

Revised Final Report

Examination of the Safety Climate and Health Culture within Trucking Companies in British Columbia and Canada: An Exploratory Study

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WorkSafeBC-UNBC Trucking Research Study

Executive Summary

Introduction

Long-haul truck drivers in the Province of British Columbia (BC) and Canada face multiple challenges to their health, safety and wellness (HS&W) while on the road. Truck driving, as a profession, is associated with hectic work hours and prolonged irregular schedules, poor work environments which include less access to nutritious healthy foods and physical inactivity. Furthermore, chronic fatigue is a major dilemma for many truck drivers who are subsequently exposed to increased risk for truck accidents and collisions.

In British Columbia, there is paucity of information and knowledge regarding the HS&W of truck drivers and their access to health promotion and wellness programs within their trucking carriers/companies (i.e., employers).

The main purpose of this research study was to identify HS&W programs/initiatives provided by trucking companies in BC. Our study cohort, within trucking companies, included both employers/managers as well as truck drivers (employees). This study identified the prevalence of existing HS&W programs available to truck drivers, and compared how well such programs are aligned with existing best practice standards; such as the National Institute for Occupational Safety and Health Total Workers Health (a US Federal agency responsible for conducting research and making recommendations for the prevention of work-related disease and injury), and the European Workplace for Health Promotion.

Other study objectives included identifying differences between trucking companies with HS&W programs versus those without HS&W programs. The study further identified among carriers with existing HS&W programs, the proportion of subset carriers that are integrated in other quality management and assurance programs (e.g., the Certificate of Recognition/COR). Finally, an important study objective was to review organizational culture, practices and policies, and personal lifestyle risk factors and behaviours pertinent to BC truck drivers.

Methods

Using a cross-sectional survey design, we employed two online surveys through the UNBC Survey Monkey Platform. One online survey questionnaire was geared to truck drivers and the other online survey questionnaire was geared to managers within trucking companies. The two online questionnaires were administered in the English language only. Our research team considered translating the questionnaire. However, after thinking about it we believe that administering the

questionnaire in multiple languages may have provide inconsistent results and language proficiency issues with multiple translations.

These surveys included different scales and questions which improve understanding about truck drivers' health, trucking companies, prevalence and characteristics of health and wellness programs within the trucking industry in BC. These questionnaires also provided information about access to health and wellness programs, as well as barriers and facilitators to adopting health and wellness programs within the trucking industries in BC.

This study adapted questions from several authors including Gillespie's (2014) questions on workplace health promotion, Spielholz et al.'s (2008) questions about work operations within trucking companies, and other questions which provided descriptive data such as age, sex, geographic location of work, and country of work. A scale about the safety climate within the trucking industry was included in the manager's survey, and another scale about work place culture was also included in the truck driver's survey. The workplace culture scale included questions adapted from Ben Amick's 19 item questions on organizational support (Amick et.al, 2011); a question on workplace culture from Shi et al. (2017), and questions on group safety climate from Huang et al. (2016). We also collected information about fatigue and participants' response to fatigue, prevalence of some health behaviours and chronic medical conditions among truck drivers.

In total, there were 81 questions in the truck driver's survey and 64 questions in the manager's survey. These surveys contained skip questions so that no participant would answer all questions. The time to complete each survey was an average of 30 to 45 minutes. Both surveys provided a comprehensive description of health, wellness and safety programs for truck drivers in BC, as well as the organizational policies and practices that support these programs and truck drivers' health.

A random purposeful sampling strategy was used initially to recruit participants (both truck drivers and managers) for the study. This was followed by more targeted recruitment of participants from medium and large sized companies. Email blasts were sent to all trucking carriers with valid email addresses registered in BC. In total, 8827 surveys were sent out via email blasts to all companies registered in BC via Survey Monkey. At the end of the survey, approximately 10% had responded to the survey.

Results

The study identified high awareness about safety irrespective of trucking company size. Companies with a high safety climate exemplified by *high* scores on the *safety climate scale*, *Tiers 1 and 2*, scored *low* on the *health culture scale*. Some

companies with very high safety climate scores were also scored negatively, as low as -39 (the lowest possible score) on the health culture scale. Very few trucking companies have a workplace health promotion (WHP) program (31.1% with a WHP and 69.2% without a WHP). The wellness programs in trucking companies are fragmented and not comprehensive. The study also brought interesting results about driver fatigue. In this study, drivers frequently reported awareness of the following chronic medical conditions in the trucking industry: high blood pressure (66.4%), sleep apnea and other sleep disorders (59.6%), diabetes (50.8%), and fatigue (63.4%).

Discussion

This study is an exploratory study examining the prevalence of health, safety and wellness (HS&W) programs in trucking companies in BC, characteristics of these programs and integration into other management systems. This study also examined the safety climate and health culture within trucking companies in BC, and compared HS&W in British Columbia (BC) to international standards like NIOSH and ENWHP with hopes to identify evidence-based best practices in existing programs -- so that recommendations can be made for the trucking industries in BC.

This study showed that few trucking companies in BC have a workplace health promotion (WHP) program (31.1% with a WHP and 69.2% without a WHP). The wellness programs offered by trucking companies to their employees are also fragmented and not comprehensive. Very small and small companies are just as likely to report a WHP as well as large companies. However, large companies provided more comprehensive programs than very small or small companies did. Promotion of physical activity through gym memberships or organization of sporting events is the most popular health promotion target in many trucking companies in BC. This is similar to findings from the Workplace Health in America Survey (CDC, 2018b). Promotion of physical activity is the most popular workplace intervention adopted by all industries, including the transportation industry, in the United States (CDC, 2018b).

This study found several barriers to providing and participating in WHP programs. In this study, some managers did not see the need to provide a WHP for their drivers. Similarly, some truck drivers did not think it was their employer's responsibility to provide a WHP. Some truck drivers also were not aware of the presence of a company's WHP program. Among those that were aware of an existing WHP, some cited a lack of time, prolonged work hours, and demands of their work as barriers to participating in a WHP program. These findings are similar to findings from previous studies among

truck drivers (Apostolopoulos et al., 2014; Lemke, Meissen, & Apostolopoulos, 2016). A small percentage of drivers also expressed fear of being replaced at work if they took time off to care for their health. Overall, this study showed a need to educate employers and truck drivers about workplace health and wellness programs, and the benefits of WHP.

With regards to the evaluation of the safety climate in trucking companies in BC, the results of this study show that there is a high awareness about safety. This study identified the presence of a high safety climate across all trucking companies in BC irrespective of company size. A company's safety climate culture is a predictor of job satisfaction, truck driver performance (Zohar et al., 2014), and employee engagement or truck driver turnover (Huang et al., 2016).

Another area identified within this study is that some truck drivers were unable to distinguish between wellness practices and safety practices in their organization. While it is common for companies to have a combined program that addresses the safety and wellness of their employees, workplaces and/or employees should however not assume that having a safety program is synonymous with having a workplace health and wellness program (CDC, 2017). In this study, companies with a high safety climate exemplified by *high* scores on the *safety climate scale, Tiers 1 and 2*, scored *low* (scores of less than 26 on a possible total score of 39) on the *health culture scale*. Some companies with very high safety climate scores were also scored negatively, as low as -39 (the lowest possible score) on the health culture scale. The results of this study support existing literature that safety, and health and wellness are two different things (Nelson et al., 2015; Pronk, 2013).

An important contributor to truck driver safety is fatigue. Driver fatigue (a subjective sense of tiredness) is an important contributing factor to road crashes (Vanlaar, Simpson, Mayhew, & Robertson, 2008). The role fatigue plays in crashes is difficult to capture due to underreporting and poor assessment/measurement (Thiffault, 2011). Causes of fatigue include poor scheduling, long hours of work, sleep disorders like obstructive sleep apnea, and insufficient sleep (Stern, 2019). Obstructive sleep apnea and insufficient sleep are risk factors for other chronic medical conditions such as depression, obesity, diabetes, hypertension, and other cardio vascular diseases identified among the truck drivers (Watson et al., 2015). Fatigue contributes to inattention, distracted driving, hypovigilance and slowed response while driving (Thiffault, 2011).

In this study, drivers frequently reported awareness of the following chronic medical conditions: high blood pressure (66.4%), sleep apnea and other sleep disorders (59.6%), diabetes (50.8%), and fatigue (63.4%) in the trucking industry.

The Federal Motor Carrier Safety Administration (FMCSA) (2005) identified driver fatigue as responsible for 13% of fatal crashes in the US from 2001 to 2003. In BC, there were 14,000 road crashes and 56 fatalities from 2013 to 2017 involving at least one truck (Insurance Corporation of British Columbia (ICBC), 2018). Contributory factors to road crashes in BC include speeding (27%), distracted driving (27%) and driving under impairment (25%) (ICBC, 2018). Identification of truck driver fatigue and management and/or prevention can potentially reduce incidence of aforementioned chronic medical conditions and reduce crash incidences. An effective measure to address driver fatigue is taking a rest (Vanlaar et al., 2008).

From the truck drivers' responses, it is evident that the nature of the work (truck driving) exerts a negative toll on the health and wellbeing of truck drivers. Drivers complained about the long work hours, high demands of the job, poor remunerations, and poor work relationship between employer, movement and truck drivers as reason for dissatisfaction with their jobs. In addition, truck drivers also reported long hours of service at upper limits of what is allowed by the province. A small number of drivers (3%) report working beyond the allowable hours of service in the province. In response to awareness about the dangerous hazards caused by fatigue, the federal government of Canada is mandating electronic monitoring of truck drivers' hours of service by 2020 as means to reduce incidences of inadequate manual logging of work hours and to reduce safety related outcomes resulting from truck driver fatigue (Sanderson, 2018).

Conclusions and Recommendations

The workplace plays an important role in the health and wellbeing of workers and indeed the public as a whole. Increased adoption of comprehensive health promotion wellness and safety (HPW&S) programs in the workplace should be a goal of agencies tasked with improving worker health as well as public health. Truck driving is one of the most common occupations in Canada and one for which integrated HPW&S is critical as drivers heavily rely on their workplace for access to healthy food, physical activity, and safety (Lemke & Apostolopoulos, 2015). *It is incumbent on employers within the trucking industry, the provincial and national organizations to leverage knowledge about what works in HPW&S and about the challenges within the unique trucking work environment to improve the health, safety and wellness of truck drivers.*

Comprehensive HPW&S programs should target individual health behaviours of truck drivers including an increase in physical activity and access to healthy food while truck drivers are on road trips. These programs should also target adequate fatigue management, in addition to safety. *One recommendation is to integrate separately-run wellness and safety programs, or to develop a wellness program and incorporate it into an existing safety program.*

WorkSafeBC can play an important role in Comprehensive HPW&S programs. The results indeed show that WorkSafeBC is an important source of information about health and wellness. Plausible reasons for this include their role as regulators of worker's safety and compensation; and the fact that they have been working with the trucking industry for a long time. An effective approach *WorkSafeBC can take will be to leverage on this information to link trucking companies with recognized safety organizations like SafetyDriven, who can then provide the technical oversight for health and safety within trucking companies including, ensuring that separate employees are responsible for the safety and wellness programs adopted in the trucking company and that multiple methods are used within the industry to facilitate truck drivers uptake of health safety and wellness measures.*

Identification of Best Practices in health, safety and wellness (HS&W) within the trucking industry in BC is both a limitation of this research and a suggestion for future research. Many HS&W programs examined in this study, using a cross-sectional study design, were fragmented. Therefore, it was not possible to identify a best practice model within the trucking industry in BC. *A future study design such as a case study approach to compare two to five companies with and without HS&W programs in terms of incidence/prevalence of health conditions is recommended.*

A potential limitation of this study is the relatively low response rate (10% which represents 4.5% for Managers and 6.5% for Truck Drivers). However, when we consider the number of people that received the emails (based on the number of emails that were opened), the response rates were higher; being 7.5% for the manager survey and 12% for the truck driver survey.

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Background

Many people are at high risk for overall mortality following a crash incident or chronic medical conditions like diabetes, obesity, or cardiovascular disease. However, fewer people have risks for these conditions resulting from the type of work they do, such as truck drivers. Truck driving is associated with irregular work hours and prolonged schedules; poor work environments and access to nutritious meals; as well as, exposure to repeated vibrations while driving, and fatigue which may increase risk of a truck accident (Bigelow et al. 2014). So far, there is limited knowledge about the relationship between truck drivers' health status and their access to health and wellness initiatives or programs.

Truck drivers in British Columbia (BC) for the most part, can be categorized into one of two groups: long-haul drivers who operate for greater than 160 km distance from their home terminal and short haul drivers who remain within a 160 km radius (Employment Standards Branch Province of BC, 2016). All truck drivers, irrespective of the distance they drive from their home terminal, are at elevated risk for chronic medical conditions and fatigue as compared to workers in other occupations. However, long haul truck drivers compared are at increased risk for obesity, diabetes, and fatigue due to the nature of their job (Dahl et al., 2009; Hanowski, Wierwille & Dingus, 2003).

The traditional approach to improving truck drivers' health and wellness focused on individual health behaviours and risks such as diet, exercise, use of stimulants and/ or exposure to carcinogens like tobacco smoke (Gillespie, Wang & Tia, 2014). Presently, the focus has however shifted to organizational policies and practices that influence workers' health, the work environment and access to health and wellness resources, in addition to truck drivers' own health behaviours and risk factors for ill health (Gillespie et al., 2014; Muto & Yamauchi, 2001; Nelson, Allen, McLellan, Pronk, & Davis, 2015; Pronk, 2013; Sochert, Siebeneich & De Broeck, 2012). Consequently, this study aims at identifying the prevalence of health and wellness programs in BC, and the frequency with which organizational policies and practices within trucking companies integrate their safety practices with health and wellness practices. The study also focusses on the prevalence of individual health behaviours and diseases among truck drivers in BC, even though it was not listed as a primary study objective.

The following section provides the purpose, study objectives, and information about the research team and partner. The second section describes the methodology including the research protocol and the various measurement tools used in the study. The third section describes how data was analysed and gives a report of the results of the study. The final section

interprets the results in light of scientific literature, describes some of the challenges and limitations of the study and articulates recommendations.

Section 1

Purpose and objective of the study

The overarching purpose of this study was to identify initiatives provided by trucking companies (which include both large and small employers as well as truck drivers who are independent operators) to improve truck drivers' health safety and wellness (HS&W) and, through identification of industry best-practices, promote the widespread adoption of evidence-informed HS&W programs for truck drivers. Specifically, this project identified the prevalence of HS&W initiatives available to truck drivers and compared how well these programs aligned with existing best-practice models - the National Institute for Occupational Safety and Health Total Workers Health (a US Federal agency responsible for conducting research and making recommendations for the prevention of work-related disease and injury) and European Workplace for Health Promotion.

This study also identified differences between carriers with HS&W programs and those without such programs. It also identified among existing HS&W programs the proportion that are integrated into other quality management & assurance systems (e.g., Certificate of Recognition). The study also reviewed workplace culture, practices and policies, and personal health risks and behaviours of truck drivers in BC with the aim of proposing best practice guidelines for the trucking industry. Lastly, the project aimed at identifying barriers and facilitators to the adoption of HS&W practices in BC.

Research team

A team of researchers from three Canadian universities—the University of Northern British Columbia (UNBC), the University of Saskatchewan and the University of Waterloo— along with researchers from SafetyDriven (an industry safety association focused on transportation in BC) and Transport Canada came together to deliberate on this problem and to steer research on the topic. The expertise and connections of all team members helped to gain access to important advocates in the trucking industry and to media who were instrumental in promoting the study and its objectives.

Research partner and funding

This project was funded by WorkSafeBC. WorkSafeBC is a provincial organization/agency mandated to promote the prevention of workplace injury, illness, and disease; facilitate the rehabilitation of injured workers and promote return to work; arrange with employers to ensure that injured workers are compensated fairly, and to assist in practical ways to ensure that workers are duly compensated (WorkSafeBC, 2018). In addition to funding the project, WorkSafeBC provided access to contact information on registered trucking companies in the province.

Ethical considerations and confidentiality

The study protocol was approved by the University of Northern British Columbia Research Ethics Board (UNBC-REB) on January 2, 2018. Confidentiality of the survey data was strictly maintained throughout all phases of the study. Each respondent was given a unique identifying number in the dataset. All electronic data files were stored on a password-protected computer to maintain anonymity and confidentiality. The electronic files were further placed in a folder that required a username and password for login purposes; which was only accessible to the principal investigator (PI) and the research associate (RA).

Section 2

Methodology

This section of the report describes the sampling strategy, participant recruitment techniques, research design, and the research protocol. It also describes the strategy employed to deal with incomplete responses retrieved during the study.

Participants, Sampling Strategy and Design

Criteria for selecting participants for the survey were predetermined by the team and limited to trucking companies registered and working in BC. To complete the truck driver survey, participants had to be currently driving, and be employed by a trucking company in BC. For the manager version of the survey, participants were required to be currently employed within the trucking industry in BC and be knowledgeable about the health and safety program in the company such as a health, and safety personnel or a manager within the trucking industry. In many instances, especially for very small or small companies, this person was an owner operator running a small family business.

