103
Variance Components			
Within-organisation (L1) variance	0.183***	0.011	16.694
Intercept (L2) variance	0.005	0.004	1.520
Slope (L2) variance	0.006	0.011	0.513
Number of estimated parameters	10		
Retention model			
Level 1			
KM	0.013*	0.005	2.672
Age	−0.005*	0.002	−2.951
Gender	−0.014	0.026	−0.545
Level 2			
Retention practices (**k**)	0.030	0.020	1.502
Cross-level interaction			
Safety-Value Perceptions	0.061	0.047	1.302
Variance Components			
Within-organisation (L1) variance	0.182*	0.011	16.781
Intercept (L2) variance	0.005	0.003	1.493
Slope (L2) variance	0.005	0.010	0.562
Number of estimated parameters	10		
Performance appraisal model			
Level 1			
KM	0.012*	0.005	2.515
Age	−0.005*	0.002	−2.948
Gender	−0.016	0.026	−0.594
Level 2			
Performance appraisal (**k**)	0.026	0.017	1.570
Cross-level interaction			
Safety-Value Perceptions	−0.019	0.029	−0.662
Variance Components			
Within-organisation (L1) variance	0.183***	0.011	16.651
Intercept (L2) variance	0.005	0.003	1.555
Slope (L2) variance	0.005	0.013	0.373
Number of estimated parameters	10		

Notes: Values in parentheses are standard errors; *t*-statistics were computed using the as the ratio of each regression coefficient divided by its standard error.
**p < 0.01.
* p < 0.05.
*** p < 0.001.

First, under conditions of high investment in remuneration, drivers reported safer behaviour when they perceived their managers valued and prioritised safety, as opposed to conditions where they perceived that safety was not valued or prioritised by management. Thus, contrary to past research, the results of this study suggest that investment in remuneration encourages safe driver behaviour, but only under conditions of high commitment to safety. There has been growing recognition that broader economic factors, such as financial pressures and compensation methods can play a significant role in producing conditions that encourage unsafe driving behaviour (Quinlan and Wright, 2008; Thompson et al., 2015; Thompson and Stevenson, 2014; Williamson et al., 1996) and discouraging reporting of incidents or injuries (Murray et al., 2003). The moderation results of the study showed that this effect was countered when management safety values were high. This result was not replicated for other HPWS practices but suggest further avenues for exploring the overall impact.

Second, it has been established that workplace road safety has not been well integrated within the broader OHS system (Newnam and Watson, 2011). The findings of this study further this understanding by showing that management does not consider the safety of the driver in its operational activities. That is, the driver safety is not considered within the operational activities of the organisation or supported within broader OHS systems. One reason for this is that safe driving is considered the responsibility of the driver. This conclusion has been well supported in the existing literature (Newnam and Goode, 2015).

Consistent with these arguments, the results of this study suggest that HPWS have not been designed or implemented with consideration of the driving role and safety. The results showed that job and work design, selection and communication had a negative influence on safe driver behaviour. These findings suggest that individuals are being selected, jobs are being designed and communication practices are focused on supporting operational activities, such as performance-based indicators rather than safety. That is, selectivity is based on skills and knowledge to support operational needs; the work task/s is designed to support productivity and efficiency, and; the messages and methods of communication are targeted at the 'primary' job role (eg., providing medical attention). This arguments are supported when interpreting the results in context of the study population.

The majority of organisations that participated in this study were health care and social assistance organisations (eg., allied health employees, community nurses). In these organisations, driving is often considered to be a secondary task to the primary job role (eg., in-home nursing care; Newnam et al., 2012); with the comparison context being organisations where driving is the core business activity (eg., transport ancillaries). Thus, the results of this study suggest that HPWS are not designed or implemented with consideration of how these practices will influence driver safety, particularly in organisations where driving is not the core business activity. Thus, these results highlighting the lack the integration of road safety within the workplace.

4.1. Practical applications

The results of this study offer practical guidance for organisations in designing and implementing management practices that consider road and vehicle use within their strategy to ensure the safety of their workforce. In regards to remuneration practices, the results suggested that remuneration encourages safe driver behaviour, but only under conditions of high commitment to safety. This finding suggests that investment by senior management in the health, safety and wellbeing of its employees is fundamental in balancing the extrinsic motivations inherent in remuneration. In support, Mearns et al. (2010) found that management practices that explicitly placed a priority on worker health were found to implicitly communicate priorities placed on safety within the organisation. Thus, it is recommended that organisations integrate safety initiatives, such as cultural change programs (eg., Newnam et al., 2014; Newnam and Oxley, 2016) as part of any initiative designed to reward staff through remuneration. It is also recommended that these systems are embedded and inclusive of all activities related to OHS within the organisation, including performance management (ie., key performance indicators). HRM systems should, together with risk management, form part of an integrated risk management approach.

The results indicate that HPWS practices are not being designed or implemented with consideration of the safety of drivers. Rather, HPWS practices are, on the whole, predisposing drivers to unsafe driving conditions. The results of this study suggest that organisations need to focus on (i) designing jobs where there is clear guidance on role-behaviour expectancies in relation to the driving role (eg., well-designed and monitored work schedules), (ii) selecting individuals that have a safe driving record (eg., character reference for driving from previous employment, crash history check, where possible) and can demonstrate the ability to consider safety within role-behaviour expectancies, and (iii) using communication strategies and methods that support safe driver behaviour (eg., bottom-up information sharing programs, formalised process for reporting hazards).

These recommendations could be achieved through a top down and bottom up approach, focused on integrating driver safety within the broader OHS system. The top down approach could focus on ensuring that risk management strategies are in place to ensure safety within (i) vehicles (ie., 5 start ANCAP rating), (ii) road users (eg., sufficient training and induction programs), (iii) journey management practices (eg., integrated journey management planning), (iv) road management practices (eg., safety policies & procedures) and (v) post-crash response (ie., reporting and investigation processes) (Warmerdam et al., 2017).

The bottom up approach could be focused on gaining a thorough understanding of the driver context and the factors influencing safe driver behaviour. This exercise could be achieved through programs designed to encourage drivers to discuss situations that place them at risk on the road. Past research has found support for interventions focused on group discussion, feedback and goal setting in gaining an understanding of the driving context and, ultimately, improving safe driver behaviour (Newnam et al., 2014).

Second, information gained from understanding the factors that predispose drivers to unsafe driving conditions could then be considered in the development and implementation of management practices, including HPWS and risk management strategies. That is, management could design communication campaigns that specifically target safe driving practices, job descriptions could specify expectations when driving a vehicle, work-role tasks could be designed to consider safety while driving a vehicle (ie., including expectations on fitness for duty), and the selection process could consider alignment between individuals driving ability and the driving environment and workplace factors that place them at risk on the road. Anecdotal evidence has shown support for this approach in the development of policies and procedures designed to support productivity and safety, including safe driving practices (NRSPP, 2015).

4.2. Limitations

The limitations of this study need to be acknowledged. First, driver behaviour was measured with a self-report driving questionnaire. Although research has found that driving questionnaires are associated with minimal social desirability responding (Lajunen and Summala, 2003), it is possible that a bias did exist. Future

research could overcome this possible limitation through collecting data on driving behaviour using objective measures (ie., using in-vehicle telemetry).

A second limitation relates to cross-sectional measurement. It was not possible to test the causal relationships between HPWS practices and driver behaviour. Therefore, reverse causation could also explain the significant relationships. For example, it is possible that both drivers and management perceive safe driving as the responsibility of the individual driving the vehicle; thus, management do not consider driving as an integral part of operational activities. Longitudinal research is required to provide further validation of the hypothesised relationships.

A third limitation relates to the representativeness of the sample. As discussed previously, the high proportion of organisations where driving is considered a secondary work-role may have biased the results. It is unknown whether the business activities operating within particular industries predispose drivers to unsafe driving conditions. For example, it is possible that individuals within organisations in which driving is the core business (e.g., transport ancillaries) are exposed to a different management practices compared with organisations where driving is secondary to the individuals' core responsibility (e.g., in-home nursing care). Future research could address this limitation through comparing safety behaviour in organisations based on their core business activity (transport ancillaries vs non-transport ancillaries).

5. Conclusion

Despite road traffic injury being the leading cause of work-related death in Australia, many organisations are unaware of the management practices, beyond risk management, that predispose drivers to unsafe driving conditions. This study addresses this gap in the literature and, more importantly, provides recommendations to improve the safety of work-related drivers. Overall, these results support the argument that road safety is not well integrated within the workplace and, in fact, that this lack of integration deters safe driving practices. To achieve reductions in injuries and deaths in this safety critical domain, this situation needs to change. The results of this study hope to provide the impetus to generate this essential discussion that will act to initiate change.

