

# **Online Resources File – Incremental costs of fragility fractures: a population-based matched-cohort study from Ontario, Canada**

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**Online Resource Table 1 Diagnosis codes for fragility fractures and trauma codes**

<b>Category</b>	<b>ICD-10 Code</b>
Fracture site	
Hip	S72.0, S72.1, S72.2
Radius and Ulna	S52.0, S52.1, S52.2, S52.3, S52.4, S52.7, S52.8, S52.9
Wrist	S52.5, S52.6
Humerus/ Shoulder	S42.2, S42.3, S42.4, S42.8, S42.9
Vertebral	S22.0, S22.1, S32.0
Femur	S72.3, S72.4, S72.7, S72.8, S72.9
Other (tibia, fibula, knee)	S82.0, S82.1, S82.2, S82.3, S82.4, S82.5, S82.6
Sternum, Clavicle and Ribs	S22.2, S22.3, S22.4, S42.0
Pelvis	S32.1, S32.2, S32.3, S32.4, S32.5, S32.7, S32.8
Multiple sites	S42.7, T02.1, T02.2, T02.3, T02.4, T02.5, T02.6, T02.7, T02.8, T02.9
Trauma	
Accidents	V01-V99, X00-X58, X59.9, W20-W99
Injuries involving multiple body regions	T00-T01, T03-T07
Falls	W02-W04, W09, W11-W17

**Online Resource Table 2 ICES Health Services Datasets**

Dataset	Description
CCRS - Continuing Care Reporting System	The CCRS database is compiled by the Canadian Institute for Health Information and contains demographic, clinical, functional, and resource utilization information for individuals receiving facility-based continuing care (also known as extended, auxiliary, or complex chronic care) in Ontario hospitals and residential care providing 24 hour nursing services (i.e. nursing home). Clinical assessment data (on the physical, functional, cognitive, and social domains of health) is ascertained using the Resident Assessment Instrument Minimum Data Set (RAI-MDS) version 2.0 which is administered by trained healthcare professionals.
CIHI DAD - Discharge Abstract Database	The DAD is compiled by the Canadian Institute for Health Information and contains administrative, clinical (diagnoses and procedures/interventions), demographic, and administrative information for all admissions to acute care hospitals, rehab, chronic, and day surgery institutions in Ontario. At ICES, consecutive DAD records are linked together to form ‘episodes of care’ among the hospitals to which patients have been transferred after their initial admission.
CIHI SDS - Same Day Surgery Database	The SDS is compiled by the Canadian Institute for Health Information and contains administrative, clinical (diagnoses and procedures), demographic, and administrative information for all patient visits made to day surgery institutions in Ontario. The main data elements include patient demographics, clinical data (diagnoses, procedures, physician), administrative data (institution/hospital number etc.), financial data, service-specific data elements for day surgery and emergency.
HCDMOH - Home Care Database	The Home Care Database is maintained by Health Shared Services Ontario and is a clinical, client-centered database that captures all home care services provided or coordinated by Local Health

	Integration Networks. This dataset contains information on client, intake, assessment, admission, diagnostic and surgical procedure, and service delivery.
NACRS - National Ambulatory Care Reporting System	The NACRS is compiled by the Canadian Institute for Health Information and contains administrative, clinical (diagnoses and procedures), demographic, and administrative information for all patient visits made to hospital- and community-based ambulatory care centres (emergency departments, day surgery units, hemodialysis units, and cancer care clinics). At ICES, NACRS records are linked with other data sources (DAD, OMHRS) to identify transitions to other care settings, such as inpatient acute care or psychiatric care.
NRS - National Rehabilitation Reporting System	The NRS is compiled by the Canadian Institute for Health Information and contains client data collected from participating adult inpatient rehabilitation facilities and programs across Canada. Main data elements contain socio-demographic information, administrative data (e.g. referral, admission and discharge), health characteristics, activities and participation (e.g. ADL, communication, social interaction), and interventions.
ODB - Ontario Drug Benefit Claims	The ODB database contains prescription medication claims for those covered under the provincial drug program, mainly: those aged 65 years and older, nursing home residents, patients receiving services under the Ontario Home Care program, those receiving social assistance, and residents eligible for specialized drug programs. Main data elements include drug identifier, quantity, # days supplied, date dispensed, cost, and patient, pharmacy and physician identifiers.
OHIP - Ontario Health Insurance Plan Claims Database	The OHIP claims database contains information on inpatient and outpatient services provided to Ontario residents eligible for the province’s publicly funded health insurance system by fee-for-service health care practitioners (primarily physicians) and “shadow

	<p>billings” for those paid through non-fee-for-service payment plans. The main data elements include patient and physician identifiers (encrypted), code for service provided, date of service, associated diagnosis, and fee paid.</p>
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**Online Resource Table 3 Mean  $\pm$  standard deviation (SD) annual cost per patient up to 5 years after index fracture, by site of fracture and healthcare resource use category**

