

# Regional patterns in young driver and motorcyclist collision deaths in British Columbia, 2004 to 2012

Findings from a retrospective analysis of young driver fatalities can provide a starting point for meaningful action to evaluate and improve road policy, relevant legislation, and the current licensing system.

## ABSTRACT

**Background:** Motor vehicle collisions are a significant public health concern. Despite an encouraging downward trend in the number of young driver deaths in recent years, young drivers in BC still have the highest fatality rate per driver in the population. A better understanding of why crashes occur is needed to further reduce the young driver death rate.

**Methods:** A retrospective analysis was undertaken using data abstracted from BC Coroners Service reports of fatally injured drivers 18 years and younger from 2004 to 2012. Overall annual fatality rates were calculated per 100 000 licensed drivers age 16 to 18. Fatalities were classified using five regions served by the BC Coroners Service: Fraser, Interior, Island, Metro (Vancouver, Burnaby, Delta, and Richmond), and Northern. Factors considered along with the region included age and sex of the deceased, injuries sustained, medical cause of death, vehicle type, vehicle age, vehicle condition, type of crash, number of passengers, weather and lighting conditions, restraint use, drug or alcohol involvement, and speed.

*This article has been peer reviewed.*

**Results:** Regional patterns in fatalities were observed, with lower fatality rates in urban areas than in rural areas. As well, a striking number of young drivers from the Interior, Island, and Metro regions of BC were found to have died in nighttime crashes, while youth in other parts of the province were more often involved in daytime crashes. Speed and impairment were common and significant factors in motor vehicle collisions across the province. Nearly one-third of drivers were inadequately restrained. The majority of drivers were the sole occupants in their vehicles at the time of the crash.

**Conclusions:** More needs to be done to reduce young driver and motorcyclist fatalities. Understanding regional patterns of risk and focusing on speed, nighttime driving, and impairment are imperative when targeting changes in youth behavior at the community level. Advocacy and clinician intervention might include supporting law-enforcement efforts and improved access to public transit, ride sharing, or safe drive programs, and alcohol and drug counseling for youth.

## Background

Traffic fatalities are catastrophic and heartbreaking to families and communities. The World Health Organization recognizes the serious burden of motor vehicle collisions on public health and has reported that more than 1.2 million people are fatally injured every year.<sup>1</sup> Although Canada has among the lowest fatality rates in the world (5.8 per 100 000 in 2011), motor vehicle collisions are

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still one of the main causes of death among Canadian youth, accounting for 35.0% of all fatalities for 15- to 19-year-olds in 2001.<sup>2,3</sup> Young drivers are of particular concern because they have the highest fatality rate among all road users.<sup>3</sup> Studies estimate that teenagers are involved in 3 times as many deadly collisions per mile driven when compared with other drivers.<sup>4</sup> In BC, motor vehicle collisions are the primary cause of unintentional injury-related hospitalizations and deaths for 15- to 19-year-olds.<sup>5</sup>

The introduction of a graduated licensing program (GLP) in BC in 1998 was a key intervention aimed at addressing particular risk factors for young drivers. The GLP restricts driving hours and passenger numbers, and requires a blood alcohol concentration (BAC) of 0.00%. These restrictions are based on research showing that the rate of driver deaths per mile is more than 5 times higher at night than during daylight hours, and that having a passenger younger than 21 years of age increases fatality risk by 44.0%, while having a passenger older than 35 decreases risk by 62.0%.<sup>6</sup> The same research shows that young drivers are more likely to engage in risky behaviors such as speeding and tailgating when other youth are present in the car.<sup>6</sup> Prohibiting passengers for young drivers is associated with a 21.0% reduction in collisions; allowing only one passenger in the vehicle is related to a 7.0% reduction.<sup>6</sup>

Research has shown that lowering the BAC limit for all drivers from 0.10% to 0.08% reduces the risk of crashing, and a 0.05% legal limit reduces risk even further.<sup>7</sup> To enforce BAC limits of 0.05% for Class 5 drivers and 0.00% for GLP drivers, BC employs two types of sobriety checks: random breath testing (all drivers stopped and tested) and selective breath testing (police test those

drivers they suspect are impaired). Both types of police checks have been shown to reduce collisions involving impaired drivers.<sup>8</sup>

