A B S T R A C T

This study examines the factors associated with seat belt use for drivers and passengers in Ontario. Using the 1990 Ontario Health Survey, a population-based survey of non-institutionalized Ontario residents, factors associated with seat belt use among drivers and passengers were identified and are reported as unadjusted and adjusted odds ratios (OR; 95% CI). Seat belt non-use in Ontario drivers was most strongly associated with younger age ($p < 0.0001$), high risk health behaviours (drinking and driving (OR: 2.43), speeding (OR: 2.04), smoking (OR: 1.66)), being male (OR: 1.87), living in northern (OR: 1.80) or rural (OR: 1.69) regions, and achieving lower education (OR: 1.46). Seat belt non-use in passengers was associated with younger age ($p < 0.0001$), smoking (OR: 1.62), being male (OR: 1.68), living in northern (OR: 1.63) or rural (OR: 1.46) regions, and low education (OR: 1.31). Vehicular trauma is a major public health problem and seat belt use has been shown to reduce injuries in the event of a crash. Any strategy to increase seat belt use in Ontario should be targeted to involve both drivers and passengers. Attention should be paid to increasing seat belt usage by younger adults, males, and especially those living in northern and rural regions.

A B R É G É

L'étude traite des facteurs associés à l'usage de la ceinture de sécurité chez les conducteurs et les passagers de véhicules automobiles en Ontario. À l'aide des données de l'Enquête sur la santé en Ontario de 1990 (menée auprès d'un échantillon représentatif de la population ontarienne hors établissement), on a défini les facteurs associés à l'usage de la ceinture de sécurité chez les conducteurs et les passagers, que l'on a divisés en risques relatifs avant et après ajustement (RR; 95 % IC). Chez les conducteurs ontariens, le non-usage de la ceinture de sécurité est surtout lié à la jeunesse ($p < 0,0001$), aux comportements dangereux pour la santé (conduite en état d'ébriété (RR : 2,43), vitesse excessive (RR : 2,04), tabagisme (RR : 1,66)), au sexe masculin (RR : 1,87), au fait d'habiter dans le nord (RR : 1,80) ou en milieu rural (RR : 1,69) et aux faibles niveaux de scolarité (RR : 1,46). Chez les passagers, le non-usage de la ceinture de sécurité est associé à la jeunesse ($p < 0,0001$), au tabagisme (RR : 1,62), au sexe masculin (RR : 1,68), au fait d'habiter dans le nord (RR : 1,63) ou en milieu rural (RR : 1,46) et aux faibles niveaux de scolarité (RR : 1,31). Les accidents de la route posent un grave problème pour la santé publique, et il a été prouvé que l'usage de la ceinture de sécurité réduit les risques de blessures en cas d'accident d'automobile. Toute stratégie visant à accroître l'usage de la ceinture de sécurité en Ontario doit s'adresser à la fois aux conducteurs et aux passagers. Il faudrait songer à renforcer l'usage de la sécurité chez les jeunes adultes et chez les hommes, surtout ceux qui vivent dans la région du nord et en milieu rural.

Factors Associated with Seat Belt Use: An Evaluation from the Ontario Health Survey

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Motor vehicle collisions (MVCs) are a leading cause of trauma hospital admissions and deaths in Ontario¹ and Canada.² In addition, due to the young age of those injured, motor vehicle deaths are a leading cause of lost years of productive lives. The fixed and variable costs associated with motor vehicle trauma are enormous.³ Consequently, examination of factors associated with vehicular trauma and its prevention or reduction are important research and public health issues.

In trauma epidemiology, factors relating to the environment, the vehicle, and the operator's behaviour must be considered when examining causation. Mechanical problems do not appear to be common issues in serious vehicular trauma,⁴ while environmental factors are known to contribute to injuries and deaths in certain cases. However, the main issue identified in vehicular trauma is driver/operator behaviour.⁴ Such factors as speed, alcohol use, use of restraint devices, and aggressive driving have been closely associated with serious injuries.

Of these behavioural factors, appropriate seat belt use has been associated with

reduced fatal and serious injuries⁵⁻⁸ and health care costs.^{5,9} In addition, the protective effect of airbag technology is maximized when seat belts are simultaneously employed.¹⁰ Strategies for increasing the use of seat belts have been the focus of campaigns in public health, among automakers and with law enforcement and government agencies. Despite this, non-compliance with seat belt use remains a problem, especially in some high risk populations.

