

Baseline knowledge on vehicle safety and head restraints among Fleet Managers in British Columbia Canada: a pilot study

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Background: *Whiplash is the most common injury type arising from motor vehicle collisions, often leading to long-term suffering and disability. Prevention of such injuries is possible through the use of appropriate, correctly positioned, vehicular head restraints.*

Objective: *To survey the awareness and knowledge level of vehicle fleet managers in the province of British Columbia, Canada, on the topics of vehicle safety, whiplash injury, and prevention; and to better understand whether these factors influence vehicle purchase/lease decisions.*

Methods: *A survey was administered to municipal vehicle fleet managers at a professional meeting (n = 27).*

Results: *Although many respondents understood the effectiveness of vehicle head restraints in the prevention of whiplash injury, the majority rarely adjusted their own headrests. Fleet managers lacked knowledge about the seriousness of whiplash injuries, their associated costs for Canada's healthcare system, and appropriate head restraint positions to mitigate such injuries. The majority of respondents indicated that fleet vehicle purchase/lease decisions within their organization did not factor whiplash prevention as an explicit safety priority.*

Conclusions: *There is relatively little awareness and*

Historique : *le coup de fouet cervical est le type de blessure la plus courante suite à une collision impliquant un véhicule à moteur. Il mène souvent à une invalidité et des souffrances permanentes. La prévention de telles blessures est possible grâce à l'usage d'un appuie-tête pour véhicule correctement positionné.*

Objectif : *effectuer un sondage du niveau de connaissances des gestionnaires de parc automobile de la province de la Colombie-Britannique, au Canada, relativement à la sécurité routière, au coup de fouet cervical, et à la prévention ; et mieux comprendre si ces facteurs influence l'achat/la location d'un véhicule.*

Méthodes : *le sondage fut mené auprès de gestionnaires de parc automobile municipal lors d'une réunion professionnelle (n = 27).*

Résultats : *bien que la plupart des répondants comprennent l'efficacité d'un appuie-tête pour véhicule dans la prévention d'un coup de fouet cervical, la majorité d'entre eux ajustent rarement leur appuie-tête. Les gestionnaires de parc automobile ne possèdent pas les connaissances nécessaires sur la gravité de ce type de blessure, les coûts de celle-ci pour le système de santé canadien, et les positions appropriées de l'appuie-tête pour atténuer de telles blessures. La plupart des répondants ont indiqué que les décisions d'achat/ de location concernant le parc automobile de leur organisation ne tenaient pas compte de la prévention du*

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enforcement of whiplash prevention strategies among municipal vehicle fleet managers.
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KEY WORDS: whiplash, injury, headrest, prevention

Introduction

Traffic safety researchers have focused mainly on vehicular injury types which are likely to be life-threatening. However, although fatalities due to whiplash injuries are relatively rare,¹ whiplash often results in pain, suffering, and disability, with significant personal and societal financial consequences.² Furthermore, rear-end collisions – the leading cause of whiplash injuries – are the most common type of motor vehicle collision, and neck injuries are a frequent result of these crashes.³

Studies conducted in Sweden reveal that whiplash injuries account for 70% of all injuries leading to disability,⁴ and constitute more than half of the permanently disabling injuries resulting from motor vehicle crashes.⁵ Hence, neck injuries such as whiplash can lead to a significant economical costs to society.⁶ Within Canada, the societal costs of whiplash injuries are continuing to increase. The annual estimated cost of whiplash injury claims in Canada is \$600,000,000 resulting in a consumer cost annual estimate of \$135 per vehicle.⁷

Relatively simple safety precautions can greatly reduce the probability of whiplash-type injuries arising from vehicular collisions. Of these, appropriately positioned geometrically suitable head restraints play a particularly large role in protecting vehicle occupants from whiplash injury.^{8–10} At the 2007 World Congress on Neck Pain, it was reported that 35% of serious neck injuries – defined as injuries accompanied by pain lasting more than 6 weeks – could be prevented or mitigated with appropriate vehicular head restraints.¹ Strikingly, these numbers may represent an underestimate of the potential benefit of head restraints, since they do not take into account whether head restraints were appropriately adjusted. Unfortunately, however, consumers tend to assign lower priority

coup de fouet cervical en tant que priorité en matière de sécurité.