Research has confirmed that the driving environment also plays a role in crash risk. Rural roads, which are common in BC, are associated with higher young driver collision rates

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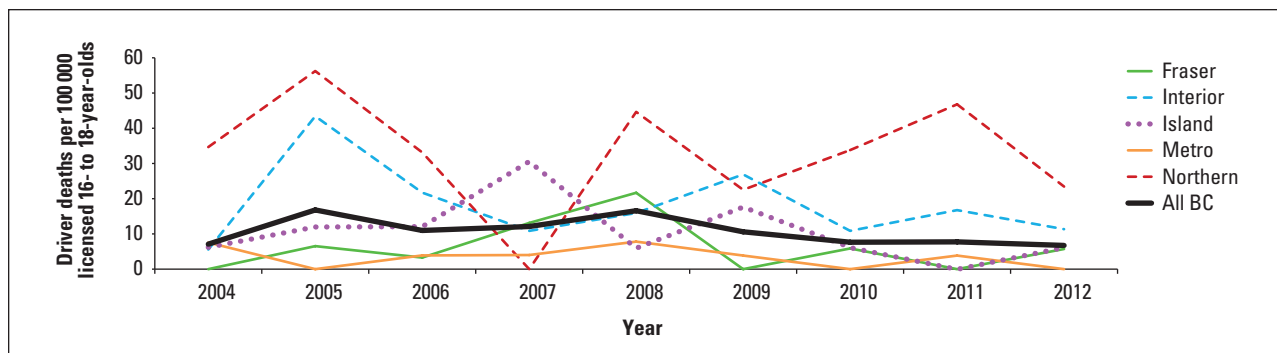
than roads in urban settings.<sup>4</sup> The higher crash incidence is associated with road design (e.g., lack of a median separating traffic, gravel surface, animals on the roadway), and the higher fatality rate is associated with limited law enforcement resources for ensuring seatbelt use, and limited access to medical facilities.<sup>4</sup> Statistics Canada reports that approximately 85.0% of British Columbians resided in urban areas between 2001 and 2011, yet the majority (88.0%) of all traffic fatalities in the province at that time occurred outside of the Greater Vancouver Regional District.<sup>9,10</sup>

Despite an encouraging downward trend in fatal crashes involving young drivers, there is still more to learn about the circumstances that commonly lead to these tragedies.<sup>10</sup> Direct examination of reports from the BC Coroners Service was proposed as

a way to identify contributing factors, target key points of intervention, and allow for meaningful evaluation of current or proposed safety programs. With a better understanding of why fatal crashes occur and how patterns in crash circumstances vary throughout BC, clinicians in youth counseling and community health advocacy can be better equipped to counsel teens and parents.

## **Methods**

Data on all young drivers and motorcyclists age 0 to 18 years who were fatally injured from 2004 to 2012 were collected retrospectively from BC Coroners Service reports. The age range included children under the legal licensing age in order to capture all relevant cases, including those where the deceased was not actually driving but was considered to be manipulating the vehicle in some way. Overall annual fatality rates were calculated per 100 000 licensed drivers age 16 to 18. Fatalities were classified by area using five regions served by the BC Coroners Service: Fraser, Interior, Island, Metro (Vancouver, Burnaby, Delta, and Richmond), and Northern. The total number of licensed drivers age 16 to 18 in each of these regions during the study period was obtained separately from ICBC upon request. Data were collected for all cases: age and sex of the deceased, injuries sustained, medical cause of death, vehicle type, vehicle age, vehicle condition, type of crash, number of passengers, weather and lighting conditions, restraint use, drug or alcohol involvement, and speed. Crashes were classified as either single-vehicle or multiple-vehicle (two or more) and on-road or off-road (the vehicle traveled onto road shoulder). Where the vehicle was struck in each case (e.g., head-on) was also considered.



