

2007

Compensated fatalities following a work injury: Comparison of Québec, Ontario and British Columbia, 1997-2003

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Duguay, P. et Massicotte, P. (2007). *Compensated fatalities following a work injury: Comparison of Québec, Ontario and British Columbia, 1997-2003* (Rapport n° R-529). IRSST.

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REPORT R-529



Compensated Fatalities Following a Work Injury: Comparison of Québec, Ontario and British Columbia, 1997-2003

*Patrice Duguay
Paul Massicotte*



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Bibliothèque et Archives nationales

2007

ISBN: 978-2-89631-193-4 (print format)

ISBN: 978-2-89631-194-1 (PDF)

Original Edition: ISBN: 978-2-89631-134-7

ISSN: 0820-8395

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en santé et en sécurité du travail,

September 2007



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SUMMARY

At the time of this study, no study existed comparing the risks of work-related fatalities in Québec and in any of the Canadian provinces or territories. Since then, a study was published in December 2006 but it does not present comparable risk indicators for the provinces. The rarity of these studies is not due to a lack of interest, but rather to the methodological difficulties in producing comparable provincial indicators. A request from the CSST's prevention-inspection division led to this comparative study of the provinces. Its goal was to compare the overall situation of work-related fatalities in three Canadian provinces, and to produce, if possible, comparable risk indicators for work-related fatalities. Because of these original aspects, this study is exploratory.

The main difficulty lies in the fact that the coverage of the provincial programs is not the same, and that it varies, among other things, by economic activity sector, the type of company, and the category of worker. To reduce the scope of the task, the study was limited to three provinces: Québec, Ontario and British Columbia, namely the ones with the most workers. Also, in order to reduce the difficulties involved in calculating comparable incidence rates, the rates were calculated only for trauma fatalities in eight economic activity sectors: 1) mining, quarrying and oil well industries, 2) primary metal industries, 3) the logging industry, 4) sawmills, 5) machinery industries, 6) road transport, 7) construction, and 8) communications and other utility industries. These are the Québec sectors that have had the highest number or frequency of compensated work-related fatalities. It is highly likely that fishing and agriculture, two sectors that were not retained for methodological reasons, are sectors with a high fatality risk.

The data on compensated work-related fatalities come from the Association of Workers' Compensation Boards of Canada (AWCBC). They are the cases accepted and compensated by the provincial workers' compensation boards. The AWCBC data do not cover all work-related fatalities, since some of the workforce was not covered, particularly some self-employed workers. An IRSST study had revealed that only five of the twelve deaths that occurred in 1994 in the logging industry sector appeared in the CSST files. The data from the Statistics Canada 2001 census are used to estimate the workforce.

In Québec, the number of compensated work-related trauma fatalities fluctuated from 1997 to 2003, then increased until 2005, reaching a number similar to that in 1997. However, since 2001, the number of compensated work-related trauma fatalities has been the lowest in Québec, and the highest in Ontario. Furthermore, since 2003, the Québec and Ontario situations, with approximately 40% trauma fatalities and 60% disease fatalities, are practically the opposite of the situation in British Columbia.

Work-related trauma or disease fatalities involve many more men than women in the three provinces studied. Furthermore, for trauma fatalities, in more than three cases out of four, the worker was under 55 years of age at the time of death; for disease fatalities, the opposite was observed.

In Québec and Ontario, transportation accidents represent close to one-third of the trauma fatalities and more than half of this type of fatality in British Columbia. Transportation accidents are, by far, the type of event that causes the most deaths. They are followed by falls, which are twice as numerous in Ontario as in Québec or in British Columbia.

In Québec, the “caught in or compressed by equipment or objects” type accident, rather than falls, ranks second for trauma fatalities. This type of event ranks fourth in Ontario and in British Columbia.

All asbestos-related diseases (lung cancer, mesothelioma, asbestosis, pulmonary disease) represent more than half of the compensated work-related disease fatalities in each of the three provinces studied. The proportion is highest in Québec.

Of the eight sectors studied, those with the largest proportion of compensated work-related disease fatalities are construction, mining and the primary metal industries. Alone, they account for approximately half of the cases in each of the three provinces. However, in Québec, these three economic activity sectors account for the largest proportion of compensated work-related disease fatalities.

In Québec, in the eight economic activity sectors studied, work-related trauma fatality risks are highest in the logging industry, mining and quarrying, sawmills, road transport, and construction. For the other provinces, these economic activity sectors also have the highest fatality risk, but not in the same order of incidence rates as in Québec.

Of the eight economic activity sectors studied, Québec has five where the trauma-related fatality risks are lower than those in the other two provinces: mining and quarrying, the logging industry, primary metal industries, construction, and road transport. Québec has an incidence rate equal to or below the two other provinces for the communications and other public utility industries. For the two other sectors, Québec has incidence rates higher than the two other provinces; they are sawmills and the machinery industries. Overall, for the eight economic activity sectors studied, the trauma fatality risks for Québec workers are lower than those for Ontario or British Columbia.

In conclusion, the compensated accident fatality risks in Québec are lower than those of Ontario and British Columbia for the majority of the eight economic activity sectors analyzed. However, we have no information on the factors that could explain these differences. The factors could include such things as the differences in work organization, in prevention management, in the work environment, in the work methods, in the production processes, in worker protection, and in the safety of the products, vehicles, machines, equipment or tools used. More detailed studies, field studies or case studies could shed light on the factors involved.

ACKNOWLEDGEMENTS

The production of this document was made possible due to the contribution of many people. First, we would like to thank Gilles Ricard, Sylvie Blouin and Manon Demers of the CSST's Direction de la comptabilité et de la gestion de l'information (DCGI), for their diligence and rigour in the production of the data necessary for this statistical study.

We also want to thank Denise Granger, assistant to the IRSST's scientific director, for the relevance of her comments on the first version of this report.

TABLE OF CONTENTS

SUMMARY	i
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	v
LIST OF TABLES	vi
LIST OF GRAPHS	vi
GLOSSARY	vii
1. INTRODUCTION	1
2. METHODOLOGY	3
3. OVERVIEW	5
3.1 Highlights.....	5
3.2 Workforce	6
3.3 Compensated work injury fatalities	7
3.4 Traumas.....	8
3.4.1 Numbers and proportions.....	8
3.4.2 By gender	10
3.4.3 By age	10
3.4.4 By event or exposure	11
3.5 Diseases.....	13
3.5.1 Numbers and proportions.....	13
3.5.2 By gender	13
3.5.3 By age	14
3.5.4 By the nature of the injury	15
4. TRAUMA FATALITY RISKS	17
4.1 Highlights.....	17
4.2 Numbers and proportions.....	18
4.3 Incidence rate	20
5. DISEASE FATALITY RISKS	25
5.1 Highlights.....	25
5.2 Numbers and proportions.....	26
5.3 Incidence rate	27
6. CONCLUSION.....	29
BIBLIOGRAPHY.....	31
APPENDIX A - DETAILED METHODOLOGY.....	33

LIST OF TABLES

Table 3.1: Number and proportion of workers covered by the provincial compensation programs, Québec, Ontario, British Columbia, 2000-2002	6
Table 4.1: Estimates of the average number and proportion of workers covered by the provincial occupational injury compensation program, by economic activity, Québec, Ontario, British Columbia, 2000 to 2002.....	18
Table 4.2: Number and proportion of compensated work-related trauma fatalities, by economic activity, Québec, Ontario, British Columbia, combined for the 2000 to 2002 period.....	19
Table 4.3: Estimate of the theoretical number of trauma fatalities in Québec, for the eight sectors studied, if the workers in Québec had the same trauma fatality risks as those in Ontario or British Columbia in the years 2000 to 2002	22
Table 5.1: Number and proportion of compensated work-related disease fatalities for the eight economic activity sectors retained, Québec, Ontario, British Columbia, combined for the 2000 to 2002 period	26

LIST OF GRAPHS

Graph 3.1: Evolution in the number of compensated work-related fatalities, Québec, Ontario and British Columbia, 1997-2005.....	7
Graph 3.2: Proportion of compensated work-related trauma fatalities, Québec, Ontario and British Columbia, 1997 to 2005.....	8
Graph 3.3: Evolution in the number of compensated work-related trauma fatalities, Québec, Ontario and British Columbia, 1997 to 2005.....	9
Graph 3.4: Relative distribution, by gender, of the compensated work-related trauma fatalities, Québec, Ontario and British Columbia, 1997 to 2003.....	10
Graph 3.5: Relative distribution, by age, of the compensated work-related trauma fatalities, Québec, Ontario and British Columbia, 1997 to 2003.....	11
Graph 3.6: Relative distribution, by event or exposure, of the compensated work-related trauma fatalities, Québec, Ontario and British Columbia, 1997 to 2003.....	12
Graph 3.7: Evolution in the annual number of compensated work-related disease fatalities, Québec, Ontario and British Columbia, 1997 to 2005.....	13
Graph 3.8: Relative distribution, by gender, of the compensated work-related disease fatalities, Québec, Ontario and British Columbia, 1997 to 2003.....	14
Graph 3.9: Relative distribution, by age, of the compensated work-related disease fatalities, Québec, Ontario and British Columbia, 1997 to 2003.....	15
Graph 3.10: Relative distribution, by the nature of illness, of the compensated work-related disease fatalities, Québec, Ontario, British Columbia, 1997-2003.....	16
Graph 4.1: Incidence rate, per 10,000 paid workers, for work-related trauma fatalities by economic activity, Québec, Ontario, and British Columbia, 2000-2002.....	21

GLOSSARY

AIAOD	Acronym for the “Act respecting industrial accidents and occupational diseases”, which came into effect in 1985 in Québec.
AWCBC	Acronym for the Association of Workers’ Compensation Boards of Canada.
Compensated claim	This term is used here as a synonym for compensated injury.
Compensated work-related fatality	Fatality that occurred following an industrial accident or an occupational disease recognized and compensated by a provincial work injury compensation board.
CSA	Acronym for the Canadian Standards Association.
CSST	Acronym for the “Commission de la santé et sécurité du travail du Québec” (Québec workers’ compensation board).
Disease	A disease that arises out of or in the course of an industrial accident, or an occupational disease.
Economic activity sector	Group of economic activities based on the Statistics Canada 1980 Standard Industrial Classification (SIC-80), which is comparable to the 1984 Québec economic activity classification (CAEQ-84)
Employment injury (work injury)	“An injury or a disease arising out of or in the course of an industrial accident, or an occupational disease, including a recurrence, relapse or aggravation” (Québec, AIAOD, sect.2).
Event or exposure	Name of the variable used in CSA classification Z795 to describe the way in which the injury or disease was produced or inflicted by the source of injury or illness.
Fatality incidence rate	Average annual number of fatalities per 10,000 workers.
IA	Acronym for industrial accident or work-related accident.
Industrial accident	“A sudden and unforeseen event, attributable to any cause, which happens to a person, arising out of or in the course of his work and resulting in an employment injury to him” (Gouvernement du Québec, AIAOD, Sect. 2).
Nature of injury or illness	Name of the variable used in CSA classification Z795 to identify and code the principal physical characteristic(s) of the injury or disease.
Occupational disease	“A disease contracted out of or in the course of work and characteristic of that work or directly related to the risks peculiar to that work” (Québec, AIAOD, Sect. 2).
OHS	Acronym for the term “occupational health and safety”.

Trauma	An injury that arises out of or in the course of an industrial accident.
WCA	Acronym for the Québec Workers' Compensation Act, which was replaced by the AIAOD in 1985.
Work injury	See "Employment Injury".

1. INTRODUCTION

At the time of this study, no study existed that compared the risks of work-related fatalities in Québec and in any of the Canadian provinces or territories. Since then, a study was published in December 2006 (Sharpe and Hardt, 2006), but it does not present comparable risk indicators for the provinces¹. The rarity of these studies is not due to a lack of interest, but rather to the methodological difficulties in producing comparable provincial indicators. Because of these original aspects, the present study is exploratory.

The Association of Workers' Compensation Boards of Canada (AWCBC) publishes data on fatalities by province (AWCBC, 2004) but they are only compilations of the raw numbers of fatalities by province in relation to different variables (economic activity, profession, etc.). The document contains no risk indicator for work-related deaths. Also, there is no distinction between accident fatalities and disease fatalities. However, it is an important distinction to be made when comparing fatality indicators between provinces for the purpose of orienting prevention activities.

The current study was carried out at the request of the CSST's Prevention-Inspection Division. The results are intended to serve as a reference for evaluating the effect of the means of prevention implemented by this division as well as to confirm the relevance and orientations of the CSST's prevention program.

The objective of this exploratory activity is to compare the overall situation of work-related deaths for three provinces (Québec, Ontario and British Columbia) as well as to compare the fatality risks, if possible. Chapter 3 presents the situation for all of the compensated work injury fatalities but also by differentiating traumas from diseases. In addition to describing the evolution in the number of fatalities during the 1997 to 2005 period, the tables present the differences by age, gender, event or exposure, and the nature of the injury or illness for the years 1997 to 2003.

