A Descriptive Study of Bicycle Helmet Use in Montreal, 2011

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ABSTRACT

OBJECTIVE: The purpose of this study was to describe bicycle helmet use among Montreal cyclists as a step towards injury prevention programming.

METHODS: Using a cross-sectional study design, cyclists were observed during 60-minute periods at 22 locations on the island of Montreal. There were 1-3 observation periods per location. Observations took place between August 16 and October 31, 2011. Standard statistical methods were used, unadjusted and adjusted odds ratios and 95% confidence interval were calculated.

RESULTS: A total of 4,789 cyclists were observed. The helmet-wearing proportion of all cyclists observed was 46% (95% CI 44-47). Women had a higher helmet-wearing proportion than men (50%, 95% CI 47-52 vs. 44%, 95% CI 42-45, respectively). Youth had the highest helmet-wearing proportion (73%, 95% CI 64-81), while young adults had the lowest (34%, 95% CI 30-37). Visible minorities were observed wearing a helmet 29% (95% CI 25-34) of the time compared to Caucasians, 47% (95% CI 46-49). BIXI (bike sharing program) riders were observed wearing a helmet 12% (95% CI 10-15) of the time compared to riders with their own bike, 51% (95% CI 49-52).

CONCLUSIONS: Although above the national average, bicycle helmet use in Montreal is still considerably low given that the majority of cyclists do not wear a helmet. Injury Prevention Programs could target the entire cyclist population, but special attention may be warranted in specific groups such as young men, visible minorities, BIXI riders, and those riding in tourist areas. Additionally, a collaborative enterprise with the bicycle sharing system BIXI Montreal™ could prove to be fruitful in addressing the availability of bike helmets for BIXI riders.

KEY WORDS: Head protective devices; prevalence; brain injuries; prevention & control

La traduction du résumé se trouve à la fin de l'article.

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The city of Montreal has recently been encouraging bicycle use as an alternative mode of transportation by expanding the bike path network, implementing urban bicycle paths, increasing bicycle parking spaces, and sponsoring a bicycle sharing rental program (BIXI). Unfortunately, cycling in a metropolis is not without risks, with records of 600 to 800 cyclist collisions each year on the island of Montreal, not including unreported incidences or those not involving a vehicle.¹

Each year, bicycle injuries are responsible for a significant proportion of hospitalizations in Canada. In 2009-2010, the Canadian Institute for Health Information reported 4,324 hospitalizations as a result of cyclist injury. Fifteen percent of these cases involved a traumatic brain injury (TBI), and the majority (78%) who sustained a TBI were not wearing a helmet at the time they were injured, potentially resulting in serious long-term consequences and morbidity, and often an economic burden on society.² In 2011 alone, the downtown Montreal Trauma Centre admitted 71 patients injured while cycling, with an average Injury Severity Score (ISS) of 16. Of these patients, 28 sustained a TBI (average ISS: 24) and warranted treatment by the TBI team, specialists who evaluate, treat and rehabilitate patients who sustain a TBI. Seventy-nine percent of these patients were not wearing a helmet at the time of their injuries.³ Fortunately, research has shown that hospitalized cyclists who were wearing a helmet at the time of their injuries sustained less severe head injuries than those not wearing a helmet, with reports of a 63-88% reduction of the risk of head injuries with helmet use.⁴⁻⁶

Studies have shown that the implementation of helmet legislation, injury prevention and awareness campaigns, and the provision of free helmets increase helmet use.⁷⁻¹² Despite the evidence, bicycle helmets are not uniformly mandated throughout all of the provinces of Canada, where there is either no helmet legislation, helmet legislation for minors only, or for all ages. In fact, Quebec has no legislation for any age group.

Our institution has committed to developing and implementing various injury prevention programs, one of which is a TBI awareness and helmet campaign. The purpose of this study was therefore to describe helmet use of Montreal cyclists as a step towards injury prevention programming.