**Figure 1.** Death rates for young drivers in BC by region, 2004 to 2012.

## Results

A total of 98 young driver and motorcyclist fatalities occurred in BC from 2004 to 2012. Blunt force trauma was the medical cause of death for more than half of the young victims (55.0%) and many died at the scene (75.5%). A slight downward trend in fatalities and fatality rates was observed overall during the study period (**Figure 1**), with peaks in 2005 and 2008. After 2008, rates declined to less than 7 deaths per 100 000 licensed young drivers in 2012.

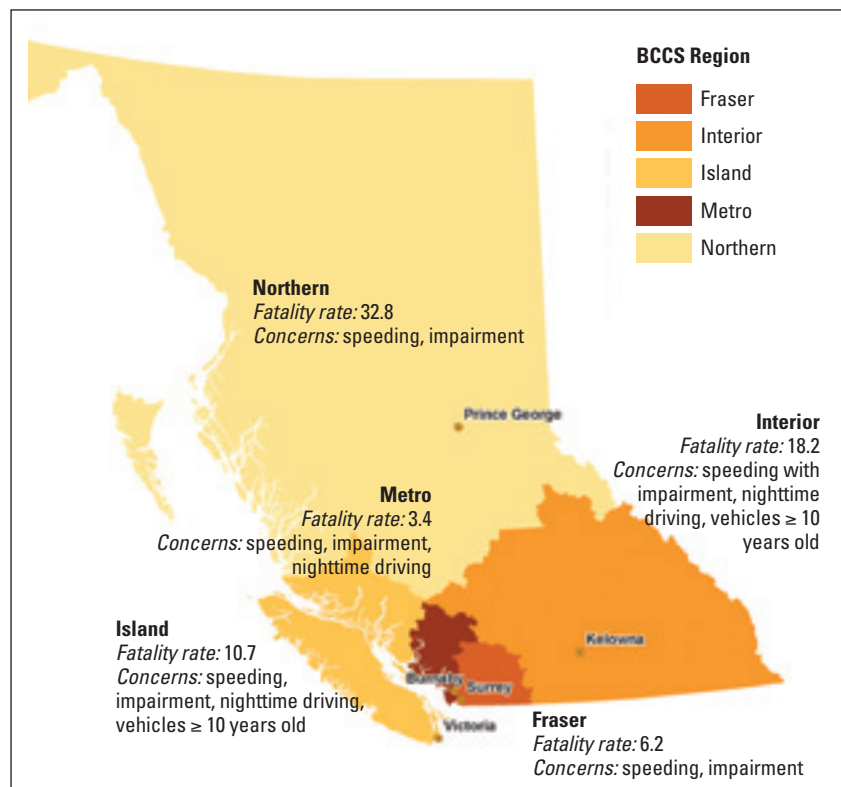
Regional variation was observed, with fatality rates in largely urban regions (Fraser and Metro) often below rates in largely rural regions (Interior, Island, and Northern).

Data for the human, environmental, and vehicular factors considered in the fatalities (**Table 1**) indicate that more male than female drivers (71.4% versus 28.6%) were involved in fatal crashes, that almost one-third of crashes (31.6%) occurred in July to September, and that the passenger car (56.1%) was the most common vehicle type. Data for other factors considered (**Table 2**) indicate that nearly one-third of drivers (28.7%) were inadequately restrained, and both speed (45.9%) and impairment (49.0%) were factors. The vast majority of off-road crashes were single-vehicle (94.6%) and half took place

at night. As well, a striking number of young drivers from the Interior, Island, and Metro regions of BC died in nighttime crashes, while youth in other parts of the province were more often involved in daytime crashes. More than one-third of the victims were impaired by alcohol (37.8%) and

many of these (86.0%) were impaired to a level beyond 0.08% BAC.

When patterns in crash circumstances specific to each region of the province were considered, the concerns common to all regions were speed, impairment, and nighttime driving (**Figure 2**).



**Figure 2.** Motor vehicle fatality rates (driver deaths per 100 000 licensed 16- to 18-year-olds) and concerns in regions served by the BC Coroners Service, 2004 to 2012.

