ECONOMIC BURDEN OF ILLNESS IN CANADA, 2005–2008

PROTECTING CANADIANS FROM ILLNESS

Public Health Agency of Canada
Agence de la santé publique du Canada

Canada

TO PROMOTE AND PROTECT THE HEALTH OF CANADIANS THROUGH LEADERSHIP, PARTNERSHIP, INNOVATION AND ACTION IN PUBLIC HEALTH.

—Public Health Agency of Canada

Également disponible en français sous le titre :
Le fardeau économique de la maladie au Canada, 2005–2008

To obtain additional information, please contact:
E-mail: EBIC-FEMC@phac-aspc.gc.ca

This publication can be made available in alternative formats upon request.

© Her Majesty the Queen in Right of Canada, as represented by the Minister of Health, 2014

Publication date: March 2014

This publication may be reproduced for personal or internal use only without permission provided the source is fully acknowledged.

Cat.: HP50-1/2013E-PDF
ISBN: 978-1-100-22519-7
Pub.: 130148

ECONOMIC BURDEN OF ILLNESS IN CANADA, 2005–2008

TABLE OF CONTENTS

ACKNOWLEDGEMENTS 1
INTRODUCTION 3
SUMMARY OF EBIC 2005–2008 RESULTS 5

TABLE 1: Cost Estimates by Cost Type and Cost Component, Canada, 2005–2008 ($'000,000 2010 Constant Dollars) 9
TABLE 2: Cost Estimates by Cost Type and Cost Component, Canada, 2005–2008 ($'000,000 Current Dollars) 10
TABLE 3: Cost Estimates by Diagnostic Category, Cost Type and Cost Component, Canada, 2008 11
FIGURE 1: Cost Distribution by Direct Cost Component for the Five Diagnostic Categories with the Highest Total Direct Costs, Canada, 2008 13
FIGURE 2: Cost Distribution by Indirect Cost Component for the Five Diagnostic Categories with the Highest Total Indirect Costs, Canada, 2008 13
FIGURE 3: Cost Distribution by Cost Component for the Five Diagnostic Categories with the Highest Total Costs, Canada, 2008 14
FIGURE 4: Direct Cost Distribution by Sex, Canada, 2008 14
FIGURE 5: Indirect Cost Distribution by Sex, Canada, 2008 15
FIGURE 6: Total Cost Distribution by Sex, Canada, 2008 15
FIGURE 7: Cost Distribution by Sex and Cost Component, Canada, 2008 16
FIGURE 8: Cost Distribution by Cost Component and Sex, Canada, 2008 16
FIGURE 9: Direct Cost Distribution by Age Group, Canada, 2008 17
FIGURE 10: Indirect Cost Distribution by Age Group, Canada, 2008 17
FIGURE 11: Total Cost Distribution by Age Group, Canada, 2008 18
FIGURE 12: Cost Distribution by Age Group and Cost Component, Canada, 2008 18
FIGURE 13: Cost Distribution by Cost Component and Age Group, Canada, 2008 19

REPORT 1: EBIC HOSPITAL CARE EXPENDITURES, 2004–2008 20
FIGURES AND TABLES
TABLE 4: Hospital Care Expenditures by Diagnostic Category, Canada, 2004–2008 31
TABLE 5: Hospital Care Expenditures by Diagnostic Category and Sex, Canada, 2008 32
FIGURE 14: Hospital Care Expenditures by Age Group, Canada, 2008 33
FIGURE 15: Hospital Care Expenditure Distribution by Diagnostic Category and Age Group, Canada, 2008 33

REPORT 2: EBIC DRUG EXPENDITURES, 2005–2008 . . . . . **34**

FIGURES AND TABLES

TABLE 6: Drug Expenditures by Diagnostic Category, Canada, 2005–2008 42

TABLE 7: Drug Expenditures by Diagnostic Category and Sex, Canada, 2008 43

FIGURE 16: Drug Expenditures by Age Group, Canada, 2008 44

FIGURE 17: Drug Expenditure Distribution by Diagnostic Category and Age Group, Canada, 2008 44

REPORT 3: EBIC PHYSICIAN CARE EXPENDITURES, 2005–2008 . . . . . **45**

FIGURES AND TABLES

TABLE 8: Physician Care Expenditures by Diagnostic Category, Canada, 2005–2008 50

TABLE 9: Physician Care Expenditures by Diagnostic Category and Sex, Canada, 2008 . . . 51

TABLE 10: Comparison of the Cost Distribution by Diagnostic Category for Manitoba and Ontario (EBIC 2000) 52

TABLE 11: Comparison of Manitoba 2008 Physician Care Cost Distribution Using Two Methods 53

FIGURE 18: Physician Care Expenditures by Age Group, Canada, 2008 54

FIGURE 19: Physician Care Expenditure Distribution by Diagnostic Category and Age Group, Canada, 2008 54

REPORT 4: EBIC VALUE OF LOST PRODUCTION DUE TO PREMATURE MORTALITY, 2004–2008 . . . . . **55**

FIGURES AND TABLES

TABLE 12: Mortality Costs by Diagnostic Category, Canada, 2005–2008 60

TABLE 13: Mortality Costs by Diagnostic Category and Sex, Canada, 2008 61

TABLE 14: EBIC 2004–2008 National Mortality Costs 62

FIGURE 20: Mortality Costs by Age Group, Canada, 2008 62

FIGURE 21: Mortality Cost Distribution by Diagnostic Category and Age Group, Canada, 2008 62

REPORT 5: EBIC VALUE OF LOST PRODUCTION DUE TO MORBIDITY, 2005–2010 65

FIGURES AND TABLES

TABLE 15: Value of Lost Production due to Morbidity by Diagnostic Category and Selected Demographic Group, Canada, 2010 77

TABLE 16: Value of Lost Production due to Morbidity by Diagnostic Category and Selected Demographic Group, Canada, 2009 78

TABLE 17: Value of Lost Production due to Morbidity by Diagnostic Category and Selected Demographic Group, Canada, 2008 79

TABLE 18: Value of Lost Production due to Morbidity by Diagnostic Category and Selected Demographic Group, Canada, 2007 80

TABLE 19: Value of Lost Production due to Morbidity by Diagnostic Category and Selected Demographic Group, Canada, 2006 81

TABLE 20: Value of Lost Production due to Morbidity by Diagnostic Category and Selected Demographic Group, Canada, 2005 82

TABLE 21: Value of Lost Production due to Morbidity by Age Group, Canada, 2005–2010 . 83

TABLE 22: Value of Lost Production due to Morbidity, Canada, 2005–2010 83

APPENDIX A: LIST OF ABBREVIATIONS 86

APPENDIX B: DEFINITIONS 87

APPENDIX C: EBIC 2005–2008 DIAGNOSTIC CATEGORIES 89

APPENDIX D: EBIC 2005–2008 PROJECT TEAM 97

REFERENCES 98

ACKNOWLEDGEMENTS

The *Economic Burden of Illness in Canada*, 2005–2008 report was prepared by the Public Health Agency of Canada's Population Health Economics team.

The acquisition of the EBIC data inputs required to produce this report would not have been possible without the support of the Public Health Agency of Canada's Data Coordination and Access Program.

Acknowledgement is also due to the Canadian Institute for Health Information and Statistics Canada for their collection and management of health-related data used throughout the EBIC report. Although parts of this material are based on data and information provided by the Canadian Institute for Health Information and Statistics Canada, the analyses, conclusions, opinions and statements expressed herein are those of the Public Health Agency of Canada, and not necessarily those of the Canadian Institute for Health Information or Statistics Canada.

INTRODUCTION

The Economic Burden of Illness in Canada (EBIC) is a comprehensive cost-of-illness study that provides estimates of the burden of illness and injury by cost type, cost component, diagnostic category, sex, age group and province/territory. The primary goal of EBIC is to supply objective and comparable information on the magnitude of the economic burden or cost of illness and injury in Canada based on standard reporting units and methods. EBIC is the only comprehensive Canadian cost-of-illness study that provides comparable costing information for all major illnesses. Supplementing other health indicators, EBIC provides important evidence to support public health policy and program planning.

Health Canada published the first edition of the *Economic Burden of Illness in Canada, 1986* (EBIC 1986), in the year 1991; subsequently, the *Economic Burden of Illness in Canada, 1993* (EBIC 1993) and the *Economic Burden of Illness in Canada, 1998* (EBIC 1998) were published in 1997 and 2002 respectively (1–3). An unpublished version, the Economic Burden of Illness in Canada, 2000 (EBIC 2000), was also completed (4). Responsibility for the production of EBIC was transferred to the Public Health Agency of Canada (PHAC) after creation of the organization in 2004. The demand for current cost-of-illness information along with the positive feedback associated with previous EBIC reports contributed to the decision to complete a new edition, the *Economic Burden of Illness in Canada, 2005–2008* (EBIC 2005–2008). The EBIC 2005–2008 report and its complementary web-based tool (accessed at www.phac-aspc.gc.ca/ebic-femc/index-eng.php) offer Canadian cost-of-illness estimates by EBIC categories (diagnostic category, sex, age group and province/territory).

For EBIC 2005–2008, a prevalence-based approach was used to estimate all costs. A prevalence-based cost-of-illness study estimates the total cost of a disease incurred in a given year regardless of the date of disease onset.

The EBIC 2005–2008 report includes estimates for direct and indirect costs; for intangible costs, such as pain and suffering, estimates are not provided. Direct costs refer to health care expenditures for which the primary objective was to improve and prevent the deterioration of health status. Three direct cost components were estimated in this report: hospital care expenditures, physician care expenditures and drug expenditures. Other direct health expenditure totals, comprising other institutions and additional direct health expenditures (e.g. other professionals, capital, public health and other health spending), were included in the report but could not be attributed by EBIC categories. The Canadian Institute for Health Information's (CIHI) National Health Expenditure Database (NHEX) was used to obtain all direct cost component totals (5). Total EBIC direct expenditures are compared with NHEX totals to calculate the amount of expenditures not attributable by EBIC categories.

Indirect costs refer to the dollar value of lost production due to illness, injury or premature death. In this report, only the value of lost production due to an individual's 'own' illness, injury or premature death associated with time away from labour market activities was considered (costs associated with presenteeism, non-labour market activities and informal caregiving were not included). The indirect cost components estimated in this report are the value of lost production due to premature mortality and the value of lost production due to morbidity. In previous editions of EBIC, indirect costs (mortality and morbidity costs) were estimated using

the human capital method. For EBIC 2005–2008, on the basis of feedback from international experts who attended the 2009 and 2010 EBIC Workshops (organized by PHAC), the friction cost method was adopted to estimate indirect costs. This method does not assume full employment and considers lost production to occur only from the time an individual leaves his or her job as a result of illness, injury or premature death until the job vacancy is filled. The change in methods is further discussed in the individual indirect cost component reports.

Cost estimates were assigned to the most responsible health conditions, and almost all cost component estimates could be attributed to an International Classification of Diseases (ICD) code, either version 9 (ICD-9) or version 10 (ICD-10), depending on the data source. The one exception was the value of lost production due to morbidity, which utilized surveyed period of lost production estimates by broad health condition categories. The EBIC estimates attributable to an ICD code were further grouped into 24 diagnostic categories and 165 subcategories. The ICD code groupings are described in Appendix C and are largely based on the Global Burden of Disease study's groupings (6).

The EBIC 2005–2008 age groups are 0–14 years, 15–34 years, 35–54 years, 55–64 years, 65–74 years and 75 years and older. EBIC 1998 included only four age groups: 0–14 years, 15–34 years, 35–64 years and 65 years and older. The inclusion of additional age groups in EBIC 2005–2008 allows for more detailed analysis of the economic burden of illness and injury patterns given that individuals between the ages of 35 to 64 years and individuals aged 65 years and older likely have very different cost-of-illness magnitudes and distributions. On the basis of assumptions regarding labour market participation, mortality and morbidity costs were estimated only for individuals aged 15–64 years and 15–75 years respectively; please consult the appropriate indirect cost component reports for further information.

The EBIC 2005–2008 estimates should be considered in the context of the limitations described earlier and of those identified in each of the individual cost component reports. In general, comparisons of the EBIC 2005–2008 results with those of previous EBIC editions are not recommended. Differences between results may reflect improved or alternative data sources and/or changes and/or refinements to methods rather than actual differences in the magnitude and distribution of the economic burden of illness and injury. There may also be minor differences between the current years of analysis; please consult the individual cost component reports for further information.

The remainder of the report presents a summary of the EBIC 2005–2008 estimates and individual cost component reports. Each cost component report provides a background, description of the data sources and methods used, high-level results and an explanation of the assumptions and limitations that may affect the interpretation of results. While analysis has been conducted for 2005–2008, certain cost components include additional years. For example, estimates for hospital care expenditures and the value of lost production due to premature mortality have been completed for 2004–2008, as data were available. Estimates for the value of lost production due to morbidity have been completed for 2005–2010, as estimates are based on 2010 labour market missed work days. Appendices for abbreviations, definitions and the ICD code groupings used in the report are found at the end of the document.

SUMMARY OF EBIC 2005–2008 RESULTS

ECONOMIC BURDEN OF ILLNESS IN CANADA BY COST TYPE AND COST COMPONENT

In 2008, the estimated total economic burden of illness and injury in Canada, in 2010 constant dollars, was $192.8 billion, as shown in Table 1.[1] Direct costs accounted for $175.6 billion (91.1%) and indirect costs for $17.2 billion (8.9%) of total costs in 2008. In 2005, the total cost estimated was $169.5 billion: $153.2 billion (90.4%) and $16.2 billion (9.6%) in direct and indirect costs respectively. Therefore, the estimates of the total Canadian economic burden of illness and injury increased 13.8% from 2005 to 2008.

Table 2 illustrates the EBIC 2005–2008 national cost estimates in current dollars, by cost type and cost component. In all years of analysis, direct costs represented a significant percentage of total costs, on average 90.8%, while indirect costs represented, on average, only 9.2%. In all years of analysis, hospital care expenditures were the largest direct cost component (with attributable expenditures) and morbidity costs were the largest indirect cost component. In 2008, hospital care, drug and physician care expenditures represented 26.0% ($49.1 billion), 14.8% ($27.9 billion) and 12.6% ($23.8 billion) of total costs respectively. Morbidity and mortality costs represented 8.7% ($16.4 billion) and 0.2% ($0.5 billion) of total costs, in 2008, respectively.

ECONOMIC BURDEN OF ILLNESS IN CANADA BY DIAGNOSTIC CATEGORY AND COST TYPE[2]

Table 3 illustrates EBIC 2008 cost estimates by diagnostic category, cost type and cost component. In 2008, 50.1% ($94.6 billion of $188.9 billion) of the costs of illness and injury could be attributed by diagnostic category. The unattributable costs consisted of direct ($88.1 billion) and indirect ($6.2 billion) costs that could not be attributed by diagnostic category. Specifically, 48.8% ($83.9 billion) and 63.3% ($10.7 billion) of direct and indirect costs could be attributable to a specific diagnostic category. With the exception of the diagnostic category respiratory infections, direct costs were larger than indirect costs for all diagnostic categories.

Diagnostic Categories with the Largest Direct Costs

As illustrated in Table 3, in 2008 the five diagnostic categories with the highest total direct costs were cardiovascular diseases ($11.7 billion, 6.8%), neuropsychiatric conditions ($11.4 billion, 6.6%), musculoskeletal diseases ($5.8 billion, 3.4%), digestive diseases ($5.5 billion, 3.2%) and injuries ($5.1 billion, 3.0%). Together, the five categories represented almost a quarter ($39.5 billion of $172.0 billion, 23.0%) of total direct costs and almost half ($39.5 billion of $83.9 billion, 47.1%) of direct costs attributable by diagnostic category.

---

[1] EBIC cost estimates in current dollars were converted to constant dollars using Statistics Canada's Consumer Price Index values (7).

[2] The diagnostic categories 'Symptoms, signs and ill-defined conditions' and 'Factors influencing health and contact with health services' are presented in the results tables but are not ranked or discussed in this report, as these categories include health conditions that are ill-defined or that can result from multiple health conditions, making it hard to attribute costs to a single disease/disorder.

Figure 1 shows the cost distribution by direct cost component for the five diagnostic categories with the highest total direct costs in 2008. Hospital care expenditures represented the largest percentage of direct costs for all diagnostic categories, except for the musculoskeletal diseases category. Specifically, hospital expenditures represented over 50% of direct costs for digestive diseases ($2.8 billion, 51.6%), and over 65% for injuries ($3.4 billion, 66.7%). Physician care expenditures were the most costly direct cost component in the musculoskeletal diseases category ($2.0 billion, 34.6%).

Diagnostic Categories with the Largest Indirect Costs

In 2008, as shown in Table 3, the five diagnostic categories with the highest total indirect costs were injuries ($3.0 billion, 17.8%), respiratory infections ($2.8 billion, 16.7%), musculoskeletal diseases ($1.4 billion, 8.3%), neuropsychiatric conditions ($1.0 billion, 6.2%) and certain infectious and parasitic diseases ($0.8 billion, 5.0%). Together, the five diagnostic categories represented over half ($9.0 billion of $16.9 billion, 54.0%) of total indirect costs and over 80% ($9.0 billion of $10.7 billion, 85.3%) of indirect costs attributable by diagnostic category.

Figure 2 shows the cost distribution by indirect cost component for the five diagnostic categories with the highest total indirect costs in 2008. Morbidity costs represented over 97% of indirect costs for all five diagnostic categories and represented almost 100% of indirect costs for respiratory infections ($2.8 billion, 99.8%) and musculoskeletal diseases ($1.4 billion, 99.8%). Of the five diagnostic categories, injuries showed the highest percentage of mortality costs ($0.1 billion, 2.8%).

Diagnostic Categories with the Largest Total Costs

As illustrated in Table 3, the five diagnostic categories with the highest total costs in 2008 were neuropsychiatric conditions ($12.5 billion, 6.6%), cardiovascular diseases ($12.1 billion, 6.4%), injuries ($8.1 billion, 4.3%), musculoskeletal diseases ($7.2 billion, 3.8%) and digestive diseases ($5.7 billion, 3.0%). Together, the five diagnostic categories represented almost a quarter ($45.5 billion of $188.9 billion, 24.1%) of total costs and almost half ($45.5 billion of $94.6 billion, 48.1%) of total costs attributable by diagnostic category.

Figure 3 shows the cost distribution by cost component for the five diagnostic categories with the highest total costs in 2008. Hospital care expenditures represented the largest percentage of total costs for all five diagnostic categories, except for the musculoskeletal diseases category for which it was the third largest. Physician care expenditures represented the largest percentage of total costs for musculoskeletal diseases ($2.0 billion, 27.9%). Drug expenditures were the second largest percentage for neuropsychiatric conditions ($3.6 billion, 28.5%), cardiovascular diseases ($4.3 billion, 35.4%) and digestive diseases ($1.4 billion, 25.2%). Morbidity costs accounted for the second highest costs for injuries ($2.9 billion, 36.0%).

ECONOMIC BURDEN OF ILLNESS IN CANADA BY SEX

Fifty-three percent of the total cost of illness ($100.7 billion of $188.9 billion) could be attributed by sex. The unattributable costs ($88.1 billion) consisted of direct costs that could not be attributed by sex.[3]

Economic Burden of Illness by Sex and Cost Type

Figures 4–6 show the distribution of direct, indirect and total costs by sex. Males accounted for a lower percentage of direct costs (45.9% versus 54.1%) and a higher percentage of indirect costs (54.9% versus 45.1%) compared to females. In considering direct and indirect costs together, males accounted for a lower percentage of the burden of illness and injury than females with 47.4% and 52.6% of the burden attributed respectively.

Economic Burden of Illness by Sex and Cost Component

Figure 7 illustrates the cost distribution by sex and cost component in 2008. Total costs were lower for males ($47.8 billion) compared to females ($53.0 billion). Relative to females, costs for males comprised a larger percentage of hospital care (39.7% versus 37.7%), mortality (0.7% versus 0.2%) and morbidity (18.7% versus 14.1%), and a lower percentage of drug (20.4% versus 21.6%) and physician care (20.6% versus 26.3%) costs.

Figure 8 illustrates the cost distribution by cost component and sex in 2008. Males accounted for a higher percentage of morbidity ($8.9 billion, 54.4%) costs. Additionally, males accounted for over two-thirds of mortality costs ($0.3 billion, 74.0%). Females accounted for a higher percentage of hospital care ($20.0 billion, 51.3%), drug ($11.5 billion, 54.1%) and physician care ($14.0 billion, 58.7%) costs.

ECONOMIC BURDEN OF ILLNESS IN CANADA BY AGE GROUP

Fifty-three percent of the total cost of illness ($100.7 billion of $188.9 billion) could be attributed by age group.[4] The unattributable costs ($88.1 billion) consisted of direct costs that could not be attributed by age group.[5]

Economic Burden of Illness by Age Group and Cost Type

Figures 9–11 show the distribution of direct, indirect and total costs by age group. Individuals aged 35–54 years ($20.2 billion, 24.1%) and 75 years and older ($18.1 billion, 21.6%) accounted for the highest percentage of direct costs. Indirect costs were highest for individuals aged 35–54 years ($10.1 billion, 60.2%), followed by individuals aged 15–34 years ($3.8 billion, 22.5%). When direct and indirect costs are considered together, the distribution more similarly reflects that of the direct costs with individuals aged 35–54 years ($30.4 billion, 30.1%) and 75 years and older ($18.1 billion, 18.0%) accounting for the highest percentage of total costs.

---

[3] For direct costs, the unattributable amount of each direct cost component is calculated as the NHEX total for the specific component minus the cost attributable by EBIC categories (5).

[4] Mortality and morbidity costs were estimated only for individuals aged 15–64 years and 15–75 years respectively.

[5] For direct costs, the unattributable amount of each direct cost component is calculated as the NHEX total for the specific component minus the cost attributable by EBIC categories.

Economic Burden of Illness by Age Group and Cost Component

Figure 12 illustrates the cost distribution by age group and cost component in 2008. For all age groups, with the exception of individuals aged 15–34 years and 35–54 years, hospital care expenditures were the cost component that accounted for the highest costs. Hospital care expenditures represented half of costs for individuals aged 0-14 years ($3.2 billion, 50.0%) and almost half of the costs for individuals aged 65–74 years ($6.4 billion, 48.2%); these groups all had no or very low indirect costs. Morbidity costs were the cost component with the highest costs for individuals aged 35–54 years ($9.9 billion, 32.7%). For all age groups for which mortality costs were estimated, these costs accounted for the lowest percentage of costs within each age group.

Figure 13 illustrates the cost distribution by cost component and age group in 2008. Individuals aged 75 years and older accounted for the highest percentage of hospital care expenditures ($11.5 billion, 29.4%). The highest percentage of drug ($6.4 billion, 30.0%), physician care ($6.4 billion, 26.8%), mortality ($0.2 billion, 51.8%) and morbidity ($9.9 billion, 60.5%) costs were attributable to individuals aged 35–54 years.

FIGURES AND TABLES

TABLE 1: Cost Estimates by Cost Type and Cost Component, Canada, 2005–2008 ($'000,000 2010 Constant Dollars)[4]

COST COMPONENT	2008	% OF TOTAL	2007	% OF TOTAL	2006	% OF TOTAL	2005	% OF TOTAL
DIRECT COSTS[1,2]								
Hospital Care Expenditures	**50,155.8**	***26.0***	**47,780.6**	***25.9***	**46,120.0**	***26.0***	**44,217.6**	***26.1***
Attributable	39,744.9	*20.6*	38,224.2	*20.8*	35,935.7	*20.2*	33,831.1	*20.0*
Unattributable	10,410.8	*5.4*	9,556.4	*5.2*	10,184.4	*5.7*	10,386.5	*6.1*
Drug Expenditures	**28,509.7**	***14.8***	**27,625.2**	***15.0***	**26,796.6**	***15.1***	**25,253.6**	***14.9***
Attributable	21,633.3	*11.2*	20,952.3	*11.4*	19,990.9	*11.3*	19,296.7	*11.4*
Unattributable	6,876.4	*3.6*	6,672.8	*3.6*	6,805.7	*3.8*	5,956.9	*3.5*
Physician Care Expenditures	**24,280.5**	***12.6***	**22,520.9**	***12.2***	**21,406.6**	***12.1***	**20,203.7**	***11.9***
Attributable	24,280.5	*12.6*	22,520.9	*12.2*	21,406.6	*12.1*	20,203.7	*11.9*
Unattributable	0.0	*0.0*	0.0	*0.0*	0.0	*0.0*	0.0	*0.0*
Other Direct Costs	**72,676.8**	***37.7***	**69,503.5**	***37.7***	**66,745.7**	***37.6***	**63,548.8**	***37.5***
Attributable	0.0	*0.0*	0.0	*0.0*	0.0	*0.0*	0.0	*0.0*
Unattributable	72,676.8	*37.7*	69,503.5	*37.7*	66,745.7	*37.6*	63,548.8	*37.5*
Total Direct Costs	**175,622.8**	***91.1***	**167,430.2**	***90.9***	**161,069.0**	***90.7***	**153,223.7**	***90.4***
INDIRECT COSTS								
Mortality Costs	**463.5**	***0.2***	**461.5**	*0.3*	**470.7**	*0.3*	**469.8**	*0.3*
Attributable	463.5	*0.2*	461.5	*0.3*	470.7	*0.3*	469.8	*0.3*
Unattributable	0.0	*0.0*	0.0	*0.0*	0.0	*0.0*	0.0	*0.0*
Morbidity Costs	**16,741.3**	***8.7***	**16,312.9**	***8.9***	**16,028.0**	***9.0***	**15,760.4**	***9.3***
Attributable	10,423.1	*5.4*	10,117.0	*5.5*	9,931.4	*5.6*	9,766.3	*5.8*
Unattributable[3]	6,318.23	*3.3*	6,195.9	*3.4*	6,096.6	*3.4*	5,994.1	*3.5*
Total Indirect Costs	**17,204.8**	***8.9***	**16,774.4**	***9.1***	**16,498.7**	***9.3***	**16,230.2**	***9.6***
Total Cost of Illness	**192,827.6**	***100.0***	**184,204.5**	***100.0***	**177,567.8**	***100.0***	**169,453.9**	***100.0***

[1] The cost totals for each direct cost component were obtained from CIHI's *National Health Expenditure Trends, 1975 to 2012* (5).

[2] For direct costs, the unattributable amount of each direct cost component is calculated as the NHEX total for the specific component minus the cost attributable by EBIC categories.

[3] The unattributable amount of morbidity costs refers to the value of lost production that could not be designated to a specific diagnostic category.

[4] EBIC cost estimates in current dollars were converted to constant dollars using Statistics Canada's Consumer Price Index values (7).

NOTE: Any discrepancies may be due to rounding.

TABLE 2: Cost Estimates by Cost Type and Cost Component, Canada, 2005–2008 ($'000,000 Current Dollars)

COST COMPONENT	2008	% OF TOTAL	2007	% OF TOTAL	2006	% OF TOTAL	2005	% OF TOTAL
DIRECT COSTS[1,2]								
Hospital Care Expenditures	**49,122.5**	***26.0***	**45,729.9**	***25.9***	**43,190.5**	***26.0***	**40,611.9**	***26.1***
Attributable	38,926.1	*20.6*	36,583.7	*20.8*	33,653.0	*20.2*	31,072.4	*20.0*
Unattributable	10,196.4	*5.4*	9,146.3	*5.2*	9,537.5	*5.7*	9,539.5	*6.1*
Drug Expenditures	**27,922.4**	***14.8***	**26,439.5**	***15.0***	**25,094.5**	***15.1***	**23,194.3**	***14.9***
Attributable	21,187.6	*11.2*	20,053.1	*11.4*	18,721.1	*11.3*	17,723.2	*11.4*
Unattributable	6,734.8	*3.6*	6,386.4	*3.6*	6,373.4	*3.8*	5,471.1	*3.5*
Physician Care Expenditures	**23,780.3**	***12.6***	**21,554.3**	***12.2***	**20,046.9**	***12.1***	**18,556.2**	***11.9***
Attributable	23,780.3	*12.6*	21,554.3	*12.2*	20,046.9	*12.1*	18,556.2	*11.9*
Unattributable	0.0	*0.0*	0.0	*0.0*	0.0	*0.0*	0.0	*0.0*
Other Direct Costs	**71,179.6**	***37.7***	**66,520.5**	***37.7***	**62,506.1**	***37.6***	**58,366.7**	***37.5***
Attributable	0.0	*0.0*	0.0	*0.0*	0.0	*0.0*	0.0	*0.0*
Unattributable	71,179.6	*37.7*	66,520.5	*37.7*	62,506.1	*37.6*	58,366.7	*37.5*
Total Direct Costs	**172,004.8**	***91.1***	**160,244.3**	***90.9***	**150,838.0**	***90.7***	**140,729.0**	***90.4***
INDIRECT COSTS								
Mortality Costs	**454.0**	***0.2***	**441.7**	*0.3*	**440.8**	*0.3*	**431.5**	*0.3*
Attributable	454.0	*0.2*	441.7	*0.3*	440.8	*0.3*	431.5	*0.3*
Unattributable	0.0	*0.0*	0.0	*0.0*	0.0	*0.0*	0.0	*0.0*
Morbidity Costs	**16,396.4**	***8.7***	**15,612.7**	***8.9***	**15,010.0**	***9.0***	**14,475.2**	***9.3***
Attributable	10,208.3	*5.4*	9,682.8	*5.5*	9,300.6	*5.6*	8,969.9	*5.8*
Unattributable[3]	6,188.07	*3.3*	5,930.0	*3.4*	5,709.4	*3.4*	5,505.3	*3.5*
Total Indirect Costs	**16,850.4**	***8.9***	**16,054.5**	***9.1***	**15,450.7**	***9.3***	**14,906.7**	***9.6***
Total Cost of Illness	**188,855.2**	***100.0***	**176,298.8**	***100.0***	**166,288.8**	***100.0***	**155,635.8**	***100.0***

[1] The cost totals for each direct cost component were obtained from CIHI's *National Health Expenditure Trends, 1975 to 2012* (5).

[2] For direct costs, the unattributable amount of each direct cost component is calculated as the NHEX total for the specific component minus the cost attributable by EBIC categories.

[3] The unattributable amount of morbidity costs refers to the value of lost production that could not be designated to a specific diagnostic category.

NOTE: Any discrepancies may be due to rounding.

TABLE 3: Cost Estimates by Diagnostic Category, Cost Type and Cost Component, Canada, 2008 ($'000,000 Current Dollars)

DIAGNOSTIC CATEGORY	HOSPITAL CARE	% OF HOSPITAL CARE	DRUG	% OF DRUG	PHYSICIAN CARE	% OF PHYSICIAN CARE	OTHER DIRECT	% OF OTHER DIRECT	TOTAL DIRECT	% OF TOTAL DIRECT	DIRECT RANK
Certain Infectious and Parasitic Diseases	871.1	1.8	696.7	2.5	509.3	2.1	0.0	0.0	2,077.0	1.2	16
Respiratory Infections	958.9	2.0	509.3	1.8	1,125.2	4.7	0.0	0.0	2,593.3	1.5	12
Maternal Conditions	1,382.7	2.8	58.5	0.2	792.1	3.3	0.0	0.0	2,233.3	1.3	13
Perinatal Conditions	928.6	1.9	9.8	0.0	42.0	0.2	0.0	0.0	980.4	0.6	18
Nutritional Deficiencies	108.7	0.2	77.2	0.3	158.0	0.7	0.0	0.0	343.9	0.2	22
Malignant Neoplasms	2,329.4	4.7	467.1	1.7	1,031.7	4.3	0.0	0.0	3,828.2	2.2	8
Other Neoplasms	431.3	0.9	49.8	0.2	484.0	2.0	0.0	0.0	965.1	0.6	19
Diabetes Mellitus	492.7	1.0	1,198.2	4.3	487.3	2.0	0.0	0.0	2,178.2	1.3	14
Endocrine Disorders	423.4	0.9	1,728.4	6.2	587.5	2.5	0.0	0.0	2,739.2	1.6	11
Neuropsychiatric Conditions	5,520.3	11.2	3,551.3	12.7	2,347.0	9.9	0.0	0.0	11,418.6	6.6	2
Sense Organ Diseases	520.3	1.1	283.4	1.0	1,329.3	5.6	0.0	0.0	2,132.9	1.2	15
Cardiovascular Diseases	5,068.0	10.3	4,272.7	15.3	2,352.0	9.9	0.0	0.0	11,692.7	6.8	1
Respiratory Diseases	1,818.5	3.7	1,197.2	4.3	632.6	2.7	0.0	0.0	3,648.3	2.1	10
Digestive Diseases	2,839.4	5.8	1,434.0	5.1	1,232.6	5.2	0.0	0.0	5,506.0	3.2	5
Genitourinary Diseases	1,499.2	3.1	670.8	2.4	1,626.4	6.8	0.0	0.0	3,796.5	2.2	9
Skin Diseases	410.3	0.8	680.5	2.4	833.1	3.5	0.0	0.0	1,923.9	1.1	17
Musculoskeletal Diseases	1,795.9	3.7	1,982.5	7.1	2,002.5	8.4	0.0	0.0	5,780.8	3.4	4
Congenital Anomalies	302.9	0.6	35.0	0.1	139.0	0.6	0.0	0.0	477.0	0.3	20
Oral Conditions	153.6	0.3	42.3	0.2	214.1	0.9	0.0	0.0	410.0	0.2	21
Injuries	3,395.8	6.9	259.7	0.9	1,435.0	6.0	0.0	0.0	5,090.5	3.0	7
Symptoms, Signs and Ill-Defined Conditions	2,131.7	4.3	1,283.1	4.6	1,846.1	7.8	0.0	0.0	5,260.8	3.1	6
Factors Influencing Health and Contact with Health Services	5,543.4	11.3	700.4	2.5	2,573.7	10.8	0.0	0.0	8,817.5	5.1	3
Total EBIC Cost Estimates	**38,926.1**	**79.2**	**21,187.6**	**75.9**	**23,780.3**	**100.0**	**0.0**	**0.0**	**83,894.0**	**48.8**	-
Unattributable Costs[1]	**10,196.4**	**20.8**	**6,734.8**	**24.1**	**0.0**	**0.0**	**71,179.6**	**100.0**	**88,110.8**	**51.2**	-
Total Costs[2]	**49,122.5**	**100.0**	**27,922.4**	**100.0**	**23,780.3**	**100.0**	**71,179.6**	**100.0**	**172,004.8**	**100.0**	

[1] The unattributable amount of expenditures for each direct cost component was calculated as the NHEX expenditure total minus the costs attributable by EBIC categories.