Conclusions : les gestionnaires de parc automobile municipal sont très peu sensibilisés à la prévention du coup de fouet cervical et à la mise en œuvre de stratégies à cet égard.
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MOTS CLÉS : coup de fouet cervical, blessure, appuie-tête, prévention

to safety features which can prevent whiplash injuries, such as head restraints, compared to advanced braking systems and front passenger airbags, when making vehicle purchase/lease decisions.¹¹

Head restraints are designed to prevent whiplash injuries by minimizing neck movement during a collision.³ According to the Insurance Institute of Highway Safety (IIHS), to be effective, a head restraint must be positioned behind and close to the back of the head (i.e., between 2–7 cm behind the head), while the vertical position of the head restraint should be level with the top of the head.¹² However observational studies report that only 14% of Canadians implement proper adjustment of vehicular head restraints (23% of all surveyed females and 7% of all surveyed males), and that only 18% of drivers in the province of British Columbia adjust their head restraints appropriately.¹³ Surprisingly, this lack of awareness also extends to Canadian health care professionals.¹⁴ Indeed, a recent study of chiropractic interns from the New York Chiropractic College in the United States revealed that only 13.3% of interns knew the recommended vertical distance for vehicular head restraints, and only 20% of surveyed interns knew the recommended horizontal distance.¹⁵ The failure to practice simple safety precautions for such injuries is probably related to a scarcity of transport professionals, as well as a general lack of public awareness of the importance of proper head restraint positioning in the prevention of whiplash-type injuries.

Vehicle fleet managers are responsible for purchasing and managing company vehicle fleets. Fleet management often includes a range of additional functions such as financial management, vehicle maintenance, vehicle tracking and diagnostics, driver supervision and training, management of fuel usage, and health/safety manage-

ment.¹⁶ In order to make informed decisions to optimize vehicle occupant safety, it is imperative that fleet managers be knowledgeable of key vehicle safety features, including the effectiveness of head restraints in whiplash injury prevention, and knowledge of appropriate head restraint positioning.

The objective of the present pilot study, therefore, was to examine the awareness and knowledge level of vehicle fleet managers regarding the benefits of head restraints and appropriate head restraint positioning for the prevention of whiplash injury. Further, whether whiplash injury prevention factored into vehicle acquisition decision-making or driver training was also examined. Here, we report results obtained from a cross-sectional survey conducted during a municipal fleet manager association annual general meeting held in British Columbia, Canada. To our knowledge, this is the first study of its kind conducted within a North American sample population. This study was undertaken as a part of the “AUTO21 whiplash injury prevention” project, initiated in 2009 to increase whiplash prevention awareness among fleet managers, injury prevention stakeholders and general consumers within the province of British Columbia, Canada.

Methods

Study Design and Population

A voluntary written survey was administered to a cross-sectional convenience sample of 27 municipal fleet managers from municipalities within British Columbia, Canada. Ethics approval was obtained through the University of British Columbia’s Institutional Review Board and informed consent was obtained from each participant before enrolment in the project. To prepare for this study, a small focus group session was held, which included five fleet managers and one occupational health and safety professional, in order to better understand their roles and responsibilities, their knowledge regarding whiplash and whiplash prevention, and the fleet vehicle selection process. Within the focus group session we identified key challenges facing fleet managers, opportunities to foster dissemination of knowledge, and common information resources used by fleet managers, including social media and communication networks. This information was used to develop and refine the finalized survey questionnaire administered at a subsequent meeting of municipal fleet

managers. The final survey questionnaire contained 26 questions on the following topics: fleet vehicle and organization characteristics (7 questions); vehicle safety knowledge (2 questions); head restraint awareness knowledge (8 questions); opinion questions (3 questions); and behavioural questions on safety and head restraint adjustment practices (6 questions). Questions were mostly multiple choice format (e.g., choose correct/most accurate answer from a list of options, rank items in order of importance, or yes/no responses). Some questions utilized visual analogue scale responses, where the respondent indicated their response relative to two extremes by marking an “x” along a horizontal 10 cm line. Further, some questions required short written answers and/or included a comment section. The survey was designed to take approximately 10–15 minutes to complete.