Chapter 4 presents the risk indicators by province, namely the 2000-2002 incidence rate for compensated work-related trauma fatalities for eight economic activity sectors:

- Mining, quarrying and oil well industries
- Primary metal industries
- Logging industry
- Sawmills
- Machinery industries (except electrical machinery)
- Road transport
- Construction

¹ The mortality rates were calculated without taking into account the differences in the coverage rates of the provincial compensation programs. Therefore, in this study, to calculate the mortality rate, the number of fatalities compensated by the provincial compensation board is divided by the total number of workers in the province, whether they are covered or not by the compensation program. This favours an underestimation of the mortality rates for the provinces with a low coverage rate, such as Ontario, whose coverage rate is estimated at 68%.

- Communications and other utility industries

Before the conclusion, a final chapter discusses, for the eight economic activity sectors, data on the number of compensated work-related disease fatalities. For methodological reasons, no risk indicators were produced for compensated work-related disease fatalities.

2. METHODOLOGY

This section presents a summary of the main aspects of the methodology (see Appendix A for more details).

To reduce the scope of the task and improve the comparability of the results, the study was limited, in the production of risk indicators, to three provinces (Québec, Ontario and British Columbia) and to seven priority sectors, based on the CSST classification: there are in fact eight distinct economic activity sectors according to the 1984 Québec economic activity classification (CAEQ)². Besides Québec, the two other provinces retained are those with the highest populations.

The sectors were chosen on the basis of two criteria relating to Québec data: having had, during the 1998 to 2000 period (period for which we had indicators), more than five fatalities compensated by the CSST and a work-related fatality incidence rate higher than the Québec average.

The greatest difficulty in this study is to produce comparable risk indicators for the provinces. To calculate these indicators, the number of fatalities (numerator) must be related to the workforce covered by the program (denominator). Each province has detailed information on compensated work-related fatalities but they do not have data on the insured workforce by economic activity. An estimate published on the AWCBC web site indicates that, overall, approximately 94% of the workforce in Québec and British Columbia is covered, compared to 68% in Ontario.

The data on work-related fatalities, for the years 1997 to 2003, were supplied by the Association of Workers' Compensation Boards of Canada (AWCBC). These data involve the accepted and compensated cases for each of the provinces. We have added information, for the years 2004 and 2005, solely relating to the number of cases per injury category (trauma or disease).

Detailed data were obtained by economic activity sector and by province for the years 1997 to 2003, and summary data for the years 2004 and 2005. These fatalities are classified by the year of the acceptance of the death for compensation purposes. These data do not cover all of the work-related fatalities because some of the workers were not insured, in particular some of the self-employed workers. An IRSST study on the logging industry (Hébert, Cloutier, Massicotte and Lévy, 1997) mentioned that of the twelve deaths that occurred in 1994, only five were recorded in the CSST's files.

For the descriptive analyses, it would have been desirable to retain the distinction between industrial accident fatalities and occupational disease fatalities, as defined in the Québec AIAOD. However, the data from the AWCBC files do not allow this distinction to be made. Nevertheless, it was possible to differentiate disease fatalities from those that resulted from an injury (trauma), based on the "nature of injury or illness" variable, which is coded using the same classification (CSA Z795) in each of the provinces. Therefore, even if a disease is caused by an industrial accident, it will be included among the diseases. For example, if a nurse accidentally

² This classification requires minor changes in order to be comparable to the Statistics Canada 1980 Standard Industrial Classification, which is used for the AWCBC data.

pricks herself with a contaminated needle and gets a fatal disease, her death will be included among the diseases and not the accidents.

From the data of the 2001 population census (Statistics Canada), the workforces by economic activity sector could be estimated. Since the compensation program covers only a very small proportion of self-employed workers, at least in Québec, it was preferable to exclude them from the workforce. In fact, only the compilations on paid workers were retained from the survey data, which excludes approximately two-thirds of the self-employed workers.

Compensated work-related injury fatality risks were estimated from the incidence rate. By convention, this rate is an annual rate. More specifically, in this study, it corresponds to the average annual number of fatalities per 10,000 paid workers during the period from 2000 to 2002. Paid workers, taken from the 2001 population census, are used as an estimate of the average number of workers during the 2000 to 2002 period to calculate this rate.

The population at risk of suffering compensated work-related fatalities is difficult to estimate for work-related disease fatalities. In fact, considerable time may have elapsed between the period of exposure to the risk factors that are involved in the disease and the worker's death. For these deaths, the number of workers during the year of acceptance of the fatalities is not a good estimate of the population at risk of these deaths, namely the population that was exposed to the risk factors several years beforehand, in the majority of cases. In addition, this period of time between the risk-exposure period and the death can vary from one disease to another. For all these reasons, it is risky to calculate an incidence rate for diseases that caused a work-related fatality. As a result, we did not calculate these rates for fatalities resulting from work-related diseases.

Fishing and agriculture are economic activities for which we have probably underestimated the fatality risk. They were not retained for this study due to a lack of suitable data to represent them properly. For example, in agriculture, there are many self-employed owners and workers for whom the provincial board's coverage is optional and who, in the majority of cases, have not taken it; however, the data that we have available do not allow this reality to be considered.

Due to these data-related limitations, the only risk indicator produced is the trauma fatality incidence rate for eight economic activities in each of the three provinces studied. Furthermore, while the methodological choices described above have limited the scope of this indicator, their main purpose is to increase its validity. In the end, we consider that the incidence rates produced are sufficiently valid to allow comparisons between the three provinces studied.

3. OVERVIEW

3.1 Highlights

- The coverage rate for the compensation program is estimated at approximately 94% for the workforce of Québec and British Columbia, and 68% for Ontario;
- In Québec, the total number of compensated work-related injury fatalities dropped significantly in 1999, remained rather stable until 2004, and then increased in 2005. While Ontario has approximately only 20% more covered workers than Québec, its number of compensated work-related fatalities has been almost double since 2002;
- During the 1999 to 2003 period, Québec had nearly two times more covered workers than British Columbia, but only slightly more compensated work injury fatalities. However, since then, the difference in the number of deaths has increased;
- Since 2003, the Québec and Ontario situations, with approximately 40% trauma fatalities and 60% disease fatalities, have been practically the opposite of what has happened in British Columbia;
- In Québec, the number of compensated work-related trauma fatalities fluctuated from 1997 to 2003, and then increased in 2004 and 2005. Since 2001, Québec has had the fewest trauma fatalities of the three provinces studied;
- Regardless of the province, in more than 94% of cases, it is men who suffer compensated work injury fatalities;
- For trauma fatalities, in more than three cases out of four, the worker was under 55 years of age at the time of death; for disease fatalities, it was the opposite;
- In Québec and Ontario, transportation accidents represent close to one-third of the trauma fatalities, compared to half in British Columbia. Transportation accidents constitute, by far, the most important event that causes deaths. These accidents are followed by falls in Ontario and British Columbia, and by being caught in or compressed by equipment or objects in Québec;
- In Québec, the number of compensated work-related disease fatalities, after decreasing from 1997 to 1999, increased until 2004 and particularly in 2005. In Ontario, during this same period, this type of fatality almost doubled. In British Columbia, it tended to increase slightly;
- All asbestos-related diseases (lung cancer, mesothelioma, asbestosis or pulmonary disease) represent more than half of the compensated work-related disease fatalities in each of the three provinces studied. In Québec, this proportion is the highest.

The production of work-related fatality risk indicators requires the collection of information on the fatalities as well as on the workers covered by the provincial occupational injury

compensation programs. First, workforce data will be presented, and second, information on all of the work-related fatalities. Trauma fatality risk indicators are presented in Chapter 4. For methodological reasons, occupational disease fatality risk indicators have not been produced.

3.2 Workforce

There are no direct measurements of the number of workers covered by the provincial compensation programs, which constitutes a major problem in calculating incidence rates. However, the AWCBC publishes, on its web site³, an overall estimate of the coverage rates of compensation programs. We used this rate, combined with the workers in the 2001 census, to estimate the total number of workers covered for the years 2000 to 2002 (Table 3.1).

Table 3.1: Number and proportion of workers covered by the provincial compensation programs, Québec, Ontario, British Columbia, 2000-2002

Category of workers	Workforce					
	Québec		Ontario		British Columbia	
	N	%	N	%	N	%
Covered	3,219,228	94.1%	3,888,128	68.2%	1,751,268	93.9%
Not covered	200,632	5.9%	1,815,727	31.8%	114,032	6.1%
Total	3,419,860	100.0%	5,703,855	100.0%	1,865,300	100.0%

Note: The average of the coverage rates for the 2000-2002 period was calculated from the annual estimates of the rates published on the AWCBC web site.

While the coverage rate for Québec and British Columbia workers is estimated at approximately 94%, this proportion is 68% for Ontario. One of the reasons for the different situation in Ontario is the large number of economic activities where insurance coverage is optional for Ontario employers, which is not the case in the two other provinces. In addition, Ontario has a larger number of economic activities where the employers are “personally responsible for the payments,” meaning that they must assume all of the payments related to their compensation files (AWCBC, 2005b). This is the case for municipal employers, airline companies, shipping companies, telephone companies, and employers in the public utilities field, among others.

Thus, the result of these differences is, even though Ontario has 2.284 million workers more than Québec, it has only 669,000 insured workers more than Québec (3.888 million compared to 3.219 million), namely a difference of approximately 21%. British Columbia, however, has 1.751 million workers covered out of a total of 1.865 million workers.

While this method could be used to estimate the population covered by the provincial compensation programs in these three provinces, it could not be used to estimate the number of workers covered by economic activity because neither the AWCBC nor any other organization

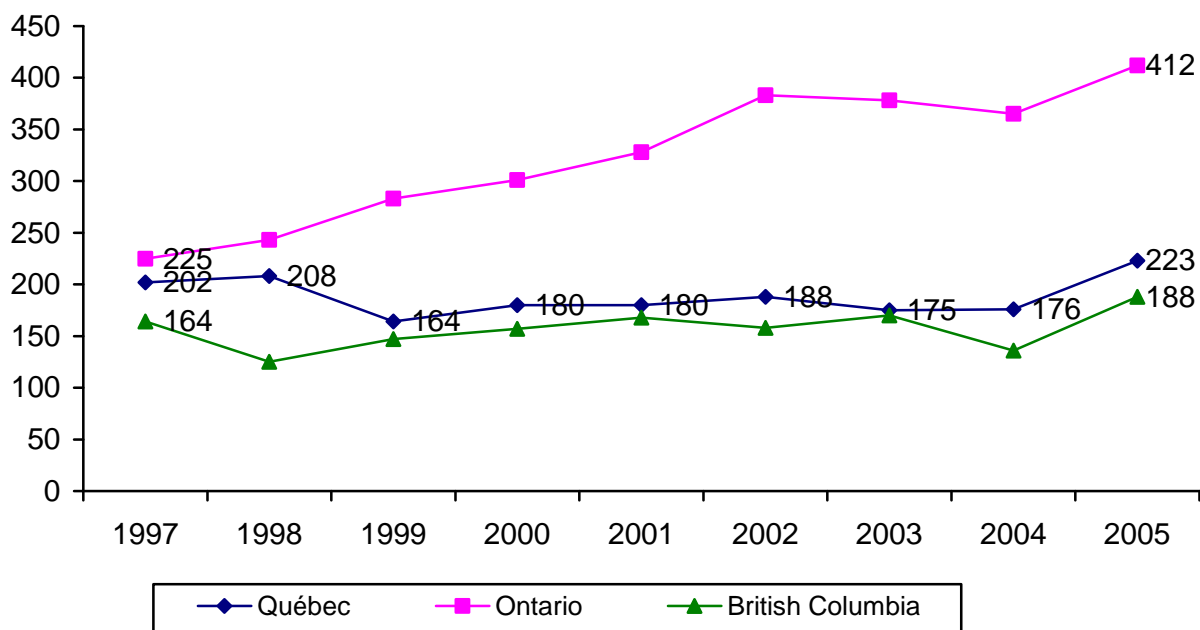
³ For more details, see the document “Key Statistical Measures for 2004” available on the AWCBC web site (http://www.awcbc.org/english/board_pdfs/2004KSMs.pdf).

publishes these coverage rates. The numbers of workers covered by economic activity were estimated from data from the Statistics Canada 2001 census.

3.3 Compensated work-related fatalities

The number of compensated work-related fatalities (Graph 3.1) dropped significantly in Québec between 1998 (208 deaths) and 1999 (164 deaths), then remained rather stable until 2004 (176 deaths), and then increased significantly in 2005 (223 deaths). A significant increase in the number of compensated work-related fatalities, from 2004 to 2005, is seen for each of the three provinces. Furthermore, Ontario, which has approximately 20% more covered workers than Québec, has had almost twice as many compensated work-related fatalities as Québec since 2002. In British Columbia, the number of compensated work-related fatalities, after having been well below that of Québec in 1997 and in 1998, was then close until 2003, and then approximately 20% below afterwards. However, these differences are less than those for workforces, with British Columbia having almost twice as few workers covered as Québec.