[2] Source: Canadian Institute for Health Information, National Health Expenditure Trends, 1975 to 2012 (2).

NOTE: Any discrepancies may be due to rounding.

TABLE 3 (continued): Cost Estimates by Diagnostic Category, Cost Type and Cost Component, Canada, 2008 ($'000,000 Current Dollars)

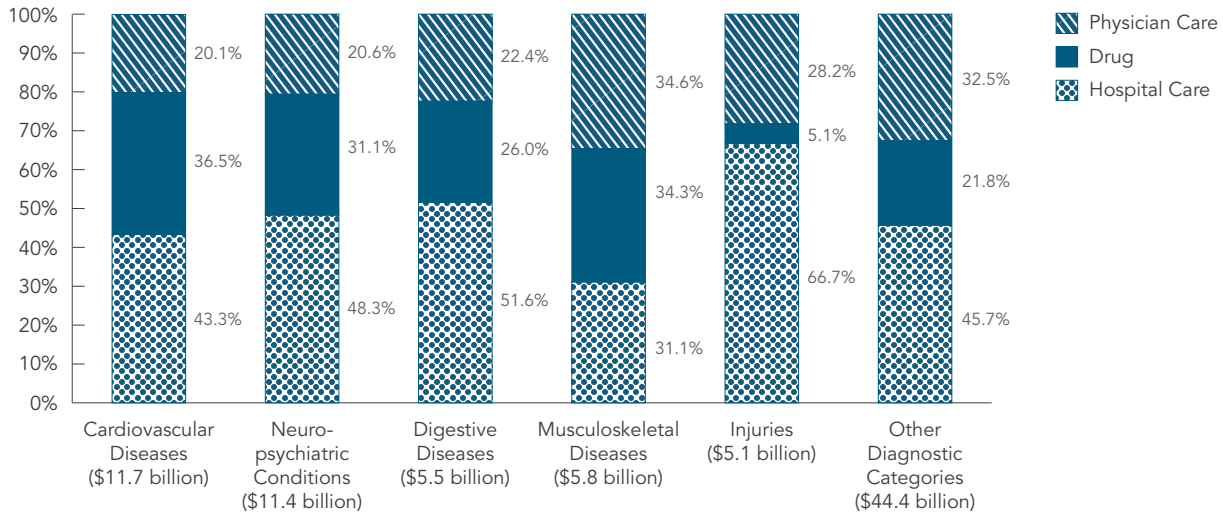
DIAGNOSTIC CATEGORY	MORTALITY	% OF MORTALITY	MORBIDITY	% OF MORBIDITY	TOTAL INDIRECT	% OF TOTAL INDIRECT	INDIRECT RANK	TOTAL (DIRECT + INDIRECT)	% OF TOTAL (DIRECT + INDIRECT)	TOTAL (DIRECT + INDIRECT) RANK
Certain Infectious and Parasitic Diseases	13.0	2.9	826.9	5.0	839.9	5.0	5	2,916.9	1.5	12
Respiratory Infections	5.1	1.1	2,812.4	17.2	2,817.6	16.7	2	5,410.8	2.9	7
Maternal Conditions	0.2	0.0	-	-	0.2	0.0	18	2,233.5	1.2	15
Perinatal Conditions	0.1	0.0	-	-	0.1	0.0	19	980.5	0.5	18
Nutritional Deficiencies	0.3	0.1	-	-	0.3	0.0	17	344.2	0.2	22
Malignant Neoplasms	166.0	36.6	420.0	2.6	586.1	3.5	6	4,414.2	2.3	9
Other Neoplasms	1.8	0.4	-	-	1.8	0.0	15	966.9	0.5	19
Diabetes Mellitus	12.3	2.7	132.9	0.8	145.2	0.9	10	2,323.4	1.2	14
Endocrine Disorders	6.3	1.4	-	-	6.3	0.0	13	2,745.6	1.5	13
Neuropsychiatric Conditions	19.1	4.2	1,024.4	6.2	1,043.4	6.2	4	12,462.0	6.6	1
Sense Organ Diseases	0.0	0.0	-	-	0.0	0.0	21	2,132.9	1.1	16
Cardiovascular Diseases	92.4	20.4	269.6	1.6	362.0	2.1	7	12,054.7	6.4	2
Respiratory Diseases	11.3	2.5	110.0	0.7	121.3	0.7	11	3,769.6	2.0	11
Digestive Diseases	24.5	5.4	151.1	0.9	175.6	1.0	8	5,681.6	3.0	6
Genitourinary Diseases	3.8	0.8	156.5	1.0	160.3	1.0	9	3,956.8	2.1	10
Skin Diseases	0.4	0.1	-	-	0.4	0.0	16	1,924.3	1.0	17
Musculoskeletal Diseases	2.5	0.5	1,395.5	8.5	1,398.0	8.3	3	7,178.8	3.8	5
Congenital Anomalies	2.9	0.6	-	-	2.9	0.0	14	479.8	0.3	20
Oral Conditions	0.0	0.0	-	-	0.0	0.0	20	410.0	0.2	21
Injuries	84.6	18.6	2,909.0	17.7	2,993.5	17.8	1	8,084.1	4.3	4
Symptoms, Signs and Ill-Defined Conditions	7.5	1.6	-	-	7.5	0.0	12	5,268.3	2.8	8
Factors Influencing Health and Contact with Health Services	-	-	-	-	0.0	0.0	22	8,817.5	4.7	3
Total EBIC Cost Estimates	**454.0**	***100.0***	***10,208.3***	**62.3**	**10,662.3**	***63.3***	-	***94,556.4***	**50.1**	-
Unattributable Costs[1]	**0.0**	***0.0***	***6,188.1***	**37.7**	**6,188.1**	***36.7***	-	***94,298.8***	**49.9**	-
Total Costs[2]	**454.0**	***100.0***	***16,396.4***	**100.0**	**16,850.4**	***100.0***		***188,855.2***	**100.0**	

[1] The unattributable amount of expenditures for each direct cost component was calculated as the NHEX expenditure total minus the costs attributable by EBIC categories.

[2] Source: Canadian Institute for Health Information, National Health Expenditure Trends, 1975 to 2012 (2).

NOTE: Any discrepancies may be due to rounding.

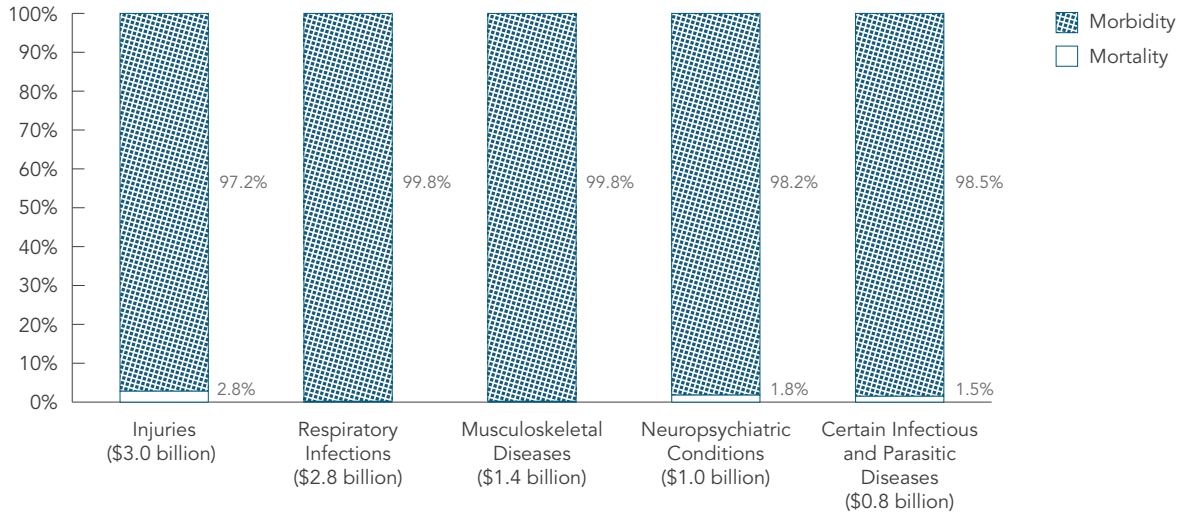
FIGURE 1: Cost Distribution by Direct Cost Component for the Five Diagnostic Categories with the Highest Total Direct Costs, Canada, 2008



NOTES: 'Other diagnostic categories' include the costs from all other EBIC diagnostic categories not individually displayed in the figure.

Any discrepancies may be due to rounding.

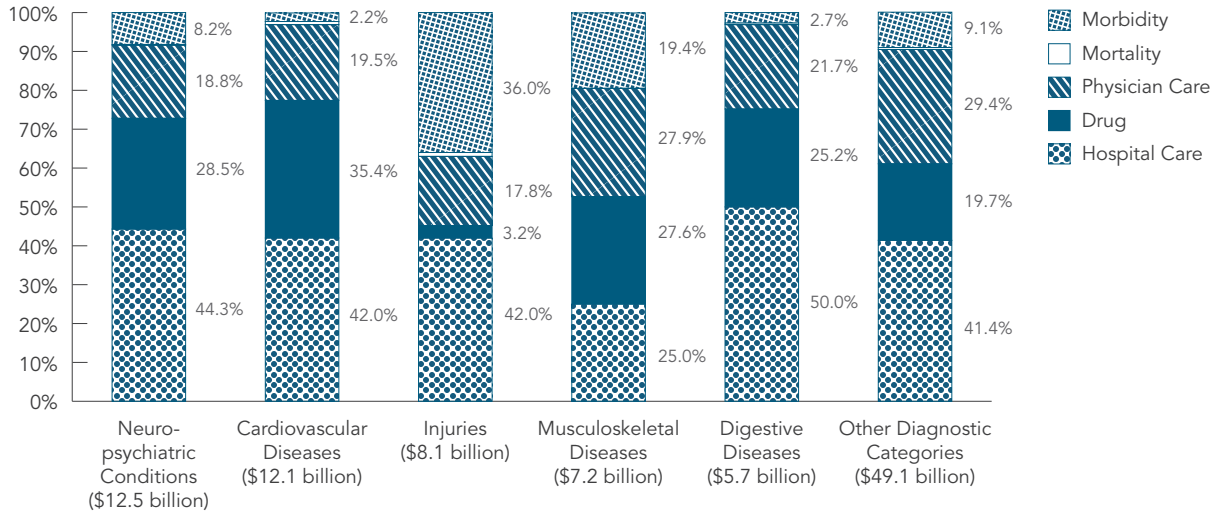
FIGURE 2: Cost Distribution by Indirect Cost Component for the Five Diagnostic Categories with the Highest Total Indirect Costs, Canada, 2008



NOTES: Mortality costs represented 0.2% of costs in the 'Respiratory infections' and 'Musculoskeletal diseases' categories; these numeric values are represented but not displayed in the figure. 'Other diagnostic categories' include the costs from all other EBIC diagnostic categories not individually displayed in the figure.

Any discrepancies may be due to rounding.

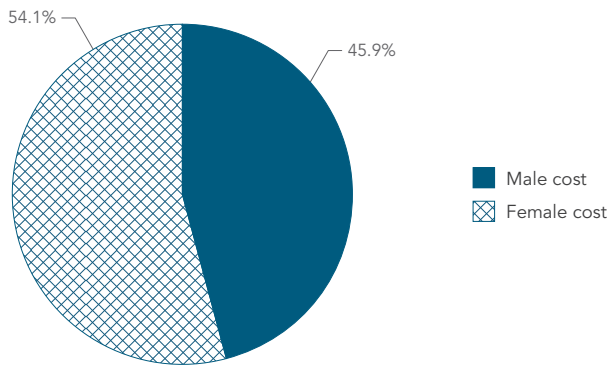
FIGURE 3: Cost Distribution by Cost Component for the Five Diagnostic Categories with the Highest Total Costs, Canada, 2008



NOTES: Mortality costs represented 0.2%, 0.8%, 1.1%, 0.0%, 0.4% and 0.5% of costs in the 'Neuropsychiatric conditions', 'Cardiovascular diseases', 'Injuries', 'Musculoskeletal diseases', 'Digestive diseases' and 'Other diagnostic categories' respectively; these numeric values are represented but not displayed in the figure. 'Other diagnostic categories' include the costs from all other EBIC diagnostic categories not individually displayed in the figure.

Any discrepancies may be due to rounding.

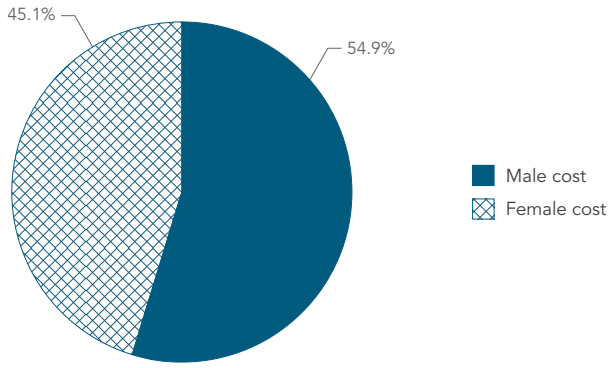
FIGURE 4: Direct Cost Distribution by Sex, Canada, 2008



NOTES: The above figure represents the cost distribution by sex for total direct costs of $83.9 billion.

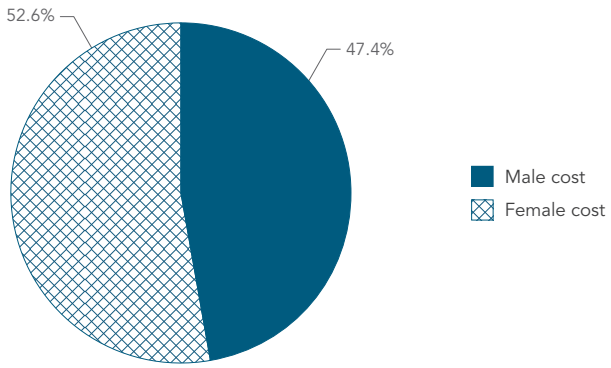
Any discrepancies may be due to rounding.

FIGURE 5: Indirect Cost Distribution by Sex, Canada, 2008



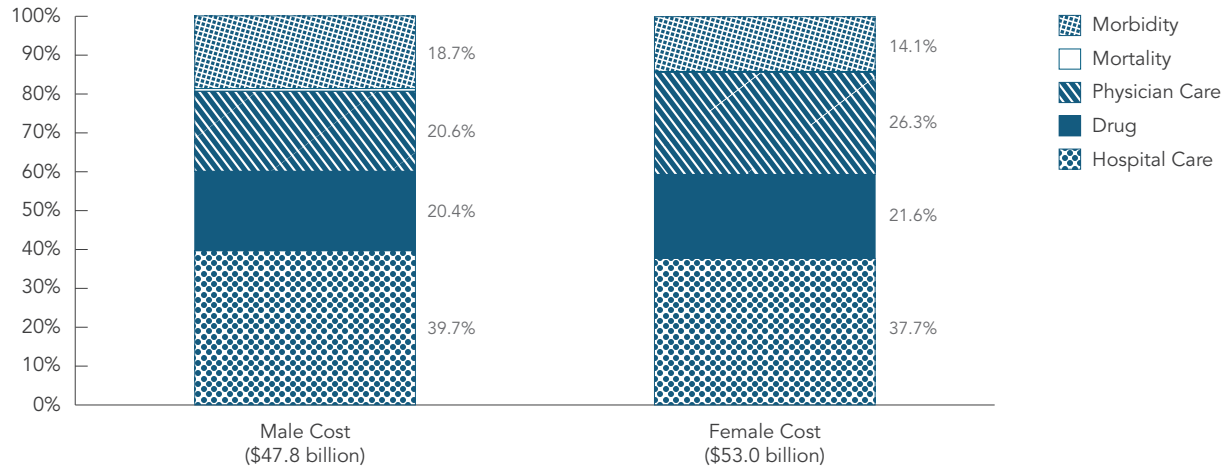
NOTES: The above figure represents the cost distribution by sex for total indirect costs of $16.9 billion. Any discrepancies may be due to rounding.

FIGURE 6: Total Cost Distribution by Sex, Canada, 2008



NOTES: The above figure represents the cost distribution by sex for total costs of $100.7 billion. Any discrepancies may be due to rounding.

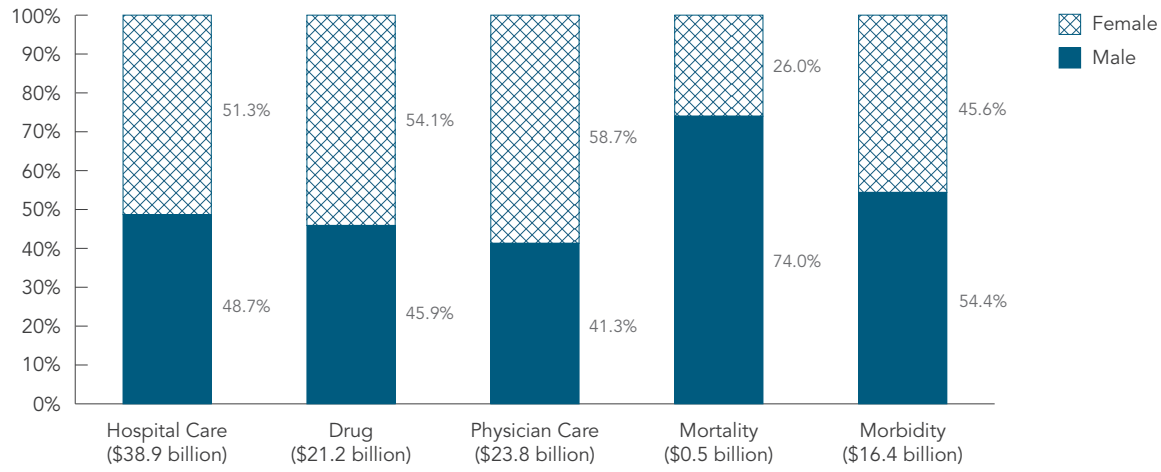
FIGURE 7: Cost Distribution by Sex and Cost Component, Canada, 2008



NOTES: Mortality costs for males and females represented 0.7% and 0.2% of totals costs respectively; this numeric value is represented but not displayed in the figure.

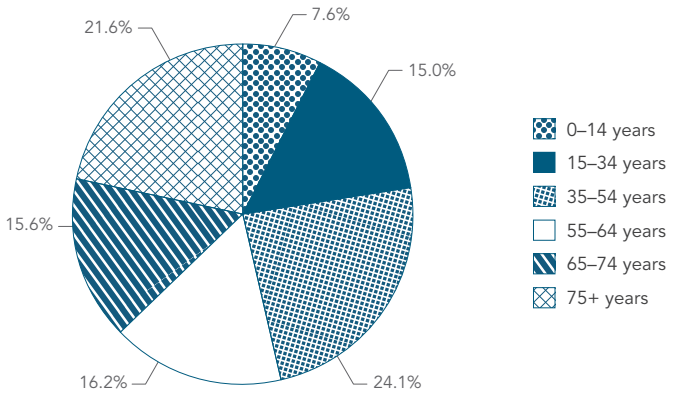
Any discrepancies may be due to rounding.

FIGURE 8: Cost Distribution by Cost Component and Sex, Canada, 2008



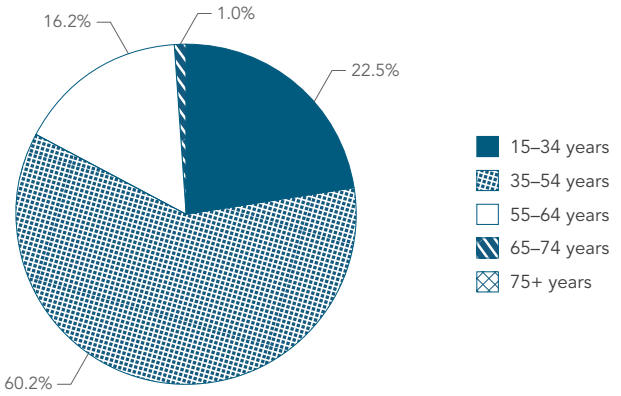
NOTE: Any discrepancies may be due to rounding.

FIGURE 9: Direct Cost Distribution by Age Group, Canada, 2008



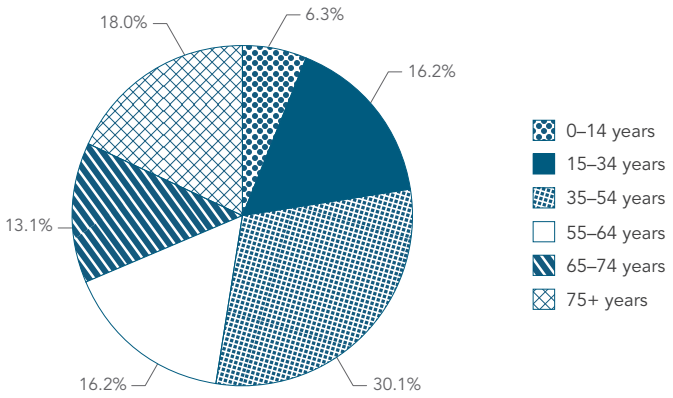
NOTES: The above figure represents the cost distribution by age group for total direct costs of $83.9 billion. Any discrepancies may be due to rounding.

FIGURE 10: Indirect Cost Distribution by Age Group, Canada, 2008



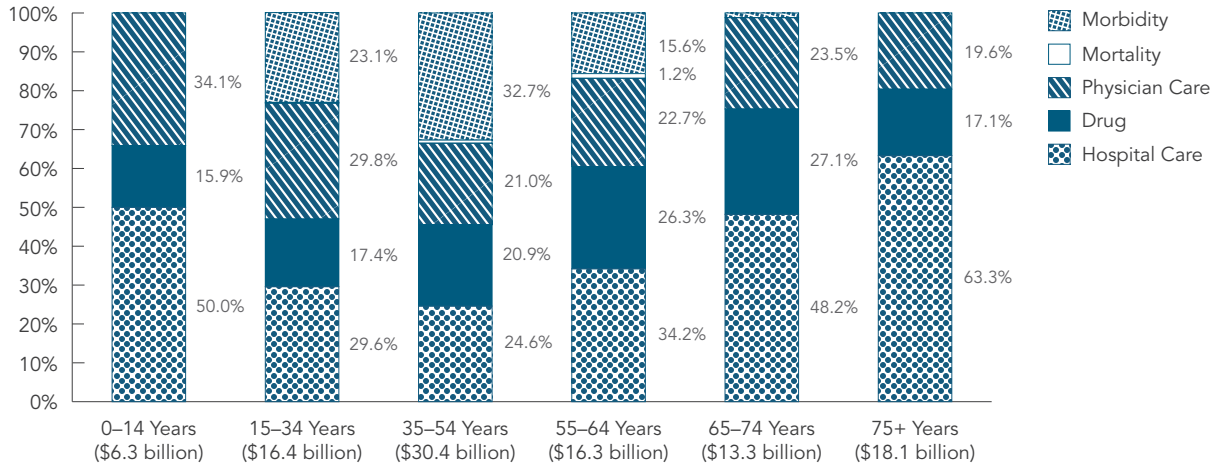
NOTES: The above figure represents the cost distribution by age group for total indirect costs of $16.9 billion. Individuals aged 75 years and older represented 0.0% of indirect costs; this numeric value is represented but not displayed in the figure. Any discrepancies may be due to rounding.

FIGURE 11: Total Cost Distribution by Age Group, Canada, 2008



NOTES: The above figure represents the cost distribution by age group for total costs of $100.7 billion.
Any discrepancies may be due to rounding.

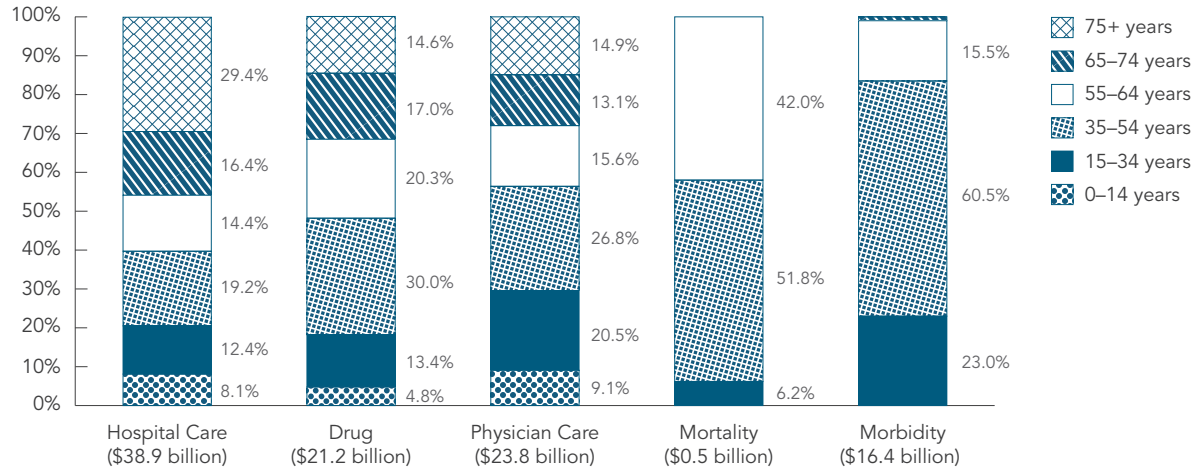
FIGURE 12: Cost Distribution by Age Group and Cost Component, Canada, 2008



NOTES: Mortality costs for individuals aged 15–34 years and 35–54 years represented 0.2% and 0.8% of totals costs respectively; this numeric value is represented but not displayed in the figure. Similarly, morbidity costs for individuals aged 65–74 years represented 1.2% of total costs, this number is represented but not displayed in the figure. In this report, mortality and morbidity costs were only estimated for individuals aged 15–64 years and 15–75 years respectively.

Any discrepancies may be due to rounding.

FIGURE 13: Cost Distribution by Cost Component and Age Group, Canada, 2008



NOTES: Morbidity costs for individuals aged 65–74 years and 75+ years represented 1.0% and 0.0% of total morbidity costs respectively; these numeric values are represented but not displayed in the figure. In this report, mortality and morbidity costs were only estimated for individuals aged 15–64 years and 15–75 years respectively.

Any discrepancies may be due to rounding.

REPORT 1: EBIC HOSPITAL CARE EXPENDITURES, 2004–2008

1. BACKGROUND

A hospital is an institution licensed or approved by a provincial/territorial government or operated by the Government of Canada in which patients are accommodated on the basis of medical/nursing need and are provided with continuing medical/nursing care and supporting diagnostic and therapeutic services.[6] Hospital expenditures include all costs of operating and maintaining both public and private hospitals in Canada: drugs dispensed in hospitals, medical supplies, therapeutic and diagnostic outpatient costs, administrative costs, some research costs, accommodation and meals for patients, maintenance of hospital facilities, and gross salaries and wages for all hospital staff (such as physicians on hospital payroll, nurses, technicians and medical students) (5).

Although the current edition of EBIC focuses on the years 2005–2008, the 2004 results are also presented, as the data required to produce 2004 estimates were available. EBIC 2004–2008 hospital care expenditures were estimated and distributed across diagnostic category/subcategory, sex, age group and province/territory for each year of analysis. This report describes the data sources and methods used to derive the 2004–2008 hospital care expenditure estimates. Additionally, it presents and discusses the results and the data and methods limitations.

2. DATA SOURCES

To estimate EBIC hospital care expenditures, the following databases from CIHI were used: Discharge Abstract Database (DAD), Hospital Morbidity Database (HMDB), National Ambulatory Care Reporting System (NACRS), Hospital Mental Health Database (HMHDB), Canadian Management Information Systems Database (CMDB) and NHEX.

The DAD, HMDB, NACRS and HMHDB hold information on hospital separations (discharges, deaths, sign-outs and transfers). In these databases, the data collected on each discharge abstract includes coded diagnoses, coded intervention, patient demographic information and administrative information. The DAD is a national database (excluding Quebec) of information on all acute inpatient hospital separations for each fiscal year (8–13).[7] Additionally, the DAD contains information on day surgeries for most provinces/territories and some data on chronic, rehabilitation and psychiatric hospital separations.[8] The HMDB is a national database that contains information on all acute inpatient hospital separations by fiscal year, similar to the DAD (14–19). However, the HMDB holds information on Quebec acute inpatient separations and excludes all day surgery records. The NACRS contains

---

[6] Hospital/service types are acute inpatient, ambulatory care (day surgery, emergency, clinic and other ambulatory care), chronic, rehabilitation and psychiatric.

[7] Acute inpatient separations refer to separations from acute wards of general hospitals with a length of stay greater than 24 hours.

[8] In the years of analysis, day surgery records for Ontario were captured in NACRS, while day surgery records for Nova Scotia are contained in both the DAD and NACRS. Alberta reported all ambulatory care data to the ACCS, which was not available for EBIC analyses.

records of all Ontario ambulatory care separations (day surgery, emergency department, clinic and other ambulatory care), as well as some ambulatory care separations for a few other provinces/territories (20–25). The HMHDB contains information by fiscal year on all Ontario psychiatric hospital separations and on all separations from designated adult psychiatric beds in Ontario general hospitals; this information is partial for other provinces/territories (26–28).[9]

The CMDB and NHEX hold hospital expenditure information. The CMDB provides public and private hospital financial information, such as total expenses and detailed inpatient and outpatient expenses incurred, by hospital and fiscal year (29,30). The NHEX supplies public and private hospital expenditure totals, as well as other expenditure totals (e.g. drug, physician), by province/territory and fiscal/calendar year (5).

3. METHODS

In previous EBIC editions, variations of two costing methods were used to allocate hospital care expenditures by EBIC categories, the per diem method and the resource intensity weight (RIW) method. The former involves multiplying record-level length of stay (LOS) by a facility per diem (or cost per bed per day) to obtain a record-level cost (each record represents a hospital separation). Costs per diagnostic category/subcategory, sex, age group and province/territory are the sum of the costs per record within each category. The RIW method involves multiplying record-level RIWs by a facility-level cost per weighted case (CPWC) to obtain a record-level cost.[10,11] Costs per diagnostic category/subcategory, sex, age group and province/territory are the sum of the costs per record within each category.

A variation of the RIW method was used to estimate hospital care expenditures for EBIC 1998, whereas the per diem method was used for EBIC 2000 (3,4). The RIW method is considered a superior method for estimating hospital care expenditures since it does not assume a homogeneous patient population within a given hospital. When the per diem method is used, two patients in the same hospital with the same LOS would be assigned the same cost, when in reality their resource utilization may be very different. Several factors are considered in CIHI's calculation of RIW values for DAD acute inpatient records: case mix group, age factor, comorbidity factor, a number of flagged interventions factor, intervention event factor, out-of-hospital intervention factor and possible interactions (32).[12]

The EBIC costing method used to estimate 2004–2008 hospital care expenditures varied as a result of the differences in data availability by hospital type/service. However, the RIW or other weighting method, such as weighted LOS, was used when available. All RIW, CPWC and per diem fields were calculated and provided by CIHI.[13] For further information on these calculations, please consult the appropriate CIHI documentation (30–32).

---

[9] The HMHDB also holds information obtained from the DAD and HMDB on all general hospital separations with a primary diagnosis of mental illness. Thus, the HMHDB holds all available data on mental health separations.

[10] The CPWC is calculated as net total inpatient hospital expenditures (from the CMDB) divided by total weighted inpatient cases (∑ RIW) (31).