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**Table 1. Human, environmental, and vehicular factors in BC fatalities involving young drivers, 2004 to 2012.**

| Human factors |             |               |         |            |       |           |
|---------------|-------------|---------------|---------|------------|-------|-----------|
| Age of Driver |             | Sex of driver |         | Passengers |       |           |
| < 17 years    | 17–18 years | Males         | Females | 0          | 1     | 2 or more |
| 9.2%          | 90.8%       | 71.4%         | 28.6%   | 66.3%      | 21.4% | 12.2%     |

| Environmental factors |        |        |          |          |           |             |
|-----------------------|--------|--------|----------|----------|-----------|-------------|
| Region                |        |        |          |          | Road type |             |
| Metro                 | Island | Fraser | Northern | Interior | Highway   | City street |
| 8.2%                  | 16.3%  | 18.4%  | 26.5%    | 30.6%    | 53.1%     | 46.9%       |

| Time of year |         |         |         | Time of day*             |               |                            |
|--------------|---------|---------|---------|--------------------------|---------------|----------------------------|
| Jan–Mar      | Apr–Jun | Jul–Sep | Oct–Dec | Daytime<br>6 a.m.–6 p.m. | Dawn and dusk | Nighttime<br>9 p.m.–4 a.m. |
| 20.4%        | 22.4%   | 31.6%   | 25.5%   | 39.8%                    | 21.4%         | 37.8%                      |

| Vehicular factors |                          |                    |             |           |            |
|-------------------|--------------------------|--------------------|-------------|-----------|------------|
| Vehicle type      |                          |                    | Vehicle age |           |            |
| Passenger car     | Motorcycle/ATV†/Dirtbike | Truck/Minivan/SUV‡ | < 5 years   | 5–9 years | ≥ 10 years |
| 56.1%             | 13.3%                    | 28.6%              | 20.4%       | 21.4%     | 46.9%      |

| Crash type |          | Restraint use      |                               |
|------------|----------|--------------------|-------------------------------|
| Head-on    | Off-road | Drivers restrained | Motorcyclists wearing helmets |
| 32.6%      | 57.1%    | 63.2%              | 90.9%                         |

\*time of collision was not available for one case (total = 99%)

† all-terrain vehicle

‡ sport utility vehicle

**Table 2. Other factors in BC fatalities involving young drivers, 2004 to 2012.**

| No restraint or improper use of restraint | Distraction | Driver inexperience |
|---|-------------|---------------------|
| 28.7%                                     | 13.3%       | 21.4%               |

| Speed  | Impairment   | Speed plus impairment   |
|--|--|---|
| 45.9%  | 49.0%  | 21.4%   |
| <ul style="list-style-type: none"> <li>Speeding in a 50–60 km/h zone: 48.9% <ul style="list-style-type: none"> <li>Of these, 68.0% were traveling &gt; 90 km/h</li> </ul> </li> <li>Speeding in single-vehicle crash: 64.4%</li> <li>Speeding at night: 40.0%</li> </ul> | <ul style="list-style-type: none"> <li>Alcohol: 37.8% <ul style="list-style-type: none"> <li>Of these, 86.0% had &gt; 0.08% BAC*</li> </ul> </li> <li>Drugs: 11.2%</li> <li>Alcohol + drugs: 15.3%</li> <li>Impaired in single-vehicle crash: 77.1%</li> <li>Impaired at night: 54.2%</li> </ul> | <ul style="list-style-type: none"> <li>Speed + alcohol: 13.4%</li> <li>Speed + drugs: 5.1%</li> <li>Speed + alcohol + drugs: &lt; 5 cases</li> <li>Speeding + impaired in single-vehicle crash: 85.7%</li> <li>Speeding + impaired at night: 57.1%</li> </ul> |

\*blood alcohol concentration

## Conclusions

Study results showed a slight downward trend in fatality rates in BC among young drivers and motorcyclists from 2004 to 2012, which could be explained in part by increased efforts to develop targeted national road safety programs.<sup>11</sup> The analysis of data from BC Coroners Service reports suggests that there are regional variations in fatality patterns and that reducing fatalities requires focusing on speed, nighttime driving, and impairment.