	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Year 4</b>	<b>Year 5</b>	<b>Total Costs</b>
	<b>Mean <math>\pm</math> SD</b>	<b>Mean <math>\pm</math> SD</b>	<b>Mean <math>\pm</math> SD</b>	<b>Mean <math>\pm</math> SD</b>	<b>Mean <math>\pm</math> SD</b>	<b>Mean <math>\pm</math> SD</b>
<b>Hip</b>	<b>N=31,613</b>	<b>N=31,613</b>	<b>N=23,943</b>	<b>N=16,106</b>	<b>N=8,872</b>	<b>N=31,613</b>
CCRS, home care, LTC	20,037 $\pm$ 28,664	11,952 $\pm$ 21,935	10,221 $\pm$ 20,010	8,367 $\pm$ 18,054	6,929 $\pm$ 16,715	45,938 $\pm$ 67,816
Hospitalization	24,625 $\pm$ 26,312	3,869 $\pm$ 13,989	3,155 $\pm$ 11,379	2,551 $\pm$ 10,584	2,127 $\pm$ 9,614	32,780 $\pm$ 35,761
Inpatient rehabilitation	6,922 $\pm$ 10,700	432 $\pm$ 3,277	403 $\pm$ 3,271	307 $\pm$ 2,885	276 $\pm$ 3,360	7,893 $\pm$ 12,749
Prescription drugs	2,194 $\pm$ 3,503	1,945 $\pm$ 3,757	1,643 $\pm$ 3,434	1,326 $\pm$ 2,880	1,056 $\pm$ 2,385	6,355 $\pm$ 10,350
Other health care services*	9,015 $\pm$ 5,289	2,404 $\pm$ 3,769	2,004 $\pm$ 3,508	1,599 $\pm$ 3,118	1,318 $\pm$ 2,833	14,123 $\pm$ 10,098
<b>All health care services</b>	<b>62,793 <math>\pm</math> 44,438</b>	<b>20,602 <math>\pm</math> 30,650</b>	<b>17,426 <math>\pm</math> 27,974</b>	<b>14,150 <math>\pm</math> 25,631</b>	<b>11,707 <math>\pm</math> 23,763</b>	<b>107,088 <math>\pm</math> 89,833</b>
<b>Humerus</b>	<b>N=13,237</b>	<b>N=13,237</b>	<b>N=10,062</b>	<b>N=6,657</b>	<b>N=3,703</b>	<b>N=13,237</b>
CCRS, home care, LTC	9,766 $\pm$ 20,256	6,887 $\pm$ 17,018	6,475 $\pm$ 16,079	6,328 $\pm$ 16,550	5,844 $\pm$ 14,890	26,392 $\pm$ 52,402
Hospitalization	9,328 $\pm$ 20,568	3,904 $\pm$ 13,199	3,732 $\pm$ 15,212	3,493 $\pm$ 15,149	3,056 $\pm$ 14,984	18,679 $\pm$ 34,968
Inpatient rehabilitation	1,090 $\pm$ 5,374	492 $\pm$ 3,715	455 $\pm$ 3,507	379 $\pm$ 3,079	333 $\pm$ 2,778	2,211 $\pm$ 8,140
Prescription drugs	2,054 $\pm$ 3,203	1,957 $\pm$ 3,618	1,859 $\pm$ 3,793	1,737 $\pm$ 4,004	1,520 $\pm$ 3,310	6,723 $\pm$ 11,039
Other health care services*	6,154 $\pm$ 4,856	2,790 $\pm$ 3,960	2,510 $\pm$ 3,955	2,274 $\pm$ 3,796	1,994 $\pm$ 3,672	12,554 $\pm$ 10,635
<b>All health care services</b>	<b>28,391 <math>\pm</math> 36,838</b>	<b>16,029 <math>\pm</math> 26,922</b>	<b>15,031 <math>\pm</math> 27,689</b>	<b>14,210 <math>\pm</math> 27,980</b>	<b>12,748 <math>\pm</math> 26,158</b>	<b>66,559 <math>\pm</math> 80,114</b>
<b>Vertebral</b>	<b>N=7,721</b>	<b>N=7,721</b>	<b>N=5,805</b>	<b>N=3,887</b>	<b>N=2,072</b>	<b>N=7,721</b>
CCRS, home care, LTC	11,990 $\pm$ 21,382	9,373 $\pm$ 19,538	9,139 $\pm$ 19,502	8,376 $\pm$ 17,987	7,620 $\pm$ 18,479	34,495 $\pm$ 59,260
Hospitalization	17,023 $\pm$ 31,607	5,166 $\pm$ 16,827	4,228 $\pm$ 13,048	3,518 $\pm$ 11,453	3,222 $\pm$ 12,100	28,003 $\pm$ 42,901
Inpatient rehabilitation	2,616 $\pm$ 8,637	583 $\pm$ 3,913	518 $\pm$ 3,533	403 $\pm$ 3,352	483 $\pm$ 3,514	3,921 $\pm$ 11,120
Prescription drugs	2,438 $\pm$ 3,598	2,208 $\pm$ 3,700	2,074 $\pm$ 5,314	1,913 $\pm$ 6,444	1,940 $\pm$ 14,994	7,689 $\pm$ 17,741
Other health care services*	6,834 $\pm$ 5,946	3,072 $\pm$ 4,310	2,616 $\pm$ 4,026	2,208 $\pm$ 3,882	1,928 $\pm$ 3,666	13,501 $\pm$ 11,457
<b>All health care services</b>	<b>40,900 <math>\pm</math> 47,837</b>	<b>20,401 <math>\pm</math> 31,970</b>	<b>18,575 <math>\pm</math> 29,668</b>	<b>16,418 <math>\pm</math> 27,786</b>	<b>15,193 <math>\pm</math> 31,425</b>	<b>87,609 <math>\pm</math> 93,841</b>
<b>Wrist</b>	<b>N=17,859</b>	<b>N=17,859</b>	<b>N=13,585</b>	<b>N=9,069</b>	<b>N=5,032</b>	<b>N=17,859</b>
CCRS, home care, LTC	4,424 $\pm$ 12,335	4,286 $\pm$ 12,905	4,453 $\pm$ 13,146	4,739 $\pm$ 13,542	4,493 $\pm$ 13,355	15,770 $\pm$ 40,706