The finalized survey was delivered to attendees at a fleet manager association general meeting. Following a verbal introduction describing the voluntary nature and purpose of the survey, as well as providing an introduction to the team conducting the survey, participants were invited to complete the questionnaire. A participation incentive (two GPS units) was included, with winners selected by raffle after completion of the questionnaires. No personal identifiers were collected and the survey results were anonymous. Subsequent to the survey, a 30 minute educational presentation was conducted focusing on the causes, consequences, and prevention of whiplash injury, as well as the societal costs of whiplash injuries.

Data analysis

Survey data was entered into a spreadsheet. Responses from visual analogue scale questions were directly converted to a scale ranging from 0–10, based on measurement of the position of the respondent’s mark along the 10 cm line, and data is presented as mean \pm standard deviation (SD).

Results

A total of 27 participants completed the questionnaire. Results from demographic questions revealed that the majority of respondents represented large organizations – 64% were employees of institutions with more than 200 employees, 20% were employees of institutions with 50–200 employees, and 16% were employees of institutions with less than 50 employees. Participants represented

organizations operating a total of 7839 vehicles (mean 340.8 ± 430.7), and employing 11541 drivers (mean 501.8 ± 666.0).

To examine the perceptions of respondents regarding the seriousness of whiplash injuries (in terms of being a medical/economic burden), participants were asked to place a mark along a visual analogue scale ranging from 0 (not serious) to 10 (extremely serious). The mean response to this question was 8.0 ± 1.4 . On the same scale, when asked whether whiplash injuries were a serious issue among professional drivers, the mean analogue response was 6.3 ± 2.3 . Whiplash injury is, however, considered to be an extremely serious issue both among the general driving population¹⁷ and professional drivers.¹⁸ In Canada, approximately 2,000,000 whiplash-related injury claims are made each year.¹⁷ In a multiple choice-type question querying this issue, only 13.3% of respondents chose the correct answer of 2,000,000 claims, while 40.0% chose 1,000,000 claims, 23.3% chose 500,000 claims, 13.3% chose 200,000 claims, and 10.0% chose 100,000 claims. Taken together, these results indicate that respondents generally underestimated the overall seriousness of whiplash injuries.

To examine the opinions of respondents on the importance of different vehicular safety features in preventing injuries resulting from front- or rear-end collisions, participants were asked to rank the top three safety features from a list of eleven items. For front-end collisions, 62.1% of respondents ranked seatbelts as the most important safety feature, 45.2% ranked airbags as the second most important safety feature, and 26.7% ranked vehicle crushability as the third most important safety feature (figure 1). For rear-end collisions, 55.2% of respondents ranked seatbelts as the most important safety feature. Headrests and airbags received an equal number of responses as the second most important safety feature (22.6% of responses each), and these two features were also tied for the third most important safety feature (30.0% of responses each) (figure 2).

The subsequent set of questions examined respondent knowledge level regarding the causes and prevention strategies of whiplash injuries. All respondents (100%) correctly selected rear end collisions^{3, 19, 20} over front-end or side impact collisions as the collision-type most associated with whiplash. The mean response for the question “How preventable are whiplash-type injuries with correct

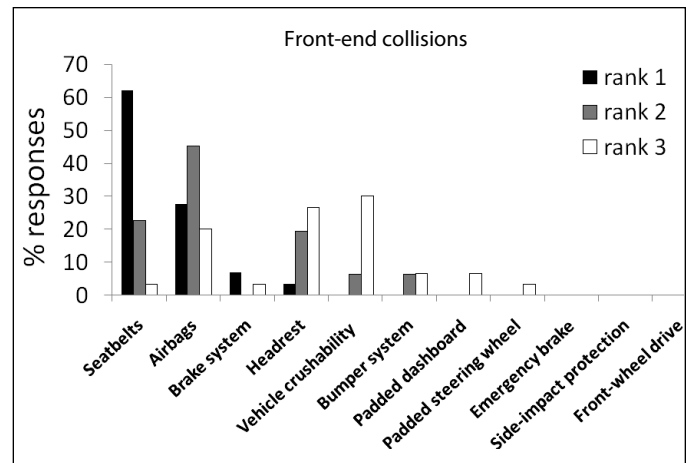


Figure 1 Summary of survey results indicating fleet managers' rankings of vehicular safety features which best mitigate injuries resulting from front-end collisions.