[11] If a facility level CPWC is unavailable, a regional or provincial/territorial CPWC may be used.

[12] A case mix group is formed by grouping patients that are homogeneous according to the most responsible diagnosis (or manifestation diagnosis) and interventions (32).

[13] CIHI calculated all DAD 2004–2008 RIW and CPWC fields using the CMG+ 2009 methodology. Similarly, CIHI calculated all NACRS 2004–2008 RIW and CPWC fields using the Comprehensive Ambulatory Classification System Directory (CACS) 2009 methodology. Per diems were not provided for the fiscal year 2004.

An EBIC database for each year of analysis (2004–2008) was created to house total hospital care expenditures by diagnostic category/subcategory, sex, age group and province/territory.[14,15,16,17] For all hospital types/services and years of analysis, all record-level costs were attributed to the health condition most responsible for the hospital stay. The most responsible health condition was coded in CIHI's hospital databases using the International Classification of Diseases (ICD) coding; depending on the database either version 9 or 10 was used (33,34). Please consult the EBIC diagnostic category table (Appendix C) which illustrates how costs were grouped into the EBIC diagnostic categories/subcategories using ICD codes.[18] Although EBIC hospital care expenditure totals are not available by hospital/service type, the sections below (3.1–3.4) detail the method used for each hospital/service type, which often differed because of differences in data sources and availability.

3.1 Acute Inpatient Hospital Care

Acute inpatient 2004–2008 hospital care expenditures for all provinces/territories (except Quebec) were estimated using data from the DAD, employing the RIW method (RIW*CPWC).[19,20,21] Acute inpatient expenditures for Quebec were estimated using data from the HMDB, employing the per diem method (per diem*LOS), as RIWs and CPWCs were not available.[22] However, although record-level LOS was available for Quebec in the years of analysis, facility and provincial per diems were not. Therefore, the weighted average per diem for acute inpatient discharges of other provinces was used as a proxy for a Quebec per diem in the years 2005–2008. Per diems were not provided for any province in the 2004 hospital databases. Therefore, a 2004 Quebec per diem was estimated using a linear regression of the weighted average of per diems from 2005–2008, after adjusting for inflation.[23]

Acute inpatient hospital care expenditures for general hospital designated psychiatric beds were estimated for Ontario in 2006–2008 using information from the HMHDB, employing the per diem method.[24,25] It was not possible to estimate these expenditures for Ontario in 2004 and 2005 or for the other provinces/territories in 2004–2008.

---

[14] EBIC age groups are as follows: 0–14 years, 15–34 years, 35–54 years, 55–64 years, 65–74 years and 75+ years.

[15] Province/territory of residence was used to allocate 2004–2008 hospital care expenditures across provinces/territories. Province/territory of occurrence was used when province/territory of residence was missing. Province/territory of residence was not available for Quebec hospital stays, thus all costs were attributed to Quebec.

[16] The EBIC hospital care expenditure databases also have a field for ICD-9/ICD-10 code and five-year age group. Therefore, expenditure totals are searchable to this level of disaggregation. However, the level of disaggregation to which hospital care expenditure totals can be released may depend on the release restrictions of other EBIC cost components.

[17] The CIHI hospital databases are by fiscal year (April 1st yr1 to March 31st yr2). For EBIC, all costs within a fiscal year were assigned to the year in which the fiscal year started. For example, EBIC 2008 hospital care expenditures were obtained through analysis of hospital databases of the fiscal year 2008–2009.

[18] In the hospital databases, the most responsible health condition field had all injuries coded using S and T codes (ICD-10). No injuries were coded using V, W, X, or Y codes (ICD-10). Similarly, injuries for Quebec records in 2004 and 2005 were coded using 800–999 (ICD-9), while Quebec 2006–2008 injuries were coded using S and T codes (ICD-10).

[19] Acute records were selected using the DAD field institution type in 2004–2006 and analytical institution type in 2007 and 2008, as analytical institution type was not available in 2004–2006.

[20] The most responsible health condition was coded in ICD-10-CA for these records.

[21] Most CPWCs were at the facility level. For example, in 2004, 84% of CPWCs were facility level, others were regional or provincial. CPWCs were not available for Nunavut. In this case, PHAC derived a Nunavut CPWC estimate using available Northwest Territories CPWCs and the average percentage change in CPWC for each year of analysis.

[22] For Quebec acute inpatient records the most responsible health condition was coded using ICD-9 in 2004 and 2005, and ICD-10-CA in 2006–2008.

[23] Statistics Canada's Canadian Consumer Price Index was used to adjust for inflation (7).

[24] It was assumed that these costs would be coded as psychiatric in the DAD/HMHDB and would not have been accounted for in other areas of the analysis.

[25] The most responsible health condition was coded in ICD-9 for these records.

3.2 Ambulatory Hospital Care

3.2.1 Day Surgery

Day surgery expenditures were estimated using information in the DAD and NACRS, employing the RIW method.[26] In the years 2004–2008, Quebec and Alberta did not submit day surgery information to these databases, thus their expenditures had to be estimated using different methods.[27] The cost distribution of all DAD and NACRS day surgery records, after adjustment for population, was used to distribute day surgery expenditure totals for Quebec and Alberta across EBIC categories.[28,29] These totals were obtained by multiplying the DAD and NACRS day surgery cost per capita by the population of the respective province.[30]

3.2.2 Emergency, Clinic and Other Ambulatory Care

For the years of analysis, the NACRS contained complete reporting of emergency department, clinic and other ambulatory care visits for Ontario and partial reporting for certain other provinces/ territories.[31] Therefore, Ontario's cost distribution for ambulatory care (excluding day surgery), after adjustment for population, was used to distribute CMDB ambulatory care expenditure totals (excluding day surgery costs) across EBIC categories for all provinces/territories.[32,33] CMDB emergency, clinic and other ambulatory care expenditure totals were not available for Quebec and Nunavut; these expenditure totals were estimated by multiplying an ambulatory care (excluding day surgery) cost per capita by the population of the respective province.[34]

3.3 Psychiatric Hospital Care

As of April 2006, it has been mandatory for Ontario to report all information on psychiatric hospital stays to the Ontario Mental Health Reporting System (OMHRS); all OMHRS closed records (discharges) are also included in the HMHDB. As well, the HMHDB contains partial reporting of psychiatric hospital separations for other provinces/territories. RIWs were not available for HMHDB psychiatric hospital separations. Instead, CIHI maintains and updates the System for Classification of In-Patient Psychiatry (SCIPP) grouping and weighting

---

[26] Day surgery weights (RIWs) were not included in the denominator of the CPWC calculation; therefore, cost estimates for day surgery records were obtained by multiplying the day surgery RIWs by the facility-level 'acute inpatient' CPWC.

[27] In the years of analysis, Alberta reported all ambulatory care data to the ACCS, which was not available for EBIC analyses.

[28] All population adjustments in this report were made using Statistics Canada's population estimates (35–39)

[29] To distribute Quebec and Alberta day surgery cost totals across EBIC categories, it was assumed that the DAD and NACRS day surgery cost distribution, after adjustment for population, represented that of Quebec and Alberta.

[30] The cost per capita was estimated by dividing total DAD and NACRS day surgery costs by the population of the provinces/ territories with day surgery records.

[31] For years 2004–2008, Alberta reported all ambulatory care information to the ACCS.

[32] Expenditures obtained from the CMDB to be distributed for emergency, clinic and other ambulatory care were as follows: emergency, specialty clinics, specialty day/night care, and poison and drug information services. Ontario CMDB ambulatory care expenditures (excluding day surgery costs) were also distributed across category using Ontario's cost distribution; however, there was no need for adjustments to population. This method was used for Ontario, instead of using the costs obtained directly from RIW*CPWC, in order to maintain consistency across the provinces/territories. CMDB ambulatory care expenditure totals (excluding day surgery) included costs for poison and drug information services, while NACRS did not hold data on Ontario poison and drug information services. It was not possible to obtain provincial/territorial CMDB expenditure totals for private clinics.

[33] To distribute CMDB ambulatory care expenditures (excluding day surgery) for provinces/territories other than Ontario, it was assumed that Ontario's cost distribution, after adjustment for population, represented that of the other provinces/territories. Ontario's emergency, clinic and other ambulatory care cost distribution was estimated using the RIW method.

[34] The cost per capita used for Quebec was estimated by dividing the total ambulatory care expenditures (excluding day surgery costs) of all other provinces/territories (excluding Nunavut) by the population of these provinces/territories. The cost per capita used for Nunavut was estimated by dividing the Northwest Territories' total ambulatory care expenditures (excluding day surgery costs) by the population of the Northwest Territories.

methodology for Ontario mental health data (OMHRS data) (40).[35] Additionally, CIHI produces SCIPP Weighted Patient Days (SWPDs) for Ontario mental health data. SWPDs weight a patient's LOS according to resource utilization.[36] To estimate EBIC 2006–2008 psychiatric hospital care expenditures, Ontario's SWPD distribution for psychiatric hospital separations, after adjustment for population, was used to distribute CMDB psychiatric hospital expenditure totals across categories for all provinces/territories.[37,38,39]

For the years 2004 and 2005, Ontario did not have mandatory reporting of psychiatric hospital separations. Thus, for these years, Ontario's 2006 SWPD distribution for psychiatric hospital separations, after adjustment for population, was used to distribute CMDB psychiatric hospital expenditure totals across categories for all provinces/territories.[33,34,40]

3.4 Chronic and Rehabilitation Hospital Care

The EBIC 1998 methods used to distribute chronic and rehabilitation hospital care expenditure totals across EBIC categories were adopted, in the absence of the Continuing Care Reporting System (CCRS) and the National Rehabilitation Reporting System (NRS) data.[41] For each year of analysis, the cost distribution of all DAD acute inpatient discharges with a length of stay equal to 100 days or more, after adjustment for population, was used to distribute CMDB chronic and rehabilitation hospital expenditure totals across EBIC categories for all provinces/territories.[42,43,44,45]

---

[35] CIHI produces these groupings and methodologies on behalf of Ontario's Ministry of Health and Long-Term Care.

[36] For further information on the System for Classification of In-Patient Psychiatry (SCIPP) grouping and weighting methodologies and SCIPP weighted patient days please consult appropriate CIHI documentation (40).

[37] To distribute 2006–2008 provincial/territorial psychiatric hospital expenditures, it was assumed that the Ontario SCIPP weighted patient day distribution, after adjustment for population, represented the weighted patient day distribution for all other provinces/territories.

[38] The most responsible health condition was coded in ICD-9 for these records.

[39] Not all provinces and territories had psychiatric hospital expenditure totals in the CMDB. It was assumed that if a province/territory did not have a total in the CMDB, that jurisdiction did not have designated psychiatric hospital facilities in the given year. This assumption may not be accurate for Quebec since the CMDB did not hold Quebec expenditure information in the years of analysis.

[40] To distribute 2004 and 2005 provincial/territorial psychiatric hospital cost totals, it was assumed that the 2006 SCIPP weighted patient day distribution for Ontario psychiatric hospital separations, after adjustment for population, represented the weighted patient day distribution of all other provinces/territories in 2004 and 2005.

[41] For the fiscal years 2004–2008, the CCRS contained complete reporting of Ontario chronic hospital stays and partial reporting for certain other provinces/territories. Similarly, the NRS contained complete or near complete (at least 97% submission rate) reporting of adult rehabilitation hospital stays for the provinces of Ontario, Saskatchewan and Newfoundland, and partial reporting for certain other provinces/territories.

[42] The cost distribution from the DAD was estimated employing the RIW method.

[43] To distribute provincial/territorial chronic and rehabilitation hospital expenditure totals, it was assumed that the DAD cost distribution for abstracts with a LOS equal to 100 days or more, after adjustment for population, represented the distribution for all other provinces/territories.

[44] Not all provinces and territories had chronic and rehabilitation hospital totals in the CMDB. It was assumed that if a province/territory did not have a total in the CMDB, that jurisdiction did not have designated hospitals of that type in the given year. This assumption may not be accurate for Quebec since the CMDB did not hold Quebec expenditure information in the years of analysis.

[45] The most responsible health condition was coded in ICD-10-CA for these records.

4. RESULTS[46]

4.1 Expenditures by Hospital Type/Service

In the years 2004–2008, acute inpatient and ambulatory hospital care expenditures accounted for, on average, 88.7% of total hospital care expenditures. Across the same years of analysis, psychiatric, chronic and rehabilitation hospital care expenditures accounted for much smaller percentages, on average 5.2%, 5.2% and 0.9% respectively.

4.2 Expenditures by Diagnostic Category

Table 4 illustrates EBIC hospital care expenditures by diagnostic category for the years 2004–2008. The five diagnostic categories with the largest expenditures in 2008 were neuropsychiatric conditions ($5.5 billion, 11.2%), cardiovascular diseases ($5.1 billion, 10.3%), injuries ($3.4 billion, 6.9%), digestive diseases ($2.8 billion, 5.8%) and malignant neoplasms ($2.3 billion, 4.7%); this is consistent across all years of analysis. Together, the costs for these five diagnostic categories represented almost 40% of total hospital care expenditures. EBIC unattributable hospital care expenditures are defined as total NHEX hospital expenditures minus total EBIC hospital care expenditures distributed across categories. As shown in Table 4, the unattributable percentage of EBIC 2008 hospital care expenditures was 20.8% ($10.2 billion).

4.3 Expenditures by Diagnostic Category and Sex

Table 5 illustrates EBIC 2008 hospital care expenditures by diagnostic category and sex. In 2008, 48.7% ($19.0 billion) and 51.3% ($20.0 billion) of expenditures were attributable to males and females respectively. The three diagnostic categories with the largest expenditure for males were neuropsychiatric conditions ($2.9 billion), cardiovascular diseases ($2.9 billion) and injuries ($1.7 billion). For females these were neuropsychiatric conditions ($2.6 billion), cardiovascular diseases ($2.1 billion) and injuries ($1.7 billion).

The five diagnostic categories with the largest difference in cost distribution across the sexes were other neoplasms (36.2% male, 63.8% female), genitourinary diseases (39.6% male, 60.4% female), endocrine disorders (41.0% male, 59.0% female), cardiovascular diseases (57.9% male, 42.1% female) and nutritional deficiencies (42.2% male, 57.8% female).[47] Estimation of unattributable hospital care expenditures by sex was not possible.

4.4 Expenditures by Diagnostic Category and Age Group

Figure 14 illustrates EBIC 2008 hospital care expenditures for each age group. Individuals aged 0–14 years incurred the lowest percentage of hospital care expenditures (8.1%) and those aged 75+ years the highest (29.4%). Additionally, individuals aged 55 years and older accounted for approximately 60% of total EBIC hospital care expenditures. Estimation of unattributable hospital care expenditures by age group was not possible.

---

[46] The diagnostic categories 'Symptoms, signs and ill-defined conditions' and 'Factors influencing health and contact with health services' are presented in the results tables but are not ranked or discussed in this report, as these categories include health conditions that are ill-defined or that can result from multiple health conditions, making it hard to attribute costs to a single disease/disorder.

[47] The 'Maternal conditions' category is not included in this ranking because costs are attributable only to females.

Figure 15 illustrates EBIC 2008 hospital care expenditures by diagnostic category and age group for the five most costly diagnostic categories. Expenditures were highest for individuals aged 75+ years, except in the neuropsychiatric conditions category where individuals aged 35–54 years (31.1%) accounted for the highest expenditures. Expenditures for cardiovascular diseases and malignant neoplasms increased with age; individuals aged 75+ years accounted for 44.7% and 31.3% of expenditures in the cardiovascular diseases and malignant neoplasms categories respectively. Finally, individuals aged 35–54 years together with those aged 75+ years accounted for 50% of hospital care expenditures in both the injuries and digestive diseases categories.

5. DISCUSSION AND LIMITATIONS

5.1 Comparison Across EBIC Categories and Years

Comparisons of EBIC 2004–2008 hospital care expenditures across provinces/territories should be made with caution. Each province/territory maintained different levels of reporting, which resulted in varying levels of unattributable costs. For example, province A may have unattributable costs of 30% and province B may have unattributable costs of 18%. Therefore, a lower per capita cost for a diagnostic category in one particular province could be a reflection of a higher unattributable cost. Additionally, the unattributable costs for one province could vary across years. The per diem method was used to estimate costs of Quebec acute inpatient separations, which may have resulted in higher estimated costs relative to other provinces.[48] Additionally, province/territory of residence was used to assign hospital care costs by geographic category; however, this field was unavailable for Quebec hospital stays.[49] Therefore, all Quebec hospital separation costs were assigned to Quebec using the province of occurrence field; this may have resulted in higher hospital costs for the province.

Previous editions of EBIC used different data sources and methods to estimate hospital care expenditures. A variation of the RIW method was used to estimate hospital care expenditures for EBIC 1998 and the per diem method was used for EBIC 2000 (3,4). Although a variation of the RIW method was used in EBIC 1998, comparisons between EBIC 1998 and EBIC 2004–2008 hospital care expenditures should be made with extreme caution. First, EBIC 2004–2008 and EBIC 1998 grouped costs by ICD code; however, different groupings were used. The diagnostic grouping tables of both editions should be compared before any attempt is made to compare costs by diagnostic category. For example, cardiovascular diseases were coded in the same way in both editions, although infectious and parasitic diseases were not. Second, there were differences in the RIW method used in the two editions. For EBIC 2004–2008, costing information was available by facility (in most cases), from which a CPWC or per diem was estimated. The availability of costing information for EBIC 1998 was much more limited. EBIC 1998 distributed hospital type expenditure totals (not at the facility level) across categories using an RIW or LOS distribution. These hospital type expenditure totals were estimated using the per diem method, specifically, by multiplying

[48] For 2008 acute inpatient costs of other provinces/territories (which had RIW, CPWCs and per diems provided), costs were 17% higher when using the per diem method compared with the RIW method.

[49] In 2008, province of residence did not equal province of occurrence for approximately 2.8% of DAD acute inpatient records.

an average per diem for all hospital types by the total number of beds for a particular hospital type. Thus, the same per diem cost was assigned for all hospital types. Furthermore, in EBIC 2004–2008, the NACRS was used to distribute ambulatory care costs for Canada instead of the Ambulatory Care Classification System (ACCS), which was used in EBIC 1998. Additionally, in EBIC 2004–2008 weighted cost and weighted LOS distributions were used to distribute chronic/rehabilitation and psychiatric hospital expenditures across EBIC categories, instead of a simple LOS distribution, as used in EBIC 1998. Finally, there are different percentages of unattributable costs in the two editions.

5.2 Data Limitations

There are several data limitations that may lead to a misrepresentation of hospital care expenditures across categories. First, the hospital databases capture hospital separations only by fiscal year.[50] These separations may not represent the distribution of expenditures across categories within a fiscal year, since certain individuals with costly health conditions may stay in hospital for longer than a fiscal year. If patients stayed in a hospital for longer than a fiscal year, all of their respective costs would be assigned to the year in which they were discharged. Furthermore, if some of these patients' costs fell in years other than the year of study, assigning all hospital costs for the stay to the year of study is not consistent with a prevalence-based approach.

Day surgery information was available for most provinces/territories.[51] However, complete information on emergency, clinic and other ambulatory care separations was available only for Ontario. Therefore, Ontario's cost distribution of these services was used to distribute the CMDB provincial/territorial ambulatory care expenditure totals (excluding day surgery) across EBIC categories. Although Ontario represents approximately 38% of Canada's population, Ontario's burden of disease may not reflect that of other provinces/territories, even after adjustment for differences in population (sex and age specific). Specifically, it may misrepresent the burden of disease for jurisdictions with different disease-specific risk factor profiles, as well as those with different distributions of urban/rural, aboriginal and other minority populations. Furthermore, the CMDB ambulatory care expenditure totals (excluding day surgery) distributed across category included different hospital types/services than did the data used to distribute the totals. The CMDB expenditure totals included costs for poison and drug information services and excluded all private clinic costs, whereas the cost distribution was based on data that excluded information on Ontario poison and drug information services and included information on Ontario private clinic visits. It was not possible to obtain provincial/territorial CMDB hospital expenditure totals for private clinics. The inclusion of poison and drug information service costs in the distributions will likely have minimal effect on costs by category, as less than half of the provinces/territories have these services. For province/territories with poison and drug information services, costs are on average only 0.3% of ambulatory care expenditure totals (excluding day surgery).

[50] NACRS is an exception to this, as abstracts are reported in the database according to year of patient registration, not separation. Additionally, records in the NACRS would not have a LOS of longer than a year.

[51] In the years of analysis, day surgery information for Quebec and Alberta were unavailable. Alberta reported ambulatory care data to the ACCS. The ACCS was not available for EBIC analysis.

For 2004–2008, information on psychiatric hospital separations was partial for most provinces/territories. However, this information was complete for the province of Ontario. Therefore, Ontario's SCIPP weighted patient day distribution of psychiatric hospital separations was used to distribute CMDB psychiatric hospital expenditure totals across EBIC categories. Ontario's weighted patient day distribution may not accurately represent that of other provinces/territories. Adjusting for the differences in sex- and age-specific populations attempts to account for changes in the number of discharges due to the differences in these populations. However, it is possible that the prevalence of certain diseases/disorders within the same sex and age group is different across jurisdictions.

Databases containing information on chronic (CCRS) and rehabilitation (NRS) hospital stays were not available for EBIC analyses. The cost distribution of acute inpatient DAD discharges with a LOS equal to 100 days or more was used to distribute total CMDB chronic and rehabilitation hospital expenditures across EBIC category; this method was also used in EBIC 1998. DAD patient separations with a LOS equal to 100 days or more may not reflect the characteristics (sex, age, diagnosis) of patients in chronic/rehabilitation hospitals. However, expenditures for these hospital types represent, on average, only approximately 6% of total EBIC hospital care expenditures in the years 2004–2008. Therefore, the effect on the overall EBIC estimates is likely small, unless certain diagnoses are a majority in these hospital types and not represented to the same proportion in the distribution. The accuracy of future EBIC estimates would likely increase with the inclusion of CCRS and NRS data.

As mentioned in section 5.1, both the absence of the province of residence field and the use of the per diem method for Quebec cost estimates may have resulted in higher acute inpatient and ambulatory care costs assigned to Quebec relative to other province/territories. Expenditure data for Quebec were largely unavailable for the years of analysis, as the province did not submit information to the CMDB. Although PHAC estimated Quebec acute inpatient and ambulatory care costs, costs for psychiatric, chronic and rehabilitation hospitals were not estimated. As these hospital types may operate in the province, lower costs for illnesses largely seen in such hospitals may have been assigned to Quebec relative to other provinces/territories. Also, Nunavut did not submit costing data to the CMDB. PHAC estimated acute inpatient and ambulatory hospital care expenditures for Nunavut but assumed the province did not have designated psychiatric, chronic and rehabilitation hospitals. Therefore, costs for these hospital types were not estimated.

General hospitals may have designated psychiatric, chronic and/or rehabilitation beds. However, it was not possible to estimate expenditures for these hospital bed separations, except for Ontario general hospital designated psychiatric beds in 2006–2008.[52] As a result, Ontario may have slightly higher costs for neuropsychiatric conditions costs for 2006–2008 relative to the other provinces/territories.

[52] The costs captured here were only for adult designated psychiatric health beds (in general hospitals).

A small number of separations in the hospital databases had required fields with missing values. For example, 0.002% of acute inpatient records in 2008 were missing a value for the most responsible health condition, province, sex and/or age field; these records accounted for 0.005% of total 2008 acute inpatient expenditures. Given the small magnitude of records missing required fields no attempt was made to distribute these costs across category.

In 2004–2008, annual unattributable hospital care expenditures were, on average, 23%.[53] The presence of unattributable hospital care expenditures may misrepresent the true distribution of expenditures across EBIC category. If unattributable costs account for a large percentage of costs for a particular category and this is not reflected in the cost distribution of attributable costs, costs by category may be misrepresented. For example, if cardiovascular diseases represented 30% of unattributable costs in 2008 and now suddenly we could attribute all these costs, cardiovascular diseases could surpass neuropsychiatric conditions as the most costly diagnostic category. However, if the unattributable and attributable cost distributions were similar, then EBIC hospital care expenditures would reflect the true distribution of the economic burden.

5.3 Methodological Limitations

There are many health conditions that cause secondary health conditions, which themselves result in hospitalization. Secondary health conditions may also contribute to the development of more severe (primary) health conditions, which require hospitalization. Furthermore, secondary health conditions may increase hospital resource utilization and LOS even if they are not the main reason for the hospital visit. Comorbidity refers to the presence of one or more diseases/disorders in addition to a primary disease/disorder, as well as to the effect these secondary diseases/disorders may have. Examples of common comorbidities are diabetes and hypertension (high blood pressure). CIHI's calculation of RIW values involved a comorbidity factor that considered certain comorbidities to increase hospital costs anywhere from 25% to 125% (31,32). Although RIWs were used to estimate record-level expenditures (for most hospital types/services), all EBIC hospital care expenditures were attributed solely to the most responsible health condition. Since EBIC hospital care expenditures were not attributed to comorbid conditions, costs may be underestimated for certain conditions. Each discharge abstract, in the majority of hospital databases, contained information on comorbidities. Future editions of EBIC would benefit from the development of methods to weight expenditures across primary and comorbid conditions.

[53] Certain record types were excluded from the DAD and NACRS provided for EBIC analyses; these included therapeutic abortions, stillbirths and cadaveric donors. Therapeutic abortions were defined as ICD-10-CA code = [O04.^^], in any position within the diagnosis fields, or CCI codes = [5.CA.20.^^, 5.CA.24.^^, 5.CA.88.^^, 5.CA.89.^^, 5.CA.90.^^], in any position within the intervention fields.

6. CONCLUSION

EBIC 2004–2008 hospital care expenditures were estimated by diagnostic category/subcategory, sex, age group and province/territory. In 2008, these expenditures were attributed to the EBIC categories for 79.2% of total hospital care expenditures. The three diagnostic categories with the highest expenditures were neuropsychiatric conditions (11.2%), cardiovascular diseases (10.3%) and injuries (6.9%). Females accounted for just over half (51.3%) of 2008 hospital care expenditures. EBIC 2008 hospital care expenditures were lowest and highest for individuals aged 0–14 years (8.1%) and 75+ years (29.4%) respectively.

Given the changes in methods, it is not recommended that comparisons be made between 2004 and 2008 estimates and those from previous EBIC editions. The main limitation in the current edition was incomplete hospital separation data for certain hospital types/services. In these cases, distributions for provinces with complete hospital separation data (100% submissions) were used to distribute cost totals for the other provinces/territories with incomplete data. The availability of complete data for all provinces/territories and hospital types/services would likely increase the accuracy of future EBIC estimates.

TABLE 4: Hospital Care Expenditures by Diagnostic Category, Canada, 2004–2008 ($'000,000 Current Dollars)

DIAGNOSTIC CATEGORY	2008 COST	% OF 2008 COST	2007 COST	% OF 2007 COST	2006 COST	% OF 2006 COST	2005 COST	% OF 2005 COST	2004 COST	% OF 2004 COST
Certain Infectious and Parasitic Diseases	871.1	1.8	784.8	1.7	658.6	1.5	565.6	1.4	488.4	1.3
Respiratory Infections	958.9	2.0	868.3	1.9	821.8	1.9	764.9	1.9	739.9	1.9
Maternal Conditions	1,382.7	2.8	1,343.1	2.9	1,211.5	2.8	1,112.5	2.7	1,034.8	2.7
Perinatal Conditions	928.6	1.9	853.2	1.9	808.7	1.9	666.5	1.6	557.1	1.4
Nutritional Deficiencies	108.7	0.2	95.5	0.2	92.9	0.2	82.1	0.2	80.0	0.2
Malignant Neoplasms	2,329.4	4.7	2,254.6	4.9	2,071.3	4.8	1,959.9	4.8	1,822.3	4.7
Other Neoplasms	431.3	0.9	404.9	0.9	373.3	0.9	353.3	0.9	341.1	0.9
Diabetes Mellitus	492.7	1.0	490.7	1.1	464.8	1.1	381.7	0.9	341.4	0.9
Endocrine Disorders	423.4	0.9	403.2	0.9	368.3	0.9	355.2	0.9	324.4	0.8
Neuropsychiatric Conditions	5,520.3	11.2	5,056.2	11.1	4,893.0	11.3	4,456.4	11.0	4,159.4	10.8
Sense Organ Diseases	520.3	1.1	508.8	1.1	465.8	1.1	430.8	1.1	373.8	1.0
Cardiovascular Diseases	5,068.0	10.3	4,714.9	10.3	4,380.8	10.1	4,172.7	10.3	3,864.9	10.0
Respiratory Diseases	1,818.5	3.7	1,650.0	3.6	1,569.8	3.6	1,466.9	3.6	1,326.6	3.4
Digestive Diseases	2,839.4	5.8	2,659.9	5.8	2,445.4	5.7	2,234.1	5.5	2,059.6	5.3
Genitourinary Diseases	1,499.2	3.1	1,383.5	3.0	1,257.5	2.9	1,183.3	2.9	1,066.9	2.8
Skin Diseases	410.3	0.8	391.8	0.9	339.3	0.8	314.8	0.8	272.8	0.7
Musculoskeletal Diseases	1,795.9	3.7	1,698.7	3.7	1,563.1	3.6	1,442.9	3.6	1,252.2	3.3
Congenital Anomalies	302.9	0.6	285.5	0.6	272.9	0.6	254.5	0.6	264.3	0.7
Oral Conditions	153.6	0.3	147.0	0.3	136.3	0.3	130.0	0.3	121.8	0.3
Injuries	3,395.8	6.9	3,152.8	6.9	2,877.1	6.7	2,650.7	6.5	2,408.1	6.3
Symptoms, Signs and Ill-Defined Conditions	2,131.7	4.3	2,059.7	4.5	1,830.4	4.2	1,711.4	4.2	1,483.0	3.8
Factors Influencing Health and Contact with Health Services	5,543.4	11.3	5,376.6	11.8	4,750.3	11.0	4,382.1	10.8	3,687.9	9.6
Total EBIC Hospital Care Expenditures	**38,926.1**	**79.2**	**36,583.7**	**80.0**	**33,653.0**	**77.9**	**31,072.4**	**76.5**	**28,070.7**	**72.9**
Unattributable Hospital Care Expenditures[1]	**10,196.4**	**20.8**	**9,146.2**	**20.0**	**9,537.4**	**22.1**	**9,539.4**	**23.5**	**10,459.1**	**27.1**
Total Hospital Care Expenditures[2]	**49,122.5**	**100.0**	**45,729.9**	**100.0**	**43,190.4**	**100.0**	**40,611.8**	**100.0**	**38,529.8**	**100.0**

[1] Unattributable hospital care expenditures were calculated by subtracting EBIC total hospital care expenditures from NHEX total hospital expenditures.

[2] Annual total hospital care expenditures were obtained from CIHI's *National Health Expenditure Trends, 1975 to 2012* (5).

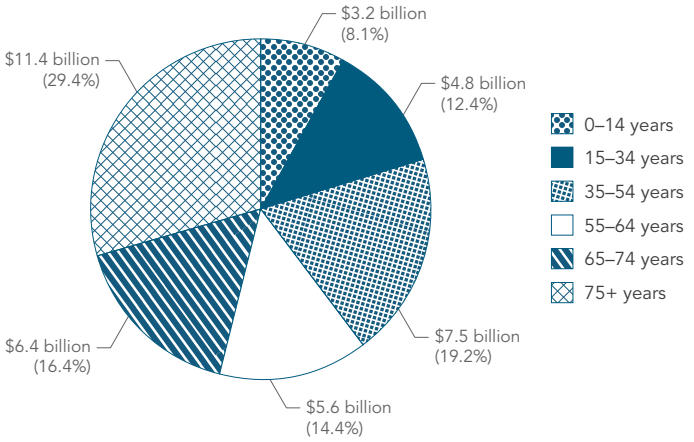
NOTE: Any discrepancies may be due to rounding.