Graph 3.1: Evolution in the number of compensated work-related fatalities, Québec, Ontario and British Columbia, 1997-2005



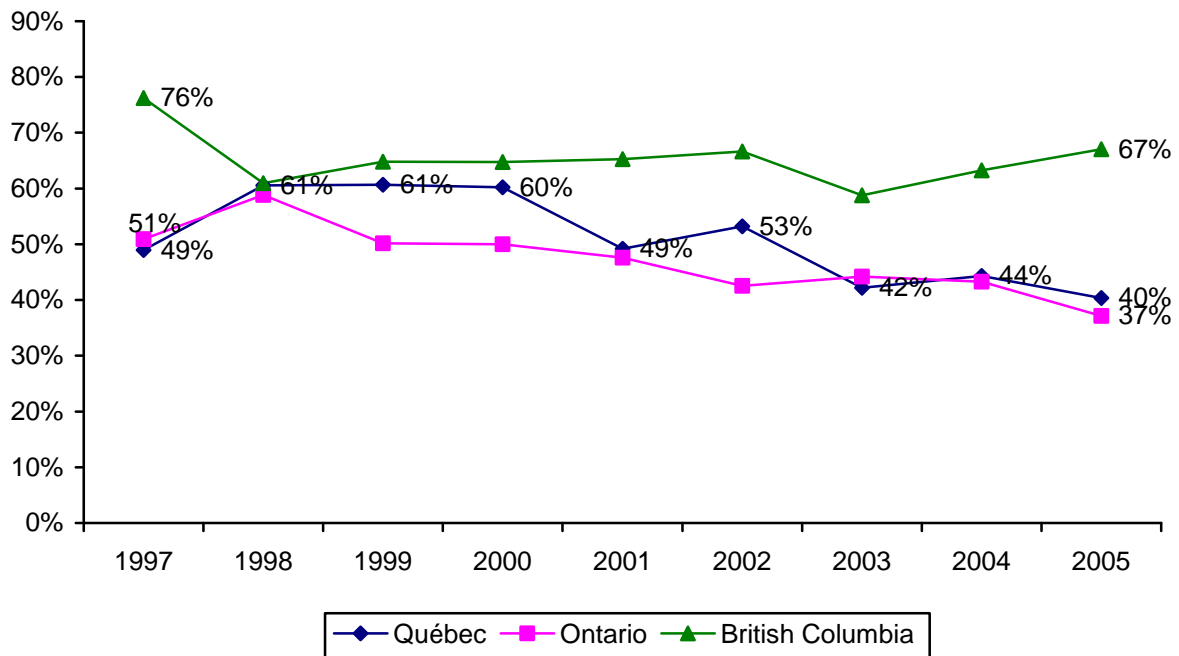
Analysis of all of the work-related fatalities is somewhat restrictive because it groups two very different aspects: traumas and diseases. While trauma refers to working conditions and circumstances at the time of the accident, occupational diseases generally relate to the working conditions and circumstances (exposure) that existed several years beforehand and that still exist or no longer exist at the time of death. Therefore, for comparability purposes, it is preferable to analyze traumas and diseases separately; this is what is done in the following sections.

3.4 Traumas

3.4.1 Numbers and proportions

The proportion of compensated work-related trauma fatalities increased in Québec from 1997 (49%) to 1998 (61%), and then, after a stable three-year period, tended subsequently to drop, reaching 44% in 2004 and 40% in 2005 (Graph 3.2). This evolution was similar for Ontario, namely an increase from 1997 (49%) to 1998 (59%), followed by a decrease until 2004 (43%) and 2005 (37%). The situation evolved differently in British Columbia, ending with an increase from 2003 (63%) to 2005 (67%). Since 2003, the Québec and Ontario situations, with approximately 40% trauma fatalities and 60% disease fatalities, are practically the opposite of that in British Columbia.

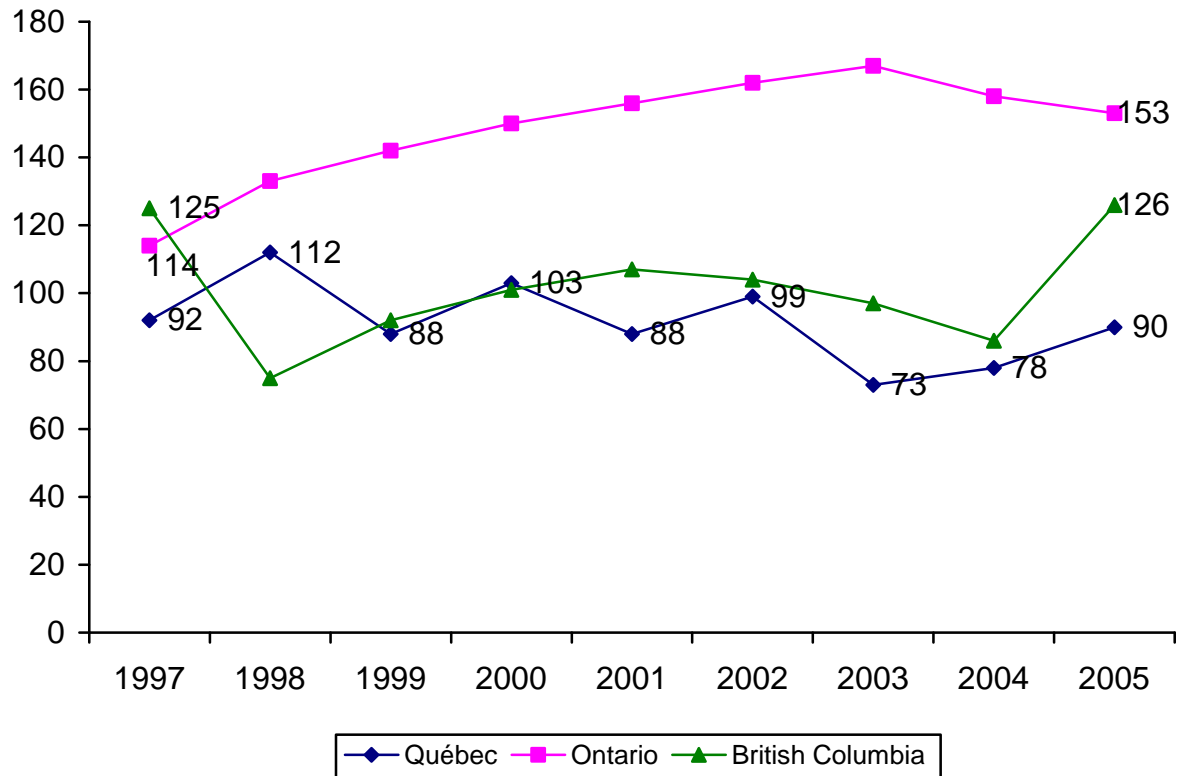
Graph 3.2: Proportion of compensated work-related trauma fatalities, Québec, Ontario and British Columbia, 1997 to 2005



Note: These proportions were calculated by excluding the cases whose nature of injury or illness was not coded or was coded as “not elsewhere classified.”

In Québec, the number of compensated work-related trauma fatalities fluctuated from 1997 (92 cases) to 2003 (73 cases), and then increased to 78 cases in 2004 and 90 cases in 2005, namely a number similar to that at the start of the period (Graph 3.3). This fluctuating evolution is different from that found in British Columbia or in Ontario.

Graph 3.3: Evolution in the number of compensated work-related trauma fatalities, Québec, Ontario and British Columbia, 1997 to 2005



In British Columbia, there was a significant reduction, from 1997 to 1998, in compensated work-related trauma fatalities, with their number decreasing from 125 to 75 deaths. From 1998 (75 deaths) to 2001 (107 deaths), the number of compensated work-related trauma fatalities increased and then decreased to reach 86 deaths in 2004, and jumped to 126 deaths in 2005, consequently returning to the number of deaths at the start of the period. Therefore, as in Québec, the number of compensated work-related trauma fatalities in 2005 returned to the 1997 value, thus cancelling the changes that had occurred.

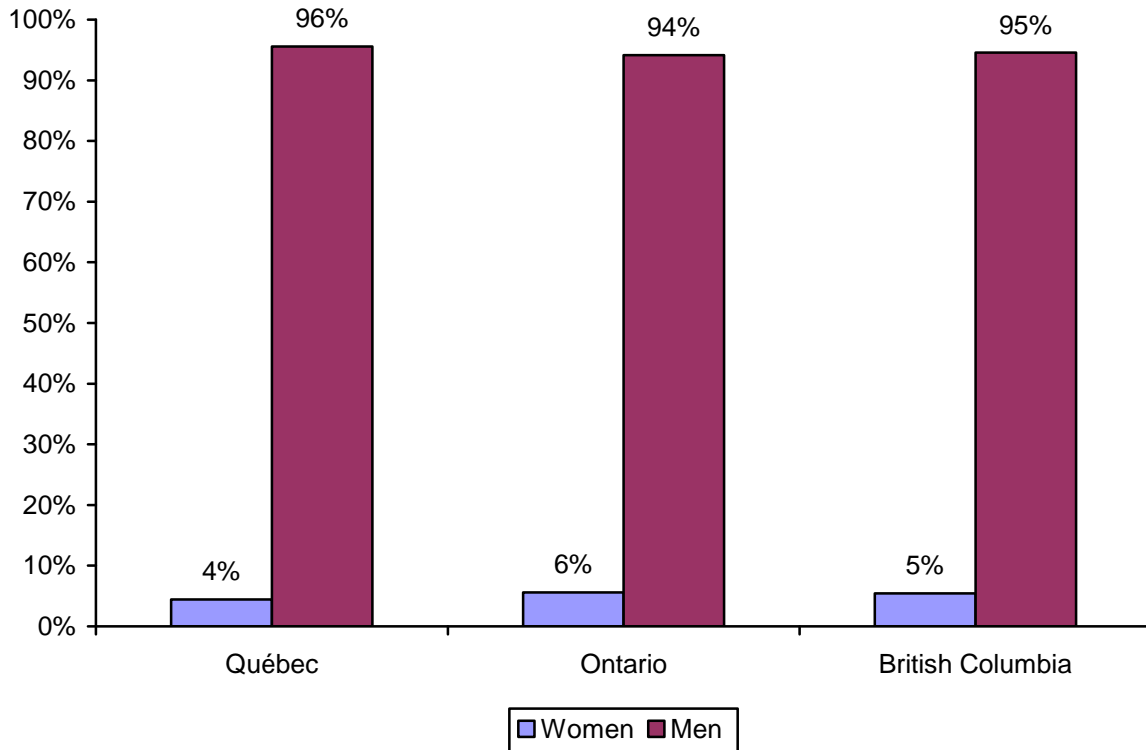
In Ontario there was an almost regular increase in the number of trauma fatalities between 1997 (114 deaths) and 2003 (167 deaths), and then a reduction in 2004 (158 deaths) and in 2005 (153 deaths). Despite this reduction since 2003, the number of trauma fatalities in 2005 was higher than that in 1997, the opposite of the situation in the two other provinces.

Overall, since 2001, the annual number of compensated work-related fatalities in Québec due to trauma has been less than that in Ontario and British Columbia.

3.4.2 By gender

Compensated work-related trauma fatalities involve more men than women. In each of the three provinces studied, more than 94% of the trauma fatalities are men (Graph 3.4). This proportion is slightly higher in Québec than in British Columbia or Ontario.

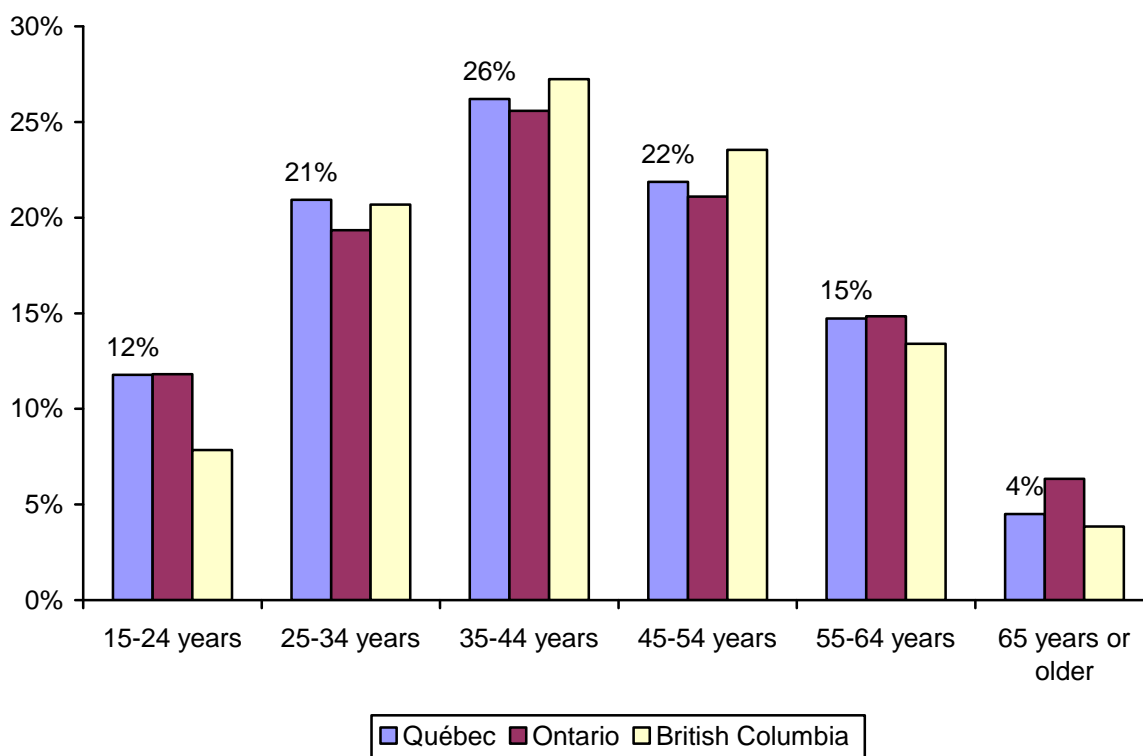
Graph 3.4: Relative distribution, by gender, of the compensated work-related trauma fatalities, Québec, Ontario and British Columbia, 1997 to 2003



3.4.3 By age

If the workers' ages at the time of death are taken into account, the situation is rather similar from one province to the next (Graph 3.5). Therefore, one-fourth of the trauma fatalities involve workers between 35 and 44 years of age. The two other age groups with the most trauma fatalities are the 45-54 years of age and 25-34 years of age groups. In total, more than three-fourths of the compensation applications accepted between 1997 and 2003 involved workers under 55 years of age at the time of death, regardless of the province. It should be noted that workers from 15-24 years of age account for slightly fewer trauma fatalities in British Columbia.

