

# Projection of health care costs in the last year of life among Canadians

From 2015 to 2030

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- In the next 15 years, Canada will experience an unprecedented growth in the proportion of seniors.
- As the baby boomers reach the age of 65, this rapidly expanding cohort is expected to use more health care, especially care provided at the end of life.
- About one-third of all health care spending among seniors occurred in the last year of life.
- The use of population-level health administrative data could offer better estimates to support health system planning.

Figure 1. Health care costs at the end of life

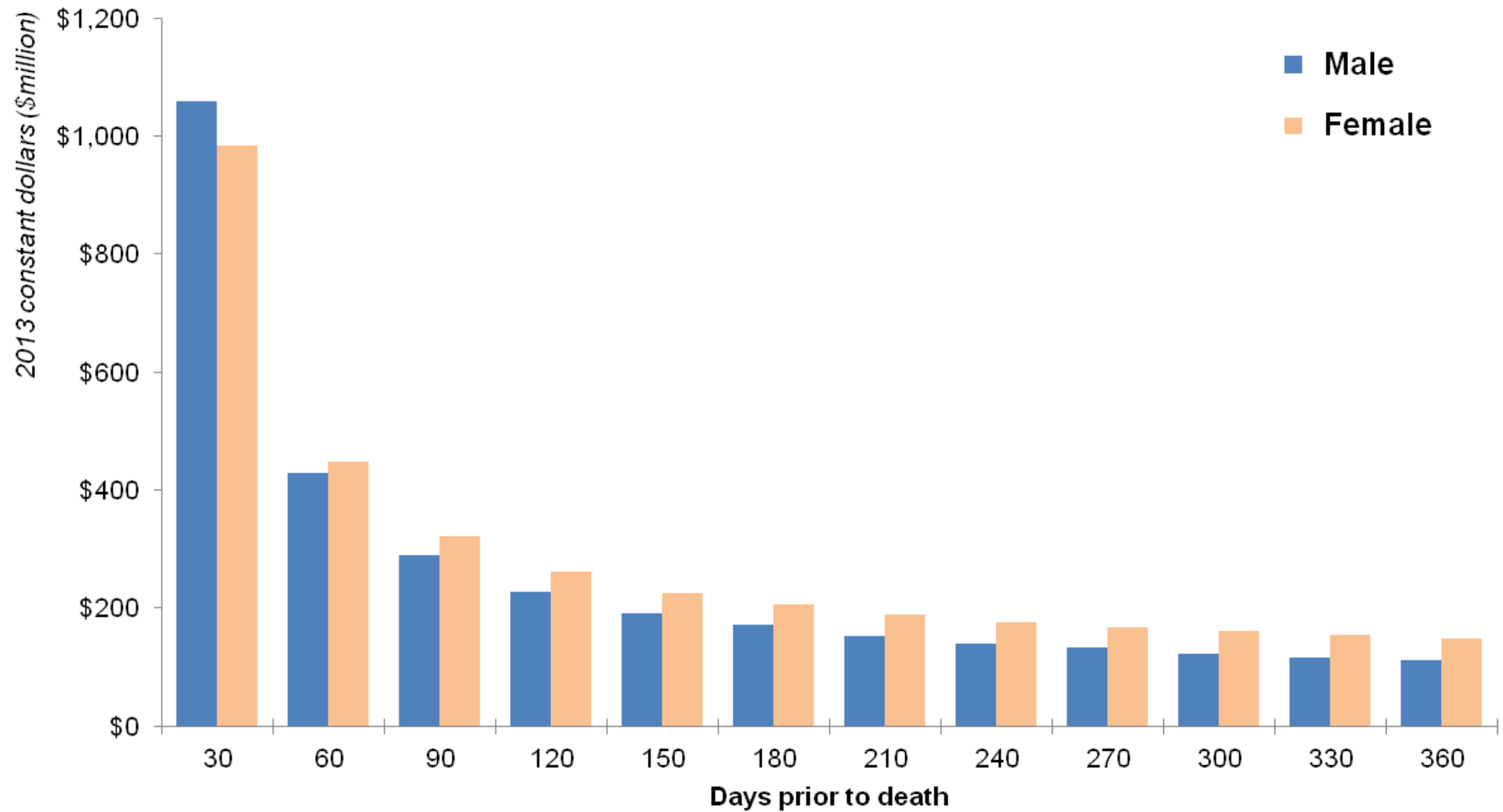
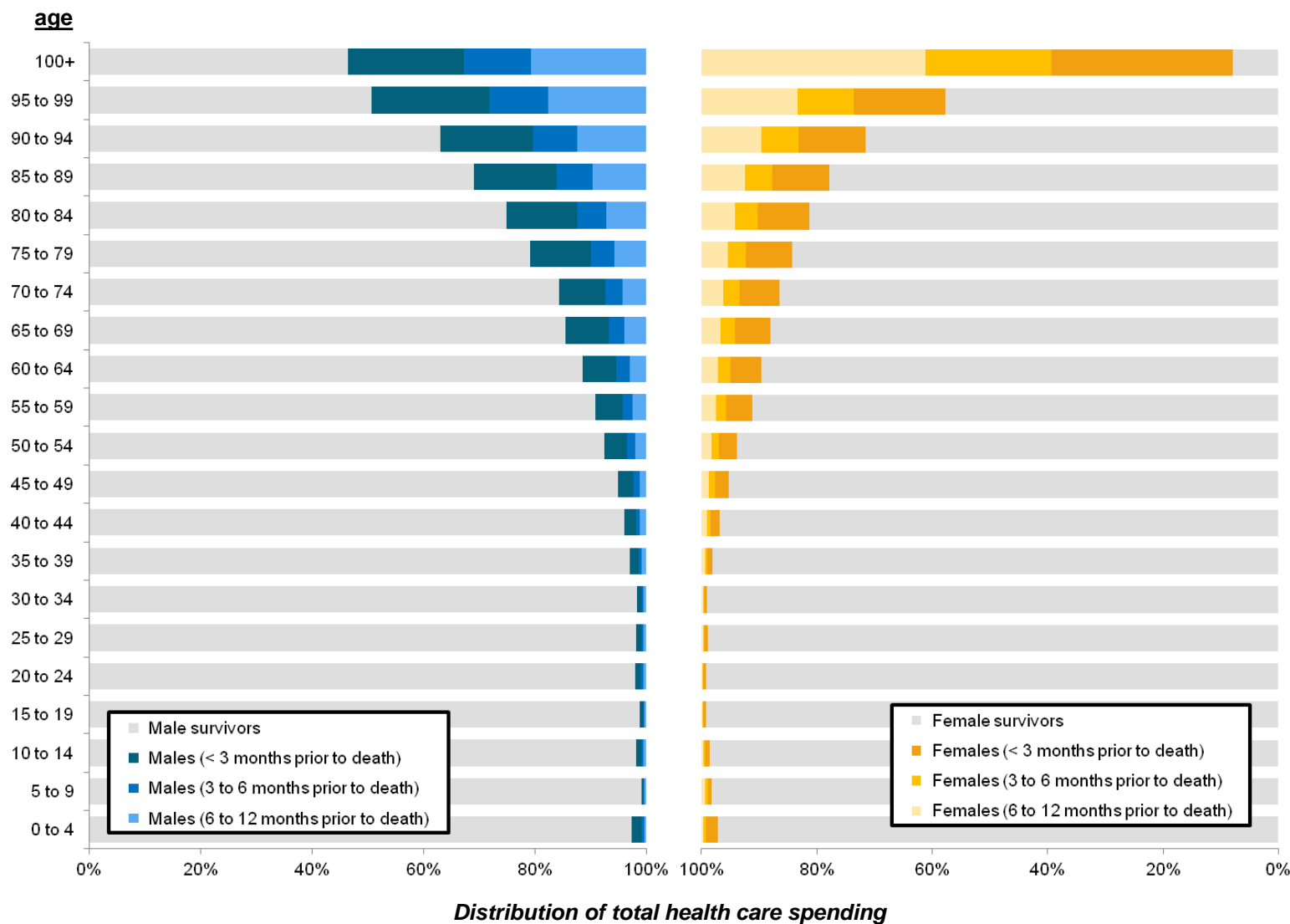
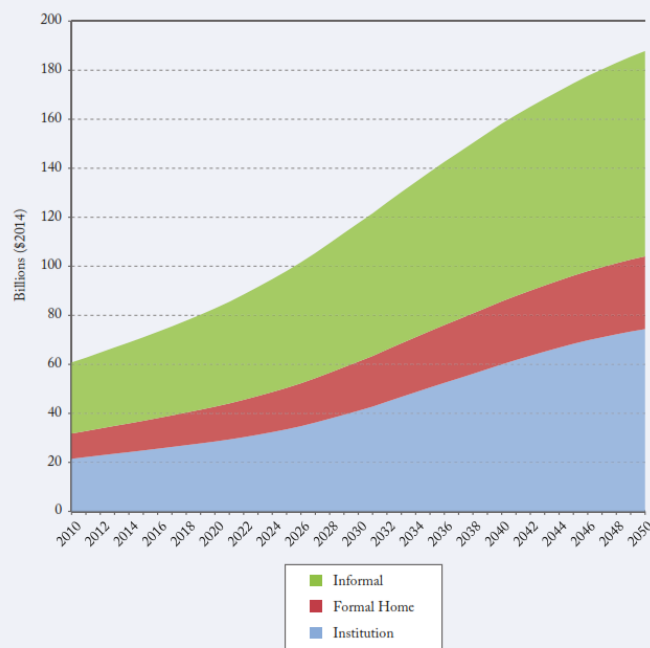