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Chapter 4 demonstrated that organisations are communicating, selecting and designing jobs and work in a way that does not support safe driving behaviour. Moreover, it demonstrated the importance of drivers' perceptions of the safety climate in moderating the relationship between remuneration and safe driving behaviour. The paper advocated for a bottom up approach through activities such as group discussion. This approach has been shown to improve safety performance in other research.

Chapter 5 extends this research by examining the role of HPWS in moderating the relationship between drivers' attitudes towards safety and safe driving behaviour. Building on the understanding the HPWS have a negative impact on driver behaviour, the research draws on role theory to understand how individual employee attitudes direct behaviour. Looking at all levels of the organisation, as identified in the first paper, allowed for identification of a mitigation effect of the attitudes and provided deeper insight into creating a safe working environment.

Chapter Five

Monash University

Declaration for Thesis Chapter 5

Warmerdam, A., Newnam, S., Sheppard D., Wang, Y., Griffin, M., & Stevenson, M. High Performance Workplace Systems' influence on safety attitudes and occupational driver behaviour. *Submitted to Safety Science.*

Declaration by candidate

In the case of Chapter 5 (i.e., paper four), the nature and extent of my contribution to the work involved the following:

Nature of the contribution	Extent of the contribution (%)
Primary author responsible for the concept, design, data collection, data analysis and interpretation of results and writing up the manuscript	60

The following co-authors contributed to the work:

Name	Nature of the contribution	Extent of the contribution (%)
Dr. Sharon Newnam	Contributed to the concept and design of the study, and wrote sections of the manuscript	10
Dr. Dianne Sheppard	Contributed to the concept and design of the study, and critically reviewed the manuscript	10
Dr. Lena Wang	Contributed to the concept and critically reviewed the manuscript	10

Prof. Mark Griffin	Critically reviewed the manuscript	5
Prof. Mark Stevenson	Critically reviewed the manuscript	5

The undersigned hereby certify that the above declaration correctly reflects the nature and extent of the candidate's and co-authors' contributions to this work.

Student signature: [redacted] **Date:** 9 May 2017

Main Supervisor signature: [redacted] **Date:** 9 May 2017

Abstract

For organisations employing occupational light vehicle drivers, there are unique challenges to developing a safe working environment. Drawing on role theory, this study elaborates on these challenges within a framework that identifies the role of both workplace management practices and individual attributes. The aim of this paper was to explore the relationship between attitudes and behaviour, and the role of High Performance Workplace Systems (HPWS) in moderating these relationships. The sample consisted of 911 drivers and 161 supervisors from 83 organisations. The results suggest that individual drivers' safety attitudes had a positive effect on safety behaviour in the work-related driver context, yet their organisation's HPWS has a negative impact on this type of safety behaviour. More importantly, organisation's HPWS appeared to moderate the relationship between safety attitudes and safety behaviour, such that safety attitudes had a stronger effect on safety behaviour when HPWS was low, rather than when HPWS was high. These findings suggest that when there is a lack of guidance through HPWS practices, employees draw on individual attitudes to direct behaviour. A key implication of this research is the need for multi-level interventions, addressing individual attitudes through behavioural modification programs, whilst also incorporating reform at the supervisory and senior management levels.

High Performance Workplace Systems' influence on safety attitudes and occupational driver behaviour

Work-related driving is a major risk for organisations. This is due, in part, to factors such as fleet vehicles in Australia travelling three times the distance of average private vehicles (WorkSafe, 2008). It has also been suggested that the higher risk can be attributed to a lack of understanding of how employers create a workplace that supports safe driving practices (Newnam, Warmerdam, Sheppard, Griffin, & Stevenson, 2017; Warmerdam, Newnam, Griffin, Sheppard, & Stevenson, 2017).

Government agencies provide some direction for employers to support compliance with safe driving practices, and in some jurisdiction, it has been mandated that organisations who employ work-related drivers comply with Occupation Health and Safety (OHS) legislation. This legislation is designed to ensure that the health, wellbeing and safety of all employees are protected. The World Health Organisation also provides International Organisation for Standardisation 39001 'Road Traffic Safety Management' to guide employers in the management of workplace road safety. Despite these efforts, it has been well established that OHS has not been well integrated within organisations that employ individuals to drive light (i.e., < 4.5 tonnes) vehicles (Newnam & Watson, 2011b; Warmerdam, Newnam, Griffin, et al., 2017).

The occupational driver context varies from 'traditional office environments' for two reasons: a) the organisational structure around the management of work-related drivers, and b) the preconceptions related to safe driving practices of individuals who are employed in a role that involves driving (Newnam, Griffin, & Mason, 2008; Newnam et al., 2017; Warmerdam, Newnam, Griffin, et al., 2017). This study explores the unique context of occupational drivers within a framework that identifies the role of both workplace practices and individual attributes and demonstrates the interaction between workplace practices and individual attributes.

The work-related driving context

The driving task has characteristics that distinguish it from other tasks performed within the workplace. First, there are inherent challenges associated with managing behaviour associated with a job task conducted outside the physical boundaries of the organisation. That is, driving is generally an autonomous task where there is low visibility between a supervisor and a driver; thus, limiting opportunity to manage behaviour through the collection of objective performance measures and the timely delivery of associated feedback (Newnam, Lewis, & Watson, 2012). Second, there is limited formalised leadership in the safety management of drivers (Newnam et al., 2008; Newnam et al., 2012). Driving activities often fall outside line management responsibilities, and drivers are typically supervised by individuals who are not part of the same management structure associated with other aspects of their work roles (Newnam et al., 2008). Rather, driver behaviour is managed by the fleet manager, despite the fact these individuals often do not have formal responsibilities beyond asset (i.e., vehicle) management (Warmerdam et al., 2017).

These challenges are further complicated when driving is considered as a secondary job role (Lynn & Lockwood, 1998). To illustrate, in the role of a sales representative, driving is often perceived secondary to the role of selling a product or service. The consequence is that the driving task is less likely to be formalised within position descriptions and performance evaluations (Warmerdam, Newnam, Griffin, et al., 2017). As highlighted in the research literature, this has a negative impact on safe driving performance (Newnam et al., 2017; Warmerdam, Newnam, Griffin, et al., 2017). That is, the management practices predispose drivers to an unsafe working environment. To understand this relationship, this study draws on role theory.

Role Theory

Role theory describes how individuals assume characteristic behaviour patterns or roles, identities, and develop expectations (Biddle, 1986). The theory posits that an

individual's behaviour is guided by membership of social groups and that roles communicate expectations for behaviour (Biddle, 1986). Establishing role behaviour expectancies is particularly challenging in uncertain work environments (Griffin, Neal, & Parker, 2007). Uncertainty is a condition under which work roles are not well formalised in the organisational environment. Research has identified that uncertainty levels can influence workers' attitudes and behaviours (Ilgen & Hollenbeck, 1991). Environments characterised by uncertainty have been linked adaptive performance whereby behaviour is more discretionary (Griffin et al., 2007).

The work-related driving context is a good example of an uncertain workplace environment. Given that driving is often considered secondary to the primary job role, it has been argued that there is a high level of uncertainty with regard to the role-behaviour expectancies when driving a vehicle (Newnam & Watson, 2009). Moreover, the physical distance between the worker and the supervisor may increase uncertainty. The level of uncertainty may account for variation in drivers' attitudes towards safe driving.

Attitudes towards safe driving

An attitude is an evaluation of a person, entity or idea that directly impacts on social behaviour (Eagly & Chaiken, 1993). In the workplace environment, an attitude can be formed through an assessment of how closely policy and procedure established by the organisation aligns with the workers' own personal goals (James & James, 1989). That is, the way the role is understood by the individual has an impact on their behaviour. In the work-related driving context, favourable or unfavourable attitudes toward rule violations and speeding has been defined as a safety attitude (Iversen & Rundmo, 2004).

Attitudes towards safe driving have been found to play a critical role in influencing safe driving behaviour. For example, Newnam et al. (2008) found that attitudes predicted motivation to drive safely and self-reported crashes. Wills et al., (2006) also demonstrated how attitudes predicted traffic violations, driver error, driving while distracted, and pre-trip

vehicle maintenance, and that attitudes were a strong predictor of future intentions to drive safely in a work-related vehicle (Wills et al., 2009). Although these findings have provided valuable insight into the development of interventions designed to challenge drivers' key beliefs regarding safe driving practices (Newnam et al., 2012), it is still not understood how the attitudes of drivers would interplay with the organisational context in influencing their safe driving behaviours. The focus of this paper is to explore the lack of understanding in this interplay.

