Road Safety Report

for the

Interior Health Authority

Photo: Keith McNeill, Clearwater Times

PREPARED BY:
Office of the Senior Medical Health Officer

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Interior Health

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EXECUTIVE SUMMARY

The report provides data on road-related deaths and hospitalisations in the Interior Health (IH) Authority region by road user type and time during the period 2001–2010.

MVCs account for a large number of deaths and hospitalisations in the IH region. A high proportion of deaths and hospitalisations involved non-residents of IHA. Comparing road user types for IHA residents injured within and outside the IHA region, MV occupants experienced high death and hospitalisation rates. Males between 15 to 34 and 75 years and older were highly represented age categories for crashes involving MV occupants. Females had similar highly represented age categories for MV occupants, but their death and hospitalisation rates were much lower. However, actual risk per unit of distance travelled for different road user groups, age and sex cannot be ascertained from the data provided. The fact that there were no infant or toddler deaths, no infant and few toddler hospitalisations from MVC suggests that current road safety measures have been highly successful in protecting these age groups.

Between 2001 and 2009, the overall MVC death rate for males and females of all road user types combined showed no improvement. On the other hand, hospitalisation rates for both sexes during 2001-2010 demonstrated a significant decreasing trend, more so for males than females.


Photo: Guy Bertrand, Trail Daily Times

There was no reduction in deaths or hospitalisations of motorcyclists during the study period. Male motorcyclists between the ages of 15 to 34 were at the highest risk of death and hospitalisation for this road user type. Female motorcyclists between 34-44 years of age experienced the highest rate of hospitalisation among females for this road user type, while the death rate for female motorcyclists was quite low across all age groups. This could be related to low numbers of female motorcyclists in the IHA region, or other factors.

For bicyclists and pedestrians, the number of collisions in addition to the rate of hospitalisations and deaths, remained fairly constant between 2001 and 2009/10. The hospitalisation and death rates for pedestrians were second highest after vehicle occupants and for bicyclists lower. However the numbers are still high considering that most MVCs should be preventable. The data for all MVCs in the IHA region, including residents and non-residents, demonstrate that most collisions involving pedestrians and bicyclists occurred in 30-50 km/hr speed zones. Additionally, on city and municipal streets, where pedestrians and cyclists were most frequently killed in 30-50 km/hr speed zones, only 1% of crashes on this road type occurred in speed zones under 30 km/hr.

The Interior Health Authority currently accounts for about 36% of road deaths in British Columbia, with 18% of the population, as contrasted with Vancouver which has 6% of road deaths and 17% of the population, which parallels data for hospitalisations.

INTRODUCTION

The Interior Health Authority (IHA) has a population of 735 000 people in an area of British Columbia (BC) about the size of England, rising from the eastern boundaries of the coastal health authorities as far as the Alberta border in the east, and south to the United States border. There is a mix of rural road users with mainly vehicle occupants and motorcyclists at risk, and small cities and towns where vulnerable road users, including pedestrians and bicyclists, are also exposed on residential streets. Because of the mountainous terrain, many cities and towns are situated in valleys with the main road for heavy long-distance traffic passing through the city centre. The region has many mountains and rural roads, some of which can be quite dangerous during winter months due to icy conditions, and even avalanches. The roads are crowded with tourists during summer, and with heavy trucks, many transiting the area, at all times of the year. Many out-of-province road users, especially from Alberta, travel into and through the region on major highways. For all such reasons and others, the pattern of road traffic injury in the BC Interior differs from metropolitan coastal areas of the province.

This Road Safety report focuses on On-Road motor vehicle crashes (MVC). While On-Road MVC account for the majority of crashes in the IH region, it should be noted that injuries resulting from Off-Road MVC are also an important area of injury surveillance for this region. Only a few data to indicate the importance of off-road injuries for IH are included in the report (See Appendix 1). This report differentiates between four road user types, including motor vehicle occupants, motorcyclists, bicyclists, and pedestrians. The latter three are generally considered vulnerable road users. The World Health Organisation road injury codes are included in Appendix 2. Other data from the Insurance Corporation of BC (ICBC) providing number of incidents per highway section are in Appendix 3, as they do not include data on traffic volume, have not been recently updated, and do not specify whether hospitalisation occurred.

Photo: Guy Bertrand, Trail Daily Times

METHODS

Data Sources and Study Populations

Data for MVC deaths of residents were from BC Vital Statistics. Vital Statistics data are by the health authority of residence of the victim, not by health authority of incident, by calendar year, January 1 to December 31. For example, collision data presented for 2001 to 2009 cover January 1, 2001 to December 31, 2009.

Data for hospitalisations of IH region residents injured in MVCs were obtained through the BC Ministry of Health Hospitalisation Discharge Abstract Database (DAD) (2010). Hospitalisation data are presented by government fiscal year, April 1 to March 31. For example, hospitalisation data presented for 2001 to 2010 cover April 1, 2001 to March 31, 2010.

Data from the above two sources were supplied by the BC Injury Research and Prevention Unit in Vancouver, rather than obtained from the original sources, and included deaths and hospitalisations of IHA residents injured in MVCs in the IH region, elsewhere in BC, and outside BC; data on non-residents injured within the IHA region were not included. Hence to estimate actual numbers of dead and hospitalised MVC victims within the IHA region, visitors to the region and persons only transiting would have needed to be added, as described below. The data did include deaths and hospitalisations of IHA residents outside the IHA region. These are the data presented in this report, with the exception of Figures 3 and 4 comparing hospitalisations by health authority, which do include non-residents of IHA.

The ICBC provided the following data from police-reported crashes: personal factors contributing to MVC, MVC location including speed zone and road type classification, season of MVC, and MVC outcome as fatality, injury, or no injury. ICBC/police data were by calendar year. The population included for ICBC data differed from death and hospitalisation data since they included both residents and non-residents all crash incidents occurring in the IHA region.

Road User Types

• *Motor Vehicle Occupant (MV Occupant)* refers to i) a driver of a transport vehicle who is operating or intending to operate it or, ii) a passenger of a transport vehicle other than a driver.

• *Motorcyclist* is any person riding on a motorcycle or in a sidecar or trailer attached to such a vehicle

• *Bicyclist* is any person riding on a pedal cycle or in a sidecar or trailer attached to such a vehicle.

• *Pedestrian* is a person involved in an incident and not in or on a vehicle.

• *Other transport* classification codes have been excluded from hospitalisation and mortality data.

Population Estimates for Death and Hospitalisation Rate Analyses

For hospitalisation and death rates produced by year, IH population denominators were determined using censal and inter-censal estimates from BC Vital Statistics. Rates were ascertained by dividing the number of hospitalisations or deaths in a given year by the year's population or subpopulation (example: total male or total female population for a given year). Annual rates are presented per 100 000 persons. The numerators for these rates included only injuries to IHA residents inside and outside the IHA region. Hence any injuries of non-residents that occurred inside the IHA would not be counted and hence the rates presented underestimate the true burden of MVC deaths and injuries inside the IHA.

For hospitalisation and death rates by age, 2001 and 2006 censal estimates from BC Stats were used to determine a population average for each five year age group. These censal estimates were used as they are actual census data, and not the less valid inter-censal projections. To determine the average number of hospitalisations or deaths per year, the total number of incidents was divided by the number of years that the data covered. For example, if the total hospitalisations was for 2001-2010, the per year estimate was determined by dividing the total number of hospitalisations from 2001-2010 by ten. Rates were then ascertained by dividing the per year estimate by the censal population average. These rates by age group are presented as an incidence density of deaths per 100 000 person years, rather than per year.

Trends in death and hospitalisation rates were assessed using the Cochran-Armitage trend test. Trend analyses were performed using the SAS (version 9.3) software. All other analyses were performed using Microsoft Excel.

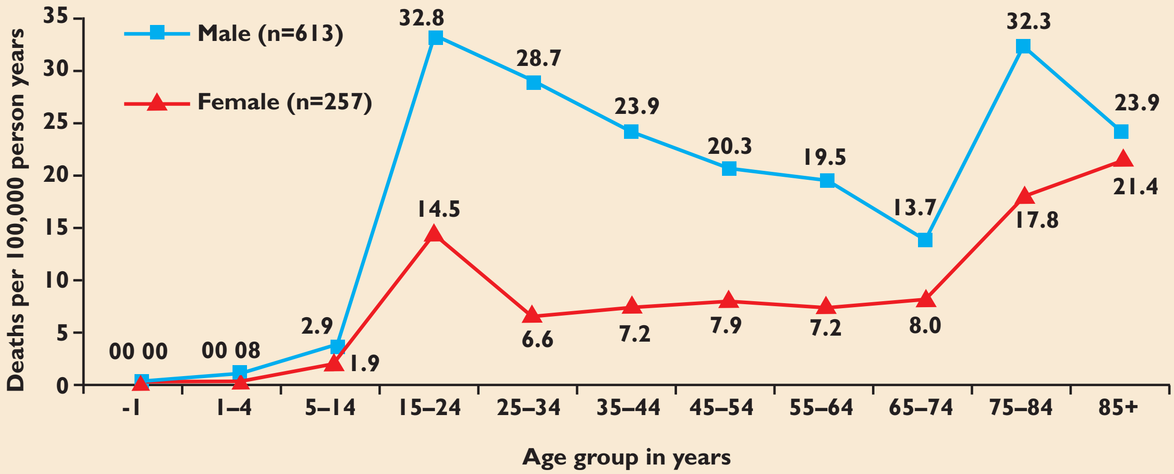
RESULTS

On-Road Motor Vehicle Crash Death and Hospitalisation Rates in IH

Hospitalisation rates from MVC were naturally higher than death rates; however the pattern by age and sex was similar. For males, numbers of deaths and hospitalisations were about twice those of females (Figures 1a, 1b).

For both sexes, the risk of dying or being hospitalised following an MVC was very low for persons aged 14 years and younger. Indeed there were no deaths and few hospitalisations for infants during the entire period. Males between 15-34 years were at greatest risk of death and hospitalisation. In that high risk age group, males had death rates 2.3 to 4.3 times and hospitalisation rates 2.3 to 2.5 times those for females. Death rates for males 75 years and older were comparable to rates of 15-24 year old males, although hospitalisation rates were less than among 15-34 year olds. Death rates for females 75 years of age and older surpassed death rates of 15-24 year old females, while hospitalisation rates were about the same.