Figure 2. Relative costs between decedents and survivors



# Cost Projections in Canada

Figure 3: LTC Costs Projections (\$2014), By Location of Care, 2010 to 2050



Source: Authors' calculations as described in text.

C. D. Howe (2014)

Table 10.4: Projected "Other Health Spending" of Provinces/Territories, 2012 to 2037, Base Scenario (millions of constant 2012 dollars)

Years	Newfoundland & Labrador	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Yukon	Northwest Territories	Nunavut	Canada	% of GDP
2012	377	137	588	452	4,746	9,031	1,020	960	2,810	3,943	66	64	124	24,318	1.5%
2013	378	138	591	455	4,780	9,123	1,029	967	2,839	3,987	66	64	125	24,543	1.4%
2014	379	139	595	457	4,815	9,215	1,039	973	2,868	4,031	66	65	125	24,767	1.4%
2015	381	140	598	459	4,849	9,308	1,048	979	2,897	4,076	67	65	127	24,994	1.4%
2016	382	142	602	462	4,882	9,401	1,057	986	2,925	4,121	67	66	128	25,220	1.4%
2017	383	143	605	464	4,916	9,495	1,066	992	2,954	4,165	67	66	129	25,446	1.4%
2018	385	144	608	467	4,948	9,587	1,075	999	2,983	4,209	68	67	131	25,671	1.4%
2019	386	145	611	469	4,980	9,679	1,084	1,005	3,010	4,253	78	67	132	25,892	1.4%
2020	388	146	615	471	5,011	9,771	1,093	1,011	3,038	4,297	68	67	133	26,111	1.4%
2021	389	147	618	474	5,043	9,864	1,103	1,018	3,066	4,341	69	68	134	26,333	1.4%
2022	390	148	621	476	5,073	9,957	1,112	1,024	3,093	4,386	69	68	135	26,553	1.4%
2023	392	150	624	478	5,103	10,049	1,121	1,030	3,120	4,430	70	69	136	26,773	1.3%
2024	393	151	627	480	5,134	10,143	1,130	1,037	3,147	4,474	70	69	137	26,992	1.3%
2025	394	152	631	482	5,163	10,235	1,139	1,043	3,175	4,518	70	70	139	27,211	1.3%
2026	395	153	633	485	5,192	10,328	1,148	1,049	3,201	4,563	71	70	139	27,428	1.3%
2027	396	154	636	487	5,221	10,420	1,157	1,056	3,228	4,607	71	71	139	27,644	1.3%
2028	398	155	639	489	5,250	10,512	1,167	1,062	3,255	4,651	72	71	141	27,861	1.3%
2029	399	156	642	491	5,278	10,603	1,176	1,068	3,282	4,696	72	72	142	28,075	1.3%
2030	400	157	645	492	5,306	10,695	1,185	1,075	3,309	4,740	72	72	143	28,291	1.3%
2031	401	158	648	494	5,334	10,787	1,194	1,081	3,336	4,785	73	73	144	28,508	1.3%
2032	402	159	651	496	5,362	10,881	1,204	1,088	3,363	4,829	73	73	144	28,726	1.3%
2033	403	160	653	498	5,390	10,974	1,213	1,095	3,390	4,874	74	74	145	28,943	1.3%
2034	404	161	656	500	5,418	11,066	1,223	1,101	3,417	4,919	74	74	147	29,161	1.2%
2035	406	162	659	502	5,445	11,159	1,232	1,108	3,444	4,963	75	75	148	29,378	1.2%
2036	407	163	662	504	5,472	11,251	1,242	1,115	3,471	5,007	75	75	149	29,593	1.2%
2037	408	164	665	506	5,500	11,345	1,252	1,122	3,498	5,052	75	76	151	29,812	1.2%