Hospitalization	4,567 ± 13,905	2,898 ± 10,800	2,722 ± 10,098	2,761 ± 11,510	2,389 ± 10,529	11,611 ± 25,080
Inpatient rehabilitation	586 ± 4,736	318 ± 2,906	313 ± 2,776	364 ± 3,217	277 ± 2,458	1,405 ± 6,810
Prescription drugs	1,751 ± 5,298	1,737 ± 5,410	1,673 ± 3,415	1,569 ± 3,129	1,517 ± 3,332	5,985 ± 13,387
Other health care services*	5,212 ± 3,997	2,516 ± 3,612	2,356 ± 3,423	2,232 ± 3,458	2,066 ± 3,454	11,236 ± 9,572
<b>All health care services</b>	<b>16,541 ± 25,687</b>	<b>11,755 ± 22,304</b>	<b>11,518 ± 21,587</b>	<b>11,666 ± 22,941</b>	<b>10,742 ± 21,772</b>	<b>46,008 ± 63,629</b>
<b>Pelvis</b>	<b>N=8,328</b>	<b>N=8,328</b>	<b>N=6,210</b>	<b>N=4,140</b>	<b>N=2,242</b>	<b>N=8,328</b>
CCRS, home care, LTC	15,579 ± 23,450	10,153 ± 19,445	9,074 ± 18,396	8,385 ± 19,375	7,456 ± 17,769	38,674 ± 59,406
Hospitalization	16,651 ± 21,033	4,428 ± 13,724	3,542 ± 12,313	2,951 ± 12,933	2,476 ± 9,546	25,854 ± 32,665
Inpatient rehabilitation	4,583 ± 9,851	532 ± 4,240	465 ± 3,554	394 ± 3,333	345 ± 2,764	5,750 ± 12,492
Prescription drugs	2,263 ± 3,336	2,050 ± 3,551	1,804 ± 3,808	1,588 ± 3,686	1,436 ± 3,964	6,834 ± 10,936
Other health care services*	6,274 ± 5,048	2,731 ± 3,927	2,262 ± 3,515	1,899 ± 3,442	1,673 ± 3,134	12,086 ± 10,160
<b>All health care services</b>	<b>45,350 ± 38,572</b>	<b>19,894 ± 29,339</b>	<b>17,146 ± 27,300</b>	<b>15,216 ± 28,400</b>	<b>13,388 ± 25,341</b>	<b>89,198 ± 82,653</b>
<b>Femur</b>	<b>N=3,002</b>	<b>N=3,002</b>	<b>N=2,287</b>	<b>N=1,551</b>	<b>N=821</b>	<b>N=3,002</b>
CCRS, home care, LTC	21,965 ± 32,067	10,223 ± 20,914	8,857 ± 19,695	7,428 ± 18,139	6,718 ± 18,208	44,610 ± 69,827
Hospitalization	25,821 ± 35,846	4,479 ± 17,455	3,466 ± 11,853	3,231 ± 12,205	3,235 ± 13,720	35,494 ± 48,324
Inpatient rehabilitation	5,316 ± 9,493	469 ± 3,244	385 ± 3,068	284 ± 2,556	225 ± 1,990	6,286 ± 11,195
Prescription drugs	2,387 ± 5,160	2,197 ± 5,328	1,911 ± 3,614	1,833 ± 5,602	1,701 ± 6,324	7,451 ± 14,892
Other health care services*	10,001 ± 5,858	2,760 ± 4,186	2,418 ± 3,894	2,103 ± 3,932	1,871 ± 3,774	16,202 ± 12,092
<b>All health care services</b>	<b>65,490 ± 54,116</b>	<b>20,127 ± 32,817</b>	<b>17,036 ± 27,931</b>	<b>14,879 ± 27,294</b>	<b>13,749 ± 29,294</b>	<b>110,043 ± 101,049</b>
<b>Clavicle, ribs and sternum</b>	<b>N=14,559</b>	<b>N=14,559</b>	<b>N=10,781</b>	<b>N=7,086</b>	<b>N=3,840</b>	<b>N=14,559</b>
CCRS, home care, LTC	7,304 ± 16,391	6,465 ± 15,385	6,079 ± 15,230	5,841 ± 14,818	5,236 ± 15,118	22,494 ± 45,200
Hospitalization	10,660 ± 22,608	4,781 ± 17,065	3,954 ± 17,104	3,398 ± 13,544	2,683 ± 9,538	20,730 ± 38,702
Inpatient rehabilitation	1,246 ± 5,981	520 ± 4,160	386 ± 3,081	366 ± 3,324	374 ± 3,791	2,329 ± 8,870
Prescription drugs	2,198 ± 4,199	2,042 ± 4,188	1,831 ± 3,866	1,651 ± 3,960	1,484 ± 3,955	6,791 ± 12,389
Other health care services*	5,557 ± 5,352	3,090 ± 4,337	2,642 ± 3,937	2,310 ± 3,745	1,971 ± 3,316	12,248 ± 11,001