Figure 1a: ON ROAD TRANSPORTATION DEATH RATE BY AGE AND SEX INTERIOR HEALTH AUTHORITY, BRITISH COLUMBIA, 2001–2009 (n=870)



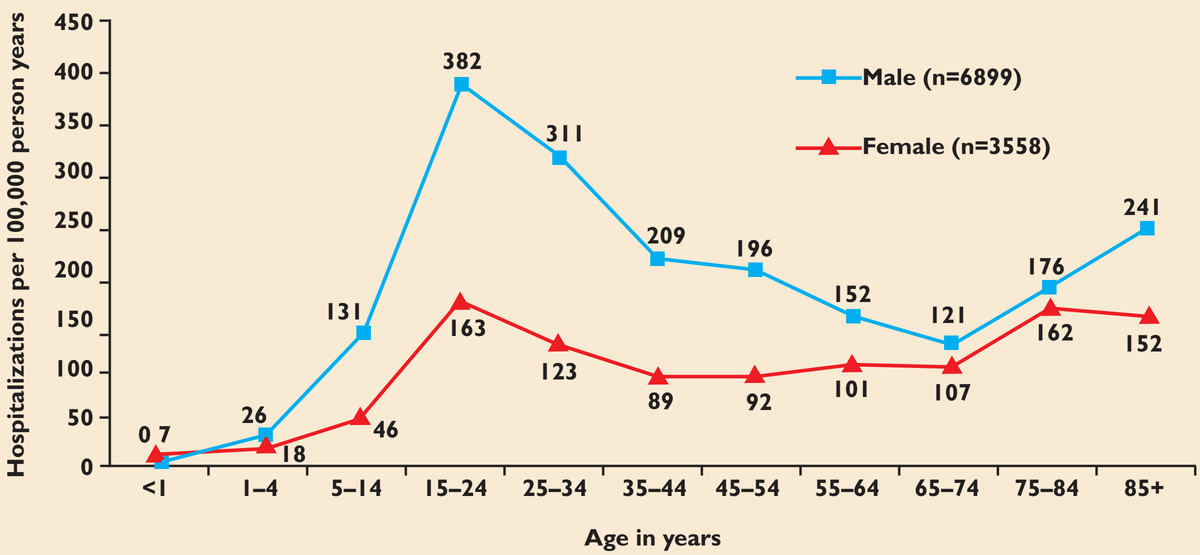
Number of Deaths by Age and Sex

	<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	TOTAL
Males	0	1	11	131	91	104	98	74	40	53	10	613
Females	0	0	7	54	21	33	39	28	23	36	16	257

Notes 1: *There were 101 deaths of males and 40 of females due to Other Transport Accidents during 2001-2009 that were not included in this figure. Source: British Columbia Vital Statistics, 2012.*

Notes 2: *Includes deaths of IHA residents occurring outside the region, and excludes non-residents inside the region.*

Figure 1b: ON-ROAD TRANSPORTATION HOSPITALIZATION RATES BY AGE AND SEX INTERIOR HEALTH AUTHORITY, BRITISH COLUMBIA, 2001–2010 (n=10457)



Number of Hospitalizations in Age Group

	<1	1-4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	TOTAL
Males	0	34	547	1694	1093	1012	1051	640	392	324	112	6899
Females	2	22	186	675	436	458	508	439	342	364	126	3558

Note: *There were 1194 hospitalisations of males and 823 of females due to Other Transport Accidents during 2001-2010 that were not included in this figure. Source: Discharge Abstract Database, British Columbia Ministry of Health Services, 2012.*

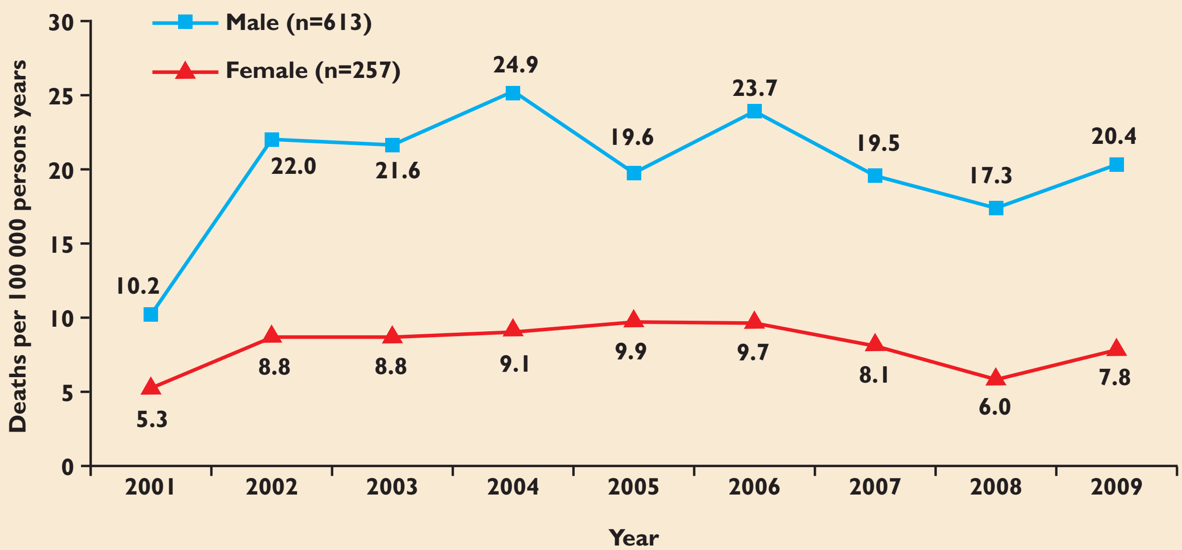
* *Includes hospitalisations of IHA residents occurring in and outside the region, and exclude non-residents inside the region.*

Trends in MVC Deaths and Hospitalisations in IH

In the IH region, between 2001 and 2009 there were 870 deaths resulting from MVCs (Figure 2a).[1]
Between 2001 and 2010, there were 10457 hospitalisations resulting from on-road MVCs (Figure 2b).

The highest number of deaths in the IH region was seen in 2006 (n=115), while the lowest number was in 2001 (n=52). No trend was found for males (p=0.14) or females (p=0.48).

Figure 2a: ON-ROAD TRANSPORTATION DEATH RATE BY YEAR AND SEX INTERIOR HEALTH AUTHORITY, BRITISH COLUMBIA, 2001–2009 (n=870*)



Number of Deaths by Age and Sex

	2001	2002	2003	2004	2005	2006	2007	2008	2009	TOTAL
Males	34	73	72	83	66	81	68	62	74	613
Females	18	30	30	31	34	34	29	22	29	257

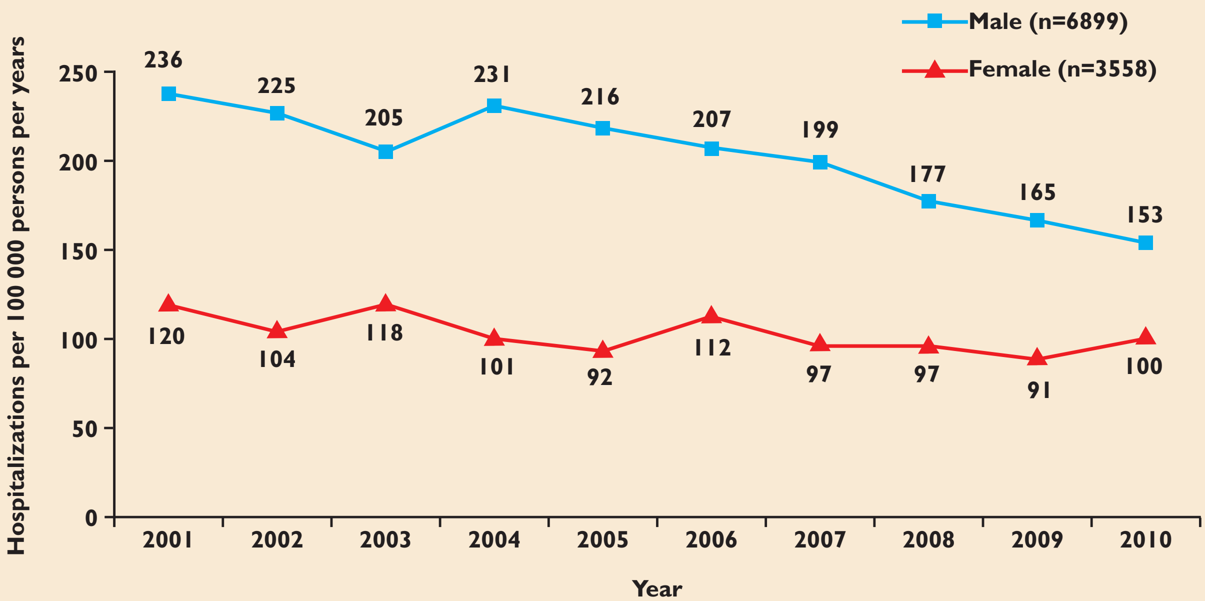
Note: *2010 data showed 34 deaths for males and 17 for females. 2010 data were excluded due to likelihood of incomplete reporting of Coroners' reports.*

Source: *British Columbia Vital Statistics, 2012. Includes deaths of IHA residents occurring in and outside the region, and excludes non-residents inside the region.*

The highest number of hospitalizations was in 2001 (n = 1194) and the lowest in 2010 (n = 926). The peak number of hospitalizations for both sexes was in 2001-2002 fiscal year, with 1.9 times more males than females hospitalized (Figure 2b). Over this ten year period there was a decrease in hospitalization rates for males and females of 35% and 17% respectively. These decreasing trends were significant for both sexes ($p < 0.0001$).

[1] *Total number of deaths and hospitalisations include motor vehicle occupants, motorcyclists, pedestrians, bicyclists, and 'other transport'. For inclusion criteria for 'other transport' see the Appendix.*

Figure 2b: ON-ROAD TRANSPORTATION HOSPITALIZATION RATE BY YEAR AND SEX INTERIOR HEALTH AUTHORITY, BRITISH COLUMBIA, 2001–2010 (n=10457)



Number of Hospitalizations by Year and Sex

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL
Males	785	748	682	770	729	706	693	632	598	556	6899
Females	409	354	402	344	317	390	344	354	336	370	3558

Note: *Includes hospitalisations of IHA residents in and outside the region, and excludes non-residents inside the region.*

Source: *Discharge Abstract Database, British Columbia Ministry of Health Services, 2012.*

Deaths and Hospitalisations from MVCs by Road User Type

MV Occupant: Death rates for male vehicle occupants 15-84 years of age were consistently higher than for females, and were by far the highest for all road user types (Table 1a). Between 2001 and 2009, the overall death rate for males was 2.2 times greater than for females, while the hospitalisation rate was 1.4 times greater. Male occupants between 15-34 years of age had the highest death rates, 2.3-3.8 times higher than females of the same age. Males between 15-35 had the highest rate of hospitalisation resulting from MVCs, 2.1-3.8 times greater than females in the same age groups. For females, the peak hospitalisation rates were in the 15-24 and 75-84 year age groups. Persons less than 15 years old had the lowest death and hospitalisation rates. There were no deaths and few hospitalisations of infants or toddlers.

Motorcyclists: Males had an overall death rate from motorcycle crashes 11 times higher than females, and a hospitalisation rate 6 times greater. The highest hospitalisation and death rates were found in males 25-34 years of age. Females had low rates of death from motorcycle MVCs, with only 6 deaths from 2001 to 2009.

Bicyclists: There were no female bicyclist deaths during 2001-2009. However, there were 19 for males. Males 34-44 years of age had the highest death rates for bicyclists. Males 15-24 years of age experienced the highest rate of bicyclist hospitalisation from MVC. The overall rate of hospitalisation of bicyclists for males was about 4.5 times that for females.

Pedestrians: Risk of death for pedestrians was second to vehicle occupants for both sexes. For females, 75-84 year olds were at the greatest risk of death. For males, the 85 and older age group had the highest death rate; however, fewer than five people died during nine years in this age category. Males 45-54 had the highest number of deaths comparing both sexes and all age categories. Male pedestrians had an overall rate of hospitalisation 2.1 times higher than females. Comparing both sexes, females 85 years of age and older had the highest rate of hospitalisation, while males 15-24 years of age had the greatest number of hospitalisations.