A worker's interpretation of role-behaviour expectancies has been found to be influenced by how the organisation measures employee effectiveness (i.e., achievement of organisational goals; Griffin et al., 2007). However, some degree of ambiguity is likely to exist when interpreting safety goals in the driving role given the uncertainty in the workplace environment. The degree of uncertainty is also likely to be influenced by the behaviours performed when a driver is driving for personal purposes. Newnam et al. (2002) found that individuals drive differently for work and personal purposes and that organisational safety policies and procedures account for some of the variation (see also: Dimmer & Parker, 1999; Downs, Keigan, Maycock, & Grayson, 1999; Grayson, 1999). To illustrate, a worker may regularly use a hands-free mobile phone when driving for personal purposes, particularly if the individual has not experienced any negative reinforcement (i.e., crash, infringements) in their past driving. Kim and Yamashita (2007) found that seat belt use increased in commercial vehicles in association with frequent supervisor communication. This creates a challenge for organisations trying to cultivate a safe working environment.

Although it could be argued that driver behaviour could be modified through workplace training or other risk management practices (eg., OHS communication such as newsletters or safety alerts; Warmerdam, Newnam, Griffin, et al., 2017), research has established that there is a low level of maturity in the development, implementation and evaluation of such programs in the workplace (see Warmerdam, Newnam, Griffin, et al.,

2017). In particular, Warmerdam et al., (2017) identified multiple areas for improvement, including training, ensuring management commitment to safety, standardisation and formalisation of organisational policies impacting drivers and the need for systems to validate practices that are implemented.

According to role theory, the lack of maturity in risk management practices in this context is likely to lead to a high degree of uncertainty in drivers' role behavioural-expectancies. This suggests that driver behaviour is likely to be influenced by factors in the driver's personal environment including their own attitudes towards safe driving behaviour. Thus, it was hypothesised that:

Hypothesis 1: Positive safety attitudes would be associated with safer driving behaviour.

High Performance Workplace Systems

Although there is limited support for risk management practices in supporting a safe driving environment, there is a body of research that has explored the relationship between health promotion practices and safe driving. Much of this research has focused on safety culture (see Zohar, 2010). In the work-related driving context, a body of research has found a positive relationship between culture and safer driving (eg., Newnam, Griffin, & Mason, 2005; Wills, Watson, & Biggs, 2006)

More recently, research has focused on the role of human resources in creating a safe driving environment; specifically, the relationship between High Performance Workplace Systems (HPWS) and safety performance (Newnam et al., 2017; Zacharatos, Barling, & Iverson, 2005). HPWS are defined as a set of distinct yet interconnected human resource management practices. An organisation's implementation of HPWS is designed to cultivate reciprocity norms, whereby investment in HPWS is positively related to employee's concern for customers and other employees (Chuang & Liao, 2010). That is, when employees perceive an organisation values their contributions and cares about their well-being via supportive HPWS practices, they reciprocate with cooperative behaviour toward co-

workers. This enriched environment has been found to support employee health and well-being through implicit communication of the organisation's concern for safety (see Mearns, Hope, Ford, & Tetrick, 2010). This suggests that organisations investing in HPWS create an environment that supports safety behaviours. In support of this, Zacharotas et al. (2005) found that management practices had a positive impact on employee work safety.

However, there is also compelling evidence to refute this argument, with some research showing that HPWS can have a *negative* impact on behaviour. A study of government workers nested in 87 departments found that investment in HPWS is associated with poor psychosocial outcomes, including role overload and anxiety (Jensen, Patel, & Messersmith, 2013). This finding was attributed to workers having the perception of low control over their job. In support, a study of 287 different firms found that the implementation of HPWS was associated with negative psychological outcomes such as anxiety, turnover and burnout, and these indicators were amplified when employees perceived they were not adequately consulted or treated fairly (Gulzar, Moon, Attiq, & Azam, 2014). These findings suggest HPWS can have negative impact on performance and negative individual psychosocial implications.

The negative influence of HPWS on behaviour has also been demonstrated in the work-related driving context. Newnam et al., (2017) examined how senior management impact driver behaviour through HPWS practices. The study explored individual HPWS practices and found relationships between job and work design, communication, and selection practices and driver behaviour, such that, higher investment in these practices resulted in poorer driver behaviour. This study concluded that HPWS practices are not designed or implemented to consider the safety of the worker who operates a vehicle as part of their job role.

This research suggests that role theory may play a key role in understanding how context influences driver behaviour. That is, when safety is a core part of the work goals

(e.g., in manufacturing context it directly impacts on productivity and performance), then HPWS has a positive impact on safety behaviour. However, when safety is a secondary part of the work role, like in the work-related driving context then HPWS has a negative impact on safety performance. Thus, this study will explore this relationship through examining the relationship between HPWS practices and safe driver behaviour. There is strong consensus that multiple practices have the greatest effect (Wright & Boswell, 2002). This is because each practice has a unique contribution that can be optimised through its interaction with other practices (Combs, Liu, Hall, & Ketchen, 2006). It is, therefore, hypothesised that:

Hypothesis 2: Greater investment in HPWS will be directly related to poorer driving behaviour, hence unsafe driving.

HPWS as a moderator in predicting driver behaviour

The research literature provides support for a positive relationship between attitudes and safe driver behaviour and a negative relationship between HPWS and safe driver behaviour. However, the interplay between these two relationships has yet to be explored. That is, in addition to having a direct relationship with driver behaviour, HPWS are likely to interact with drivers attitudes towards safe driver behaviour. This argument will be elaborated upon, below.

Takuchi et al., (2009) tested a multi-level model examining the mechanisms through which HPWS impacts employee outcomes and found that a HPWS system that communicates care and support may supports positive workplace attitudes. Liao et al., examined the differences between management and employee perspectives of HPWS and found that both perceptions influenced individual performance and that this relationship was mediated by individual attributes (i.e., empowerment) for employees' perceptions. In support, Kehoe and Wright (2013) found that HPWS modified employees' attitudes and behaviours to the extent that there was alignment between employees and management perceptions of HPWS. These studies suggest that when HPWS is aligned, at management and worker

levels, there will be greater clarification of role-behaviour expectancies as it sends a strong situational cue that makes salient an employees' role performance on core tasks. This relationship is less likely in the unique context of work-related driving where the driving task is considered secondary to the primary role and thus these situational cues are less likely to be salient. This means that individuals are more likely to use their discretion when driving and thus the effect of their innate safety attitude might influence their behaviour more directly.

The study found that employees' perceptions of HPWS implementation likely affect employees' behaviours to at least some extent through their effect on attitudes. These findings indicate the importance of assessing individual attitudes within the work system context (Kehoe & Wright, 2013). HPWS practices articulate the organisation's values and priorities. These organisational goals drive the organisational climate and influence attitudes and behaviour (Ostroff & Bowen, 2000). In the work-related driving context there are two additional challenges. First, there is a lack of formalisation of the driving role. Second, the safety attitudes relating to the driving task are influenced by an individual's experience of driving in their personal lives.

The current study argues that an individual with a strong positive safety attitude is likely to be immune to the negative influence of HPWS activities. On the contrary, when individuals do not have strong attitudes, their behaviours will be more susceptible to influences of organisational climate (i.e., group norms or social informational cues), and thus for these people, the impact of the level of HPWS will influence their behaviour. Thus, it is hypothesised that:

Hypothesis 3: HPWS will moderate the relationship between attitudes and safety behaviour, such that under conditions of low HPWS, drivers with stronger safety attitudes will report safer behaviour.

Methods

Participants and Procedure

This research study was granted ethics approval by the Monash University Human Research Ethics Committee. Recruitment of senior managers, occupational drivers and supervisors was facilitated through a government injury database spanning 13 industries, categorised according to Australian and New Zealand Industrial Classification (ABS, 2016). Enterprise-sized organisations (500+ employees; n=52; 64%) were more highly represented in the sample compared with small to medium (1-199 employees; n=22; 27%) and large organisations (200-500 employees, n=7; 9%). Organisations were recruited from a list of work-related injury claims relating to motor vehicle crashes received by the regulatory body between July 2010 and end of May 2014. A screening process excluded claims from the following categories: vehicle types such as the primary 'agency of injury' including taxi, bus, tram, train, motorbikes, trucks, emergency service vehicles, other machinery driving / operating; claims that involved a fatality; organisations with fleet sizes of < 5 vehicles, those with fleets primarily consisting of heavy vehicles (trucks, buses, trains), and; driving schools or driver training schools. Following the selection process, eligible organisations were contacted by the regulatory body to seek their agreement to be contacted by the research team.