The initial sampling strategy for the survey was a random sampling strategy. Email blasts were sent to all trucking companies registered with WorkSafeBC. As a result, all trucking companies had an equal opportunity to participate in the study. However, due to a low response rate in the first half (wave 1) of the study, more follow up of medium and large sized companies was done in the second half (wave 2) of the study. In total, 8827 surveys were sent out via email blasts to all companies registered in BC via Survey Monkey. At the end of the survey, approximately 10% have responded to the survey. While this response rate of 10% may be considered relatively low; and in consultation with our strategic partner (SafetyDriven), this is what our research team have expected *a priori* regarding a 10% response rate; which is considered satisfactory -- for the purposes of the data analysis of this study. A previous study of commercial vehicle value of time for operation at border crossings conducted by researchers at the University of British Columbia (UBC) in 2009, in collaboration with the BC Trucking Association (BCTA), similarly reported a survey response rate of 10-15% (Ismail, Sayed, & Lim, 2009). This UBC study was funded by Transport Canada and the British Columbia (BC) Ministry of Transportation. Likewise, Curtis and Chen (2003) analyzed the effect of transport cost on Canadian trade patterns and found that the reduction in transport cost had contributed to expand trade in differentiated products between Canada and its trade partners. These researchers reported a response rate of 10% (Curtis & Chen, 2003).

A cross-sectional study design was used to obtain data from respondents. A cross-sectional study provides a snapshot of population characteristics and data at a single point in time. This method was identified as the best study design to provide background information of trucking companies in BC, and to demonstrate the usefulness of information about existing health, safety and wellness programs for truck drivers.

Participants recruitment

Participants were recruited from a list of trucking companies obtained from WorkSafeBC. WorkSafeBC categorized companies based on payroll sizes: Large companies had a payroll size greater than \$1.6million; medium sized companies had a payroll size between \$600,000 and \$ 1.6 million; small sized companies had a payroll size between \$150,000 and \$600,000; and very small sized companies had a payroll size between \$0 and 150,000. Participants were also recruited via other routes such as LinkedIn, web blogs, word of mouth, posters and through one of the study partners, SafetyDriven. In total, the study reached out to owner operators/ drivers and managers/ health personnel/ health and safety personnel in 8827 companies. This included 8316 small and very small-sized companies, 296 medium-sized companies and 215 large-sized companies.

Research protocol

A research protocol was developed for the study. Information included the methods to be used in participant recruitment; how often to send reminders about the survey, and what methods to take in the event of any challenges encountered. The team decided to start with a social media campaign consisting of web-blogs, online newsletters, and adverts on LinkedIn and Facebook lasting about 2 weeks followed by email blasts and weekly reminders to all participants in two different waves. The first wave ran from August 14 to October 1 2018 and the second from October 2 2018 to January 31 2019.

The recruitment strategies differentiated the two waves. During the first wave, participants were recruited by generalized emails and online advertisements and the second wave targeted recruitment of medium and large sized companies via phone calls and personalized emails to companies' health and safety managers. In addition, weekly reminders were sent to all non-responders and partial responders throughout the study. The aforementioned protocol served as a road map to guide execution of the study after questionnaire development.

Questionnaire development

Questionnaire development was an iterative process which occurred online, face- to- face and over the phone via member meetings, meetings with media representatives in the trucking industry, and with truck drivers and managers. Questions in the survey covered several domains including truck driver characteristics (age, sex/ gender, geographic location, country of work, nature of job and compensation); job satisfaction, prevalence of health behaviours, chronic medical conditions, safety climate, and access to health and safety programs. Questions were adapted from Amick (2010, 2011), Shi (2017), Huang et al. (2016), Gillespie (2014) and Spielholz (2008). The research team also engaged two media publicists, several truck drivers and employers or managers within the trucking industry to review the questionnaire and to provide feedback and suggestions. Based on the feedback received from numerous sources, the questionnaires were revised before the official launch of the online survey in August 2018.

Online Survey Software

Survey Monkey, an online survey development tool, was used to develop the survey, collect and analyze data, and to send weekly reminders. Online software packages for developing and distributing surveys are quick, convenient and easy to use (Wright, 2017). Survey Monkey has unique functions that extend beyond developing surveys. These include survey distribution via platforms such as emails, social media and web links; as well as team collaboration, data processing, data management, and file sharing. Using this software, the research team developed and revised the truck drivers' and managers' surveys and generated online codes and web links, which were extensively used throughout the study's media campaign and during the actual data collection. Importantly, Survey Monkey complied with research ethical standards and was approved by the University of Northern British Columbia's Research Ethics Board.

Survey revision techniques

The survey revision techniques used in this study include expert reviews, cognitive interviews, pilot study and a final check as described by Dillman (2000, p.140-147). Different survey revision techniques achieve different objectives. For example, expert reviews from content experts might identify inappropriate wording or missing constructs in the survey. Moreover, questionnaire design experts might also identify questions with limited analytical usefulness, and / or comparability of survey instrument, or whether the instrument will elicit information that can be compared to existing data sets in other surveys (Dillman, Smyth, Christian, 2014). Cognitive interviews help to assess how respondents understand

questions to see if they respond to questions as intended by researchers. Finally, a pilot study, which is a mini dress rehearsal of the study protocol, helps to identify if the proposed questionnaire and procedures are adequate for the current study (Dillman et al., 2014, p. 251). The manager and truck driver surveys used in this study were revised using the aforementioned techniques, which included 3 cognitive interviews and 14 participants in the pilot study. These various methods helped to revise and improve the quality of the surveys.

Survey administration

Online links to the survey were placed in newsletters, on web blogs and social media. Two weeks before sending out email blasts to all our contacts, we sent out weekly messages via various social media platforms including Facebook, twitter, LinkedIn and via company web blogs and newsletters. SafetyDriven and BCTA were very helpful in publicizing the study. The executive phase of the study progressed with social media campaign and a pre-notification email to all contacts about the survey before sending out email blasts. Response to social media campaign only appeared to be minimal. At the end of week 2 of social media campaign via blogs, web-links, LinkedIn and Facebook, we received 3 truck drivers' surveys and 1 employer survey. Twenty –two percent of surveys were complete. While public response to the social media campaign was minimal, this medium likely raised awareness about the survey before email blasts were sent to participants.

Measurement tools, Variables studied and Sources of questions

Two questionnaires were developed for this study: a manager survey and a truck driver survey. These surveys included different scales and questions which gather information about truck drivers' health, trucking companies, prevalence and characteristics of health and wellness programs within the trucking industry in BC. These questionnaires also provided information about access to health and wellness programs, as well as barriers and facilitators to adopting health and wellness programs within the trucking industries in BC.

The two online questionnaires were administered in the English language only. Our research team considered translating the questionnaire. However, after thinking about it we believe that administering the questionnaire in multiple languages may have provide inconsistent results and language proficiency issues with multiple translations.

This study adapted questions from several authors including Gillespie's (2014) questions on workplace health promotion, Spielholz et al.'s (2008) questions about work operations within trucking companies, and other questions which provided descriptive data such as age, sex, geographic location of work, and country of work. A scale about the safety climate within the trucking industry was included in the manager's survey, and another scale about work place culture was also included in the truck driver's survey. The workplace culture scale included questions adapted from Ben Amick's 19 item questions on organizational support (Amick et.al, 2011); a question on workplace culture from Shi et al. (2017), and questions on group safety climate from Huang et al. (2016). We also collected information about fatigue and participants' response to fatigue, prevalence of some health behaviours and chronic medical conditions among truck drivers.

In total, there were 64 questions in the manager's survey and 81 questions in the truck driver's survey. These surveys contained skip questions so that no participant would answer all questions. The time to complete each survey was 30 to 45 minutes. Both surveys provided a comprehensive description of health, wellness and safety programs for truck drivers in BC; as well as, the organizational policies and practices that support these programs and truck drivers' health.

Section 3

Overview

In wave 1 of the study, surveys were sent via email blasts to 8774 employer/ managers and 8351 truck drivers. Of the 8774 surveys sent to managers, 3544 surveys (40.4%) remained unopened, 348 surveys (4%) bounced, and 594 participants (6.8%) opted out. Of the 8351 surveys sent to truck drivers, 3837 surveys (45.9%) remained unopened, 325 surveys (3.9%) bounced, and 545 participants (6.5%) opted out.

In wave 2 of the study, surveys were sent out via email blasts to 681 employers and 2108 truck drivers. Of the 681 surveys sent to managers, 279 (41%) remained unopened, 38 surveys (5.6%) bounced and 59 participants (8.7%) opted out. Of the 2108 invitations sent to truck drivers, 565 (26.8%) remained unopened, 77 (3.7%) bounced and 303 (14.4%) opted out of the study. Below are response rates tables in wave 1 and wave 2 of the study.

	Total invitations sent	Total received	Complete responses	Incomplete responses
Employer Survey	8774	271	85 (31.4%)	186 (68.6%)
Truck driver's Survey	8351	254	96 (37.8%)	158 (62%)
		525	181	344

Table 2: Responses retrieved during Wave 2 of the study (Oct 2, 2018 to January 31st, 2019)				
	Total invitations sent	Total received	Complete responses	Incomplete responses
Employer Survey	681	123	91 (74%)	32 (26%)
Truck driver's Survey	2108	290	171 (58.9%)	119 (41.1%)
		413	262	151

From the tables above, it is clear that we received more complete responses (defined here as participants who proceeded to the end of the survey by clicking the done button at the end of the survey) in wave 2 of the study than in wave 1; due, in part, to the personalized nature of the recruitment strategy adopted in wave 2: phone calls to recruit participants, and personalized emails to health and safety managers/ the person responsible for the health and wellness in the company. Response rate for both waves of the study were calculated as follows

$$\frac{\text{Total received Survey responses}}{\text{Total invitation sent}} * 100$$

For wave 1 of the study, the survey response rates for the manager and truck driver surveys were each 3%. For the wave 2 of the study, survey response rates for the manager and truck driver surveys were 18% and 13.8% respectively. For the entire survey, the response rates (based on total number of invitations sent out) for the manager and truck driver surveys were 4.5% and 6.5% respectively (note that the invitations sent out in wave 2 were a subset of invitations sent out in wave 1, hence the value used to calculate the denominator/ total invitations sent out was 8774 and 8351 for manager and truck drivers survey respectively). Based on the number of people that received the emails (based on the number of emails that were opened), the response rates were 7.5% for the manager survey and 12% for the truck driver survey.

Missing data analysis

As response rates and completion rates of the online survey were low, we had a lot of missing data as high as 50% for some questions. Missing values occur when values for certain variables (such as size of company) or cases (such as respondents) are missing (Allison, 2002). Incomplete responses are differentiated from non-response, which occurs in a scenario when all values for a particular question are missing (Allison, 2002). In our survey, there was a non-response question: “Which one of these programs do you offer in your company?” Respondents had the option to choose one or more of the following options: North American Fatigue Management Program (NAFMP), or the Healthy Trucker Program/Healthy Fleet Challenge (NAL Insurance). As none of the respondents answered this question, it was considered a non-response question and omitted from data analysis. When questionnaires are incompletely filled out by respondents, the quality of data is compromised.

Many old statistical software handled missing data by deleting cases with missing data, a process called listwise deletion or complete case analysis (Allison, 2002). This results in reduced sample size and loss of statistical power. To minimize this, many authors have suggested the use of Multiple Imputation Methods (Allison, 2002; Graham, 2009, Sterne et al., 2009). Graham (2009) explains that multiple imputation methods is the best method for analyzing and imputing missing data even when missing data is high.

In this study, missing data were analyzed using Multiple Imputation Method on SPSS version 24 for Windows. Before conducting MIM, the relationship between cases with complete values and cases without complete values was analyzed to determine if these values were missing completely at random (MCAR), missing at random (MAR) or missing not at random (MNAR). Cases in this study were MNAR. Then, variables of interest were examined to determine if they were normally distributed: it was determined that variables of interest in this study were not normally distributed. The Chi-square test for independence was then used to identify relationships between categorical variables as this statistical test does not require normal distribution of data (Garson, 2012).

MIM creates multiple datasets of the original data, imputes missing data in the new datasets, and combines the results obtained from each data set. As appropriate, and depending on the research question, 20 rounds of MIM were conducted. Variables included in MIM include company sizes, presence of workplace health and wellness programs in companies, and COR certification. Stern et al. (2009) advocates that researchers compare results of MIM with the results for complete cases in their data sets. In this study, data from complete cases were compared to individual MIM data sets

and to the pooled result. No difference was identified between results obtained from the original data set and that obtained from the pooled analyses of twenty rounds of MIM. Further detail is provided in appropriate sub-sections of the report.

Results

The current study is exploratory in nature, and most of the results represent univariate descriptive analysis. Hence, no need to adjust for any potential confounders (which is not applicable). The entire data analysis was based on 10% response rate from a total of 8827 surveys that were sent out via email blasts (in Survey Monkey Platform) to all truck drivers and employers/trucking companies registered in British Columbia.

This results section presents the demographic characteristics of participants/ respondents in this study, including answers to the study's research questions. This section also provides a brief summary of the challenges and limitations encountered during survey administration and during data analysis.

Demographic data for Managers' Survey

This study was a BC based study; however, it sampled respondents across the globe including respondents from the United States and other countries. The majority of respondents (n= 369) were based in Canada (97%); a small percentage (n= 12 or 3%) were based in the United States and other countries. These non- Canadian based respondents were removed from further data analyses. For the managers' survey, 69.1% of respondents (n=353) identified as male, 27.2% identified as female and 3.7% said they preferred not to give an answer.

The primary work location of most respondents (n=356) was British Columbia (92%). A small number worked primarily from Alberta (5%) and a smaller number (less than 2%) from Ontario and Saskatchewan. Data from managers/ employers outside of British Columbia were included in the analyses because they were registered with WorkSafeBC, which means that they have trucking companies operating in BC and likely also employ truck drivers from BC.

Analyses of the job titles of respondents in the manager survey (n= 394) revealed that most respondents identified as owner operators (46.2%), health and/ safety and compliance officers (14.7%), or other managers/ supervisors (10.4%) (see table below). Some respondents also identified as "other position" including, the CEO of the company (1.1%), owner of the company (2.7%), director / director of operations (0.6%), or the president of the company (1.8%). In this study,

there were very few lease operators (3.8%). Among owner operators and lease operators (n=190), 66.8% worked exclusively for one company and 31.6% did not. Furthermore, most respondents (n= 333) reported that their companies were not unionized (72.1%).

In British Columbia, very small companies make up the bulk of companies in the transportation industry. Using the Government of Canada's (2018) criteria for categorizing companies within the transportation industry (with the exception of very small companies), responses received from respondents in this survey were categorized as: very small companies if employee size was 25 or less; small companies if employee size was 25 to 100; medium sized companies if employee size was 100 to 500, and large sized companies if employee size was greater than 500 employees. In this study (manager survey, n= 294), 53.7% of very small companies, 26.9% of small companies, 11.2% of medium sized companies, and 2.4% of large sized companies responded to our survey. Few people (0.19%) did not know their company employee size.

Most companies (n=330) transported more general freight goods (41. 2%) compared to specialized goods like construction materials (20.9%), lumber (29.7%) and dangerous goods like acids, fuel and asphalt (17.6 %). For this question about types of transported goods, companies were allowed to choose multiple responses and so the total count is greater than 100%.

Night work is not popular among trucking companies in BC. Among all respondents (n= 326), 39% operate between 6am and 6pm. Few companies operate between 6pm to midnight (7.2%) and between midnight to 6am (7.4%). Majority of companies (46.4%) operate at any time of the day from sun up to sun down (that is all aforementioned hours). Among the four options of truck configurations, the most popular (n= 319) truck configuration was the tractor and semi-trailer (55.5%), followed by the straight truck and trailer (26.3%), straight truck only (23.2%) and the train (15.7%).

Demographic data for Truck Drivers' Survey

From our truck driver survey, we received responses from 84% of respondents currently working as truck drivers and 16 % who were not currently working as truck drivers. Participants not currently working as truck drivers were exited from the survey hence, data from these truck drivers are excluded from subsequent results detailed below. Most of our respondents (n=429) worked primarily in Canada (90.4%) and a few worked primarily in the United States of America (8.4%) and other countries (1.2%). As this study focused primarily on truck drivers in British Columbia and Canada, drivers whose primary work location was outside of Canada were removed from further data analysis. The primary work

locations of drivers retained in this study (n= 386) were in British Columbia (80.6%); a few drivers worked primarily in Alberta (7.8%), in Manitoba (4.4%) and other provinces (6.2%). All these drivers were retained in the analysis as they were with employers registered with WorkSafeBC.

Most of the survey respondents were educated and married. Forty-four percent of respondents (n= 376) had completed high school only, 21.3% had a college degree, 9.8% had some graduate school education, and 5.3% had completed graduate school. About 19.4% did not complete high school. Concerning the marital status of drivers (n= 238), 81.9% of respondents were married, 11.3% were single, 5.9% were separated or divorced and 0.8% reported they had lost their spouse.

We assessed the truck driver training in BC, as well as remunerations and description of driving assignments (frequently transported goods). Training for truck driving was not always formalized via a truck driving school. Of 358 responses received, most respondents were privately trained (58.1%); others received training from a family member (33.2%), from a technical school (6.1%) or from their trucking company (24.3%). A very small number of people were trained in the military (1.7%). The primary method of compensation was evenly spread across different payment plans: by the hour, by the trip, by the miles, or by a percentage of revenue. From one of our multiple response questions, drivers (n= 345) reported that they frequently transported general freight goods (51.3%) than other specialized goods such as dangerous liquids (15.7%), construction materials (34.2%), and frozen foods (12.5%).

Many respondents (n=334) reported their driving assignment was loading a truck (39.2 %), driving regional routes (35.9%), driving local routes (35.6%), long haul driving (28.1%), loading less than a truck load (19.5%), or specialty carrier (15.3%). From this sample (n= 335), the average driving hours was 11 hours daily, with the most frequently reported daily driving of 12 hours, and a maximum of 18 hours a day. The minimum any respondent reported was 1 hour daily of truck driving.