Table 1a: Death Rates in Person Years from Motor Vehicle Crashes by Road User Type and Age Interior Health Authority, British Columbia, 2001-2009 (N =870*)

Male (Road User Type)		AGE IN YEARS <1	1- 4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	Total
MV Occupant	Rate per 100 000	0	0	1.6	27.1	22.7	16.3	14.1	16.1	9.9	25.6	14.3	15.0
	Number	0	0	6	108	72	71	68	61	29	42	6	463
Motorcyclist	Rate per 100 000	0	0	0.0	2.5	5.1	3.7	3.1	1.3	1.4	0.6	0.0	2.2
	Number	0	0	0	10	16	16	15	5	4	1	0	67
Bicyclist	Rate per 100 000	0	0	0.8	1.0	0.0	1.6	0.4	0.5	0.3	0.0	0.0	0.6
	Number	0	0	3	4	0	7	2	2	1	0	0	19
Pedestrian	Rate per 100 000	0	0.85	0.53	2.25	0.95	2.30	2.69	1.58	2.06	6.09	9.55	2.11
	Number	0	1	2	9	3	10	13	6	6	10	4	64
									Total Number of Deaths				613

Female (Road User Type)		AGE IN YEARS <1	1- 4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	Total
MV Occupant	Rate per 100 000	0	0	1.4	12.9	6.0	6.1	7.1	5.4	6.9	12.9	17.4	6.9
	Number	0	0	5	48	19	28	35	21	20	26	13	215
Motorcyclist	Rate per 100 000	0	0	0.0	0.5	0.0	0.4	0.2	0.3	0.0	0.0	0.0	0.2
	Number	0	0	0	2	0	2	1	1	0	0	0	6
Bicyclist	Rate per 100 000	0	0	0	0	0	0	0	0	0	0	0	0
	Number	0	0	0	0	0	0	0	0	0	0	0	0
Pedestrian	Rate per 100 000	0	0	0.6	1.1	0.6	0.7	0.6	1.5	1.0	5.0	4.0	1.0
	Number	0	0	2	4	2	3	3	6	3	10	3	36
									Total Number of Deaths				257

Note: *Includes deaths of IHA residents occurring in and outside the region, and excludes non-residents inside the region.*

Source: *British Columbia Vital Statistics, 2012.*

Trends in MVC Deaths and Hospitalisations in IH by Road User Type

MV Occupants: The peak death rate for MV occupants in MVC was in 2004 and the lowest rate in 2001 (Table 2a). Since 2004, there has been a modest downward trend in the annual death rate ($p=0.02$). From 2001 to 2010, there was a decreasing trend in hospitalisations within the IH region ($p<0.01$). During this period, the rate of hospitalisation for MV occupants declined by about 42%.

Motorcyclists: From 2001-2009, the death rate for both sexes for motorcyclists increased ($p<0.01$). Hospitalisation rates remained constant ($p=0.15$). Peak death rates were in 2005 and 2006, with 12 motorcyclists killed each year. Comparing the specified road-user types, motorcyclists had the third highest average rate of hospitalisation during 2001-2010.

Bicyclists: From 2001-2009, the death rate for bicyclists was fairly low averaging 0.31 deaths per 100 000 persons annually. Hospitalisation rates for bicyclists showed no trend between 2001 and 2010. On average, about 202 bicyclists were hospitalised per year in the IH region.

Pedestrians: Following MVC occupants, pedestrians had the second highest average death rate for 2001 to 2009. The peak death rate was in 2004, when 15 pedestrians in the IH region were killed. On average, 10 pedestrians were killed per year in the IH region. Hospitalisation rates for pedestrians showed no trend between 2001 and 2009.

Table 1b: Hospitalisation Rates in Person Years from Motor Vehicle Crashes by Road User Type and Age Interior Health Authority, British Columbia, 2001-2010 (N=10457*)

Male			AGE IN YEARS											
			<1	1- 4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	Total
ROAD USER TYPE	MV Occupant	Rate per 100 000	0	8	16	197	156	110	98	79	82	132	180	103
		Number	0	10	67	872	548	533	527	333	267	241	84	3482
	Motorcyclist	Rate per 100 000	0	2	14	59	68	47	51	35	15	6	13	38
		Number	0	3	57	263	238	229	276	149	48	11	6	1280
	Bicyclist	Rate per 100 000	0	5	94	97	70	42	33	25	12	20	19	49
		Number	0	7	393	429	245	205	176	104	40	36	9	1644
	Pedestrian	Rate per 100 000	0	11	7	29	18	9	13	13	11	20	28	15
		Number	0	14	30	130	62	45	72	54	37	36	13	493
									Total Number of Hospitalisations					6899

Female			AGE IN YEARS											
			<1	1- 4	5-14	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	Total
ROAD USER TYPE	MV Occupant	Rate per 100 000	3	6	17	130	93	61	63	73	85	130	112	75
		Number	1	7	70	539	330	315	346	316	272	291	93	2580
	Motorcyclist	Rate per 100 000	0.0	0.0	2.0	7.5	7.9	12.1	9.3	6.2	1.6	1.8	1.2	6.3
		Number	0	0	8	31	28	62	51	27	5	4	1	217
	Bicyclist	Rate per 100 000	0	4	17	10	16	9	13	12	8	4	4	11
		Number	0	5	67	42	58	47	71	53	25	10	3	381
	Pedestrian	Rate per 100 000	3	8	10	15	6	7	7	10	12	26	35	11
		Number	1	10	41	63	20	34	40	43	40	59	29	380
									Total Number of Hospitalisations					3558

Note: Includes hospitalisations of IHA residents occurring in and outside the region, and excludes non-residents inside the region.

Source: Discharge Abstract Database, British Columbia Ministry of Health Services, 2010.

Table 2a: On-Road Transportation Death Rate per 100,000 by Road User Type and Year Interior Health Authority, British Columbia, 2001-2009 (N = 870*)

ROAD USER TYPE		YEAR									
		2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
MV Occupant (n=678)	Rate per 100 000	5.8	12.6	12.0	13.6	11.0	12.7	10.8	8.7	10.8	10.9
	Number	39	85	81	92	75	88	76	63	79	678
Motorcyclist (n=73)	Rate per 100 000	0.45	0.74	0.74	0.89	1.8	1.7	1.1	1.7	1.4	1.2
	Number	3	5	5	6	12	12	8	12	10	73
Bicyclist (n=19)	Rate per 100 000	0.15	0.30	0.59	0.15	0.29	0.29	0.43	0.14	0.27	0.31
	Number	1	2	4	1	2	2	3	2	2	19
Pedestrian (n=100)	Rate per 100 000	1.3	1.6	1.8	2.2	1.6	1.9	1.4	0.97	1.6	1.6
	Number	9	11	12	15	11	13	10	7	12	100

Note: *Excludes deaths of IHA residents occurring outside the region, and of non-residents inside the region.*

Source: *British Columbia Vital Statistics, 2012.*

Table 2b: On-Road Transportation Hospitalisation Rate per 100 000 by Road User Type and Year Interior Health Authority, British Columbia, 2001-2010 (N=10457*)

ROAD USER TYPE		YEAR										
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
MV Occupant (n=6062)	Rate per 100 000	113	97	98	97	85	89	80	82	69	65	87
	Number	758	654	662	655	581	613	566	593	504	476	6062
Motorcyclist (n=1497)	Rate per 100 000	20	21	19	21	23	24	22	22	22	20	22
	Number	132	140	131	141	157	166	158	161	165	146	1497
Bicyclist (n=2025)	Rate per 100 000	31	32	30	33	32	32	31	22	26	23	29
	Number	206	215	203	226	219	221	216	158	189	172	2025
Pedestrian (n=873)	Rate per 100 000	15	14	13	14	13	14	14	10	10	10	13
	Number	98	93	88	92	89	96	98	74	75	70	873

Note: *Includes hospitalisations of IHA residents occurring in and outside the region, and excludes non-residents inside the region.*

Source: *Discharge Abstract Database, British Columbia Ministry of Health Services, 2012.*

MVCs by Speed Zone and by Road User Type

Just under half of all MVCs occurred in 30-50 km/hr speed zones. For each road user type, based on the assigned speed categories, the majority of crashes occurred in the 30-50 km/hr zone, while for pedestrians and cyclists 81% occurred on roads in that zone. Less than 1% of all MVCs were in speed zones under 30 km/hr (Table 3). Severity of crashes and injuries were unavailable from ICBC.

Table 3: Proportion of Persons in Motor Vehicle Crashes by Road User Type and Speed Zone Interior Health Authority, British Columbia, 2001-2008 (n=34 090*)

		ROAD SPEED ZONE									
		<30 km/hr		30-50 km/hr		60-80 km/hr		>90 km/hr		Total	
ROAD USER	MV Occupant, % (n)	<1%	(154)	**48%**	(14 736)	29%	(8992)	23%	(7110)	100%	(30 992)
	Motorcyclist, % (n)	<1%	(3)	**44%**	(569)	38%	(486)	18%	(229)	100%	(1287)
	Bicyclist, % (n)	1%	(9)	**84%**	(669)	12%	(99)	2%	(18)	100%	(795)
	Pedestrian, % (n)	3%	(27)	**78%**	(793)	13%	(131)	6%	(65)	100%	(1016)
	Total, % (n)	<1%	(193)	**49%**	(16 767)	28%	(9708)	22%	(7422)	100%	(34 090)

Note: *Includes all MVCs in IHA*

Source: *Traffic Accident System, Insurance Corporation of British Columbia, 2010.*

Based on the pre-specified speed zones and road types, the category with the highest proportion of MVCs was city and municipal streets with 30-50 Km/hr speed zones, which was also true for all road types combined (Table 4). Looking at all speed types combined, provincial highways have slightly more MVCs than city and municipal streets. On provincial highways, most MVC occurred in the >90 Km/hr speed zone, followed closely by 60-80Km/hr zones. On rural roads the majority of collisions were in 60-80 Km/hr speed zones.

Table 4: Proportion of On-Road Motor Vehicle Crashes by Road Type and Speed Zone Interior Health Authority, British Columbia, 2001-2008 (n=33 993*)

		ROAD TYPE							
		City/Municipal Street		Provincial Highway		Rural Road		All Road Types	
SPEED ZONE	<30km/hr, % (n)	1%	(115)	<1%	(64)	1%	(22)	1%	(201)
	30-50km/hr, % (n)	**83%**	(12 825)	18%	(2917)	41%	(1047)	**49%**	(16 789)
	60-80km/hr, % (n)	15%	(2233)	38%	(6149)	**52%**	(1326)	29%	(9708)
	>90km/hr, % (n)	1%	(194)	**43%**	(6958)	6%	(143)	21%	(7295)
	Total, % (n)	100%	(15 367)	100%	(16 088)	100%	(2538)	100%	(33 993)

MVCs of IH Residents Compared to all MVCs in IH

It is apparent that the burden of deaths of IHA residents inside and outside the region is considerably less than the total burden of deaths of residents and non-residents in the region (Table 5).