The published literature provides limited information on factors associated with use/non-use of seat belts. For non-use, those most commonly reported are male gender,¹¹⁻¹⁴ passenger status,^{11,15} high risk takers/drinkers,^{13,16,17} younger age,^{14,15,18} and rural living.^{14,15} Disagreement exists on the importance and breadth of predictive factors in articles which purport to examine the factors predicting seat belt use. In addition, there is a paucity of population-based studies examining the behaviour and beliefs of drivers and passengers with respect to the use of seat belts. In summary, few studies have included comprehensive evaluations of multiple factors, been large enough to accurately estimate the contributions of each factor, or been population-based.

The variability in research results and their lack of generalizability has made it particularly difficult to enhance the aforementioned general strategies by targeting certain groups to promote seat belt use. The objectives of this study were to use a large, population-based sample of questionnaire respondents to more clearly elaborate the factors associated with seat belt use. There were several specific objectives of this study: 1) to identify factors associated with driver seat belt use; 2) to identify

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factors associated with passenger seat belt use; and 3) to identify factors of potential importance for injury prevention.

METHODS

Ontario Health Survey

The Ontario Health Survey (OHS) is a province-wide population survey that was administered in 1990 to households throughout Ontario. Full description of the methodology can be obtained elsewhere.¹⁹ People living in institutions, on Native reserves, in extremely remote locations, and nationals from other countries were excluded from the survey. A total of 61,239 individual responses were available for analysis, representing a population of 9.7 million people in Ontario. In this paper, we have derived data sets from those respondents who were 16 years of age or older.

Regional divisions

Living in the north was defined as anyone living in the northeastern or northwestern regions of the province (Districts of Muskoka-Parry Sound, Nipissing, Algoma, Cochrane, Sudbury-Manitoulin, Timiskaming, Kenora, Rainy River and Thunder Bay). Rural areas are defined by Statistics Canada as those enumeration areas that are not continuously built-up, have a population of less than 1,000 people, and a population density of less than 400 people per square kilometre. While these are not perfect definitions, they represent an option available within the OHS to designate northern and rural populations.

Dependent variables

The dependent variables were a) the use of seat belt while driving and b) the use of seat belt as a passenger. Seat belt use was assessed using a four-point scale (i.e., all of the time, most of the time, rarely, never). Separate seat belt questions were included for both passengers and drivers in the survey. In the former case, the respondents were asked, "How often do you fasten your seat belt in a motor vehicle when you are a driver?" The response was recorded as positive if the answer was "always", all other responses were coded as 0 to indicate a

negative response. Survey respondents also answered a similar question about their seat belt use while riding as a passenger. A response of "always" was coded 1; all other responses were coded as a 0.

Independent variables

The independent variables were selected on the basis of their biological plausibility and previous association with seat belt usage as determined by literature review. All the independent variables were categorical. Low income was as defined in the OHS (1990) taking into account income, family size and living location.¹⁹ Low education was defined as anyone not finishing high school. Age was divided into four categories (16-24, 25-44, 45-64 and 65 and over) with the 65+ group used as the reference. In this analysis, a smoker was defined as a current daily smoker.

Data analysis

Data for all cases were analyzed using the SPSS statistical software program.²⁰ All of the categorical values that are reported in this paper as percentages (%) meet the OHS release guidelines, for Unqualified Release (coefficients of variation less than or equal to 16.5%). Both adjusted and unadjusted analyses were performed using analytical weights²¹ to account for the sampling design.²² Analytical weights are calculated by dividing the individual OHS weight by the average of the individual weights so the sum of the analytical weights equalled one. Logistic regression was used to examine the association between the dependent variables (the use of seat belts in the driver and passenger populations) and the independent variables described above. The Wald statistic was used to test the hypothesis that the regression coefficients associated with the independent variables are equivalent to 0.0. Bi-variable analyses of independent variables are reported as odds ratios (OR) with 95% confidence intervals (95% CI).

RESULTS

Data

Where appropriate, OHS survey responses were excluded based on age and if any of the independent/dependent vari-

able information was missing. Of the 45,650 questionnaires available from the OHS for those 16 years of age and over, 25,987 were used for the driver's analyses while 34,053 were used for the passenger analyses. The weighted percentage of drivers and passengers whose responses were used and who always used seat belts are recorded in Table I.