Graph 3.5: Relative distribution, by age, of the compensated work-related trauma fatalities, Québec, Ontario and British Columbia, 1997 to 2003

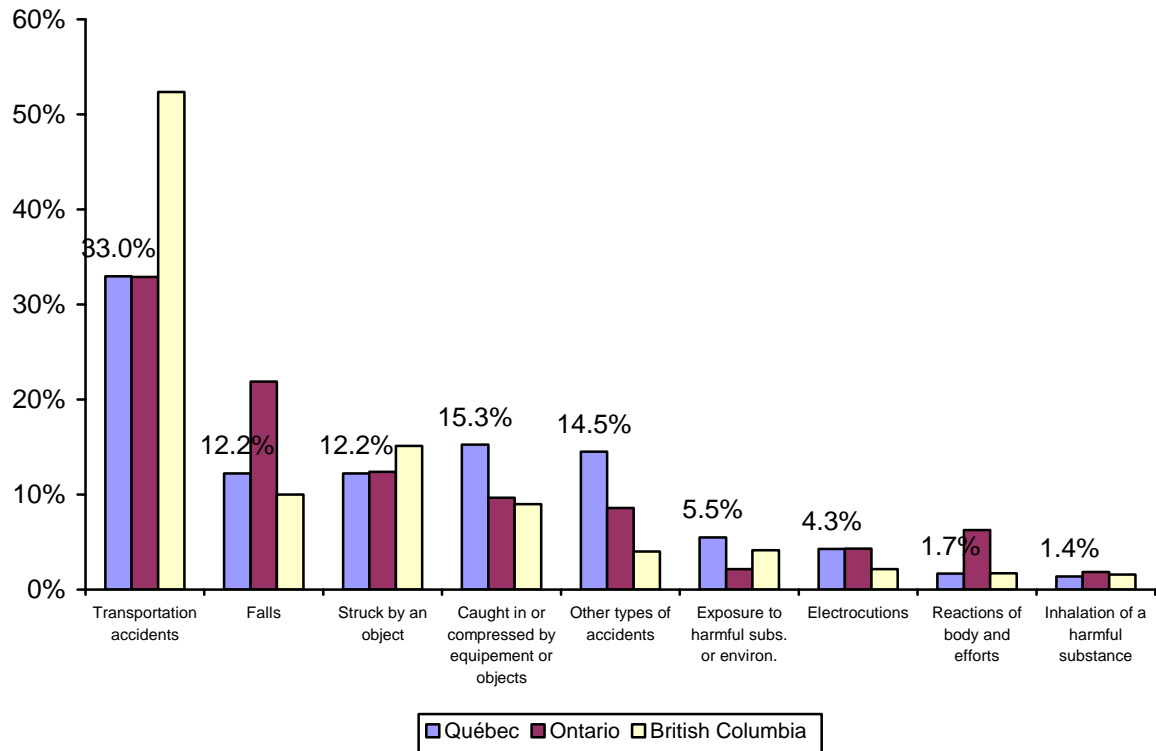


3.4.4 By event or exposure

Graph 3.6 presents the main types of accidents that led to compensated work-related trauma fatalities in the three provinces studied. In Québec and Ontario, transportation accidents represent close to one-third of the trauma fatalities; they account for more than half of the deaths in British Columbia. Transportation accidents are by far the most important event that causes deaths. They correspond, three times out of four, to road transportation accidents (data not presented). British Columbia stands out due to the proportion of air transportation accidents. In fact, these accidents represent close to one transportation accident in six. British Columbia is followed by Québec, with close to one air transportation accident out of ten transportation accidents, while this event accounts for less than one air transportation accident in twenty transportation accidents in Ontario (data not presented).

In Ontario, transportation accidents are followed by falls (22%), and in British Columbia by the “struck by an object” event (15%).

Graph 3.6: Relative distribution, by event or exposure, of the compensated work-related trauma fatalities, Québec, Ontario and British Columbia, 1997 to 2003



In Québec, it is not falls or “struck by an object” type accidents that rank second, but being caught in or compressed by equipment or objects (15%). This event ranks fourth in Ontario (10%) and in British Columbia (9%).

In Québec, 12% of the trauma fatalities result from being struck by a flying, swinging, sliding or falling object (materials, machinery, tree, etc.), which constitutes the 4th type of event, equal to falls. The “struck by an object” event has the same importance in Ontario as in Québec.

There are approximately twice as many fatalities that occur following *exposure to harmful substances or environments* in Québec (5%) as in Ontario (2%), but their importance is comparable to that of British Columbia (4%). This type of event includes, for example, drownings, contacts with a hot substance or object, or a hot environment, oxygen depletion in an enclosed, restricted or confined space, exposure to a caustic, harmful or allergenic substance, and the ingestion of a substance.

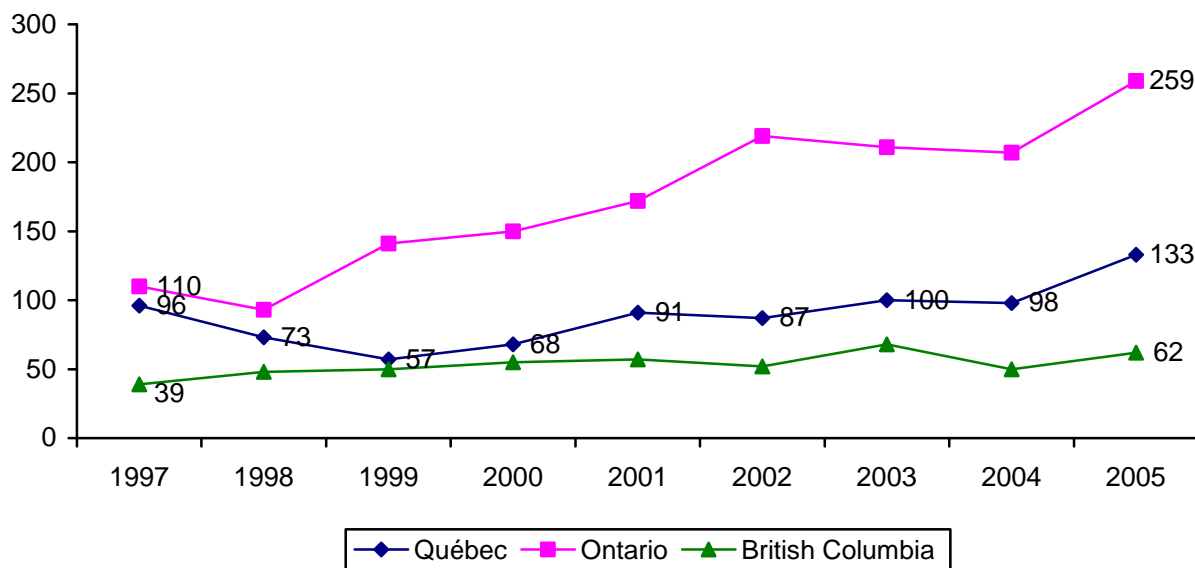
3.5 Diseases

3.5.1 Numbers and proportions

The number of compensated work-related disease fatalities in Québec (Graph 3.7) dropped by approximately half from 1997 (96 deaths) to 1999 (57 deaths), but then increased, reaching 98 deaths in 2004 and 133 in 2005, or more than at the start of the period. In British Columbia, there was an increasing trend from 1997 (39 deaths) to 2003 (68 deaths), their number then dropped to 50 in 2004, and then increased to 62 in 2005, or more than in 1997.

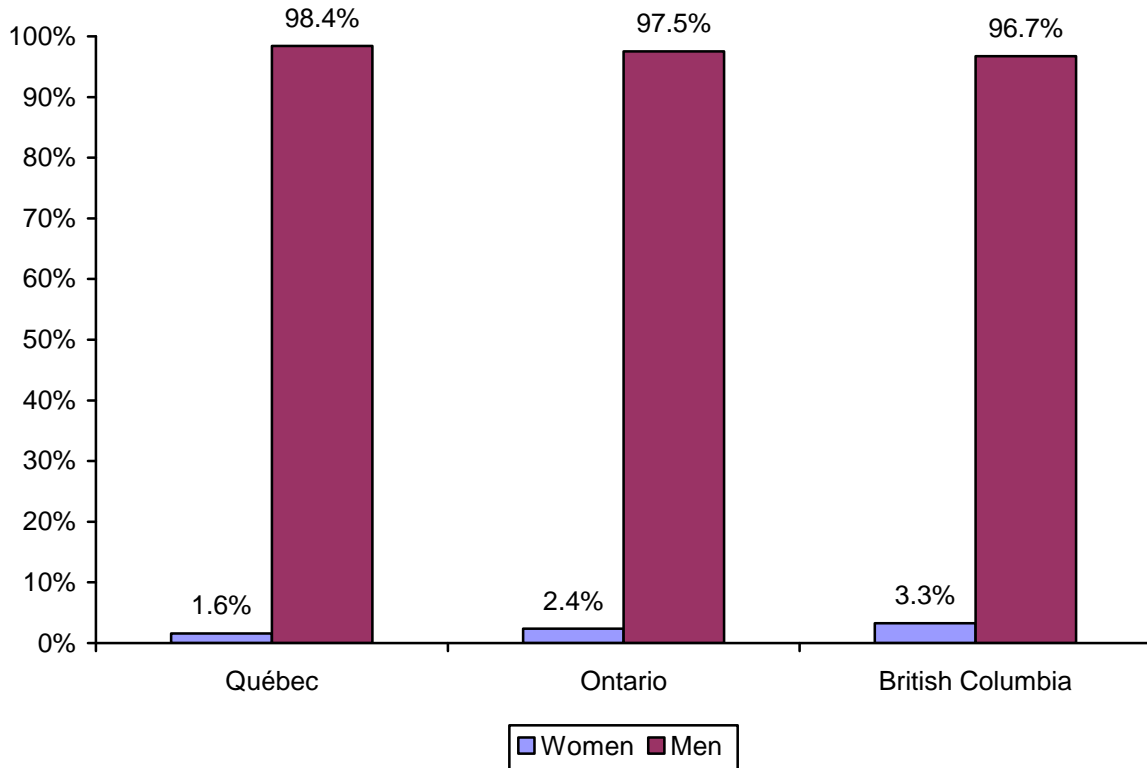
The changes were the most marked in Ontario for disease fatalities. After dropping from 1997 (110 deaths) to 1998 (93 deaths), the number more than doubled afterwards, reaching 219 deaths in 2002, and 259 in 2005.

Graph 3.7: Evolution in the annual number of compensated work-related disease fatalities, Québec, Ontario and British Columbia, 1997 to 2005



3.5.2 By gender

As in the case of trauma fatalities, compensated work-related disease fatalities essentially involve men (Graph 3.8). In fact, the proportions are slightly higher than for trauma, with more than 97% of the deceased workers. This proportion is similar from province to province. Furthermore, it should be noted that the proportion of deaths in women is two times higher in British Columbia (3.3%) than in Québec (1.6%).