Three stages of recruitment were conducted. The first stage involved recruitment of senior managers who completed a HPWS questionnaire. Senior managers were organisational representatives with Occupational Health and Safety (OHS) and/or fleet management experience. These managers had a strong understanding of the implementation of workplace practices and the relevance of these practices to safety (e.g. general manager and managing director). The majority were male (61%), with a mean age of 47.5 years (SD = 8.72, Range =28 to 67 years). There was an average organisational tenure of 7.75 years and an average of five years in their current organisational role.

The second stage of recruitment involved occupational drivers. A minimum of five drivers were recruited from each organisation to complete a telephone interview incorporating measures of safety climate, self-efficacy, and attitudes. An occupational driver was defined as an employee who drove at least once per week for occupational purposes (Newnam & Watson, 2011a). The driver sample consisted of individuals employed in a range of roles such as nurses, plumbers, construction workers, sales representatives, couriers, and security guards. The majority of the sample were male (58.5%) with an average age of 45 years (SD = 11.07, Range = 20 to 73 years) and drove an average of 191 km/week for work-related purposes (SD = 1608.38, Range = 2 to 2000km/week)[1].

The final stage of recruitment involved supervisors of drivers. This group was recruited by asking the drivers who completed the interview to identify their supervisors and provide their email address. Emails with an embedded link to an online questionnaire containing the HPWS items were subsequently sent, inviting supervisors to participate. Supervisors were defined as those responsible for the daily management of occupational drivers (Newnam et al., 2012). The majority of supervisors were male (59%) with a mean age of 47 years (SD = 9.34, Range = 26 to 67 years) and an average organisational tenure of 8.86 years and an average of six years in their current organisational role. Supervisors represented 37 of the 81 organisations within the sample and on average supervised 11 work-related drivers (SD = 17.92, Range = 1 to 125).

The serial recruitment process allowed the research team to match individual, supervisor-level and senior management responses in a multi-level structure and maintain anonymity. The final sample consisted of 911 drivers and 161 supervisors from 83 organisations. Response rates were 63%, 28% and 13% respectively.

[1] These statistics represent the sample means while the table shows only the matched cases. The authors modified the exposure variable to exclude scores outside of one standard deviation from the mean (limiting the variability), and analyses were re-run with no modification to the model result.

Measures

High Performance Workplace Systems. A total of 27 items (from 1 = *strongly disagree* to 5 = *strongly agree*) were used to measure HPWS including nine subscales (practices). The full list of subscales and example items is available in Table 1. Practice configurations may be modified to meet industry sector idiosyncrasies (Evans & Davis, 2005) and to explore differing facets of HPWS. For example, research examining HPWS and caring behaviours used caring as a HPWS practice (Chuang & Liao, 2010). In this study, practices were selected based on a review of the literature (Posthuma, Campion, Masimova, & Campion, 2013) and their relevance to the work-related driving context. For example, as occupational stress had been shown to contribute to driving behaviour (eg., Strahan, Watson, & Lennonb, 2008) questions related to retention practices were modified to more better understand work-life balance practices in the organisation. Questions were prefixed with the statement "In thinking about the organisation that you work for…"

Table 5.1 High Performance Workplace Systems factors with example items

Factor	Example Item
Remuneration	"paying above average wages is a priority."
Job and Work Design	"fostering involvement in decision-making at all levels of this organisation is a priority."
Staff Development	"encouraging participation in staff development and/or training (e.g., driving skills, health and safety, IT skills) is considered important."
Selection	"selecting the right person for a job is considered an important HR function."
Communication	"formal information sharing programs e.g., newsletters, employee input suggestion scheme, are considered important."
Promotion	"providing employees with clear career paths is a priority."
Performance Appraisal	"considerable importance is placed on ensuring that performance appraisals are standardised and documented."
Job Security	"providing job security to employees is a priority in this organisation."
Retention	"modifying workplace practices to meet the needs of all employees, eg. offering flexible work schedules, is considered important."

Higher order factor analysis. A higher order factor analysis was conducted with the nine HPWS practices to assess their suitability as indicators of the higher order HPWS factor. The model showed good fit to the data χ^2 (351, N = 911) = 4731.617, p <0.05, CFI = .954, TLI = .949, RMSEA = 0.06. All hypothesised loadings were statistically significant with loadings ranging from .624 to .867. These results supported aggregation of the individual practices into a HPWS measure. Further support for aggregation was identified through Cronbach alpha (.92). This subscale aggregation approach has been supported by Drasgow and Kanfer (1985) and used in prior HPWS research such as Zacharatos et al. (2005).

Occupational Driver Behaviour Scale. The dependent variable was a self-reported measure of driver behaviour. The scale consisted of 12-items measuring speeding, rule violation, inattention and tiredness while driving. Questions were prefixed with "During a typical week when you drive for work purposes, how often do you…" An example speeding item is "Deliberately exceed the speed limit on a residential road." Items were measured on a five-point Likert scale, ranging from rarely or never (1) to very often (5). Lower scores indicated safer driving practices. The Occupational Driver Behaviour Scale is an established measure that has been found to be structurally and psychometrically sound (Newnam, Greenslade, Newton, & Watson, 2011). This scale has also been justified as a more appropriate scale for measuring work-related driving behaviour compared with the frequently used Driver Behaviour Questionnaire (Newnam & Von Schuckmann, 2012). Reliability scores for all scales are presented in Table 2.

Driver attitudes. Attitudes toward rule violations and speeding were assessed using 11 items. These items were adapted from Iversen and Rundmo's (2004) rule violations and speeding scale. An example item is "It is acceptable to drive when traffic lights shift from yellow to red." This was measured on a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5). These items are negatively worded, where a higher score is equal to a poorer attitude toward safer driving. The items were reversed prior to analysis.

Control measures. We included drivers' age, gender, the number of kilometres driven, safety climate and self-efficacy as control variables. Kilometres per week determines individual exposure to work-related driving risk. Research has found that Australian occupational drivers, on average, accumulate higher mileage in comparison to the average private motorist, leading to an excessive level of exposure (Albert, Hakkert, & Shiftan, 2014; Newnam et al., 2012; WorkSafe, 2008), and age and gender have been suggested as a potential factors contributing to driving behaviour (Duke, Guest, & Boggess, 2010; Newnam et al., 2008). For example, drivers under the age of 27 and over the age of 63 have been shown to have higher accident/fatality involvement.

Perceptions of the value and priority given to safety (ie., safety values; Neal & Griffin, 2006) and belief in ability to perform a task (Bandura, 1997) have been shown to be strong predictors of safety outcomes in the work-related driving context. In fact, Newnam et al. (2008) found that self-efficacy and safety values predicted work-related driver crashes. Thus, it is important to consider these variables when assessing the hypothesised relationships in this study.

Safety climate (safety values) was assessed as drivers' perceptions of their senior manager's safety values using the safety values items from Newnam et al. (2008). Three items made up this measure and were reworded to correspond with perceptions of senior management. An example item is "Senior level management place a strong emphasis on motor vehicle safety." Items were measured on a five-point Likert scale, ranging from strongly disagree (1) to strongly agree (5). Safety climate has been consistently shown to contribute to the impact of HPWS and safety behaviour. Self-efficacy, in the specific context of work-related driving, was assessed using four items adapted from Renn and Fedor (2001). Items were prefixed with "When driving for work purposes, how often do you feel…". An example item is "That you are on top of things when driving?" The items were measured on a 5-point Likert scale, ranging from rarely or never (1) to very often (5).

Analysis Overview

We conducted multi-level modelling in Mplus 7.0 to assess the hypothesised relationships. The model nested drivers within a two-level multi-level model, where senior management and supervisor's scores on HPWS represented Level 2 data.

Data Checking and Aggregation

With this staged approach to recruitment, only 37 sets of complete three level data were collected. This was partly due to supervisor attrition over the lengthy data collection process and partly due to multiple drivers reporting the same supervisor, limiting the total number of complete data sets. The number of drivers per supervisor ranged from 1 to 11. To improve the power to detect the hypothesised cross-level moderation effect, we chose to aggregate the supervisor data into the senior management data. The senior managers and supervisors completed the same measure of HPWS. Prior to aggregation, the organisational-level properties were assessed and contained adequate agreement with the supervisor-level properties (ICC = .123). This value is comparable with previous HPWS studies where the data have been aggregated (eg., Chuang & Liao, 2010). These results present sufficient support for aggregating the data.