Drivers

Data in Table II indicate the results of the logistic regression for seat belt use among drivers and passengers. Table III shows the unadjusted and adjusted relationships between seat belt use as a driver and the independent variables. In the bi-variable analysis, low income was the only variable that was not statistically significant. There was a significant association between seat belt use while driving and the younger age groups. When the younger age groups were compared to the 65 and over group, the resulting ORs were highly significant. For example, those 16-24 were 3.1 times less likely to always wear their seat belt when compared to the 65+ age group. These associations were strengthened by logistic regression analysis. The ORs associated with having two or more drinks and driving within the hour and seat belt use as a driver was 3.17 (95% CI: 2.98-3.37).

In the bi-variable analyses, being single was significantly associated with seat belt use as a driver. However, when the other independent variables were controlled for in the multi-variable analysis, this variable was no longer strongly associated with not wearing a seat belt.

Passengers

Table IV shows the unadjusted and adjusted relationships between seat belt use as a passenger and selected independent variables. The direction and the magnitude of the relationship between the independent variables and seat belt use as a passenger are similar to those of seat belt use among drivers. Again, in the bi-variable analysis, income was the only variable that was not significantly associated with seat belt use as a passenger. However, being single and having family dependents were not significant in the adjusted analysis.

TABLE I
Respondent Characteristic for Drivers and Passengers, Weighted* Percentage and Frequencies Using Seat Belts
Within the Sample of Ontario Respondents

Variables	Drivers				Passengers			
	Respondents Drivers Weighted %	Estimated Number of Drivers in Ontario*	Seat Belt Use Drivers Weighted %	Estimated Number of Drivers in Ontario using Seat Belts*	Respondents Passenger Weighted %	Estimated Number of Passengers in Ontario*	Seat Belt Use Passengers Weighted %	Estimated Number of Passengers in Ontario using Seat Belts*
Age 65+	9.6	401,702	83.6	335,823	12.2	687,365	74.6	512,774
45-64	25.1	1,050,283	74.8	785,612	25.4	1,431,071	65.7	940,214
25-44	49.9	2,088,013	70.1	1,463,697	45.7	2,574,802	61.1	1,573,204
16-24	15.5	648,581	63.9	414,443	16.7	940,901	48.5	456,337
Male sex	54.1	2,263,757	64.6	1,462,387	49.7	2,800,167	55.5	1,554,093
Single	25.7	1,075,389	68.2	733,415	27.2	1,532,486	54.9	841,335
Family with dependents	46	1,924,821	70.1	1,349,300	44.4	2,501,558	59.6	1,490,928
Low education	27.6	1,154,893	65.6	757,610	32.3	1,819,827	57.3	1,042,761
Low income	9	376,595	70.8	266,630	12	676,097	61.1	413,095
Have children	33.9	1,418,510	69.1	980,190	34.2	1,926,876	55.8	1,075,197
Rural	13.9	581,631	60.9	354,213	12.9	726,804	52.5	381,572
Living in the North	8.7	364,042	57.7	210,052	8.7	490,170	49	240,183
Current smokers	31.9	1,334,822	61.7	823,585	31.8	1,791,656	52.3	937,036
Fast drivers	2.2	92,057	45.3	41,702	N/A	N/A	N/A	N/A
Two or more drinks before driving	21.3	891,276	51.5	459,007	N/A	N/A	N/A	N/A
Always use seat belt	71.6	2,996,026	N/A	N/A	61.8	N/A	N/A	N/A
Estimated Total Number of Drivers in Ontario age 16 and over = 4,184,394					Estimated Total Number of Passengers in Ontario age 16 and over = 5,634,139			

* These estimates were based on the weighted frequencies from the Ontario Health Survey.

TABLE II
Results of the Logistic Regression for Seat Belt Use by Drivers and Passengers