<b>All health care services</b>	<b>26,965 ± 36,737</b>	<b>16,898 ± 29,478</b>	<b>14,892 ± 28,336</b>	<b>13,566 ± 25,592</b>	<b>11,748 ± 23,412</b>	<b>64,593 ± 77,566</b>
<b>Radius and ulna</b>	<b>N=4,828</b>	<b>N=4,828</b>	<b>N=3,655</b>	<b>N=2,443</b>	<b>N=1,274</b>	<b>N=4,828</b>
CCRS, home care, LTC	5,259 ± 13,266	4,663 ± 12,892	4,448 ± 11,989	4,323 ± 12,964	3,880 ± 11,673	16,501 ± 38,296
Hospitalization	6,628 ± 18,235	3,191 ± 11,357	3,238 ± 11,385	2,421 ± 9,128	2,320 ± 9,563	14,107 ± 27,927
Inpatient rehabilitation	801 ± 4,926	334 ± 3,060	357 ± 2,909	276 ± 2,557	325 ± 2,755	1,631 ± 6,966
Prescription drugs	1,896 ± 3,137	1,884 ± 3,889	1,830 ± 3,812	1,572 ± 2,692	1,512 ± 3,469	6,359 ± 10,608
Other health care services*	5,671 ± 4,716	2,800 ± 3,800	2,601 ± 3,811	2,290 ± 3,491	2,131 ± 3,538	12,161 ± 10,535
<b>All health care services</b>	<b>20,255 ± 29,462</b>	<b>12,871 ± 22,267</b>	<b>12,474 ± 22,188</b>	<b>10,883 ± 20,784</b>	<b>10,169 ± 20,235</b>	<b>50,759 ± 62,858</b>
<b>Tibia, fibula, knee</b>	<b>N=10,894</b>	<b>N=10,894</b>	<b>N=8,213</b>	<b>N=5,411</b>	<b>N=3,018</b>	<b>N=10,894</b>
CCRS, home care, LTC	8,352 ± 20,131	5,317 ± 15,975	4,906 ± 14,355	4,844 ± 14,651	4,781 ± 15,577	21,098 ± 50,137
Hospitalization	9,159 ± 20,323	3,311 ± 10,904	3,295 ± 12,150	2,915 ± 11,712	2,737 ± 12,209	17,161 ± 31,104
Inpatient rehabilitation	1,320 ± 5,589	318 ± 2,707	349 ± 3,437	300 ± 2,525	266 ± 2,639	2,125 ± 7,700
Prescription drugs	1,978 ± 3,297	1,959 ± 3,926	1,902 ± 3,846	1,762 ± 3,145	1,596 ± 2,926	6,689 ± 11,242
Other health care services*	5,866 ± 4,962	2,746 ± 3,898	2,582 ± 3,783	2,353 ± 3,659	2,149 ± 3,472	12,323 ± 10,831
<b>All health care services</b>	<b>26,676 ± 37,569</b>	<b>13,652 ± 24,819</b>	<b>13,034 ± 24,400</b>	<b>12,173 ± 23,528</b>	<b>11,528 ± 24,321</b>	<b>59,395 ± 77,675</b>
<b>Multiple</b>	<b>N=3,735</b>	<b>N=3,735</b>	<b>N=2,781</b>	<b>N=1,878</b>	<b>N=987</b>	<b>N=3,735</b>
CCRS, home care, LTC	16,670 ± 26,645	9,637 ± 20,525	8,540 ± 19,004	7,113 ± 15,424	6,728 ± 16,632	38,020 ± 62,405
Hospitalization	21,033 ± 31,575	4,097 ± 12,652	3,119 ± 10,293	2,875 ± 10,150	2,121 ± 6,918	29,459 ± 38,936
Inpatient rehabilitation	4,697 ± 10,794	418 ± 2,892	435 ± 3,243	273 ± 2,302	285 ± 2,479	5,652 ± 12,087
Prescription drugs	2,164 ± 3,993	2,000 ± 3,704	1,776 ± 3,256	1,630 ± 4,631	1,365 ± 3,263	6,667 ± 10,911
Other health care services*	8,517 ± 6,180	2,683 ± 3,912	2,188 ± 3,449	1,908 ± 3,299	1,641 ± 3,079	14,222 ± 10,953
<b>All health care services</b>	<b>53,082 ± 50,422</b>	<b>18,835 ± 28,977</b>	<b>16,058 ± 26,364</b>	<b>13,800 ± 23,336</b>	<b>12,140 ± 23,357</b>	<b>94,020 ± 90,011</b>
<b>All fractures</b>	<b>N=115,776</b>	<b>N=115,776</b>	<b>N=87,322</b>	<b>N=58,228</b>	<b>N=31,861</b>	<b>N=115,776</b>
CCRS, home care, LTC	12,221 ± 23,037	8,151 ± 18,360	7,396 ± 17,227	6,701 ± 16,458	5,959 ± 15,828	30,961 ± 57,074
Hospitalization	14,655 ± 24,636	3,907 ± 13,801	3,375 ± 12,759	2,944 ± 12,020	2,533 ± 10,975	23,285 ± 35,634
Inpatient rehabilitation	3,213 ± 8,442	435 ± 3,454	399 ± 3,240	340 ± 3,016	313 ± 3,054	4,206 ± 10,530
Prescription drugs	2,103 ± 3,925	1,959 ± 4,143	1,779 ± 3,762	1,582 ± 3,752	1,414 ± 4,993	6,588 ± 12,086