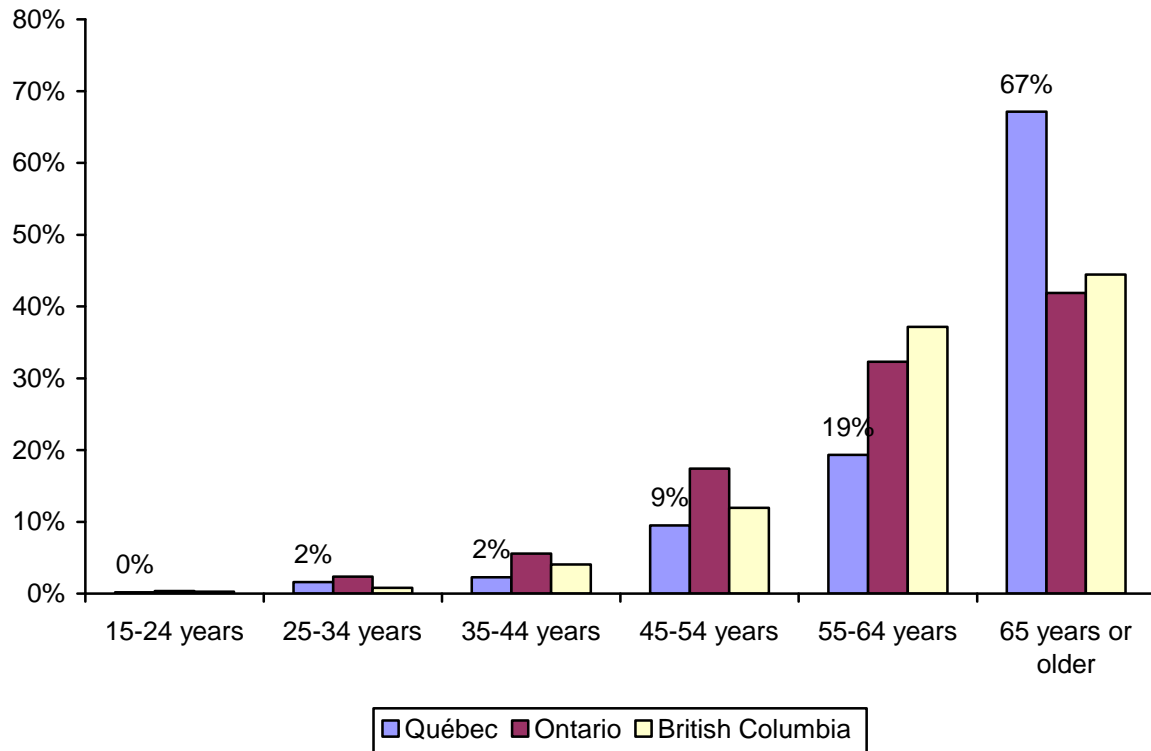
Graph 3.8: Relative distribution, by gender, of the compensated work-related disease fatalities, Québec, Ontario and British Columbia, 1997 to 2003

3.5.3 By age

Workers who died due to a work-related disease between 1997 and 2003 were in general much older than what we saw for trauma fatalities (Graph 3.9). They were 55 years of age or older in three cases out of four; this is the opposite of the situation for industrial accident fatalities. It is in Québec that workers are the oldest at the time of death. In fact, 67% are 65 years of age or older at the time of death, compared to 42% in Ontario and 44% in British Columbia.

Moreover, since the majority of the workers are 55 years of age or older at the time of death due to a work-related disease, it is highly probable that they are, in large part, ex-workers rather than workers, because these deaths occur at ages when the workers have generally left the workforce. This particular characteristic clearly differentiates compensated work-related disease fatalities from work-related accident fatalities.

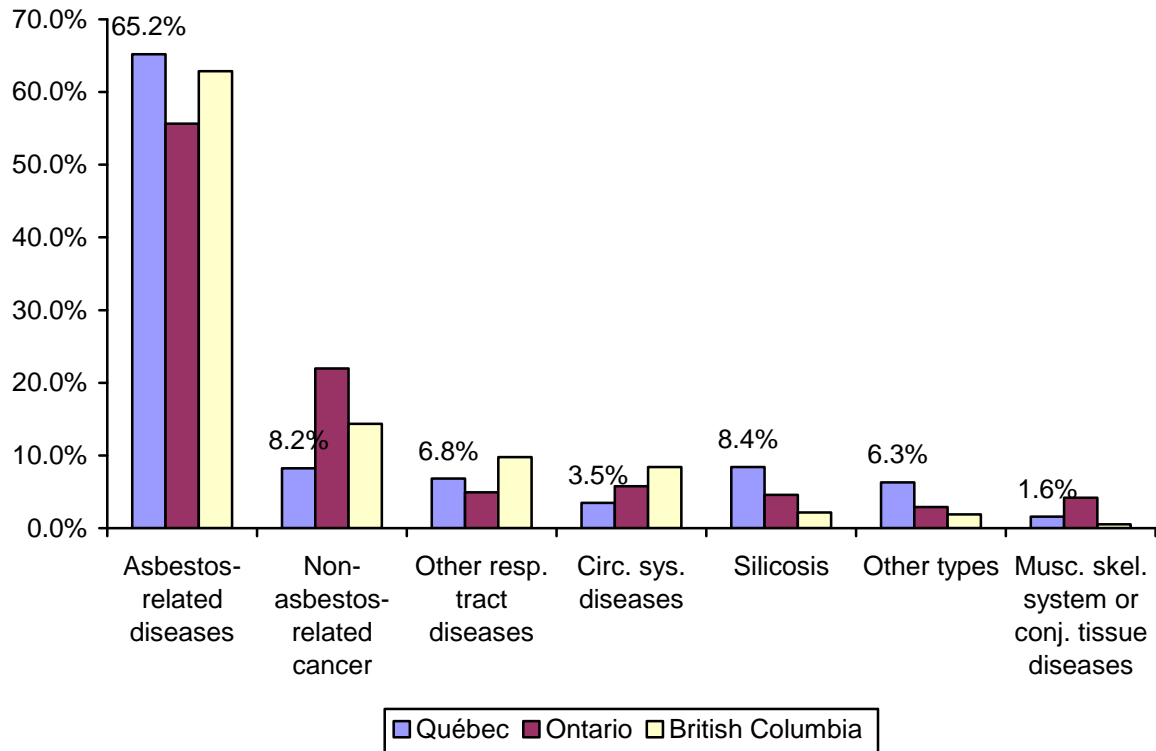
Graph 3.9: Relative distribution, by age, of the compensated work-related disease fatalities, Québec, Ontario and British Columbia, 1997 to 2003



3.5.4 By the nature of illness

Graph 3.10 presents the relative distribution, by the nature of the illness, of the compensated work-related disease fatalities. The main causes of work-related disease fatalities are by far asbestos-related diseases, namely lung cancer, mesothelioma, asbestosis or lung diseases. These diseases are responsible for approximately 65% of the compensated work-related disease fatalities in Québec, compared to 63% in British Columbia and 54% in Ontario.

Cancers, other than those that are asbestos-related, are the second cause of compensated work-related disease fatalities. They represent 22% of the cases in Ontario, more than 14% in British Columbia, and more than 8% in Québec.

Graph 3.10: Relative distribution, by the nature of illness, of the compensated work-related disease fatalities, Québec, Ontario, British Columbia, 1997-2003

In Québec, the proportion of fatalities due to silicosis is just as high as that for non-asbestos-related cancers (8%). In addition, it is twice as high as in Ontario and four times higher than in British Columbia. The percentage is practically the opposite for diseases of the circulatory system, which are proportionally much lower in Québec than in the two other provinces. The final major disease category is the one involving the respiratory system. It represents between 5% (Ontario) and 10% (British Columbia) of the cases, with Québec being halfway between (7%).

In summary, during the 1997 to 2003 period, regardless of the province, asbestos-related diseases and non-asbestos-related cancers were the cause of approximately three compensated work-related fatalities out of four for work-related disease fatalities.

4. TRAUMA FATALITY RISKS

4.1 Highlights

- During the 2000-2002 period, the eight economic activity sectors studied represent close to half of the compensated work-related trauma fatalities, for the three provinces in question;
- In Québec and Ontario, the construction and road transport sectors have the largest number of compensated work-related trauma fatalities. However, construction has many more fatalities, particularly in Ontario. In total, these two sectors account for more than 23% of the trauma fatalities in Québec and close to 33% of the trauma fatalities in Ontario. Furthermore, the logging industry ranks third in Québec, while it is mining and quarrying in Ontario;
- In British Columbia, the road transport sector is at the top of the list, with close to 17% of the compensated work-related trauma fatalities, followed very closely by the logging industry (16%) and then construction (13%);
- Of the eight economic activity sectors studied, Québec and Ontario have five where the risks of a compensated work-related trauma fatality are at least one fatality per 10,000 workers. They are the logging industry, mining and quarrying, sawmills, road transport, and construction sectors;
- British Columbia presents a slightly different situation with four sectors, rather than five, with an incidence rate of at least one fatality per 10,000 workers. Although the logging industry also ranks first, road transport ranks second, followed by mining and the construction sector;
- Of the eight economic activity sectors studied, Québec has five where the work-related trauma fatality risk is less than that in the other two provinces: mining and quarrying, the logging industry, the primary metal industries, construction and road transport. In two other sectors, namely sawmills and the machinery industries, Québec has incidence rates higher than the two other provinces;
- During the 2000-2002 period, overall, for the eight economic activity sectors studied, the work-related trauma fatality risks for Québec workers are less than those for Ontario or British Columbia.

The previous chapter revealed that compensated work-related trauma fatalities have characteristics and an evolution very different from disease fatalities. For example, one-fourth of the workers who die due to trauma are 55 years of age or older, compared to three-fourths of the compensated workers who die due to a work-related disease. In addition, disease fatality cases involve a history of worker exposure that generally covers several years, while trauma involves more recent and current realities of the work environment. For these reasons, the analyses were done separately for trauma fatalities and disease fatalities.

The present chapter deals only with the compensated work-related trauma fatalities that occurred between 2000 and 2002. These years were chosen because we have workforce data for the year 2001. The data from the 2001 census are used as an estimate of the insured workforce for these years.

4.2 Numbers and proportions

The industrial structure of the three provinces studied, for the eight sectors retained, is different (Table 4.1). These eight sectors represent less than 12% of the workforce covered in Québec compared to close to 17% in Ontario and 13% in British Columbia.

Table 4.1: Estimates of the average number and proportion of workers covered by the provincial occupational injury compensation program, by economic activity, Québec, Ontario, British Columbia, 2000 to 2002

Economic activity	QC		ON		BC		Total	
	N	%	N	%	N	%	N	%
Mining, quarrying	13,445	0.4%	20,350	0.5%	11,835	0.7%	45,630	0.5%
Logging industry	8,495	0.3%	4,920	0.1%	17,275	1.0%	30,690	0.3%
Sawmills	22,160	0.7%	9,070	0.2%	28,250	1.6%	59,480	0.7%
Machinery industries	21,585	0.7%	44,150	1.1%	6,330	0.4%	72,065	0.8%
Primary metal industries	26,095	0.8%	42,290	1.1%	4,045	0.2%	72,430	0.8%
Construction	130,085	4.0%	267,490	6.9%	86,325	4.9%	483,900	5.5%
Road transport	73,040	2.3%	114,915	3.0%	30,810	1.8%	218,765	2.5%
Communications and other utility industries	82,560	2.6%	141,965	3.7%	43,365	2.5%	267,890	3.0%
Subtotal	377,465	11.7%	645,150	16.6%	228,235	13.0%	1,250,850	14.1%
Other covered activities	2,841,763	88.3%	3,242,978	83.4%	1,523,033	87.0%	7,607,774	85.9%
Total covered activities	3,219,228	100.0%	3,888,128	100.0%	1,751,268	100.0%	8,858,624	100.0%

The relative importance of the mining sector is similar in the three provinces, but the logging industry and sawmill sectors are much more important in British Columbia (2.9%) than in Québec (1.0%) and particularly Ontario (0.3%). There are also major differences for the construction and road transport sectors.

During the three-year period between 2000 and 2002, there were 1,070 compensated work-related trauma fatalities in all of the three provinces studied (Table 4.2). Of this number, the eight economic activity sectors studied account for close to 50% of these fatalities.

Table 4.2: Number and proportion of compensated work-related trauma fatalities, by economic activity, Québec, Ontario, British Columbia, combined for the 2000 to 2002 period

Economic activity	QC		ON		CB		Total	
	N	%	N	%	N	%	N	%
Mining, quarrying	11	3.7%	24	5.1%	10	3.2%	45	4.2%
Logging industry	21	7.1%	17	3.6%	51	16.3%	95	8.8%
Sawmills	13	4.4%	5	1.1%	5	1.6%	23	2.1%
Machinery industries	5	1.7%	5	1.1%		0.0%	10	0.9%
Primary metal industries	1	0.3%	8	1.7%	1	0.3%	10	0.9%
Construction	40	13.6%	96	20.5%	40	12.8%	176	16.4%
Road transport	28	9.5%	56	12.0%	52	16.7%	136	12.7%
Communications and other utility industries	10	3.4%	17	3.6%	8	2.6%	36	3.4%
Subtotal	129	44.5%	228	48.7%	167	53.5%	531	49.6%
Other economic activities	157	54.1%	240	51.3%	145	46.5%	535	50.0%
Not coded, n.e.c.	4	1.4%		0.0%		0.0%	4	0.4%
Total	290	100.0%	468	100.0%	312	100.0%	1070	100.0%

However, variations are observed between the provinces. In Québec, these eight sectors account for close to 45% of the trauma fatalities, while they account for slightly more in Ontario (49%) and close to 54% in British Columbia.

In Québec and Ontario, the construction and road transport sectors account for the largest number of compensated work-related trauma fatalities. Construction, however, accounts for many more fatalities, particularly in Ontario with close to 21% of the cases. In total, these two sectors account for more than 23% of the trauma fatalities in Québec and close to 33% of the trauma fatalities in Ontario. Furthermore, the logging industry ranks third in Québec, and mining and quarrying in Ontario.