Variables	Drivers				Passengers			
	B	S.E.	Wald	P-Value	B	S.E.	Wald	P-Value
Male sex	.6310	.0311	412.6435	.0000	.5185	.0232	498.3257	.0000
Single	.0296	.0441	.4528	.5010	.0186	.0346	.2906	.5898
Family with dependents	.1062	.0393	7.2973	.0069	.0022	.0306	.0052	.9428
Low education	.3757	.0335	125.9308	.0000	.2680	.0260	105.9551	.0000
Low income	.0753	.0518	2.1184	.1455	.0449	.0369	1.4857	.2229
No children	.1720	.0497	11.9571	.0005	.0969	.0385	6.3501	.0117
Rural	.5256	.0404	169.1889	.0000	.3776	.0342	122.2582	.0000
Living in the North	.5896	.0482	149.6004	.0000	.4861	.0403	145.6463	.0000
Current smoker	.5040	.0309	266.2410	.0000	.4833	.0247	381.5278	.0000
Fast drivers	.7135	.0908	61.7154	.0000	N/A	N/A	N/A	N/A
Two or more drinks before driving	.8868	.0342	672.8506	.0000	N/A	N/A	N/A	N/A
Age 65+	*Ref	*Ref	*Ref	*Ref	*Ref	*Ref	*Ref	*Ref
45-64	.4656	.0651	51.1207	.0000	.4094	.0444	84.9160	.0000
25-44	.7877	.0692	129.4986	.0000	.6141	.0478	164.9897	.0000
16-24	1.1351	.0866	171.6607	.0000	1.0232	.0620	272.1428	.0000
Constant	2.5486	.0643	1573.209	.0000	1.7013	.0427	1587.064	.0000

* Ref = Reference standard

There was an inverse association between seat belt use and age. Younger passengers, as with drivers, were less likely to wear seat belts.

DISCUSSION

These findings suggest that a variety of factors influence whether drivers and passengers utilize seat belts regularly while riding in motor vehicles. However, the striking finding is the similarity between the analyses for drivers and passengers. Overall, a similar set of factors predict dri-

ver and passenger seat belt use. Moreover, rates of seat belt use are lower in passengers than drivers. These results suggest that interventions to increase seat belt use should be targeted at drivers and passengers equally, not just drivers.

The factors most strongly associated with seat belt non-compliance are worthy of elaboration. Seat belt non-use is most strongly associated with younger age, and overall seat belt use increases with age. This may reflect greater avoidance of risk taking with advancing age or heightened awareness of the value of seat belts. Thus,

strategies to increase the use of seat belt targeting young drivers continue to be needed.

In addition, these results suggest that seat belt non-use is strongly associated with other high risk health behaviours. For example, smokers less frequently utilize seat belts than non-smokers and this may reflect the fact that non-smokers are more health conscious and take fewer risks overall.²³ Specific driving behaviours such as drinking while driving and speeding are also strongly associated with non-compliance with seat belt use.¹⁸ Thus, the

paradox whereby those at highest risk of injury are also least likely to be employing restraint devices to prevent injury in the event of a crash is observed.

Other demographic factors less strongly associated with seat belt use included gender (i.e., females use seat belts more than males), education, number of household dependents, and having children. These associations are reassuring since they are generally non-modifiable factors associated with seat belt use and their importance is minimized further by the magnitude of their association ($OR < 1.5$).

Geographically, two important factors were identified for both drivers and passengers. The analyses indicate that people who reside in northern areas of the province report regular use of seat belts less frequently as both drivers and passengers than those living in southern regions of the province; an association which is maintained after multi-variable modelling. In addition, rural residence, as defined by the OHS, is also associated with lower regular seat belt use in both drivers and passengers. Further research is required to explain these findings, since rural and northern vehicular trauma is both more frequent and more commonly fatal.²⁴⁻²⁷

There are a number of factors which limit the generalizability of this study. First, the OHS measured self-reporting behaviour of the respondent regarding seat belt use, as opposed to actual behaviour. Thus, responses may be biased;¹³ however, previous research has demonstrated a positive correlation between seat belt self report and observed use.^{28, 29}

Second, the selected outcome was reported seat belt use "always" vs. "not always" which represents a compromise. This approach appears to result in an underestimation of the magnitude of these results. Moreover, recent research suggests using the "always" option, for a question susceptible to socially desirable responses, reduces this bias and is a more valid method of analysis.²⁹

Finally, questions relating to other factors possibly associated with seat belt use or vehicular crashes were not included in the survey. Despite the fact that the majority of motor vehicle crashes occur close to home and people less frequently utilize seat

TABLE III
The Odds Ratios, Adjusted Odds Ratios and Confidence Intervals for Drivers Not Always Wearing a Seat Belt by Selected Demographic, Behavioural and Geographic Variables in the Population Age 16 and Over, Ontario, 1990