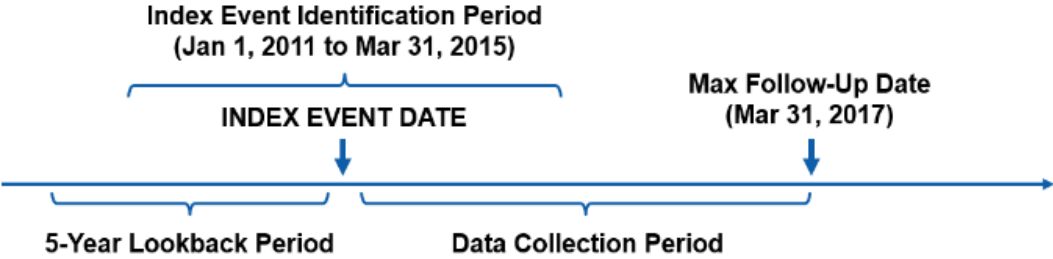


Other health care services*	6,898 ± 5,332	2,687 ± 3,929	2,351 ± 3,696	2,046 ± 3,516	1,794 ± 3,313	12,880 ± 10,535
<b>All health care services</b>	<b>39,089 ± 43,272</b>	<b>17,139 ± 28,292</b>	<b>15,300 ± 26,655</b>	<b>13,613 ± 25,507</b>	<b>12,013 ± 24,489</b>	<b>77,921 ± 84,825</b>