Table 5: Number of On-Road Motor Vehicle Deaths of Interior Health Residents and in the Interior Health Region, Interior Health Authority, British Columbia, 2005-2009 (n=509 deaths of residents*, 681 deaths in region†)

		YEAR					
		2005	2006	2007	2008	2009	TOTAL
IH RESIDENTS	Males	66	81	68	62	74	351
	Females	34	34	29	22	29	148
						Total number of deaths	499
IH REGION	Males	91	100	97	86	112	486
	Females	49	42	38	32	34	195
						Total number of deaths	681

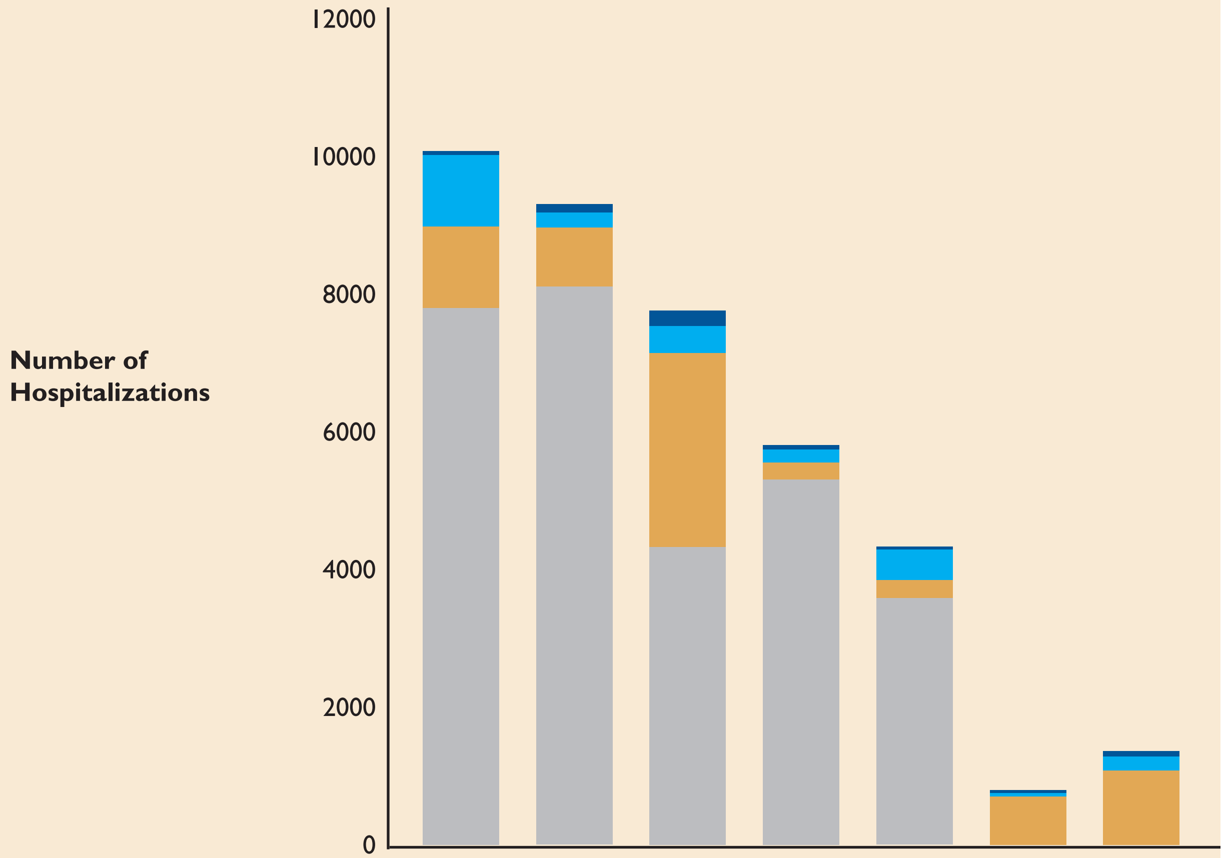
**Source: BC Vital Statistics, 2012 †Source: BC Coroner, 2010*

All MVC Hospitalisations in IH compared with other BC HAs

The following data were prepared for IHA and other health authorities by the MOH and the BC Injury Research and Prevention Unit, at the request of IH, to verify the total burden of road and off-road injury hospitalisations on the IHA, for all victims and for IHA residents. When examined by HA location of hospitals, Interior HA hospitals treated the largest proportion (26%) of patients hospitalized due to MV injury, followed by Fraser HA hospitals (24%), Vancouver Coastal HA (20%), Vancouver Island HA (15%) and Northern HA (11%).

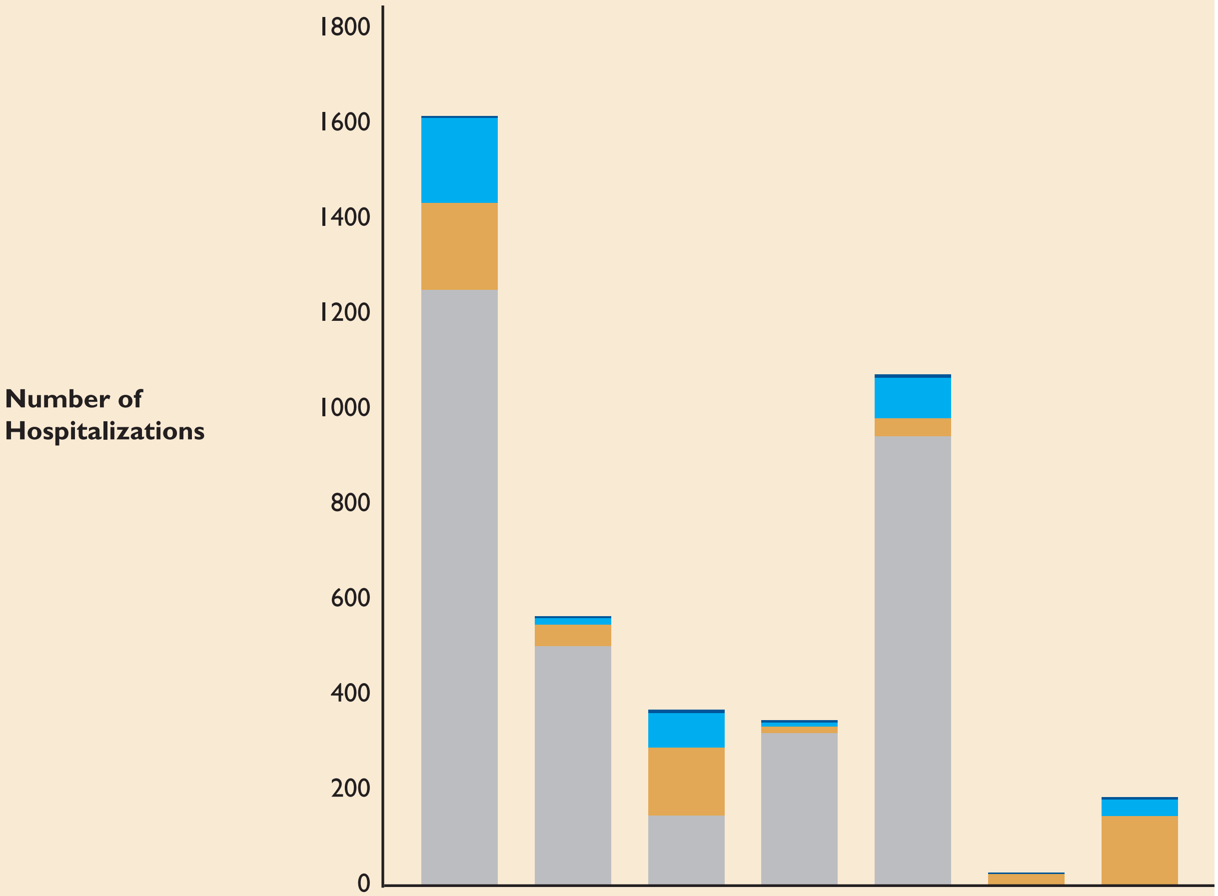
IHA hospitals had the greatest burden of all on-road MVCs (10,024 or 26% of all 39,169 on-road injuries) and off-road (n=1604 or 39% of all 4156 off-road injuries) injury hospitalisations among all HAs in BC for the period 2001/02 to 2008/09 (see Figures 3 and 4 next two pages). IHA residents represented the second largest proportion of all MV injury hospitalizations (n=8970, 23% of 39,169), and the largest proportion of off-road (n=1337, 32% of 4156) injury hospitalisations in BC (data not shown). The additional burden placed on Interior HA hospitals for treating MV injury patients is explained by the high number of other BC HA and non-BC residents treated in IHA hospitals. 21% of the burden of all on-road MV injuries treated in IHA hospitals (2123 of 10,024) (Figure 3) and 22% of off-road MV injuries (354 of 1604) (Figure 4) were due to treatment of other BC HA and non-BC residents. The Vancouver Coastal HA also deals with considerable number of non-VCHA residents, many of which could be transfers to large tertiary hospitals.

Figure 3: Number of All On-Road Motor-Vehicle Injury Hospitalizations by Treating Hospital Location, BC, 2001/02-2008/09



	Interior	Fraser	Vancouver Coastal	Vancouver Island	Northern	PHSA	Out of Province / Unknown
BC unspecified treated by HA hospitals	59	115	211	57	20	19	72
Non-BC residents treated by HA hospitals	994	216	375	180	423	26	202
Other HA-BC residents treated by HA hospitals	1129	819	2699	235	246	675	1033
HA-BC residents treated by HA hospitals	7842	8118	4474	5306	3624		

Figure 4: Number of Off-Road Injury Hospitalisations by Treating Hospital Location, BC,2001/02-2008/09 (n=4156)



	Interior	Fraser	Vancouver Coastal	Vancouver Island	Northern	PHSA	Out of Province / Unknown
BC unspecified treated by HA hospitals	2	3	7	5	7	0	5
Non-BC residents treated by HA hospitals	178	14	71	8	85	4	35
Other HA-BC residents treated by HA hospitals	180	44	141	13	37	25	146
HA-BC residents treated by HA hospitals	1244	500	148	319	935		

DISCUSSION

If no action is taken, we can expect annually the following in the IH region:

1. **280 MVC traumatic brain injury (TBI) hospitalisations** (95% confidence interval 247, 313) , representing 50% of the IH total of 560 TBI hospitalisations, with main causes concussion/brain injury, subdural hemorrhage, diffuse brain injury, subarachnoid hemorrhage, and chronic sequelae. The peak age is 15-29 years resulting in prolonged disability and a profound loss of human capital (lost wages). Long term care, human capital, and social costs expected to be high due to the young age of most victims. Direct annual costs to IH are estimated to be $5 million and indirect $50 million. Half of the patients require help for chronic issues, many for a lifetime. Costs are growing with the rising prevalence as new patients are added to the burden each month. Total annual costs are estimated to exceed $60 million, and growing. These data exclude wage losses, which could exceed $7 million per year for 140 new victims with chronic health issues, and with an average working life expectancy of 30 years, this equates to lifetime losses of about $200 million for a single year of victims.[2,3]

2. **140 MVC deaths** (95% CI 117, 163). These include 2505 years of life lost, at 3.34 years per 1000 population (contrasting with 375 life years lost for falls, at 0.50 years per 1000). The highest MVC death rates are among 15-54 year old males. The estimated medical and human capital costs of these deaths for all ages is $280 million annually, at a conservative $2 million per death.

3. **1000 MVC hospitalisations** (95% CI 968, 1062) mainly among working age persons. The average length of hospital stay is 9 days, i.e., 9000 hospital days per year (IH Information Support and Research 2008). The group with the highest hospitalisation rate is 15-54 year old males. At over $1000 per day for acute care and intensive care beds, this equates to direct medical costs of about $9 million per year. Other medical, rehabilitation, human capital, lost wages, and social costs would need to be added. Even if we assumed that victims returned to work after an average 10 days of lost wages, which is unlikely, at $1000 per week wage losses or sickness costs to employers would be an annual $2 million.

These annual MVC injury costs are very high, and exceed the entire ICBC provincial budget for road safety by a factor of about 10. During 2011, the Insurance Corporation of British Columbia (ICBC) website states that they expended $38 million on road safety in the province. However, for the two largest cities in the BC Interior, ICBC reported that they spent only $84,000 in road safety improvements in Kelowna and $204,000 in Kamloops (ICBC 2013a, 2013b).

The death and hospitalisation data as generally provided to IHA by the Provincial Health Authority's injury unit do not include dead or hospitalised MVC crash victims who were not IH region residents, and IHA residents killed or hospitalised outside IHA in other health authorities, provinces, and countries. This was eventually provided on special request for hospitalisations but not fatalities. On the other hand the data do include deaths and hospitalisations of IHA residents outside IHA. Hence, there appear to be considerably greater numbers of non-IHA residents killed within IHA than of IHA residents killed and injured outside IHA. In seeking and allocating funding for prevention, acute treatment, and rehabilitation, future data used must include service load of both residents and non-residents to fairly cover all costs to IHA health facilities from MVCs in the region. The data from ICBC differ and include MVCs involving both residents and non-residents that occurred inside the IHA region and provide a more valid representation of service loads.