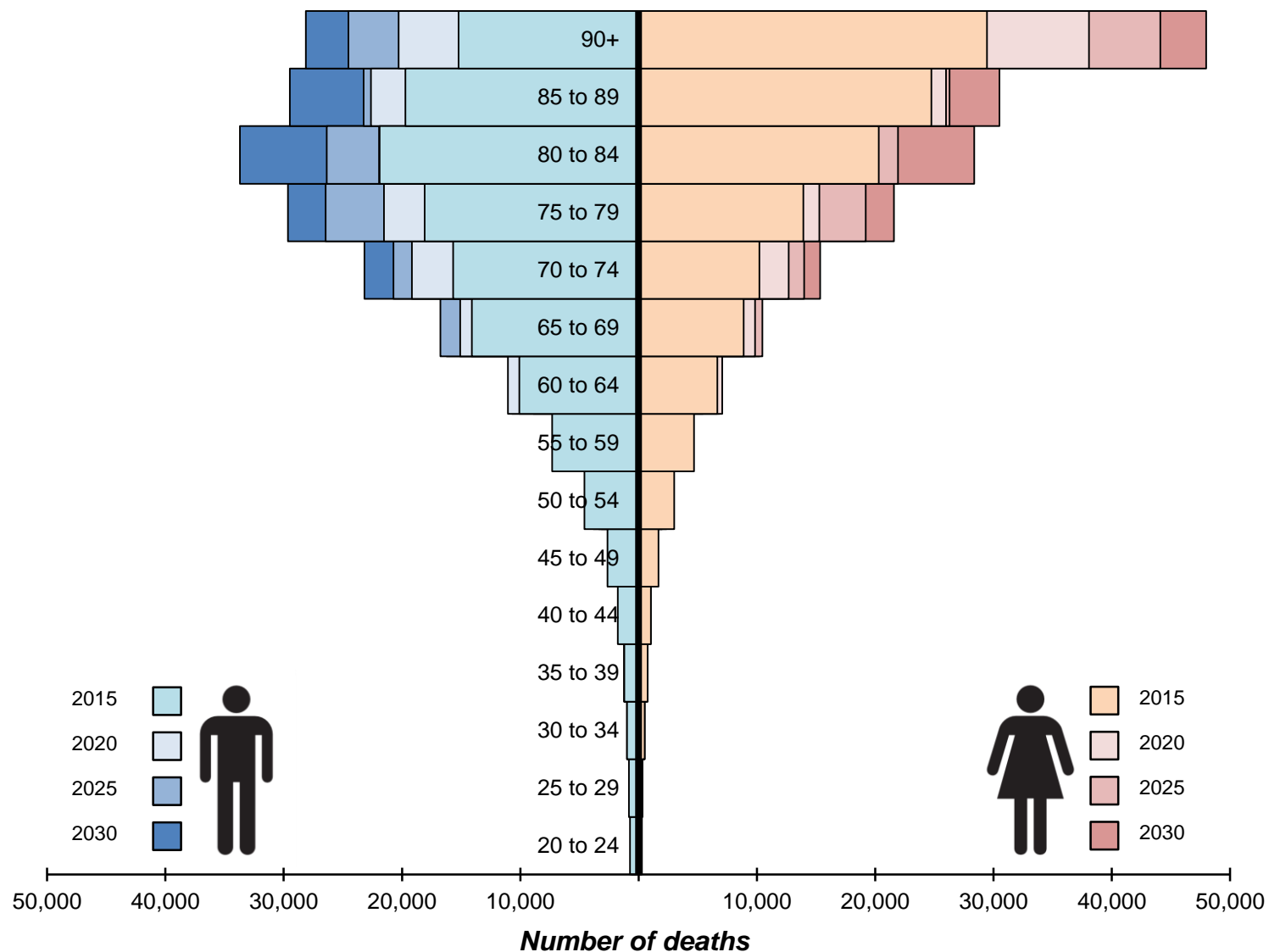
Source: CIHI, 2012b and calculations by the author.

Canadian Institute of Actuaries (2014)

- EOL care costs were estimated from a 3-year decedent cohort (March 31, 2010 – April 1, 2013) in Ontario.
- Costs were stratified by age (5-year age groups), sex, and types of health care service.
- Mortality counts were obtained from Statistics Canada's microsimulation model, POpulation HHealth Model (POHEM).
- Projected total cost for 9 types of health services from 2015 to 2030.