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Figure 1. Observation locations on the island of Montreal

METHODS

Using a cross-sectional study design, consecutive bicyclists were observed during 60-minute periods at 22 locations on the island of Montreal, in the downtown area and its surroundings (Figure 1). The downtown area was defined as within a 5 km radius from the summit of Mont-Royal. There were 1-3 observation periods per site. Each observation period occurred during weekdays and weekends, during daytime hours (7AM-7PM) and between August 16 and October 31, 2011. Locations were chosen based on areas known to have high commuter traffic and on safety of observers. Only non-motorized bicycles were included in the study. Children towed on a bicycle, in a trailer or in a seat were also regarded as a rider. Cyclists walking with their bicycle were not considered in the study, and cyclists carrying their helmet did not qualify as wearing one. No cyclists were stopped nor interrogated. The observation was stationary and cyclists were observed from both directions. Seven observers conducted observations after being trained in the use of

the recording tool, which was developed during pilot testing and allows simple data collection. If a cyclist was seen twice, only one recording was made. If the observer was not able to see the cyclist adequately to identify sex, age, race, bicycle type or helmet use, the cyclist was not recorded.

The cyclists were classified according to sex (male or female), age group (youth, young adult, adult, or senior), and race (Caucasian or visible minority). The type of bike the cyclists were riding was also recorded (BIXI or non-BIXI). The time of day (AM or PM), the day (weekday or weekend), the temperature (0-14°C or 15-29°C), the type of area (central Montreal or outskirts), and path type (commuter route, residential, isolated bike path, park, or tourist area) were also recorded.

Since cyclists were not interviewed, observers classified cyclists' age group and race using the following guidelines and judgement: Youth: short or small in stature, pre-pubescent; Young adult: average stature, post-pubescent, youthful-looking; Adult: career-aged;

Table 1. Prevalence of Helmet Wearing and Multivariate Regression Analysis of Factors Associated With Helmet Wearing in Montreal Cyclists

Variable	Helmet Prevalence		Odds Ratio (Unadjusted)		Odds Ratio (Adjusted)		p-value (Adjusted)
	n/N*	% (95% CI)	Value	95% CI	Value	95% CI	
Overall	2192/4789	46 (44-47)	–	–	–	–	n/a
Sex							
Male	1354/3102	44 (42-45)	–	–	–	–	<0.0001
Female	838/1687	50 (47-52)	1.274	1.131-1.435	1.396	1.228-1.586	
Age							
Youth	72/98	73 (64-81)	2.128	1.302-3.476	2.080	1.253-3.453	<0.0001
Young adult	229/681	34 (30-37)	0.390	0.302-0.503	0.432	0.330-0.567	<0.0001
Adult	1670/3619	46 (45-48)	0.659	0.534-0.813	0.750	0.602-0.935	0.0097
Senior	221/391	57 (52-61)	–	–	–	–	
Location							
Commuter route	931/2269	41 (39-43)	–	–	–	–	0.0052
Residential	136/321	42 (37-48)	1.057	0.834-1.339	0.643	0.479-0.865	
Isolated bike path	694/1278	54 (52-57)	1.708	1.487-1.961	1.296	1.113-1.509	<0.0001
Park	364/726	50 (47-54)	1.445	1.222-1.709	1.213	1.006-1.462	0.0002
Tourist area	67/195	34 (28-41)	0.752	0.553-1.023	0.595	0.431-0.823	0.0015
Area							0.0064
Downtown	2038/4515	45 (44-47)	–	–	–	–	
Outskirts	154/274	56 (50-62)	1.560	1.220-1.994	1.538	1.129-2.097	
Bicycle type							<0.0001
BIXI	75/612	12 (10-15)	–	–	–	–	
Non-BIXI	2117/4177	51 (49-52)	7.358	5.736-9.440	7.701	5.488-9.111	
Race							<0.0001
Caucasian	2073/4378	47 (46-49)	–	–	–	–	
Visible minority	119/411	29 (25-34)	0.453	0.363-0.566	0.499	0.396-0.630	
Day							0.0982
Weekday	1996/4311	46 (45-48)	–	–	–	–	
Weekend	196/478	41 (37-45)	0.806	0.665-0.977	0.833	0.670-1.034	
Temperature							0.0615
0-14°C	239/512	47 (42-51)	–	–	–	–	
15-29°C	1953/4277	46 (44-47)	0.960	0.799-1.153	0.822	0.669-1.009	
Time							0.2132
AM	573/1260	45 (43-48)	0.984	0.865-1.120	0.909	0.782-1.057	
PM	1619/3529	46 (44-48)	–	–	–	–	

* Number wearing helmet/total number of cyclists observed.

Senior: greying hair, significant wrinkles, frail-looking, and age spots. Cyclists' race was noted using Statistics Canada classifications as a guide and were classified as Caucasian/white-skinned or visible minority.¹³ No inter-rater reliability test was conducted.