Results

Univariate Descriptions

The bivariate correlations between the hypothesised variables are reported in Table 2. Consistent with the hypotheses, driver behaviour was found to be significantly correlated with HPWS (r = .13), safety climate (r = -.18), efficacy (r = -.14) and driver attitudes (r = -.19). These correlations showed that driver behaviour was negatively influenced by HPWS but positively influenced by individual attributes. This analysis does not take into account the multi-level nature of the data. As such, multi-level modelling was applied to further investigate the hypothesised relationships.

Table 5.2 Means, Standard Deviations, and Correlations between Constructs

Variable	Mean	SD	1	2	3	4	5	6	7	8
1.0 Driver Age (years)	45.50	11.07	-							
2.0 Driver Gender (% male)	58.50	-	-.11**	-						
3.0 KM driven (100's)	4.31	3.70	-.04	-.30***	-					
4. Driver rated safety climate	4.12	.83	.05	-.13***	-.08*	.94				
5. Driver self-efficacy	4.79	.37	.07*	-.13***	.01	.12***	.68			
6. Driver attitudes	3.95	.44	-.02	.13***	-.05	.15***	.07*	.65		
7. Manager rated HPWS	3.75	.19	.12***	-.19***	.20***	-.04	.03	-.07*	.92	
8. Driver behaviour (DV)	1.76	.44	-.13***	-.01	.11**	-.18***	-.14***	-.19***	.13***	.71

Notes: Supervisor responses to High Performance Workplace Systems questionnaire were aggregated into Senior Management level in the table. KM driven variable was re-scaled by dividing the original KM variable by 100. Driver attitudes scale variable was reversed prior to analyses. Reliability scores for each of the scales is reported in the final diagonal row.

* p < .05. ** p < .01. ***p < .001.

Multi-level model results

The two-level nested model is shown below and the results are shown in Table 3. Relationships between all variables are shown in Figure 1 and will be elaborated below.

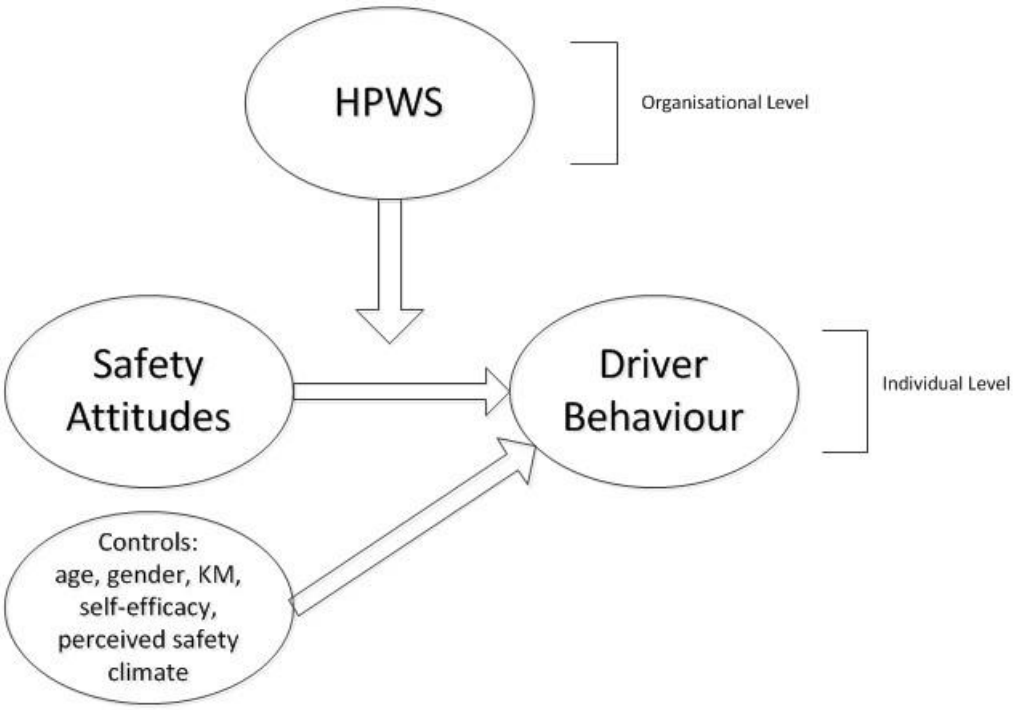

Figure 5.1 The hypothesised relationships between variables in the model

Table 5.3 Results of Multilevel Modelling Analysis for Driver Behaviour

Level and Variable	Driver Behaviour		
	Estimate	*SE*	Ratio
Level 1			
KM (CV)	.012*	.004	2.963
Age (CV)	-.005**	.002	-2.838
Gender (CV)	.008	.029	.273
Safety Climate (CV)	-.069**	.021	-3.334
Self-efficacy (CV)	-.135***	.038	-3.575
Level 2			
HPWS	.106*	.047	2.261
Cross-level interaction			
HPWS * Safety attitudes	-.176*	.068	-2.567
Variance Components			
Within-organisation (L1) variance	.175***	.010	16.785
Intercept (L2) variance	.002	.002	1.229
Slope (L2) variance	.001	.012	.085
Number of estimated parameters	13		

CV (control variable)

* p < .05. ** p < .01. ***p < .001.

n = 911

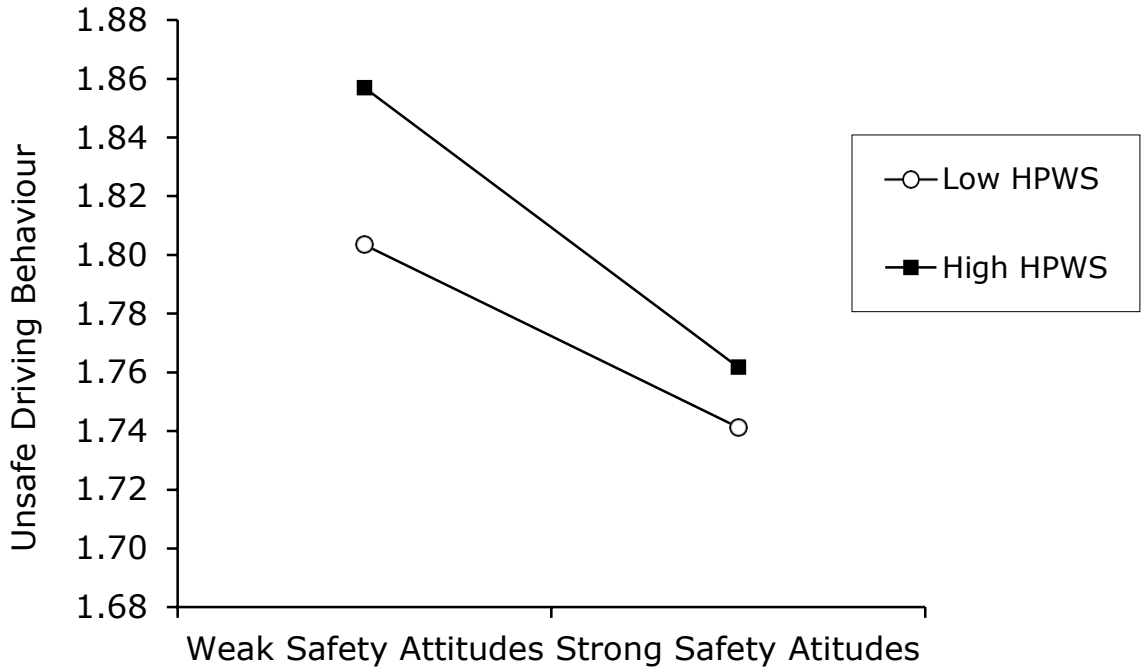

Figure 5.2 The interaction between attitudes toward safe driving and high performance workplace systems. Lower scores indicate safer behaviour.

Consistent with H1, safety attitudes were positively related to safer driving behaviour. This finding suggests that positive safety attitudes were associated with better driving behaviour. Thus, safety attitudes is a positive predictor of safety behaviour in the driving context.

Consistent with H2, a significant relationship was identified between HPWS and driver behaviour. This finding suggests that higher investment in HPWS resulted in more dangerous driving behaviour. Thus, HPWS has a negative impact on the self-reported safety of work-related drivers.