- POpulation HEalth Model (POHEM)
  - POHEM is a microsimulation model, developed by Statistics Canada.
  - Simulates transitions (e.g., education, employment, region of residence, etc.) from birth to death, for each case (i.e., person) in the population.
  - Mortality in the Canadian population (age 20+) was simulated to 2030.

Figure 3. Projected mortality in the Canadian population





- Created a cohort of decedents from the Ontario Registered Persons Database (RPDB)
  - Deaths between April 1, 2010 and March 30, 2013
- Costs of various publicly-funded services were derived using top-down, as well as bottom-up approaches using data housed at ICES (Wodchis et al., 2013).
- We adjusted Ontario costs to reflect the average health care spending at the national level, by comparing the 3-year (2010 to 2012) average in per capita public-sector health expenditure in Ontario versus all of Canada (NHES).

Table 1. Data @ ICES		Database	Description
<b>Continuing Care</b>			
Long-Term Care (Facilities)	Continuing Care Reporting System (CCRS)	Resident information for over 600 publicly-funded residential care homes with 24-hour nursing care.	
Complex Continuing Care	CCRS	Hospitalized patients who are deemed to be in a non-acute state.	
Home Care	Home Care Database (HCD)	Data from the Ontario Association of Community Care Access Centers (OACCAC), responsible for coordinating publicly-funded home care services.	
Rehabilitation (Facilities)	National Rehabilitation Reporting System (NRS)	Data from participating adult in-patient rehabilitation facilities and programs across Ontario.	
<b>Acute Care</b>			
In-patient Care	CIHI-DAD*	Administrative, clinical, and demographic data on hospital discharges.	
Emergency Department	National Ambulatory Care Reporting System (NACRS)	Records of emergency department visits.	
<b>Outpatient Care</b>			
Physician Billings	Ontario Health Insurance Plan (OHIP) Claims Database	Claims data for physicians in Ontario, which includes claims in both in-patient and outpatient settings.	
Drugs/Devices	Ontario Drug Benefit (ODB), Assistive Devices Program (ADP)	Drugs for individuals who are over 65 years, on social assistance, residents of LTC homes, home care recipients, eligible for the Trillium Drug Program, and special drugs program recipients qualified for assistance. ADP provides financial assistance towards select medically-necessary devices, such as home oxygen and respiratory devices, wheelchairs/mobility aids, etc.	
<b>Other Outpatient Services</b>			
Non-Physician Billings	OHIP	Health professionals for provincially insured services, such as select midwives, oral surgeons, chiropractors, optometrists, and physiotherapists. Some care may have been delivered in hospitals.	
Outpatient Clinics	NACRS	Outpatient visits held in hospitals, including dialysis clinics and cancer care clinics.	
Laboratory Services	OHIP	Outpatient laboratory services. Does not include laboratory services for in-patients.	

**Note:**

\*CIHI-DAD = Canadian Institute for Health Information-Discharge Abstract Database

Table 2. Per-decedent cost in the last year of life (Ontario)			Males					Females		
	N	mean		Q1 <sup>1</sup>	Q3	N	mean		Q1	Q3
Age										
20 to 29 years	1,279	\$30,180		\$440	\$27,360	708	\$49,550		\$1,060	\$59,060
30 to 39 years	1,705	\$39,750		\$700	\$50,050	1,286	\$56,020		\$4,980	\$74,860
40 to 49 years	4,548	\$45,170		\$1,580	\$61,290	3,572	\$61,010		\$11,200	\$81,560
50 to 59 years	11,811	\$51,100		\$6,530	\$68,890	8,718	\$61,660		\$17,310	\$79,030
60 to 69 years	20,715	\$56,460		\$13,820	\$73,580	14,731	\$61,630		\$21,240	\$79,650
70 to 79 years	30,907	\$57,870		\$19,790	\$72,140	24,555	\$59,000		\$22,640	\$73,830
80 to 89 years	41,272	\$53,990		\$22,530	\$67,530	47,685	\$51,890		\$24,190	\$64,870
≥ 90 years	14,554	\$48,920		\$22,710	\$61,450	32,625	\$47,860		\$28,490	\$59,320
Use by service type			(% of total)					(% of total)		
All health services	126,791	\$53,740		\$17,350	\$68,100	133,880	\$54,190		\$23,390	\$66,350
Continuing care sectors										
Long-term care (facilities)		\$5,480	(10.2%)	\$0	\$0		\$11,270	(20.8%)	\$0	\$24,280
Home care		\$4,210	(7.8%)	\$0	\$5,090		\$4,670	(8.6%)	\$0	\$5,740
Complex continuing care		\$3,560	(6.6%)	\$0	\$0		\$3,430	(6.3%)	\$0	\$0
Rehabilitation (facilities)		\$960	(1.8%)	\$0	\$0		\$850	(1.6%)	\$0	\$0
Acute care sectors										
In-patient hospital stays		\$25,100	(46.7%)	\$1,920	\$29,770		\$20,950	(38.7%)	\$0	\$25,300
Emergency dept. visits		\$1,360	(2.5%)	\$540	\$1,880		\$1,220	(2.3%)	\$200	\$1,720
Outpatient care sectors										
Physician billings		\$5,750	(10.7%)	\$2,100	\$7,650		\$5,010	(9.2%)	\$1,820	\$6,550
Drugs <sup>2</sup> /devices		\$2,930	(5.4%)	\$510	\$3,700		\$3,030	(5.6%)	\$850	\$3,890
Other <sup>3</sup>		\$4,400	(8.2%)	\$120	\$2,210		\$3,750	(6.9%)	\$180	\$2,090

Notes:

Summary statistics were based on all recorded deaths in Ontario between April 1, 2010 and March 31, 2013.

All monetary values are in 2013 constant dollars.