Data analysis

JMP 8.0 Statistical Software and SAS 9.2 were used to analyze the data. Proportions of helmet wearing and their associated 95% confidence interval (CI) were calculated for the pooled population and for certain subpopulations. Both univariable and multivariable logistic regression analyses were used to determine the association between helmet compliance and relevant factors like age and sex. We chose a sample size of at least 4,500 as this size produces a two-sided 95% confidence interval with a width of about 0.03 (accuracy of $\pm 1.5\%$) when helmet wearing is about 50%. The study was approved by the MUHC Department of the Director of Professional Service and the Internal Research Ethics Review Board.

RESULTS

During the study, there were 1-3 observation periods per location for a total of 32 observation periods. A total of 4,789 cyclists were observed. The characteristics of the observations are summarized in Table 1. Of all cyclists observed, the overall helmet-wearing percentage was 46%. Within their categories, the highest prevalence of helmet wearing was observed in female cyclists (50%), youth (75%), Caucasians (47%), non-BIXI riders (51%), and on isolated bike paths (54%). Based on a multivariate regression analysis, the results of which are in Table 1, female cyclists were significantly more likely to wear a helmet than male cyclists (OR 1.396, 95% CI 1.228-

1.586), after adjusting for other factors. Non-BIXI users were significantly more likely to wear a helmet than BIXI users (OR 7.701, 95% CI 5.488-9.111). Also, cyclists of visible minorities were significantly less likely to wear a helmet than Caucasian cyclists (OR 0.499, 95% CI 0.396-0.630).

DISCUSSION

Based on our study, the proportion of helmet-wearing cyclists in Montreal is considerably low at 46%. However, considering that Montreal does not have helmet legislation, the proportion of helmet wearing remains above the national average of 36.5%, comparable to some Canadian jurisdictions where helmet laws exist.^{9,14} Furthermore, our results compare favourably to a 2008 report by the Quebec Automotive Insurance Society (SAAQ) in which helmet use in Montreal was 37%.¹⁵ According to the Canadian Community Health Survey (2009), Quebec is ranked 10th out of the 12 provinces and territories, with a proportion of helmet use at 26%, below the previously mentioned national average. Interestingly, Ontario's helmet use is also below the national average, at 34%, despite having helmet legislation for minors. On the other hand, in provinces where mandatory helmet laws exist for all ages, helmet use ranged from 48% to 66%, above the national average.¹⁴

In our study, the proportion of helmet wearing with respect to age and sex is consistent with other studies and reports which conclude that female cyclists have higher helmet-wearing proportions than male cyclists, that youth have the highest helmet wearing compared to adolescents and adults, while adolescents have the lowest helmet wearing compared to youth and adults.¹⁵⁻¹⁷ Our study further shows that seniors have higher helmet-wearing proportions

than adults and adolescents, yet lower than youth. In our study, female cyclists were more likely to wear a helmet throughout all age categories.

Although visible minorities had significantly lower helmet use than Caucasian riders, they represented a small minority of the bicycle users (9%). The Statistics Canada 2006 Census reveals that 26% of Montreal's population is part of a visible minority.¹⁸ Furthermore, during observations, there appeared to be a greater representation of visible minorities walking as compared to riding (further studies would be required to confirm this observation). Visible minorities' helmet usage is significantly low and targeted injury prevention programs may be warranted. Perhaps greater efforts may also be made to increase their bicycle ridership.

Our results show that fewer BIXI riders in Montreal wore helmets as compared to those in Toronto (12% vs. 21%), despite Montreal's being the first city to acquire the named bicycle sharing program.¹⁹ The type of cyclists targeted and the lack of provision of helmets for BIXI bikes likely play a role in the low helmet compliance. Last-minute commuters and tourists would not necessarily plan on carrying a helmet with them when deciding to take a BIXI bike; making helmets available may help improve their usage. However, the dilemma of how to make helmets available to BIXI riders is a challenge. Hygiene is a constraint to providing a shared helmet program. Encouraging regular riders and those with BIXI memberships to bring their own helmets along with them would be ideal, though this only partially addresses the problem. Offering free or discounted helmets may be an effective measure of encouragement to the remainder of the riders.¹² Innovative discount programs twinning retail bike shops and BIXI riders may be a solution.