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2 *Brain Injury Managers. Number of new brain injury patients in IH and associated costs. Telephone interviews of IH Brain Injury Managers, Peter Barss, MHO.*

3 *IH Information Support and Reserch. IH Head Injury data for 2008-2009, June 2010, prepared by Scott Mazurkewich, Strategic Information Analyst, review by Sharon McMillan.*

The term generally used in public health for conditions that need to be monitored by public health is "reportable" or "notifiable" health conditions or diseases. Notification is most frequently used for contagious diseases. For injuries, it has been mainly applied to intentional injuries, especially child abuse, although most deaths from injuries of any cause are usually reported to coroners/medical examiners. Certain workplace injuries are reportable to WorkSafeBC.

It is time to consider whether certain categories of injury should be made reportable/notifiable. Typically most injuries are tracked long after the fact using secondary databases, which frequently lack essential details regarding modifiable risk factors.

Our HA covers a vast territory and victims with all degrees of severity are seen in ERs, by physicians in their offices, hospitalised, die or are disabled. Hence reporting of all MVC incidents is clearly not feasible. Efforts should be focused on the most serious injuries with the greatest risk to life or long-term consequences.

A list of notifiable injuries for reporting by specified priority external causes and nature of injury together with injury severity should be developed. While severe disabling injuries impose a major cost burden on the health system for long term care, more so than many deaths, only deaths are investigated by coroners. Hence severe disabling injuries should be a priority for public health injury surveillance.

This approach should provide an effective surveillance and research basis for developing and evaluating interventions to prevent deaths, hospitalisations, and costly chronic disabilities such as traumatic brain injury.

To develop appropriate prevention strategies, further epidemiologic analyses investigating determinants of MVC hospitalisations and deaths are warranted. Assessments should determine causes including personal, equipment, and environment risk factors by road user type. This will allow for the development of appropriate prevention programs to target high risk groups among residents and non- residents. To provide a valid estimate of the total burden of on-road MVC injuries for the IHA region and for its residents, data must always be provided for non-IHA residents injured within the boundaries of the IHA, and separately for residents of the IHA injured inside, and outside, the region. Further investigation as to why overall hospitalisation rates but not death rates have declined is also needed. Considering road user type, the lack of improvement of both deaths and hospitalisations of motorcyclists merits investigation. The IHA prevalence and incidence burdens of chronic brain injury by road user type and other determinants also warrants research and evidence-based interventions.

Prevention programs should be targeting current high risk age groups such as young adults in the 15 to 34 years age group. Focusing on this younger high risk population is likely the most effective strategy to decrease deaths and hospitalisations, and prevent associated factors, such as human capital costs due to loss of productivity of many wage earners with dependent families, high rehabilitation and chronic care costs, and other costly social issues from brain injury. The small number of infant and toddler deaths and hospitalisation from MVC implies that current multi-sectorial programs targeting these age groups are effective and those that work should receive continued support.

Reducing speed limits on city and municipal streets is an effective strategy to reduce the severity of all crashes and to decrease pedestrian and bicyclist hospitalisation and death rates, and should be implemented in priority locations. Speed is the most important factor and one of the easiest to regulate to decrease the number of injuries and deaths resulting from MVCs (Elvik, 2004). Stopping distance is a factor resulting from the speed at which a vehicle is travelling that has a major impact on the outcome of the crash. It was reported at the 2005 UN Road Safety Meeting that at 30 km/h a driver can stop in 13 meters, while at 50 km/h the stopping distance will double (White, 2005) and death rates can differ by a factor of 10.

A systematic review assessing the effect of decreased speed zones has shown that traffic calming in towns and cities has the potential to reduce road traffic injuries and deaths (Bunn et al., 2003). In 2006, a large study conducted by a European transport research centre concluded that reductions in average speed of about 5% would yield a reduction in fatalities as much as 20% (OECD/ECMT Transport Research Centre, 2006). Many countries including Austria, Denmark, Finland, Germany, The Netherlands, Sweden, UK, Australia and New Zealand have implemented lower speed zones (30-40 km/h) in urban and residential spaces. Closer to home in Ontario, traffic calming measures including speed humps ("sleeping policemen") and pinch points were assessed and found to be highly effective; urban speed limits of 40 km/hr on arterial roads and 25 km/hr on other roads were proposed (Gilbert & O'Brien, 2005).

A counter argument to decreased speed zones is that it will result in a large increase in travel times. However, in Melbourne, Australia, where speed limits were reduced from 60 Km/h to 50 km/h for roads other than freeways, travel time was found to increase by only 3%, with a 10% decrease in accidents (SMEC Australia Pty Ltd., 1999). In Stockholm, Sweden, where there are 30 km/h speed zones in all built-up areas, traffic flow has remained unaffected while the maximum speed travelled has decreased notably (Archer, Forheringham, Summon, & Corben, 2008).

To ensure compliance with lowered speed zones the use of other measures to slow traffic should be used to enforce slower speeds. Such measures include narrowing of selected portions of roads, speed bumps, and guideposts. As these additional measures may augment costs of a speed reduction intervention, it may be most cost economical to implement them in residential areas to protect children and the elderly, who are often at high risk as vulnerable cyclists and pedestrians, and in other reputedly hazardous areas. In order to prioritise locations, denominator data such as vehicle volumes on roadways that have many crashes should be assessed.

Over the longer term, a health authority injury council where public health and other appropriate ministry staff such as police and ICBC could meet and work together to share their different data sources for road injuries and other issues and to develop appropriate multi-sectorial interventions would be helpful. The City of Victoria has such a council. On a provincial level, such a multi-sectorial collaboration for road safety has been headed by the Superintendent of Motor Vehicles, BC Ministry of Justice, as part of the Canadian and BC Road Safety 2015. They are using a comprehensive approach with similarities to that of the Haddon injury matrix (Barss et al, 1998; Haddon 1980). It is unclear from the ICBC statistics website (appendix 3) whether the Interior Health Authority region is receiving a share of the annual total provincial allocation ($38 million in 2011) for road safety proportionate to the IH burden of injury mortality and morbidity. Hence an important function of improved surveillance would be to ensure that other agencies are aware of the burden of injury on the IHA and allocate adequate safety resources to the region.

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APPENDIX I

Off-Road (Icd-10:V86) Transport Crashes. Number of Hospitalisations by ICD-10 Code and Year Interior Health Authority Residents*, 2002-2011 (N=1,618)

First ICD10-CA Encode	ICD-10 Description	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2002 to 2011
	Crashes involving traffic											
V8600	Driver of snowmobile injured in traffic crash	8	4	3	3	1	3	1	0	0	3	**26**
V8608	Driver of other all-terrain or other off road motor vehicle injured in traffic crash	3	6	6	3	4	7	9	13	8	10	**69**
V8618	Passenger of other all-terrain or other off road motor vehicle injured in traffic crash	1	0	0	0	0	0	0	0	2	0	**3**
V862	Person on outside of all-terrain or other off-road motor vehicle injured in traffic crash	0	1	0	0	0	0	1	1	1	0	**4**
V8630	Unspecified occupant of snow-mobile injured in traffic crash	0	0	0	1	0	0	0	0	1	0	**2**
V8638	Unspecified occupant of other all-terrain or other off road motor vehicle injured in traffic crash	0	0	0	0	1	0	0	0	0	0	**1**
	Non-traffic crashes											
V864	Person injured while boarding or alighting from all-terrain or other off-road motor vehicle	0	1	1	0	0	1	0	1	0	0	**4**
V8650	Driver of snowmobile injured in non-traffic land crash	44	33	32	22	21	31	30	25	28	21	**28**
V8651	Driver of snowmobile injured in non-traffic crash, falling through ice	0	1	0	0	0	0	0	0	0	0	**1**
V8658	Driver of other all-terrain or other off road motor vehicle injured in non-traffic crash	55	53	92	86	76	135	155	138	144	124	**105**
V8660	Passenger of snowmobile injured in non-traffic land crash	1	4	3	1	2	2	2	1	2	0	**18**

First ICD10-CA Encode	ICD-10 Description	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2002 to 2011
	Non-traffic crashes (cont'd.)											
V8668	Passenger of other all-terrain or other off road motor vehicle injured in non-traffic crash	2	3	5	6	4	3	6	8	10	3	**50**
V867	Person on outside of all-terrain or other off-road motor vehicle injured in non-traffic crash	2	4	0	0	0	2	0	2	8	1	**19**
V8690	Unspecified occupant of snow-mobile injured in non-traffic land crash	1	2	2	1	3	2	2	3	1	0	**17**
V8698	Unspecified occupant of other all- terrain or other off road motor vehicle injured in non-traffic crash	6	8	4	2	2	11	4	5	3	14	**59**
Total		**123**	**120**	**148**	**125**	**114**	**197**	**210**	**197**	**208**	**176**	

**Note: Total does not include non-residents of the Interior Health Authority treated in IHA health facilities.*

APPENDIX 2

'Other Transport' for hospitalisation data includes the Following International Classification of Diseases Codes, World Health Organisation ICD version 10, Chapter 20

V803 - V805

V80.3 Rider or occupant injured in collision with two- or three-wheeled motor vehicle

V80.4 Rider or occupant injured in collision with car, pick-up truck, van, heavy transport vehicle or bus

V80.5 Rider or occupant injured in collision with other specified motor vehicle

V810 - V811

V81.0 Occupant of railway train or railway vehicle injured in collision with motor vehicle in non-traffic accident

V81.1 Occupant of railway train or railway vehicle injured in collision with motor vehicle in traffic accident

V820 -V821

V82.0 Occupant of streetcar injured in collision with motor vehicle in non-traffic accident

V82.1 Occupant of streetcar injured in collision with motor vehicle in traffic accident

V830 - V833

V83.0 Driver of special industrial vehicle injured in traffic accident

V83.1 Passenger of special industrial vehicle injured in traffic accident

V83.2 Person on outside of special industrial vehicle injured in traffic accident

V83.3 Unspecified occupant of special industrial vehicle injured in traffic accident

V840 - V843

V84.0 Driver of special agricultural vehicle injured in traffic accident

V84.1 Passenger of special agricultural vehicle injured in traffic accident

V84.2 Person on outside of special agricultural vehicle injured in traffic accident

V84.3 Unspecified occupant of special agricultural vehicle injured in traffic accident

V850 - V853

V85.0 Driver of special construction vehicle injured in traffic accident

V85.1 Passenger of special construction vehicle injured in traffic accident

V85.2 Person on outside of special construction vehicle injured in traffic accident

V85.3 Unspecified occupant of special construction vehicle injured in traffic accident

V870 - V878

V87.0 Person injured in collision between car and two- or three-wheeled motor vehicle (traffic)

V87.1 Person injured in collision between other motor vehicle and two- or three-wheeled motor vehicle (traffic)

V87.2 Person injured in collision between car and pick-up truck or van (traffic)

V87.3 Person injured in collision between car and bus (traffic)

V87.4 Person injured in collision between car and heavy transport vehicle (traffic)

V87.5 Person injured in collision between heavy transport vehicle and bus (traffic)

V87.6 Person injured in collision between railway train or railway vehicle and car (traffic)

V87.7 Person injured in collision between other specified motor vehicles (traffic)

V87.8 Person injured in other specified non collision transport accidents involving motor vehicle (traffic)

V880 - V888

V88.0 Person injured in collision between car and two- or three-wheeled motor vehicle, non-traffic

V88.1 Person injured in collision between other motor vehicle and two- or three-wheeled motor vehicle, non- traffic

V88.2 Person injured in collision between car and pick-up truck or van, non-traffic

V88.3 Person injured in collision between car and bus, non-traffic

V88.4 Person injured in collision between car and heavy transport vehicle, non-traffic

V88.5 Person injured in collision between heavy transport vehicle and bus, non-traffic