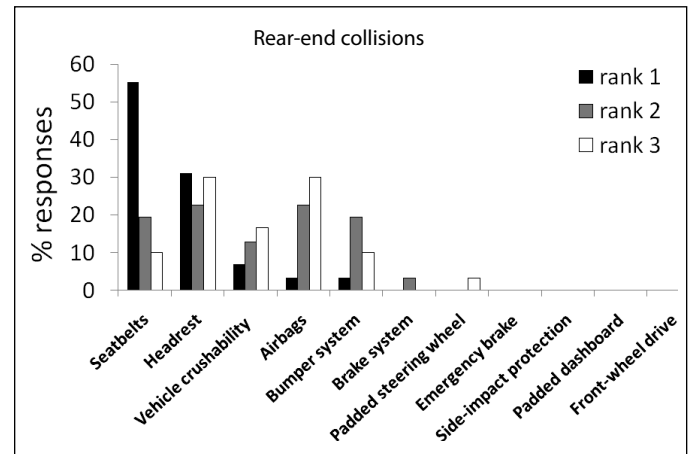


Figure 2 Summary of survey results indicating fleet managers' rankings of vehicular safety features which best mitigate injuries resulting from rear-end collisions.

headrest positioning?,” on a visual analogue scale of 0 (not preventable) to 10 (completely preventable) was 7.4 ± 2.0 , consistent with reports from various sources.^{5,12,19} Together, these results indicate that participants were well aware of the primary causes and preventability of whiplash-type injuries due to vehicle collisions. Despite this knowledge, however, the majority of respondents rarely adjust their own headrests, both as a driver and when travelling as a passenger (table 1). Results show that the

Table 1 Respondent head restraint adjustment patterns

Vehicle type	Head restraint adjustment (%)			
	Never	Once	Frequently	Every time
Personal vehicle	23.3	46.7	23.3	6.7
Work vehicle	30.4	30.4	39.2	0.0
Other vehicle as driver	69.0	17.2	6.9	6.9
Other vehicle as passenger	76.6	10.0	6.7	6.7
Rental vehicle as driver	50.0	23.3	16.7	10.0
Rental vehicle as passenger	73.3	6.7	10.0	10.0

majority of fleet managers (70.0%) do not adjust their head restraints frequently in their personal vehicles, and 60.8% of respondents do not routinely adjust their head restraints before driving work vehicles. Similarly, a large proportion of fleet managers only infrequently adjust head restraints in other vehicles or rented vehicles either as driver (86.2% and 73.3%, respectively) or as a passenger (86.7% and 80.0%, respectively). The majority of respondents (90%) also believed that only a small proportion of individuals in the general population ($\leq 25\%$) correctly adjusted their headrests. Surprisingly, 33.3% of participants indicated that they would *not* advise family/friends regarding the correct positioning of head restraints before driving a vehicle.

When asked to select from a list of factors that affect whether or not respondents adjusted their own headrests, the majority reported that they never considered adjusting their headrests (43.4%), while 33.3% reported that adjustments were too inconvenient or time consuming, 16.7% responded that they didn't know how to adjust it, 16.7% responded that their headrests were not adjustable, and 10.0% responded that their headrests were too difficult to adjust. Interestingly, on a scale ranging from 0 (least important) to 10 (most important) respondents placed similar levels of importance on comfort (6.1 ± 2.4) and being able to view their "blind spot" (6.7 ± 2.4) with the importance of protecting themselves from injury (7.3 ± 2.6).