Consistent with H3, the results identified that HPWS moderated the relationship between attitudes and driver behaviour. The direction of this relationship was explored through simple slopes analysis (analogous to performing main effects in ANOVA designs; see Aiken and West, 1991; Preacher et al., 2003). The findings suggest that under low and high conditions of HPWS ($p < .05$), safety attitudes significantly predicted safer driving behaviour. In other words, drivers with

strong safety attitudes report safer behaviour, regardless of the level of investment in HPWS. However, Figure 2 also shows that a cross-level interaction occurred between organisational investment in HPWS and individuals' safety attitude, such that drivers are more likely to report safer driver behaviour under conditions of low investment in HPWS compared to high investment in HPWS. The interaction is graphed in Figure 2.

Discussion

The aim of the paper was to explore the relationship between attitudes and behaviour, and the role of HPWS in moderating this relationship. This study provides unique contributions to the existing body of safety research in the specific context of work-related driving. It is the first study to examine the impact of attitudes on behaviour within a nested, multi-level data structure considering the role of workplace practices (i.e., HPWS). It is also unique in that it is the first study to explore these relationships within a large sample of organisations of varying sizes and differing business activities. Overall, the results demonstrate that individual attributes and organisational practices have an impact on safe driving behaviour and that, in combination, a driver's attitude towards safe driving helped to ameliorate the negative impact of organisations investing in HPWS. These results have strong implications for policy and practice to improve workplace road safety including the need for interventions to operate at multiple levels of the organisation (Warmerdam, Newnam, Sheppard, Griffin, & Stevenson, 2017).

The results showed that positive safety attitudes were associated with safer driving behaviour. This is consistent with a large body of research demonstrating the importance of attitudes in modifying safety behaviour (Hofmann, Jacobs, & Landy, 1995), including behaviour in a work vehicle (Newnam et al., 2008; Wills, Watson, & Biggs, 2009; Wills et al., 2006). This finding highlights the need to better understand the 'bottom up' impact of driver attitudes on safety performance. That is, safe driving behaviour can be optimised through understanding the causes of unsafe driving behaviour and using this information to generate solutions to avoid situations of risk in future driving (eg., Newnam, Lewis, & Warmerdam, 2014).

It was also found that high investment in HPWS resulted in poorer driver behaviour. This is consistent with previous research that has found that HPWS has negative influence on employee wellness (Gulzar et al., 2014; Jensen et al., 2013) and safe driving behaviour (Newnam et al., 2017). However, this finding is inconsistent with research by Zacharatos et al., (2005) which found a positive influence of HPWS on safety performance. This finding could be partly attributed to the context in which the research was conducted. The study by Zacharatos was conducted in a manufacturing environment, which could be characterised by a high degree of reliability (ie., interdependent work processes such that a failure at one point leads to a failure down the line; Weick, Sutcliffe, & Obstfeld, 2008). In contrast, the work-related driving context is more dynamic and complex characterised by tightly coupled systems where there is sometimes insufficient time and understanding to control incidents and avoid accidents. This is partly due to the remote nature of the driving task (ie., work conducted outside the physical boundaries of the organisation; Huang et al., 2013) and poor integration of OHS into risk management (Warmerdam, Newnam, Griffin, et al., 2017) and operational activities (Newnam et al., 2017).

The result that HPWS constrains safe driver behaviour provides a unique theoretical contribution to the literature in that it demonstrates the importance of the workplace environment in the design of HPWS. This fills a gap in the literature, as identified by several authors, who recognise the need to identify contexts where the influence of HPWS varies (see, Combs et al., 2006). By way of example, the work-related driver context is characterised by low visibility in the driver-supervisor relationship. This is important as Luria et al. (2008) demonstrated that increased visibility generates more frequent exchanges between supervisors and employees, and that this process improves safety behaviour. In support, the frequency of exchange of safety-related communication has been found to predict safe driving behaviour (Newnam et al., 2012). With this in mind, it appears that HPWS practices have not been designed or implemented in a way that supports safe driving practices. This conclusion suggests that HPWS should not be designed without consideration given to the context in which these practices will be implemented.

Extending these findings, this study found that HPWS moderated the relationship between drivers' attitudes towards safe driving and behaviour. Drivers were more likely to report safer driver behaviour if they had a positive attitude toward safe driving, and this relationship was accentuated if their organisation had low investment in HPWS. There is some research to support this finding. The literature suggests that climate can act as a mechanism through which management practices influence individual attitudes, as climate shapes how employees construe the meaning of organisational practices (eg., Ostroff & Bowen, 2000). Given that HPWS practices are not designed or implemented to support safety of the driver, this lack of clarity creates a negative climate and drivers must rely on their own individual attitudes to direct behaviour. This finding suggests that policy and practice relevant to HPWS (and risk management; Warmerdam et al., 2017) need to be developed and align with the safety goals for the driving role.

Practical Implications

It appears that HPWS practices are not being designed or implemented to support safety of the driver and that safe driving behaviour is primarily being influenced by drivers' own attitudes towards safe driving. The results of this research highlight the need to better integrate OHS into top-level management practices, and workplace road safety. These findings have several implications for policy and practice.

First, the positive relationship between attitudes and driving behaviour supports the need for a bottom up approach to the management of safe driving. Programs focused on understanding the factors influencing safe work-related driver behaviour have been developed. These programs incorporate feedback and goal setting exercises to challenge drivers' key beliefs regarding safe driving practices (Newnam et al., 2014). Evaluation studies have found these programs to be effective in improving safe driving behaviour (Newnam et al., 2014; Newnam & Watson, 2009).

The results suggest that HPWS are not designed or implemented to support safety of the driver. This finding has implications for the current and future design of HPWS systems in organisations which employ individuals who drive a work vehicle. Employers need to gain a better

understanding of how HPWS can operate to support the safety of the driver. For example, safety performance may form part of indicators of overall performance when considering individuals for promotion activities.

This study also found that drivers were more likely to report safer driver behaviour if they had a positive attitude toward safe driving and that this relationship was accentuated if their organisation had low investment in HPWS. This finding provides some practical guidance for organisations in the review and/or development of HPWS systems. It is possible that safe driver behaviour could be optimised if HPWS practices incorporate clear goals relevant to safe driving.

For instance, an organisation that does not clearly communicate safety performance expectations through management practices will be less likely to influence individual level attitudes and behaviours (Kehoe & Wright, 2013; Liao, Toya, Lepak, & Hong, 2009). In this sense, management practices must be adapted to the relevant context to achieve productivity and safe driving practices. In support, past research has demonstrated that improved frequency and quality of communication of management practices results in individuals expanding their roles and behaving in ways that are consistent with safer drivers (Hoffman et al., 2003). Other research has also demonstrated a direct link between quality of communication practices and improved safety performance (Newnam et al., 2008).

Limitations

There are limitations of this study that need to be taken into account when interpreting the findings. First, driver behaviour was measured with a self-report driving questionnaire. Although research has found that driving questionnaires are associated with minimal social desirability responding (Lajunen & Summala, 2003), it is possible that a bias did exist. Future research could overcome this possible limitation through collecting data on driving behaviour using objective measures (i.e., using in-vehicle telemetry).

A second limitation relates to cross-sectional measurement. It was not possible to test the causal relationships between attitudes and driver behaviour. Therefore, reverse causation could

also explain the significant relationships. For example, drivers may modify behaviour due to the attitude of a co-worker. Longitudinal research is required to provide further validation of the hypothesised relationships.

Finally, consideration must be given to the representativeness of the sample. The high proportion of organisations where driving is considered a secondary work-role may have biased the results as it is unknown whether the activity within particular industries may predispose drivers to unsafe driving conditions.

The multi-level nature of this study is a strength. Future research could broaden the systematic nature of this research by examining data at the regulator and government level. Research should also seek to identify additional individual attributes that contribute to safety performance in the context of HPWS as this information would aid managers in developing practices and supervisors in creating effective feedback mechanisms and development of interventions to improve workplace safety.

Conclusion

Despite research efforts, work-related driving remains a major risk for organisations. This is the first study to test the higher order concept of HPWS across a sample of multiple organisations using a multi-level nested data structure that accounts for individual and organisational level contributions to safety. Overall, the results demonstrated that HPWS practices need to be aligned with safety goals in the work-related driver context in order to challenge driver's attitudes toward safe driving. These findings extend current research by contributing to theoretical knowledge of the psychological dimensions contributing to safety behaviour in the work-related driver context. These results aid in potentially improving driving behaviour in the work context and, by extension, reducing work-related road traffic injury.