V88.6 Person injured in collision between railway train or railway vehicle and car, non-traffic

V88.7 Person injured in collision between other specified motor vehicles, non-traffic

V88.8 Person injured in other specified non collision transport accidents involving motor vehicle, non-traffic

V89.2 **P**erson injured in unspecified motor-vehicle accident, traffic

Other Transport' for Mortality Data includes:

V87 Traffic accident of specified type but victim's mode of transport unknown
Excludes: collision involving: pedal cyclist, pedestrian

V87.0 Person injured in collision between car and two- or three-wheeled motor vehicle (traffic)

V87.1 Person injured in collision between other motor vehicle and two- or three-wheeled motor vehicle (traffic)

V87.2 Person injured in collision between car and pick-up truck or van (traffic)

V87.3 Person injured in collision between car and bus (traffic)

V87.4 Person injured in collision between car and heavy transport vehicle (traffic)

V87.5 Person injured in collision between heavy transport vehicle and bus (traffic)

V87.6 Person injured in collision between railway train or railway vehicle and car (traffic)

V87.7 Person injured in collision between other specified motor vehicles (traffic)

V87.8 Person injured in other specified non collision transport accidents involving motor vehicle (traffic)

V87.9 Person injured in other specified (collision)(non-collision) transport accidents involving non motor vehicle (traffic)

V88 Non traffic accident of specified type but victim's mode of transport unknown
Excludes: collision involving: pedal cyclist, pedestrian

V88.0 Person injured in collision between car and two- or three-wheeled motor vehicle, non-traffic

V88.1 Person injured in collision between other motor vehicle and two- or three-wheeled motor vehicle, non-traffic

V88.2 Person injured in collision between car and pick-up truck or van, non-traffic

V88.3 Person injured in collision between car and bus, non-traffic

V88.4 Person injured in collision between car and heavy transport vehicle, non-traffic

V88.5 Person injured in collision between heavy transport vehicle and bus, non-traffic

V88.6 Person injured in collision between railway train or railway vehicle and car, non-traffic

V88.7 Person injured in collision between other specified motor vehicles, non-traffic

V88.8 Person injured in other specified non collision transport accidents involving motor vehicle, non- traffic

V88.9 Person injured in other specified (collision) (non-collision) transport accidents involving non motor vehicle, non-traffic

V89 Motor- or non-motor vehicle accident, type of vehicle unspecified

V89.0 Person injured in unspecified motor-vehicle accident, non-traffic motor vehicle accident NOS, non-traffic

V89.1 Person injured in unspecified non-motor vehicle accident, non-traffic
Non-motor vehicle accident NOS (non-traffic)

V89.2 Person injured in unspecified motor-vehicle accident, traffic
Motor-vehicle accident

APPENDIX 3

Older Data from ICBC for the IHA Region

Data and Limitations

ICBC data contain information on crashes, entities, and individual participants. For example, 1 crash could involve two cars (entities), and five participants (three people in one car; two in the other). There is no way to link between these datasets to determine which participants belong to which entities and crashes. The data available in each of these three datasets differ slightly, as not all fields are available across the three datasets. Data are not current.

Data were cleaned prior to analysis, removing and correcting incorrectly allocated crashes, entities, and participants. For example, some crashes were assigned an Interior Health LHA, whereas their geocoded location showed outside IH boundaries. In the case of a discrepancy, the geocode was taken as the location of incidence.

Not all crashes have geographic coordinates, and those that do have been truncated by ICBC, making location- based analysis less precise (off by up to 1000m in any direction).

Some crashes listed within Interior Health had coordinates well outside IH boundaries and were subsequently removed.

Findings & Analysis

All Crashes

Between 2003 and 2007, the Insurance Corporation of British Columbia reported 21,857 road motor vehicle crashes within Interior Health Authority boundaries where someone was either injured or killed. Of these crashes, 652 were fatal, while 21,205 involved personal injuries. Within these crashes, there were 35,732 entities, and 52,532 participants involved.

Table 1 shows the breakdown of crashes by Local Health Area and Crash Type. Unsurprisingly, the greatest number and highest percentage of crashes occur in the Central Okanagan (22.6%) and Kamloops (15.9%) local health areas. These are the largest urban centres within Interior Health and draw significant tourist populations in the summer months. Lillooet local health area shows the lowest percentage of crashes, with 0.1%. However, it also has the highest proportion of fatal crashes, with greater than 19% (6 fatal / 31 total crashes). The Interior Health fatal crash rate is 3%.

Table 1: Crashes by Local Health Area and Type of Crash

Local Health Area	Fatal		Personal Injury		All Crashes		Population 2007
	# of Fatal Crashes	% of Fatal Crashes	# of Injury Crashes	% of Injury Crashes	Total	% of Total Crashes	
100 Mile House	22	3.4%	528	2.5%	550	2.5%	14,354
Armstrong-Spallumcheen	11	1.7%	269	1.3%	280	1.3%	9,292
Arrow Lakes	5	0.8%	171	0.8%	176	0.8%	4,695
Cariboo-Chilcotin	35	5.4%	728	3.4%	763	3.5%	26,159
Castlegar	11	1.7%	368	1.7%	379	1.7%	12,856
Central Okanagan	80	12.3%	4,868	23.0%	4,948	22.6%	173,647
Cranbrook	13	2.0%	618	2.9%	631	2.9%	24,782
Creston	13	2.0%	298	1.4%	311	1.4%	12,235
Enderby	5	0.8%	235	1.1%	240	1.1%	7,503
Fernie	24	3.7%	389	1.8%	413	1.9%	14,378
Golden	26	4.0%	513	2.4%	539	2.5%	7,053
Grand Forks	15	2.3%	227	1.1%	242	1.1%	8,821
Kamloops	75	11.5%	3,397	16.0%	3,472	15.9%	10,7021
Keremeos	14	2.1%	161	0.8%	175	0.8%	5,007
Kettle Valley	6	0.9%	223	1.1%	229	1.0%	3,561
Kimberley	4	0.6%	188	0.9%	192	0.9%	8,102
Kootenay Lake	4	0.6%	102	0.5%	106	0.5%	3,780
Lillooet	6	0.9%	25	0.1%	31	0.1%	4,306
Merritt	28	4.3%	858	4.0%	886	4.1%	11,428
Nelson	16	2.5%	573	2.7%	589	2.7%	24,154
North Thompson	16	2.5%	145	0.7%	161	0.7%	4,252
Penticton	16	2.5%	1,013	4.8%	1,029	4.7%	40,987
Princeton	15	2.3%	387	1.8%	402	1.8%	4,942
Revelstoke	19	2.9%	276	1.3%	295	1.3%	7,90
100 Mile House	22	3.4%	528	2.5%	550	2.5%	14,354
Armstrong-Spallumcheen	11	1.7%	269	1.3%	280	1.3%	9,292
Arrow Lakes	5	0.8%	171	0.8%	176	0.8%	4,695
Cariboo-Chilcotin	35	5.4%	728	3.4%	763	3.5%	26,159
Castlegar	11	1.7%	368	1.7%	379	1.7%	12,856
Central Okanagan	80	12.3%	4,868	23.0%	4,948	22.6%	173,647
Cranbrook	13	2.0%	618	2.9%	631	2.9%	24,782
Creston	13	2.0%	298	1.4%	311	1.4%	12,235
Enderby	5	0.8%	235	1.1%	240	1.1%	7,503
Fernie	24	3.7%	389	1.8%	413	1.9%	14,378
Salmon Arm	54	8.3%	962	4.5%	1,016	4.6%	33,319
South Cariboo	30	4.6%	488	2.3%	518	2.4%	7,127
Southern Okanagan	15	2.3%	492	2.3%	507	2.3%	19,033
Summerland	6	0.9%	197	0.9%	203	0.9%	11,458
Trail	12	1.8%	396	1.9%	408	1.9%	19,011
Vernon	35	5.4%	1,749	8.2%	1,784	8.2%	63,339
Windermere	21	3.2%	361	1.7%	382	1.7%	9,781
Grand Total	**652**	**100%**	**21,205**	**100%**	**21,857**	**100%**	**704,283**

Seasonality

An examination of crashes by month (Table 2) reveals that more crashes occur in July (11%) and August and December (10% each) than other months. Even after removing the Central Okanagan and Kamloops (separately or simultaneously), July and August still had the highest volume of crashes. This suggests that crash risk increases during summer months, most likely due to increased traffic (see Table 3 for a sample).

Table 1: Crashes by Month and Type of Crash

	Fatal		Personal Injury		Total Crashes	
Accident Month	**# of Fatal Crashes**	**% of Fatal Crashes**	**# of Injury Crashes**	**% of Injury Crashes**	**Total**	**% of Total**
January	52	8.0%	1777	8.4%	1829	8.4%
February	28	4.3%	1252	5.9%	1280	5.9
March	44	6.7%	1330	6.3%	1374	6.3%
April	47	7.2%	1316	6.2%	1363	6.2%
May	43	6.6%	1622	7.6%	1665	7.6%
June	58	8.9%	1883	8.9%	1941	8.9%
July	70	10.7%	2240	10.6%	2310	10.6%
August	75	11.5%	2161	10.2%	2236	10.2%
September	46	7.1%	1772	8.4%	1818	8.3%
October	64	9.8%	1832	8.6%	1896	8.7%
November	60	9.2%	1927	9.1%	1987	9.1%
December	65	10.0%	2093	9.9%	2158	9.9%
Grand Total	**652**	**100%**	**21205**	**100%**	**21857**	**100%**

Weather did not appear to be a major factor, with the majority of crashes (54%) occurring in clear weather conditions (47% of fatal; 54% of personal injury). Snowy conditions accounted for 8% of all crashes (6% of fatal; 8% of crashes with injury).

Road Type

Motor vehicle crashes between 2003 and 2007 within Interior Health occurred primarily on provincial highways, with more than 53% of the total. A further 36% occurred on municipal roads, while only 11% occurred on rural roads. Provincial highways had far more fatalities than the other two road types, with 76% of all fatal crashes (Figure 1), compared to personal injury crashes, where only 52% occurred on a provincial highway (Figure 2).

Figure 1: Fatal Crashes by Road Type

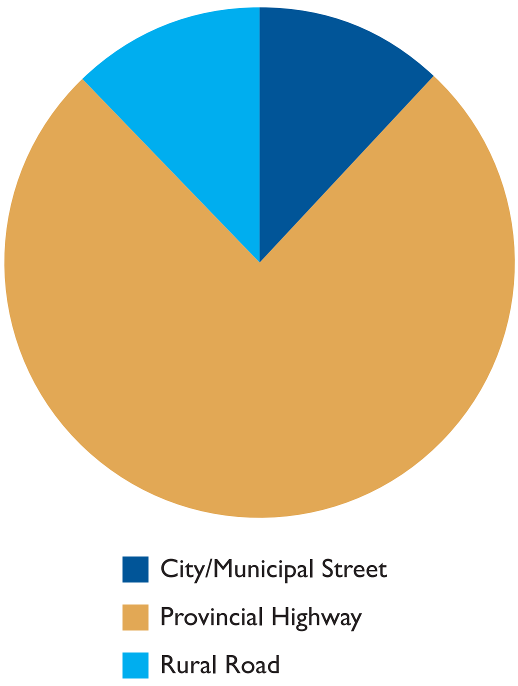
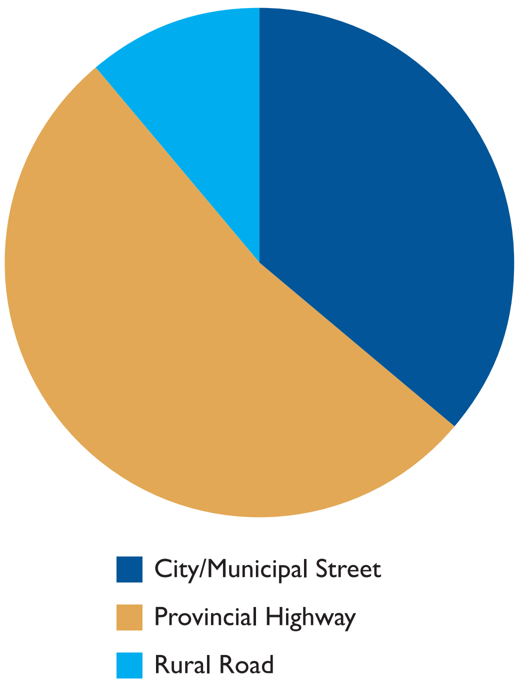


Figure 2: Personal Injury Crashes by Road Type



Crashes by Geographic Location Road crashes by fatal and non-fatal injury by section of highway and per kilometer of highway Interior Health Authority Region 2003-2007 (Data by volume of traffic not available More recent data unavailable, Data provided by ICBC to Brent Harris of IHA)

The following are breakdowns of fatal (Figure 3) and personal injury (Figure 4) crashes by speed range. The 90-100km/hr speed range shows the most fatalities, with provincial highways making up the bulk of that classification (over 40% of all fatal crashes). The greatest volume of personal injury crashes occurred in the 30-50km/hr range, where municipal streets are the primary road type (more than 30% of all personal injury crashes). These figures highlight that higher speeds appear to cause more fatalities than lower speeds.