In British Columbia, the road transport sector is at the top of the list, with close to 17% of the compensated work-related trauma fatalities, followed closely by the logging industry (16%) and then the construction sector (13%).

4.3 Incidence rate

The data examined in the previous section indicate the economic activity sectors that account for the largest number of compensated work-related trauma fatalities but this does not mean that these sectors have the highest trauma fatality risks. Therefore, for the sectors with a high number of fatalities, we do not know whether this is because these sectors have many more workers than the other sectors or because these sectors have a higher fatality risk.

In order to estimate the fatality risk, the number of fatalities is divided by the number of workers who were exposed to the risks; this is the role of the incidence rate. This rate allows economic activity sectors as well as provinces to be compared, which is the ultimate objective of this study.

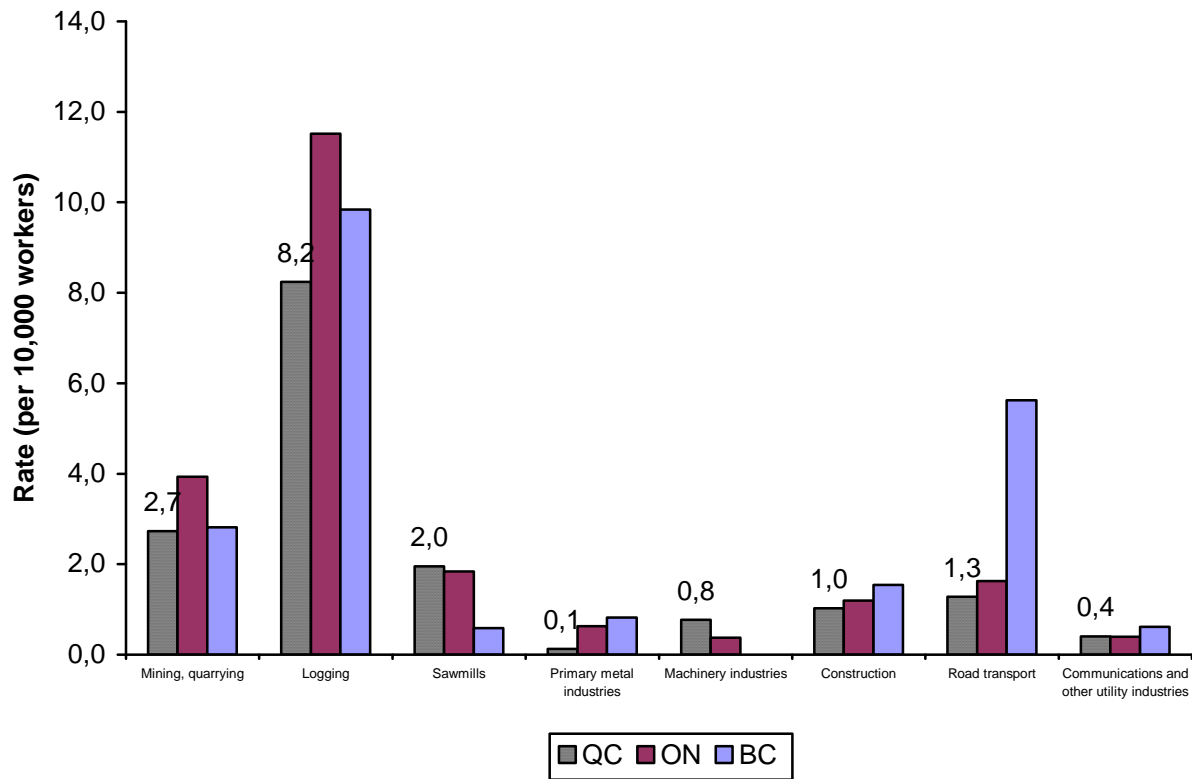
Of the eight economic activity sectors studied, Québec has five where the compensated work-related trauma fatality risks are at least one fatality per 10,000 workers (Graph 4.1). These sectors are: the logging industry⁴ (8.2 fatalities per 10,000 workers); mining and quarrying (2.7 fatalities per 10,000); sawmills (2.0 fatalities per 10,000); road transport (1.3 fatalities per 10,000); and construction (1.0 fatalities per 10,000).

Ontario also has five sectors that have a trauma fatality incidence rate of at least one case per 10,000 workers. They are the same five sectors as in Québec and in the same order in terms of incidence rates.

British Columbia presents a somewhat different situation. It has only four sectors that have a trauma fatality incidence rate of at least one fatality per 10,000 workers. Although the logging industry also ranks first, with a rate of 9.8 fatalities per 10,000 workers, road transport ranks second with a rate of 5.6 fatalities per 10,000 workers. This rate is approximately four times higher than in Québec or Ontario. Mining ranks third (2.8 fatalities per 10,000 workers), followed by the construction sector (1.5 fatalities per 10,000 workers).

⁴ The incidence rates for the logging industry, which are comparable for the three provinces, are probably overestimated in relation to the other sectors because it was impossible to adjust the data to take into account the monthly variations in the workforce, or the variations in the number of hours worked. However, the difference in relation to the other sectors is such that, even with adjustments, this sector could still rank first or second in terms of incidence rates.

Graph 4.1: Incidence rate, per 10,000 paid workers, for work-related trauma fatalities by economic activity, Québec, Ontario, and British Columbia, 2000-2002



Of the eight economic activity sectors studied, Québec has five where the fatality risks are below those in the two other provinces (Graph 4.1): mining and quarrying, the logging industry, the primary metal industries, construction, and road transport. Québec has a rate equal to or below that in the two other provinces for the communications and other public utilities sector. For the two other sectors (sawmills and machinery industries), Québec has incidence rates higher than the two other provinces.

The data presented in Graph 4.1 do not allow an overall assessment of the fatality risks for all of the eight sectors studied, but only a sector-by-sector estimate. We therefore do not know whether, overall, for all eight economic activity sectors, Québec workers have compensated work-related fatality risks that are higher or lower than those for workers in the two other provinces.

However, this question can be answered. It involves estimating, for the eight economic activity sectors studied, for the 2000 to 2002 period, what would have been the annual number of trauma fatalities in Québec if the workers had had the same trauma fatality risks as those in Ontario or British Columbia (Table 4.2). While this number of deaths is higher than the actual number of compensated work-related fatalities in Québec, this means that the compensated work-related fatality risks in Québec are lower than those in the two other provinces.

Thus, if the workers in Québec, for the eight sectors studied, had had the same fatality risks as those of Ontario, there would have been nine more fatalities, or 52 instead of 43. If the risks had been those of British Columbia, there would have been close to twice the number of fatalities, or 82 instead of 43. This difference with British Columbia is explained mainly by the high trauma fatality risks in the road transport sector.

Overall, for the eight economic sectors studied for the 2000 to 2002 period, the trauma fatality risks for Québec workers are lower than those of Ontario and, particularly, those of British Columbia.

Table 4.3: Estimate of the theoretical number of trauma fatalities in Québec, for the eight sectors studied, if the workers in Québec had the same trauma fatality risks as those in Ontario or British Columbia in the years 2000 to 2002

Economic activity	Annual number for Québec, 2000-2002 period			
	Actual number		Theoretical number of trauma fatalities	
	paid workers	trauma fatalities	with the rates of Ontario	with the rates of British Columbia
Mining, quarrying	13,445	4	5	4
Logging industry	8,495	7	10	8
Sawmills	22,160	4	4	1
Primary metal industries	26,095	0	2	2
Machinery industries	21,585	2	1	0
Construction	130,085	13	16	20
Road transport	73,040	9	12	41
Communications and other utility Industries	82,560	3	3	5
Total	377,465	43	52	82

Care must be taken in giving meaning to these results because the eight economic activity sectors retained for this study are not necessarily those with the highest compensated work-related trauma fatality risks. In fact, as is mentioned in the methodology appendix, these sectors were retained by considering the number and frequency of all of the compensated work-related fatalities (trauma and disease) in Québec. When the economic activities to be retained for the present study were determined, the specific contexts of the traumas and diseases were not considered separately, nor the overall context in Ontario or British Columbia.

For example, for the primary metal industries sector, which had twenty-one compensated work-related fatalities in three years (2000-2002) in Québec, the result is that twenty of these fatalities were compensated for a work-related disease and only one for trauma. This sector therefore has a low trauma fatality incidence rate, and other economic activity sectors that we did not analyze surely ranked ahead of it.

An analysis of the fatalities, which we did previously (data not reported) based on Québec compensation data for the 1996-2003 period, revealed that the fishing sector, while it had only five compensated work-related fatalities during this eight-year period, ranked second in terms of compensated industrial accident fatality risks. The agriculture sector is also a sector whose risks are probably underestimated due to the presence of a large number of self-employed workers not covered by the compensation program. Furthermore, American data, more exhaustive than Canadian data for work-related fatalities, rank fishing and agriculture at the top of the list of economic activities with the highest industrial accident fatality risk (NIOSH, 2004).

5. DISEASE FATALITY RISKS

5.1 Highlights

- There were 965 compensated work-related disease fatalities during the 2000 to 2002 period for all of the three Canadian provinces studied. The eight economic activity sectors retained account for at least half of these deaths;
- In Québec, the sectors with the largest proportion of compensated work-related disease fatalities are the mining and construction sectors, which alone account for close to half of the cases. These two economic activity sectors are also at the top of the list in British Columbia, but with different proportions;
- In Ontario, the primary metal industries rank first, followed by construction, with the greatest proportions of fatalities. However, mining is not very far behind. These three sectors therefore account for close to half of the compensated work-related disease fatalities in Ontario;
- Methodological limitations, mainly in estimating the population at risk of fatalities at the time a worker dies, or even the criteria for recognizing work-related diseases, make the calculation of the incidence rate for compensated work-related disease fatalities risky and somewhat invalid. Based on this fact, interprovincial comparisons of work-related disease fatality risks are practically impossible.

The statistics presented here involve work-related diseases that have caused workers' deaths, whether these diseases are due to an industrial accident or are occupational diseases as defined in the Québec Act respecting industrial accidents and occupational diseases (AIAOD). Since we did not have the data to make this distinction between industrial accidents and occupational diseases for the other Canadian provinces, we used, for the three provinces studied, the nature of illness classification, with this classification⁵ being the same in all Canadian provinces. This allows trauma-related injuries to be differentiated from disease-related injuries.

5.2 Numbers and proportions

There were 965 compensated work-related disease fatalities during the 2000 to 2002 period for all of the three Canadian provinces studied (Table 5.1). The eight economic activity sectors retained for each province account for at least half of these disease fatalities. In fact, they account for half of the work-related disease fatalities in Ontario, but for close to two-thirds in Québec. The proportion in British Columbia is between those of these two provinces, with 56% of the work-related disease fatalities for all of these eight economic activity sectors.

Table 5.1: Number and proportion of compensated work-related disease fatalities for the eight economic activity sectors retained, Québec, Ontario, British Columbia, combined for the 2000 to 2002 period

Economic activity	QC		ON		CB		Total	
	N	%	N	%	N	%	N	%
Mining, quarrying	65	25.0%	74	13.7%	14	8.5%	153	15.9%
Logging industry	3	1.2%		0.0%	1	0.6%	4	0.4%
Sawmills		0.0%		0.0%	3	1.8%	3	0.3%
Machinery industries	9	3.5%	5	0.9%	3	1.8%	17	1.8%
Primary metal industries	20	7.7%	94	17.4%	13	7.9%	127	13.2%
Construction	57	21.9%	85	15.7%	49	29.9%	191	19.8%
Road transport	4	1.5%	5	0.9%	4	2.4%	13	1.3%
Communications and other utility industries	6	2.3%	6	1.1%	4	2.4%	16	1.7%
Subtotal	164	63.1%	269	49.7%	91	55.5%	524	54.3%
Other economic activities	95	36.5%	272	50.3%	71	43.3%	438	45.4%
Not coded, n.e.c.	1	0.4%		0.0%	2	1.2%	3	0.3%
Total	260	100.0%	541	100.0%	164	100.0%	965	100.0%

In Québec, the sectors with the highest proportion of compensated work-related disease fatalities are mining (25%) and construction (22%), which alone account for close to half of the cases. These two economic activity sectors are also at the top of the list in British Columbia, but in

⁵ Canadian provinces use the CSA-Z795 standard for coding data on industrial accidents and occupational diseases. The *nature of injury or illness* is one of the variables covered by this standard.

different proportions: 30% of the fatalities are in the construction sector and less than 9% in mining.

In Ontario, the primary metal industries sector (17%) is first, and then construction (16%) with the highest proportions of fatalities, followed by mining (14%). In Ontario, these three sectors therefore account for close to half of the compensated work-related disease fatalities.

Furthermore, it should be noted that the primary metal industries sector ranks third in Québec (8%) and in British Columbia (8%); it also therefore represents a sector to be monitored for these provinces.

5.3 Incidence rate

The fatality incidence rate expresses the relationship between the number of fatalities for a given year and the number of workers who ran the risk of dying during that same year. In the case of work-related trauma, since the worker generally dies a very short time after the accidental event, the incidence rate can then be calculated by using the workforce for the year as an estimate of the number of workers at risk.