Some truck drivers, as reported by study respondents, in BC work very long hours. Average hours of local drivers was 40 hours; albeit, long haul drivers frequently worked (including non-driving tasks) an average of 70 hours per week. A small percent of drivers (3%) worked between 70 and 100 hours weekly. The Motor Vehicle Acts Regulations (2019) stipulates that for commercial vehicle truck drivers, hours of service in BC is no more than 13 hours of daily driving or 14 hours of on duty service (driving inclusive). Furthermore, drivers are not to exceed 65 hours of driving, or 80 hours of on

duty service, weekly. From this study, it appears that a small percentage of drivers exceed the provincial number of hours of service. The importance of these findings will be outlined in the discussion section.

Research question 1

The first research question was “what proportion of carriers have programs that address the health, safety and wellness (HS&W) of their long-haul drivers?” From 188 respondents to the manager survey within the trucking industry in BC, 30.9% of companies had some form of workplace health and wellness program (WHP) for their truck drivers and 69.1% did not. These values were similar to values obtained from the pooled frequency estimates using multiple imputation method to account for missing values.

Figure 1 Pie Chart showing the percentages of all trucking companies in BC with a Health and Wellness program for all employees (truck drivers and non-truck drivers)



Table 3 Comparison Table of Original Data Set and the Result if Multiple Imputation Data set

	No WHP	Yes WHP
Original Data (n= 188)	69.1	30.9
Multiple Imputation Data, pooled estimate from 20 MIMs (n= 296)	67.7	32.3

MIM= Multiple imputation method

Chi square analysis was subsequently conducted to determine the availability of WHPs by company size. Missing data was first imputed using multiple imputation method (MIM). Chi square analysis of MIM data revealed that within BC companies, very small companies showed the most significant difference among companies with a WHP and those without a WHP (See table below). The variables included in this MIM data set were Q17 (Company Size, the independent variable) and Q38 (WHP, the dependent variable). Twenty models (logistic regression only and no interaction models) were used for this MIM. Of the 20 MIM data sets, including the original data set, the p values from the chi square analysis of 3 data sets did not reach statistical significance meaning that the association identified from Chi square analysis is more likely to be a true association. In spite of the missing data, very small companies are less likely to have a WHP.

Table 4 Presence of a Workplace Health and Wellness Program (WHP) by company size		
	No WHP	Yes WHP
Very Small Companies	77.7%	22.3%
Small Companies	58.7%	41.3%
Medium Size Companies	52.4%	47.6%
Large size Companies	50%	50%
I don't know the Size of my Company	60%	40%

Research question 2

The second research question was “do the elements of carrier HS&W programs for long-haul drivers align with program elements recommended in the documentation of the NIOSH Total Worker Health Program and the European Network for Workplace Health Promotion (ENWHP)?” Occupational Health and Safety Standards in the international scene include the National Institute for Occupational Safety and Health (NIOSH) Total Workers Health Approach (TWH), and the European Network for Workplace Health Promotion (ENWHP). This study presents the findings from data analysis on how well BC WHP within trucking companies align with these international standards. Before these results, below is brief description about NIOSH TWH program and ENWHP. These two programs are briefly described below.

NIOSH Total Worker Health Program

The National Institute for Occupational Safety and Health (NIOSH) is an American organization charged with development of knowledge about workers’ health and safety and transfer of this knowledge into practice using evidenced based scientific methods. In 2003, NIOSH developed an initiative called Total Workers Health (TWH) approach which is defined as “policies, programs, and practices that integrate protection from work-related safety and health hazards with promotion of injury and illness prevention efforts to advance worker well-being” (Lee et al., 2016). The TWH is a holistic approach to worker well-being, which considers integration of work safety practices (such as risk assessment and management, fatigue and stress prevention, and overtime management) with measures that target workers’ health and wellness (such as access to healthy and affordable food options, chronic disease prevention and management) (Centers for Disease Control and Prevention [CDCa], 2018). The NIOSH institute argues that the workplace is an important health determinant for workers either as a source of poor health and wellbeing, or as an aggravator of existing ill-health (CDCa, 2018).

Given evidence of its promising effects in the United States (Carr et al., 2016; Feltner et al., 2016), this study decided to compare activities within BC WHP to the NIOSH recommended TWH approach. A few authors have detailed how they included the TWH approach in their studies. Olson, Anger, Elliot, Wipfli, and Gray (2009) designed a workplace health promotion program, weight loss and safe driving competition for truck drivers that incorporated computer-based training, behavioural self-monitoring (BSM), and motivational interviewing. This program represented

specific elements of TWH approach including driver safety, healthy shift training, and chronic disease prevention and health promotion. Olson et al. (2009) study revealed clinically significant reduction in weight and improved safety behaviours of drivers when the TWH approach was implemented. These authors add to the dialogue about TWH, the need to actively engage drivers in health, safety and wellness via social comparisons feedback. Their approach which involved driver competition was found to be more successful than passive driver engagement using lone health education programs (Holmes, Power, & Walter, 1996; Roberts & York, 1999). Further, Olson et al. (2009) noted that involvement of supervisors in health, safety and wellness programs was necessary for sustained driver participation in the health, safety and wellness programs introduced in their study.

LaMontagne, Stoddard, Youngstrom, Lewiton, and Sorensen (2005) echo similar findings about the importance of targeting upstream factors such as management and organizational support to ensure improved total worker health in the manufacturing industry. In their study, they administered an upstream health intervention, which was identification and risk reduction of hazardous materials (harmful silica dust) in the manufacturing industry, by conducting a needs assessment and offering risk reduction support to company management. LaMontagne et al. (2005) combined both management focused exposure prevention with management focused workplace environment control with promising results when they compared the intervention group to the control group. Consequently, TWH addressed in the manufacturing industry has potential to improve wellbeing of workers by targeting upstream factors.

The TWH approach shows lots of promise but suffers from diverse applications within various industries and inconsistently applied guidelines. Anger et al. (2015) noted that TWH was effective in improving workers' health and safety when workplace interventions addressed both safety and chronic disease prevention. Similarly, Feltner et al. (2016) felt the evidence for improvements in health behaviour was strong when TWH interventions were used in workplaces. Nevertheless, it should be noted that though different authors have published articles on programs that integrate safety with health promotion programs, which align with NIOSH TWH values, there are no available best practice interventions that embody TWH (Anger et al., 2015).

The European Network for Workplace Health Promotion (ENWHP)

The European Network for Workplace Health Promotion (ENWHP) was established in 1996 and has both national and international support for workers' health in enterprises within the European Union (ENWHP, 2001). The ENWHP gathered information that workplace health promotion activities were mainly recognized and carried about within large

enterprises in Europe, but there was a gap for small and middle enterprises (SME) in Europe. Since 2001, much stride has been made to ensure healthy work environments in European countries. The ENWHP believe that a healthy work environment and healthy workers are ethically sound practices and prerequisites for innovation and productivity. Integration of safety practices and health wellness programs bring gains to individuals, employers, the work force, and the country.

A successfully implemented workplace health promotion strategy is comprehensive and receives collaborative input from all sectors of an organization. Based on research, ENWHP summarized components of a healthy work environment: (1) analysis of the health requirements and needs of an organization (2) participatory involvement of all stakeholders in an organization, especially the workers, and managers (3) WHP should have a multilevel target which includes individual behavioural lifestyle risks and the work environment (4) Integration of WHP into management practices and daily activities of the organization.

Therefore, to address how well WHP in BC trucking companies are aligned with the aforementioned international standards (in the absence of best practices both locally and internationally), this study looked at three variables: the safety climate, the health culture, and a fatigue management measure, organizational support for napping.

Program strengths and Leadership Oversight of WHP

This study adapted an existing Organizational Health Culture Scale developed by Jung et al. (2010), and refined by Gillespie et al. (2014). The Health Culture Scale assesses the health culture within an organization, which is the basis for a thriving WHP (Gillespie et al., 2014). This scale is made up of 13 statements/ items rated on a 7 point Likert scale from strongly disagree (-3) to neither agree/ disagree (0) to strongly agree (+3). These items were then summed to produce 3 scores: (1) the program strength score, (2) leadership oversight score (3) the health culture score.

Table 5 Health Culture Scale adapted from Gillespie et al., 2014
Statement 1: “upper management has made employee health promotion a top priority;
statement 2,” Union leadership supports and participates in the workplace health promotion program”;
statement 3, “Union leadership supports and participates in the workplace health promotion program”;
statement 4, “Others in the company take active responsibility for the program”;

statement 5, ‘There is a person identified who has the primary responsibility for the program’;
statement 6, “Management allocates adequate resources for the program (budget, space, etc.)”; and
statement 7, “Managers actively promote participation in health promotion activities”.
Statement 8: “The program has a long range (3-5 year) strategic plan”;
Statement 9: “Workplace data is used to determine program direction”;
Statement 10: “Employee health promotion has been integrated with other operational administrative policies and procedures”;
Statement 11: “The program links with other organizational areas, for example, occupational health and safety, benefits, etc.”
Statement 12: “The program responds to changing needs”;
Statement 13: “Truck drivers are actively involved in program development and implementation.”

These set of statements were analyzed using factor analysis (principal component analysis followed by oblique rotation method, with Kaiser Normalization) to determine the underlying component parts which consistently mapped unto the two constructs termed, “program strengths of WHP” and “leadership oversight of WHP”. These constructs are similar to Gillespie et al. (2014) constructs of program strengths and organizational support except that in this study, 2 items originally belonging to the construct, “program strengths” in Gillespie et al., (2014) study, mapped onto the second construct, “leadership oversight” in this study.

The summative program strength score is the sum of the scores obtained for items (statements) 8 to 13 and the leadership oversight summative score is the sum of the scores of items 1 to 7. The higher the score, the higher the strength of the WHP or leadership’s input and support for the program. A score of zero by respondents means company employees are neutral about the health culture within their trucking company. The health culture score is the combined scores for program strength and leadership oversight.

Based on 50 respondents, the maximum and minimum summative scores out of 18 possible points for program strength were +18 (4%) and -18 (4%) respectively. The most frequent score for program strength was zero (18%). Based on 53 respondents, the maximum and minimum summative scores for leadership oversight of WHP within trucking companies in BC, were +21 (3.8%) and -21 (1.9%) respectively. As with program summative strength scores, the most

frequent leadership summative score was zero (9.4%). The total possible score for the health culture score within trucking companies is 39, if companies rated the strength of their program a maximum of 3 for 7 program strength items, and a maximum of 3 for 6 leadership oversight items. In this study (n= 50), maximum and minimum health culture scores were +36 (4%) and -39 (2%) with a modal frequency of 0 (10%). For programs that are scored negatively, respondents perceive their company WHP to perform lower than expected standards and vice versa (see frequency bar charts below).

Figure 2: Bar chart showing frequency of Program Strength scores among respondents

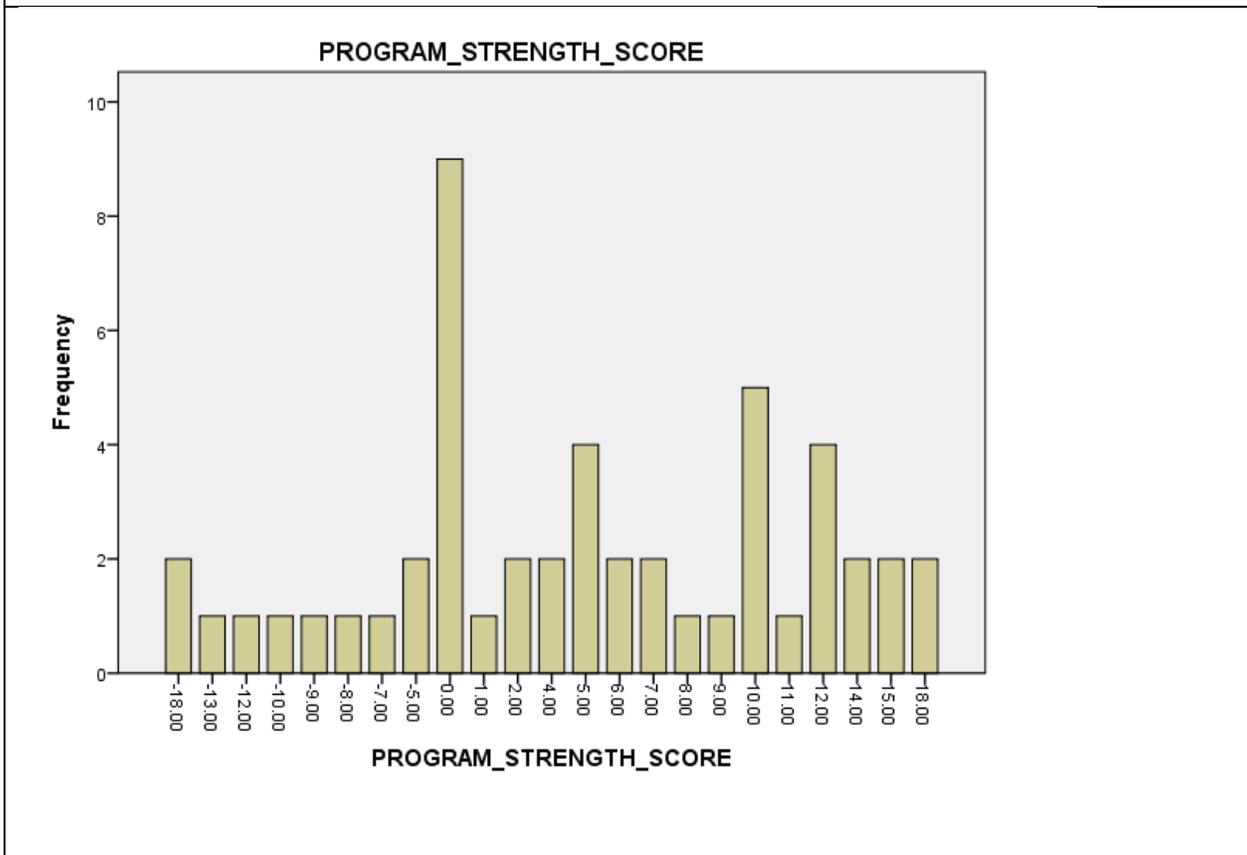


Figure 3: Bar chart showing frequency of leadership oversight scores among respondents

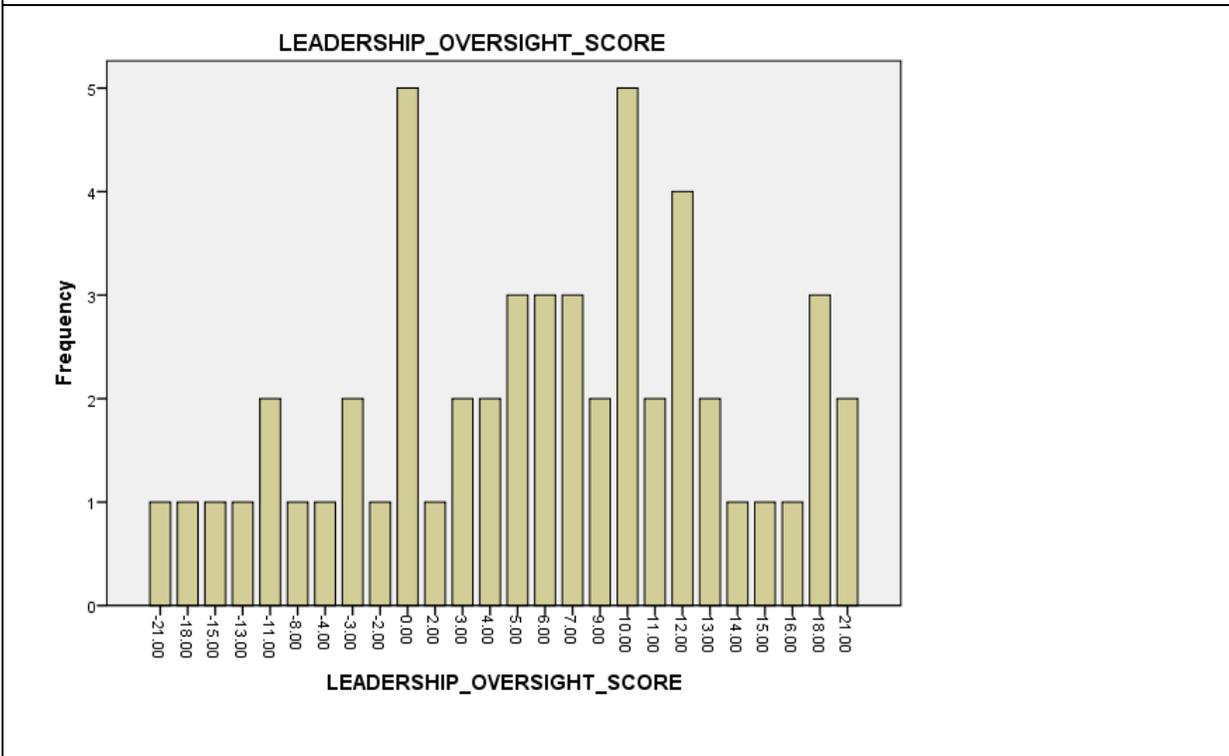
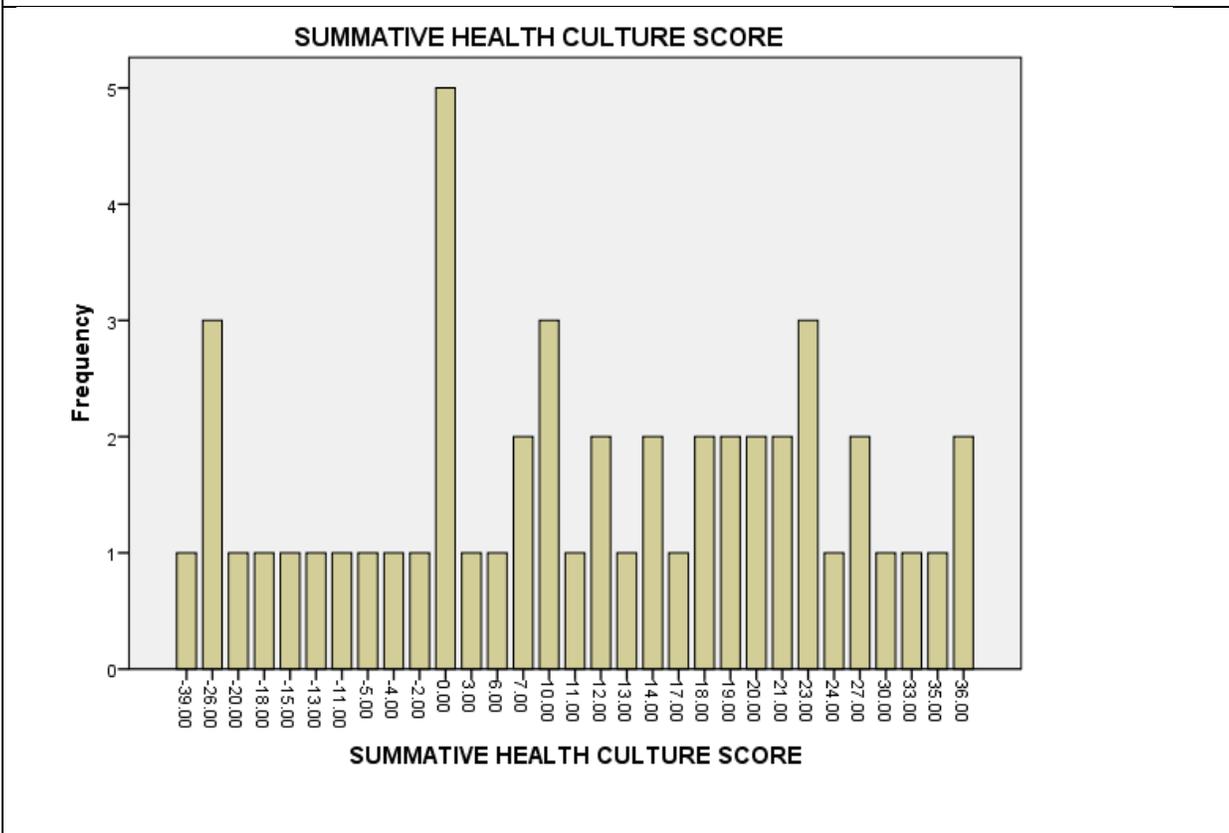