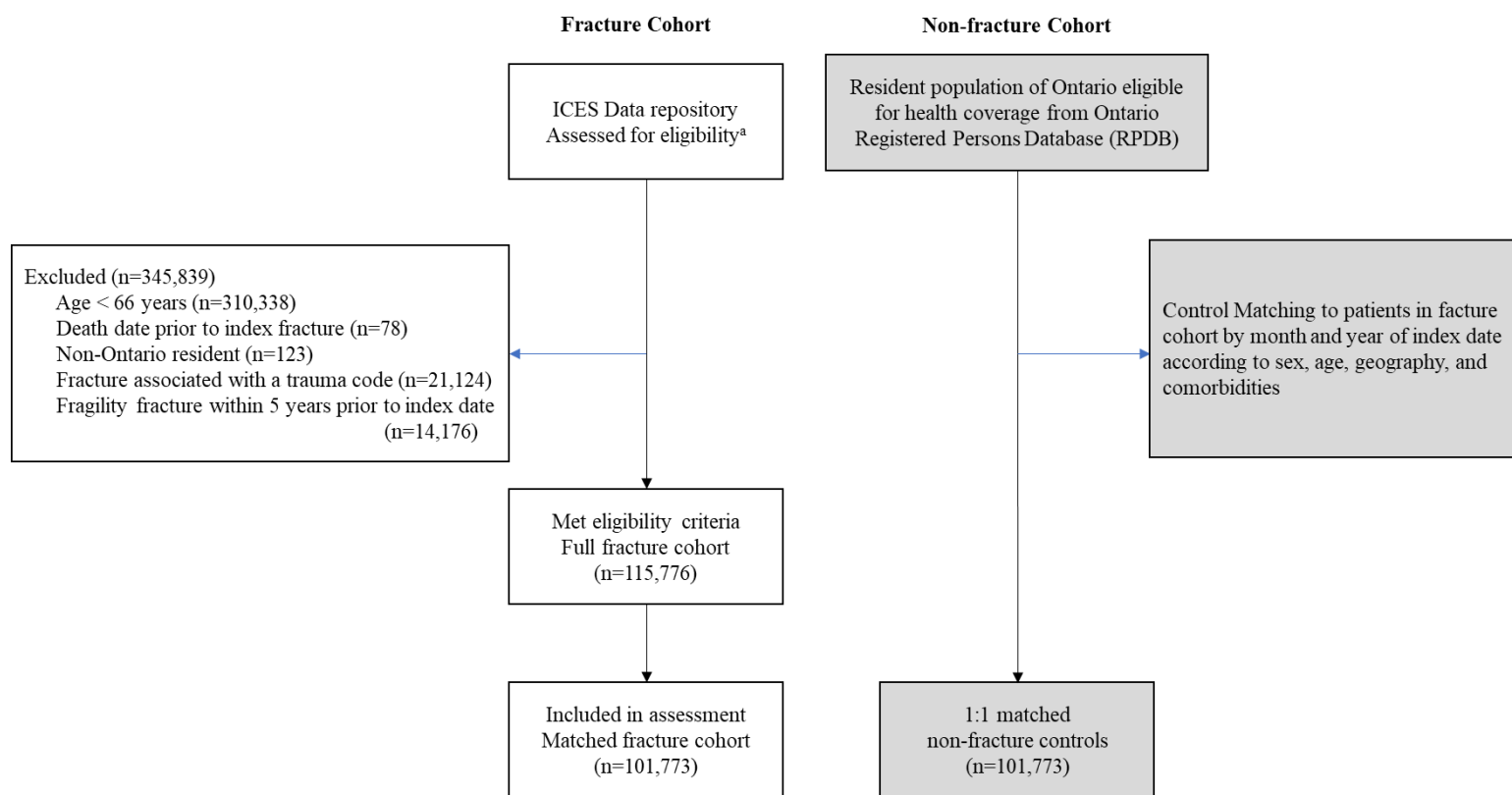
CCRS, Continuing Care Reporting System; LTC, Long-term care

\*Other health care services include emergency department visits, hospital outpatient clinic visits, physician billings, non-physician billings, and laboratory claims