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Chapter 5 provided unique insights into the relationship between drivers' attitudes towards safety and safe driving behaviour, and the effect of HPWS in moderating this relationship. This paper not only presents a significant contribution to the research literature, it provides a holistic perspective to furthering prevention efforts in workplace road safety through exploring the role of risk management and HPWS in managing safe driving. Each paper has provided implications for individuals, supervisors and senior management. The final chapter highlights how system reform can be applied to improve occupational driver safety.

Chapter Six

The overall aim of this PhD was to identify the organisational determinants of safe driver behaviour. This project addressed gaps in research and practice by investigating the landscape of risk management in workplace road safety in Australia and the broader organisational practices that support and constrain safe driver behaviour. This was achieved through a mixed methods program of research. The PhD comprised four components. First, a new approach to managing work-related road safety was presented in the form of a novel health investment framework (Study 1). The framework provided a holistic interpretation of the complex interactions within and across organisational levels influencing workplace road safety. It promotes the development of interventions that consider the role of all organisational members (i.e., senior management, supervisors and individual fleet drivers) in improving safe driving practices. Second, the landscape of workplace road safety risk management in Australia was explored (Study 2). This research highlighted a lack of maturity in workplace road safety risk management practices in Australia. The results provide baseline data for organisations to identify strengths and limitations in their existing approaches to fleet safety management. Third, this program of research explored the human resource (i.e., HPWS) practices that support and constrain safe driver behaviour (Study 3). The results demonstrated that some management practices (selection, communication and job and work design) predispose drivers to unsafe driving practices, while others support safe driving behaviour, but only when safety is valued and prioritised. The final study explored how a system of HPWS practices moderated the relationship between attitudes and safety behaviour (Study 4). The results demonstrated that individual attributes and organisational practices have an impact on safe driving behaviour and that, in combination, a driver's attitude towards safe driving helped to ameliorate the negative impact of organisations investing in HPWS.

Overall, this program of research demonstrated that safe work-related driving is influenced by factors at multiple levels within the workplace including senior level managers, supervisors and individual fleet drivers. The conclusions from the studies also highlight the role of other actors

beyond the workplace context in supporting safe driver behaviour, including workplace safety regulators. Thus, to ensure the safety of employees driving vehicles, a reform in prevention approaches is needed to incorporate a systems perspective in prevention efforts.

The systems thinking perspective suggests that safety performance can only be optimised through consideration of each diverse and individual component as an integrated whole (Levenson, 2002). In other safety-critical domains, systems based thinking has been used to understand the complex system of factors involved in accidents (e.g., Leveson, 2004; Rasmussen, 1997; Reason, 1990; Svedung and Rasmussen, 2002). This thinking is underpinned by the idea that safety, and hence accidents, are emergent properties arising from interactions between multiple components across complex sociotechnical systems (e.g., Leveson, 2004). The behaviour of those at the front line of system operation (e.g., drivers) is no longer seen as the primary cause of accidents, rather it is treated as a consequence of system wide interactions, created by decisions and actions at all levels of the organisational system (e.g., government, regulators, company management).

Although many have advocated a systems approach to road transport (e.g., Salmon & Lenné, 2015), this view has not meaningfully penetrated road safety research, practice or policy in light vehicle fleets. Existing prevention efforts do not consider contributing factors and interactions between factors at all levels of the system in workplace road safety. Rather, they are reductionist-focused and aim to reduce human error through individual compliance (e.g., driver training, incentive schemes). A good example of this gap in research and practice is evidenced at the regulatory level. Currently, there is no method of estimating the magnitude of work-related road traffic injury in Australia as regulators do not collect crash data that identifies whether an individual was driving for work or personal purposes (i.e., purpose of journey). Without this critical information, workplace road safety prevention efforts cannot be fully informed by the system and thus will be less effective in the endeavour to reduce injuries and fatalities.

The results from this program of research identify several approaches to better align prevention efforts with the systems perspective. The framework in Study One provides the impetus for establishing a Chain of Responsibility (CoR) for organisations operating light vehicle fleets. The results of Study Two consider the role of the regulator in improving risk management practices through the production of standards and guidelines that can be enforced and communicated through risk assessment tools. Studies Three and Four identify the need for integration of risk management and operational systems (i.e., HPWS) and advocate the use of health promotion programs in the occupational driver context. This chapter will elaborate on these recommendations, highlighting the need for interventions to be designed and implemented within a systems approach. Methodological considerations and overall conclusions are also discussed in this chapter.

6.1 Key Findings and Implications of Study 1: Conceptual Framework

This study presented a multi-level framework for understanding work-place road safety, characterised by a focus on health investment. The framework extended traditional approaches to behavioural management which focus on the individual driver and considered the actions of supervisors and senior level management in creating a safe work environment. The key implication of this research is that the roles and responsibilities of all actors in the workplace, including drivers, supervisors and senior management, need to be clarified to ensure a safe working environment. Consistent with the systems perspective, this could be achieved through establishing a CoR for organisations that employ individuals to drive for work.

The CoR would ensure that all actors in the system share equal responsibility for ensuring breaches in the legislation do not occur and that each actor has clear roles and responsibilities in promoting a safe working environment. To illustrate, the CoR could ensure there are systems in place to manage fatigue; government agencies and regulators would ensure (i) employers have policies and procedures in place to manage driver fatigue (ii) work-group supervisors are given clear guidance on practices to manage fatigue (e.g., rostering, diaries) (iii) employees have clear

role-behaviour expectancies in fitness for duty (e.g., adequate sleep, drug and alcohol free). Regulators must also play a role in this space by ensuring they provide clear guidance on issues such as establishing maximum driving times for light vehicle fleet drivers, regulate driving hours, and educating individuals and organisations on what is required to ensure compliance.

As indicated in study two, there is also a role for the fleet manager in the management of workplace road safety. Fleet managers are generally placed outside of the management structure without clear responsibilities or authority in relation to safety (Newnam et al., 2008). Past research has identified that fleet managers play a critical role in creating a safe working environment (Newnam et al., 2008); thus, these individuals need to be acknowledged within the CoR. It is recommended that a training program is established for fleet managers. This program would have the potential to create a national standard (i.e., consistent guideline) and align expectations for fleet managers within a national CoR framework. Furthermore, this program would ensure that fleet managers are better incorporated within a systematic approach to workplace road safety. Training program delivery mechanisms may require additional investigation/evaluation but incentive should be provided to organisations trying to achieve high safety standards (e.g., obtaining ISO 39001). Implementation of CoR laws may require improved data systems to fully demonstrate the extent of crash and injury burden associated with work-related light-vehicles. This data could be used to create further impetus for regulators and policy makers to acknowledge the need for government regulation.

In summary, study one demonstrated the need for clear roles and responsibilities of all actors in workplace road safety. It is recommended that change in this area could be achieved through establishing a CoR that acknowledges the role of not only the individual driver but employers, the fleet manager, workplace regulators and government agencies.

6.2 Key Findings and Implications of Study 2: Risk Management

The aim of this research was to explore the landscape of risk management in workplace road safety. The findings established (i) there is opportunity for employers to increase the effectiveness

of risk management practices for employees who drive a vehicle and (ii) that safety of the driver is not well integrated within OHS and the broader organisational context. The results of this study demonstrate that risk management in workplace road safety could be optimised through a systems approach that both regulates and supports risk management in workplace road safety through compliance and education. The key implication from this research is the production of baseline data which could be used to inform the development of an audit tool (i.e., risk assessment tool) that could be implemented by both employers and regulators to assess risk management practices for vehicle use. The results from this research could also be synthesised with safety audit tools developed in Australia (e.g., Mitchell, Friswell, & Mooren, 2012) and internationally, such as ANSI/ASSE standard Z15.1-2017.

Currently, there are no national guidelines for risk management in organisations that operate light vehicle fleets. Study two demonstrated that industries' lack of knowledge of 'best practice' through standards or guidelines was a limitation in the development of effective risk management practices in organisations. Specially, the study highlighted the need to build accountability within organisations, improve communication practices, improve journey management, reduce vehicle-related risk, improve driver competency through an effective workplace road safety management program, and review organisational incident and infringement management. These findings suggest a role for regulators in this space.

These findings support the need for the development of a risk assessment tool in light vehicle fleets. Such a tool could be used by regulators to assess the risk management practices of vehicle use within workplaces. Using licencing as an example, inspectors at the regulatory level could ensure that the workplace has systems in place to regularly check that employees who drive a vehicle have a valid driver's licence. This could be achieved through systematic audits and/or management of expiry dates and demerit points, as well as policies and procedures to ensure clear role behaviour expectancies for operating a vehicle with a valid licence. Regulators could also use the data from the audits to educate the workplace on best practice in risk management in

workplace road safety. This, in turn, could directly benefit employers in being able to establish a benchmarking program so that they can assess maturity levels with similar organisations.