## Speed

Speed was one of the largest contributing factors to crashes across the province. Research shows that the risk of fatality increases exponentially with speeds over 60 km/h<sup>12</sup> and that speed plays a role in determining injury severity, so reducing speed limits can have a positive impact on the number of crashes causing severe injuries. In BC, both fines and roadside vehicle impoundment programs have been implemented to address the problem of speeding. Automated speed enforcement with cameras has also been shown to be an effective strategy for reducing speeds.<sup>13</sup> Although more than half of the drivers in our study were correctly restrained, the number of drivers exceeding the speed limit suggests that seatbelt use must be coupled with speed reduction to be optimally life-saving.

## Restraint use

Most drivers were reported to be wearing a seatbelt (63.2%), but in the absence of crash reconstruction, correct restraint use is often overestimated.<sup>14</sup> Since about half (50.9%) of the vehicles of correctly restrained drivers in the study were 10 or more years old at the time of the crash, it is also possible that the restraint systems themselves were out of date, especially in

poorly maintained vehicles.

In the absence of faulty restraints, there are other factors that can contribute to fatal outcomes despite correct seatbelt use. Seatbelts do not protect occupants from drowning when the vehicle becomes submerged in water, or prevent fatal injuries caused by significant intrusions. Intrusion can be caused by trees, utility poles, larger vehicles (especially commercial vehicles), or rollovers. One or more of these factors was present in 44 cases (80.0%) where the driver was reported to be correctly restrained. This finding would suggest the need to reduce speeds in order to protect drivers who wear their seatbelts correctly.

It has been well documented that using seatbelts significantly decreases the risk of severe injuries in a crash.<sup>15</sup> Mandatory seatbelt legislation has existed in BC for the last 30 years, yet not all drivers use seatbelts consistently. In BC in 2007, between 20.0% and 40.0% of injured and deceased drivers were unrestrained.<sup>16</sup> Safety campaigns, seatbelt checkpoints, and tickets for violations have been effective in reducing instances of unrestrained drivers and passengers.<sup>17</sup>

## Distraction

Although distraction was not a key finding in this study, current literature has raised concerns that reported rates may not accurately reflect the actual risk of using electronic devices while driving.<sup>18</sup> BC amended the Motor Vehicle Act to prohibit the use of hand-held devices in 2010. Research has confirmed that these devices take the driver's attention away from the road and lead to cognitive impairments when processing external environmental cues.<sup>19</sup> Further research has demonstrated no difference in distraction experienced by drivers using hands-free devices.<sup>20</sup> BC currently bans hand-held devices for all

drivers, as well as hands-free devices for drivers in the GLP. Despite the ban on electronic devices, observational data presented at the World Injury Conference in 2010 highlights a gap between GLP requirements and teen compliance.<sup>21</sup> Oda and colleagues<sup>21</sup> observed teens exiting the parking lot after school in three cities in Canada, including Vancouver. The majority of drivers observed in Vancouver (75.0%) were seen using their cell phones while driving, suggesting that context strongly influences specific driving behaviors. Given the ubiquitous use of cell phones by this age group, our study may underreport the role played by distraction.

The passenger restriction is another key factor in the GLP intended to help reduce distraction, based on the known relationship between crash risk and the presence of other youth in the vehicle.<sup>22</sup> Most drivers in our study were alone at the time of the crash, indicating a high level of compliance with the GLP. This finding does not necessarily contradict previous research. Because crash risk is increased at night and in rural regions, drivers who are tired and have a long drive home after a social event may have difficulty maintaining an alert state, thus increasing the risk of a crash in spite of the protective effect of a passenger restriction.

## Nighttime driving

Further investigation is needed to determine why a striking number of young drivers from the Interior, Island, and Metro regions of BC died in nighttime crashes, while youth in other parts of the province were more often involved in daytime collisions. The problem may be related to aspects of teen culture in these regions, such as availability of public transit or scheduling of school and extracurricular activities, or the prob-



lem may be related to road construction and signage.