TABLE 5: Hospital Care Expenditures by Diagnostic Category and Sex, Canada, 2008 ($'000,000 Current Dollars)

DIAGNOSTIC CATEGORY	2008 MALE COST	% OF TOTAL COST	2008 FEMALE COST	% OF TOTAL COST	TOTAL COST
Certain Infectious and Parasitic Diseases	437.6	50.2	433.4	49.8	871.1
Respiratory Infections	483.6	50.4	475.3	49.6	958.9
Maternal Conditions			1,382.7	100.0	1,382.7
Perinatal Conditions	517.3	55.7	411.3	44.3	928.6
Nutritional Deficiencies	45.8	42.2	62.9	57.8	108.7
Malignant Neoplasms	1,235.9	53.1	1,093.4	46.9	2,329.4
Other Neoplasms	156.3	36.2	275.0	63.8	431.3
Diabetes Mellitus	267.4	54.3	225.4	45.7	492.7
Endocrine Disorders	173.4	41.0	250.0	59.0	423.4
Neuropsychiatric Conditions	2,889.1	52.3	2,631.2	47.7	5,520.3
Sense Organ Diseases	228.7	44.0	291.6	56.0	520.3
Cardiovascular Diseases	2,933.4	57.9	2,134.7	42.1	5,068.0
Respiratory Diseases	964.5	53.0	854.0	47.0	1,818.5
Digestive Diseases	1,396.7	49.2	1,442.7	50.8	2,839.4
Genitourinary Diseases	593.7	39.6	905.6	60.4	1,499.2
Skin Diseases	223.5	54.5	186.8	45.5	410.3
Musculoskeletal Diseases	807.1	44.9	988.8	55.1	1,795.9
Congenital Anomalies	164.0	54.1	138.9	45.9	302.9
Oral Conditions	76.2	49.6	77.4	50.4	153.6
Injuries	1,722.5	50.7	1,673.3	49.3	3,395.8
Symptoms, Signs and Ill-Defined Conditions	957.7	44.9	1,174.0	55.1	2,131.7
Factors Influencing Health and Contact with Health Services	2,697.7	48.7	2,845.7	51.3	5,543.4
Total EBIC Hospital Care Expenditures	**18,972.2**	**48.7**	**19,953.9**	**51.3**	**38,926.1**

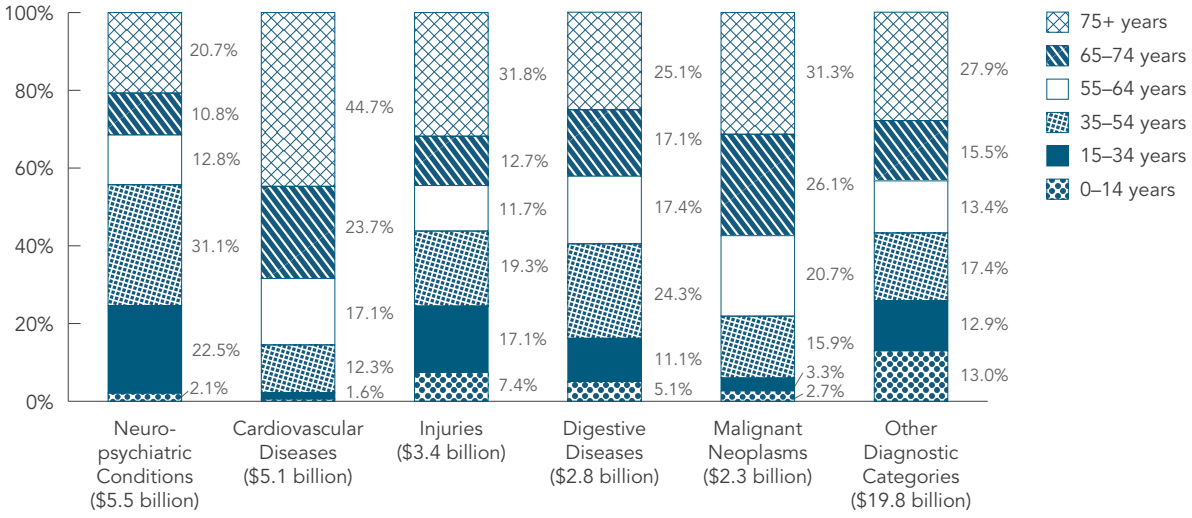
NOTES: Hospital care expenditures by sex can be determined only for attributable EBIC hospital care expenditures.
Any discrepancies may be due to rounding.

FIGURE 14: Hospital Care Expenditures by Age Group, Canada, 2008



NOTE: Any discrepancies may be due to rounding.

FIGURE 15: Hospital Care Expenditure Distribution by Diagnostic Category and Age Group, Canada, 2008



NOTES: Individuals aged 0–14 years have an attributable cost of 0.6% for cardiovascular diseases; this numeric value is represented but not displayed in the figure. 'Other diagnostic categories' include the costs from all other EBIC diagnostic categories not individually displayed in the figure.

Any discrepancies may be due to rounding.

REPORT 2: EBIC DRUG EXPENDITURES, 2005–2008

1. BACKGROUND

Drug expenditure estimates comprise public and private costs associated with prescription and non-prescription (i.e. over-the-counter) drugs purchased in retail stores. Estimates represent the final costs to consumers, including dispensing fees, markups and appropriate taxes. Drugs dispensed in hospitals and other institutions are excluded; drug expenditures in hospitals are captured under the hospital care expenditures cost component of EBIC (5).

The EBIC drug expenditure estimates include prescription drug costs only; non-prescription drug costs could not be allocated across EBIC categories (diagnostic category/subcategory, sex, age group and province/territory). This report describes the data sources and methods used to derive the 2005–2008 drug expenditure estimates. It also presents and discusses the results and the limitations of the data used.

2. DATA SOURCES

Data were obtained from two IMS Brogan (a division of IMS Health Inc.) datasets: the 2006–2008 Canadian Disease and Therapeutic Index (CDTI) and the 2005–2008 CompuScript (CS).[54]

2.1 Canadian Disease and Therapeutic Index

The CDTI is a survey that provides information on the drug prescribing patterns of 652 office-based physicians across Canada (41).[55] It collects information on patient demographic characteristics (e.g. sex and age), diagnosis (coded using ICD version 9) and drugs prescribed (e.g. product, strength, form, dosage, new/continued therapy). The CDTI does not include data for the territories, and data for the Prairies (Manitoba, Saskatchewan, Alberta) and Maritimes (Newfoundland and Labrador, Nova Scotia, Prince Edward Island, New Brunswick) are grouped as regions instead of by individual province (41,42).

The CDTI uses the Universal Classification System (USC) to standardize and categorize all drugs according to product type and therapeutic class. The USC is a five-digit code classifying drugs along four levels of categorization, USC2 being the broadest and USC5 the most specific. Example 1 illustrates the associated USC codes of a drug used for bronchial therapy (41).

Example 1: USC code for inhaled steroids for bronchial therapy

USC CODE	CLASS	# DIGITS	DESCRIPTION
28000	USC2	2	Bronchial therapy
28300	USC3	3	Asthma
28310	USC4	4	Asthma therapy
28312	USC5	5	Inhaled steroids

[54] IMS Brogan archives its data for a period of only 6 years. At the time the CDTI and CS datasets were obtained for the EBIC project, the 2005 CS data were no longer available.

[55] The survey does not capture physicians who practise in non-office-based settings, such as hospitals.

2.2 Compuscript

The CS contains information, for nearly 70% of all pharmacies across Canada, on total prescription drug costs (retail price plus dispensing fees) and total drug prescriptions (volume of prescriptions) sold in retail pharmacies across Canada, excluding the territories (41,42). In the CS dataset, total prescription drug costs and drug prescriptions are captured by USC and province.

3. METHOD

3.1 EBIC 2006–2008 Drug Expenditure Methods

The fields in the CDTI used to produce EBIC estimates were USC5 code, ICD-9 code, sex, age, region (Maritimes, Quebec, Ontario, Prairies and British Colombia) and drug use.[56] Similarly, the CS fields used in the analysis were USC code, province, total number of drug prescriptions and total prescription drug costs. The CDTI and the CS were merged, using the USC5 code and region/province fields, to create a CDTI-CS database.[57] Example 2 illustrates a simplified example for one USC5-province group.

Example 2: CDTI-CS Database Post-Merge

USC5 CODE (CS AND CDTI)	PROVINCE/ REGION (CS/CDTI)	ICD-9 CODE (CDTI)	SEX (CDTI)	AGE (CDTI)	DRUG USE (CDTI)	TOTAL NO. OF DRUG PRESCRIPTIONS (CS)	TOTAL DRUG COSTS (CS)
28312	Ontario	493	Male	14	50	20	1000
28312	Ontario	493	Female	35	25	20	1000
28312	Ontario	493	Female	20	25	20	1000

NOTE: The ICD-9 code may not always be the same for all records within a USC5-province group.

As shown in Example 2, every record with the same USC5 and province field will be matched with the same total number of drug prescriptions and total drug costs. After the CDTI-CS database had been created, the total drug prescriptions and total drug costs for each USC5-province group were distributed across the CDTI-CS records using the drug use distribution. Example 3 illustrates the process using the same numerical example as Example 2.

Example 3: CDTI-CS Database After the Distribution of Totals

USC5 CODE (CS AND CDTI)	PROVINCE/ REGION (CS/CDTI)	ICD-9 CODE (CDTI)	SEX (CDTI)	AGE (CDTI)	TOTAL NO. OF DRUG PRESCRIPTIONS (CS)	TOTAL DRUG COSTS (CS)
28312	Ontario	493	Male	14	10	500
28312	Ontario	493	Female	35	5	250
28312	Ontario	493	Female	20	5	250

NOTE: The ICD-9 code may not always be the same for all records within a USC5-province group.

[56] The drug use field represents the number of times a drug was mentioned and associated with a diagnosis.
[57] Only a very small percentage of CS drug expenditures could not be matched to the CDTI data.

As the CDTI contains a region field and not a province field, each prairie and maritime province was assumed to have the same ICD code, sex, age and drug use distribution as its associated region. For example, if 10% of drug use in the CDTI prairie data was attributable to males aged 15–34 years for the ICD-9 code 493, Alberta, Saskatchewan and Manitoba would each have 10% of provincial drug costs attributed to males aged 15–34 years for the ICD-9 code 493.

After the total drug prescriptions and total drug costs had been distributed across records in each USC5-province group, the costs were aggregated by EBIC diagnostic category/subcategory, sex, EBIC age group (0–14 years, 15–34 years, 35–54 years, 55–64 years, 65–74 years, 75+ years) and province. EBIC drug expenditures were not estimated for the territories as the CDTI and CS data sources do not hold information on these jurisdictions.

3.2 Redistribution of 2006–2008 Drug Expenditures for Records with Unknown Age and/or Sex

In the CDTI, a small percentage of records were missing values for sex (2.4%) and age (2.0%). Therefore, the costs associated with these records could not be distributed across sex and age categories. Although the number of records with missing data values was small, it was decided to distribute the costs associated with these records across sex and age categories using alternative methods, as described in sections 3.2.1 to 3.2.3. A hypothetical example of asthma in Ontario is used in each section.

3.2.1 Records with missing age values

In the case of records in which a value was present for sex but not for age, costs were redistributed proportionally across all other records with the same sex and a known age, province and diagnostic category using the cost distribution for these records. Example 4 provides a numerical example of the redistribution of costs for records with missing age values. Although EBIC has six age groups, this example assumes only two age groups (35–54 and 55–64 years) for simplification. The cost of $2 million is redistributed to other records with known age and the same sex, diagnosis and province.

Example 4: Cost Redistribution for Data with Missing Age Values

	Total Asthma Expenditures (known by Age and Sex)	Asthma Expenditures (Males, Unknown Age)	MALES, AGE 35–54 YEARS		MALES, AGE 55–64 YEARS	
			Asthma Expenditures	% Total Expenditures	Asthma Expenditures	% Total Expenditures
Cost before redistribution	$100M	$2M	$75M	75%	$25M	25%
Cost after redistribution	$102M	$0M	$75M + (75% x $2M) = $76.5M	75%	$25M + (25% x $2M) = $25.5M	25%

3.2.2 Records with missing sex values

For records with known age but missing sex values, costs were redistributed to records of both sexes within the same age group, diagnosis and province, using the cost distribution of these records. Example 5 provides a numerical example of the redistribution of costs for records with missing sex values.

Example 5: Cost Redistribution for Data with Missing Sex Values

	Total Asthma Expenditures (known by Age and Sex)	Asthma Expenditures (Age 15–34 years, Unknown Sex)	MALES, AGE 15-34 YEARS		FEMALES, AGE 15-34 YEARS	
			Asthma Expenditures	% Total Expenditures	Asthma Expenditures	% Total Expenditures
Cost before redistribution	$100M	$3M	$60M	60%	$40M	40%
Cost after redistribution	$103M	$0M	$60M + (60% x $3M) = $61.8M	60%	$40M + (40% x $3M) = $41.2M	40%

3.2.3 Records with missing age and sex values

For records missing both age and sex values, costs were redistributed across records with known age and sex with the same diagnosis and province, using the cost distribution of these records. Example 6 provides a numerical example of the redistribution of costs for records with missing age and sex values. For simplicity, it was assumed that only two groups of individuals (males aged 55–64 years and females aged 15–34 years) have costs with known sex and age for asthma in the province of Ontario.

Example 6: Cost Redistribution for Data with Missing Age and Sex Values

	Total Asthma Expenditures (known by Age and Sex)	Asthma Expenditures (Unknown Age and Sex)	MALES, AGE 55-64 YEARS		FEMALES, AGE 15-34 YEARS	
			Asthma Expenditures	% Total Expenditures	Asthma Expenditures	% Total Expenditures
Cost before redistribution	$100M	$5M	$20M	20%	$80M	80%
Cost after redistribution	$105M	$0M	$20M + (20% x $5M) = $21M	20%	$80M + (80% x $5M) = $84M	80%

3.3 EBIC 2005 Drug Expenditure Methods

At the time analysis for the current edition of EBIC began, the CS dataset was not available for the year 2005, since IMS Brogan held these data for a period of only 72 months. To obtain total drug costs for 2005 for each USC5-province group, the costing information from the CS 2006–2010 dataset was used. Specifically, 2005 total drug costs by USC5 and province were estimated by multiplying an estimated cost per prescription by the drug prescription totals. The 2005 cost per prescription by USC5 and province was estimated using the average annual growth rate, after adjusting for inflation, of 2006–2010 CS cost per prescription data (total prescription drug costs/total number of prescriptions) for each USC5-province group. The 2005 total drug prescriptions by USC5 and province were also estimated using the average annual growth rate of 2006–2010 CS drug prescription totals for each USC5-province group. Furthermore, the average annual growth rate for total drug costs and total drug prescriptions for each USC5-province group was estimated using at least three years of CS data. Records in the CDTI 2005 with missing values for required fields (ICD-9, sex, age and region) were dropped before this dataset was merged with the CS 2005 (estimated). Once the CS 2005 (estimated) had been merged with the CDTI 2005, 99.5% of CDTI records were matched with a cost; records not matched with a cost were dropped. As in the other years of analysis, the total drug costs and total drug prescriptions for a USC5-province group were then distributed to records within that USC5-province group using the drug use distribution.

4. RESULTS[58]

4.1 Expenditures by Diagnostic Category

Table 6 provides an overview of the EBIC 2005–2008 national drug expenditures by diagnostic category. In 2008, the top five diagnostic categories with the highest expenditures were cardiovascular diseases ($4.3 billion, 15.3%), neuropsychiatric conditions ($3.6 billion, 12.7%), musculoskeletal diseases ($2.0 billion, 7.1%), endocrine disorders ($1.7 billion, 6.2%) and digestive diseases ($1.4 billion, 5.1%). Together, the costs for these five diagnostic categories represented just over 46% of total drug expenditures. EBIC unattributable drug expenditures are defined as total NHEX drug expenditures minus total EBIC drug expenditures distributed across categories. The unattributable amount of EBIC 2008 national drug expenditures was $6.7 billion (24.1%).

[58] The diagnostic categories 'Symptoms, signs and ill-defined conditions' and 'Factors influencing health and contact with health services' are presented in the results tables but are not ranked or discussed in this report, as these categories include health conditions that are ill-defined or that can result from multiple health conditions, making it hard to attribute costs to a single disease/disorder.

4.2 Expenditures by Diagnostic Category and Sex

Table 7 illustrates EBIC 2008 drug expenditures by diagnostic category and sex. In 2008, 45.9% ($9.7 billion) and 54.1% ($11.5 billion) of expenditures were attributable to males and females respectively. The three diagnostic categories with the largest expenditures for males were cardiovascular diseases ($2.4 billion), neuropsychiatric conditions ($1.5 billion) and endocrine disorders (0.9 billion). For females these were neuropsychiatric conditions ($2.0 billion), cardiovascular diseases ($1.9 billion) and musculoskeletal diseases ($1.3 billion).

In 2008, the five diagnostic categories with the largest difference in cost distributions across the sexes were nutritional deficiencies (21.5% male and 78.5% female), other neoplasms (25.7% male and 74.3% female), congenital anomalies (30.1% male and 69.9% female), malignant neoplasms (32.3% male and 67.7% female) and musculoskeletal diseases (33.0% male and 67.0% female). The 'maternal conditions' category is not included in this ranking because costs are only attributable to females. Furthermore, estimation of unattributable drug expenditures by sex was not possible.

4.3 Expenditures by Diagnostic Category and Age Group

Figure 16 illustrates EBIC 2008 drug expenditures for each age group. Individuals aged 0–14 years incurred the lowest percentage of drug expenditures (4.8%) and individuals aged 35–54 years the highest (30.0%).

Figure 17 illustrates EBIC 2008 drug expenditures by diagnostic category and age group for the five most costly diagnostic categories. Expenditures were highest for individuals aged 35–54 years, except for the cardiovascular diseases category.

5. LIMITATIONS

EBIC 2005–2008 drug expenditure estimates reflect only prescription drugs and exclude non-prescription (i.e. over-the-counter) drugs. Therefore, EBIC may underestimate total drug expenditures, as shown by the 24%–25% unattributable percentage of drug expenditures across the years 2005–2008. Information on non-prescription drug expenditures by diagnostic category would have provided value by reducing the unattributable amount of EBIC drug expenditures. Information on non-prescription drugs may also be important since the cost distribution may be considerably different than that of prescription drugs. With non-prescription drug costs distributed, the costs for certain diagnostic categories may increase relative to other diagnostic categories. The collection of data for non-prescription drugs may be difficult to obtain as these drugs are often used to treat multiple health conditions. Additionally, if the costs associated with drugs prescribed in hospitals could be separated from the hospital care cost component this may also affect the distribution of drug costs by EBIC categories (as well as the distribution of hospital care expenditures by EBIC categories).

The greatest limitation of the EBIC 2005–2008 drug expenditure estimates pertains to the use of the CDTI to distribute total drug expenditures across EBIC categories (diagnosis, sex, age and province). The CDTI was the only data source that linked drug costs to diagnosis for all health conditions. However, the CDTI surveyed only 652 physicians (1% of the physician population) 2 days every quarter (41).[59] Given the CDTI's small sample size and reporting period, the cost distribution of EBIC 2005–2008 drug expenditures may not reflect the true burden across EBIC categories. Additionally, the CDTI data were grouped for provinces in the Prairies and Maritimes, when in reality drug use patterns may vary among these provinces within each region. Although the CDTI captures the pattern of drugs that physicians prescribe for patients, there is no information to determine whether the written prescriptions were actually filled.

As the CS database was not available for 2005, the 2006–2010 CS databases were used to estimate total drug prescriptions and total drug costs for each USC5-province group; these estimates may not represent true values.

Drug costs for records in the 2006–2008 CDTI-CS database with missing sex and/or age data were distributed across the corresponding records with known values; unfortunately, misrepresentation of drug costs by EBIC category may have occurred.

The available data sources did not contain information on prescription drug expenditures for the territories. Several methods were considered to estimate these expenditures; however, they were considered inappropriate for the current edition of EBIC.[60] The primary concerns were related to differences in population, illness and injury distributions and price variations between the territories and the other provinces/regions.

Given the stated limitations, the distribution of 2005–2008 EBIC drug expenditures may not reflect the true cost distribution by EBIC categories. It is expected that drug expenditures for some diagnostic categories/subcategories (perhaps sex and age groups also) were either over or underestimated; the direction and magnitude of these inaccuracies is unknown.

6. CONCLUSION

EBIC 2005–2008 drug expenditures were estimated by diagnostic category/subcategory, sex, age group and province/territory. In 2008, 75.9% of total drug expenditures were attributable across EBIC categories. The three diagnostic categories with the highest expenditures were: cardiovascular diseases ($4.3 billion, 15.3%), neuropsychiatric conditions ($3.6 billion, 12.7%) and musculoskeletal diseases ($2.0 billion, 7.1%). Males accounted for 45.9% of 2008 drug expenditures while females accounted for 54.1%. EBIC 2008 drug expenditures were lowest and highest for individuals aged 0–14 years (4.8%) and 35–54 years (30.0%) respectively.

[59] Specifically, 652 out of 52,959 physicians were surveyed (survey year not specified) (41).
[60] The methods used in EBIC 1998 and EBIC 2000 were among the methods considered.

The unattributable amount of drug expenditure estimates is influenced by non-prescription drug costs, as EBIC drug expenditure estimates include only the costs associated with prescription drugs (out of hospital). Additionally, drug expenditures for the territories are not included in the EBIC 2005–2008 estimates. EBIC drug expenditure estimates were distributed across diagnostic category/subcategory, sex, age group and province using a survey that captured drugs dispensed by physicians. Unfortunately, this survey had a small sample size and sampling period, and therefore EBIC estimates may misrepresent the true distribution of drug expenditures across EBIC categories.

FIGURES AND TABLES

TABLE 6: Drug Expenditures by Diagnostic Category, Canada, 2005–2008 ($'000,000 Current Dollars)

DIAGNOSTIC CATEGORY	2008 COST	% OF 2008 COST	2007 COST	% OF 2007 COST	2006 COST	% OF 2006 COST	2005 COST	% OF 2005 COST
Certain Infectious and Parasitic Diseases	696.7	2.5	525.6	2.0	629.8	2.5	507.3	2.2
Respiratory Infections	509.3	1.8	458.9	1.7	495.5	2.0	515.7	2.2
Maternal Conditions	58.5	0.2	39.8	0.2	38.6	0.2	30.9	0.1
Perinatal Conditions	9.8	0.0	3.5	0.0	5.2	0.0	4.1	0.0
Nutritional Deficiencies	77.2	0.3	109.0	0.4	89.5	0.4	64.5	0.3
Malignant Neoplasms	467.1	1.7	504.7	1.9	552.1	2.2	353.1	1.5
Other Neoplasms	49.8	0.2	39.2	0.1	43.6	0.2	125.2	0.5
Diabetes Mellitus	1,198.2	4.3	1,012.7	3.8	901.3	3.6	878.1	3.8
Endocrine Disorders	1,728.4	6.2	1,670.1	6.3	1,628.5	6.5	1,641.0	7.1
Neuropsychiatric Conditions	3,551.3	12.7	3,340.1	12.6	3,156.8	12.6	2,946.3	12.7
Sense Organ Diseases	283.4	1.0	257.8	1.0	256.4	1.0	261.7	1.1
Cardiovascular Diseases	4,272.7	15.3	3,981.6	15.1	3,721.3	14.8	3,637.6	15.7
Respiratory Diseases	1,197.2	4.3	1,086.7	4.1	985.1	3.9	931.9	4.0
Digestive Diseases	1,434.0	5.1	1,384.3	5.2	1,339.2	5.3	1,317.4	5.7
Genitourinary Diseases	670.8	2.4	601.8	2.3	563.4	2.2	572.4	2.5
Skin Diseases	680.5	2.4	594.2	2.2	541.1	2.2	523.0	2.3
Musculoskeletal Diseases	1,982.5	7.1	1,813.9	6.9	1,643.6	6.5	1,463.1	6.3
Congenital Anomalies	35.0	0.1	23.6	0.1	12.0	0.0	8.9	0.0
Oral Conditions	42.3	0.2	38.7	0.1	27.6	0.1	29.5	0.1
Injuries	259.7	0.9	261.1	1.0	257.2	1.0	272.8	1.2
Symptoms, Signs and Ill-Defined Conditions	1,283.1	4.6	1,447.8	5.5	1,270.7	5.1	1,092.2	4.7
Factors Influencing Health and Contact with Health Services	700.4	2.5	858.0	3.2	562.6	2.2	546.5	2.4
Total EBIC Drug Expenditures	**21,187.6**	**75.9**	**20,053.1**	**75.8**	**18,721.1**	**74.6**	**17,723.2**	**76.4**
Unattributable Drug Expenditures[1]	**6,734.8**	**24.1**	**6,386.4**	**24.2**	**6,373.4**	**25.4**	**5,471.1**	**23.6**
Total Drug Expenditures[2]	**27,922.4**	**100.0**	**26,439.5**	**100.0**	**25,094.5**	**100.0**	**23,194.3**	**100.0**

[1] Unattributable drug expenditures were calculated by subtracting EBIC total drug expenditures from NHEX total drug expenditures.

[2] Annual total drug expenditures were obtained from CIHI's *National Health Expenditure Trends, 1975 to 2012* (5).

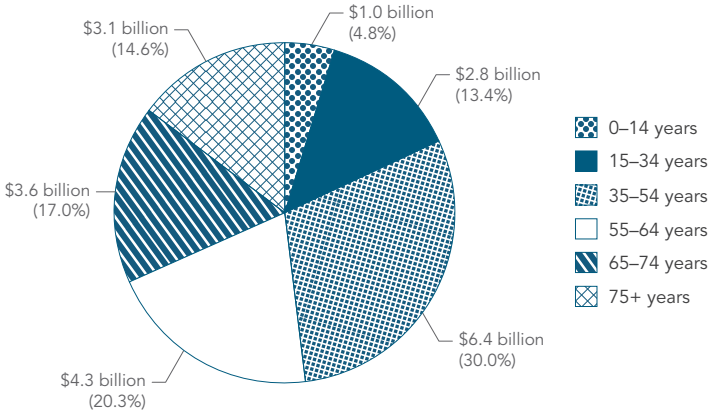
NOTE: Any discrepancies may be due to rounding.

TABLE 7: Drug Expenditures by Diagnostic Category and Sex, Canada, 2008 ($'000,000 Current Dollars)

DIAGNOSTIC CATEGORY	2008 MALE COST	% OF TOTAL COST	2008 FEMALE COST	% OF TOTAL COST	TOTAL COST
Certain Infectious and Parasitic Diseases	385.0	55.3	311.7	44.7	696.7
Respiratory Infections	224.5	44.1	284.8	55.9	509.3
Maternal Conditions			58.5	100.0	58.5
Perinatal Conditions	5.2	52.6	4.7	47.4	9.8
Nutritional Deficiencies	16.6	21.5	60.6	78.5	77.2
Malignant Neoplasms	150.7	32.3	316.4	67.7	467.1
Other Neoplasms	12.8	25.7	37.0	74.3	49.8
Diabetes Mellitus	723.3	60.4	474.9	39.6	1,198.2
Endocrine Disorders	942.8	54.6	785.5	45.4	1,728.4
Neuropsychiatric Conditions	1,525.0	42.9	2,026.2	57.1	3,551.3
Sense Organ Diseases	143.5	50.6	139.9	49.4	283.4
Cardiovascular Diseases	2,351.4	55.0	1,921.3	45.0	4,272.7
Respiratory Diseases	585.1	48.9	612.1	51.1	1,197.2
Digestive Diseases	620.8	43.3	813.2	56.7	1,434.0
Genitourinary Diseases	253.5	37.8	417.4	62.2	670.8
Skin Diseases	306.9	45.1	373.6	54.9	680.5
Musculoskeletal Diseases	654.6	33.0	1,327.9	67.0	1,982.5
Congenital Anomalies	10.5	30.1	24.5	69.9	35.0
Oral Conditions	16.4	38.8	25.9	61.2	42.3
Injuries	126.7	48.8	133.0	51.2	259.7
Symptoms, Signs and Ill-Defined Conditions	548.1	42.7	735.0	57.3	1,283.1
Factors Influencing Health and Contact with Health Services	127.8	18.2	572.6	81.8	700.4
Total EBIC Hospital Care Expenditures	**9,731.1**	**45.9**	**11,456.5**	**54.1**	**21,187.6**

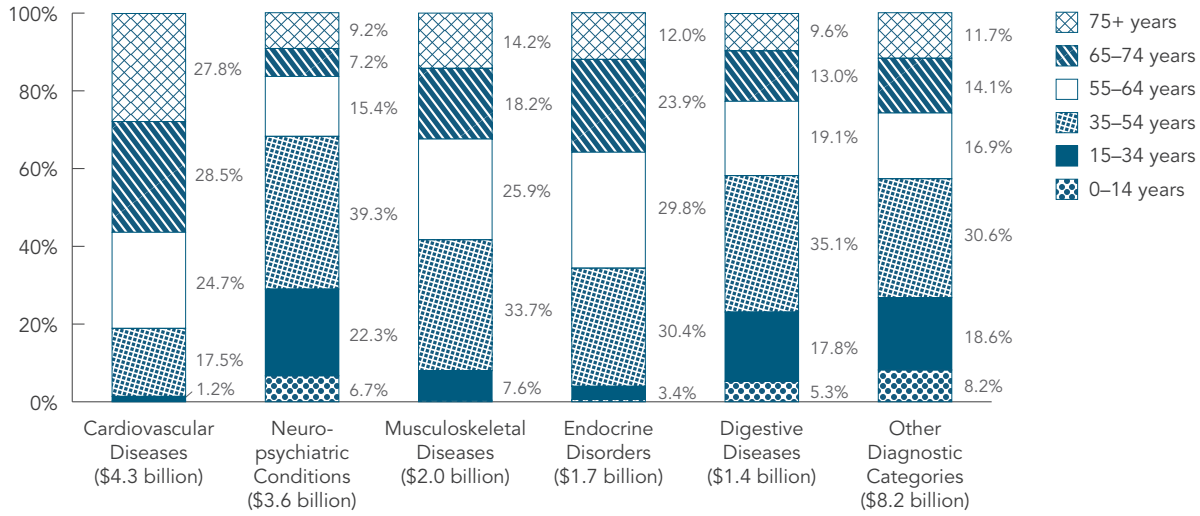
NOTES: Drug expenditures by sex can be determined only for attributable EBIC drug expenditures.
Any discrepancies may be due to rounding.

FIGURE 16: Drug Expenditures by Age Group, Canada, 2008



NOTE: Any discrepancies may be due to rounding.

FIGURE 17: Drug Expenditure Distribution by Diagnostic Category and Age Group, Canada, 2008



NOTES: Individuals aged 0–14 years have an attributable cost of 0.2%, 0.4% and 0.6% for cardiovascular diseases, musculoskeletal diseases and endocrine disorders, respectively; these numeric values are represented but not displayed in the figure. 'Other diagnostic categories' include the costs from all other EBIC diagnostic categories not individually displayed in the figure.

Any discrepancies may be due to rounding.

REPORT 3: EBIC PHYSICIAN CARE EXPENDITURES, 2005–2008

1. BACKGROUND

Physician care expenditures include fee-for-service payments made by provincial/territorial medical care insurance plans to physicians in private practice, as well as alternative forms of payment (salaries, sessional, capitation) made to physicians (5). Fees for services rendered in hospitals are also included in the physician care expenditures component when the provincial/territorial medical insurance plans make payments directly to the physicians. While previous versions of EBIC utilized provincial and territorial physician fee-for-service claims data, this was not feasible for EBIC 2005–2008. As an alternative, Manitoba's publicly available fee-for-service physician care expenditure totals, by sex and ICD-9 chapter, were used along with EBIC 2000 data to distribute NHEX physician cost totals across EBIC categories (diagnostic category/subcategory, sex, age group and province/territory) for each year of analysis (5,33). Information on physician care expenditures for services remunerated by alternative payment methods was not available by diagnostic category for any province or territory. This report describes the data sources and methods used to derive the 2005–2008 physician care expenditure estimates. It also presents and discusses the results and limitations of the data used.

2. DATA SOURCES

Publicly available Manitoba fee-for-service physician care expenditure totals by sex and ICD-9 chapter were obtained from the Manitoba Health Annual Statistics (43–46). Unpublished EBIC 2000 physician care expenditure data were obtained from PHAC. NHEX province/territory annual physician cost totals were obtained from CIHI (5).

3. METHODS

The distribution of Manitoba's fee-for-service physician care expenditures according to ICD-9 chapter, and sex, was used to distribute NHEX provincial/territorial physician cost totals by ICD-9 chapter and sex for all provinces/territories.[61] For jurisdictions other than Manitoba, the jurisdictional cost distribution used to distribute the NHEX cost totals was obtained by multiplying Manitoba's cost per capita for each ICD-9 chapter and sex group by the appropriate provincial/territorial population count.

For all provinces/territories, the sex-specific ICD-9 chapter physician care expenditure totals were then distributed across individual ICD-9 codes and age groups using the EBIC 2000 cost distributions specific to each province/territory and ICD chapter. For all analyses, the EBIC 2000 cost distribution was adjusted for differences in population between the year 2000 and the year of analysis.[62] In PHAC's EBIC 2000 database, Manitoba and Newfoundland did not

[61] The physician expenditure totals for the category 'laboratory, X-ray and other claims without diagnosis' listed in the Manitoba Health Annual Statistics were omitted from the EBIC analyses.

[62] The population adjustments were made using Statistics Canada's population estimates (36–39).

have records for the ICD-9 chapter 'Factors Influencing Health Status and Contact with Health Services'. Physician care expenditure totals for these chapters were distributed across individual ICD codes and age groups using the EBIC 2000 national (excluding Manitoba and Newfoundland) cost distribution for the chapter, after adjusting for differences in population. Costs by ICD code were then grouped into the EBIC diagnostic categories and subcategories according to the groupings described in Appendix C.