Table 2 shows the summary of a set of questions examining respondents' knowledge of the properties of position of head restraints that best protect from whip-

lash-type injuries. From a list of five possible answers querying properties of head restraints that best protect from whiplash-type injuries, roughly half of the respondents (52.9%) correctly identified that headrests must be of sufficient stiffness such that it will reduce the relative displacement between the head and the body.²¹ Seventy percent of respondents were aware that the recommended distance between the back of the head and the headrest is 5 cm (2 inches) or less;²¹ almost two-thirds of respondents (65.7%) were aware that the recommended positioning of headrests is immediately behind the head;²¹ however, less than a quarter of participants (23.3%) were aware that the top of the headrest is recommended to be aligned with the top of the head.²¹

A striking result of this survey was that acknowledgement of fleet managers of the unawareness of their own employees of whiplash prevention policies in place within their organization, the mean response being 2.5 ± 1.5 on a visual analogue scale ranging from 0 (not at all aware) to 10 (very aware). In addition, only a small fraction of respondents indicated that their organization monitors incidences of rear-end collisions (33.3%), whiplash injuries (20.0%), or maintains records detailing the duration of employee absenteeism/disability due to vehicle collisions (30.0%).

While many respondents indicated that their organizations routinely record the incidence of motor vehicle collisions (81.8%), when specifically referring to rear-end collisions, this number decreased to 47.6%. Importantly, only 28.6% of respondents indicated that their organiza-

Table 2 Summary of participant responses to question querying properties of head restraints that best protect from whiplash-type injuries

<i>What are the most important qualities of good head restraint design to reduce risk of injury during a rear end collision?</i>	
It is shaped to fit the contour of your neck when the occupant hits it	17.6%
The head restraint cushion does not adjust forward past the top end of the seat	26.5%
It is quite soft such that the head can easily rotate over it	0.0%
It is sufficiently stiff such that it will reduce the relative displacement between the head and the body [CORRECT RESPONSE]	52.9%
It is compliant and thus bends substantially rearward when your head contacts it	3.0%
<i>How do you normally position your headrest?</i>	
Immediately behind your neck	14.3%
Immediately behind your head [CORRECT RESPONSE]	65.7%
Below your neck	14.3%
I don't have a preference	5.7%
<i>Where is the top of your headrest situated when you are seated in your vehicle?</i>	
Level with the top of your head [CORRECT RESPONSE]	23.3%
In the middle of your head	63.3%
Below your ears	3.4%
Don't know	10.0%
<i>How far away is your headrest from the back of your head when you are seated in your vehicle?</i>	
Touching the back of your head	16.7%
5 cm (2 in) or less away from your head [CORRECT RESPONSE]	70.0%
More than 5 cm (2 in) but less than 10 cm (4 in)	3.3%
10 cm (4 in) or more	0.0%
Don't know	10.0%

tions recorded the incidence of whiplash and duration of disability (42.9%). Only 42.9% of the organizations represented by surveyed respondents maintain records detailing the duration of employee absenteeism/disability due to vehicular collisions. Furthermore, only one-third (33.3%) of respondents indicated that this surveillance

information was taken into consideration in vehicle purchase/lease decisions. It is not surprising, therefore, that when asked to rank the top criteria respondents' organizations consider when acquiring fleet vehicles, on average, vehicle safety lags behind functional requirements, vehicle cost, and other economical considerations such as

Table 3 Collection and utilization of collision and disability data within respondents' organizations

	yes	no	unaware
Routine recording of incidence/types of motor vehicle collisions	81.8%	9.1%	9.1%
Consider collected collision data when purchasing/leasing fleet	42.9%	52.4%	4.8%
Routine incident/injury surveillance include			
• Rear-end collisions	47.6%	42.9%	9.5%
• Incidence of whiplash	28.6%	57.1%	14.3%
• Duration of disability	42.9%	42.9%	14.3%
Consider surveillance information when purchasing/leasing fleet	33.3%	52.4%	14.3%

fuel economy and maintenance costs. The top ten considerations were: (i) functional requirements (22.2%), (ii) cost (18.5%), (iii) economical considerations (14.8%), (iv) safety (13.6%), (v) reliability (9.9%), and (vi) “green” value (8.6%), (vii) comfort (3.7%), (viii) resale value (2.5%), (ix) make (1.2%), (x) trade-in value (1.2%).