In summary, study two found that there was a knowledge gap in industry regarding how to best manage risk associated with employees who drive a work-related vehicle. Regulators could bridge this gap using the results from this study to develop a risk assessment tool or adopt a tool by reference to a guideline developed by another body which could improve regulation, compliance and education of risk management in light vehicle fleets. Development of a risk assessment tool would also benefit employers in better understanding their maturity in risk management practices.

6.3 Key Findings and Implications of Studies 3 and 4: Management Practices

Studies three and four aimed to identify the leadership practices that support and constrain safe driver behaviour (Study 3), and the influence of leadership practices on the relationship between driver attributes and safe driving behaviour. These studies illustrated that risk management and operational activities (i.e., HPWS) within the workplace currently operate in silos and conflict with each other, which has a negative influence on safe driving practices. The key implication of these studies was that there is a need to integrate risk management and HPWS to optimise prevention efforts in workplace road safety, and to use these systems to promote positive attitudes towards safe driving. This could be achieved through a regulatory or organisational initiative, focused on integrating health promotion and health protection.

Health promotion focuses on systems targeting personal and social aspects of worker's health and safety (Bandura, 2004), and health protection focuses on the systems targeting hazards within the workplace. Health promotion and protection frameworks are multifaceted and risk management comprises only a portion of cultivating a safe work environment. There is strong evidence to suggest an integrated system is the optimal solution to the development of targeted OHS activities (McLellan, Harden, Markkanen, & Sorensen, 2012). In support, a case study report undertaken by the Institute of Safety Compensation and Recovery Research demonstrated that integrated

systems are effective for both physical (e.g., smoking reduction and prevention of musculoskeletal

disorders) and mental health outcomes (e.g., diminution of stress and poor mental health) and demonstrate a positive return on investment (Cooklin, Husser, Joss, & Oldenburg, 2013). Furthermore, Hunt et al. (2005) reported greater participation in preventive health programs by both employees and managers when an integrated approach was used.

An integrated approach to workplace road safety could be used to optimise the effectiveness of risk management and HPWS, as well as challenge drivers' attitudes towards safe driving. Within this approach, HPWS would need to be implemented in such a way that does not negatively influence individual driver wellness, while risk management practices would need to be optimised for each individual and context.

To illustrate, one goal of this initiative could be to improve journey management planning. This could be achieved through a coordinated planning effort between supervisors and drivers, with a focus on educating drivers on the negative impact that time pressure and associated stress can have on safe driving behaviour. Another initiative could be to embed a positive safety culture within the organisation by considering safety performance in promotion and performance appraisal activities. This approach challenges driver's traditional views of performance and encourages safety-related communication between drivers and management.

In summary, Studies Three and Four suggest that an integrated approach to workplace safety will optimise safe driving efforts. Together these studies provide strong impetus for change at the individual and organisational levels.

6.4 Theoretical research implications

These were the first studies to consider the organisational context in relation to workplace road safety and take account of the complex system when identifying the management practices associated with work-related driving behaviour. The results of this study both refute and extend past research, but most importantly, offer practical guidance for organisations in designing and implementing management systems designed to support safe driving behaviour and reduce death and injury.

The systems thinking perspective suggests that safety performance can only be optimised through consideration of each diverse and individual component as an integrated whole (Levenson, 2002). In other safety-critical domains, systems based thinking has been used to understand the complex system of factors involved in accidents (e.g., Leveson, 2004; Rasmussen, 1997; Reason, 1990; Svedung and Rasmussen, 2002). This approach requires less focus on individual drivers and treatment of accidents as a consequence of system wide interactions, created by decisions and actions at all levels of the organisational system (e.g., government, regulators, company management).

At the organisational level, this research highlighted the role of supervisors and senior managers in developing a safer working environment. Safety leadership decisions and those leadership practices that underpin their successful execution can result in actions changing across the work system. Moreover, without the application of systems thinking to organisational accidents, organisations may fail to learn from the past and make inadequate changes in response to losses. The findings from this program of research support the continued use of systems approaches to reducing accidents, including work-related road traffic injury. Future research priorities should continue to focus on gathering data to help advocate for systemic change.

6.5 Methodological Considerations

There are strengths and limitations associated with this program of research. These issues are elaborated on in the following sections.

6.5.1 Research Strengths

This program of research has provided much needed data relating to the landscape of work-related road safety in Australia. First, to date, almost all research related to work-related road traffic injury has been undertaken within a single organisation. There are inherent challenges with obtaining data given the non-traditional structures in managing the safety of drivers. A key strength of this program of research was the nested, multi-level structure of the data collection which

enabled analysis of the factors influencing safe driving behaviour at individual-driver (e.g., attitudes) and management levels (i.e., HPWS).

Second, relationships were explored across a large sample of small, medium and large organisations, representing over 13 industry types. The characteristics of the sample support generalisability of the research findings. This diverse sample has provided much needed data relating to occupational drivers.

Third, the research employed a mixed-methods approach. Face-to-face interviews were employed to explore the landscape of workplace road safety, and surveys where used to explore factors at the individual, supervisor and senior manager levels. A large amount of previous research has focused solely on driver perceptions and the relationship with unsafe driver behaviour (Newnam & Watson, 2011b) and self-reported crash outcomes (Newnam et al., 2008), with only few studies exploring the cross-level relationship between perceptions and practices of leaders and safe driving. This is a unique methodological approach in the area of workplace road safety as it allowed a richer understanding of how leaders support and constrain safe driver behaviour, and the maturity of risk management practices in organisations that operate light vehicle fleets.

6.5.2 Research Limitations

The limitations of this research also need to be acknowledged. First, one-third of the sample comprised health care and social assistance organisations. Due to this, it is less clear whether industry type is strongly associated with unsafe driving behaviour. Future analyses could control for industry type or weight the data so that industries are more evenly represented. For new data sets, recruitment methods could be modified to develop a more balanced sample.

The lack of objective outcome data is a key limitation of the research. Studies three and four used self-reported measures within a cross-sectional design. Gaining access to objective outcome data presents a key challenge in this area. As mentioned previously, regulatory bodies do not collect purpose of journey data; thus, researchers must rely on organisations to access crash data. However, the ethical (i.e., privacy issues) and practical (i.e., crash investigation methods)

challenges associated with organisational crash data are prevalent in this context (Huang, Roetting, McDevitt, Melton, & Smith, 2005). Future research could rely on proxy measures of objective data using in-vehicle monitoring systems, such as speeding (Newnam et al., 2014) and eye tracking (Horrey, Wickens, & Consalus, 2006; Nabatilan, Aghazadeh, Nimbarte, Harvey, & Chowdhury, 2012). An examination of risk management practices and management practices needs to be conducted using objective data.

This program of research was not able to link injury data from drivers that responded to the survey at the organisational level. This would have provided additional depth of analysis to the current research; in particular, identifying the practices most strongly associated with workplace injury.

A final limitation of this program of research relates to the fact that all studies drew participants from the same 83 organisations. While the focus of each study was different, the commonality of the organisations across the program of research has implications for the generalisability of the findings.

6.6 Conclusions

This research has presented a novel organisational-system model of safety, benchmarked risk management practices in organisations and operationalised the management practices that may predispose drivers to risk. The results from this program of research support the need for better integration of workplace road safety within OHS. The recommendations are supported by the findings of a low level of maturity in risk management practices and that leadership practices were largely constraining safe driver behaviour. These findings provide an opportunity for system reform in preventive approaches to workplace road safety in Australia and internationally.

The conclusions drawn from this program of research identify the roles of actors, beyond the workplace context, in supporting safe driver behaviour. These findings and conclusions support the need for better integration of workplace road safety within Health and Safety systems, including risk management practices and operational activities. This goal could be achieved through various

activities such as: reviewing the roles and responsibilities of those involved in the safety management of drivers (i.e., supervisors) and vehicles (i.e., fleet managers), establishing a national guideline for risk management in light vehicle fleets across Australia, and capturing data on purpose of journey data following a road crash to enable better understanding of the magnitude of the problem and accurate allocation of resources toward prevention efforts. This program of research provides valuable insight into the determinants of safe driving behaviour and an opportunity to advocate for system reform in preventive approaches to workplace road safety in Australia and internationally. The findings and recommendations presented within this PhD demonstrate advanced understanding of the safety of work-related drivers and have the capacity to protect Australian workers from injury or death.

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