1. Q1 and Q3 represent the 25th and 75th percentiles, respectively, in the distribution of per decedent spending.

2. Public expenditure on drugs were obtained from the ODB, which only covers individuals who are over 65 years of age, on social assistance, residents of LTC facilities, home care clients, eligible recipients under the Trillium Drug Program, and qualifying recipients for other special drugs programs.

3. “Other” = includes non-physician OHIP billings, outpatient clinics, and spending on laboratory tests.

# RESULTS

Figure 4a. Projected total cost in the last year of life, Canadian males

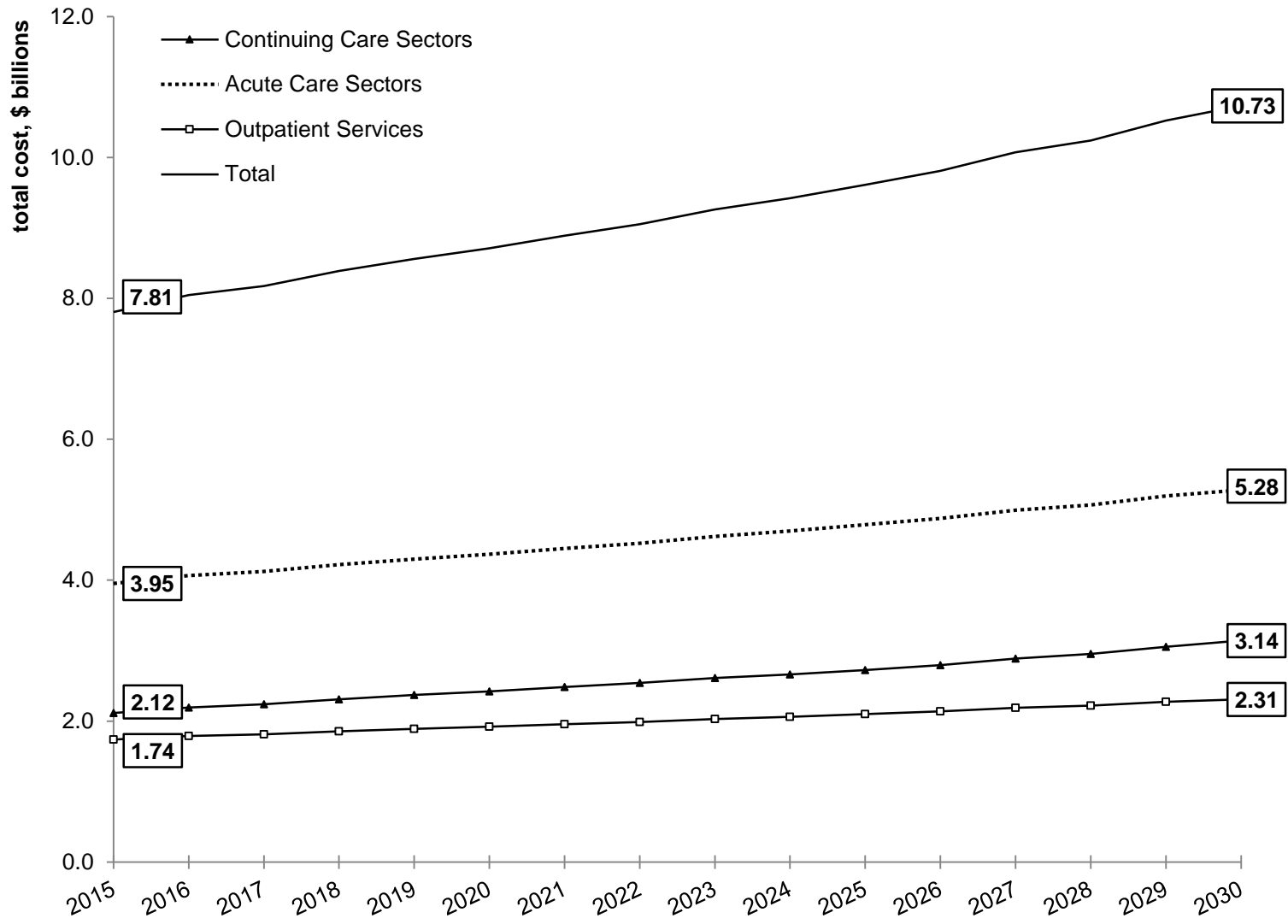


Figure 4b. Projected total cost in the last year of life, Canadian females

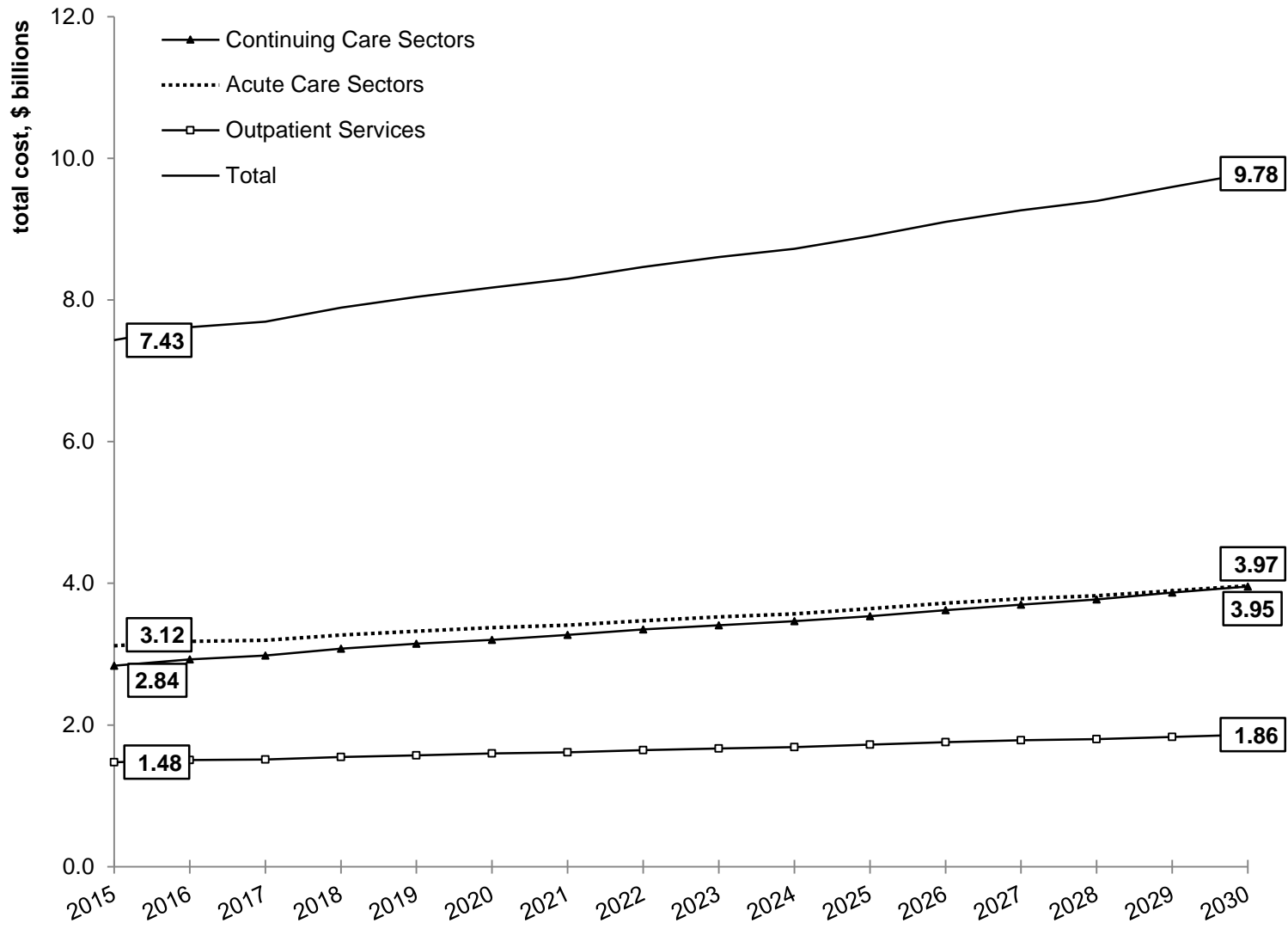


Table 3: Projected total public spending on health services in the last year of life	Total public spending on health care (\$ millions)				Change in total public spending on health care (2015 to 2030)	
	2015	2020	2025	2030	Annual	Total
All Health Services	15,239.9	16,888.3	18,510.4	20,517.5	350.0 (2.0% <sup>1</sup> )	5,277.5 (34.6% <sup>2</sup> )
Continuing Care						
Long-term care (facilities)	2,349.6	2,724.3	3,066.0	3,517.2	77.6 (2.8%)	1,167.6 (49.7%)
Complex continuing care	1,002.9	1,121.1	1,238.6	1,398.2	26.1 (2.2%)	395.3 (39.4%)
Home care	1,340.8	1,488.5	1,634.1	1,816.7	31.6 (2.1%)	475.9 (35.5%)