Variable*	Unadjusted OR+	95% CI [^] Lower	95% CI [^] Upper	Adjusted OR	95% CI Lower	95% CI Upper
Sociodemographic Factors						
Age 65+	1.00	Ref #	Ref	1.00	Ref	Ref
45-64	1.71	1.94	1.52	1.59	1.40	1.81
25-44	2.17	2.44	1.94	2.00	1.91	2.52
16-24	2.88	3.26	2.54	3.11	2.63	3.69
Gender (Male)	2.18	2.06	2.31	1.87	1.40	2.54
Low education	1.49	1.40	1.58	1.46	1.36	1.55
Single	1.25	1.18	1.33	1.03	.945	1.12
No children	1.20	1.14	1.27	1.19	1.07	1.31
Family with dependents	1.15	1.09	1.21	1.11	1.03	1.30
Low income	1.05	.95	1.15	1.08	.974	1.19
Behavioural Factors						
2 or more drinks before driving	3.17	2.98	3.37	2.43	2.23	2.60
Fast drivers	3.14	2.66	3.70	2.04	1.71	2.44
Current smokers	2.00	1.89	2.11	1.66	1.56	1.76
Geographic Factors						
Living in the North	1.98	1.81	2.16	1.80	1.64	1.98
Rural location	1.76	1.64	1.90	1.69	1.56	1.83

* See methods for designation of predictor variables; OR+ = Odds Ratio; 95% CI[^] = 95% confidence interval; Ref# = reference standard; number of cases included in the analyses = 25,987.

TABLE IV
The Odds Ratios, Adjusted Odds Ratios and Confidence Intervals for Passengers not Always Wearing a Seat Belt by Selected Demographic, Behavioural and Geographic Variables in the Population Age 16 and Over, Ontario, 1990

Variable*	Unadjusted OR+	95% CI [^] Lower	95% CI [^] Upper	Adjusted OR	95% CI Lower	95% CI Upper
Sociodemographic Factors						
Age 65+	1.00	Ref #	Ref	1.00	Ref	Ref
45-64	1.53	1.41	1.66	1.51	1.38	1.64
25-44	1.87	1.73	2.02	1.84	1.68	2.03
16-24	3.12	2.85	3.40	2.78	2.46	3.14
Gender	1.70	1.63	1.78	1.68	1.60	1.76
Low education	1.33	1.27	1.39	1.31	1.24	1.38
Single	1.49	1.42	1.56	1.02	0.52	2.01
No children	1.47	1.40	1.54	1.10	1.02	1.19
Family with dependents	1.19	1.13	1.24	1.00	0.94	1.06
Low income	1.03	.966	1.11	1.05	0.97	1.12
Behavioural Factors						
Current smokers	1.79	1.71	1.87	1.62	1.54	1.70
Geographic Factors						
Living in the North	1.77	1.65	1.92	1.63	1.50	1.76
Rural location	1.55	1.46	1.66	1.46	1.36	1.56

* See methods for designation of predictor variables; OR+ = Odds Ratio; 95% CI[^] = 95% confidence interval; Ref# = reference standard; number of cases included in the analyses = 34,053.

belts while travelling short distances, the OHS did not permit sub-analyses of seat belt use patterns on the basis of the length of the trip. In addition, issues such as the use of cellular phones,³⁰ make, year and model of vehicle,¹³ air bag technology¹⁰ and other factors associated with seat belt non-use were not sampled in the OHS.

While the associated factors are reflective of the published literature and were derived using appropriate methodological principles, further research is required to uncover other factors associated with seat belt non-use.

Finally, this is the first comprehensive, population-based examination of seat belt use by drivers *and* passengers; other similar studies need to be completed in order to determine whether these results are generalizable. Large population-based surveys are currently being planned or conducted and inclusion of questions related to safety and injury permit this type of work to be completed.

This report indicates that a strategy for increasing the use of seat belts requires both multi-dimensional interventions and further research. For example, increasing

the use of seat belts needs to be directed at both drivers and passengers, younger age groups, those known to speed and drink, and be cognizant of the needs of the poorly educated. Interventions designed to increase seat belt use have been successfully employed with compelling results. Mortimer documented driver seat belt use increased from 12% to 50% within two months of the implementation of a state-wide seat belt law in Illinois.³¹ Further evaluation of educational, surveillance, and legislative interventions, alone or in combination, are required to improve the statistics reported here.

The strongest association with seat belt use is seen with advancing age, however reasons for this need to be identified. In addition, why northern and rural drivers and passengers are more reluctant to employ their seat belts requires further detailed examination.¹⁴ Nonetheless, it appears that interventions targeted to younger age groups, males, and northern/rural regions of the province need to be made a provincial priority.

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