Figure 4: Bar chart showing frequency of health culture scores among respondents



Safety Climate

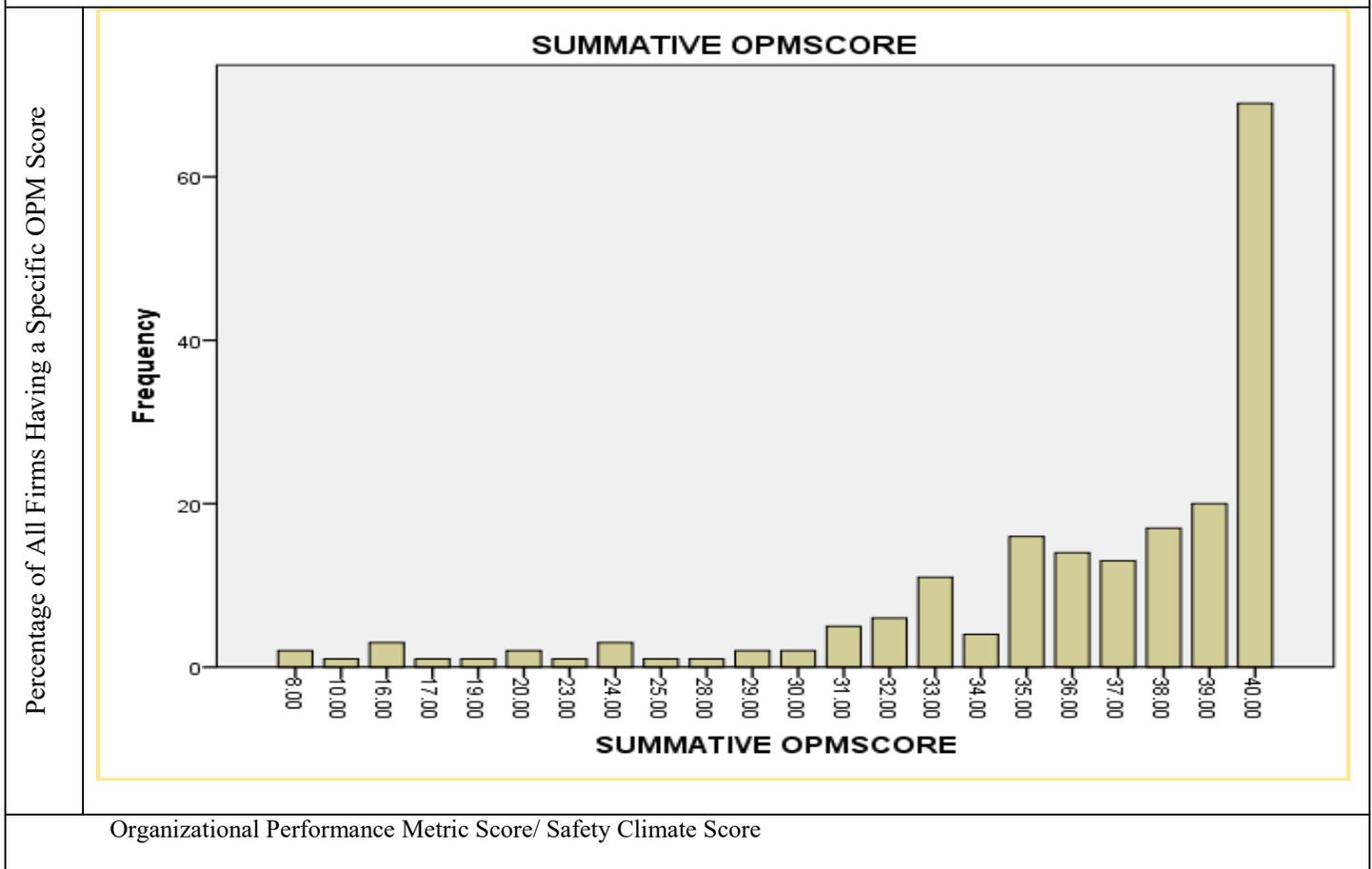
Boyle, Peng, Neyens, and Short (2010) defined safety climate as “employee perception of how safety is managed and how safety policies are implemented in an organization.” A closely related, but different, term is safety culture defined as the safety norms, attitudes, values and beliefs of an organization which is expressed by its management and employees (Short, Boyle, Shackelford, Inderbitzen, & Bergoffen, 2007). These norms, attitudes, values, and beliefs include written and unwritten rules (Swartz et al., 2000). They are evident in a company’s operational environment and dictated by people who represent the voice of the company (Harvey et al., 2002). Company safety climate suggests a more temporary virtue while safety culture is more stable (Boyle et al., 2010).

This study accessed the organizational safety climate using an eight-item questionnaire developed by Amick et al. (2011). Respondents were asked to respond to statements about their organization’s health and safety practices, based on the percentage of time each practice took place in their organization. Participants rated their responses by choosing one of the following scores: 0-20%, 20-40%, 40-60%, 60-80%, and 80-100%. Previous research using factor analysis shows that all 8 statements on this scale measure one item only, and all questions hang well together (Amick et al., 2011). The Cronbach’s alpha score of the scale is 0.82 (Amick et al., 2011). The table below lists all 8 items/ statements.

Statement 1	“formal safety audits at regular intervals are a normal part of our business;
Statement 2	“everyone at this organization values ongoing safety improvement in this organization;
Statement 3	“this organization considers safety at least as important as production and quality in the way work is done;
Statement 4	“workers and supervisors have the information they need to work safely;
Statement 5	“employees are always involved in decisions affecting their health and safety;

Statement 6	“those in charge of safety have the authority to make the changes they have identified as necessary”;
Statement 7	those who act safely receive positive recognition”;
Statement 8	“everyone has the tools and/or equipment they need to complete their work safely”.

Figure 5: Bar chart showing organizational performance metric score/ safety climate score among respondents



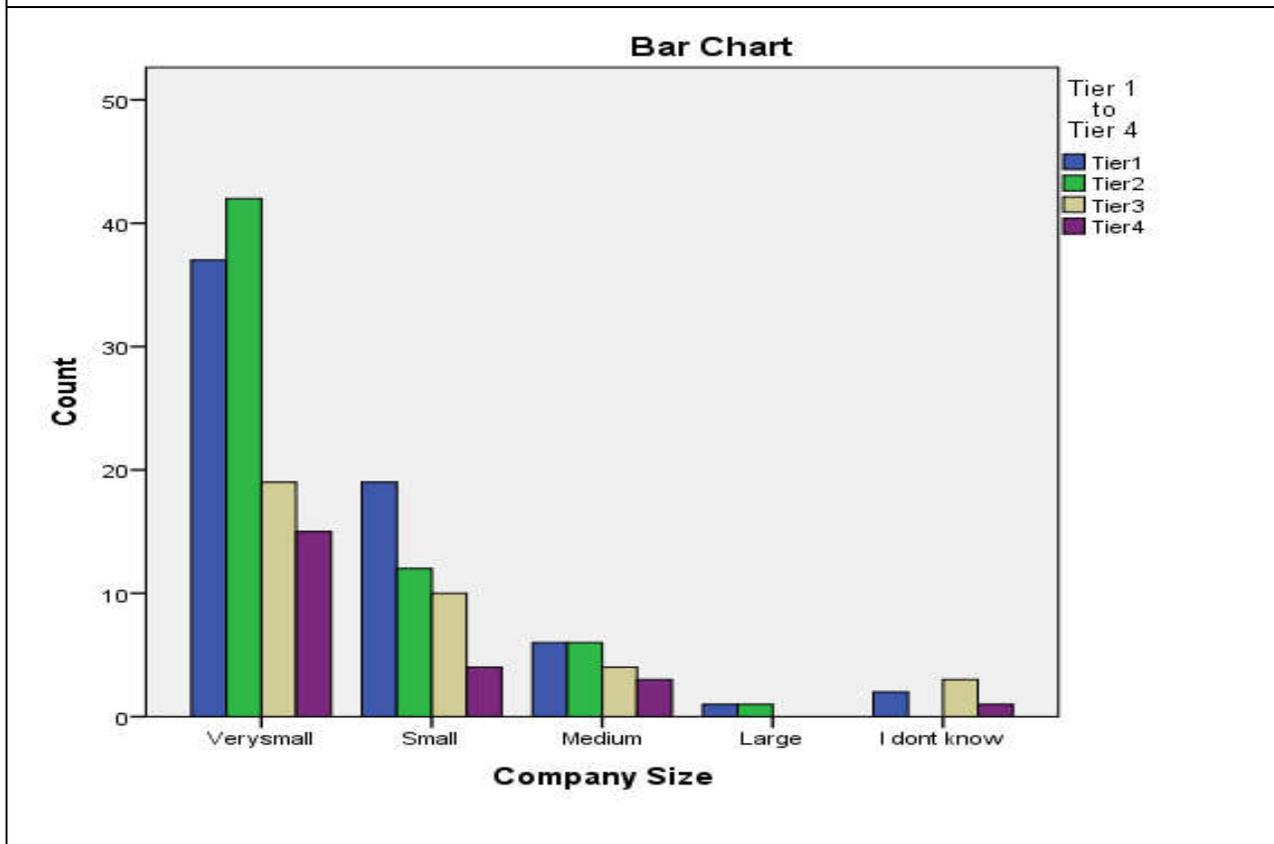
The above bar chart represents the summative score frequency of responses (n= 187) to the safety climate scale. The chart shows a wide dispersion of scores across all respondents, but with pooling in the upper tiers 1 and 2. The maximum and minimum Organizational Performance Metric Score (OPM) are 8 and 40 depending on employee’s perception of the safety climate within their organization.

Amick et al. (2011) described four safety climate tiers. A score of 40 means respondents rated the safety climate culture in their company very high, 80 to 100%, for all eight statements. This is known as Tier 1. Tier 2 is when respondents rate the safety climate culture in their company 80 to 100% for 7 of 8 statements. Tier 3 is when respondents rate the safety climate culture in their company 80 to 100% for 6 of 8 statements; and the final tier, Tier 4, is when respondents rate the safety climate in their company 80 to 100% for 5 of 8 statements. Hence, Tier 1 corresponds to a score of 40, Tier 2 with a score of 36 to 39, Tier 3 with a score of 32 to 35, and Tier 4 with a score of 8 to 31.

In this study (n= 187), 35.3% of respondents rated their companies as Tier 1, 33.2% rated their companies as Tier 2, 19.3% rated their companies as Tier 3 and 12.3% rated their companies as Tier 4. Two other charts are presented below: The first is a table which shows the frequency of safety climate scores across the different company sizes (= 185), and the next chart is a bar chart which shows the safety climate ranking within the companies and the number of respondents per company size. In this second chart, blue charts depict high OPM score of Tier 1, green charts depict Tier 2, beige charts depict Tier 3 and purple charts depict Tier 4. As most respondents in this study were from very small and small companies, the OPM results show higher frequency among the small and very small companies. From these charts also, it is clear that employees within BC trucking companies rank the safety climate within their companies favourably high.

	Very Small	Small	Medium	Large
Tier 1	32.7 %	42.2 %	31.6 %	50 %
Tier 2	37.2 %	26.7 %	31.6 %	50 %
Tier 3	16.8 %	22.2 %	21.1%	
Tier 4	13.9 %	8.9 %	15.8 %	

Figure 6: Bar charts showing Safety Climate Ranking/ OPM Ranking by Company Size



Next, this study examined if there was a relationship between (A) safety climate and health culture within BC companies (n= 47) and, (B) the safety climate in a company and the presence or absence of a workplace health and wellness program. Complete Case Analysis (the number of respondents without missing values) was used to determine aforementioned associations because total number of responses were very small and MIM could introduce bias and errors into the results.

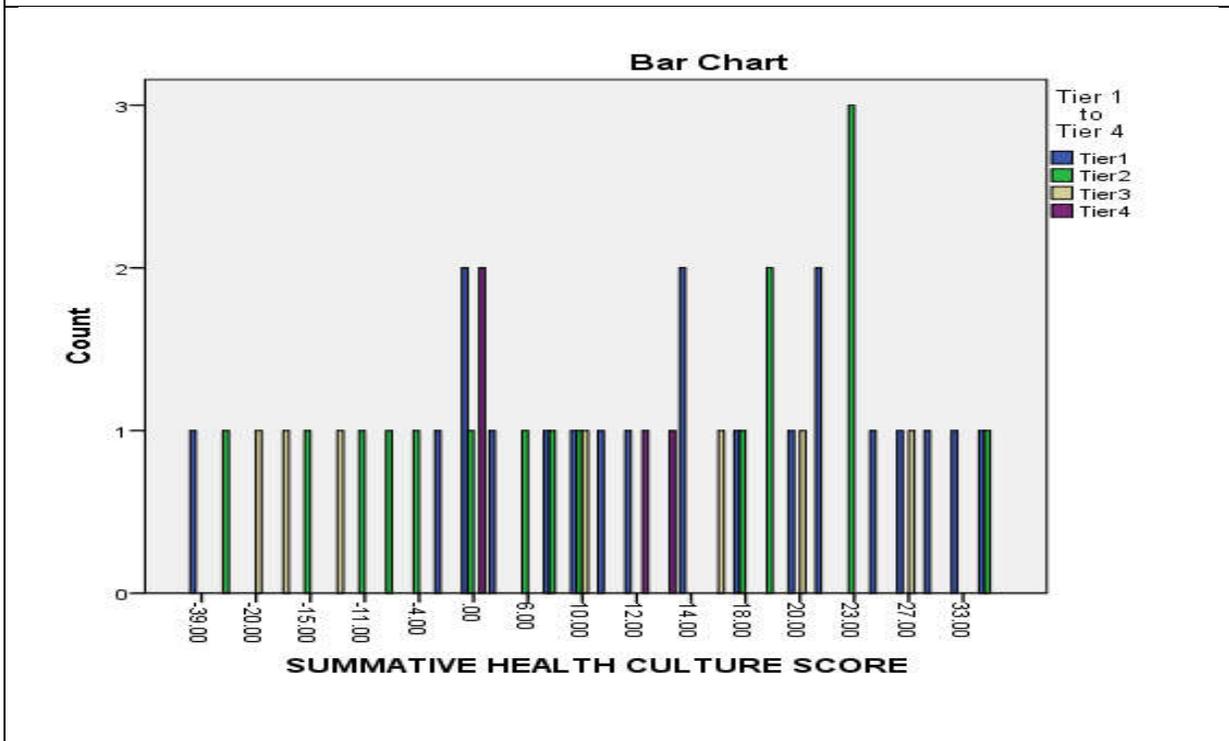
From the analysis, safety climate was unrelated to the health culture or the presence of a health and wellness program in BC trucking companies. From the chi square analysis depicting the association between safety climate and the health cultures within BC trucking companies, both companies with very low health cultures (-39) and companies with highly rated health cultures (+36) were ranked high on safety climate scores (Tier 1 and Tier 2). The table and graph below depict these associations.