Rehabilitation (facilities)	261.5	290.8	321.8	363.8	6.7 (2.2%)	102.3 (39.1%)
Acute Care						
In-patient hospital stays	6,699.6	7,333.2	7,978.5	8,751.2	135.9 (1.8%)	2,051.6 (30.6%)
ED <sup>3</sup> visit	373.1	411.3	449.6	497.8	8.3 (1.9%)	124.8 (33.4%)
Outpatient Services						
Physician billings	1,291.0	1,413.7	1,536.8	1,683.4	26.0 (1.8%)	392.4 (30.4%)
Drugs <sup>4</sup> /Devices	781.9	868.4	956.1	1,066.0	18.8 (2.1%)	284.1 (36.3%)
Other <sup>5</sup>	1,139.6	1,237.2	1,329.0	1,423.1	19.0 (1.5%)	283.5 (24.9%)

**Notes:**

The sum of costs from individual services may not be identical to reported total due to rounding.

Estimates are based on the medium life expectancy scenario simulated in POHEM.

1. The annual percentage change in cost.

2. The proportional change in cost between 2015 and 2030.

3. ED = Emergency department.

4. Public expenditure on drugs were obtained from the Ontario Drug Benefit Program, which only covers individuals who are over 65 years of age, on social assistance, residents of LTC facilities, home care clients, eligible recipients under the Trillium Drug Program, and qualifying recipients for other special drugs programs.

5. "Other" outpatient services include non-physician OHIP billings, outpatient clinics, and laboratory tests.

Figure 5. Change in projected per-decedent cost (from 2015)