4. RESULTS[63]

4.1 Expenditures by Diagnostic Category

Table 8 illustrates EBIC physician care expenditures by diagnostic category for the years 2005–2008. In 2008, the five diagnostic categories with the largest expenditures were cardiovascular diseases ($2.4 billion, 9.9%), neuropsychiatric conditions ($2.3 billion, 9.9%), musculoskeletal diseases ($2.0 billion, 8.4%), genitourinary diseases ($1.6 billion, 6.8%) and injuries ($1.4 billion, 6.0%).

4.2 Expenditures by Diagnostic Category and Sex

Table 9 illustrates EBIC 2008 physician care expenditures by diagnostic category and sex. In 2008, 41.3% ($9.8 billion) and 58.7% ($13.9 billion) of expenditures were attributable to males and females respectively. The three diagnostic categories with the largest expenditure for males were cardiovascular diseases ($1.2 billion), neuropsychiatric conditions ($0.9 billion) and musculoskeletal diseases ($0.8 billion). For females, the three diagnostic categories with the largest expenditure were neuropsychiatric conditions ($1.4 billion), musculoskeletal diseases ($1.2 billion) and genitourinary diseases ($1.1 billion).

The five diagnostic categories with the largest difference in cost distribution across the sexes were genitourinary diseases (31.5% male, 68.5% female), nutritional deficiencies (34.0% male, 66.0% female), certain infectious and parasitic diseases (36.2% male, 63.8% female), other neoplasms (36.7% male, 63.3% female) and endocrine disorders (38.1% male, 61.9% female).[64]

4.3 Expenditures by Diagnostic Category and Age Group

Figure 18 illustrates EBIC 2008 physician care expenditures for each age group. Individuals aged 0–14 years incurred the lowest percentage of physician care expenditures (9.1%) and individuals aged 35–54 years the highest (26.8%). Additionally, individuals aged 55 years and older accounted for approximately 44% of total EBIC physician care expenditures.

Figure 19 illustrates EBIC 2008 physician care expenditures by diagnostic category and age group for the five most costly diagnostic categories. Expenditures of the highlighted diagnostic categories were highest for individuals aged 35–54 years, except in the cardiovascular diseases category.

[63] The diagnostic categories 'Symptoms, signs and ill-defined conditions' and 'Factors influencing health and contact with health services' are presented in the results tables but are not ranked or discussed in this report, as these categories include health conditions that are ill-defined or that can result from multiple health conditions, making it hard to attribute costs to a single disease/disorder.

[64] The 'Maternal conditions' category is not included in this ranking because costs are attributable only to females.

5. DISCUSSION AND LIMITATIONS

Record-level fee-for-service claims data were not obtained from the respective provinces/territories and therefore could not be used to estimate EBIC 2005–2008 physician care expenditures. Access to record-level claims data offers high value to the EBIC publication, as these records contain information on physician care expenditures by ICD code, sex, age group and province/territory. In the absence of claims data, assumptions had to be made using the available data, and the results may not reflect the true distribution of physician care expenditures across EBIC categories.

Manitoba was the only province/territory with publicly available physician care expenditures by diagnostic category (specifically, by ICD-9 chapter and sex). These cost distributions were used to estimate the sex-ICD chapter specific cost distributions for all other provinces/territories. There are several limitations to these methods. Primarily, Manitoba's costs per capita may not be an appropriate method to cost for other provinces/territories. The costs per capita were estimated by sex but not by age group, given that the Manitoba ICD chapter expenditure totals were only available by sex. Thus, differences in the age distribution of Manitoba's population and that of the other provinces/territories could not be adjusted for. Furthermore, using Manitoba's cost per capita distribution to cost for other provinces/territories does not consider that the prevalence of certain health conditions may vary among jurisdictions. Also, in 2008, Manitoba represented a very small percentage (3.6%) of the overall Canadian population and may have had very different distributions of urban/rural, aboriginal and other minority populations. All these factors may make Manitoba's cost per capita distribution an inaccurate proxy for the other provinces/territories.

Table 10 illustrates the comparison between the EBIC 2000 cost distribution by diagnostic category for Manitoba and Ontario. The three diagnostic categories with the largest difference (in absolute value) were neuropsychiatric conditions (6.5%), symptoms, signs and ill-defined conditions (3.0%) and injuries (2.6%). For the remaining categories, 13 are associated with a difference of 1% or less and 5 are associated with a difference of greater than 1% and less than or equal to 2%. Overall, Table 10 shows that for most diagnostic categories (85.7%), Manitoba's 2000 cost distribution was similar to Ontario's. The significance of a magnitude of difference may vary with personal opinion, with some individuals considering a difference of less than 1% or 2% to be significant. Although the EBIC 2000 cost distribution for Manitoba may be considered to closely reflect that of Ontario's, this may not be the case for the years 2005–2008, and using Manitoba's cost distribution to produce estimates for Ontario (and other provinces/territories) may have resulted in inaccuracies. Ontario was used as the comparator in Table 10; however, larger or smaller differences may exist for other provinces/territories.

Fee-for-service physician care expenditures by ICD code were not publicly available for any province/territory. As the ICD code groupings for the EBIC diagnostic categories are different from those in the ICD chapters, it was necessary to distribute costs for an ICD chapter across ICD codes, so that costs could then be re-grouped into the EBIC diagnostic categories. Additionally, it was necessary to distribute costs within an ICD chapter across ICD codes, so that costs by EBIC diagnostic subcategory could be obtained. As mentioned in the methods section of this report, ICD chapter costs were distributed across ICD codes using each respective jurisdiction's EBIC 2000 cost distribution (after adjustment for changes in

population). Table 11 illustrates the difference between a Manitoba 2008 cost distribution obtained by adjusting EBIC 2000 Manitoba data for population changes and Manitoba's 2008 cost distribution taken from the Manitoba Health Annual Statistics publication. The largest difference (in absolute value) is for the diagnostic category 'injuries' (3.3%). For the remaining diagnostic categories, 16 were associated with a difference of 1% or less, 2 were associated with a difference of greater than 1% and equal to or less than 2%, and 2 were associated with a difference of greater than 2% and equal to or less than 4%. Table 11 shows that adjusted EBIC 2000 data may be a reasonable proxy for other years (at least for Manitoba in 2008). Although, adjusted EBIC 2000 estimates may not produce substantial differences in the cost distribution by EBIC diagnostic category, differences (in absolute value) may be larger at the diagnostic subcategory level. Using EBIC 2000 data to distribute costs across ICD code does not take into consideration that the distribution of costs within an ICD chapter may be different across the years, even after adjustment for population changes. Costs were also distributed across age groups using the EBIC 2000 cost distribution specific to province/territory, sex and ICD chapter; similar limitations follow from these methods.

Record-level data or aggregated data by diagnostic category, sex and age group for alternative physician payment methods (salaries, sessional, capitation) were not available. CIHI's National Physician Database (NPDB) showed that in 2008 the total national clinical payments made to physicians remunerated on a fee-for-service basis were 73.1% of total clinical payments, a decrease from 89.3% in 1999 (47).[65] As physician remuneration by fee-for-service method declines, ways of capturing the services by cost, patient diagnosis and demographic information when physicians are paid by other methods become more important. Shadow billing and/or physician surveys for services remunerated using alternative payment methods could produce valuable information, especially if physician remuneration methods influence the treatment that physicians provide to their patients and/or if patient characteristics (e.g. chronic illness, age) vary with payment method. The fee-for-service cost distributions used in this report may not accurately represent the cost distributions across EBIC category for physician services remunerated using alternative methods. In the absence of individual claims data for all provinces and territories, serious limitations exist when looking at specific diseases, especially those whose prevalence may change in response to exposure (e.g. food-borne illness outbreaks). The estimates in this report are not sensitive enough to capture these fluctuations in specific diseases across years and provinces/territories. Therefore, comparisons of EBIC physician care expenditure estimates across the years 2005–2008 and across provinces/territories are not recommended.

[65] Differences exist between NHEX and NPDB expenditure totals (5,47).

6. CONCLUSION

EBIC 2005–2008 physician care expenditures were attributed by EBIC categories for fee-for-service remuneration using publicly available Manitoba data, in conjunction with EBIC 2000 data. The three diagnostic categories with the highest expenditures were cardiovascular diseases ($2.4 billion, 9.9%), neuropsychiatric conditions ($2.3 billion, 9.9%), musculoskeletal diseases ($2.0 billion, 8.4%). Males accounted for 41.3% of 2008 physician care expenditures while females accounted for 58.7%. EBIC 2008 physician care expenditures were lowest and highest for individuals aged 0–14 years (9.1%) and 35–54 years (26.8%) respectively.

The estimates in this report offer value in that they can be added to other EBIC cost components to obtain an estimate of the economic burden of illness and injury in Canada. EBIC 2005–2008 physician care expenditures should not be compared across years or provinces/territories. Given the limitations mentioned in this report, these expenditures may not accurately represent the cost burden by illness and injury, especially when more disaggregated disease categories are examined (e.g. EBIC diagnostic subcategories).

FIGURES AND TABLES

TABLE 8: Physician Care Expenditures by Diagnostic Category, Canada, 2005–2008 ($'000,000 Current Dollars)

DIAGNOSTIC CATEGORY	2008 COST	% OF 2008 COST	2007 COST	% OF 2007 COST	2006 COST	% OF 2006 COST	2005 COST	% OF 2005 COST
Certain Infectious and Parasitic Diseases	509.3	2.1	470.1	2.2	436.5	2.2	408.4	2.2
Respiratory Infections	1,125.2	4.7	1,042.1	4.8	1,018.7	5.1	1,003.9	5.4
Maternal Conditions	792.1	3.3	723.2	3.4	656.3	3.3	611.3	3.3
Perinatal Conditions	42.0	0.2	36.3	0.2	35.7	0.2	29.9	0.2
Nutritional Deficiencies	158.0	0.7	137.4	0.6	124.2	0.6	106.1	0.6
Malignant Neoplasms	1,031.7	4.3	924.6	4.3	789.5	3.9	732.2	3.9
Other Neoplasms	484.0	2.0	435.8	2.0	373.8	1.9	347.8	1.9
Diabetes Mellitus	487.3	2.0	444.0	2.1	404.2	2.0	377.1	2.0
Endocrine Disorders	587.5	2.5	529.5	2.5	483.1	2.4	443.2	2.4
Neuropsychiatric Conditions	2,347.0	9.9	2,167.3	10.1	2,047.4	10.2	1,842.1	9.9
Sense Organ Diseases	1,329.3	5.6	1,248.3	5.8	1,169.8	5.8	1,073.7	5.8
Cardiovascular Diseases	2,352.0	9.9	2,128.7	9.9	1,974.7	9.9	1,861.4	10.0
Respiratory Diseases	632.6	2.7	581.3	2.7	569.8	2.8	565.9	3.0
Digestive Diseases	1,232.6	5.2	1,125.0	5.2	1,071.2	5.3	977.8	5.3
Genitourinary Diseases	1,626.4	6.8	1,484.5	6.9	1,403.0	7.0	1,263.9	6.8
Skin Diseases	833.1	3.5	744.5	3.5	687.8	3.4	618.4	3.3
Musculoskeletal Diseases	2,002.5	8.4	1,804.8	8.4	1,682.4	8.4	1,539.5	8.3
Congenital Anomalies	139.0	0.6	125.8	0.6	112.5	0.6	104.2	0.6
Oral Conditions	214.1	0.9	196.8	0.9	189.7	0.9	178.5	1.0
Injuries	1,435.0	6.0	1,304.7	6.1	1,204.1	6.0	1,151.9	6.2
Symptoms, Signs and Ill-Defined Conditions	1,846.1	7.8	1,623.4	7.5	1,543.2	7.7	1,426.6	7.7
Factors Influencing Health and Contact with Health Services	2,573.7	10.8	2,276.1	10.6	2,069.1	10.3	1,892.4	10.2
Total EBIC Physician Care Expenditures	**23,780.3**	**100.0**	**21,554.3**	**100.0**	**20,046.9**	**100.0**	**18,556.2**	**100.0**
Unattributable Physician Care Expenditures[1]	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total Physician Care Expenditures[2]	**23,780.3**	**100.0**	**21,554.3**	**100.0**	**20,046.9**	**100.0**	**18,556.2**	**100.0**

[1] Unattributable physician care expenditures were calculated by subtracting EBIC total physician care expenditures from NHEX total physician expenditures.

[2] Annual total physician care expenditures were obtained from CIHI's *National Health Expenditure Trends, 1975 to 2012* (5).

NOTE: Any discrepancies may be due to rounding.

TABLE 9: Physician Care Expenditures by Diagnostic Category and Sex, Canada, 2008 ($'000,000 Current Dollars)

DIAGNOSTIC CATEGORY	2008 MALE COST	% OF TOTAL COST	2008 FEMALE COST	% OF TOTAL COST	TOTAL COST
Certain Infectious and Parasitic Diseases	184.5	36.2	324.8	63.8	509.3
Respiratory Infections	501.8	44.6	623.4	55.4	1,125.2
Maternal Conditions			792.1	100.0	792.1
Perinatal Conditions	22.1	52.6	19.9	47.4	42.0
Nutritional Deficiencies	53.8	34.0	104.2	66.0	158.0
Malignant Neoplasms	525.5	50.9	506.3	49.1	1,031.7
Other Neoplasms	177.4	36.7	306.6	63.3	484.0
Diabetes Mellitus	250.2	51.4	237.1	48.6	487.3
Endocrine Disorders	223.8	38.1	363.7	61.9	587.5
Neuropsychiatric Conditions	937.2	39.9	1,409.8	60.1	2,347.0
Sense Organ Diseases	562.0	42.3	767.3	57.7	1,329.3
Cardiovascular Diseases	1,248.1	53.1	1,103.9	46.9	2,352.0
Respiratory Diseases	304.9	48.2	327.7	51.8	632.6
Digestive Diseases	572.6	46.5	660.0	53.5	1,232.6
Genitourinary Diseases	512.7	31.5	1,113.7	68.5	1,626.4
Skin Diseases	387.3	46.5	445.8	53.5	833.1
Musculoskeletal Diseases	822.1	41.1	1,180.4	58.9	2,002.5
Congenital Anomalies	74.8	53.8	64.2	46.2	139.0
Oral Conditions	95.7	44.7	118.4	55.3	214.1
Injuries	729.7	50.9	705.3	49.1	1,435.0
Symptoms, Signs and Ill-Defined Conditions	789.4	42.8	1,056.7	57.2	1,846.1
Factors Influencing Health and Contact with Health Services	855.3	33.2	1,718.4	66.8	2,573.7
Total EBIC Physician Care Expenditures	**9,830.8**	**41.3**	**13,949.5**	**58.7**	**23,780.3**

NOTES: Any discrepancies may be due to rounding.

TABLE 10: Comparison of the Cost Distribution by Diagnostic Category for Manitoba and Ontario (EBIC 2000)

DIAGNOSTIC CATEGORY	EBIC 2000 MANITOBA (%) A	EBIC 2000 ONTARIO (%) B	DIFFERENCE (%) (A–B)
Certain Infectious and Parasitic Diseases	2.8	2.9	-0.1
Respiratory Infections	7.7	6.8	0.9
Maternal Conditions	3.3	2.5	0.8
Perinatal Conditions	0.2	0.3	-0.1
Nutritional Deficiencies	0.3	0.4	-0.1
Malignant Neoplasms	3.2	3.6	-0.3
Other Neoplasms	1.6	1.5	0.1
Diabetes Mellitus	2.0	1.8	0.1
Endocrine Disorders	2.4	2.0	0.4
Neuropsychiatric Conditions	9.5	16.0	-6.5
Sense Organ Diseases	6.5	8.0	-1.5
Cardiovascular Diseases	10.1	10.6	-0.5
Respiratory Diseases	5.1	3.1	1.9
Digestive Diseases	6.1	4.1	2.0
Genitourinary Diseases	7.4	6.3	1.1
Skin Diseases	4.1	3.7	0.4
Musculoskeletal Diseases	8.6	7.0	1.5
Congenital Anomalies	0.5	0.3	0.3
Oral Conditions	0.6	0.4	0.2
Injuries	9.4	6.7	2.6
Symptoms, Signs and Ill-Defined Conditions	8.6	11.5	-3.0
Factors Influencing Health and Contact with Health Services	-	0.3	-

NOTES: The EBIC 2000 physician care expenditures were available by ICD code. The cost totals used to estimate the cost distributions included in this table were obtained using the EBIC 2005–2008 diagnostic category ICD code groupings.

Any discrepancies may be due to rounding.

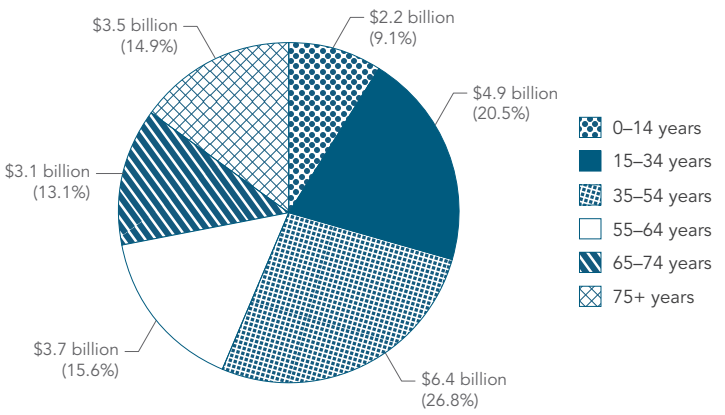
TABLE 11: Comparison of Manitoba 2008 Physician Care Cost Distribution Using Two Methods

DIAGNOSTIC CATEGORY	ESTIMATED MANITOBA 2008 USING EBIC 2000 MANITOBA DATA (%) A	MANITOBA 2008 DATA FROM MANITOBA ANNUAL STATISTICS (%) B	DIFFERENCE (%) (A–B)
Certain Infectious and Parasitic Diseases	2.6	2.1	0.5
Respiratory Infections	7.3	4.7	2.6
Maternal Conditions	3.1	3.3	-0.2
Perinatal Conditions	0.2	0.2	0.0
Nutritional Deficiencies	0.3	0.7	-0.4
Malignant Neoplasms	3.3	4.4	-1.1
Other Neoplasms	1.7	2.0	-0.3
Diabetes Mellitus	2.0	2.0	0.0
Endocrine Disorders	2.5	2.5	0.0
Neuropsychiatric Conditions	9.6	9.9	-0.3
Sense Organ Diseases	6.5	5.5	1.0
Cardiovascular Diseases	10.4	9.9	0.5
Respiratory Diseases	5.0	2.7	2.3
Digestive Diseases	6.2	5.1	1.1
Genitourinary Diseases	7.5	6.8	0.7
Skin Diseases	4.1	3.5	0.6
Musculoskeletal Diseases	8.8	8.4	0.4
Congenital Anomalies	0.5	0.6	-0.1
Oral Conditions	0.6	1.0	-0.4
Injuries	9.3	6.0	3.3
Symptoms, Signs and Ill-Defined Conditions	8.5	7.8	0.7
Factors Influencing Health and Contact with Health Services	-	11.0	-

NOTES: The EBIC 2000 physician care expenditures were available by ICD code. The cost totals used to estimate the cost distributions included in this table were found using the EBIC 2005–2008 diagnostic category ICD code groupings.

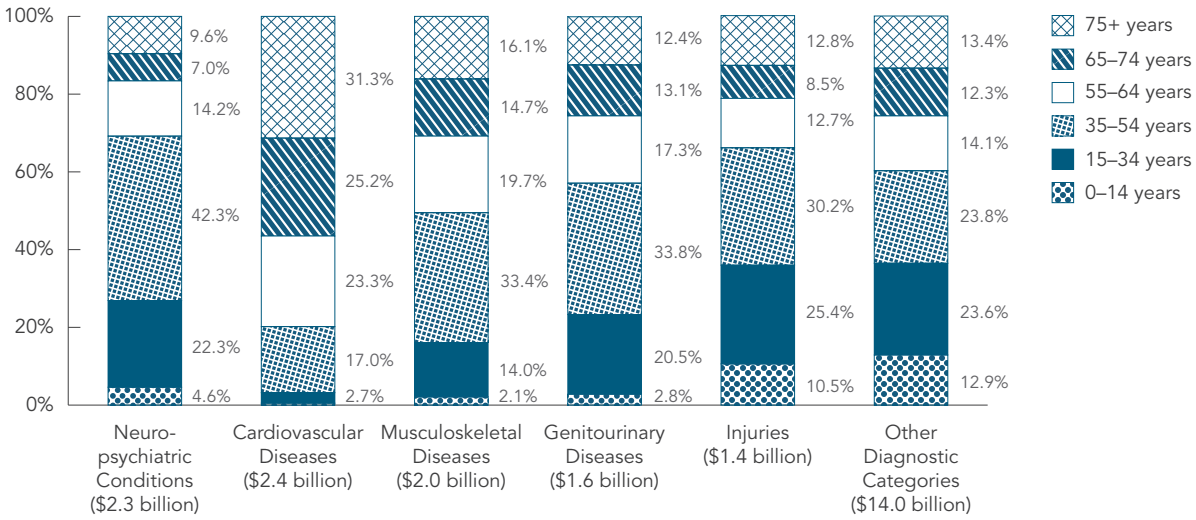
Any discrepancies may be due to rounding.

FIGURE 18: Physician Care Expenditures by Age Group, Canada, 2008



NOTE: Any discrepancies may be due to rounding.

FIGURE 19: Physician Care Expenditure Distribution by Diagnostic Category and Age Group, Canada, 2008



NOTES: Individuals aged 0–14 years have an attributable cost of 0.5% for cardiovascular diseases; this numeric value is represented but not displayed in the figure. 'Other Diagnostic Categories' include the costs from all other EBIC diagnostic categories not individually displayed in the figure.

Any discrepancies may be due to rounding.

REPORT 4: EBIC VALUE OF LOST PRODUCTION DUE TO PREMATURE MORTALITY, 2004–2008

1. BACKGROUND

Traditionally, the human capital method has been used to estimate the value of lost production due to premature mortality caused by illness and/or injury. This method estimates the value of lost production as the present value of an individual's future earnings stream lost due to premature death. It is based on the assumption of zero involuntary unemployment or, in other words, it implicitly assumes that when a person dies he or she cannot be replaced. This assumption is likely to be untrue in today's labour market, as evidenced by an unemployment rate ranging from 6% to 10% across the years 1996–2010 (48–50).

A more recent method, the friction cost method, was developed by a group of Dutch economists in the 1990s (51–54). The friction cost method allows for non-zero involuntary unemployment, which is closer to the real life situation of today's economy. The friction cost method states that when a person dies he or she will be replaced by a worker who was previously unemployed. Of course, it will take some time to replace the worker, including the time required for job training. This method estimates the loss in production only for the period it takes to replace the deceased worker, referred to as the *friction period*.

In previous EBIC reports, the value of lost production due to premature mortality was estimated using the human capital method. However, on the basis of the outcomes of the 2009 and 2010 EBIC workshops (organized by PHAC), it was recommended that the friction cost method be used to estimate mortality costs (55,56).

Although the current edition of EBIC focuses on the years 2005–2008, the 2004 results are also presented, as the data required to produce 2004 estimates were available. The EBIC 2004–2008 value of lost production due to premature mortality associated with labour market activities was estimated by diagnostic category/subcategory, age, sex, and province/territory using the friction cost method and a prevalence-based approach. This report describes the data sources and methods used to derive the 2004–2008 mortality cost estimates. Additionally it presents and discusses the results and the data and methods limitations.

2. DATA SOURCES

Statistics Canada's Vital Statistics Death Database (2003–2008) was used in the estimation of 2004–2008 mortality costs. This database contains information on all deaths that occurred in Canada, including day/month/year of death, cause of death (coded using ICD version 10 codes), age, sex, province of residence, province of occurrence and other variables.

Additional data inputs were obtained from Statistics Canada, including average annual earnings specific to sex, age and province; annual provincial unemployment duration (in consecutive weeks); and average annual employment rate specific to sex, age and province (57,58,69).

3. METHODS

The EBIC 2004–2008 estimates for the value of lost production due to mortality were derived by diagnostic category/subcategory (see Appendix C), age group, sex and province/territory.[66,67] The estimates were derived by multiplying the period of lost production by the dollar value of production, more specifically the age-sex-province-specific earnings.

Following the methods of Koopmanschap et al. the value of lost production was estimated for the working age population comprising individuals aged 15–64 years (53).[68] As mentioned earlier, the 2009 and 2010 EBIC Workshop participants recommended considering premature deaths that occurred in the year of study as well as those that had occurred in previous years if the lost production fell in the year of study. The length of the friction period determined the required timeframe considered in order to estimate the value of lost production.

Following van Ours and Ridder's model, Koopmanschap et al. estimated the length of the friction period for the Netherlands in the years 1988 and 1990 using quarterly data on uncompleted vacancy durations and the number of vacancies from a large sample of Dutch firms (53,59). Given that such data were not available for Canada, provincial unemployment duration was used as a proxy for the length of the friction period.[69] Unemployment duration data were not available for the territories, and so the national average unemployment duration was used as a proxy. Mortality costs were estimated to the nearest half month, thus in 2004–2008 the unemployment duration used in the analysis ranged from 2 to 4.5 months (58).[70]

Since the unemployment duration ranged from 2 to 4.5 months, it was only necessary to consider premature deaths that occurred in the year of study (year t) and in the previous year (year $t–1$). For example, if the friction period in year t was 4 months, then the analysis required going back 3.5 months in year $t–1$ (to September 16th) to capture the premature deaths considered for analysis (the minimum lost production of 0.5 months would have fallen in year t and the remaining 3.5 months in year $t–1$). Then, the total value of lost production in year t is the sum of the value of lost production due to all premature deaths that occurred from September 16 in year $t–1$ to December 31 in year t. Thus, the number of deaths and period of lost production valued in the analysis depended on the length of the friction period.

Once the period of lost production for each death had been determined, lost production was valued using the appropriate age-sex-province-specific earnings. Average annual sex-age-province-specific earnings were used to value lost production for each person group (57).[71,72] As earnings data for the territories were not available, corresponding national

---

66 Mortality costs were assigned by province/territory of residence. If this value was missing, costs were assigned to the province/territory of occurrence. There were very few such cases (ranging from 0.48% in 2008 to 0.66% in 2006).

67 Mortality costs were not estimated for residents of other provinces/territories who died in Quebec.

68 Individuals aged 15–64 years accounted for only 21% of all deaths that occurred from 2004–2008.

69 Goeree et al. assumed a friction period of 3 months for Canada on the basis of friction period estimates for the Netherlands, which were 2.8 months in 1988 and 3.2 months in 1990, as used by Koopmanschap et al. (53,60). In another Canadian study, Hopkins et al. used unemployment duration of 14.6 weeks (3.4 months) as a proxy for the friction period (61).

70 The provincial unemployment duration in the period 2004 to 2008 ranged from 8.1 weeks (1.9 months) in Alberta in 2007 to 20.4 weeks (4.7 months) in Quebec in 2006.

71 Earnings in constant dollars were converted to current dollars using Statistics Canada's Consumer Price Index values (7).

72 Average monthly earnings were derived by dividing the corresponding average annual earnings by 12.

averages were used. For the data marked 'use with caution', which were mainly earnings data for the youngest age group, the corresponding national average was used.[73] Additionally, earnings data for individuals less than 20 years of age were used to value lost production for individuals aged 15–19 years, as age-specific earnings data exclusive to individuals in this age group were not available.

Considering that individuals who died may have been unemployed or not in the labour force, the value of lost production associated with each premature death was multiplied by the appropriate sex-age-province-specific employment rate (69).[74] Please refer to Appendix 1 in this report for a mathematical representation of the mortality methods and to Appendix 2 for hypothetical examples. For each year of analysis, the value of lost production due to mortality by diagnostic category/subcategory, sex, age group and province/territory was found by aggregating the costs into the appropriate categories.

4. RESULTS

4.1 Costs by Diagnostic Category

Table 12 illustrates the EBIC 2004–2008 national cost estimates of the value of lost production due to mortality by diagnostic category. In 2008, total national mortality costs were $454.0 million. The three diagnostic categories with the largest costs were malignant neoplasms ($166.0 million, 36.6%), cardiovascular diseases ($92.4 million, 20.4%) and injuries ($84.6 million, 18.6%). All mortality costs were attributable across EBIC categories.

4.2 Costs by Diagnostic Category and Sex

Table 13 illustrates the EBIC 2008 national cost estimates of the value of lost production due to mortality by diagnostic category and sex. Total mortality costs were higher for males ($336.0 million, 74.0%) than for females ($118.0 million, 26.0%). The three diagnostic categories with the highest costs for males and females were malignant neoplasms ($106.2 million males, $59.8 million females), cardiovascular diseases ($77.2 million males, $15.3 million females) and injuries ($70.0 million males, $14.6 million females).

4.3 Costs by Diagnostic Category and Age

Figure 20 illustrates EBIC 2008 mortality costs for each age group. Individuals aged 15–34 years incurred the lowest percentage of mortality costs (6.3%) and individuals aged 35–54 years the highest (51.7%).

Figure 21 illustrates EBIC 2008 mortality costs by diagnostic category and age group for the five most costly diagnostic categories. Costs for the highlighted diagnostic categories were highest for individuals aged 35–54 years, except in the malignant neoplasms and cardiovascular diseases categories, in which costs were highest for individuals aged 55–64 years.

[73] Data marked as 'used with caution' were associated with a coefficient of variation greater than or equal to 16%.

[74] The employment rates were specific by 5-year age group, except for Quebec. The Quebec EBIC mortality data were only available by EBIC age group, therefore a sex-province-specific employment rate for individuals aged 15–64 years was applied to all value of lost production costs in Quebec.

4.4 Costs Across the Years 2004–2008

Table 14 illustrates the EBIC 2004–2008 national estimates of the total value of lost production due to mortality in 2010 constant dollars. The value of lost production was lowest in 2004 ($446.8 million) and highest in 2006 ($470.7 million).

5. DISCUSSION AND LIMITATIONS

The main limitation is that unemployment duration is used as a proxy for the friction period. Koopmanschap et al. estimated the length of the friction period using vacancy duration data (53). As mentioned earlier, such data were not available for Canada for 2004–2008; instead, unemployment duration was used as a proxy for the friction period.

Conceptually, the friction period is the period of time it takes to replace a worker who has died. In general, it might take longer to replace a highly skilled worker than an unskilled/low-skilled worker. This is because highly skilled workers may be in short supply and also because of the length and complexity of the training required to replace these workers.

Unemployment duration is the time it takes for an unemployed person to find a suitable job. One might argue that it would be easier to find an unskilled/low-skilled job than a highly skilled one; if so, the unemployment duration would be shorter for the unskilled/low-skilled worker.

Given the differences between the human capital method and the friction cost method, estimates from EBIC 2004–2008 should not be compared with estimates from previous EBIC editions. Koopmanschap et al. estimated 1988 mortality costs for the Netherlands using both methods and found that mortality costs were 53 times higher using the human capital method (53).

Mortality cost totals by sex and age group are influenced by the total number of deaths that occurred and the earnings used to value lost production for each sex-age group. When the earnings data were unavailable or the coefficient of variation was high (greater than 16%), the corresponding national average was used; this may have misrepresented the value of production for certain person groups.

There is no clear trend for EBIC mortality costs over the years 2004–2008, the lowest and highest costs being seen in 2004 and 2006 respectively. Although the national unemployment duration (for both sexes) is approximately 4 months across the years 2004–2008, the province-level results (not discussed in this report) show some evidence that the friction period had a considerable impact on costs, as provincial mortality costs followed the same trend as the friction period.[75]

The 2004–2008 results excluded mortality cost estimates for residents of other provinces/territories who died in Quebec. However, the magnitude of the effect is expected to be small as the majority of individuals died in their province of residence. Mortality costs may be overestimated since individuals may have been employed but off work at the time of their

[75] The unemployment duration varies more across provinces for the same year than across years for the same province. For example, in 2008, the unemployment duration varied from 2 months in Alberta to 4 months in Newfoundland. In Ontario, it remained the same at 3.5 months over the entire four year period; in Alberta, it varied from 2 months to 2.5 months and in Newfoundland from 4 months to 4.5 months.

death. If an individual died after being away from work for 3 consecutive months or longer due to an illness or injury, he or she would have been considered replaced according to the friction cost method. The value of lost production for these individuals should be included in the morbidity component, and any costs included in the mortality component would be considered double counting. Finally, unlike previous editions of EBIC, the 2004–2008 estimates do not include mortality costs associated with non-labour market activities.

6. CONCLUSION

The 2004–2008 value of lost production due to mortality associated with labour market activities was estimated for premature deaths using a prevalence-based approach and the friction cost method. Mortality cost estimates from previous EBIC editions were derived using the human capital method and thus cannot be compared with 2004–2008 estimates. The value of lost production for non-labour market activities was not considered in this edition of EBIC.