With diseases, workers can be affected many years after being exposed to the risk factors that cause these diseases. This time period between exposure and the presence of the disease, the latency period, can vary from one disease to another. It can be as long as thirty, forty or fifty years, or even more. Furthermore, once the worker has the disease, the time that elapses before the disease causes death can vary from one worker to another.

As we saw in the previous chapter, in more than three cases out of four, the worker is 55 years of age or more at the time of death. It is therefore very probable, in a large proportion of cases, that the worker is no longer employed at the time of death. For this reason, the number of employed workers during the year of the worker's death does not represent the population that ran the risk of dying from this disease. Instead it is important to know, for the economic activity sectors or professions involved, the number of workers who were employed thirty, forty or fifty years beforehand, namely at the time when each worker began to be exposed to the risks that caused the deaths. It is these workers that can be found in the statistics on compensated work-related disease fatalities. The data on these numbers of workers are generally not available and are very difficult to produce.

Another difficulty in comparing data on work-related diseases is the fact that each province establishes its own criteria for recognizing and compensating cases of diseases, which can make the number of compensated cases vary from one province to another and from one disease to another. There are many more differences between the provinces in these recognition and compensation criteria for work-related diseases than in the criteria for work-related trauma.

Therefore, in the case of diseases, the differences between the provinces can result from, among other things, the differences in the numbers of workers exposed to specific substances, the level of exposure to these substances, or even the criteria used to recognize and compensate the diseases.

It is technically possible to calculate an incidence rate for compensated work-related disease fatalities by using, for example, the number of workers at the time of the death. This was not done because we consider that this rate would be imprecise and difficult to compare from one province to another, due to the limitations that we have just mentioned. Consequently, interprovincial comparisons of work-related disease fatality risks are practically impossible.

Such comparisons may be possible for fatal diseases with short latency periods. This would require that these diseases be identified, if there are any, that they be documented from the standpoint of the medical diagnosis and prognosis, and that there be an estimate produced of the numbers of exposed workers in order to calculate the incidence rate. We did not do this because it goes beyond the mandate of the present study.

6. CONCLUSION

This study shows that, for the 2000-2002 period, based on comparable compensated work-related trauma fatality risk indicators for the eight economic activity sectors targeted, in the majority of cases, the fatality risk in Québec is less than that in Ontario and British Columbia. However, we do not have any information on the factors that can explain these differences. Among other things, the factors may be differences in work organization, prevention management, the work environment, work methods, the production process, worker protection, or even the safety of the products, vehicles, machines, equipment or tools used, etc. More detailed studies, field studies or case studies could shed light on the factors involved.

Regarding diseases, methodological limitations in estimating the population at risk of dying, or even criteria for recognizing work-related diseases, make calculation of the incidence rate risky. Based on this fact, interprovincial comparisons of work-related disease fatality risks are practically impossible to carry out.

It should be noted that the simple examination of the distribution of work-related disease fatalities provides a useful indication of the types of diseases and the economic activity sectors with the highest numbers of deaths. We know that today, asbestos-related diseases are the cause of the majority of compensated work-related disease fatalities for any of the three provinces studied. We also know that the majority of work-related disease fatalities involve workers who worked in the construction, mining or primary metal industries. What would be useful to know is whether today, the workers in these sectors are still exposed to the same risks that explain the disease fatalities observed in the last few years.

Furthermore, in the field of work-related disease prevention, it is mainly studies to measure worker exposure to pathogenic agents, or even the health effects of the constraints and agents present in the workplace, if not studies aimed at identifying or establishing means of protection against these effects, that should be the most useful.

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APPENDIX A - DETAILED METHODOLOGY

1. Issue

At the time of this study, no study existed on the comparison of the work-related fatality risks for Québec and any of the Canadian provinces. The Association of Workers' Compensation Boards of Canada (AWCBC) publishes data on fatalities by province (AWCBC, 2004) but they are compilations of the raw numbers of fatalities by province in relation to different variables (economic activity, profession, etc.). These documents do not contain any work-related fatality risk indicators. Also, there is no distinction between accident fatalities and disease fatalities. It is an important distinction that needs to be made when comparing the fatality indicators of provinces in order to orient prevention activities.

The aim of this exploratory study is to compare, between the provinces, the overall situation of compensated work injury fatalities, and particularly to produce comparable fatality risk indicators, if possible. Because of the methodological difficulties related to the comparison of indicators, the study was limited, for the production of risk indicators, to three provinces and also to seven priority economic activity sectors based on the CSST classification, which are in fact eight distinct economic activity sectors according to the 1984 Québec economic activity classification (CAEQ). In addition to Québec, the two other provinces with the largest populations were retained, namely Ontario and British Columbia.

The sectors were chosen on the basis of two criteria: having had, during the 1998 to 2000 period, more than five fatalities compensated by the CSST, and having a work-related fatality incidence rate higher than the Québec average (unpublished data taken from an internal CSST document). Of the thirty-two priority CSST sectors, seven sectors meet the selection criteria. In fact, one of these sectors includes two economic activities that we have separated: the logging industry, and sawmills. Consequently, in the presentation of data by economic activity sector, the report always mentions that eight sectors, rather than seven, are involved. Furthermore, one of these sectors, transport and storage, was limited to road transport in order to better define the high-risk activities in this sector. Briefly, these eight economic activity sectors are the following:

- Mining, quarrying and oil well industries
- Primary metal industries
- Logging industry
- Sawmills
- Machinery industries (except electrical machinery)
- Road transport
- Construction
- Communications and other utility industries

The greatest difficulty in this study is to produce comparable risk indicators for the provinces. To calculate these indicators, the number of fatalities (numerator) must be related to the workforce covered by the program (denominator). Each province has detailed information on compensated work-related fatalities but has no data on the numbers of insured workers. In addition, differences between the coverages of the provincial compensation programs, and certain

characteristics of the compensation program, affect the number of compensated work-related fatalities in each province.

To produce comparable indicators, these different aspects need to be taken into account. Therefore, it was essentially for the purpose of improving comparability that it was decided to calculate this indicator by economic activity sector, and not for all of the economic activity sectors in each province. This minimizes the effect of the differences in economic activity structure and makes it easier to verify the differences in the provincial compensation programs for a few economic activities rather than for all of these activities.

2. Data on compensated injuries that caused a fatality

For work injury data, the compiled data of the Association of Workers' Compensation Boards of Canada (AWCBC) was used. We obtained a personalized table produced from information supplied by each of the provinces.

Detailed data were obtained by economic activity sector and by province for the years 1997 to 2003. We also obtained summary data, for the years 2004 and 2005, in order to know the distribution of work-related fatalities according to the type of injury, trauma or disease⁶. For all these years, they involved work-related fatalities that were accepted and compensated by the provincial compensation boards. These fatalities are recorded according to the year of acceptance of the death for compensation purposes.

For industrial accident fatalities, the year of acceptance of the death corresponds most often to the year the accident occurred, or the year following it. With occupational diseases, several years can elapse between the year of the death and the year of acceptance of the death as being work-related.

Demographic variables on the deceased workers (gender and age) as well as descriptive variables of the injury, namely the nature of the injury or illness and the event or exposure, were also extracted from the AWCBC files.

3. Specific characteristics of the provincial compensation programs

There are many differences in the provincial occupational injury compensation programs. Several of these differences can affect the number of claims received or accepted by each of the provincial compensation boards. However, regarding compensated work-related fatalities following work injuries, a large proportion of these differences have no impact on their number.

⁶ The values for 2004 and 2005 were estimated, for Ontario, from the document "05 Workplace Safety & Insurance Board Statistical Supplement" published in 2006 by the Workplace Safety & Insurance Board (WSIB) of Ontario. For the same years, the estimates for British Columbia were produced from the "Occupational Diseases in British Columbia, 1981-2005" document published in 2006 by WorkSafeBC. The data for Québec, from 2004 and 2005, come from the CSST's "Direction de la comptabilité et de la gestion de l'information".

For example, the fact that the waiting period before the worker can be compensated for the loss of salary, namely one, two or three days, probably affects the number of claims following an industrial accident or an occupational disease but has no impact on the number of compensated work-related fatalities.

In our opinion, for work-related fatalities, the following aspects should mainly be considered:

- The criteria for recognizing and accepting a work-related fatality;
- The definitions of industrial accidents and occupational diseases as to their acceptance for compensation purposes;
- The categories of employers or workers included in or excluded from the coverage of the provincial compensation programs.

Each of these points is repeated in the three subsections below.

3.1 Work injury recognition criteria

The criteria for industrial accidents must be differentiated here from those for occupational diseases. In fact, even within each province, these criteria are very different depending on the type of injury. A publication by the AWCBC (2005b) presents a comparison of the provinces' workers' compensation legislation.

Industrial accident concepts are seen to be rather similar in the three provinces studied. Québec's definition, in the next section, will be used as reference for this study.

There do not seem to be any significant differences between the three provinces regarding recognition, namely the eligibility of industrial accident fatalities for compensation purposes. For example, in the three provinces, the injury is not compensable if it is due to serious and voluntary misconduct by the injured worker, unless it leads to a permanent or serious impairment, or even death. Another example is that an injury due to a work-related accident is assumed to have occurred during the period of employment, and vice versa, unless the opposite has been demonstrated.

Occupational diseases are not defined specifically in all the provinces (some provinces include them in the definition of industrial accidents), but this concept exists separately from accidents in each of the three provinces studied. A simple way to differentiate them from industrial accidents is in the time elapsed (latency period) to cause the damage. Québec's definition, presented in the next section, will be our reference for this study.

While the definitions of occupational disease are similar in the three provinces studied, the recognition and acceptance criteria are significantly different. As well, the structures or tools

used in decision-making and jurisprudence also affect the number of recognized and compensated cases.

For example, in Québec, when a claim involves a lung disease, the application is referred to a committee on occupational lung diseases. Its role, mandate and structure are defined by sections 227 to 232 of the Act respecting industrial accidents and occupational diseases (AIAOD). As well, in Québec, the “recueil des politiques en matière de réadaptation-indemnisation” (rehabilitation-compensation policies) is one of the tools used in deciding about occupational disease claims. This collection of policies contains a detailed description of occupational diseases, among other things.

We will not delve further into how provincial programs differ in the recognition and acceptance of occupational disease claims. We have no information for evaluating whether these differences can affect the number of cases of recognized and compensated occupational diseases. However, these differences are sufficient in number and complex enough to shed doubt on the comparability of provincial occupational disease data.

3.2 The concepts of industrial accident, occupational disease, disease and trauma

In Québec, the Act respecting industrial accidents and occupational diseases (AIAOD) defines the concepts of industrial accident, occupational disease and employment injury (Chapter I Division II). These definitions are:

“**industrial accident**”: A sudden and unforeseen event, attributable to any cause, which happens to a person, arising out of or in the course of his work and resulting in a work injury to him;

“**employment injury (work injury)**”: An injury or a disease arising out of or in the course of an industrial accident, or an occupational disease, including a recurrence, relapse or aggravation;

“**occupational disease**”: A disease contracted out of or in the course of work and characteristic of that work or directly related to the risks peculiar to that work.

In comparing risk indicators between provinces, the distinction between industrial accidents and occupational diseases in work injuries is very important. On the one hand, from a prevention perspective, fatalities due to an accident and those resulting from a disease involve very different considerations. In the first case, the fatalities are associated with the work situation at the time of the accident; occupational diseases are related to an exposure to risk factors that could have existed years beforehand, and that may still exist or not.

As noted in the definitions presented above, an industrial accident can cause a lesion that is either an injury or a disease. In the latter case, the disease is not an occupational disease since it is the result of an accidental event. For example, a nurse pricks herself accidentally with a contaminated needle and contracts a fatal disease. This injury is not an occupational disease, but the result of an industrial accident. However, the nature of this injury is a disease and not an injury.

It would have been desirable to retain the distinction between industrial accidents and occupational diseases as defined in the Québec AIAOD. However, the data available from the AWCBC files do not allow this distinction. Nevertheless, based on the “nature of injury or illness” variable, traumatic injuries (traumas) could be differentiated from diseases.

Each of the provinces uses the same classification (CSA Z795) to code the “nature of injury or illness” variable, making comparison of the data easier. Therefore, in this classification, traumas correspond to codes 00000 to 09900, and diseases to codes 10000 to 80000. We define them as follows:

Disease: a disease that arises out of or in the course of an industrial accident or an occupational disease;

Trauma: an injury that occurs out of or in the course of an industrial accident.

Unless otherwise indicated, the terms disease and trauma refer to these definitions when used in this study.

3.3 The population covered

One of the greatest difficulties in comparing work-related fatality risk indicators is that the provinces do not collect information on the number of workers covered by the provincial compensation programs or, even better, on the hours worked. Since the populations covered by the compensation programs are those that ran the risk of having a work-related fatality compensated by the provincial compensation organization, their number has to be known to estimate the risk.

In Québec and British Columbia, all industries and all workers are covered, barring exceptions. In Ontario, only the industries and workers identified by certain characteristics are included in the insurance coverage. In addition, in the three provinces, employers who work in an economic activity not provided for in the statute can apply for coverage, for their workers, from the provincial board. However, there are a few exceptions, for example professional athletes in Québec, who cannot be covered by the provincial compensation program, and the workers in some economic activities in Ontario.