Table 8: Cross tabulations of Safety Climate/ OPM scores and Health Culture scores

Safety Climate Rank/ Health Culture Score	Tier 1	Tier 2	Tier 3	Tier 4
+36	50	50		
+33	100			
+30	100			
+27	50			
+24	100			
+23		100		
+21	100			
+20	50		50	
+19		100		
+18	50	50		
+17			100	
+14	100			
+13				100
+12	50			50
+11	100			
+10	33.3	33.3	33.3	
+7		100		
+6		100		
+3	100			
0	40	20		40
-2	100			
-4		100		
-5		100		

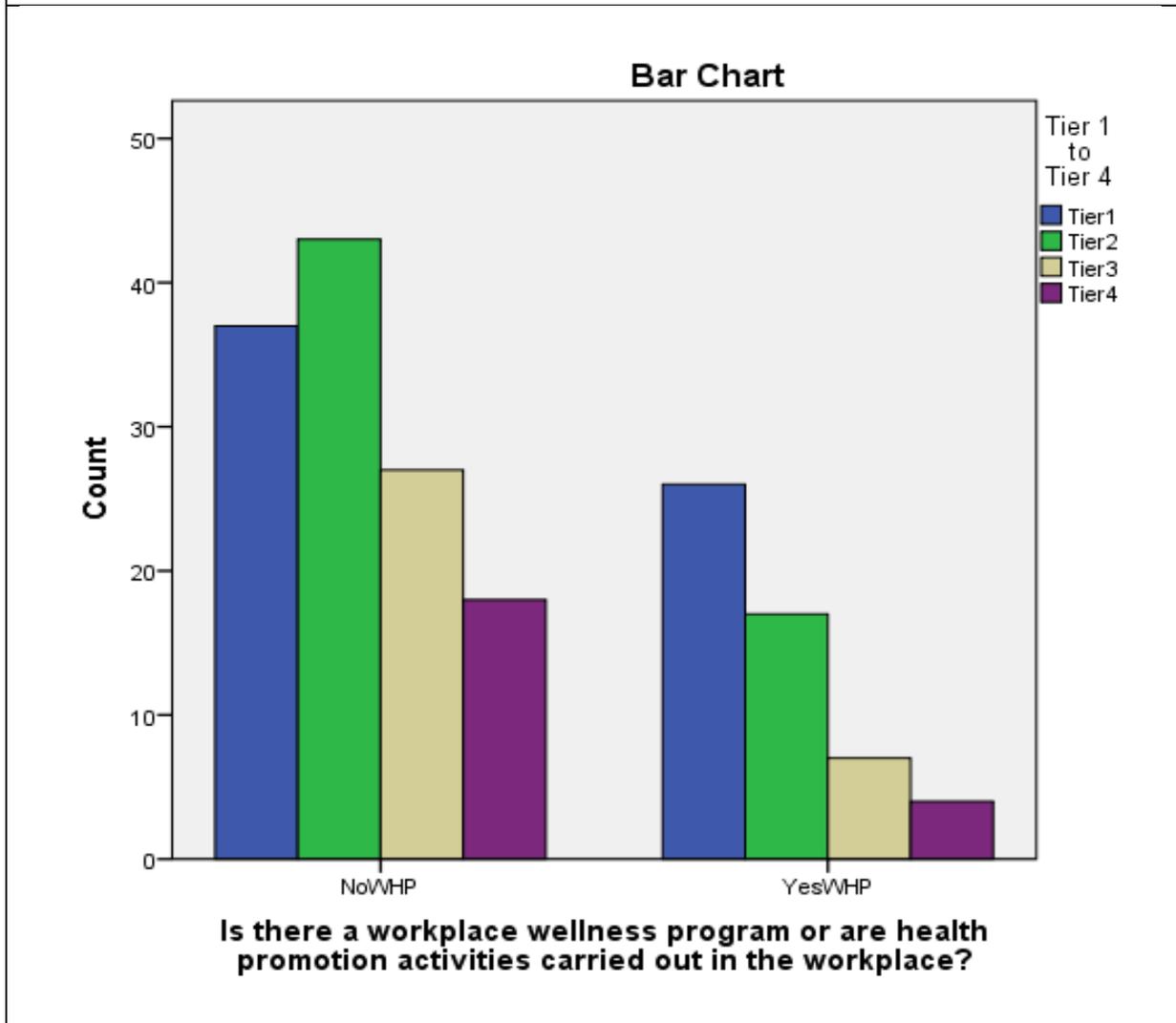
-13			100	
-15		100		
-18			100	
-20			100	
-26		100		
-39	100			

Figure 7: Bar charts showing cross tabulations of safety climate scores and health culture score



Because safety climate is unrelated to the health culture in a company, it is not surprising therefore that the safety climate within BC trucking companies is also unrelated to the presence or absence of a WHP (n= 179). Using chi square analysis, it was determined that companies without a health and wellness program had higher safety climate scores than companies with a WHP. However, it was more unlikely for companies with a wellness program to have a low safety climate (purple bar in the image below); that is, these companies were least likely to belong to Tier 4 than companies without WHP (OPM score of 8 to 30) (See image below).

Figure 8: Crosstabulations of Frequency of Health and Wellness programs and Safety Climate ranking



Next, the team identified similarities and differences between companies with very high health culture ratings, companies with very low health culture ratings and companies with neutral health culture ratings. Cut off points used to determine high and low health culture scores was a minimum score of +2 and above and -2 and below for all 13 statements. Companies were compared based on size of company, safety climate score, and characteristics of WHP. There were 16 cases identified and the tables below show company characteristics and characteristics of each company's WHP.

Figure 9: Comparison of Health Culture and Safety Climate scores among companies with a High Health Culture

Companies with a High Health Culture				
Research ID	Company Size	Health Culture Score	Safety Climate Tier	Components of WHP
81	Very Small	27	Tier 1	WC
209	Not Stated	27	Tier 3	O
283	Large Company	33	Tier 1	O; OSA; PI, WC
284	Not Stated	30	Tier 1	DS; O; P
310	Very Small	36	Tier 2	DS; O, TW, PI, P
363	Medium	35	Not calculable	TW; DS
368	Very Small	36	Tier 1	TW, PI, P

Legend: WC- workplace changes such as exercise facilities, food access, ergonomic changes; O- outreach using newsletters and advertisements; OSA- Obstructive sleep apnea screening/ treatment; PI- Participation incentives such as challenges or draws; DS- dedicated staff; P- payments to outside vendors for activities, programs or products; TW- Training/workshops.

Table 10: Comparison of Health Culture scores and Safety Climate scores among companies with a Neutral Health Culture score				
Companies with a Neutral Health Culture Score				
Research ID	Company Size	Health Culture Score	Safety Climate Tier	Components of WHP
67	Very Small	0	Tier 2	DS
130	Very small	0	Tier 1	DS
139	Medium	0	Tier 4	DS; P
174	Small	0	Tier 4	DS
215	Very small	0	Tier 1	P

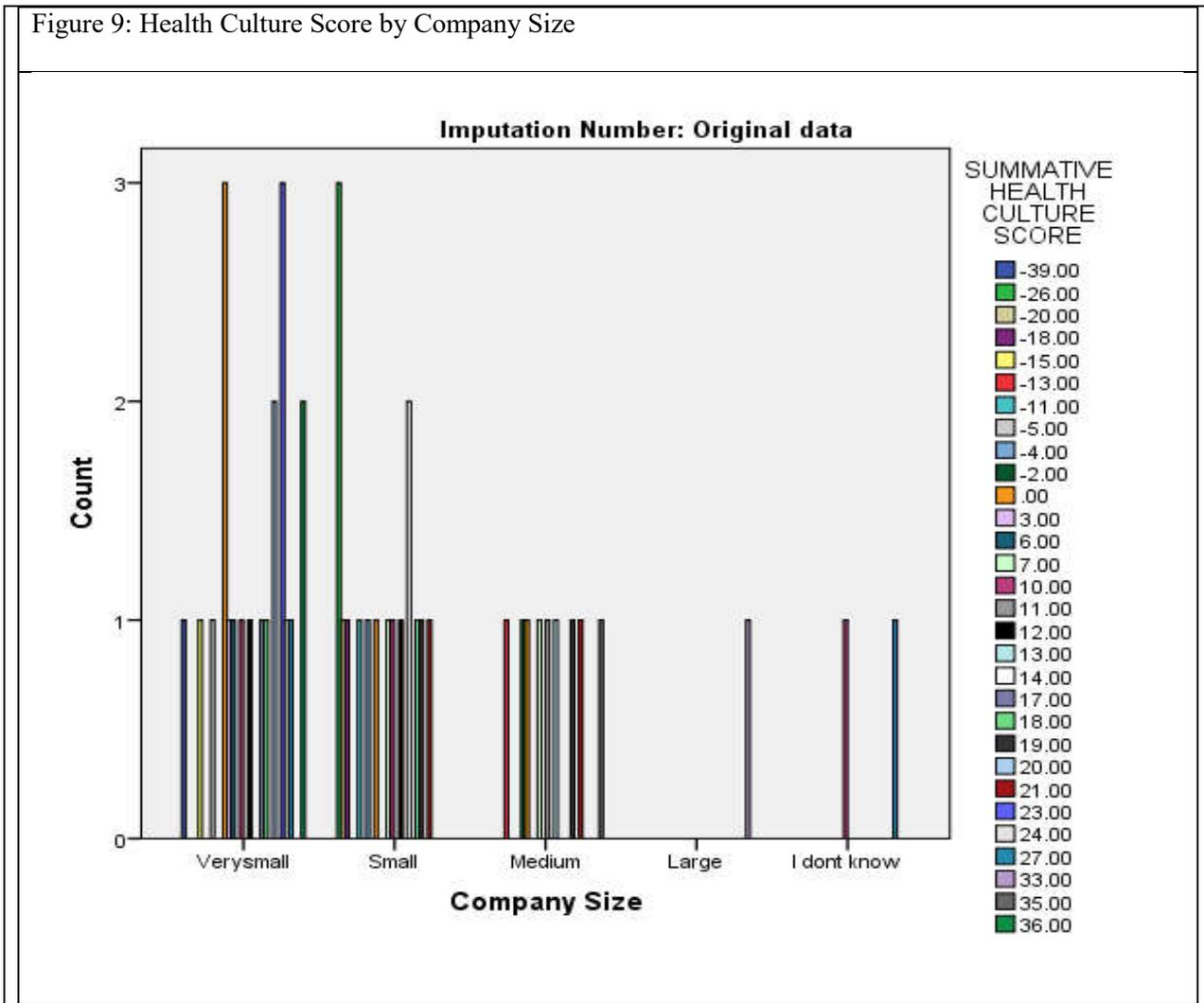
Legend: WC- workplace changes such as exercise facilities, food access, ergonomic changes; O- outreach using newsletters and advertisements; OSA- Obstructive sleep apnea screening/ treatment; PI- Participation incentives such as challenges or draws; DS- dedicated staff; P- payments to outside vendors for activities, programs or products; TW- Training/workshops.

Table 11: Comparison of Health Culture scores and Safety Climate scores among companies with a low health culture score

Companies with a Low Health Culture Score				
Research ID	Company Size	Health Culture Score	Safety Climate Tier	Components of WHP
157	Small	-26	incalculable	O
224	Very small	-39	Tier 1	DS; TW
273	Small	-26	incalculable	WC
286	Small	-26	Tier 2	TW; PI; WC, P

Legend: WC- workplace changes such as exercise facilities, food access, ergonomic changes; O- outreach using newsletters and advertisements; OSA- Obstructive sleep apnea screening/ treatment; PI- Participation incentives such as challenges or draws; DS- dedicated staff; P- payments to outside vendors for activities, programs or products; TW- Training/workshops.

Figure 9: Health Culture Score by Company Size



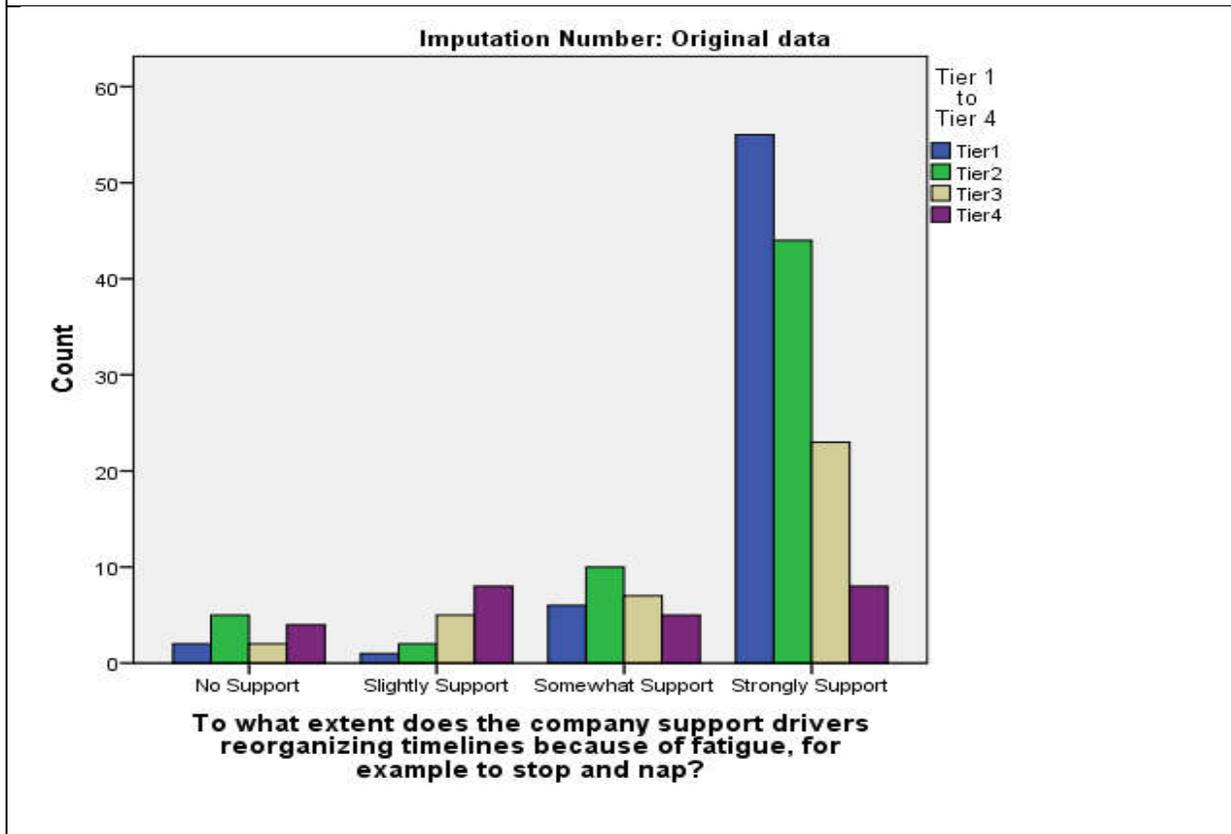
Recollect that the health culture scale was initially developed by Jung et al. (2010) to measure company willingness and capacity to adopt health promotion activities, termed health culture scale. The findings from this study therefore show that companies can adopt a WHP irrespective of their size. An important second finding is that most companies which scored neutral on health culture had minimal level of management involvement in health promoting activities reported as having a dedicated staff for workplace health and wellness. The third and surprising fact was that companies with very low health cultures, -39 to -26 reported engaging WHP program characteristics (such as training workshops, workplace changes and participant incentives) not commensurate with their health culture scores. One likely explanation for this might be that respondents filling out the survey are misinterpreting engagement in safety practices as workplace health and wellness. This explanation is supported from the open-ended responses where one of the identified themes was misrepresentation of workplace health and wellness as a safety program, or presence of a health insurance policy covered by employers. This explanation is also supported by the high safety climate ratings of these programs. Another probable

explanation is that the characteristics of the company WHP are recent changes within the company to a poor health culture which the study did not capture based on the cross-sectional study design.

Fatigue Prevention through Company Support for Napping'/ Reorganization of Schedule

Lastly, to identify other ways BC trucking companies are practicing measures that align with international standards such as NISOH and ENWHP standards, the study looked at company support for napping/ reorganization of schedules as a fatigue prevention measure. Note that these measures, napping/ reorganization of truck driver schedules are two of several measures that can be used for fatigue prevention among truck drivers. Here on in this study, these two measures will be referred to as fatigue prevention measures.

Figure 10: Bar chart showing crosstabulations between the variables, Fatigue prevention measures, and Safety Climate rankings or tiers



The bar chart above shows the relationship between fatigue prevention measures and safety climate. Chi square analysis (n= 205) revealed that, across all four tiers of OPM scores, companies showed strong support for fatigue prevention measures. Company support for fatigue prevention measures was particularly strongest for companies at Tiers 1 to 3 OPM scores. Chi square analysis by company size also revealed that though all companies, irrespective of company size, strongly support fatigue prevention measures, respondents from very small and medium sized companies were more likely to report lack of company support for these fatigue prevention measures.

Table 12: Crosstabulations between variables, Fatigue prevention measures and Company Size
(Manager's perspective)

Size of companies	Company Support for Napping/ Reorganization of schedules			
	No Support	Slight Support	Somewhat Support	Strong Support
Very Small	10.7%	7.4%	18.2%	63.6%
Small	1.9%	7.5%	11.3%	79.2%
Medium	9.1%	13.6%	18.2%	59.1%
Large	0%	0%	0%	100%

Incidentally, managers and drivers' perspectives on managerial support for napping differs. Managers and manager type personnel were more likely to report their company's strong support for napping than truck drivers. Table 2 below shows drivers' perspectives (n=305) about company support for napping/ reorganization of schedules as a fatigue prevention measure.