**Online Resource Fig. 1 Study design**

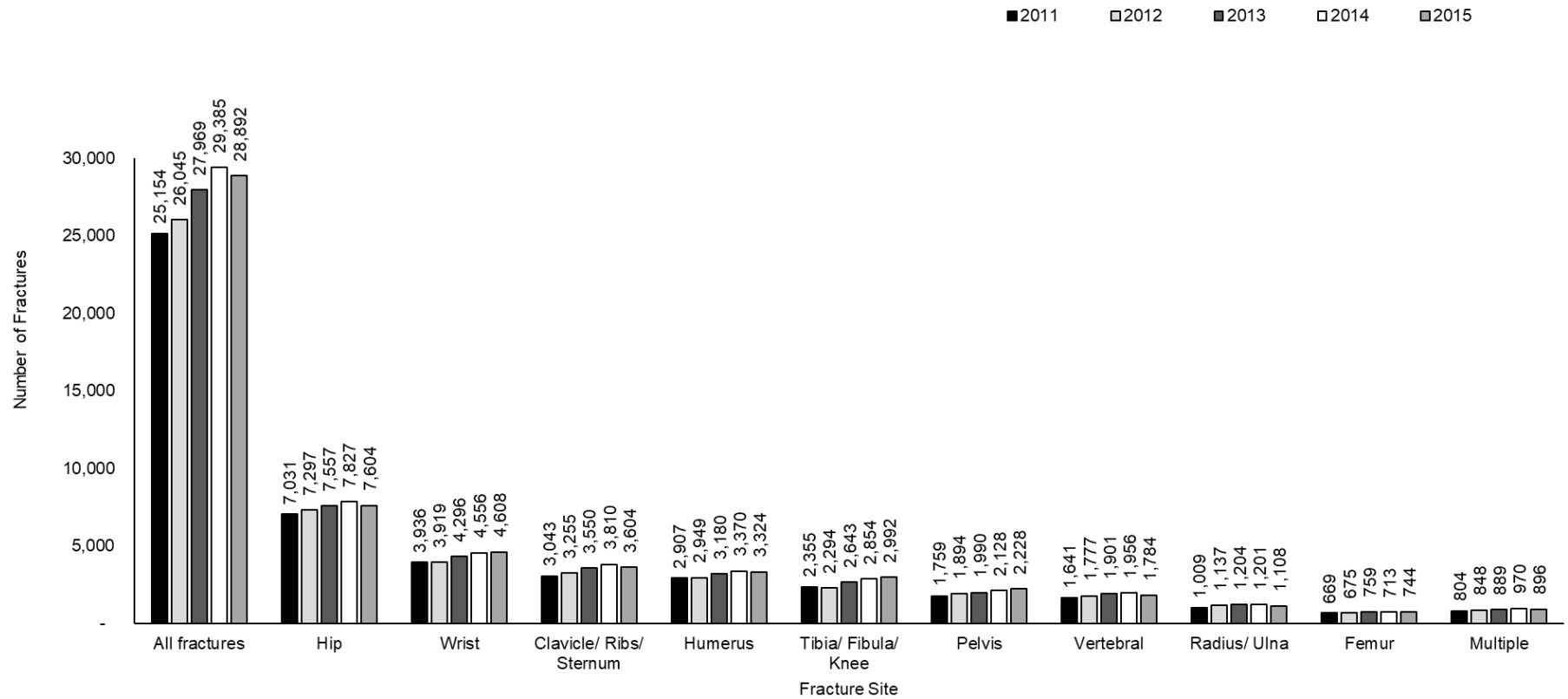


**Online Resource Fig. 2 Flow diagram of patients included in the different cohorts**



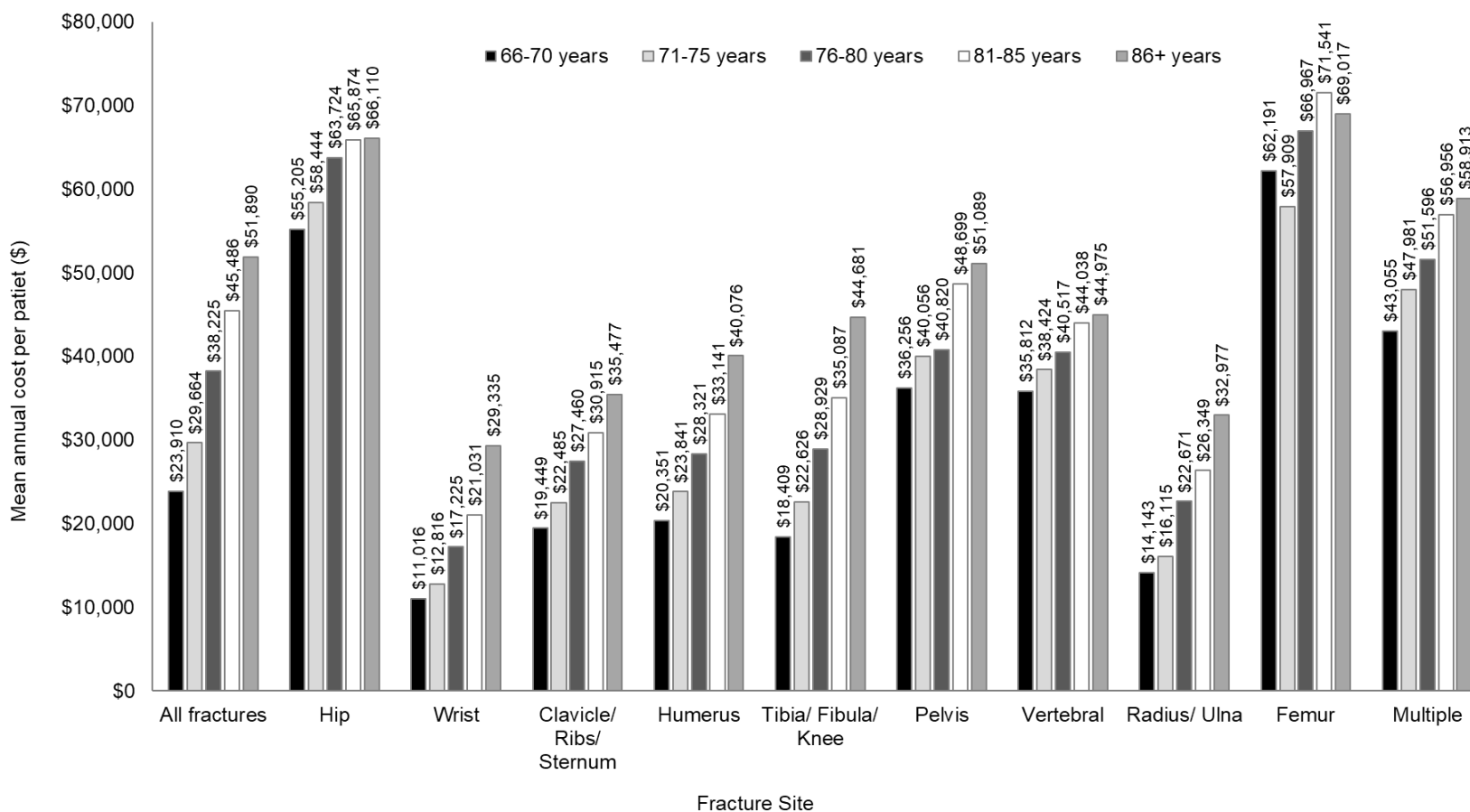
<sup>a</sup>All patients with valid ICES-specific key number (IKN) with a fracture occurring at an osteoporotic fracture site (hip, humerus, vertebral, wrist, pelvis, femur, clavicle/ribs/sternum, radius/ulna, or tibia/ fibula/knee) between January 1, 2011 and March 31, 2015. Fractures were identified using ICD-10-CA codes from hospital admissions, emergency room visits, and ambulatory care.