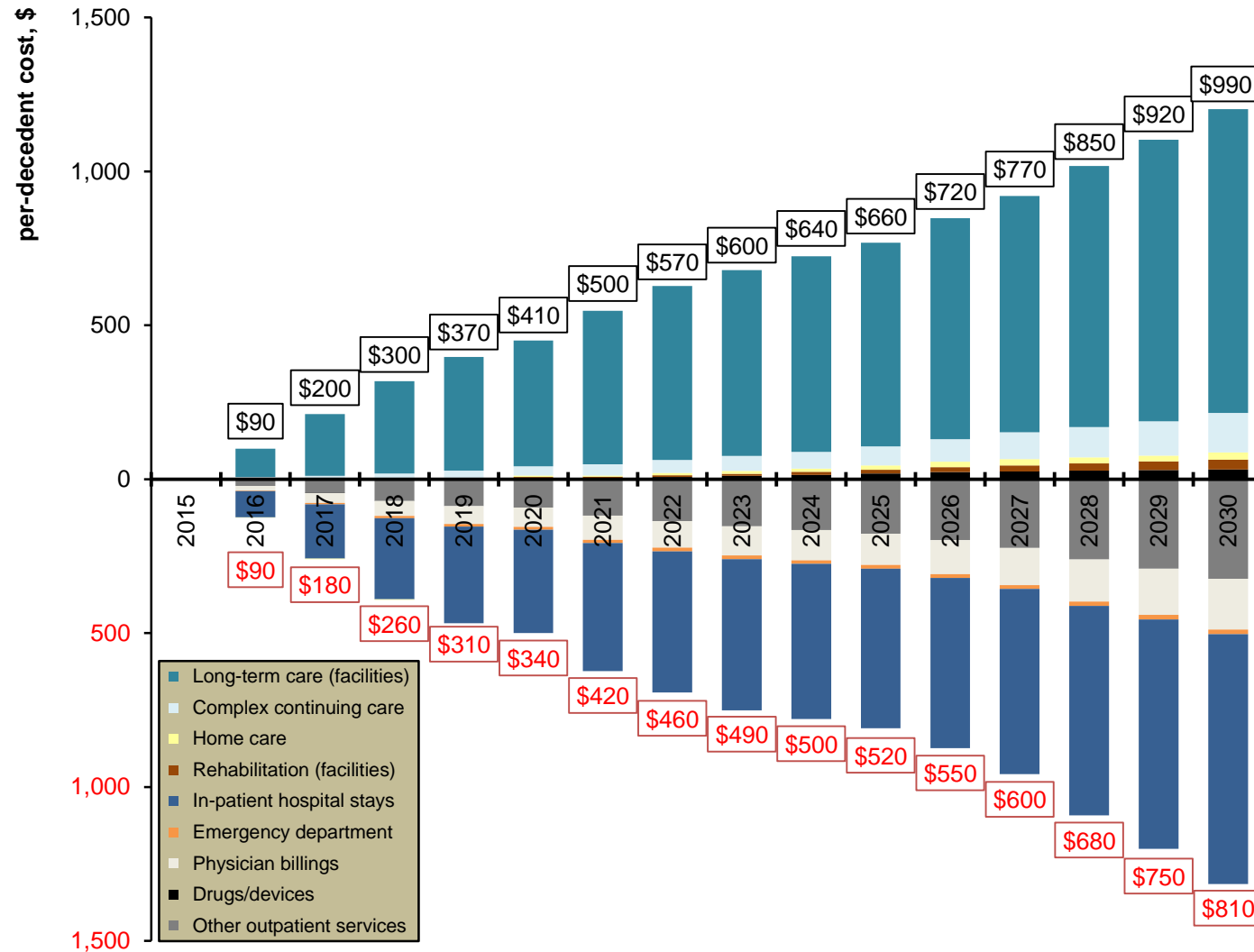
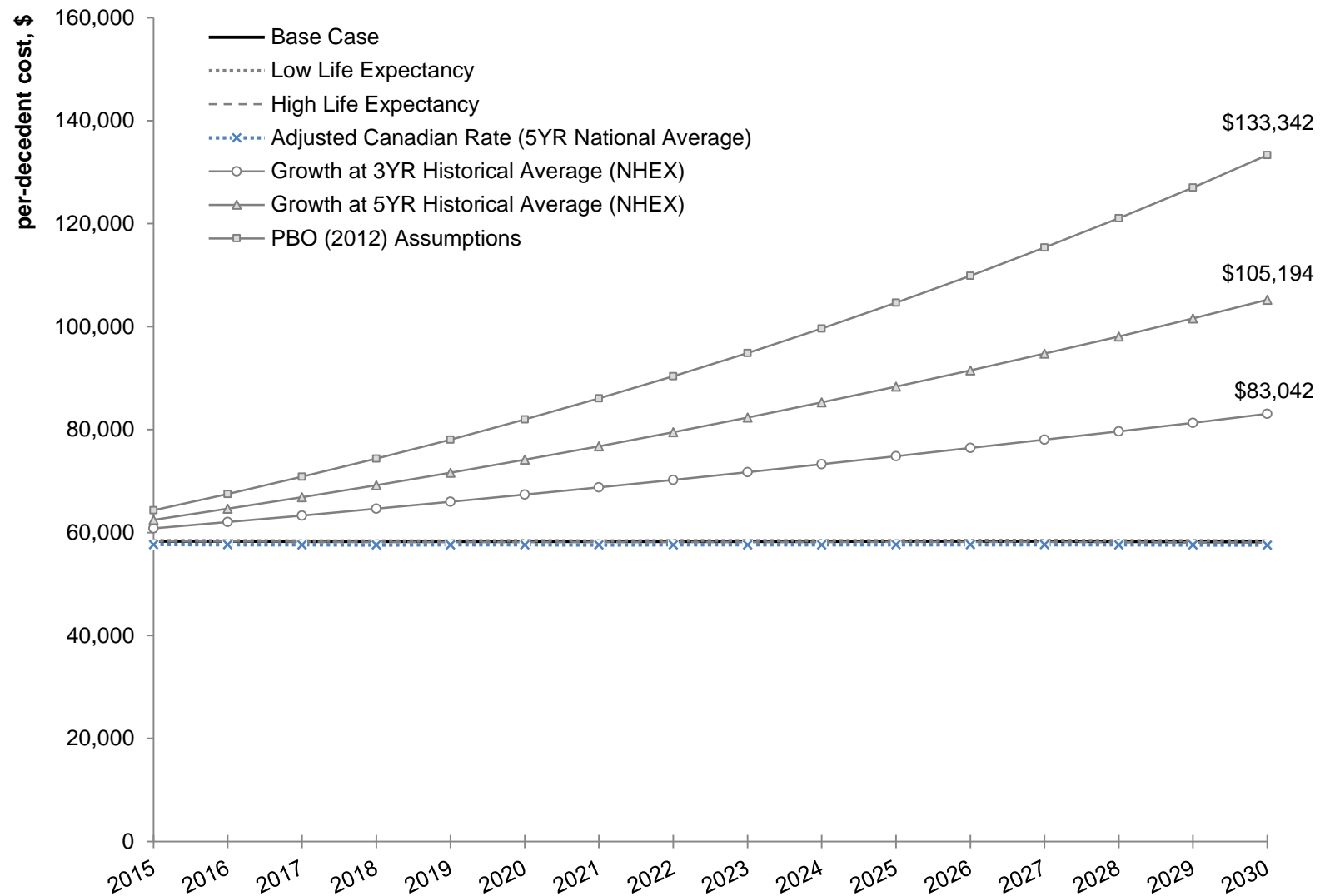