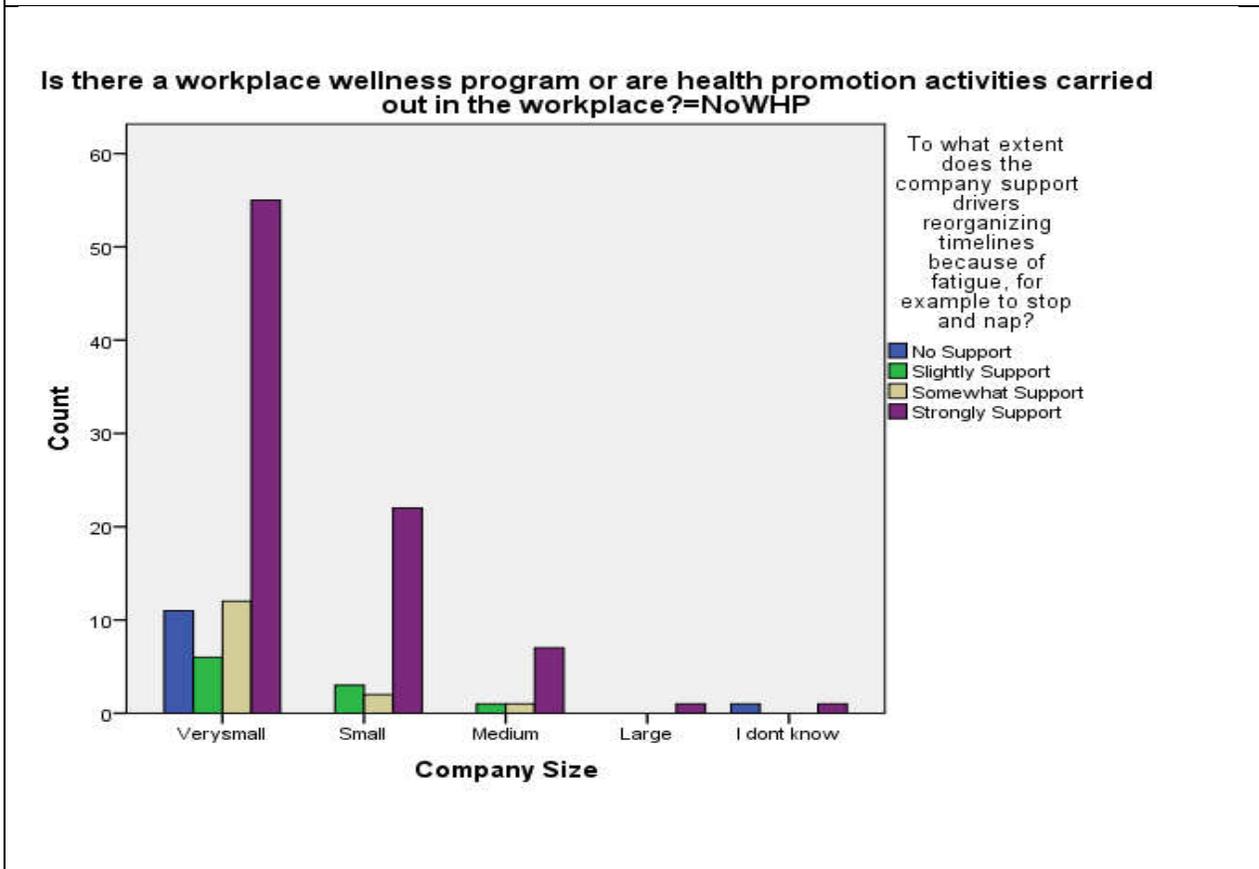
Table 13: Crosstabulations between variables, fatigue prevention measures and company size (truck drivers' perspective)

Size of companies	Company Support for Napping			
	No Support	Slight Support	Somewhat Support	Strong Support
Very Small	28.4%	12.2%	25%	34.5%
Small	32.7%	10.2%	32.7%	24.5%
Medium	31.4%	17.1%	34.3%	17.1%
Large	8.7%	17.4%	10.9%	63%

Tables 12 and 13 above shows that though strong support for fatigue prevention measures were reported by managers and manager type personnel, drivers' perception of their support differs. Put into proper perspective, these

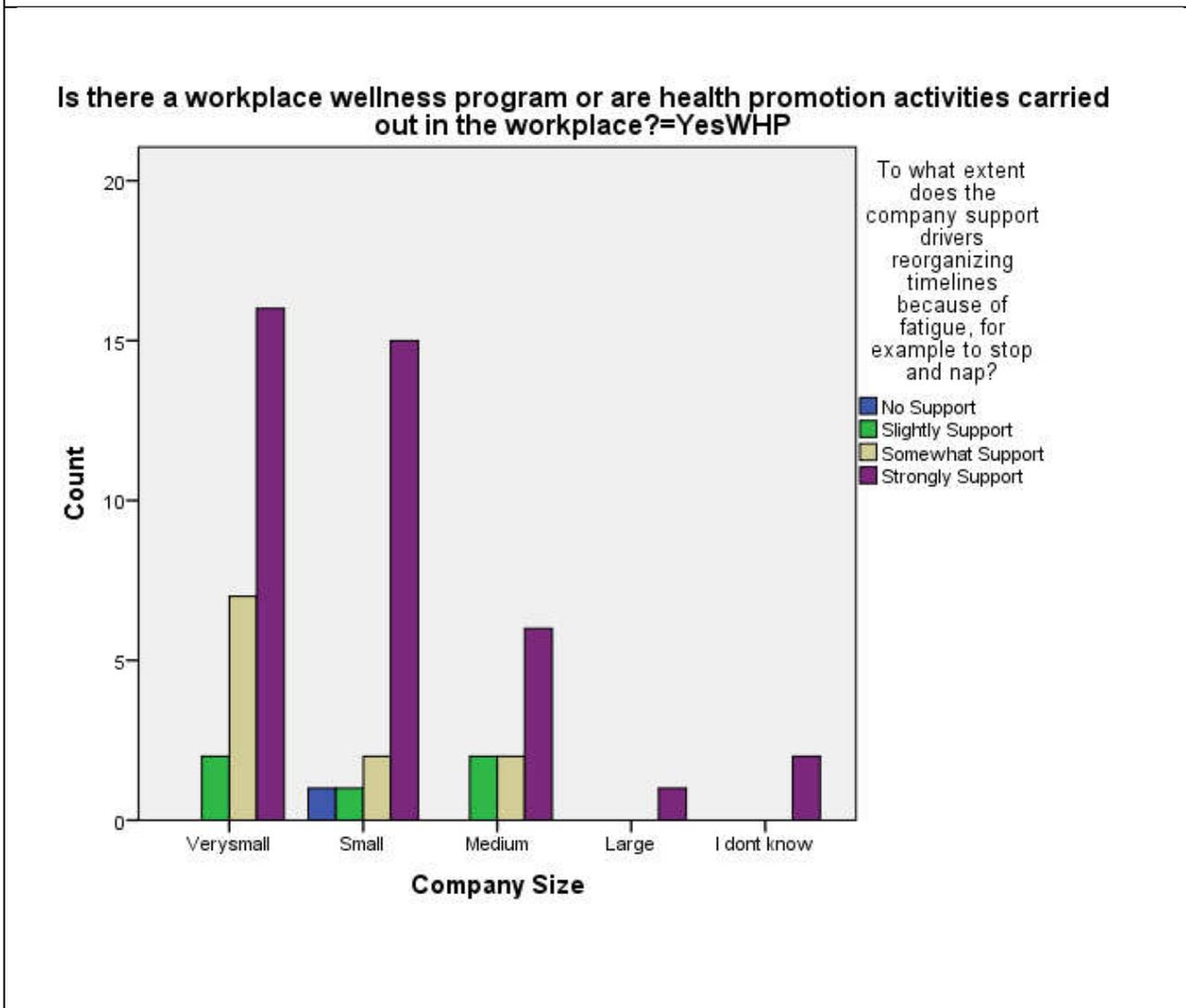
results show that manager respondents in our sample acknowledge reorganization of timelines and support of napping as fatigue prevention measures. What these results do not tell us are the things employers do to accommodate or ensure these fatigue prevention measures.

Figure 11: Bar chart showing crosstabulations between fatigue prevention measures and company sizes among companies with no wellness program



The chart above shows the frequency of responses by company sizes (n= 180) to the question about company support for fatigue prevention measures (such as reorganization of timelines and napping) among companies **without a WHP**. The second chart below shows the frequency of responses by company sizes (n=180) to the question about company support for fatigue prevention measures (such as reorganization of timelines and napping) among companies **with a WHP**.

Figure 12: Bar chart showing crosstabulations between fatigue prevention measures and company sizes among companies with a wellness program



The two charts presented above show that companies strongly support fatigue prevention irrespective of the presence or absence of a WHP.

Research question 3

The third research question sought to identify differences between companies with H&W programs and companies without H&W programs. Answer to this question has been mentioned in different sections of this report and will be summarized here. Differences between companies with a WHP and those without a WHP include

- (1) Company size: No difference between large and small companies in terms of presence or absence of a WHP.

- (2) Safety climate: All companies in our sample, irrespective of company size, have a high safety climate; however, large companies are less likely to have a low safety climate than very small and small companies.
- (3) Affiliation with a Safety Organization like SafetyDriven: Companies might have been registered with SafetyDriven and obtained a COR certificate, but did not necessarily have a workplace health and wellness program (see answer to research question 5 for explanation).
- (4) The presence or absence of a WHP is unrelated to fatigue prevention measures within trucking companies in BC irrespective of company size (see graphs below).

Research question 4

This survey also sought to know about the specific elements of Health, Safety and Wellness programs in companies reporting existing WHP (n= 58), and how these differed among different carriers (company sizes) and among different sub-sectors within the trucking industry (generalized versus specialized freight transport companies). In this report, we provide frequency of specific elements of WHP carried out within trucking companies in BC. We do not report frequency of these activities by subsector (general versus freight), because too few responses were obtained from the second analysis which precluded reporting. See table below for the responses from 51 respondents who reported the components of their company's WHP.

Table 14: Table showing components of wellness programs among respondents (n=51)

Components of WHP	Percent of Cases
Dedicated staff	46.3%
Newsletters/ advertising	37.0%
Obstructive Sleep Apnea screening and treatment	5.6%
Other health risk assessments	11.1%
Training workshops	35.2%
Participation incentives such as challenges and draws	25.9%
Exercise facilities, food access, ergonomic changes	38.9%
Payments to outside vendors for activities, programs or products	25.9%
Total	225.9%

The table above shows that among companies with a WHP, Obstructive Sleep Apnea screening and treatment and other health risk assessments (e.g. blood pressure measurement) were the least activities carried out. Information also showed that existing WHP have a staff dedicated to running the WHP. This piece of information can be leveraged upon in future studies planning to design WHP within trucking companies.

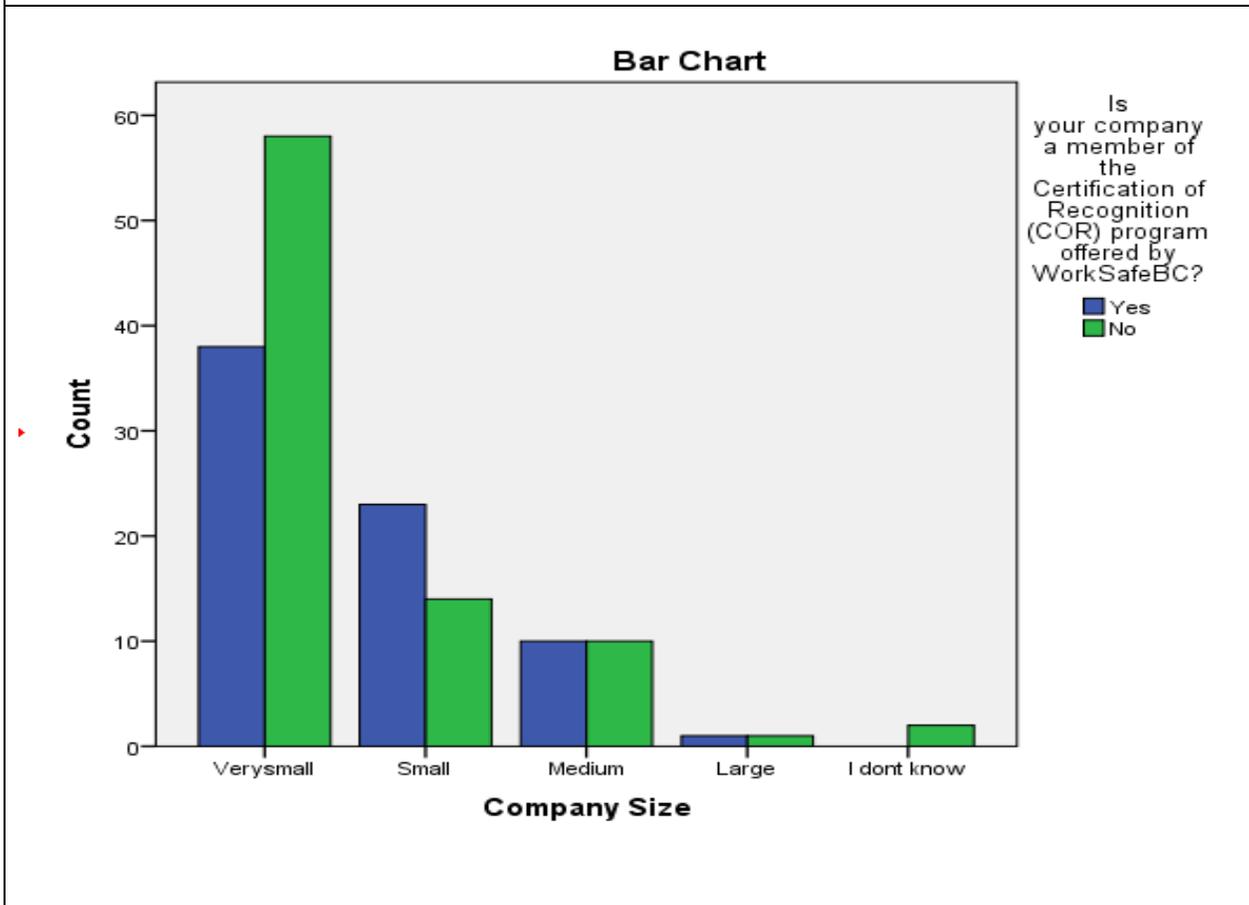
Respondents were also asked to describe (using an open-ended format) their WHP and to include any innovations they had adopted. From 36 respondents to the manager survey, the major themes identified were (1) Management support for increased physical activity (42%) by provision of free, discounted, and paid gym memberships; management support for sporting events by organizing races, bike rides or walking events. (2) Fatigue management (8%) through rescheduling of shifts, company support for napping breaks and holiday breaks. (3) Dietary lifestyle management (11%) by providing access to a fridge on the truck, providing access to home cooked meals on company property such as providing access to a kitchen, microwave and a fridge to store cooked meals. (4) Psychosocial management (25%) provided through counseling services, regular meeting with drivers, provision of drugs and addiction services, coverage of individual and family counselling services, and assertive training of drivers. (5) Health and wellness credit (3%) such as provision of an annual sum of money for health and wellness to all employees including drivers (\$1000 each). Finally, one respondent (3%) described their WHP as a multi-targeted intervention consisting of management support for physical activity, counseling services and extensive health care benefits (respondent did not indicate if this was the same thing as health care coverage).

Research question 5

The fifth research question in the study inquired about the proportion of HS&W programs for long haul drivers that were integrated into other management systems (i.e., comprehensive Occupational Health and Safety Management Systems, Certificate of Recognition (COR), ISO 9000 series). Only one of these management systems was addressed in this study: the integration of HS&W programs into the COR program.

The COR program is a program developed by SafetyDriven, a non-for-profit safety organization responsible for training and ensuring that companies registered with them comply with BC safety issues within the transportation industry. The safety climate within trucking companies can be encouraged by registration with an external organization such as SafetyDriven that monitors and ensures that the safety culture within trucking companies are standardized and align with national and international standards. Chi square analysis was used to identify COR registration by company size, and to compare COR registration with OPM tiers/ ranks among trucking companies in BC.