Self-employed workers comprise a category of workers that is considered in the same way in the three provinces. This category of worker is excluded from the provincial coverages but the workers can be covered if they apply and pay the premiums determined by the provincial board.

The result of these differences is that the compensation program has, overall, the same proportion of covered workers in Québec and British Columbia (94%), but a much lower proportion in Ontario (68%)⁷. In general, Québec and British Columbia can be considered

⁷ These rates are taken from the document “Key Statistical Measures for 2004” available on AWCBC web site AWCBC (http://www.awcbc.org/english/board_pdfs/2004KSMs.pdf)

comparable, by economic activity sector, in terms of covered populations, but this is not the case for Ontario.

In Ontario, insurance coverage is mandatory if the employer is included in Schedule 1 of Ontario regulation 175/98; it is optional if he is included in Schedule 2 of the statute. Therefore, in Ontario, a large proportion of employers are not covered by the provincial program. In addition, within the same economic activity sector, some employers may correspond to Schedule 1 while others to Schedule 2, which complicates possible comparisons with the other provinces.

Table A1, at the end of this appendix, presents a list of the economic activity subsectors that make up each of the eight economic activity sectors studied. This table identifies, for Ontario, the economic activity subsectors that have, in whole or in part, employers that belong to Schedule 2, and therefore with optional Ontario board coverage. There are three economic activity sectors that contain such subsectors: mining; the logging industry; and communications and other utility industries. If we did not adjust the numbers of workers to take into account this situation, this would imply that these numbers of workers overestimate the covered populations in these economic activity sectors for Ontario, and therefore that the incidence rates calculated from these data would be underestimated.

For this reason, we have adjusted the data by excluding from the economic activity sectors the subsectors that contain, in whole or in part, employers who are under Schedule 2. This exclusion was done for the numbers of workers as well as for the fatalities. It will also be done for the two other provinces so that we will have comparable economic activity sectors. We based ourselves on a study published in 2004 (Smith, Mustard, Payne, 2004) to identify the economic activity codes of SIC-80 where coverage is optional, for all or some of the employers.

4. The workforce

From the data of the 2001 population census (Statistics Canada), an estimate of the workforce by economic activity sector was produced.

In fact, we retained from the census data only the compilations on paid workers, which excludes the great majority of self-employed workers. As was mentioned above, self-employed workers are covered only on a voluntary basis (optional coverage) in each of the provinces studied. If a self-employed worker in fact receives a salary from his company, he is then covered like all the other employees in the company. However, if he does not receive a salary, he will only be covered if he makes a special application and pays the insurance premiums. We estimate that, in Québec, only a small proportion, or less than 6% of these workers, are covered by the CSST compensation program⁸. We have no data that enable us to understand the situation in the two other provinces.

The concept of paid workers, despite its name, includes some self-employed workers. Statistics Canada defines paid workers as follows:

⁸ A summary analysis of the data for 2004 indicates that there were approximately 20,000 self-employed workers, owners or administrators who chose to be covered by the CSST compensation program, or approximately 6% of this category of workers.

“this includes wage and salary earners and self-employed persons in incorporated companies (the latter are included because they are considered employees of their own companies and thus, paid workers)” (Statistics Canada, 2003, p. 53).

Self-employed workers, considered as employees, are not necessarily employees from the standpoint of the Québec compensation program, nor that of the two other provinces studied. The number of paid workers used here probably includes uninsured self-employed workers. In this case, this number would overestimate the number of workers covered by the provincial compensation programs, whose result would be to underestimate the incidence rates. The higher the proportion of uninsured self-employed workers in an economic activity sector and in a province, the higher this underestimation would be. However, we do not have a measure of this proportion of workers, so we are unable to adjust the data.

5. Fatality rate by province and by economic activity sector

The risk of compensated work-related fatalities following a work injury will be estimated from the incidence rate. By convention, this rate is an annual rate. It was calculated using the following formula:

$$\frac{(\text{Number of compensated work injury fatalities in 2000-2002})/3}{\text{Number of paid workers according to the 2001 census}} \times 10000$$

According to the calculation formula, this incidence rate therefore corresponds to the annual average number of fatalities per 10,000 paid workers during the 2000 to 2002 period. The numbers of paid workers, taken from the 2001 population census, are used as an estimate of the average number of workers during the 2000 to 2002 period in calculating this rate.

Ideally, it would have been preferable to adjust these data to take into account the monthly variations in the workforce, but we had this information only for Québec data. It was therefore impossible to make this adjustment in a comparable way for the three provinces.

Concerning the calculation of incidence rates, we adjusted the data by excluding from the economic activity sectors the subsectors that contain, in Ontario, employers that are under Schedule 2 of the Ontario statute (Table A1 at the end of the appendix). This exclusion was done for the workforce as well as for the fatalities. It was also done for the two other provinces, so that the estimates of insured workforces are comparable.

The incidence rate was calculated by province, for each of the eight economic activity sectors retained for the study, solely for lesions that caused injuries (trauma). For diseases, even though it was possible to calculate an incidence rate, we chose not to. This rate, for diseases, is affected by major limitations, which, in our opinion, would excessively compromise the interprovincial

comparability. There are the limitations relating to the occupational disease recognition criteria, which were discussed above, but also those relating to the estimation of the population at risk.

The population at risk of suffering compensated work-related fatalities is estimated from the 2001 census data, for the accepted deaths from 2000 to 2002. However, in the case of fatal occupational diseases, considerable time may have elapsed between the period of exposure to the risk factors causing the disease and the worker's death. For this reason, the workforce during the years in which the deaths occurred is not a good estimate of the population at risk of suffering these fatalities, namely the population that was exposed to the risk factors several years beforehand, in the majority of cases. In addition, the time elapsed between the risk-exposure period and the death can vary from one disease to another. For all these reasons, it is risky to calculate an incidence rate for work-related disease fatalities.

6. Limitations of the data and measurements

Workforce:

It was impossible to adjust the census data to take into account the monthly variations in the workforce. This probably creates differences in the workforce covered for sectors with significant monthly variations.

Of the sectors retained for the study, the logging and construction industries are the ones most likely to have significant monthly variations. According to the data that we have for Québec, based on a monthly survey by Statistics Canada⁹, we know that the number of workers in May (reference month for the 2001 census) underestimates the annual number of workers in the logging industry by approximately 30%; this underestimation is less than 10% for the construction sector.

These differences are such that the incidence rates for these two sectors are probably overestimated, at least for Québec. Since it is probable that each province has similar variations in the workforce, for the same economic activities, these differences probably have little effect on the comparability of the provinces for a given sector. What is probably most affected by these differences is the comparability of the incidence rates for one sector in relation to another. Non-consideration of the hours worked can also have the same effect of overestimation of the workforce, and therefore an underestimation of the incidence rates.

The concept of paid workers in the census includes, despite its name, some self-employed workers. We would have liked to isolate only the workers actually paid, the employees, without the uninsured self-employed workers, because the numbers would have been closer to the concepts of the population covered by the provincial compensation programs. The workforce in the census, because it probably includes some uninsured self-employed workers, overestimates the populations at risk, and therefore underestimates the incidence rates. The size of these differences will be proportional to the number of self-employed workers in unincorporated

⁹ Survey of Employment, Payrolls and Hours (SEPH).

companies, namely the subcategory of self-employed workers included in the concept of paid workers in the census.

Work injuries:

The statistics used in identifying work-related fatalities are the data on work injuries accepted and compensated by the provincial work injury compensation boards. Some work-related fatalities are not considered in these statistics, namely those that involve populations not covered by the provincial compensation programs, for example, uninsured self-employed workers.

Therefore, in a given activity sector, there may be workers covered by the compensation program and others that are not. A study published by the IRSST on the logging industry (Hébert, Cloutier, Massicotte and Lévy, 1997, p. 42) mentions that in 1994 the CSST data documented five deaths that occurred in this sector. However, from other sources, twelve could be counted for this same year in this sector. The seven cases that did not appear in the CSST files were probably deaths of self-employed workers not covered by the CSST.

While the census data obtained from Statistics Canada excluded all categories of self-employed workers, these differences would not affect the incidence rate. However, since these workforce data probably included uninsured self-employed workers, the bias generated by these differences favours an underestimation of the incidence rate. The higher the proportion of uninsured self-employed workers, the higher this underestimation will be.

The incidence rate:

Statistical tables for Québec, prepared for the IRSST's internal needs, on work-related accident fatalities during a eight-year period (1996 to 2003), ranked the fishing sector second in terms of incidence rate, with five compensated work-related fatalities during this period. However, this situation essentially resulted from one accidental event that led to four deaths by drowning in 1998. Therefore, because this sector has very few workers, and particularly hours worked, two accidental fatal events over a seven-year period were sufficient to produce a very high accident fatality incidence rate.

During the period for which we calculated a trauma fatality rate, 2000 to 2002 for the present study, there were no compensated work-related fatalities in Québec for the fishing sector. It was therefore not considered in this study, even though the risks of accidental death can be very high.

Agriculture is another sector that is also probably underestimated in terms of accident fatality risks but for different reasons. This sector has many self-employed owners and workers for whom OHS coverage is optional. It is probable that a large proportion of the trauma fatalities that occurred in this sector escape the statistics compiled from CSST data because they involved uninsured workers.

Another sector that was retained for the study, the logging industry, also has a large proportion of self-employed workers. As was mentioned above, an IRSST study (Hébert, Cloutier, Massicotte and Lévy, 1997) has already revealed that a proportion of work-related accident fatalities in this sector escape the CSST's statistics, probably because they involved self-employed workers not covered by the CSST.

By using the number of paid workers rather than the total number of workers to calculate the incidence rate, we control part but not all of this underestimation. In fact, as mentioned above, the definition of paid workers used by Statistics Canada for the population census data includes a number of self-employed workers, some of who are probably not covered by the provincial compensation programs. However, among the compensated work-related fatalities, there are also, at least in Québec, a few cases that involved self-employed workers insured by the provincial board.

Furthermore, a study published in the United States by NIOSH (Marsh and Layne, 2001) supports the idea that industrial accident fatality risks are very high for the fishing and agriculture sectors. These sectors are at the top of the list next to mining, the logging industry, transport, construction, which are the economic activity sectors with the highest accident fatality rates. Because of the methodology used for data collection, the American data are much more exhaustive than the Canadian data.

To take into account these limitations, the study covers only eight economic activity sectors in three Canadian provinces, and the incidence rates were calculated only for work-related trauma fatalities. Furthermore, while the methodological choices described above have limited the scope of this indicator, their aim is mainly to increase its validity. In the end, we consider that the incidence rates produced are sufficiently valid to allow comparisons between the three provinces studied.

Table A1: Identification of the economic activity subsectors in which all the employers are subject to Schedule 1 (mandatory coverage) or are subject in whole or in part to Schedule 2 (optional coverage) of Ontario regulation 175/98

1980 Standard Industrial Classification (SIC)		Schedule of the statute		
Sectors		Subsectors		
Description	Code	Description	1 2	
1 Mining, quarrying	061	Metal mines	X	
	062	Non-metal mines (except coal)	X	
	063	Coal mines		X
	071	Crude petroleum and natural gas industries		X
	081	Stone quarries	X	
	082	Sand and gravel pits	X	
	091	Service industries incidental to crude petroleum and natural gas		X
	092	Service industries incidental to mining	X	
	2 Primary metal industries	291	Primary steel industries	X
292		Steel pipe and tube industry	X	
294		Iron foundries	X	
295		Non-ferrous metal smelting and refining industries	X	
296		Aluminum rolling, casting and extruding industry	X	
297		Copper and copper alloy rolling, casting and extruding industry	X	
299		Other rolled, cast and extruded non-ferrous metal products industries	X	
3 Logging and forestry industries	041	Logging industry	X	
	051	Forestry services industry		X
4 Sawmills	251	Sawmill, planing mill and shingle mill products industries	X	
5 Machinery industries	311	Agricultural implement industry	X	
	312	Commercial refrigeration and air conditioning equipment industry	X	
	319	Other machinery and equipment industries	X	
6 Road transport	456	Truck transport industries	X	
	457	Public passenger transit systems industries	X	
7 Construction	412	Highway and heavy construction	X	
	401	Residential building and development	X	
	402	Non-residential building and development	X	
	411	Industrial construction (other than buildings)	X	
	412	Highway and heavy construction	X	
	421	Site work	X	
	422	Structural and related work	X	
	423	Exterior close-in work	X	
	424	Plumbing, heating and air conditioning, mechanical work	X	
	425	Mechanical specialty work	X	
	426	Electrical work	X	
427	Interior and finishing work	X		

1980 Standard Industrial Classification (SIC)			Schedule of the statute	
Sectors		Subsectors		
Description	Code	Description	1	2
	429	Other trade work	X	
	441	Project management, construction	X	
	449	Other services incidental to construction	X	
8 Communications and other utility industries	461	Pipeline transport industries		X
	481	Telecommunication broadcasting industries		X
	482	Telecommunication carriers industry	X	
	483	Other telecommunication industries		X
	484	Postal and courier service industries	X	
	491	Electric power systems industry	X	
	492	Gas distribution systems industry	X	
	493	Water systems industry		X
	499	Other utility industries, n.e.c.	X	