Discussion

The present study was designed to evaluate the baseline knowledge of municipal fleet managers in British Columbia on the causes and prevention of whiplash injury, the benefits of proper head restraint adjustment, and the overall impact and prevalence of whiplash injuries within society.

Current research provides strong evidence that whiplash prevention is possible when drivers and passengers are in vehicles with head restraints that are rated “good” or “better,” and when head restraints are positioned appropriately.^{18,19} Fleet managers can play an important role in whiplash prevention through the purchase/lease of vehicles with “good” or “better” rated head restraints and ensuring that employees are trained to frequently adjust their vehicular head restraints appropriately.²² The results from this study therefore raise important concerns. Surveyed municipal fleet managers within British Columbia appear to generally underestimate the overall seriousness of whiplash injuries, and as a consequence are either unaware or opt to overlook simple yet effective injury prevention strategies. Survey participants acknowledge that

the organizations they represent largely do not place emphasis on these safety features when making vehicle acquisition decisions. These results are in agreement with a recent survey of Swedish and Spanish fleet managers, which revealed that respondents were more likely to consider vehicle price, reliability, running costs, size, and fuel consumption rather than the vehicle safety when acquiring fleet vehicles.²³ Respondents also indicated that their employees were likely not aware of whiplash prevention policies in place within their organization. Additionally, these results suggest that routine safety checks and training sessions carried out by fleet managers likely assign lower priority toward whiplash injury prevention strategies.

Although survey-based questionnaires are relatively cost effective when collecting data from larger populations, they have some potential limitations. The most serious limitation is the validity and reliability of responses obtained. For instance, in surveys, respondents are often unwilling to indicate that they have engaged in behavior considered “unacceptable” by society as a whole. Further, respondents tend to answer questions rapidly – without extensive thought – if the questionnaire is lengthy. To reduce these potential limitations, the present questionnaire was designed to contain only 26 questions, taking approximately 10–15 minutes to complete, and was anonymous. Another possible limitation of survey-based methodology is whether the sample accurately represents the population being sampled. Although 100% of those attending the annual meeting participated in our survey, the sample size

was relatively small and therefore any extrapolations to this specific population must be made with caution. It is worth noting, however, that although this cross-sectional sample consisted of only 27 fleet managers, these individuals represented organizations operating over 7800 vehicles and employing over 11500 drivers. Our questionnaire also did not collect demographic data (sex, age, annual income, etc) and thus we cannot confirm that our sample is fully representative of the British Columbia fleet managers. Finally, we acknowledge that future surveys assessing these issues, especially those to be conducted on a larger scale, would benefit from the consultation of a larger number of safety professionals representing a variety of backgrounds, in order to better assess the relevance and validity of each item within the questionnaire.

The present cross-sectional pilot study reveals that awareness levels regarding whiplash injuries and related factors among municipal fleet manager in British Columbia is alarmingly low, congruent with reduced awareness observed in both the general population and among health care practitioners.^{14,24} It will be important, therefore, to implement educational programs targeting fleet managers – individuals well positioned to have far-reaching influence on the safety of many individuals – to increase awareness regarding (i) the seriousness and high prevalence of whiplash injuries due to vehicular collisions, (ii) the importance of purchasing/leasing vehicles with better-rated head restraints, and (iii) the appropriate adjustment of head restraints for different occupants. In addition, vehicle safety information, such as IIHS crash-test results, must be disseminated more widely and effectively, in order to play a more prominent role in new vehicle choices. Based on our results and data from previous work,¹³ our research team is proposing a province-wide social marketing campaign to increase the awareness of optimal head restraint position. Finally, health care practitioners such as chiropractic professionals, are also well poised to play a vital role in preventing whiplash injury by educating their patients about preventative strategies to avoid whiplash injuries, including the correct use of head restraints.^{15,24}

In conclusion, the results from this survey indicate that municipal fleet managers in British Columbia place relatively low importance on whiplash injury prevention strategies, which directly impact employee safety. This study highlights a need to emphasize the importance of

whiplash injury prevention strategies among fleet managers of British Columbia, and warrants an assessment of awareness levels fleet managers across other jurisdictions across Canada.

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