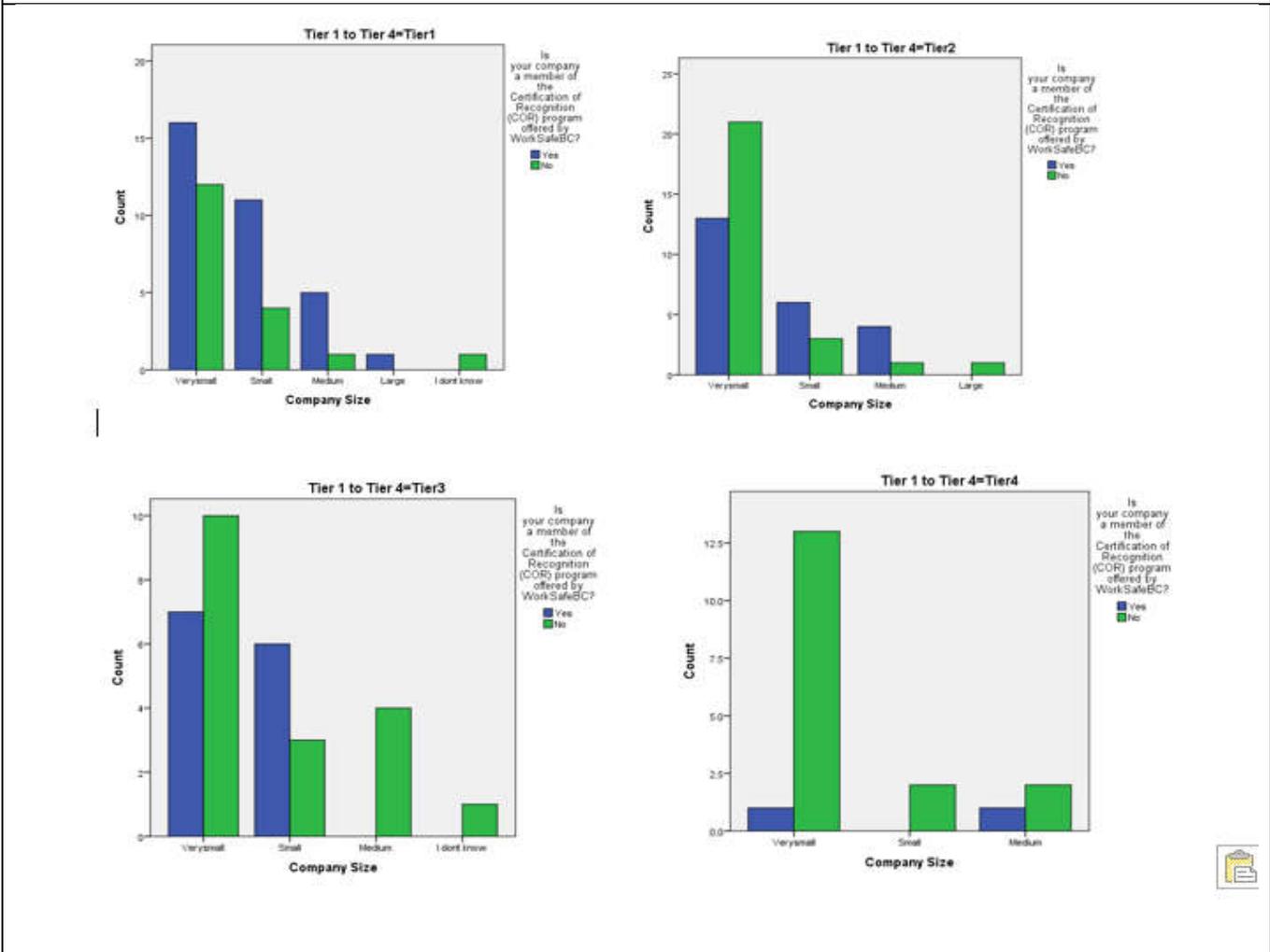
Figure 13: Bar chart showing COR membership by Company Size



From this study's sample (n=157), the bar chart above shows that very small companies frequently register with SafetyDriven. Compared to other companies however, very small companies were least likely to be registered with SafetyDriven. Plausible explanations for this could be that they are unaware about SafetyDriven, registration with SafetyDriven is an additional cost which they cannot afford, or these companies are registered with other safety organizations which provide safety monitoring services.

Cross tabulations of registration with Safety Driven and OPM scores (n=150) produced the following results below.

Figure 14: Bar Charts showing crosstabulations between COR certification and Company size layered by Safety Climate Ranks (Tiers 1 to 4)



The first two bar charts represent cross tabulations between OPM score and Company sizes for Tiers 1 and 2. The next two bar charts below represent cross tabulations between OPM score and Company sizes for Tiers 3 and 4. The blue color coded charts show companies registered with SafetyDriven, and the green charts show companies not registered with SafetyDriven.

The above charts show that Tier1 group of companies were more likely to be registered with SafetyDriven than Tiers 2, 3 or 4. The bar charts above also show that very few companies with a COR certificate possessed a low safety climate score (Tier 4) compared to those without a COR certificate. However, it was also noted that a high number of respondents in Tier 1 and Tier 2 (top charts) were not registered with SafetyDriven. Hence, it can be surmised that high safety climates within these companies are due to other factors e.g. registration with other safety organizations. This

finding supports the notion that registration with an external organization that monitors the safety practices within trucking companies actually improves the safety culture within those companies. Future studies can seek to identify if the safety climate within companies is associated with registration with other safety organizations to further explain high safety climate scores (Tiers 1 to 3) in companies not registered with SafetyDriven.

Still on the matter of safety, the study also sought to identify use of other health and safety resources like the North American Fatigue Management Program (NAFMP) and the Healthy Trucker resources. The NAFMP is a comprehensive approach to managing fatigue developed by a steering committee comprised of Transport Canada, the Federal Motor Carrier Safety Administration, Alberta Transportation, Alberta Workers Compensation Board, Alberta Employment and Immigration, Société de l'assurance automobile du Québec, Commission de la santé et de la sécurité du travail du Québec, Alberta Motor Transport Association and the American Transportation Research Institute (NAFMP, n.d). The comprehensive NAFMP approach includes information on how trucking companies can develop a company culture responsive to driver fatigue and management; education on fatigue management for drivers and their families, and the management in trucking companies. The NAFMP also provides information about screening and treatment of the most important culprits for driver fatigues including sleep disorders and trip scheduling.

The Healthy Trucker Resources are a set of health and wellness solutions developed specifically for the trucking industry. An example of HTR is the Healthy Fleet Challenge which includes step challenges, interactive fitness challenges, and weight loss challenges. Since its inception in 2014, HTR have hosted over 200 fleets and industry partners as well as over 3000 drivers (Healthy Trucker, 2019). The head company for HTR is located in London Ontario.

Knowledge about use of NAFMP and HTR resources among trucking companies in BC would have provided useful information about fatigue management and health promotion among truck drivers. Unfortunately, this study cannot provide information on how BC trucking companies use either of these resources as none of the participants in this study responded to the questions about their use of either one of these resources (resulting in a non-response rather than missing data). A likely reason for this might be a lack of awareness about these resources among trucking companies in BC.

Research question 6

Beyond seeking to identify uptake of safety and wellness resources among trucking companies in BC, this study looked at influence of safety climate (evidenced by the Organization Performance Metric Score) on driver turnover.

Cashmere (2018) defined turnover rate for any job as “the number of persons leaving that job annually versus the total number of jobs”. A proxy question that captured driver turnover rate in this study was average length of service for different categories of drivers: highway, regional (highway and local), and local/ city drivers. The assumption is that the higher the average length of service of truck drivers in a company, the less the truck driver turnover rate and vice versa. Employers were about the average length of service of their truck drivers. In this study, the average length of service for highway (n=102) and regional truck drivers (n = 88) was 10 years. The most frequent response for regional drivers was less than a year and for highway drivers was 10 years. The few number of years reported for regional truck drivers in this study reflect how long truck drivers spend in that company and does not reflect if they changed jobs within the industry or left the trucking industry. Consequently, in this study, it was not possible to determine the association between safety climate and average length of service (study proxy for driver turnover).

Research question 7

The last research question was to determine companies’ motivations for adopting a health and wellness program. The data obtained from respondents would not directly answer this question. Instead, the data captured reasons employers did not have a wellness program and barriers to adopting a health and wellness program (from managers and drivers respectively) instead of motivations for doing so. From the managers, the study asked, “If your company does not have a program or it is not currently active, can you say why?” The two most frequent responses (n=32) from managers or employers was that a health and wellness program was not needed, and some others felt that though health and wellness programs are needed, they did not have enough staff resources to manage the programs. These standardized responses corroborated with the themes generated from employer’s open-ended responses. Employers and managers were asked to give reasons, in an open-ended format, for lack of a health and wellness program in their companies. Three major themes were identified from employer’s responses (n= 30): Employers’ perceptions (47%), logistics issues (33%), futuristic plan (20%).

Employers perceptions for lack of health and wellness programs include a lack of interest (3%), the fact that health and wellness programs were not their priority (7%), and the belief that they were not responsible for their truck driver’s health (10%). Some employers also think that truck drivers will not be interested in health and wellness programs (10%) or have resisted wellness programs they had implemented in the past (10%). Several logistic issues were also identified from employer responses and include a lack of financial resources (10%), lack of time or personal inhibitions like being

too lazy to implement one (7%); the start of a new business (3%), or the closing of a business (3%). Some employers also stated that such programs were not applicable because they were an owner operator business (10%), or that truck drivers are not ill (3%), or that it was not a part of the company's culture (3%). The last theme identified from managers'/ employers' responses is called futuristic that is, health and wellness is something employers are realizing is important and considering (10%) or a program that will soon start in the company (10%).

Truck Driver's Health

This study was principally designed to obtain information from employers about prevalence of health, safety and wellness programs, characteristics of these programs and integration into other management systems. During the design stage, the research team also thought it was important to understand access to health safety and wellness programs from truck drivers' perspectives, including their health risks, health behaviours and job satisfaction. The information below provides a summary of truck drivers' responses to aforementioned lines of inquiry.

Health risks and Health Behaviours among Truck drivers.

The study examined truck drivers' health risks and behaviours including truck drivers' knowledge about commonly reported chronic diseases within the trucking industry and truck drivers' job satisfaction. Specifically, this study inquired about the average number of times per week truck drivers engaged in 30 minutes of moderate activity such as brisk walking, and light bicycling, and strenuous activities such as intense cycling, running, jogging or swimming. The study also inquired about truck drivers' access to health safety and wellness programs including access to different components of the health, safety and wellness programs.

The data showed that nearly half of the respondents (47.4%, n= 323) engaged in moderate physical activities such as brisk walking, and light bicycling for 3 or more times per week. The remaining, 34.1% of respondents engaged in moderate level of physical activity 1 or 2 or times per week and, 18.6% reported not engaging in any form of moderate physical activity during the week. With reference to engaging in strenuous activities such as intense cycling, running, jogging or swimming, 19% of truck drivers engaged reported that they engaged in strenuous activities 3 or more times per

week; 30.6% of truck drivers engaged in strenuous activities 1 or 2 times per week, while 50.5% of truck drivers reported no engagement (0 times per week) strenuous activities.

Truck drivers' reported about their knowledge of chronic medical illnesses within the trucking industry (n=239); as well as, truck drivers' satisfaction with their jobs (n= 116). Our respondents expressed knowledge about low back pain (74.1%), fatigue (62.3%), stress (76.6%), high blood pressure (65.3%), sleep issues such as sleep disturbance and sleep apnea (60.3%), and diabetes (49.4%). Respondents in our study were less knowledgeable about lung diseases (15.1%) and mental illnesses including drug addictions (27.2%) among truck drivers. The values obtained about these medical conditions exceed 100% as respondents were allowed to select multiple options. Though the question sought to assess truck drivers' awareness of aforementioned medical conditions, there is a high likelihood that the question captured both instances of personal experience of aforementioned diseases and knowledge about the diseases among other truck drivers.

Analysis of open-ended responses to a question about job satisfaction among truck drivers (n=116) identified the following five themes.

1) Emotional exhaustive factors caused by poor work relationship between truck drivers and other workers in the trucking industry including shippers, receivers, and management in the trucking company.

2) Carrier scheduling difficulties and remunerations. Truck drivers complained about the discrepancy between length of work, the rigors involved in the work, and remunerations. Many drivers complained about long work hours and waiting hours and the toll this places on them including lack of family time. Truck drivers complained that their take home pay was not commensurate with the hours they put into work including, including unpaid work hours, unpaid overtime, and long waiting hours which are not compensated. Two respondents also commented that poor remuneration was common in the industry because of the presence of foreign workers, who would receive less pay and accept to work in poor safety conditions jeopardizing work chances for other truck drivers who would otherwise have refused such jobs. Another driver stated that poor pay is reason for his desire to move to another industry when such an opportunity exists. Work and pay discrepancy is best captured by this statement from one respondent, "The adage of work 100 hours a week, log 60, and get paid for 40" is all too true."

3) Environmental factors such as driving in spite of bad weather conditions, poorly repaired roads and unavailability of social amenities such as shower areas and rest rooms while on the road, were other reasons given for job dissatisfaction.

4) Other road users such as truck drivers, car drivers, motorists and pedestrians are also sources of poor job satisfaction among truck drivers. Some truck drivers complained about the bad driving exhibited by other truck drivers especially foreign truck drivers, and other drivers on the road.

5) Finally, problems with management was another theme noted in this survey. Drivers used phrases like “greedy management,” “lack of compliance with basic employment standards,” and “inhumane employers demanding long hours” which seem to point to unrealistic expectations employers demand from truck drivers.

Access to Health Safety and Wellness Programs

Participation in Health Safety and Wellness programs is low among truck drivers, but data also shows that some truck drivers will not participate in these programs even if their employers provided them. From this study (n= 296), 26% of truck drivers say they have access to a health and wellness program at their workplace (comparable to 31.1% of employers that say they provide health and wellness programs). The table below shows responses in percentages (n=73) to a question about access to specific components of health safety and wellness programs among truck drivers. Only truck drivers who responded positively to a previous question about access to a workplace health and wellness program provided answers to this question.

Access to specific components of Health Safety and Wellness Programs provided by trucking companies	TE	TC	Yes CP	No CP	Yes, FTE	No, FTE
1. Health risk assessments	32.9%	8.2%	2.7%	47.9%	13.7%	17.8%
2. Health screenings (blood pressure/blood sugar/neck circumference/lipids/weight)	15.1%	5.5%	6.8%	39.7%	20.5%	20.5%
3. Obstructive sleep apnea screening/ treatment	11%	5.5%	1.4%	46.6%	17.8%	24.7%
4. Counseling/coaching	17.8%	8.2%	5.5%	46.6%	13.7%	19.3%
5. Support for alternative health (for example yoga, massage)	12.3%	5.5%	4.1%	47.9%	16.4%	20.5%
6. Educational messages and information	30.1%	4.1%	6.8%	38.4%	12.3%	20.5%
7. Educational classes and events	21.9%	4.1%	4.1%	42.5%	17.8%	19.2%
8. Policies that support a healthy environment (such as restricted tobacco product use at work or alcohol use at events)	20.5%	4.1%	0%	42.5%	12.3%	24.7%

9. On-site exercise facilities or programs	46.6%	2.7%	6.8%	34.2%	5.5%	13.7%
10. Subsidized off-site exercise	16.4%	2.7	2.7	45.2	12.3	24.7
11. Access to healthy food	13.7%	2.7%	12.3%	39.7%	21.9%	12.3%
12. Organizational changes (such as route scheduling, flexibility to reduce work-home family conflicts)	28.8%	1.4%	17.8%	31.5%	16.4%	9.6%
13. Occupational health and safety	43.8%	4.1%	15.1%	28.8%	8.2%	8.2%
14. Workforce development (such as continuing education like first aid training, or crisis prevention)	26%	4.1%	12.3%	35.6%	16.4%	11%
TE: Through employer; TC: through another company; Yes: Yes, I currently participate in this program; No: No, I do not currently participate in this program; Yes, FTE: Yes, I would love to participate in this program if it was available to me through my employer; No, FTE: No, I would not participate in this program if it was available to me through my employer.						

The highlighted columns are important to the discussion section of this report. Essentially, these columns represent access to the listed (1 to 14 items) components of health safety and wellness programs provided by trucking companies. Though only 73 responses were retrieved for this question, which might not be representative of the truck driver population in BC, the results (No CP) show that approximately 30 to 50% of truck drivers did not have access to various health and wellness programs offered by their companies. Interestingly as well, up to 25% of truck drivers (No FTE) were also not interested in accessing these programs even if the employer provided them.

Barriers to Access to Health Safety and Wellness among truck drivers

From aforementioned results, it is obvious that there are some barriers to workplace wellness programs within the trucking industry. Drivers were asked the question, “What do you think are some barriers to health and wellness in your company?” From 128 responses we identified the following themes: (1) infrastructural barriers (2) barriers from the management (3) barriers from poor communication (4) barriers from lack of information or misinformation about health and wellness and (4) barriers resulting from poor personal choices and health behaviours. Because the online questionnaire had a character constraint (50 characters) for open-ended questions, the researchers were careful not to read more meaning into participants’ responses than what they provided. Where possible, quotes are provided to support these responses.

Respondents (n=128) identified the following infrastructural barriers to health and wellness within the trucking industry: lack of money to fund health and wellness programs (6.3%), lack of space on company facility to host a WHP (0.8%), lack of a health and wellness personnel to run the program (0.8%), improper equipment (0.8%), and insufficient

number of drivers (0.8%). From these truck drivers' responses, it appears that a good number of these respondents are speaking from their perspectives as owner operators and / or insiders into how their employers run the trucking companies.

Respondents identified managerial issues as contributory barriers to health and wellness within the trucking industry. They raised issues such as (1) health and wellness was not a part of their company's work culture (2.3%) (2) employers disinterest in health and wellness including a lack of care for employees' health (5.5%), (3) fear of being replaced/ dismissed if they spent time on health and wellness rather than on their jobs (2.3%), (4) problems with the existing company WHP such as poor oversight of the wellness program (0.8%) and lack of incentives to participate in company's WHP (0.8%).

Health and wellness within trucking companies could also likely be hindered due to poor knowledge about health and wellness (10%), or poor communication between the management and drivers within trucking companies (10%). For example, a respondent commented that "[WHP] is not discussed [in his company]", and another said, "... [employers] leave health and wellness to local managers without ongoing evaluation".

With regards to poor knowledge and/or misinformation about WHP, 3.9% of drivers (128) said they were not aware about the presence of a health and wellness program in their company. Others were misinformed about health and wellness within the trucking industry such as equating health and wellness to safety (0.8%), or equating health and wellness programs to access to a comprehensive health insurance plan from their employers (3.2%). Yet still, others stated that competing priorities such as paying the bills, caring for their families and/ or the high cost of fuel were reasons why they do not engage in health and wellness programs, or why their company does not provide one (2.4%). Examples of quotes which reflect driver's misinformation about health and wellness and / or programs include "[I'm] on spouse's health benefits, would like to see owner-operators be able to purchase medical health benefits through mill"; "...as an owner operator it is lack of good quality plans"; "...drivers are in reasonably good health," and "inadequate team playing shop dictates our safety without consulting workers". From aforementioned examples, it appears that there is a knowledge gap in the industry about health and wellness programs, wrong perception that health and wellness is the same thing as safety, and lack of knowledge about and the importance of health and wellness.