Of the 21,857 crashes during this time period, only 17,264 (79%) had geographic coordinates to allow for mapping and spatial analysis. Even so, those with coordinates had been stripped by ICBC down to two decimal places, reducing the precision of locating these crashes. All attempts have been made to most appropriately allocate the crashes; however, placements could be off by as much as 1000m in any direction.

The maps show crashes on provincial highways, as indicated by the ICBC dataset. The crashes identified as occurring on a highway were mapped at their imprecise coordinates, then snapped to the nearest provincial highway. Highways were broken up into sections any time there was an intersection of two or more highways. This method provides a fairly simple allocation of crashes along provincial highways while also allowing for targeted recommendations.

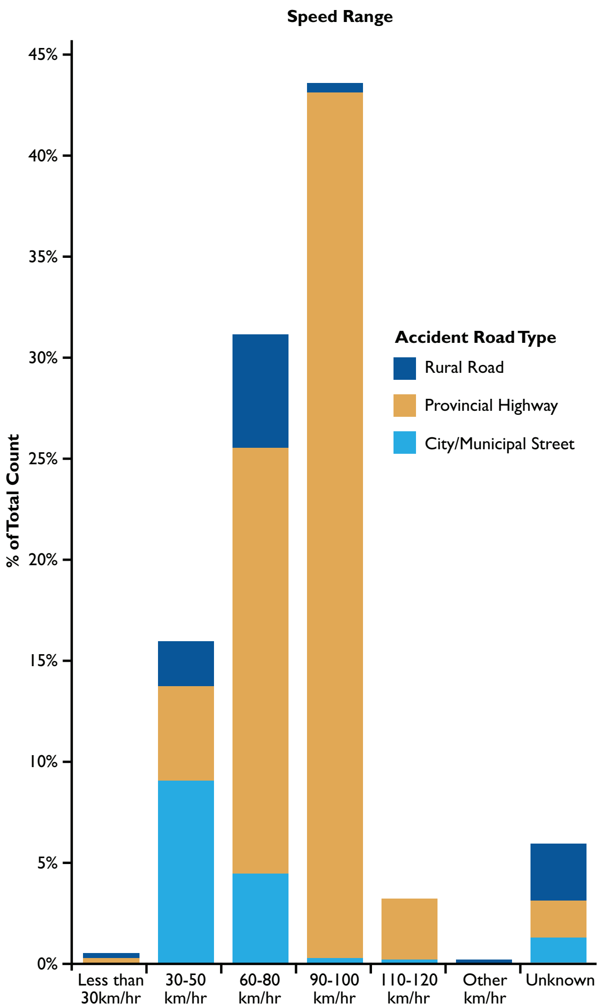


Figure 3:
Fatal Crashes by Road Type and Speed Range

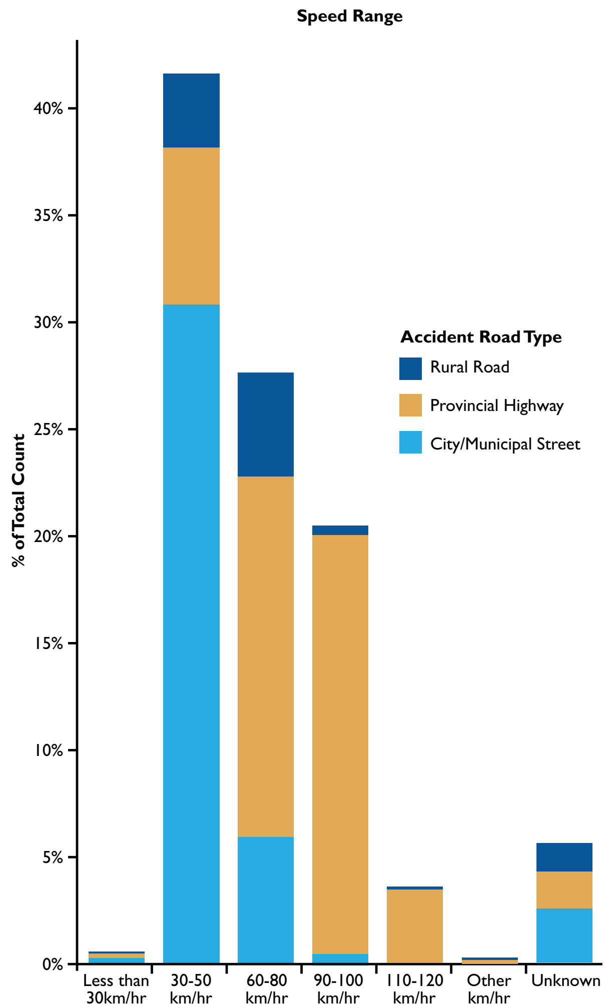


Figure 4:
Personal Injury Crashes by Road Type and Speed Range

Figure 5 shows the highway sections that have the greatest number of personal injury crashes within Interior Health Authority boundaries. Highway 97 as it runs through the City of Kelowna and District of West Kelowna (also known as Harvey Ave. with Kelowna city limits) contains the greatest absolute number of personal injury crashes with more than 1,000 between 2003 and 2007. This is more than twice the amount of the next greatest volume. This section of highway is also among the shortest in this analysis, resulting in the highest number of per kilometre personal injury crashes as well (Figure 6). On a per kilometre basis, this section of highway has more than three times as many personal injury crashes as any other section. Other sections of highway with large volumes are crashes include the sections of highway between:

Revelstoke and Golden; West Kelowna and Merritt; Kelowna north to Vernon, south to Penticton and east/south to Rock Creek; Salmon Arm through Chase en route to Kamloops; 100 Mile House to Williams Lake; Nakusp to Vernon; and Merritt south towards Hope. On a per kilometre basis, the sections of highway between Vernon and Penticton (in addition to Kelowna) along Highway 97 have high rates of personal injury crashes.

Figure 5

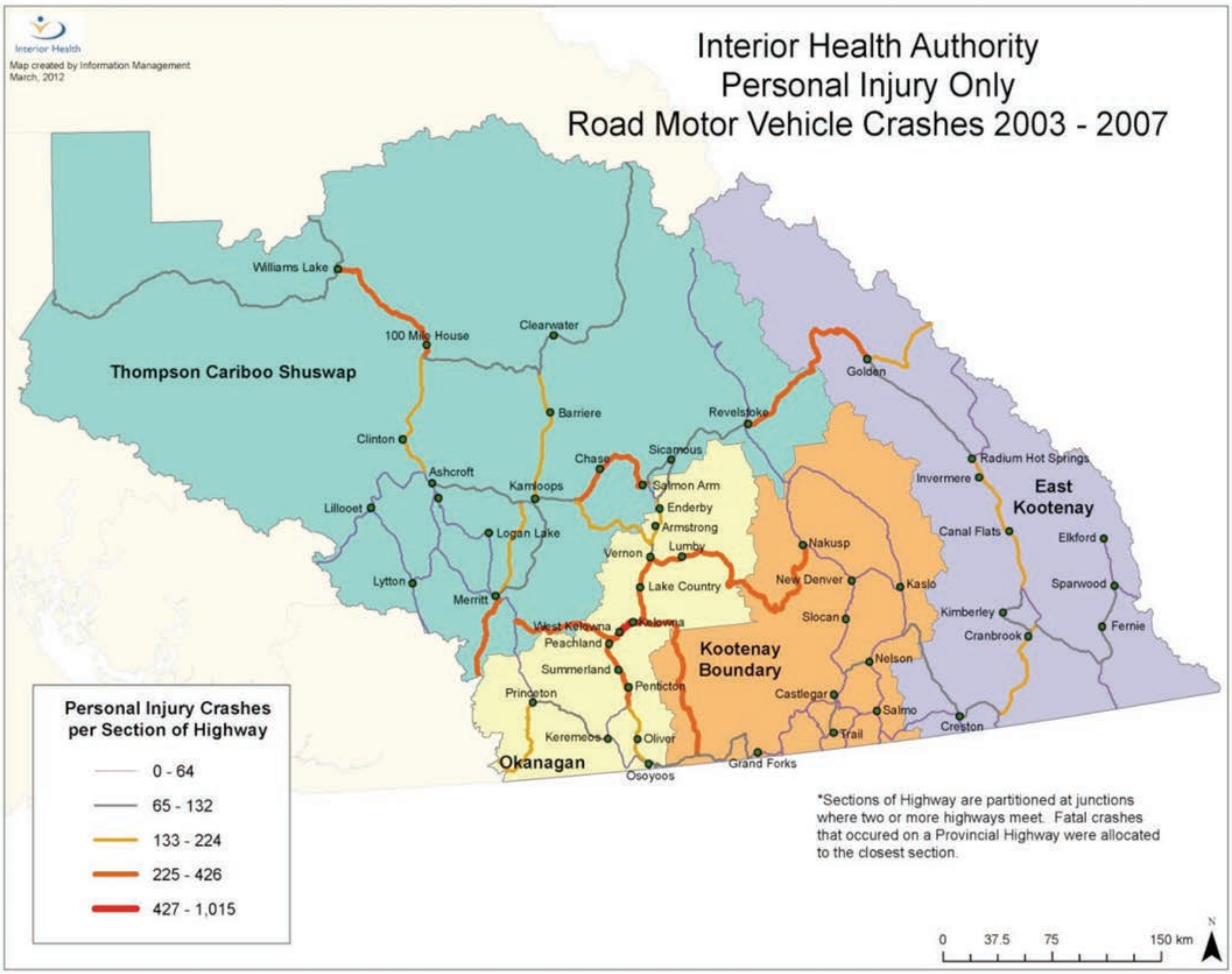
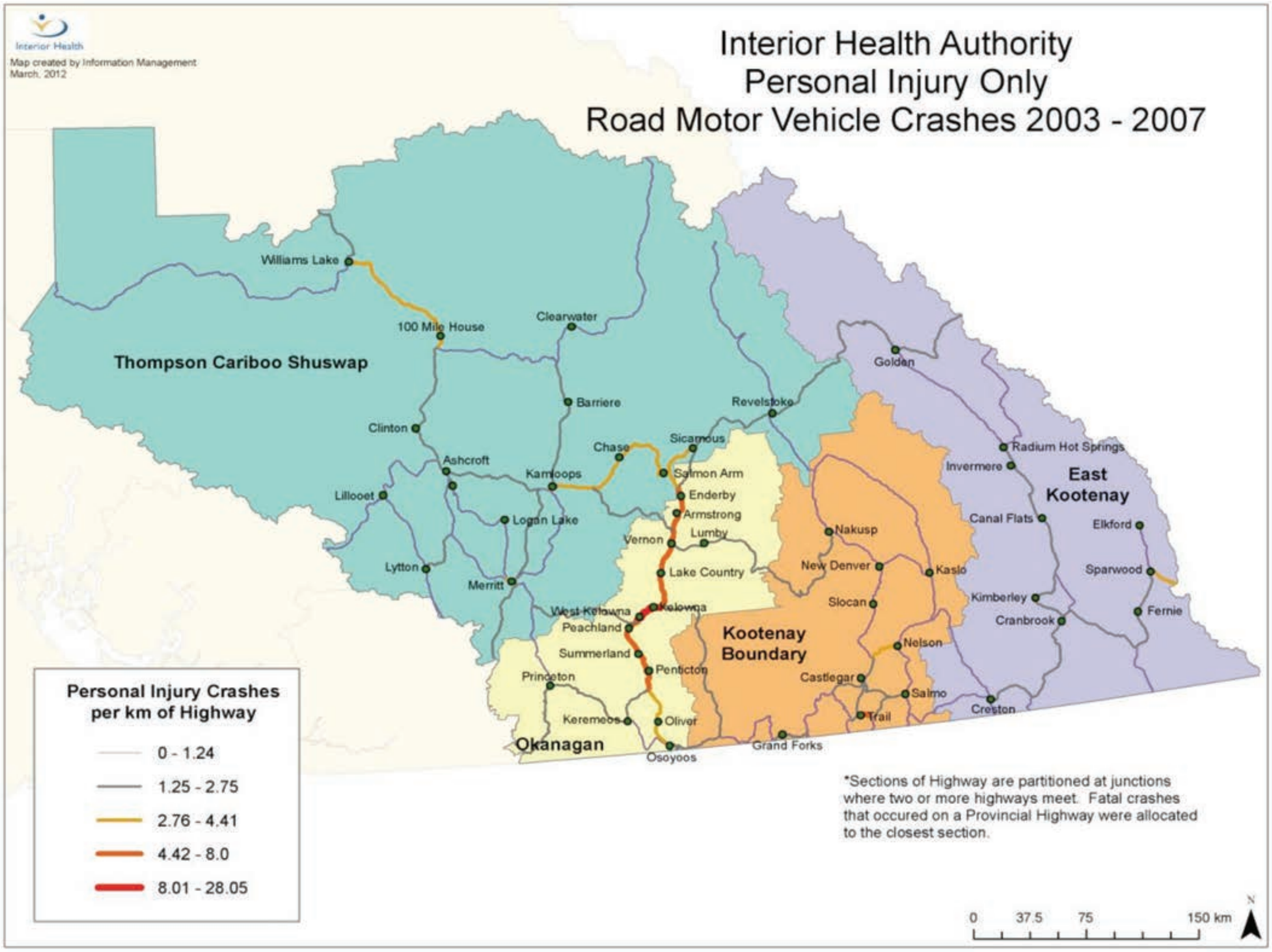