The risks of nighttime driving might be addressed by reducing speeds, as well as using road design to keep drivers in their correct lane and to help them navigate curves successfully when visibility is compromised.<sup>23</sup> Better lane markings, brighter signage, and wider use of rumble strips may be key to addressing the problem of nighttime highway fatalities.<sup>23</sup> The role of alcohol in nighttime crashes also needs to be addressed, since the largest number of crashes occurred between dusk and dawn, a time when more drivers were found to be impaired.

### Impairment

Almost 38.0% of the victims in the study were impaired by alcohol, and 86.0% of these victims were impaired at a level beyond 0.08% BAC. This finding is consistent with the impaired and fatigued driving habits that are common after social gatherings. Christoforou and colleagues studied social drinking habits in a driving simulation and found that reaction times slowed as BAC increased.<sup>24</sup> For young drivers, the increased risk of a crash is likely due to a lack of driving experience combined with the effects of alcohol and greater risk-taking behavior common among youth.<sup>22</sup>

Drivers in the Interior and Northern regions were most often involved in alcohol-related crashes, despite laws mandating zero BAC for GLP drivers. A 2002 study demonstrated that random breath testing checkpoints led to an 18.0% reduction of alcohol-related crashes, while selective check points produced a 20.0% reduction.<sup>25</sup> However, in rural regions of BC, this type of enforcement can be difficult to implement for economic, geographical, and practical reasons. Despite such challenges, BC passed

aggressive legislation in 2010 to get impaired drivers off the road. An evaluation of the Immediate Roadside Prohibition program in 2012 showed enormous reductions in the number of impaired drivers on the road—especially late at night.<sup>26</sup> These preliminary findings indicate an encouraging change in impaired driving behaviors across the province and underscore the vital role of targeted legislation in effecting dramatic reductions.

### Limitations of study

The relatively small number of young driver and motorcyclist fatalities from 2004 to 2012 presented challenges when we were analyzing and reporting on the data. To protect privacy and ensure accuracy, data for drivers and motorcyclists were combined for most of the analyses.

One limitation concerns the data for 2012, which may be incomplete in cases still under investigation by the BC Coroners Service. It is important to note, however, that the data reflect the total number of fatalities occurring in BC during the study period and are not a selected sample.

Another limitation is the absence of standardized reporting by coroners, resulting in some missing information about the circumstances of each fatality. Because postmortems were not conducted in every case, many files did not contain details of the types of injuries sustained.

### Future efforts

Road crashes continue to be a leading cause of death among youth, despite the downward trend in the overall motor vehicle collision fatality rate. Our study provides insight into the pattern of fatalities among young drivers and motorcyclists in BC for 2004 to 2012, when the most common contributing factors to crashes were high speed, impairment, and

nighttime driving.

BC has had many successes in traffic safety over the last decade—most notably in the reduction of alcohol-related road deaths—and these have resulted in an overall decline in the number of motor vehicle collision fatalities.<sup>27</sup> Through the BC Road Safety Strategy 2015 and Beyond, provincial road safety partners have provided a framework for action to make BC roads the safest in North America.<sup>28</sup>

While the data analyzed in this study are limited and incomplete, the findings describe current trends in young driver fatalities in BC and provide a starting point for meaningful action to evaluate and improve road policy, relevant legislation, and the current licensing system.

Improving compliance with GLP requirements has the potential to prevent more fatalities but requires an understanding of the social environment of young drivers and the circumstances that precede the operation of a vehicle. Clinicians from all regions of BC can be better equipped to counsel teens and parents appropriately when they are aware of the particular pattern of youth driver fatalities in their own communities. Targets for community advocacy and clinician intervention might include supporting law-enforcement efforts and improved access to public transit, ride-sharing or safe-drive programs, and alcohol and drug counseling for youth. Future efforts should also seek to clarify the relationship between driving context and crash outcomes in the special case of young drivers.

### Competing interests

None declared.

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