FIGURES AND TABLES

TABLE 12: Mortality Costs by Diagnostic Category, Canada, 2005–2008 ($'000,000 Current Dollars)

DIAGNOSTIC CATEGORY	2008 COST	% OF 2008 COST	2007 COST	% OF 2007 COST	2006 COST	% OF 2006 COST	2005 COST	% OF 2005 COST	2004 COST	% OF 2004 COST
Certain Infectious and Parasitic Diseases	13.0	2.9	12.9	2.9	12.9	2.9	13.0	3.0	11.3	2.8
Respiratory Infections	5.1	1.1	4.8	1.1	4.4	1.0	4.5	1.0	3.7	0.9
Maternal Conditions	0.2	0.0	0.1	0.0	0.2	0.0	0.2	0.0	0.1	0.0
Perinatal Conditions	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nutritional Deficiencies	0.3	0.1	0.2	0.0	0.3	0.1	0.3	0.1	0.2	0.0
Malignant Neoplasms	166.0	36.6	163.5	37.0	159.8	36.2	155.5	36.0	145.8	36.3
Other Neoplasms	1.8	0.4	1.9	0.4	2.1	0.5	2.1	0.5	1.9	0.5
Diabetes Mellitus	12.3	2.7	11.5	2.6	11.9	2.7	11.7	2.7	11.1	2.8
Endocrine Disorders	6.3	1.4	6.0	1.4	5.6	1.3	6.0	1.4	5.2	1.3
Neuropsychiatric Conditions	19.1	4.2	18.5	4.2	19.5	4.4	17.9	4.2	16.7	4.1
Sense Organ Diseases	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cardiovascular Diseases	92.4	20.4	90.4	20.5	90.5	20.5	89.8	20.8	84.8	21.1
Respiratory Diseases	11.3	2.5	11.1	2.5	10.4	2.4	10.3	2.4	9.2	2.3
Digestive Diseases	24.5	5.4	23.7	5.4	20.8	4.7	20.9	4.8	19.0	4.7
Genitourinary Diseases	3.8	0.8	3.5	0.8	3.5	0.8	3.3	0.8	3.0	0.8
Skin Diseases	0.4	0.1	0.4	0.1	0.4	0.1	0.3	0.1	0.3	0.1
Musculoskeletal Diseases	2.5	0.5	2.1	0.5	2.3	0.5	2.0	0.5	1.6	0.4
Congenital Anomalies	2.9	0.6	2.5	0.6	2.7	0.6	2.6	0.6	2.4	0.6
Oral Conditions	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Injuries	84.6	18.6	81.2	18.4	81.2	18.4	82.8	19.2	75.5	18.8
Symptoms, Signs and Ill-Defined Conditions	7.5	1.6	7.4	1.7	12.4	2.8	8.3	1.9	9.5	2.4
Factors Influencing Health and Contact with Health Services[1]	-	-	-	-	-	-	-	-	-	-
Total EBIC Mortality Costs	**454.0**	**100.0**	**441.7**	**100.0**	**440.8**	**100.0**	**431.5**	**100.0**	**401.5**	**100.0**
Unattributable Mortality Costs	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Total Mortality Costs	**454.0**	**100.0**	**441.7**	**100.0**	**440.8**	**100.0**	**431.5**	**100.0**	**401.5**	**100.0**

[1] The International Classification of Diseases (ICD) codes in this diagnostic category are not valid cause-of-death codes.

NOTE: Any discrepancies may be due to rounding.

TABLE 13: Mortality Costs by Diagnostic Category and Sex, Canada, 2008 ($'000,000 Current Dollars)

DIAGNOSTIC CATEGORY	2008 MALE COST	% OF TOTAL COST	2008 FEMALE COST	% OF TOTAL COST	TOTAL COST
Certain Infectious and Parasitic Diseases	10.3	79.2	2.7	20.8	13.0
Respiratory Infections	3.6	71.1	1.5	28.9	5.1
Maternal Conditions	-	-	0.2	100.0	0.2
Perinatal Conditions	0.0	50.6	0.0	49.4	0.1
Nutritional Deficiencies	0.1	52.6	0.1	47.4	0.3
Malignant Neoplasms	106.2	64.0	59.8	36.0	166.0
Other Neoplasms	1.2	67.3	0.6	32.7	1.8
Diabetes Mellitus	9.5	77.6	2.7	22.4	12.3
Endocrine Disorders	4.7	74.9	1.6	25.1	6.3
Neuropsychiatric Conditions	14.2	74.3	4.9	25.7	19.1
Sense Organ Diseases	0.0	62.4	0.0	37.6	0.0
Cardiovascular Diseases	77.2	83.5	15.3	16.5	92.4
Respiratory Diseases	7.6	67.6	3.7	32.4	11.3
Digestive Diseases	19.1	78.0	5.4	22.0	24.5
Genitourinary Diseases	2.6	69.7	1.1	30.3	3.8
Skin Diseases	0.3	72.5	0.1	27.5	0.4
Musculoskeletal Diseases	1.4	54.4	1.1	45.6	2.5
Congenital Anomalies	1.9	65.1	1.0	34.9	2.9
Oral Conditions	0.0	63.5	0.0	36.5	0.0
Injuries	70.0	82.8	14.6	17.2	84.6
Symptoms, Signs and Ill-Defined Conditions	5.9	78.8	1.6	21.2	7.5
Factors Influencing Health and Contact with Health Services[1]	-	-	-	-	-
Total EBIC Mortality Costs	**336.0**	**74.0**	**118.0**	**26.0**	**454.0**

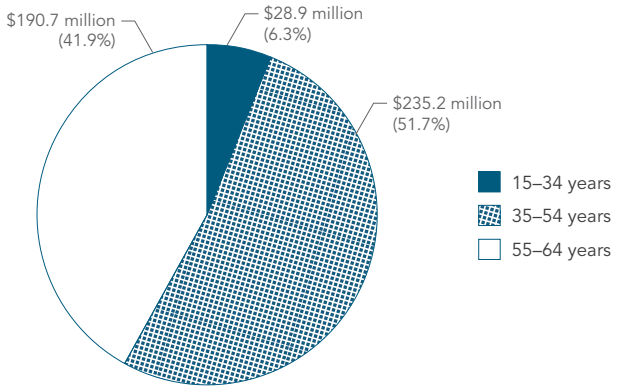
[1] The International Classification of Diseases (ICD) codes in this diagnostic category are not valid cause-of-death codes.

NOTE: Any discrepancies may be due to rounding.

TABLE 14: EBIC 2004–2008 National Mortality Costs ($'000,000 2010 Constant Dollars)

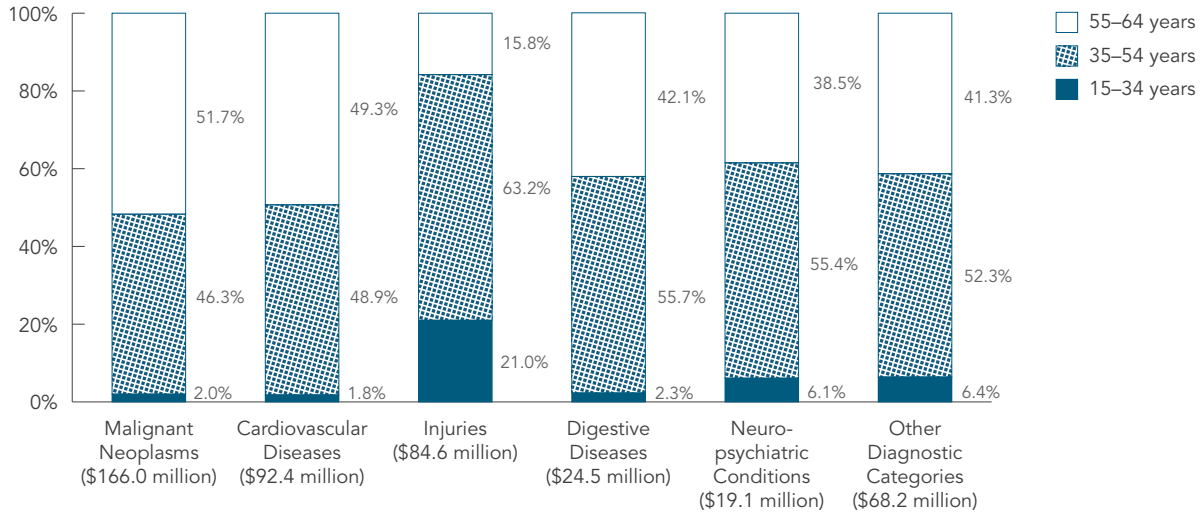
YEAR	COST
2008	463.5
2007	461.5
2006	470.7
2005	469.8
2004	446.8

FIGURE 20: Mortality Costs by Age Group, Canada, 2008



NOTE: Any discrepancies may be due to rounding.

FIGURE 21: Mortality Cost Distribution by Diagnostic Category and Age Group, Canada, 2008



NOTES: 'Other Diagnostic Categories' include the costs from all other EBIC diagnostic categories not individually displayed in the figure. Any discrepancies may be due to rounding.

APPENDIX 1: MATHEMATICAL REPRESENTATION OF THE MORTALITY COST METHODS

Value of lost production in province p in year t due to the premature deaths of all individuals of sex j age group k caused by an illness/injury in diagnostic category d

$$V_{j,k,d,p,t} = \sum_{i}(L_{i,j,k,d,p,t} * ((E_{j,k,p,t})/12) * ER_{j,k,p,t})$$

where,

j = female, male (sex)

k = 15–19 years, 20–24 years, 25–29 years, 30–34 years, 35–39 years, 40–44 years, 45–49 years, 50–54 years, 55–59 years, 60–64 years

d = EBIC diagnostic categories

p = NL, QC, NS, PE, NB, ON, MB, SK, AB, BC, NU, NT, YT

t = 2004, 2005, 2006, 2007, 2008

i = 1, 2, 3, ..., n

n is the number of deaths that occurred in the province p in the period starting $(F_{p,t} - 0.5)$ months before January of year t to the end of year t.

$F_{p,t}$ is the friction period in province p in year t.

$E_{j,k,p,t}$ is the average annual earnings of sex j age group k in province p in year t.

$ER_{j,k,p,t}$ is the annual average employment rate of sex j age group k in province p in year t.

$L_{i,j,k,d,p,t}$ is the period of lost production in province p in year t due to the death of individual i of sex j age group k caused by diagnostic category d.

$L_{i,j,k,d,p,t} = a$ if the death occurred $(F_{p,t} - a)$ months before January of year t , where a is the period of lost production in year t.

$L_{i,j,k,d,p,t} = (F_{p,t} - b)$ if the death occurred $(F_{p,t} - b)$ months before January of year $t+1$, where b is the period of lost production in $t+1$.

a = 0.5, 1, 1.5, ..., $(F_{p,t} - 0.5)$

APPENDIX 2: HYPOTHETICAL EXAMPLES OF THE MORTALITY COST METHODS

Calculation of the value of lost production in 2005 for BC

The friction period for BC in the year 2005 is 4 months. Therefore, all deaths that occurred in the period September 16, 2004, to December 15, 2005, must be considered. For each death, the value of lost production is calculated, as follows:

For a 35-year-old male who died on September 16, 2004:

The period of lost production is 0.5 months. The average monthly earnings of a 35- to 44-year-old male in BC for 2005 is $4,355. The average employment rate of a 35- to 39-year-old male in BC for 2005 is 89.6%

So, the value of lost production due to this death

= period of lost production * average monthly earnings of a 35- to 44-year-old male in BC in 2005 * average annual employment rate of a 35- to 39-year-old male in BC in 2005

= 0.5 * $4,355*0.896 = $1,951.04

For a 35-year-old male who died on January 1, 2005:

The period of lost production is 4 months. The average monthly earnings of a 35- to 44-year-old male in BC for 2005 is $4,355. The average employment rate of a 35- to 39-year-old male in BC for 2005 is 89.6%

So, the value of lost production due to this death

= period of lost production * average monthly earnings of a 35- to 44-year-old male in BC in 2005 * average annual employment rate of a 35- to 39-year-old male in BC in 2005

= 4 * $4,355*0.896 = $15,608.35

For a 35-year-old male who died on September 16, 2005:

The period of lost production is 3.5 months. The average monthly earnings of a 35- to 44-year-old male in BC for 2005 is $4,355. The average employment rate of a 35- to 39-year-old male in BC for 2005 is 89.6%

So, the value of lost production due to this death

= period of lost production * average monthly earnings of a 35- to 44-year-old male in BC in 2005 * average annual employment rate of a 35- to 39-year-old male in BC in 2005

= 3.5 * $4,355*0.896 = $13,657.28

REPORT 5: EBIC VALUE OF LOST PRODUCTION DUE TO MORBIDITY, 2005–2010

1. BACKGROUND

The value of lost production due to morbidity is an indirect cost component of EBIC. Morbidity costs are incurred when some form of illness or injury results in time lost from productive activities, whether paid or unpaid. Morbidity costs are also incurred with decreased productivity due to illness or injury (e.g. presenteeism). In this report, morbidity costs were estimated only for the value of lost production due to labour market missed work days (absenteeism). The value of lost production was not estimated for costs associated with presenteeism and non-labour market productive activities. Furthermore, the morbidity costs include only lost production costs associated with an individual's 'own' illness and injury; lost production costs due to informal caregiving for the sick and injured were not included.

The human capital method and the friction cost method are the two primary methods for estimating production losses associated with morbidity. The major difference between the two methods is the time period considered for lost production. The human capital method values all lost production from the onset of an illness or injury that results in the inability to work until expected retirement age or life expectancy. It assumes that a worker who becomes unable to work because of illness or injury cannot be replaced, implicitly assuming zero involuntary unemployment. In reality, most economies have pools of unemployed workers willing to fill vacant job positions. For example, the unemployment rate in Canada ranged from 6% to 8% of the labour force in the years 2005–2010 (49,50).[76]

In the 1990s, the friction cost method was developed by a group of Dutch economists (51–54). Unlike the human capital method, this method does not assume full employment; rather, it considers lost production to occur only in the period when the job position is vacant, denoted as the *friction period*. Specifically, the friction period is considered to start when the individual leaves his or her job, due to illness or injury, and to end when the job vacancy or chain of vacancies are filled.

Traditionally, the human capital method has been used in most studies estimating lost production costs associated with morbidity. It was used in previous published (EBIC 1986, EBIC 1993 and EBIC 1998) and unpublished (EBIC 2000) editions of EBIC (1–4). In preparation for the current edition, the methods for estimating the indirect costs of illness and injury were re-evaluated. Under advisement of economists who attended the 2009 and 2010 EBIC workshops (organized by PHAC), the friction cost method was adopted to estimate indirect costs (55,56).

[76] The unemployment rate estimated for individuals aged 15 years and over, is the number of unemployed persons expressed as a percentage of the labour force.

A prevalence-based approach was used to estimate the EBIC 2005–2010 morbidity costs, as was done in previous editions of EBIC. A prevalence-based approach values all lost production in the year in which it occurred.

In summary, EBIC 2005–2010 morbidity costs associated with labour market missed work days (absenteeism) were estimated using the friction cost method and a prevalence-based approach. The remaining sections of this report describe the data sources and methods used to derive the EBIC 2005–2010 estimates of the value of lost production due to morbidity. Additionally, the 2005–2010 results are presented and discussed along with the data limitations. Although the current edition of EBIC focuses on the years 2005–2008, 2009 and 2010 results are also presented and discussed, as all results (2005–2010) are based on surveyed 2010 missed work days due to illness and injury.[77]

2. DATA SOURCES

Statistics Canada's 2010 Canadian Community Health Survey (CCHS) Loss of Productivity (LOP) module was used to estimate missed work days due to illness and injury (62–64).[78,79] The CCHS is a cross-sectional survey that collects information related to health status, health determinants and health care utilization for the Canadian population (65). The LOP module was introduced in 2010 as common content (a mandatory module) and will appear again in the 2014 CCHS.[80] Annual provincial unemployment duration (in weeks), used as a proxy for the friction period, and annual earnings specific to sex, age and province (in constant 2010 dollars), used to value lost production, were obtained from Statistics Canada's Canadian Socio-economic Information Management (CANSIM) System (57,66).[81]

3. METHODS

The value of lost production due to morbidity was estimated for the years 2005–2010 using the friction cost method. The estimates were derived by multiplying the period of lost production by the value of production.

3.1 Period of Lost Production

Non-survey period of lost production estimates were not available for 2005–2010. The 2010 CCHS's LOP module was used to estimate missed work days due to illness and injury for all years 2005–2010, since survey estimates were not available for 2005–2009.[82,83] It was assumed

[77] The methods used to adjust 2010 missed work days due to illness and injury for each year of analysis are explained in the Methods section of this report. Furthermore, the limitations of these adjustments are discussed in the Limitations section.

[78] The CCHS targets persons aged 12 years and older who are living in private dwellings in the 10 provinces and 3 territories. Persons living on Indian Reserves or Crown lands, those residing in institutions, full-time members of the Canadian Forces and residents of certain remote regions are excluded from the survey. The CCHS covers approximately 98% of the Canadian population aged 12 years and older (65).

[79] Individuals less than 15 years and greater than 75 years of age were excluded from participation in the CCHS LOP module.

[80] As of July 2013, the LOP module is expected to appear in the 2018 and 2022 CCHS as common content; however, this decision has not yet been finalized.

[81] Statistics Canada estimates unemployment duration and earnings using information from the Labour Force Survey. Unemployment duration is the number of continuous weeks during which a person has been without work and is looking for work or is on temporary layoff. Earnings include wages, salaries, commissions and self-employment income.

[82] Respondents who had missed work days due to illness and injury were asked to exclude from their response any work days that were made up after they had been missed.

[83] The CCHS 2010 annual component share file was used and the associated weights were applied, so sampled missed work days reflected those of the Canadian population.

that after adjustment for sex- and age-specific differences in population across the years, 2010 missed work days due to illness and injury would reflect missed work days for all years. The population adjustments modified the number of employed individuals missing work days and the number of missed work days while assuming the same 2010 CCHS sex- and age-specific employment rate across all years.[84,85,86,87] The assumptions of the analysis in this report imply that missed work days due to illness and injury increase proportionally with increases in population, since if the population increased and the employment rate remained constant, the number of employed individuals would increase, increasing the number of missed work days.[88] For example, if there were 100 employed individuals who missed 20 work days due to illness and injury, now with 200 employed individuals in the workforce 40 work days are assumed missed due to illness and injury.

For EBIC 2005–2010 morbidity cost estimates, the period of lost production included missed work days due to chronic conditions, such as arthritis, and acute conditions, such as a cold or the flu.[89] Specifically, CCHS respondents were asked about missed work days due to illness or injury within the 3 month period prior to the survey.[90] For the purpose of EBIC analyses, respondents who participated in the 2010 CCHS LOP module were grouped into three categories according to their responses to particular survey questions. The categories were as follows: missed less than 90 days of work due to illness or injury in the past 3 months; missed 90 consecutive days of work due to illness or injury in the past 3 months but had worked in the past 12 months; and excluded from analysis.[91]

For respondents who reported missing less than 90 days due to illness or injury in the past 3 months, the exact number of days missed multiplied by four (to reflect the entire year) was used as the period of lost production. For respondents who reported missing 90 consecutive days of work due to illness or injury in the past three months but had worked in the past 12 months, the average annual provincial unemployment duration (in days), acting as a proxy for the friction period, was used as the period of lost production.[92,93] As these respondents indicated that they had worked in the past 12 twelve months, it was assumed that their friction period fell within the year and that they were replaced after the duration of the friction period (the unemployment duration). All respondents who indicated that they had not worked in the

---

84 All population adjustments were made using Statistics Canada's population estimates (36–39,67,68).

85 Population adjustments were made on the basis of sex-specific 5-year age groups. The following provides an example of the methods used to adjust missed work days for each year 2005–2009. If, according to the 2010 CCHS, days missed due to disease A by females aged 15–19 years were X, and population estimates showed the number of females aged 15–19 years in 2010 and 2008 to be Y and Z respectively, then in 2008 missed work days due to disease A by females 15–19 years would be X*(Z/Y).

86 The unemployment rate, estimated for individuals aged 15 years and over, is the number of unemployed persons expressed as a percentage of the labour force.

87 According to Statistics Canada's labour force estimates, the national employment rate ranged from 6% to 8% across the years 2005–2010 (49,50).

88 Missed work days due to illness and injury may be highly variable and may not increase proportionally with increases in the number employed; this limitation is discussed in the limitations section.

89 In the CCHS LOP module chronic conditions are defined as long-term physical or mental conditions diagnosed by a health professional that has lasted or is expected to last 6 months or more. Additionally, for the purpose of EBIC, acute conditions are defined as short-term physical or mental health conditions diagnosed or undiagnosed by a health professional that have lasted or are expected to last less than 6 months.

90 The period of 90 consecutive days (3 consecutive months) acted as a temporary proxy for the friction period/unemployment duration; average unemployment duration in Canada was 4 months across the years 2005–2010.

91 Individuals who indicated missed work days due to illness and injury but had not worked in the past 12 months were excluded from analysis.

92 Unemployment duration for the territories was not available, so the national average was used.

93 Unemployment duration obtained in weeks was converted to days by multiplying weekly values by 7.

past 12 months were excluded from the analysis, as the friction period and lost production for these individuals would have fallen in another year. In EBIC 1998, morbidity cost estimates were weighted for labour force participation rates; this was not necessary for EBIC 2005–2010 estimates. LOP module respondents were asked about their labour force participation at an earlier point in the CCHS survey, thus their labour force participation status was known. Estimated missed work days from the CCHS were grouped into the EBIC diagnostic categories according to the physical and mental health conditions identified by respondents. Appendix 1 illustrates the relationship between the CCHS disease categories and the EBIC diagnostic categories.

3.2 Value of Production

Average daily earning specific to province, sex and age were used to value production for EBIC 2005–2010. Average annual earnings for these groups, in constant 2010 dollars, were converted to current dollars using the national Consumer Price Index values and then were converted to average daily earnings by dividing average annual earnings by 260 (7).[94,95]

4. RESULTS

Tables 15–22 illustrate the EBIC 2005–2010 national estimates for the value of lost production due to morbidity.[96] Bootstrapping analysis was performed using the provided CCHS bootstrapping weights; Appendix 2 describes the coefficient of variation (CV) range for each type of estimate.

4.1 Costs by Diagnostic Category

Table 15 illustrates the EBIC 2010 national value of lost production due to morbidity cost estimates by diagnostic category. In 2010, total national morbidity costs were $18.2 billion. The three diagnostic categories with the largest costs were injuries ($3.2 billion, 17.8%), respiratory infections ($2.9 billion, 16.0%) and musculoskeletal diseases ($1.5 billion, 8.4%). The unattributable percentage of morbidity costs refers to costs that could not be attributed to a specific diagnostic category; these costs represented 38.0% ($6.9 billion) of total morbidity costs.

4.2 Costs by Diagnostic Category and Sex

Table 15 illustrates the EBIC 2010 national value of lost production estimates by diagnostic category and sex. Total morbidity costs were higher for males ($9.8 billion, 53.7%) than for females ($8.4 billion, 46.3%). The three diagnostic categories with the highest costs for males were injuries ($2.3 billion), respiratory infections ($1.6 billion) and musculoskeletal diseases ($0.8 billion). The three diagnostic categories with the highest costs for females were respiratory infections ($1.3 billion), injuries ($0.9 billion) and musculoskeletal diseases ($0.8 billion).

---

[94] Average annual earnings by sex and age for the territories were unavailable; the national average earnings by sex and age were used as a proxy for the territories. Furthermore, the national average earnings were used for provinces when average earnings for a certain sex-age group were unavailable (marked 'F-too unreliable to be published') or when marked 'E-use with caution' (CV greater than or equal to 16%).

[95] It was assumed, on average, that all employed individuals worked an average of 260 paid days per year. This value was estimated by assuming that, on average, individuals worked five days a week (5 days x 52 weeks = 260).

[96] The data contained in these tables are based on the Canadian Community Health Survey's (CCHS) Annual Component, Statistics Canada, 2010.

The three diagnostic categories with the largest difference in the cost distribution across the sexes were diabetes mellitus (88.6% male, 11.4% female), genitourinary diseases (81.7% male, 18.3% female) and malignant neoplasms (76.1% male, 23.9% female).

4.3 Costs by Diagnostic Category and Age

Table 15 illustrates the EBIC 2010 national value of lost production estimates by diagnostic category and age group.[97] Total morbidity costs were higher for individuals aged 15–54 years ($14.9 billion, 81.8%) than for individuals aged 55–75 years ($3.3 billion, 18.2%). The three diagnostic categories with the highest costs for individuals aged 15–54 year were respiratory infections ($2.5 billion), injuries ($2.5 billion) and musculoskeletal diseases ($1.2 billion). The three diagnostic categories with the highest costs for individuals aged 55–75 years were injuries ($0.8 billion), respiratory infections ($0.4 billion) and musculoskeletal diseases ($0.3 billion).

The three diagnostic categories with the largest difference in the cost distribution across the age groups were genitourinary diseases (95.0% 15–54 years, 5.0% 55–75 years), neuropsychiatric conditions (89.6% 15–54 years, 10.4% 55–75 years) and certain infectious and parasitic diseases (87.2% 15–54 years, 12.8% 55–75 years).

Table 21 shows total 2010 (and 2009–2005) national morbidity cost estimates by more disaggregated age groups. Given the guidelines limiting the release of costs based on small cell counts, costs by diagnostic category could not be released for these age groups. In 2010, individuals aged 35–54 years accounted for 59.0% of total morbidity costs.

4.4 Costs Across the Years 2005–2010

Table 22 illustrates the EBIC 2005–2010 national total value of lost production due to morbidity estimates in 2010 constant dollars.[98] The value of lost production increased in each year of analysis, with an overall increase of 15.3% from 2005 to 2010.

5. DISCUSSION

5.1 Value of 2005–2010 Annual Morbidity Cost Estimates

There were large benefits to estimating the value of lost production due to morbidity for each year 2005–2010, even if surveyed estimates for missed work days due to illness and injury were available only for 2010. The value of lost production due to morbidity is one of several cost components for the EBIC project; producing annual morbidity cost estimates means that estimates can be added to those of other EBIC cost components to obtain total Canadian economic burden of illness and injury estimates for each year of analysis. Three adjustments were made to 2010 missed work days to reflect missed work days in the years 2005–2009. First, the year-specific cost estimates for years other than 2010 were adjusted for sex- and age-specific differences in population. Second, the year-specific cost estimates were adjusted to reflect differences in the unemployment duration across the years of analysis. Between the years 2005 and 2010, it was common for provincial unemployment duration to increase or decrease by a magnitude of 25%–50% over the time span of a year or two. For example,

[97] These age groups do not match the age groups used in other EBIC cost components because of specific guidelines that limit release of survey data based on small cell counts.

[98] EBIC estimates in current dollars were converted to constant dollars using Statistics Canada's Consumer Price Index values (7).

Alberta's average unemployment duration was 2, 3 and 4 months in 2008, 2009 and 2010 respectively (66). Third, the year-specific cost estimates were adjusted to reflect differences in sex-, age- and province-specific earnings across the years of analysis.

5.2 Sex Differences in the Value of Lost Production Due to Morbidity

EBIC 2005–2010 morbidity cost differences between the sexes were influenced by both missed work days due to illness and injury and the sex-specific earnings. The CCHS estimates for 2010 missed work days showed that males and females missed approximately 52,967,900 and 64,678,000 work days respectively.[99] Therefore, females reported 22.1% more missed work days due to illness or injury than males. The difference in missed work days is not explained by the difference in the number employed, since in 2010 the number of males employed was 9.6% higher than the number of females (69). Therefore, working women have a higher rate of missed work days due to morbidity per employed person than working men. The higher rate of missed work days could be influenced by unknown factors, such as differences in the prevalence of illness and injury between working men and women and/or working men being more likely to go to work ill or injured.

In Canada, across the years 2005–2010, national male earnings were, on average, 52% higher than national female earnings (57). As sex-specific earnings were used to value the period of lost production, morbidity costs for males would be higher than for females given the same number of missed work days.

5.3 Age Group Differences in the Value of Lost Production Due to Morbidity

EBIC 2005–2010 morbidity cost differences between the age groups were influenced by both missed work days due to illness and injury and the age-specific earnings. Estimates for 2010 missed work days showed that individuals aged 15–54 years reported 4.1 times more missed work days than individuals aged 55–75 years; this difference could partly be explained by the difference in the number employed between the two age groups. In 2010, the number of employed individuals aged 15–54 years was 4.8 times higher than those aged 55 years and older (69).[100] Additionally, across all years 2005–2010, earnings were highest for individuals aged 35–54 years, which may have also contributed to higher costs.

5.4 Increasing Morbidity Costs Over Time

The value of lost production due to morbidity (in constant dollars) increased across each year of analysis, with a total increase of 15.3% from 2005 to 2010. On average, national unemployment duration remained fairly constant across the years 2005–2010 (66).[101] Therefore, a combination of population and labour productivity (earnings) changes are likely responsible for the increasing costs. As 2010 missed work days due to illness and injury were adjusted to reflect

[99] For the missed work day totals provided, the 3 consecutive months an individual had missed were replaced with the appropriate unemployment duration (which was not sex-specific); as well, estimates had been weighted, using the appropriate CCHS weights, to represent the Canadian population.

[100] There is no publicly available estimate for number employed aged 55–75 years.

[101] The national average unemployment duration was 4 months in 2005–2009 and 5 months in 2010.

differences in the population, which accounted for population growth, higher costs in later years may be in part due to larger populations. Specifically, the Canadian population increased by 7% from 2005 to 2010 (36–39,67,68). Similarly, average national annual earnings (in constant 2010 dollars) increased 4% across the same years (male and female earnings increased 2% and 9% respectively) (57). Comparison of total morbidity costs across the years 2005–2010 provides an estimate of the magnitude difference; however, there are limitations, as 2010 adjusted missed work days were used for all years.

5.5 Indirect Cost Methods and the Value of Lost Production Due to Morbidity

In previous editions of EBIC, the human capital method was used to estimate indirect costs, whereas the friction cost method was used in the current edition. In EBIC 1998 and EBIC 2008, morbidity costs were 55.6% and 97.3% of indirect costs respectively.[102] As premature mortality costs are the remainder of indirect costs, morbidity became considerably more costly relative to premature mortality when the friction cost method was adopted. One reason for this difference is that with the adoption of the friction cost method the period of lost production for premature mortality costs only equalled the length of the unemployment duration instead of the time of death until life expectancy. Therefore, in each year of analysis, the period of lost production for premature mortality became more comparable to that of morbidity, and since more individuals contributed to the value of lost production due to morbidity than to premature mortality (approximately 105 times, in 2008), morbidity costs became a considerably larger percentage of indirect costs.[103]

6. LIMITATIONS

6.1 Comparison Across Diagnostic Categories, Cost Components and Editions of EBIC

As a result of the change in methods used to derive the value of lost production due to morbidity, comparison of morbidity cost estimates between the current and previous editions of EBIC is not recommended. The incomparability of estimates is evidenced by several published studies comparing the costs obtained using both the methods. Specifically, these studies found the human capital method to produce estimates that ranged from 2 to 30 times higher than those resulting from the friction cost method (51,53,60,70–74).[104] The differences between the estimates found using each method vary with the number and age of individuals affected, illness(es) being studied, cost components considered, length of the friction period and the use of an elasticity. Furthermore, the estimates are not comparable to previous editions as a different survey was used to estimates missed work days and unpaid labour costs are excluded from the current edition's estimates.

---

[102] In EBIC 1998, morbidity (short-term and long-term disability) and premature mortality costs were $42.0 billion and $33.5 billion respectively. In EBIC 2008, the value of lost production estimates for morbidity and premature mortality were $16.4 billion and $0.5 billion respectively. Furthermore, in EBIC 1998, indirect costs represented 47.3% of total costs, whereas in EBIC 2008, indirect costs represented 8.9% of total costs.

[103] Morbidity person counts were weighted, using the appropriate CCHS survey weights, to represent the Canadian population.

[104] In certain studies, an elasticity for annual labour time versus labour production was applied to lost production.

EBIC 2005–2010 estimates of the value of lost production due to morbidity are not available by ICD codes or all EBIC diagnostic categories/subcategories. Since the CCHS is a survey, missed work days could be estimated only by very aggregated diagnostic categories/subcategories. The guidelines that restrict the release of data based on small cell counts also limited the release of certain diagnostic categories/subcategories. Additionally, these guidelines restricted the release of morbidity cost estimates by diagnostic category for the EBIC age groups. Instead, morbidity cost estimates were released by diagnostic category for very aggregated age groups (15–54 years and 55–75 years).[105,106] Provincial and territorial morbidity cost estimates by diagnostic category could not be released either because of the set guidelines. Therefore, a complete economic burden of illness and injury, from the summation of all EBIC costs components, can be found only for very aggregated EBIC categories.