Figure 6. Projected per-decedent cost in the last year of life



# Figure 7. Sensitivity analysis of projection assumptions



# Summary of Findings (1)

- Overall cost on health care at the EOL will increase proportionally with the number of deaths over the projection horizon (2% annually).
- At the individual level, demographic changes were associated with a 0.01% annual decline in total cost. Much of this trend may be explained by the relatively lower utilization rate in acute care settings, particularly among those over the age of 85.

# Summary of Findings (2)

- Per-decedent cost on facility-based LTC increases at a greater rate than other health services (at 0.7% per decedent, per year).
- Spending on care provided in LTC facilities will likely exceed costs associated with in-patient care.
- The impacts of varying life expectancy assumptions and were less than 1%. Other economic factors (e.g., growth in medical costs beyond general inflation) proved to be the most significant cost driver (up to 129% from base case).

- Key assumption: Current supply remains constant. What if future supply (e.g., supply of LTC beds) does not meet future demands?
- Cost declines from reduced use of acute care at the EOL may not be visible without parallel re-structuring in the continuing care sector, towards the delivery of health care towards the EOL in more cost-effective settings.
- Future research involving POHEM could explore the impact of changes to disease incidences, or disease-specific mortality rates in the population on health care spending.

# Acknowledgement

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# SUPPLEMENTAL MATERIAL

Table S1: Projected cost of health care use in the last year of life among Canadians (2013 dollars)	Per-decedent cost				Change in per-decedent cost (2015 to 2030)	
	2015	2020	2025	2030	Annual	Total
All Health Services	58,340	58,290	58,300	58,230	-10 (-0.01% <sup>1</sup> )	-110 (-0.19% <sup>2</sup> )
Continuing Care						
Long-term care (facilities)	9,000	9,400	9,660	9,980	70 (0.72%)	990 (10.97%)
Complex continuing care	3,840	3,870	3,900	3,970	10 (0.21%)	130 (3.35%)
Home care	5,130	5,140	5,150	5,160	≤ 10 (0.03%)	20 (0.45%)
Rehabilitation (facilities)	1,000	1,000	1,010	1,030	≤ 10 (0.19%)	30 (3.15%)
Acute Care						
In-patient hospital stays	25,650	25,310	25,130	24,840	-60 (-0.22%)	-810 (-3.16%)
ED <sup>3</sup> visit	1,430	1,420	1,420	1,410	≤ -10 (-0.08%)	-20 (-1.07%)
Outpatient Services						
Physician billings	4,940	4,880	4,840	4,780	≤ -10 (-0.23%)	-170 (-3.33%)
Drugs <sup>4</sup> /Devices	2,990	3,000	3,010	3,030	≤ 10 (0.07%)	30 (1.07%)
Other <sup>5</sup>	4,360	4,270	4,190	4,040	-20 (-0.50%)	-320 (-7.42%)

**Notes:**

All monetary values are in 2013 constant dollars and rounded to the nearest ten dollars.

The sum of costs from individual services may not be identical to reported total due to rounding.

Estimates are based on the medium life expectancy scenario simulated in POHEM.

1. The annual percentage change in cost.

2. The proportional change in cost between 2015 and 2030.

3. ED = Emergency department.

4. Public expenditure on drugs were obtained from the Ontario Drug Benefit Program, which only covers individuals who are over 65 years of age, on social assistance, residents of LTC facilities, home care clients, eligible recipients under the Trillium Drug Program, and qualifying recipients for other special drugs programs.

5. "Other" outpatient services include non-physician OHIP billings, outpatient clinics, and laboratory tests.



# Table S2. Sensitivity of projection assumptions

Scenario	Life expectancy assumption	Price inflation assumption	Change in per decedent cost from base case in 2030
Base Case [1]	Medium life expectancy	Adjusted Ontario spending to match national means, using ratios of per capita public-sector health expenditure from NHEX, averaged across 3 years (2010 to 2012)	---
2	Low life expectancy	Adjusted Ontario spending to match national means, using ratios of per capita public-sector health expenditure from NHEX, averaged across 3 years (2010 to 2012)	\$140 (0.2% <sup>1</sup> )
3	High life expectancy	Adjusted Ontario spending to match national means, using ratios of per capita public-sector health expenditure from NHEX, averaged across 3 years (2010 to 2012)	-\$140 (-0.2%)
4	Medium life expectancy	Adjusted Ontario spending to match national means, using ratios of per capita public-sector health expenditure from NHEX, averaged across 5 years (2008 to 2012)	-\$660 (-1.1%)
5	Medium life expectancy	Projected growth in spending based on 3-year (2010 to 2012) historical average in public-sector health expenditure in Canada (NHEX)	\$24,810 (42.6%)
6	Medium life expectancy	Projected growth in spending based on 5-year (2008 to 2012) historical average in public-sector health expenditure in Canada (NHEX)	\$46,960 (80.7%)
7	Medium life expectancy	Projection based on PBO (2012) assumptions, and where real GDP per capita growth was assumed to be 0.9% annually	\$75,110 (129.0%)

**Note:** All monetary values are in 2013 constant dollars.

Figure S1. Comparison of POHEM to official population projections from Statistics Canada (STC), 2011 to 2030