The final theme identified from truck drivers' responses to the question about barriers to health and wellness was barriers resulting from the nature of the job, the trucking industry at large, and their personal choices. Truck driving is a

demanding job which requires drivers to be on the road for many hours per day and per week. Truck drivers described the nature of their job: the long work hours and lack of time (27%), pressures at work (15%), problems with scheduling and shift work (3%), and lack of access to healthy food options as barriers to health and wellness in their companies (1.6%). Personal choices which drivers make also contribute a barrier to health and wellness of drivers within trucking companies. For example, owner operators say they are responsible for their own health and wellness a plans (11%), so choosing to adopt a wellness strategy/ plan is up to them. Other drivers identified specific health behaviours such as lack of sleep, lack of family time, and poor access to healthy meal options as reasons for poor health and wellness. Still others situated barriers to health and wellness within a broader trucking culture where they identified that “weak employment law [s], over hours work requirement, inflation, and lack of incentives to go to gyms as barriers to health and wellness. Finally, some drivers said they did not have any barriers to health and wellness programs (8%) or that they had no idea what the barriers to health and wellness were (4.7%).

Sources of information about health and wellness

The last form of analysis that was considered important to addressing truck drivers’ health and wellness was identification of truck drivers’ sources of information about health and wellness, as well as how they would like to obtain information about health and wellness. The results of the analyses (multiple response options) are presented below.

<i>Table 16: Table showing the commonest sources of information about health safety and wellness among truck drivers in BC</i>		
Where do you obtain information about occupational safety, health and wellness? (n=278)	Health and Safety	Health and Wellness
Safety Association	7.2%	6.8%
WorkSafeBC	50.4%	33.5%
British Columbia Trucking Association (BCTA)	18%	12.6%
Canadian Centre for Occupational Health and Safety (COCHS)	4%	2.9%

Through my company	36.7%	29.5%
I don't know	24.1%	39.2%

Table 16 above shows that WorkSafeBC is an important source of information about health safety and wellness among truck drivers; therefore, recommendations made in the last section of this report (section 4) are very important to WorkSafeBC's role in ensuring health, safety and wellness of truck drivers.

Last, but not the least, truck drivers (n= 275) were asked about how they would love to obtain information about health safety and wellness. Many respondents (48%) said they preferred to receive information via their emails. Other preferred avenues to receive health safety and wellness information include on-site workshops (29.8%), off site training seminars (13.8%), written training materials (23.3%), video-taped training (12.7%), train-the-trainer (8.4%), and a doctor's clinic (27.6%).

The next section, which is a discussion section, anchored this study within existing body of knowledge about truck drivers' health safety and wellness. This section also described some of the challenges encountered during this study, limitations of the study, and provided recommendations for truck drivers and trucking companies in BC.

Section 4

Discussion

This is an exploratory study examining the prevalence of health safety and wellness programs in trucking companies in BC, the characteristics of these programs and their integration into other management systems. In addition, the study examined the safety climate and health culture within trucking companies in BC, and compared HS&W in BC to international standards (e.g. NIOSH and ENWHP).

It is noteworthy to mention that trucking companies most interested in health and safety participated in this study. Health Safety and Wellness (HS&W) programs are defined as those rooted in evidence that integrate both safety and wellness programs targeting employee health. Two types of programs are identified: (1) wellness or worksite health promotion (WHP) programs and (2) health and safety programs. Wellness or WHP programs include “educational materials, activities, classes, screenings, services, environmental supports, or policies that encourage employees to be healthy” (CDCb, 2018, p. 34). Health and safety programs on the other hand are programs based on a definite plan of action taken by companies to prevent accidents and occupational diseases (Canadian Center for Occupational Health and Safety, 2019).

The study showed that few trucking companies in BC have a WHP program (31.1% with a WHP and 69.2% without a WHP). It was further observed that wellness programs offered by trucking companies are fragmented and not comprehensive. Very small and small companies are just as likely to report a WHP compared to large companies. However, large companies did provide more comprehensive programs than very small or small companies. Promotion of physical activity through gym memberships or organization of sporting events is the most popular health promotion target in many trucking companies in BC. This is similar to findings from the Workplace Health in America Survey (CDC, 2018b) that reported physical activity is the most popular workplace intervention adopted by all industries, including the transportation industry, in the United States (CDC, 2018b).

Physical activity decreases the incidence of non-communicable chronic conditions such as type 2 diabetes mellitus, coronary heart disease, as well as chronic conditions that lead to cognitive decline, such as dementia and Alzheimer’s disease (Reiner, Niermann, Jekauc, & Woll, 2013). Truck drivers are at risk for aforementioned chronic conditions (Bigelow et al., 2014). These conditions, in combination with inherent risks within the trucking environment (work

pressures, shift work, long hours, etc.) increase the risk for injuries, accidents, and fatalities among truck drivers (Apostolopoulos, Lemke, & Sönmez, 2014; Bureau of Labor Statistics, 2010; Lemke & Apostolopoulos, 2015; NIOSH, 2007). Given the many benefits of physical activity, companies should adopt policies that encourage promotion and adoption of physical activity among their truck drivers.

This study identified many barriers, also reported in the literature, in providing and participating in wellness programs within the BC trucking industry. A key problem is many truck drivers were simply not aware of the presence of a company's WHP program. Among those that were aware of an existing WHP, some cited lack of time, prolonged work hours, and work demands as barriers to participating in a WHP program. These findings are similar to findings from Apostolopoulos et al. (2014), Apostolopoulos et al., (2012), Apostolopoulos et al. (2011) and Lemke, Meissen, & Apostolopoulos (2016). A small percentage of drivers also expressed fear of losing their job if they took time off to care for their health. Overall, the study reveals a need to educate employers and truck drivers further about workplace health and wellness programs, and about the benefits of WHP.

Concerning the evaluation of the safety climate in trucking companies in BC, the results of this study show that safety awareness is high. The results indicate the presence of a strong safety climate across all trucking companies in BC, irrespective of company size. The safety climate in a company is associated with many safety and non-safety outcomes including risks of fatalities and injury rates (Beus, Payne, Bergman, & Arthur Jr, 2010; Christian, Bradley, Wallace, & Burke, 2009; Nahrgang, Morgeson, & Hofmann, 2011; Neal & Griffin, 2006). A company's safety climate culture is a predictor of job satisfaction and truck driver performance (Zohar et al., 2014), and employee engagement or truck driver turnover (Huang et al., 2016).

It is important to distinguish, however, between espoused and enacted safety climate priorities (Zohar, 2010). Espoused versus enacted safety climate priorities represent differences between what a company believes in and what a company actually does. Zohar (2003) notes that only enacted safety climate policies provide reliable information regarding safety and non-safety outcomes. The relationship between safety climate and safety outcomes should factor in the importance of competing priorities such as productivity or efficiency within trucking companies. These competing interests influence employee perception of safety, their safety practices and safety outcomes.

All factors considered, it is likely that this study tapped into espoused safety climate priorities within trucking companies in BC, rather than the enacted safety climate priorities. The result of the safety climate scale obtained from

managers'/employers' responses to the safety climate questions in the survey revealed that many companies have a high safety climate score. However, results from the truck driver's version of the survey showed that employer demands, and lack of concern about safety were incongruent. When employers, by their actions, favor productivity and related outcomes beyond the safety of their truck drivers, safety, health and wellness of truck drivers are compromised and increase risk for injuries and poor health among truck drivers.

Another key result is that some truck drivers were unable to distinguish between wellness practices and safety practices in their organization. While it is common for companies to have a combined program that addresses both the safety and wellness of their employees, workplaces and/or employees should not assume that having a safety program is synonymous with having a workplace health and wellness program (CDC, 2017). In this study, companies with a high safety climate were represented by those with *high* scores on the *safety climate scale*, *Tiers 1 and 2*, scored *low* (scores of less than 26 on a possible total score of 39) on the *health culture scale*. However, some companies with very high safety climate scores also scored negatively, as low as -39 (the lowest possible score) on the health culture scale. These results are in line with existing literature that emphasizes that safety and health & wellness are two different things (Nelson et al., 2015; Pronk, 2013).

The study also brought interesting results about driver fatigue. Fatigue is one of the key crash contributors for commercial vehicle crashes (Thiffault, 2011; Vanlaar, 2008; National Academy of Science, 2016). The contribution of fatigue in crashes is difficult to quantify due to conceptual problems and poor assessment/measurement. According to a consensus statement of international researchers, fatigue is responsible for about 20% of road crashes (Akerstedt et al., 2000).

Fatigue contributes to inattention by creating hypovigilance and slowed reaction times (Thiffault and Bergeron 2003). The causes of fatigue are time-of-day, time-on-task, time-awake, sleep deficit and sleep problems, as well as task-induced factors related to task underload (monotony) and overload (stress). Specific fatigue risk factors in the trucking industry include poor scheduling, irregular work hours, long hours of work and sleep disorders like obstructive sleep apnea (Stern, 2019, see also Thiffault 2011 for a comprehensive review). Obstructive sleep apnea and insufficient sleep are also risk factors for other chronic medical conditions such as depression, obesity, diabetes, hypertension, and other cardio vascular diseases identified among the truck drivers (Watson et al., 2015).

In this study, drivers frequently reported awareness of the following chronic medical conditions in the trucking industry: high blood pressure (66.4%), sleep apnea and other sleep disorders (59.6%), diabetes (50.8%), and fatigue (63.4%). The Federal Motor Carrier Safety Administration (FMCSA, 2005) identified driver fatigue as responsible for 13% of heavy vehicle fatal crashes in the US from 2001 to 2003, however other studies estimate that this could be as high as 31% (NTSB, 1995). In BC, there were 14,000 road crashes and 56 fatalities from 2013 to 2017 involving at least one truck (Insurance Corporation of British Columbia (ICBC), 2018). Contributory factors to road crashes in BC include speeding (27%), distracted driving (27%) and driving under impairment (25%) (ICBC, 2018). There is no question that the management of truck driver fatigue could potentially reduce incidence of aforementioned chronic medical conditions and reduce crash incidences.

The only really effective measure to mitigate fatigue is sleep (National Academy of Science, 2016). Apart from getting close to eight hours of consolidated sleep daily, driver also benefit from napping strategies (Rosekind, 2005). Among study respondents in BC, there is strong company support for napping, irrespective of the company size (63% of very small companies, 78.2% of small companies, 59.1% of medium sized companies, and 100% of large companies). However, truck drivers and managers did not agree about the level of managerial support for napping. Self-reporting by managers showed higher levels of support of napping than what was reported by drivers. This finding is important given that fatigue is now understood as a significant form of driver impairment, comparable to alcohol impairment (National Safety Council, 2019). A driver's ability to react promptly to hazards and dangers on the road depends on his alertness, sustained attention, reaction time, judgement, etc., which are all directly influenced by fatigue.

Napping however, is only one of many fatigue mitigation strategies. Other approaches include education about fatigue and its impact, fatigue detection technologies and advanced driver assistance systems (ADAS), knowledge about sedative medications, and how to implement Fatigue Risk Management Systems (FRMS) as well as organizational policies that support fatigue management (National Safety Council, 2019). Note that a key focus of education should be to make drivers understand that pre-trip countermeasures related to sleep management are far more effective than in-transit countermeasures, which only have limited short-term effects. Drivers should also be made to understand that they are close to losing consciousness - through micro sleep episodes - when they start experiencing physical symptoms associated with drowsiness (Thiffault, 2011). This would help adjusting the perception of risk associated with driver fatigue and potential influence drivers' decision to keep driving while experiencing drowsiness, which is a critical problem.

Finally, given truck drivers' responses in this survey, it is evident that the nature of the work exerts a negative toll on their health and wellbeing. Drivers complained about long work hours, high demands of the job, poor remunerations and poor work relationship with employer. The impacts of this dissatisfaction with the job can be observed through the very high driver turnover rate. Driver shortage could become critical in this industry, and improving work conditions and driver health and wellness are certainly very relevant mitigation approaches.

Truck drivers also reported long hours of service, at upper limits of what is allowed by the province. A small number of them (3%) report working beyond the allowable hours of service in the province. Note that the Government of Canada is mandating electronic monitoring of truck drivers' hours of service by 2020 as means to reduce incidences of inadequate manual logging of work hours and to reduce safety related outcomes resulting from truck driver fatigue (Sanderson, 2018).

As mentioned before, the best way to address the safety, health and wellness of truck drivers is through a comprehensive and integrated health promotion wellness and safety (HPW&S) program. Components of a comprehensive HPW&S program include safety programs, health education, supportive physical and social environments, links to related programs, program integration, and worksite screenings (Linnan et al., 2008). Comprehensive workplace wellness programs are considered a national objective in the United States (Lemke & Apostolopoulos, 2015). However, in spite of efforts taken by the NIOSH program to promote the Total Worker's health Approach in the United States, the trucking industry, as with other industries, still falls behind the national target (CDC, 2018).

Conclusions and Recommendations

The workplace plays an important role in the health and wellbeing of workers and indeed the public as a whole. Increased adoption of comprehensive HPW&S programs in the workplace should be a goal of agencies tasked with improving worker health as well as public health. Truck driving is one of the most common occupations in Canada and one for which integrated HPW&S is critical as drivers heavily rely on their workplace for access to healthy food, physical activity, and safety (Lemke & Apostolopoulos, 2015). *It is incumbent on employers within the trucking industry, the provincial and national organizations to leverage knowledge about what works in HPW&S and about the challenges within the unique trucking work environment to improve the health, safety and wellness of truck drivers.*

Comprehensive HPW&S programs should target individual health behaviours of truck drivers including an increase in physical activity and access to healthy food while truck drivers are on road trips. These programs should also target adequate fatigue management, in addition to safety. This study showed that although some companies implement health and wellness programs (such as on-site exercise facilities and access to healthy food), many drivers do not access these programs, and some are not interested in doing so even if it is provided by the employer. Yet, data from the study showed that many truck drivers (52.7%) have not attained the nationally recommended physical activity goals (a minimum of moderate to strenuous activities 3 times per week). *One recommendation is to integrate separately-run wellness and safety programs, or to develop a wellness program and incorporate it into an existing safety program.* The challenge remains about how best to do this.

It is easier for large sized companies to develop comprehensive health promotion wellness programs and to integrate these into an existing safety program. Small to medium sized companies can adopt the theory in principle by first conducting a needs assessment of organizational supports, and resources needed to adopt a comprehensive health and wellness program. Based on this needs assessment, very small, small and medium sized companies can then appropriate a model of health, safety and wellness which is unique to their industry size, type, and available resources. These resources should be easy to access by very small, small and medium sized companies: *suggested locations for these resources include WorkSafeBC, SafetyDriven, or Public Health Units. At a minimum, comprehensive HS&W programs should address both managerial support for a health and wellness program, employee interest in the program, and safety.*

Finally, WorkSafeBC can play an important role in Comprehensive HPW&S programs. The results indeed show that WorkSafeBC is an important source of information about health and wellness. Plausible reasons for this include their role as regulators of worker's safety and compensation; and the fact that they have been working with the trucking industry for a long time. An effective approach *WorkSafeBC can take will be to leverage on this information to link trucking companies with recognized safety organizations like SafetyDriven, who can then provide the technical oversight for health and safety within trucking companies including, ensuring that separate employees are responsible for the safety and wellness programs adopted in the trucking company and that multiple methods are used within the industry to facilitate truck drivers uptake of health safety and wellness measures.*

Identification of Best Practices in HS&W within the trucking industry in BC is both a limitation of this research and a suggestion for future research. Many HS&W programs examined in this study, using a cross-sectional study design,

were fragmented. It was therefore not possible to identify a best practice model within the trucking industry in BC. *A future study design such as a case study approach to compare two to five companies with and without HS&W programs in terms of incidence/prevalence of health conditions is recommended.*

Challenges encountered during the study

The issues encountered in this study are not different from those experienced by researchers administering surveys (Wright, 2005). These issues include participant recruitment, ensuring complete responses, obtaining valid information from respondents and receiver bias. The challenge related to online recruitment of participants is unique to online survey administration (Wright, 2005).

In this study, the researchers experienced some challenge with recruiting medium and large sized companies into the survey. To elaborate further, the list of contacts we, UNBC researchers, confidentially obtained from WorkSafeBC were actually linked to trucking companies' finance department accountants or human resources (HR) payroll managers. Hence, in the first wave of the study the researchers received little to no response from medium and large sized companies. This problem was addressed by telephone calling of contacts from medium and large companies using information provided by WorkSafeBC to our strategic partner (SafetyDriven), and from information obtained from the webpages of trucking companies in BC. This telephone calling approach was also used to ensure that survey respondents were employers, or safety personnel, or health managers within trucking companies.

The telephone calling approach increased the percentage of completed responses in the *second wave* of our survey data collection compared to the *first wave*. For the *Managers survey*: 74% in the second wave, versus 31.4% in the first wave. And, for the *Truck drivers' survey*: 58.9% in the second wave, versus 37.8% in the first wave.

Limitations

One of the limitations is the study design. This study used a cross-sectional design, which gives a snap shot of prevalent conditions at any point time. By nature of the study design, the results only show how variables relate to one another but cannot tell causation. These results relied on self-reported measures from managers/employers and truck drivers; therefore, these results are prone to report bias from respondents. Furthermore, there is slight chance of selection

bias whereby companies really interested in health and safety participated in the study. These findings, nevertheless, provide a snap shot of the prevalence of wellness programs in BC, the safety climate and health culture within trucking companies in BC, and also provide a foundation with which to identify other important future areas for research and or health and wellness targets within the trucking industries in BC.

Another limitation is the relatively low response rate (10%) which represents 4.5% for Managers and 6.5% for Truck Drivers). However, when we consider the number of people that received the emails (based on the number of emails that were opened), the response rates were higher; being 7.5% for the manager survey and 12% for the truck driver survey (as we previously mentioned on page 20 of this report).

Despite these two limitations, our study results are applicable and can be generalized to the larger BC trucking industry, from which the study sample was drawn. This includes both surveys' results from our study cohort within trucking companies: employers/managers; and truck drivers.

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