As mentioned earlier, Appendix 1 shows the mapping of the CCHS disease categories to the EBIC diagnostic categories; unfortunately, they do not map directly. In the CCHS LOP module, spina bifida is included in the chronic condition category 'neurological diseases', while in EBIC it is included in the diagnostic category 'congenital anomalies'.[107] Therefore, costs for spina bifida are included in a different diagnostic category for the morbidity cost component than for the other EBIC cost components. Similarly, a chronic condition category in the CCHS LOP module comprised fibromyalgia, chronic fatigue syndrome and multiple chemical sensitivities; these conditions are included in separate EBIC diagnostic categories (based on ICD coding). As only one EBIC diagnostic category could have been selected to assign costs from fibromyalgia, chronic fatigue syndrome and multiple chemical sensitivities, it was assumed that fibromyalgia was associated with the highest number of missed work days, and all costs were assigned to the EBIC diagnostic category 'musculoskeletal diseases' (the EBIC diagnostic category for fibromyalgia).

The percentage of morbidity costs unattributable by diagnostic category was significant. In 2010, unattributable EBIC morbidity costs were 38.0% ($6.9 billion) of total morbidity costs. Approximately 24.7% of CCHS LOP respondents who had missed 3 consecutive months of work due to a chronic physical or mental health condition identified a condition that fell in the 'other' category (from a set list of chronic conditions) as the chronic condition responsible for the highest number of missed work days during the 3-month period.[108] Respondents who answered 'other' were asked to specify their chronic condition; however, these 'other' conditions were not coded for in the CCHS dataset. Had these conditions been coded for, the unattributable percentage of morbidity costs would have been lower. In the future, the

[105] The EBIC age groups are 0–14 years, 15–34 years, 35–54 years, 55–64 years, 65–74 years and 75+ years. Individuals aged 0–14 years are not considered for morbidity costs.

[106] Individuals less than 15 years and more than 75 years of age were excluded from participation in the CCHS LOP module, as these individuals were considered unlikely to be working and thus would have no lost production from labour market activities. It is possible that individuals aged 76 years and older who participated in the CCHS were working and had missed work due to illness and injury.

[107] Spina bifida is included in the EBIC diagnostic category 'Congenital anomalies' to be consistent with the ICD coding.

[108] Morbidity person counts were weighted, using the appropriate CCHS survey weights, to represent the Canadian population. Additionally, respondents who answered 'don't know', 'refusal' and 'not stated' to the chronic conditions question were excluded from the calculation.

addition of other chronic condition categories such as chronic infectious diseases (e.g. HIV/AIDS, hepatitis C) and sense organ diseases (e.g. glaucoma) may also help to decrease the number of individuals identifying 'other' chronic conditions. Additionally, since respondents were asked to identify the chronic condition responsible for the highest number of missed work days, morbidity costs for 'secondary' chronic conditions contributing to missed work days may be underestimated. Finally, survey questions that ask about missed work days due to any 'other reason related to physical or mental health' could be split into two questions, one question to ask about other reasons related to mental health and the second to ask about physical health. With two separate questions, the appropriate costs could be attributed directly to mental health, reducing unattributable morbidity costs.

6.2 Period of Lost Production

Unfortunately, non-survey data on missed work days due to illness and injury were not available for 2005–2010; instead, survey data were used. There are limitations to estimates from surveys, as participants' responses may not reflect true population values, especially if missed work days due to illness and injury are highly variable. Survey estimates of missed work days due to illness and injury were only available for 2010. It was assumed that after adjustment for sex- and age-specific differences in the population, 2010 missed work days would appropriately reflect missed work days for all years. However, even after adjustment for population differences, 2010 missed work day estimates may not have accurately reflected missed work days in 2005–2009, since the prevalence of certain diseases, resulting in missed work days, within specific sex-age cohorts may vary from year to year. Additionally, even if prevalence remains the same, the number of missed work days may be highly variable, resulting in differences in missed work days from year to year. Considerable variations in missed work days may even occur for a single respondent within a given year. For example, a respondent could have missed 1 day of work because of a cold in the 3-month period surveyed but 4 days of work for the same reason in a different 3-month period in the same year, a 300% difference. Although, these limitations exist, asking respondents to recall missed work days for a period of longer than 3 months could have presented difficulties with recall accuracy, potentially resulting in even larger negative impacts on the accuracy of survey responses. Furthermore, the 3-month period acts as an appropriate proxy for the friction period. Given the limitations outlined, EBIC 2005–2010 morbidity cost estimates by category should not be compared across years, since 2010 adjusted missed work days were used for all years. Results from the 2014 CCHS LOP module may provide insight as to whether adjusted missed work days accurately represent those in other years.[109]

Koopmanschap & van Ineveld and Koopmanschap et al. used Dutch vacancy duration data to estimate the friction period for the Netherlands (51,53).[110,111] Vacancy duration data may have provided a better estimate of the friction period for Canada, but these data were unavailable. Therefore, annual provincial average unemployment duration was used as a

[109] The 2010 missed work days could be adjusted for 2014 population differences and these estimates could be compared with those obtained from the 2014 CCHS LOP module.

[110] Koopmanschap et al. added an additional time period to vacancy duration estimates, to allow for time lags, such as the time period between filling the vacancy and first work day of the new employee (53).

[111] Goeree et al. assumed a friction period of 3 months (based on Koopmanschap & van Ineveld (51) and Koopmanschap et al. (53)) to estimate the value of productivity costs due to premature mortality for schizophrenia in Canada (60).

proxy for the friction period.[112,113,114] Many labour market factors can affect how accurately the unemployment duration reflects the friction period: the number of unemployed individuals, the number of job vacancies, and how well the skills of the unemployed match the skills required for the vacant job position. Three possible relationships may exist between the unemployment duration (UD) and the friction period (FP): UD>FP, UD<FP or UD=FP. If UD>FP it may be that the number of unemployed individuals is very large relative to the number of job vacancies. Similarly, if UD<FP it may be that there are very few unemployed people relative to the number of vacant job positions. Skill-to-job match also plays an important role in both the length of the unemployment duration and the friction period, with poor skill-to-job match increasing the length of both (perhaps with different magnitudes given other labour market factors). In addition, the unemployment duration and friction period can be affected differently by various elements of the labour market. For example, given the same number of vacant job positions, an increase in the unemployment rate will likely increase the unemployment duration and decrease the friction period, as more people are unemployed and employers have a larger (and likely more diverse) pool of workers from which to select employees. For the reasons above, it is reasonable to assume that there is some number of unemployed workers and job vacancies, as well as a certain skill-to-job match in the unemployment pool of workers, that results in UD=FP. How closely the unemployment duration reflects the friction period in the years 2005–2010 is unknown. However, if an initial job vacancy is filled by an employed individual rather than an unemployed individual, a chain of vacancies will occur until the vacancy at the end of the chain is filled by the unemployed individual. If chain vacancies are occurring the majority of the time, the unemployment duration may be a reasonable estimate for the period of lost production; nevertheless, many complex labour market factors (e.g. number of unemployed individuals) will affect the representativeness of the unemployment duration.

For the lowest and highest education levels, Koopmanschap et al. estimated the friction period to range from 2.2 to 3.8 months (72% difference) and 2.8 to 3.5 months (25% difference) in 1988 and 1990 respectively (53). Unemployment duration specific to industry or education level may have provided more accurate Canadian friction period estimates; however, these were not available. Had unemployment duration specific to education level been available it could have been matched to CCHS respondents, although it would have been difficult to match industry-specific unemployment duration to each CCHS respondent.

Average provincial unemployment duration by sex and age group was available but was not used; more aggregated levels of unemployment duration were deemed more appropriate since it was unclear how closely the unemployment duration reflected the friction period in the years 2005–2010. There was not a considerable difference between the unemployment duration of each sex and age group, except for those aged 15–24 years. The unemployment

[112] Hopkins et al. used an unemployment duration of 14.6 weeks (3.4 months) as a proxy for the friction period, to estimate the national wage loss from cancer in Canada (61).

[113] The Canadian unemployment duration was, on average, 4 months across the years 2005–2010. A 1988 friction period of 2.5 months was used by Koopmanschap & van Ineveld (51). Koopmanschap et al. used an average friction period of 2.8 and 3.2 months for 1988 and 1990 respectively (53).

[114] For the territories, annual national average unemployment duration was used, since territory-specific unemployment duration was unavailable.

duration for individuals aged 15–24 years was lower than for those in other age groups; this was probably because of the high turnover of jobs for younger individuals.[115] The unemployment duration was used as a proxy for the friction period only when an individual missed 3 consecutive months of work because of illness or injury; in most cases (78%) this was due to a chronic condition. Therefore, using an average unemployment duration for all ages was expected to have little effect on the period of lost production estimates, as individuals aged 15–24 years represented only 3.8% of individuals contributing 3 consecutive months of missed work due to a chronic illness or injury.[116]

Although there are limitations to the value of lost production estimates when the friction cost method is used, the magnitude effects of these limitations on the morbidity cost estimates are negligible compared with the alternative of using the human capital method. As discussed earlier, the human capital method produces considerably larger estimates for the value of lost production, which may not reflect the true burden of lost production to society.

6.3 Missing Components of Lost Production

The value of lost production in this report was estimated for labour market missed work days due to an individual's 'own' morbidity (absenteeism); however, the inclusion of additional components of lost production would have more accurately reflected the true economic burden of illness and injury. First, although the value of lost production from absenteeism was included in this report, lost production from presenteeism was not included. Individuals may attend work while sick or injured; as a result they are less productive and lost production occurs. Second, the value of lost production for non-labour market productive activities (e.g. housework) should be considered; this may be especially important for certain segments of the population. Finally, informal caregiving costs should be considered. Healthy individuals may spend time caring for the sick and injured, which would result in time away from labour market and non-labour market productive activities. Although the above-mentioned components of lost production due to morbidity should be included in an economic burden of illness and injury study, data sources to measure these components across all diagnostic categories were not available.

7. CONCLUSION

The 2005–2010 value of lost production due to morbidity was estimated using a prevalence-based approach for the lost production incurred from labour market missed work days due to illness and injury. The friction cost method was adopted to estimate 2005–2010 morbidity costs. Morbidity cost estimates from previous EBIC editions were estimated using the human capital method and thus cannot be compared with the 2005–2010 estimates.

[115] Using individuals aged 25–54 years as the base group, across the years 2005–2010 the unemployment duration for individuals aged 15–24 years, 55–64 years and 65+ years was on average 52.6% lower, 32.0% higher and 52.5% higher respectively. Note: the unemployment duration for individuals aged 65+ years was considerably higher in 2010 than it was for the other years of analysis.

[116] Morbidity person counts were weighted, using the appropriate CCHS survey weights, to represent the Canadian population. Additionally, respondents who answered 'don't know', 'refusal' and 'not stated' to the chronic conditions question were excluded from the calculation.

In 2010, total national morbidity costs were $18.2 billion; 62.0% of these costs were attributable by diagnostic category. As adjusted 2010 missed work days were used to estimate the period of lost production for all years 2005–2010, trending morbidity cost estimates by category (e.g. diagnostic category) is not recommended. The value of lost production due to morbidity associated with presenteeism, non-labour market activities and informal caregiving should be considered in future EBIC publications in order to capture the burden of illness and injury to society for these components.

TABLE 15: Value of Lost Production due to Morbidity by Diagnostic Category and Selected Demographic Group, Canada, 2010 ($'000,000 Current Dollars)

DIAGNOSTIC CATEGORY	MALE COST	FEMALE COST	AGE 15–54 YEARS COST	AGE 55–75 YEARS COST	TOTAL COST
Certain Infectious and Parasitic Diseases	423.6	436.2	750.1	109.7 *	859.8
Respiratory Infections	1,555.0	1,349.0	2,530.8	373.2	2,904.0
Malignant Neoplasms	402.7 **	126.3 *	300.6 **	228.4 *	529.1 *
Diabetes Mellitus	140.6 **	18.1 **	53.5 *	105.2 **	158.6 *
Neuropsychiatric Conditions	623.5	625.8	1,118.9	130.4 *	1,249.3
Cardiovascular Diseases	226.5 *	74.3 *	205.9 **	94.9 *	300.8 *
Respiratory Diseases	66.1 *	51.6 *	78.9 *	38.7 *	117.6
Digestive Diseases	120.2 *	49.2 *	102.1 *	67.4 **	169.5 *
Genitourinary Diseases	180.2 **	40.4 **	209.7 **	10.9 **	220.6 *
Musculoskeletal Diseases	764.3	761.3	1,248.6	277.1	1,525.6
Injuries	2,281.4	942.8	2,468.3	755.9	3,224.2
Unattributable	2,969.8	3,935.2	5,788.8	1,116.2	6,905.0
Total	**9,753.8**	**8,410.3**	**14,856.2**	**3,307.8**	**18,164.1**

* High sampling variability

** Very high sampling variability

NOTE: Any discrepancies may be due to rounding.

TABLE 16: Value of Lost Production due to Morbidity by Diagnostic Category and Selected Demographic Group, Canada, 2009 ($'000,000 Current Dollars)

DIAGNOSTIC CATEGORY	MALE COST	FEMALE COST	AGE 15–54 YEARS COST	AGE 55–75 YEARS COST	TOTAL COST
Certain Infectious and Parasitic Diseases	406.9	421.1	726.6	101.3 *	827.9
Respiratory Infections	1,494.3	1,322.0	2,464.0	352.3	2,816.3
Malignant Neoplasms	358.2 **	111.4 *	274.8 **	194.8 *	469.6 *
Diabetes Mellitus	120.9 **	17.5 **	51.5 *	86.9 **	138.4 *
Neuropsychiatric Conditions	549.4	568.4	1,003.8	114.1 *	1,117.9
Cardiovascular Diseases	205.2 *	68.8 *	189.1 **	84.9 *	274.1 *
Respiratory Diseases	61.7 *	50.2 *	77.2 *	34.7 *	111.8
Digestive Diseases	107.7 *	47.4 *	99.2 *	55.8 **	155.1 *
Genitourinary Diseases	141.1 **	32.7 **	163.8 **	10.0 **	173.8 *
Musculoskeletal Diseases	713.0	720.4	1,184.0	249.4	1,433.4
Injuries	2,105.0	887.5	2,313.1	679.4	2,992.5
Unattributable	2,740.5	3,702.3	5,420.6	1,022.2	6,442.8
Total	**9,003.8**	**7,949.7**	**13,967.8**	**2,985.8**	**16,953.6**

* High sampling variability

** Very high sampling variability

NOTE: Any discrepancies may be due to rounding.

TABLE 17: Value of Lost Production due to Morbidity by Diagnostic Category and Selected Demographic Group, Canada, 2008 ($'000,000 Current Dollars)

DIAGNOSTIC CATEGORY	MALE COST	FEMALE COST	AGE 15–54 YEARS COST	AGE 55–75 YEARS COST	TOTAL COST
Certain Infectious and Parasitic Diseases	418.6	408.3	732.3	94.6 *	826.9
Respiratory Infections	1,537.7	1,274.8	2,483.4	329.0	2,812.4
Malignant Neoplasms	325.2 **	94.8 *	248.6 **	171.4 *	420.0 *
Diabetes Mellitus	116.1 **	16.8 **	51.7 *	81.2 **	132.9 *
Neuropsychiatric Conditions	511.8	512.5	927.9	96.5 *	1,024.4
Cardiovascular Diseases	206.3 *	63.3 *	194.1 **	75.5 *	269.6 *
Respiratory Diseases	61.6 *	48.4 *	76.8 *	33.2 *	110.0
Digestive Diseases	105.6 *	45.5 *	98.6 *	52.5 **	151.1 *
Genitourinary Diseases	129.3 **	27.3 **	145.1 **	11.5 **	156.5 *
Musculoskeletal Diseases	713.0	682.5	1,177.3	218.2	1,395.5
Injuries	2,081.7	827.3	2,290.8	618.2	2,909.0
Unattributable	2,715.6	3,472.4	5,257.2	930.9	6,188.1
Total	**8,922.5**	**7,473.9**	**13,683.8**	**2,712.6**	**16,396.4**

* High sampling variability

** Very high sampling variability

NOTE: Any discrepancies may be due to rounding.

TABLE 18: Value of Lost Production due to Morbidity by Diagnostic Category and Selected Demographic Group, Canada, 2007 ($'000,000 Current Dollars)

DIAGNOSTIC CATEGORY	MALE COST	FEMALE COST	AGE 15–54 YEARS COST	AGE 55–75 YEARS COST	TOTAL COST
Certain Infectious and Parasitic Diseases	389.4	388.2	692.7	85.0 *	777.6
Respiratory Infections	1,422.8	1,215.5	2,338.8	299.5	2,638.3
Malignant Neoplasms	331.7 **	89.5 *	254.7 **	166.5 *	421.2 *
Diabetes Mellitus	117.4 **	16.2 **	48.9 *	84.7 **	133.6 *
Neuropsychiatric Conditions	487.0	493.5	891.9	88.6 *	980.5
Cardiovascular Diseases	197.4 *	58.7 *	188.6 **	67.5 *	256.2 *
Respiratory Diseases	58.0 *	46.3 *	73.5 *	30.8 *	104.3
Digestive Diseases	104.5 *	44.4 *	94.0 *	54.9 **	148.9 *
Genitourinary Diseases	125.8 **	26.8 **	143.8 **	8.8 **	152.7 *
Musculoskeletal Diseases	677.4	644.1	1,117.0	204.5	1,321.5
Injuries	1,950.3	797.7	2,160.9	587.0	2,748.0
Unattributable	2,570.5	3,359.4	5,074.6	855.4	5,930.0
Total	**8,432.4**	**7,180.4**	**13,079.3**	**2,533.4**	**15,612.7**

* High sampling variability

** Very high sampling variability

NOTE: Any discrepancies may be due to rounding.

TABLE 19: Value of Lost Production due to Morbidity by Diagnostic Category and Selected Demographic Group, Canada, 2006 ($'000,000 Current Dollars)

DIAGNOSTIC CATEGORY	MALE COST	FEMALE COST	AGE 15–54 YEARS COST	AGE 55–75 YEARS COST	TOTAL COST
Certain Infectious and Parasitic Diseases	372.6	366.7	659.9	79.4 *	739.3
Respiratory Infections	1,354.3	1,143.4	2,216.2	281.5	2,497.7
Malignant Neoplasms	323.5 **	87.4 *	249.3 **	161.6 *	410.9 *
Diabetes Mellitus	114.8 **	15.5 **	47.0 *	83.3 **	130.3 *
Neuropsychiatric Conditions	486.7	482.7	883.8	85.7 *	969.5
Cardiovascular Diseases	184.4 *	56.5 *	176.0 **	64.9 *	240.9 *
Respiratory Diseases	52.5 *	43.5 *	67.9 *	28.1 *	96.0
Digestive Diseases	99.6 *	42.3 *	87.5 *	54.4 **	141.9 *
Genitourinary Diseases	123.1 **	27.4 **	142.8 **	7.6 **	150.5 *
Musculoskeletal Diseases	656.5	607.4	1,060.0	203.9	1,263.9
Injuries	1,902.9	757.0	2,085.6	574.2	2,659.8
Unattributable	2,490.8	3,218.6	4,902.6	806.7	5,709.4
Total	**8,161.6**	**6,848.4**	**12,578.5**	**2,431.5**	**15,010.0**

* High sampling variability

** Very high sampling variability

NOTE: Any discrepancies may be due to rounding.

TABLE 20: Value of Lost Production due to Morbidity by Diagnostic Category and Selected Demographic Group, Canada, 2005 ($'000,000 Current Dollars)

DIAGNOSTIC CATEGORY	MALE COST	FEMALE COST	AGE 15–54 YEARS COST	AGE 55–75 YEARS COST	TOTAL COST
Certain Infectious and Parasitic Diseases	359.5	352.8	638.8	73.6 *	712.4
Respiratory Infections	1,304.7	1,096.7	2,141.5	259.9	2,401.4
Malignant Neoplasms	307.8 **	86.9 *	245.1 **	149.6 *	394.7 *
Diabetes Mellitus	106.5 **	15.8 **	45.7 *	76.7 **	122.3 *
Neuropsychiatric Conditions	488.8	466.2	868.6	86.4 *	955.0
Cardiovascular Diseases	181.1 *	53.4 *	175.5 **	59.0 *	234.5 *
Respiratory Diseases	51.5 *	41.2 *	65.3 *	27.4 *	92.7
Digestive Diseases	94.4 *	39.2 *	83.6 *	50.0 **	133.6 *
Genitourinary Diseases	128.6 **	31.2 **	151.9 **	7.9 **	159.8 *
Musculoskeletal Diseases	631.0	579.2	1,021.1	189.1	1,210.2
Injuries	1,833.1	720.2	2,026.8	526.5	2,553.3
Unattributable	2,418.4	3,087.0	4,746.0	759.4	5,505.3
Total	**7,905.5**	**6,569.8**	**12,209.8**	**2,265.4**	**14,475.2**

* High sampling variability

** Very high sampling variability

NOTE: Any discrepancies may be due to rounding.

TABLE 21: Value of Lost Production due to Morbidity by Age Group, Canada, 2005–2010 ($'000,000 Current Dollars)

AGE GROUP	2010	% OF TOTAL COST	2009	% OF TOTAL COST	2008	% OF TOTAL COST	2007	% OF TOTAL COST	2006	% OF TOTAL COST	2005	% OF TOTAL COST
15–34 years	4,135.7	23	3,846.1	23	3,771.2	23	3,485.8	22	3,377.2	22	3,250.4	22
35–54 years	10,720.5	59	10,121.6	60	9,912.5	60	9,593.6	61	9,201.2	61	8,959.4	62
55–64 years	3,107.4	17	2,809.1	17	2,546.2	16	2,382.6	15	2,301.2	15	2,139.1	15
65–75 years	200.4	1	176.7	1	166.4	1	150.8	1	130.3	1	126.3	1
Total Cost	**18,164.1**	**100**	**16,953.6**	**100**	**16,396.4**	**100**	**15,612.7**	**100**	**15,010.0**	**100**	**14,475.2**	**100**

TABLE 22: Value of Lost Production due to Morbidity, Canada, 2005–2010 ($'000,000 2010 Constant Dollars)

YEAR	TOTAL MORBIDITY COST
2010	18,164.1
2009	17,264.8
2008	16,741.3
2007	16,312.9
2006	16,028.0
2005	15,760.4

APPENDIX 1: MAPPING OF CCHS DISEASE CATEGORIES TO EBIC DIAGNOSTIC CATEGORIES

INFECTIOUS AND PARASITIC DISEASES	
	Own Infectious Disease (lop_020)
	Stomach Flu (lop_084)
	Other Infectious Disease (lop_086)
RESPIRATORY INFECTIONS	
	Cold (lop_082)
	Flu or Influenza (lop_083)
	Respiratory Infection (lop_085)
MALIGNANT NEOPLASMS	
	Cancer (lop_050)
DIABETES MELLITUS	
	Diabetes (lop_050)
NEUROPSYCHIATRIC CONDITIONS	
	Migraine (lop_050)
	Mental Illness (lop_050)
	Neurological Disease (lop_050)
CARDIOVASCULAR DISEASES	
	Cardiovascular Disease (lop_050)
RESPIRATORY DISEASES	
	Asthma (lop_050)
	Chronic Bronchitis, Emphysema and Chronic Obstructive Pulmonary Disease (COPD) (lop_050)
DIGESTIVE DISEASES	
	Digestive Diseases (lop_050)
GENITOURINARY DISEASES	
	Kidney Disease (lop_050)
MUSCULOSKELETAL DISEASES	
	Arthritis (lop_050)
	Osteoporosis (lop_050)
	Back Problems (lop_050)
	Fibromyalgia, Chronic Fatigue Syndrome or Multiple Chemical Sensitivities (lop_050)
INJURIES	
	Own Injury (lop_020)
	Injury (lop_070)
UNATTRIBUTABLE	
	Other (lop_050)
	Don't Know (lop_050)
	Refusal (lop_050)
	Not Stated (lop_050)
	Other Reason Related to Physical or Mental Health (lop_020)
	Other Reason Related to Physical or Mental Health (lop_100)

NOTE: The text in the bracket indicates the 2010 CCHS LOP module question (65).

APPENDIX 2: SAMPLING VARIABILITY GUIDELINES

TYPE OF ESTIMATE	COEFFICIENT OF VARIATION (CV) IN %	GUIDELINES
Acceptable: moderate sampling variability	0.0 ≤ CV ≤ 16.5	Estimates can be considered for general unrestricted release.
Marginal: high sampling variability	16.6 ≤ CV ≤ 33.3	Estimates can be considered for general unrestricted release but should be accompanied by a warning cautioning subsequent users of high sampling variability associated with the estimates.
Unacceptable: very high sampling variability	CV > 33.3	Statistics Canada recommends not releasing estimates of unacceptable quality. The user is advised that these EBIC morbidity cost estimates do not meet Statistics Canada's quality standards for this statistical program. Conclusions based on these data will be unreliable and most likely invalid. These data and any consequent findings should not be published. If the user chooses to publish these data or findings, then this disclaimer must be published with the data.

SOURCE: Statistics Canada (64)

APPENDIX A: LIST OF ABBREVIATIONS

ACCS	Ambulatory Care Classification System
CANSIM	Canadian Socio-economic Information Management System
CCHS	Canadian Community Health Survey
CCRS	Continuing Care Reporting System
CDTI	Canadian Disease and Therapeutic Index
CIHI	Canadian Institute for Health Information
CMDB	Canadian Management Information Systems Database
CPWC	Cost per weighted case
CS	CompuScript
CV	Coefficient of variation
DAD	Discharge Abstract Database
EBIC	Economic Burden of Illness in Canada
FP	Friction period
HMDB	Hospital Morbidity Database
HMHDB	Hospital Mental Health Database
ICD	International Classification of Diseases
LOP	Loss of productivity
LOS	Length of stay
NACRS	National Ambulatory Care Reporting System
NDP	Net domestic product
NHEX	National Health Expenditure Database
NRS	National Rehabilitation Reporting System
OMHRS	Ontario Mental Health Reporting System
PHAC	Public Health Agency of Canada
RIW	Resource Intensity Weight
SCIPP	System for Classification of In-Patient Psychiatry
SWPD	SCIPP weighted patient day
UD	Unemployment duration
USC	Uniform System of Classification

APPENDIX B: DEFINITIONS

Diagnostic Category — A diagnostic category refers to a group of illnesses or injuries with similar characteristics. The diagnostic category is the first tier in EBIC's two-tiered grouping system for physical and mental health conditions. For all cost components, with the exception of the value of lost production due to morbidity, costs are grouped into the appropriate diagnostic category using the International Classification of Diseases (ICD) codes. In the current edition of EBIC there are 24 unique diagnostic categories. The list of diagnostic categories and the associated ICD codes can be found in Appendix C.

Diagnostic Subcategory — A diagnostic subcategory refers to a group of illnesses or injuries with similar characteristics. The diagnostic subcategory is the second tier in EBIC's two-tiered grouping system for physical and mental health conditions. Classification by diagnostic subcategory offers further specification than the classification by diagnostic category only. For all cost components, with the exception of the value of lost production due to morbidity, costs are grouped into the appropriate diagnostic subcategory using the International Classification of Diseases (ICD) codes. In the current edition of EBIC there are 165 unique diagnostic subcategories. The list of diagnostic subcategories and the associated ICD codes can be found in Appendix C.

Direct Costs — Direct costs refer to health care expenditures for which the primary objective was to improve and prevent the deterioration of health status. Three direct cost components were estimated in this report: hospital care expenditures, physician care expenditures and drug expenditures. Other direct health expenditure totals, comprising other institutions and additional direct health expenditures (e.g. other professionals, capital, public health and other health spending), were included in this report but could not be attributed by EBIC category (diagnostic category, sex, age and province/territory). All direct cost component totals are included in NHEX (5). Total EBIC direct expenditures are compared with NHEX expenditure totals to calculate the amount of expenditures not attributable by EBIC category.

Drug Expenditures — Drug expenditure estimates include the public and private costs associated with prescription and non-prescription (i.e. over-the-counter) drugs purchased in retail stores (5). Estimates represent the final costs to consumers, including dispensing fees, markups and appropriate taxes. Drugs dispensed in hospitals and other institutions are excluded. For the EBIC drug expenditure estimates, only expenditures for prescription drugs could be allocated across EBIC categories (diagnostic category/subcategory, sex, age group and province/territory).

Hospital Care Expenditures — Hospital care expenditures include all costs of operating and maintaining both public and private hospitals in Canada: drugs dispensed in hospitals; medical supplies; therapeutic and diagnostic outpatient costs; administrative costs; some research costs; accommodation and meals for patients; maintenance of hospital facilities; and gross salaries and wages for all hospital staff (such as physicians on hospital payroll, nurses, technicians and medical students). EBIC 2004–2008 hospital care expenditures were estimated and distributed across diagnostic category/subcategory, sex, age group and province/territory for each year of analysis (5).

Indirect Costs — Indirect costs refer to the dollar value of lost production due to illness, injury or premature death. In this report, only the value of lost production due to an individual's 'own' illness, injury or premature death associated with labour market activities was considered (costs associated with non-labour market activities and informal caregiving costs were not included). The indirect cost components in this report are the value of lost production due to morbidity and the value of lost production due to premature mortality. In the current edition of EBIC, the friction cost method was adopted to value lost production due to illness, injury and premature death.

Other Direct Health Expenditures — Other direct health expenditures comprise costs for other institutions, other professionals (dental services, vision care services and other), capital, public health and other health spending (e.g. health research) (5).

Physician Care Expenditures — Physician care expenditures include fee-for-service payments made by provincial/territorial medical care insurance plans to physicians in private practice, as well as alternative forms of payment (salaries, sessional, capitation) made to physicians. Fees for services rendered in hospitals are also included in the physician care expenditures component when the provincial/territorial medical insurance plans make payments directly to the physicians (5).

Value of Lost Production due to Morbidity — Morbidity costs are incurred when some form of illness and/or injury results in time lost from productive activities, whether paid or unpaid. In this report, morbidity costs associated with labour market missed work days (absenteeism) were estimated using the friction cost method and a prevalence-based approach. The value of lost production due to morbidity was not estimated for presenteeism or non-labour market production losses. Furthermore, the morbidity cost estimates in this report included only lost production costs associated with an individual's 'own' illness and injury; production losses due to informal caregiving for the sick and injured were not included.

Values of Lost Production due to Premature Mortality — Mortality costs are incurred as a result of premature death due to illness and/or injury. In this report, the value of lost production due to premature mortality associated with labour market activities was estimated using the friction cost method and a prevalence-based approach for individuals whose age at death was between 15 and 64 years.