Helmet wearing may vary with the type of rider (recreational, commuter, etc.) and characteristics such as socio-economic class.²⁰ The old port of Montreal is known as a tourist area. Our study showed that cyclists riding in this area were less likely to be wearing a helmet compared to those riding on other types of routes. Isolated areas such as isolated bike paths and parks had higher helmet-wearing proportions compared to urban settings such as commuter routes and residential areas. This observation may also be attributed to the type of rider. Riders outside the core of the downtown area were found to have a higher helmet-wearing proportion than those in the downtown area. However, it is unclear whether this is due to the effect of being on the outskirts or the fact that these observations were done on bike paths and in parks in order to capture a greater number of riders. It is worth noting that the helmet-wearing proportion of 56% observed for the riders in the outskirts of Montreal is consistent with the helmet-wearing proportions in parks and on isolated bike paths for the entire study cohort.

Limitations

This study has several limitations. Efforts were made to include observation sites throughout the island of Montreal, and on various types of roadways. However, due to the higher volume of cyclists in the downtown area and the convenience of capturing a large amount of cyclists on commuter routes and bike paths, the study is representative of helmet use in the downtown area of Montreal and of those riding on commuter routes and bike paths. In order for the study to be more representative of the entire island and riders riding on various route types, more suburban observa-

tion sites, an increased number of observations in parks, residential and tourist areas and increased time spent at those locations would be necessary. Improper helmet use may hinder its protective effect; due to the large number of cyclists and limited exposure to each cyclist, proper helmet fit was not recorded. There may be inter-rater differences in terms of the sex, age, and race classifications of the cyclists observed. Discrepancies may have occurred in computing the data if a cyclist was recorded a second time. The study is mostly representative of the adult population as it was conducted at the end of the summer and in the fall when youth ridership is low.

CONCLUSION

In conclusion, fewer than 50% of Montreal's cyclists wear a helmet while cycling, despite the evidence of its protective effect. Injury prevention programs could target the entire cyclist population as overall helmet usage remains low, but special attention may be warranted in specific groups such as males, visible minorities, BIXI riders, and those riding in tourist areas. These new data can aid in creating targeted injury prevention campaigns, advertisements and programs. Additionally, a collaborative enterprise with the bicycle sharing system BIXI Montreal™ could prove to be fruitful in addressing the availability of bike helmets for BIXI riders.

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RÉSUMÉ

OBJECTIF : Décrire le port du casque de cycliste chez les cyclistes montréalais en vue d'instaurer des programmes de prévention des blessures.

MÉTHODE : À la faveur d'une étude transversale, nous avons observé les cyclistes sur des périodes de 60 minutes à 22 endroits sur l'île de Montréal. Il y a eu de 1 à 3 périodes d'observation à chaque endroit. Les observations ont eu lieu entre le 16 août et le 31 octobre 2011. Nous avons utilisé des méthodes statistiques types et calculé les rapports de cotes ajustés et non ajustés et les intervalles de confiance de 95 %.

RÉSULTATS : Nous avons observé 4 789 cyclistes en tout. La proportion observée de cyclistes portant le casque était de 46 % globalement (IC de 95 % : 44-47). Cette proportion était plus élevée chez les femmes (50 %, IC de 95 % : 47-52) que chez les hommes (44 %, IC de 95 % : 42-45). Les jeunes étaient proportionnellement les plus nombreux à porter un casque (73 %, IC de 95 % : 64-81), tandis que les jeunes adultes étaient proportionnellement les moins nombreux à le faire (34 %, IC de 95 % : 30-37). Le port du casque observé chez les cyclistes membres de minorités visibles était de 29 % (IC de 95 % : 25-34), contre 47 % chez les cyclistes blancs (IC de 95 % : 46-49). Les utilisateurs du BIXI (vélo en libre-service) ont été observés en train de porter un casque 12 % du temps (IC de 95 % : 10-15), contre 51 % du temps chez les cyclistes ayant leur propre vélo (IC de 95 % : 49-52).

CONCLUSIONS : Bien qu'il soit supérieur à la moyenne nationale, le port du casque de cycliste à Montréal est encore très faible, car la majorité des cyclistes n'en porte pas. Les programmes de prévention des blessures pourraient cibler tous les cyclistes, mais il serait justifié d'accorder une attention particulière à certains groupes : les jeunes hommes, les minorités visibles, les utilisateurs du BIXI et les cyclistes dans les zones touristiques. Par ailleurs, une collaboration avec le système de vélos en libre-service BIXI Montréal^{inc} en vue d'assurer la disponibilité de casques de cyclistes pour les usagers du BIXI pourrait être fructueuse.

MOTS CLÉS : dispositifs de protection de la tête; prévalence; lésions cérébrales; prévention et contrôle