**Online Resource Fig. 3 Number of index fragility fractures per year (2011-2015\*), by site of fracture and year of fracture (full fracture cohort)**

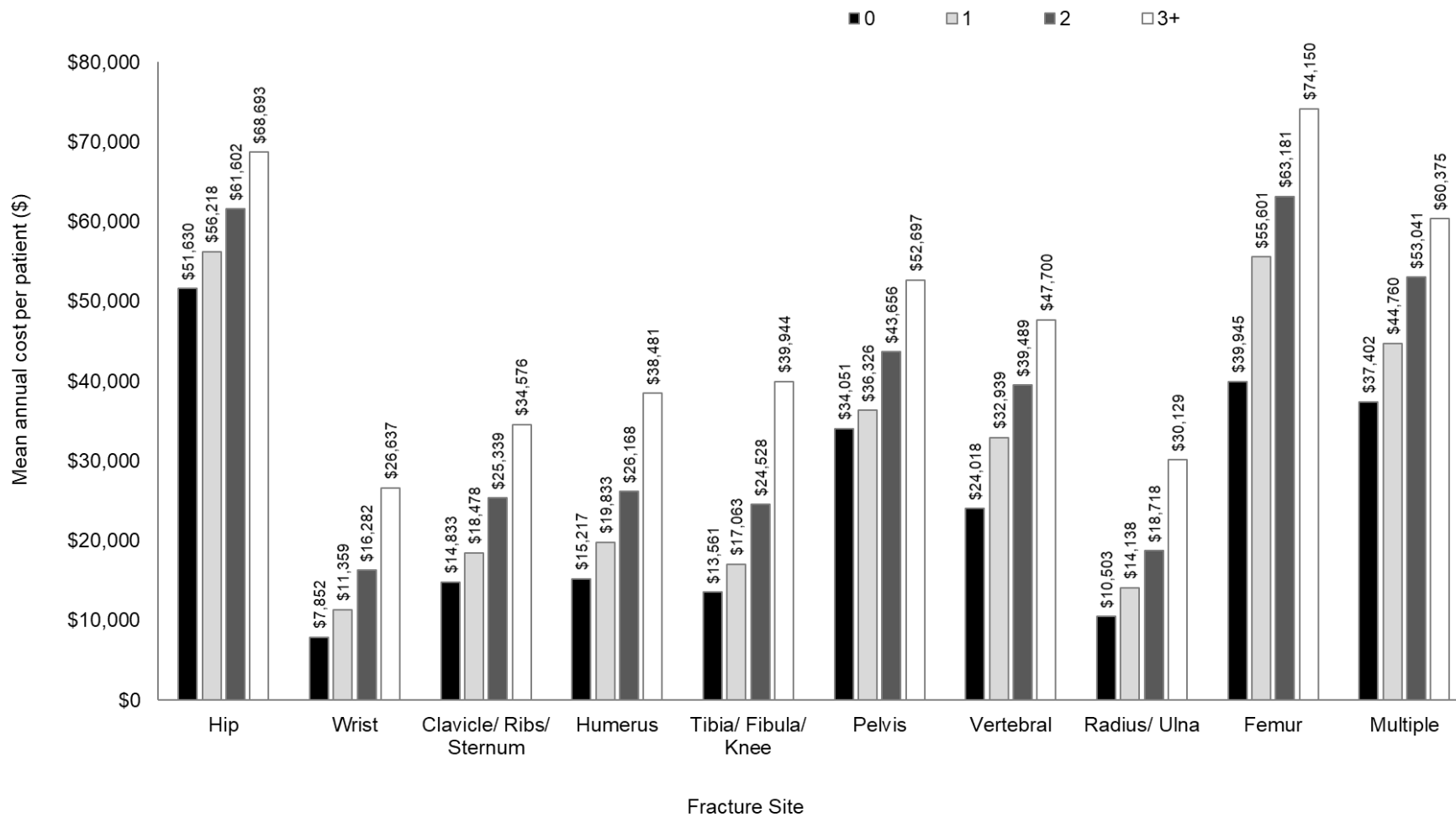


\*For 2015: Fractures were captured from January 1, 2015 to March 31, 2015, but were projected for the entire calendar year by multiplying by a factor of four

Online Resource Fig. 4 Mean annual cost per patient in 1<sup>st</sup> year post fracture, by age group (full fracture cohort)



Online Resource Fig. 5 Mean annual cost per patient in 1<sup>st</sup> year post fracture, by number of comorbidities\* (full fracture cohort)



\*Comorbidities include cancer, osteoarthritis, asthma, COPD, rheumatoid arthritis, psoriasis, spondyloarthritis, chronic kidney disease, diabetes mellitus, myocardial infarction, stroke and dementia