APPENDIX C: EBIC 2005–2008 DIAGNOSTIC CATEGORIES

EBIC CODE	EBIC 2005–2008 DIAGNOSTIC CATEGORIES	ICD-10 CODE	ICD-9 CODE
	Communicable, Maternal, Perinatal and Nutritional Conditions [a]	**A00-B99, G00-G05, N70-N73, J00-J06, J09-J18, J20-J22, H65-H66, O00-O99, P00-P96, E00-E02, E40-E46, E50, D50-D53, D64.9, E51-E64, U80.1, U81.0, U04**	**001-139, 243, 260-269,279.5, 280-281,285.9, 320-323, 381-382,460-465, 466, 480-487, 614-616, 630-676, 760-779, V02.7, V09.8**
E01	**Certain Infectious and Parasitic Diseases**	**A00-B99, G00, G03-G05, N70-N73, U80.1, U81.0**	**001-139, 279.5, 320-323, 614-616, 771.3, V02.7, V09.8**
E01.1	**Tuberculosis**	**A15-A19, B90**	**010-018, 137**
	Sexually Transmitted Diseases (excluding HIV)	**A50-A64, N70-N73**	**090-099, 614-616**
E01.2	Syphilis	A50-A53	090-097
E01.3	Chlamydia	A55-A56	076, 099.1, 099.5
E01.4	Gonorrhoea	A54	098, V02.7
E01.5	Other STDs	A57-A64, N70-N73	099.0, 099.2-099.4, 099.8, 099.9, 614-616
E01.6	**HIV/AIDS**	**B20-B24**	**279.5 (=042-044)**
	Diarrhoeal Diseases	**A00-A09**	**001-009**
E01.7	Salmonella	A02	003
E01.8	Giardiasis	A07.1	007.1
E01.9	Escherichia coli	A04.0-A04.4	008.0
E01.10	Shigellosis	A03	004
E01.11	Campylobacter [b, c]	A04.5	N/A
E01.12	Yersinia enterocolitica [b, c]	A04.6	N/A
E01.13	Clostridium difficile [b, c]	A04.7	N/A
E01.14	Other Diarrhoeal Diseases	A00, A01, A04.8, A04.9, A05-A09 (minus A07.1)	001, 002, 005-009 (minus 007.1, 008.0)
	Selected Vaccine Preventable Diseases	**A33-A37, A80, B01, B05, B06, B26, B91**	**032, 033, 037, 045, 055, 138, 771.3, 052, 072, 056**
E01.15	Pertussis	A37	033
E01.16	Poliomyelitis	A80, B91	045, 138
E01.17	Diphtheria	A36	032
E01.18	Measles	B05	055
E01.19	Chickenpox	B01	052
E01.20	Mumps	B26	072
E01.21	Rubella	B06	056
E01.22	Tetanus	A33-A35	037, 771.3

EBIC CODE	EBIC 2005–2008 DIAGNOSTIC CATEGORIES	ICD-10 CODE	ICD-9 CODE
	Meningitis	**A39, A87, G00, G03**	**036, 047.0, 047.1, 047.8, 047.9, 049.0, 049.1, 320-322**
E01.23	Meningococcal Infection	A39	036
E01.24	Viral Meningitis	A87	047.0, 047.1, 047.8, 047.9, 049.0, 049.1
E01.25	Bacterial Meningitis	G00	320
E01.26	Meningitis Due to Other Organisms	G03.0-G03.8	321
E01.27	Meningitis of Unspecified Cause	G03.9	322
E01.28	**Hepatitis A**	**B15**	**070.0, 070.1**
E01.29	**Hepatitis B**	**B16-B19 (minus B17.1, B18.2)**	**070.2-070.9 (minus 070.7)**
E01.30	**Hepatitis C**	**B17.1, B18.2**	**070.7**
E01.31	**Malaria**	**B50-B54**	**084**
E01.32	**Tropical-Cluster Diseases**	**B55-B57, B65, B73, B74.0-B74.2**	**085, 086, 120, 125.0, 125.1, 125.3**
E01.33	**Leprosy**	**A30**	**030**
E01.34	**Dengue**	**A90-A91**	**061**
E01.35	**Encephalitis**	**A83-A86, B94.1, G04, G05**	**062-064, 139.0, 323**
E01.36	**Trachoma**	**A71, B94.0**	**076, 139.1**
E01.37	**Intestinal Nematode Infections**	**B76-B81**	**126-129**
E01.38	**Brucellosis**	**A23**	**023**
E01.39	**Rabies**	**A82**	**071**
E01.40	**Infectious Mononucleosis**	**B27**	**075**
E01.41	**West Nile Virus**	**A92.3**	**066.4**
E01.42	**Listeriosis**	**A32**	**027.0**
E01.43	**Other Infectious Diseases**	**A20-A22, A24-A28, A31, A38, A40-A49, A65-A70, A74-A79, A81, A88, A89, A92-A99 (minus A92.3), B00, B02-B04, B07-B14, B25, B28-B49, B58-B60, B64, B66-B72, B74.3-B74.9, B75, B82-B89, B92-B99 (minus B94.0, B94.1), U80.1, U81.0**	**020-022, 024-026, 027.1-027.9, 031, 034, 035, 038-041, 046, 048, 049 (minus 049.0, 049.1), 050-051, 053-054, 057-059, 060, 065-066.3, 066.8, 066.9, 073-074, 077-083, 087-088, 100-104, 110-118, 121-124, 125.2, 125.4, 125.5-125.9, 130-136, 139.8, V09.8**
E02	**Respiratory Infections**	**J00-J06, J09-J18, J20-J22, H65-H66, U04**	**460-466, 480-487, 381-382**
E02.1	Pneumonia	J12-J18	480-486
E02.2	Influenza	J09-J11	487
E02.3	Bronchitis and Bronchiolitis	J20, J21	466
E02.4	Common Cold	J00	460

EBIC CODE	EBIC 2005–2008 DIAGNOSTIC CATEGORIES	ICD-10 CODE	ICD-9 CODE
E02.5	Otitis Media	H65-H66	381-382
E02.6	Other Respiratory Infections	J01-J06, J22, U04	461-465
E03	**Maternal Conditions**	**O00-O99**	**630-677**
E03.1	Maternal Haemorrhage	O44-O46, O67, O72	640, 641, 666
E03.2	Maternal Sepsis	O85-O86	670
E03.3	Hypertensive Disorders of Pregnancy	O10-O16	642
E03.4	Obstructed Labour (Dystocia)	O64-O66	660
E03.5	Abortion	O00-O07, O08	630-639
E03.6	Other Maternal Conditions	O20-O43, O47-O63, O68-O71, O73-O75, O87-O99	643-659, 661-665, 667-669, 671-677
E04	**Perinatal Conditions**	**P00-P96**	**760-779 (minus 771.3)**
E04.1	Low Birth Weight	P05-P07	764-765
E04.2	Birth Asphyxia and Birth Trauma	P03, P10-P15, P20-P29	767-770
E04.3	Other Perinatal Conditions	P00-P02, P04, P08, P35-P96	760-763, 766, 771 (minus 771.3), 772-779
E05	**Nutritional Deficiencies**	**E00-E02, E40-E46, E50-E64, D50-D53, D64.9**	**243, 260-269, 280-281, 285.9**
E05.1	Protein-Energy Malnutrition	E40-E46	260-263
E05.2	Iodine Deficiency	E00-E02	243
E05.3	Vitamin A Deficiency	E50	264
E05.4	Iron-Deficiency Anaemia	D50, D64.9	280, 285.9
E05.5	Other Nutritional Deficiencies	D51-D53, E51-E64	265-269, 281
	Non-communicable Conditions	**C00-C97, D00-D48, D55-D64 (minus D 64.9) D65-D89, E03-E07, E10-E16, E20-E34, E65-E88, F01-F99, G06-G98, H00-H61, H68-H93, I00-I99, J30-J98, K00-K92, N00-N64, N75-N98, L00-L98, M00-M99, Q00-Q99**	**140-242, 244-259, 270-279 (minus 279.5), 282-285 (minus 285.9), 286-319, 324-380, 383-459, 470-478, 490-611, 617-629, 680-759**
E06	**Malignant Neoplasms [e]**	**C00-C97**	**140-208, 238.6**
E06.1	Oral Cancers	C00-C14	140-149
E06.2	Esophagus Cancer	C15	150
E06.3	Stomach Cancer	C16	151
E06.4	Colorectal Cancer	C18-C21, C26.0	153, 154, 159.0
E06.5	Liver Cancer	C22.0, C22.2-C22.7	155 (minus 155.1, 155.2)
E06.6	Pancreas Cancer	C25	157
E06.7	Larynx Cancer	C32	161
E06.8	Trachea Cancer	C33	162.0

EBIC CODE	EBIC 2005–2008 DIAGNOSTIC CATEGORIES	ICD-10 CODE	ICD-9 CODE
E06.9	Bronchus and Lung Cancers	C34	162.2-162.9
E06.10	Melanoma	C43	172
E06.11	Other Skin Cancers	C44	173
E06.12	Breast Cancer	C50	174, 175
E06.13	Cervix Cancer	C53	180
E06.14	Body of Uterus Cancer	C54-C55	179, 182
E06.15	Ovary Cancer	C56	183
E06.16	Prostate Cancer	C61	185
E06.17	Testis Cancer	C62	186
E06.18	Bladder Cancer (including *in situ*)	C67	188
E06.19	Kidney Cancer	C64-C65	189.0, 189.1
E06.20	Brain Cancer	C70-C72	191, 192
E06.21	Thyroid Cancer	C73	193
E06.22	Hodgkin Lymphoma	C81	201
E06.23	Non-Hodgkin Lymphoma	C82-C85, C96.3	200, 202 (minus 202.4)
E06.24	Multiple Myeloma	C90.0, C90.2	203.0
E06.25	Leukaemia	C90.1, C91-C95	202.4, 203.1, 204-208
E06.26	Other Malignant Neoplasms	C17, C22.1, C22.9, C23, C24, C26-C31, C37-C41, C45-C49, C51, C52, C57-C60, C63, C66, C68-C69, C74-C80, C86, C88, C90.3, C96, C97	152, 155.1, 155.2, 156, 158-160, 163-171, 176, 81, 184, 187, 189.2-190, 194-199, 203.8, 238.6
E07	**Other Neoplasms**	**D00-D48**	**210-239 (minus 238.6)**
E08	**Diabetes Mellitus**	**E10-E14**	**250**
E09	**Endocrine Disorders**	**D55-D64 (minus D64.9), D65-D89, E03-E07, E15-E16, E20-E34, E65-E89**	**240-242, 244-246, 251-259, 270-279 (minus 274, 279.5), 282-285 (minus 285.9), 2 86-289, 330.0-330.3**
E09.1	Cystic Fibrosis	E84	277.0
E09.2	Other Endocrine Disorders	D55-D64 (minus D64.9), D65-D89, E03-E07, E15-E16, E20-E34, E65-E88 (minus E84), E89	240-242, 244-246, 251-259, 270-279 (minus 274, 277.0, 279.5), 282-285 (minus 285.9), 286-289
E10	**Neuropsychiatric Conditions**	**F01-F99, G06-G98 (minus G45.0-G45.3, G45.8, G45.9)**	**290-319, 324-359 (minus 330.0-330.3)**
E10.1	Mood Disorders	F30-F33	296, 298.0, 298.1, 309.1, 311
E10.2	Schizophrenia, schizotypal and delusional disorders	F20-F29	295, 297, 298.3, 298.4, 298.9

EBIC CODE	EBIC 2005–2008 DIAGNOSTIC CATEGORIES	ICD-10 CODE	ICD-9 CODE
E10.3	Epilepsy	G40-G41	345
E10.4	Alcohol Use Disorders	F10	291, 303, 305.0
E10.5	Alzheimer and Other Dementias	F01, F03, G30-G31	290 (minus 290.3), 330 (minus 330.0-330.3), 331
E10.6	Parkinson Disease and Secondary Parkinsonism	G20-G21	332
E10.7	Multiple Sclerosis	G35	340
E10.8	Drug Use Disorders	F11-F16, F18-F19	304, 305.2-305.7
E10.9	Post-Traumatic Stress Disorder [b, d]	F43.1	N/A
E10.10	Nonorganic Sleep Disorders	F51	307.4
E10.11	Anxiety Disorders	F40-F45 (minus F43.1), F48, F68	298.2, 298.8, 300, 306, 307.8, 308, 309 (minus 309.1)
E10.12	Migraine	G43	346
E10.13	Mental Retardation	F70-F79	317-319
E10.14	Cerebral Palsy	G80	343
E10.15	Other Neuropsychiatric Disorders	F04-F09, F17,F34-F39, F46-F47, F49-F50, F52-F67, F69, F80-F99, G06-G12, G23-G25, G36, G37, G44, G45.4,G46-G79, G81-G98	290.3, 292-294, 299, 301-302, 305.1, 305.8, 305.9, 307 (minus 307.4, 307.8), 310, 312-316, 324-327, 333-339, 341-342, 344, 347-359
E11	**Sense Organ Diseases**	**H00-H61, H68-H93, H95**	**360-380, 383-389**
E11.1	Glaucoma	H40	365
E11.2	Cataracts	H25-H26	366
E11.3	Vision Disorders, Age-Related	H52.4	367.4
E11.4	Hearing Loss	H90-H91	389
E11.5	Other Sense Organ Diseases	H00-H21, H27-H35, H43-H61 (minus H52.4), H68-H83, H92-H93, H95	360-364, 367-380 (minus 367.4), 383-388
E12	**Cardiovascular Diseases**	**I00-I99, G45 (minus G45.4)**	**390-459**
E12.1	Myocardial Infarction	I21, I22, I25.2	410, 412
E12.2	Other Ischemic Heart Diseases	I20, I23-I25 (minus I25.2)	411, 413, 414
E12.3	Essential Hypertension	I10	401
E12.4	Other Hypertensive Diseases	I11-I13, I15	402-405
E12.5	Heart Failure	I50	428
E12.6	Cerebral Infarction	I63	434
E12.7	Subarachnoid Haemorrhage	I60	430

EBIC CODE	EBIC 2005–2008 DIAGNOSTIC CATEGORIES	ICD-10 CODE	ICD-9 CODE
E12.8	Intracerebral Haemorrhage	I61	431
E12.9	Acute but Ill-defined Stroke	I64	436
E12.10	Other Cerebrovascular Disease	I62, I65-I69	432-433, 437-438
E12.11	Transient Ischemic Attack	G45 (minus G45.4)	435
E12.12	Other Cardiovascular Diseases	I00-I09, I14, I16-I19, I26-I28, I30-I49, I51-I52, I70-I89, I95-I99	390-398, 415-417, 420-427, 429, 440-449, 451-459
E13	**Respiratory Diseases**	**J30-J98**	**470-478, 490-519**
E13.1	Chronic Obstructive Pulmonary Disease	J40-J44	490-492, 495-496
E13.2	Asthma	J45-J46	493
E13.3	Other Respiratory Diseases	J30-J39, J47-J98	470-478, 494, 500-508, 510-519
E14	**Digestive Diseases**	**K20-K92**	**530-579**
E14.1	Peptic Ulcer Disease	K25-K27	531-533
E14.2	Cirrhosis of the Liver	K70, K74	571
E14.3	Appendicitis	K35-K37	540-543
E14.4	Other Digestive Diseases	K20-K22, K28-K31, K38, K40-K66, K71-K73, K75-K92	530, 534-537, 550-553, 555-558, 560-570, 572-579
E15	**Genitourinary Diseases**	**N00-N64, N75-N99**	**580-611, 617-629**
E15.1	Acute Renal Failure	N17	584
E15.2	Chronic Renal Failure	N18	585
E15.3	Unspecified Renal Failure	N19	586
E15.4	Other Nephritis and Nephrosis	N00-N16	580-583, 587-589
E15.5	Benign Prostatic Hypertrophy	N40	600
E15.6	Other Genitourinary System Diseases	N20-N39, N41-N64, N75-N98, N99	590-599, 601-611, 617-629
E16	**Skin Diseases**	**L00-L98**	**680-709**
E17	**Musculoskeletal Diseases**	**M00-M99**	**710-739, 274**
E17.1	Rheumatoid Arthritis	M05-M06	714
E17.2	Osteoarthritis	M15-M19	715
E17.3	Gout	M10	274
E17.4	Low Back Pain	M45-M48, M54 (minus M54.2)	720-724 (minus 721.1, 722.0, 722.4)
E17.5	Osteoporosis	M80, M81	733.0
E17.6	Other Musculoskeletal Disorders	M00-M02, M08, M11-M13, M20-M43, M50-M53, M54.2, M55-M79, M82-M99	710-713, 716-719, 721.1, 722.0, 722.4, 723, 725-739 (minus 733.0)
E18	**Congenital Anomalies**	**Q00-Q99**	**740-759**
E18.1	Abdominal Wall Defect	Q79.2-Q79.5	756.7
E18.2	Anencephaly	Q00	740.0

EBIC CODE	EBIC 2005–2008 DIAGNOSTIC CATEGORIES	ICD-10 CODE	ICD-9 CODE
E18.3	Anorectal Atresia	Q42	751.2
E18.4	Cleft Lip	Q36	749.1
E18.5	Cleft Palate	Q35, Q37	749.0
E18.6	Oesophageal Atresia	Q39.0-Q39.1	750.3
E18.7	Renal Agenesis	Q60	753.0
E18.8	Down Syndrome	Q90	758.0
E18.9	Congenital Heart Anomalies	Q20-Q28	745-747
E18.10	Spina Bifida	Q05	741
E18.11	Other Congenital Anomalies	Q01-Q04, Q06-Q07, Q10-Q18, Q30-Q34, Q38, Q39.2-Q39.9, Q40-Q41, Q43-Q56, Q61-Q78, Q79.0, Q79.1, Q79.6, Q79.8, Q79.9, Q80-Q89, Q91-Q99	740.1, 740.2, 742-744, 748, 749.2, 750.0, 750.1, 750.2, 750.4-751.1, 751.3-751.9, 752, 753.1-753.9, 754, 755, 756.0-756.6, 756.8, 756.9, 757, 758.1-758.9, 759
E19	**Oral Conditions**	**K00-K14**	**520-529**
E19.1	Dental Caries	K02	521.0
E19.2	Periodontal Disease	K05	523
E19.3	Other Oral Diseases	K00, K01, K03,K04, K06-K14	520, 521.1-521.9, 522, 524-529
	Injuries [f]	**V01-Y89, S00-T98**	**E800-E999, 800-999**
E20	**Unintentional Injuries**	**V01-X59, Y40-Y86, Y88, Y89 (minus Y89.9)**	**E800-E949**
E20.1	Road Traffic Accidents	V01-V06 fourth digits 1-9 (example V01.1, V01.2, V01.3 etc.); V09.2; V09.3; V10, V11, V15-V18 & V29-V79 fourth digits 4-9; V12-V14 & V20-V28 fourth digits 3-9; V19.4-V19.6; V80.3-V80.5; V81.1; V82.1; V83-V86 fourth digits 0-3; V87.0-V87.8, V89.2; V89.9; V99; Y85.0	E810-E819, E826-E829, E929.0
E20.2	Poisonings	X40-X49	E850-E869
E20.3	Falls	W00-W19	E880-E888
E20.4	Fires	X00-X09	E890-E899
E20.5	Drownings	W65-W74	E910
E20.6	Other Unintentional Injuries	Rest of V, W20-W64, W75-W99, X10-X39, X50-X59, Y40-Y86 (minus Y85.0), Y88, Y89 (minus Y89.9)	E800-E807, E820-E848, E870-E879, E900-E909, E911-E949
E21	**Intentional Injuries**	**X60-Y09, Y35-Y36, Y87.0, Y87.1**	**E950-E978, E990-E999**
E21.1	Self-inflicted Injuries	X60-X84, Y87.0	E950-E959
E21.2	Violence	X85-Y09, Y87.1	E960-E969
E21.3	Other Intentional Injuries	Y35, Y36	E970-E978, E990-E999

EBIC CODE	EBIC 2005–2008 DIAGNOSTIC CATEGORIES	ICD-10 CODE	ICD-9 CODE
E22	Injuries of Undetermined Intent	Y10-Y34, Y87.2, Y89.9, S00-T98	E980-E989, 800-999
	Other	R00-R99, Z00-Z99	780-799, V01-V89
E23	Symptoms, Signs and Ill-Defined Conditions	R00-R99	E980-E989, 800-999
E24	Factors Influencing Health and Contact with Health Services	Z00-Z99	E980-E989, 800-999

[a] Diagnostic cost totals in this section exclude most congenital/neonatal costs of these diseases.

[b] Cost totals of this category/these categories are unavailable for cost components that used version ICD-9 coding.

[c] When version ICD-9 coding was used, costs for these categories are included in E01.14.

[d] When version ICD-9 coding was used, costs for this category are included in E10.11.

[e] ICD code groupings for the EBIC cancer categories are consistent with those used in the Canadian Cancer Statistics.

[f] The ICD coding used to code for injuries may vary with cost component and data source, please refer to the individual cost component reports for more information.

APPENDIX D: EBIC 2005–2008 PROJECT TEAM

Members of the Public Health Agency of Canada's Economic Burden of Illness in Canada's project team include:

Alan Diener

Jacqueline M. Dugas

Ken Eng

Christine A. Kennedy

Patricia W. Lau

Sameer Rajbhandary

Erin L. Schock

Serge Tanguay

REFERENCES

1 Wigle, D.T., Mao, Y., Wong, T., & Lane, R. (1991). Economic Burden of Illness in Canada, 1986. *Chronic Dis Can*, 12(Suppl 3). Accessed in August 2013, from http://publications.gc.ca/site/eng/448765/publication.html.

2 Moore, R., Mao, Y., Zhang, J., & Clarke, K. (1997). *Economic Burden of Illness in Canada, 1993*. (Ottawa: Canadian Public Health Association). Accessed in August 2013, from http://publications.gc.ca/site/eng/448769/publication.html.

3 Health Canada. (2002). *Economic Burden of Illness in Canada, 1998*. (Ottawa: Health Canada). Accessed in August 2013, from http://publications.gc.ca/site/eng/448770/publication.html.

4 Public Health Agency of Canada (2008). *Economic Burden of Illness in Canada, 2000: Methodological Notes* (unpublished).

5 Canadian Institute for Health Information, National Health Expenditure Trends, 1975 to 2012 (Ottawa, Ont.: CIHI, 2012). Accessed in May 2013 from https://secure.cihi.ca/estore/productFamily.htm?locale=en&pf=PFC1952.

6 Murray, C.J.L, Lopez, A.D., Mathers, C.D & Stein, C. (2001). The Global Burden of Disease 2000 project: aims, methods and data sources. World Health Organization. Accessed in June 2011, from www.who.int/healthinfo/paper36.pdf.

7 Statistics Canada. Table 326–0021 - Consumer Price Index (CPI), 2009 basket, annual (2002=100 unless otherwise noted), CANSIM (database).

8 Discharge Abstract Database (DAD), Canadian Institute for Health Information, [2004–2008].

9 Canadian Institute for Health Information (CIHI), (2005). *Data Quality Documentation: Discharge Abstract Database, 2004–2005 (Executive Summary)*.

10 Canadian Institute for Health Information (CIHI), (2006). *Data Quality Documentation: Discharge Abstract Database, 2005–2006 (Executive Summary)*.

11 Canadian Institute for Health Information (CIHI), (2007). *Data Quality Documentation: Discharge Abstract Database, 2006–2007 (Executive Summary)*.

12 Canadian Institute for Health Information (CIHI), (2008). *Data Quality Documentation: Discharge Abstract Database, 2007–2008 (Executive Summary)*.

13 Canadian Institute for Health Information (CIHI), (2009). *Data Quality Documentation: Discharge Abstract Database, 2008–2009 (Executive Summary)*.

14 *Hospital Morbidity Database (HMDB)*, Canadian Institute for Health Information, [2004–2008].

15 Canadian Institute for Health Information (CIHI), (2006). *Data Quality Documentation: Hospital Morbidity Database (HMDB), 2004–2005 (Executive Summary)*.

16 Canadian Institute for Health Information (CIHI), (2007). *Data Quality Documentation: Hospital Morbidity Database (HMDB), 2005–2006 (Executive Summary)*.

17 Canadian Institute for Health Information (CIHI), (2010). *Data Quality Documentation: Hospital Morbidity Database (HMDB), 2006–2007 (Executive Summary)*.

18 Canadian Institute for Health Information (CIHI), (2010). *Data Quality Documentation: Hospital Morbidity Database (HMDB), 2007–2008 (Executive Summary).*

19 Canadian Institute for Health Information (CIHI), (2010). *Data Quality Documentation: Hospital Morbidity Database (HMDB), 2008–2009 (Executive Summary).*

20 *National Ambulatory Care Reporting System (NACRS),* Canadian Institute for Health Information, [2004–2008].

21 Canadian Institute for Health Information (CIHI), (2005). *Data Quality Documentation: National Ambulatory Care Reporting System (NACRS), 2004–2005.*

22 Canadian Institute for Health Information (CIHI), (2006). *Database Background and General Data Limitations Documentation: National Ambulatory Care Reporting System (NACRS), 2005–2006 (Executive Summary).*

23 Canadian Institute for Health Information (CIHI), (2007). *Database Background and General Data Limitations Documentation: National Ambulatory Care Reporting System (NACRS), 2006–2007 (Executive Summary).*

24 Canadian Institute for Health Information (CIHI), (2008). *Database Background and General Data Limitations Documentation: National Ambulatory Care Reporting System (NACRS), 2007–2008 (Executive Summary).*

25 Canadian Institute for Health Information (CIHI), (2009). *Database Background and General Data Limitations Documentation: National Ambulatory Care Reporting System (NACRS), 2008–2009.*

26 *Hospital Mental Health Database* Canadian Institute for Health Information, [2006–2008].

27 Canadian Institute for Health Information (CIHI), (2006). *Hospital Mental Health Database, 2005–2006 (User Documentation).*

28 Canadian Institute for Health Information (CIHI), (2006). *Hospital Mental Health Database, Data Dictionary for Fiscal Year 2006–2007 to 2008–2009.*

29 Canadian MIS Database (CMDB), Canadian Institute for Health Information, [2004–2008].

30 Canadian Institute for Health Information, *Canadian MIS Database: Hospital Financial Performance Indicators, 2006–2007 to 2010–2011 Methodological Notes.* (Ottawa, Ont.: CIHI, 2012).

31 Canadian Institute for Health Information, *The Cost of Hospital Stays: Why Costs Vary* (Ottawa: CIHI, 2008).

32 Canadian Institute for Health Information, *DAD Resource Intensity Weights and Expected Length of Stay for CMG+ 2008* (Ottawa, Ont.: CIHI, 2008).

33 World Health Organization (WHO), (1975). *Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death: Ninth revision.*

34 World Health Organization (WHO), (1992). *International Statistical Classification of Diseases and Related Health Problems: Tenth Revision.*

35 Statistics Canada, Demography Division, Demographic Estimates Section, October Population Estimates, 2004 Final Intercensal Estimates.

36 Statistics Canada, Demography Division, Demographic Estimates Section, October Population Estimates, 2005 Final Intercensal Estimates.

37 Statistics Canada, Demography Division, Demographic Estimates Section, October Population Estimates, 2006 Final Postcensal Estimates.

38 Statistics Canada, Demography Division, Demographic Estimates Section, October Population Estimates, 2007 Final Postcensal Estimates.

39 Statistics Canada, Demography Division, Demographic Estimates Section, October Population Estimates, 2008 Final Postcensal Estimates.

40 Canadian Institute for Health Information (CIHI), (2012). *Ontario Mental Health Reporting System: Case Mix System for Classification of In-Patient Psychiatry and SCIPP Weighted Patient Days Resource Materials and Frequently Asked Questions, 2011–2012*.

41 IMS Brogan. (2012–08–24). *Health Canada—IMS Brogan Audit Overview*.

42 IMS Brogan. (2010). Health Canada—*IMS Brogan Product Overview*.

43 Manitoba Health Annual Statistics, 2008–2009 www.gov.mb.ca/health/annstats/index.html (accessed: March 21st, 2013).

44 Manitoba Health Annual Statistics, 2007–2008 www.gov.mb.ca/health/annstats/index.html (accessed: March 21st, 2013).

45 Manitoba Health Annual Statistics, 2006–2007 www.gov.mb.ca/health/annstats/index.html (accessed: March 21st, 2013).

46 Manitoba Health Annual Statistics, 2005–2006 www.gov.mb.ca/health/annstats/index.html (accessed: March 21st, 2013).

47 Canadian Institute for Health Information, National Physician Database, 2008–2009— Data Release (Ottawa, Ont.: CIHI, 2010). https://secure.cihi.ca/estore/productFamily.htm?pf=PFC1566&locale=en&lang=EN&mediatype=0 (accessed: July 2nd, 2013).

48 Statistics Canada. Table 109–5004—Unemployment rate, by age group, Canada, provinces, health regions (January 2000 boundaries) and peer groups, annual (percent), CANSIM (database), Using E-STAT (distributor). http://estat.statcan.gc.ca/cgi-win/cnsmcgi.exe?Lang=E&EST-Fi=EStat/English/CII_1-eng.htm (accessed: May 8, 2012).

49 Statistics Canada. Table 109–5304—Unemployment rate, Canada, provinces, health regions and peer groups, annual (percent), CANSIM (database), Using E-STAT (distributor). http://estat.statcan.gc.ca/cgi-win/cnsmcgi.exe?Lang=E&EST-Fi=EStat/English/CII_1-eng.htm (accessed: May 8, 2012).

50 Statistics Canada. Table 109–5324—Unemployment rate, Canada, provinces, health regions (2011 boundaries) and peer groups, annual (percent), CANSIM (database), Using E-STAT (distributor). http://estat.statcan.gc.ca/cgi-win/cnsmcgi.exe?Lang=E&EST-Fi=EStat/English/CII_1-eng.htm (accessed May 8, 2012).

51 Koopmanschap M. A. and van Ineveld B. M. (1992). Towards a new approach for estimating indirect costs of disease. *Soc. Sci. Med.* 34(9): 1005–1010.

52 Koopmanschap M. A. and Rutten F. F. H. (1993). Indirect costs in economic studies: Confronting the confusion. *Pharmacoeconomics* 4(6):446–54.

53 Koopmanschap M. A., Rutten F. F. H., van Ineveld B. M., and van Roijen, L. (1995). The friction cost method for measuring indirect costs of disease. *Journal of Health Economics* 14:171–189.

54 Koopmanschap M. A. and Rutten F. F. H. (1996). A practical guide for calculating indirect costs of disease. *Pharmacoeconomics* 10(5):460–66.

55 Public Health Agency of Canada (2009). Economic Burden of Illness in Canada Workshop. Ottawa, Ontario. (unpublished)

56 Public Health Agency of Canada (2010). Economic Burden of Illness in Canada Workshop Summary Report. Ottawa, Ontario. (unpublished)

57 Statistics Canada. *Table 202–0407—Income of individuals, by sex, age group and income source, 2010 constant dollars, annual, CANSIM (database)*. Retrieved on July 17, 2012.

58 Statistics Canada. 2010. Labour Force Historical Review 2009 (Table 048). Ottawa: Statistics Canada.

59 van Ours J. and Ridder G. (1991). Cyclical variation in vacancy durations and vacancy flows, An empirical analysis. European Economic Review 35:1143–1155.

60 Goeree R., O'Brien B. J., Blackhouse G., Agro K., Goering P. (1999). The valuation of productivity costs due to premature mortality: A comparison of the Human-Capital and Friction-Cost Methods for Schizophrenia. *Can J Psychiatry* 1999; 44:455–463.

61 Hopkins R. B., Goeree R., and Longo C. J. (2010). Estimating the national wage loss from Cancer in Canada. *Current Oncology* 2010; 17(2):40–49.

62 Statistics Canada. Canadian Community Health Survey-Annual Component: 12 Month Share File, 2010 (Share File).

63 Statistics Canada. Canadian Community Health Survey-Annual Component: 12 Month Share File, 2010 (Bootstrapping Weights File).

64 Statistics Canada, 2011. Canadian Community Health Survey- User Guide: 2010 and 2009–2010 Microdata files.

65 Statistics Canada, 2011. Canadian Community Health Survey: Annual Component-2010 Questionnaire.

66 Statistics Canada. *Table 282–0048 - Labour force survey estimates (LFS), duration of unemployment by sex and age group, annual (persons unless otherwise noted)*, CANSIM (database), Using E-STAT (distributor). Retrieved on April 18, 2012, from http://estat.statcan.gc.ca/cgi-win/cnsmcgi.exe?Lang=E&EST-Fi=EStat/English/CII_1-eng.htm.

67 Statistics Canada, Demography Division, Demographic Estimates Section, October Population Estimates, 2009 Updated Postcensal Estimates.

68 Statistics Canada, Demography Division, Demographic Estimates Section, October Population Estimates, 2010 Updated Postcensal Estimates.

69 Statistics Canada. Table 282–0002 - Labour force survey estimates (LFS), by sex and detailed age group, annual (persons unless otherwise noted), CANSIM (database), Using E-STAT (distributor). http://estat.statcan.gc.ca/cgi-win/cnsmcgi.exe?Lang=E&EST-Fi=EStat/English/CII_1-eng.htm (accessed: June 3, 2012).

70 Zheng, Ehrlich & Ami (2010). Productivity Loss Resulting from Coronary Heart Disease in Australia. *Applied Health Economics and Health Policy*, 8(3),179–89.

71 Wieser et al. (2011). Costs of low back pain in Switzerland in 2005. *European Journal of Health Economics*, 12(5), 455–67.

72 Borghouts et al. (1999). Cost-of-illness of neck pain in The Netherlands in 1996. *Pain*, 80(3), 629–36.

73 Hutubessy et al. (1999). Indirect costs of back pain in the Netherlands: a comparison of the human capital method with the friction cost method. *Pain*, 80(1–2), 201–7

74 Kristian et al. (2012). Lifetime Productivity Losses Associated with Obesity Status in Early Adulthood: A Population-Based Study of Swedish Men. *Applied Health Economics and Health Policy*, 10(5), 309–17 method with the friction cost method. Pain, 80(1–2), 201–7.

75 CPB (Central Planning Bureau). (1987). Uncertainties on labour time reduction in the medium term (in Dutch), Working document 14 (Den Haag).

76 De Koning, J. and F.A.W.M. Tuyl. (1984). The relation between labour time, production and employment (in Dutch), (Netherlands Economic Institute, Rotterdam).

77 WRR (Scientific Council for Government Affairs). (1977). Do we make it work? Research of the relation between active and inactive people (in Dutch) (Den Haag).

78 Statistics Canada. *Table 282–0016—Labour force survey estimates (LFS), by usual hours worked, main or all jobs, sex and age group, annual (persons unless otherwise noted)*, CANSIM (database), Using E-STAT (distributor). http://estat.statcan.gc.ca/cgi-win/cnsmcgi.exe?Lang=E&EST-Fi=EStat/English/CII_1-eng.htm (accessed: February 1, 2012).

79 Statistics Canada. *Table 384–0001—Gross domestic product (GDP), income-based, provincial economic accounts, annual (dollars)*, CANSIM (database), Using E-STAT (distributor). http://estat.statcan.gc.ca/cgi-win/cnsmcgi.exe?Lang=E&EST-Fi=EStat/English/CII_1-eng.htm (accessed: February 1, 2012).