Figure 6



Fatal crashes are presented in Figures 7 and 8. The greatest number of fatal crashes can be found in the sections of highway between Revelstoke and Golden; and Salmon Arm through Chase en route to Kamloops (Figure 7). In terms of fatal crashes per kilometre of highway, the sections from Sicamous to Salmon Arm, and on through Chase; Kelowna north all the way to Enderby; Castlegar north towards Nelson; and Sparwood east into Alberta all show high rates.

Figure 7

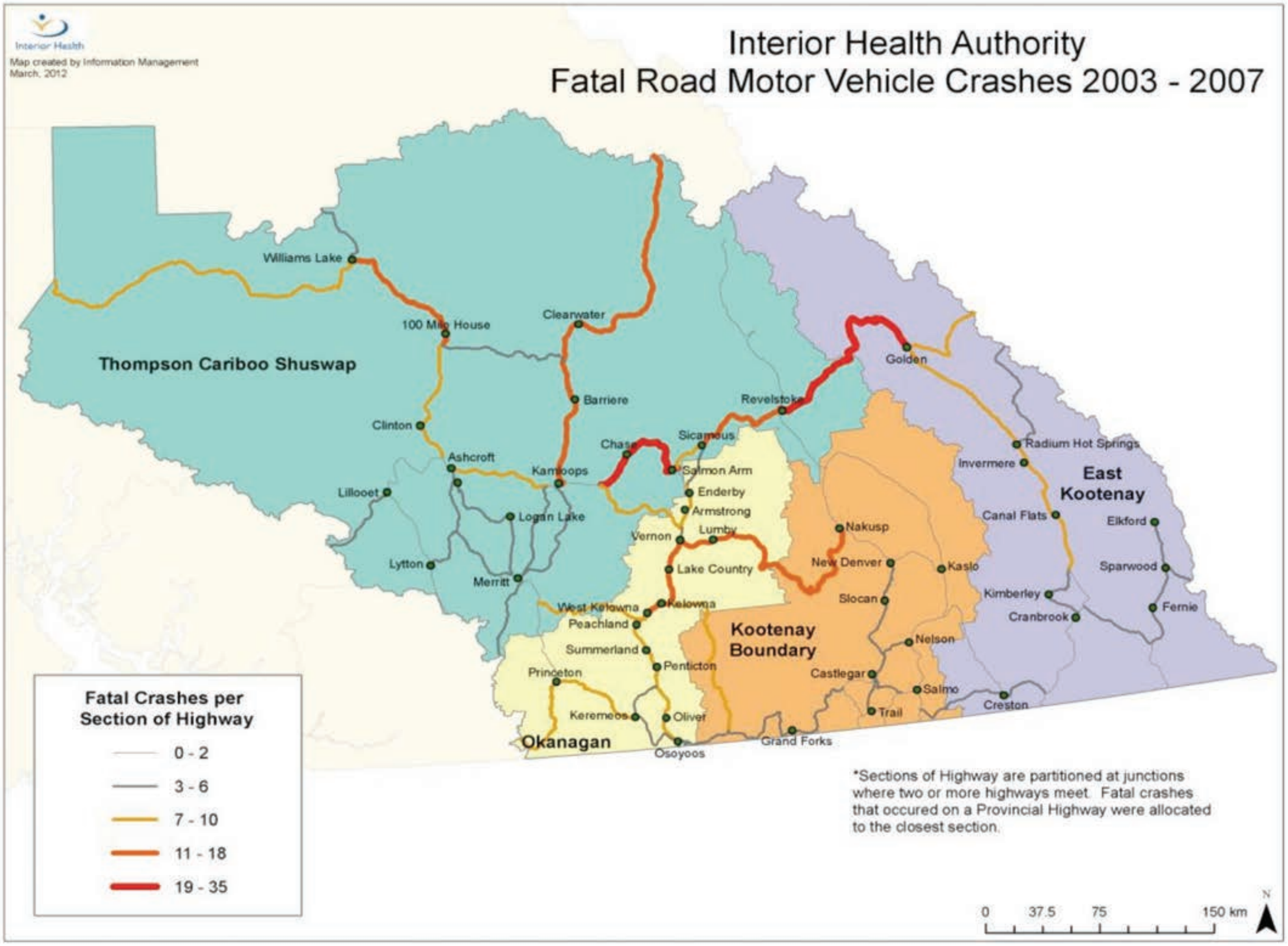

Interior Health
Map created by Information Management
March, 2012
Interior Health Authority
Fatal Road Motor Vehicle Crashes 2003 - 2007
Thompson Cariboo Shuswap
Okanagan
Kootenay Boundary
East Kootenay
Williams Lake
100 Mile House
Clearwater
Barriere
Clinton
Ashcroft
Kamloops
Lillooet
Logan Lake
Lytton
Merritt
Chase
Sicamous
Salmon Arm
Enderby
Armstrong
Lumby
Vernon
Lake Country
Revelstoke
Golden
Radium Hot Springs
Invermere
Canal Flats
Elkford
Sparwood
Fernie
Kimberley
Cranbrook
Nakusp
New Denver
Kaslo
Slocan
Nelson
Castlegar
Salmo
Trail
Creston
Grand Forks
West Kelowna
Kelowna
Peachland
Summerland
Penticton
Princeton
Keremeos
Oliver
Osoyoos
Fatal Crashes per Section of Highway
0 - 2
3 - 6
7 - 10
11 - 18
19 - 35
*Sections of Highway are partitioned at junctions where two or more highways meet. Fatal crashes that occured on a Provincial Highway were allocated to the closest section.
0 37.5 75 150 km
N

Figure 8


Interior Health
Map created by Information Management
March, 2012
Interior Health Authority
Fatal Road Motor Vehicle Crashes 2003 - 2007
Thompson Cariboo Shuswap
Williams Lake
100 Mile House
Clearwater
Barriere
Clinton
Ashcroft
Kamloops
Lillooet
Logan Lake
Lytton
Merritt
Chase
Sicamous
Salmon Arm
Enderby
Armstrong
Lumby
Vernon
Lake Country
Revelstoke
Golden
Radium Hot Springs
Invermere
East
Kootenay
Canal Flats
Elkford
Sparwood
Fernie
Kimberley
Cranbrook
Nakusp
New Denver
Kaslo
Slocan
Nelson
Castlegar
Salmo
Trail
Creston
Kootenay
Boundary
Grand Forks
West Kelowna
Kelowna
Peachland
Summerland
Penticton
Princeton
Keremeos
Oliver
Osoyoos
Okanagan
Fatal Crashes per
km of Highway
0 - 0.026
0.027 - 0.07
0.071 - 0.13
0.131 - 0.213
0.214 - 0.41
*Sections of Highway are partitioned at junctions where two or more highways meet. Fatal crashes that occured on a Provincial Highway were allocated to the closest section.
0
37.5
75
150 km
N

Table 3: Crash Numbers by Community, Interior Health Authority, 2011

Community	Crashes	Injured Victims	Pedestrian Crashes
Castlegar	570	180	5
Cranbrook	1,360	240	10
Creston	340	50	5
Fernie	290	50	n/a
Golden	380	90	n/a
Invermere	190	20	0
Kamloops	5,500	1,610	50
Kelowna	7,580	2,570	60
Kimberley	260	40	n/a
Merritt	960	380	5
Nelson	890	150	n/a
Osoyoos	370	40	5
Penticton	1,870	440	30
Revelstoke	450	100	0
Rossland	160	20	0
Salmon Arm	800	190	5
Summerland	380	100	n/a
Trail	540	100	n/a
Vernon	3,000	820	20
Williams Lake	1,030	210	n/a
Other*	10,120	2,480	30
Total	**37,040**	**9880**	**225**

Note: Injured Victims data do not include categories on severity, hospitalisation, fatalities

Source: Adapted from ICBC available at url: ***http://www.icbc.com/about-ICBC/Newsroom/southern-interior.pdf***
Accessed 17 April 2013

Data specific to communities can also be located at the ICBC under community road safety snapshots For example for Kamloops at: http://www.icbc.com/road-safety/community/Kamloops_snapshot.pdf, while specific numbers can be found at: http://public.tableausoftware.com/views/AzIntersectionCrashesfortheSouthernInterior0711/SIDashboa rd?:embed=y. A limitation of ICBC data is that they do not provide information about specific external causes, nature, and severity of injury, except for fatality versus personal injury. This is where health data are crucial.

It is of concern that despite the high cost of road injury, death and disability, very little money is being spent by ICBC on interventions to make roads safer, for example $204,000 in Kamloops and $84,000 in Kelowna for 2011.