Ontario Osteoporosis Strategy - Provincial Performance Data for Osteoporosis Management

Technical Report

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The datasets were linked using unique, encoded identifiers and analyzed at ICES.

Intercensal and postcensal estimates of the Ontario population, by sex, age, and geographic area (LHIN) for 2005 – 2014 were provided by the Ontario Ministry of Health and Long-Term Care: IntelliHEALTH ONTARIO.

We also thank IMS Brogan Inc. for use of their Drug Information Database.

Abbreviations

AHRQ	Applied Health Research Questions
BMD	Bone Mineral Densitometry
CAPE	Client Agency Program Enrolment
CCRS	Continuing Care Reporting System (chronic care)
CCRS-LTC	Continuing Care Reporting System – Long-Term Care
CIHI	Canadian Institute for Health Information
CPDB	Corporate Provider Database
DAD	Discharge Abstract Database
DIN	Drug Identification Number
DXA	Dual-energy X-ray absorptionmetry
ED	Emergency Department
GAPP	Generic Alternative Payment Program
HCD	Home Care Database provided by the OACCAC
HCDMOH	Home Care Database provided by the MOHLTC
IC/ES	Institute for Clinical Evaluative Sciences
IPDB	ICES Physician Database (comprises information from the OHIP, CPDB and OPHRDC)
LHIN	Local Health Integration Network
LTC	Long Term Care
MNS	Master Numbering System database (maps the institution numbers found in many of the databases to the name and type of the institution)
MOHLTC	Ministry of Health and Long Term Care
NACRS	National Ambulatory Care Reporting System (contains both same day surgery and emergency department visits)
NRS	National Rehabilitation Reporting System
ODB	Ontario Drug Benefit database
OHIP	Ontario Health Insurance Plan Claims Database
OACCAC	Ontario Association of CCACs
OMHRS	Ontario Mental Health Reporting System
OOS	Ontario Osteoporosis Strategy
OPHRDC	Ontario Physician Human Resource Data Centre
RPDB	Registered Persons Database

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Executive Summary

The Ontario Ministry of Health and Long Term Care launched the Ontario Osteoporosis Strategy (OOS), a population-based initiative to improve quality of care for osteoporosis in Ontario, in 2005 and it became a Program in 2011.[1] The Ontario Osteoporosis Strategy represents the vision and coordinated efforts of many groups, including the Ministry of Health and Long-Term Care (MOHLTC), Osteoporosis Canada, health care and research professionals, and numerous community-based stakeholders.

Ontario Osteoporosis Strategy Mandate[2]

To reduce morbidity, mortality and costs from osteoporotic fractures using a patient-centred, multi-disciplinary approach that is integrated across healthcare sectors.

A number of performance indicators for osteoporosis management were developed to monitor the Ontario Osteoporosis Strategy from a health system perspective.[3] For the purpose of this report, indicators using available administrative data are presented.[4] Analyses were conducted by the Institute for Clinical Evaluative Sciences (IC/ES) as part of their Applied Health Research Questions (AHRQ) program.

Evaluation Objectives

1) To describe trends over time in fracture rates, bone mineral density (BMD) testing and osteoporosis treatment in Ontario since the launch of the Osteoporosis Program (2005/06 through 2017/18); and,
2) To provide data to inform and guide the direction and continued delivery of the Osteoporosis Program.

Report Overview

In this report, we present data on indicators for osteoporosis management and examine differences associated with sex, age, Local Health Integration Network (LHIN), and trends across time. The indicators focus on:

- Rates and numbers of fracture
- Trends in BMD testing in the population

[1] Jaglal SB, Hawker GA, Cameron C, Canavan J, Beaton DE, Bogoch E, Jain R, Papaioannou A, ORMEW working group. The Ontario Osteoporosis Strategy: implementation of a population-based osteoporosis action plan in Canada. Osteoporos Int. 2010 Jun;21:903-8.

[2] Strategic Plan 2013-2016 Ontario Osteoporosis Strategy April 2013

[3] Where appropriate, indicators and algorithms were aligned with other national and provincial initiatives on musculoskeletal disorders including: POWER; PHAC's Osteoporosis Surveillance Working Group; Canadian Chronic Disease Surveillance System; and, Pharmaco-Epidemiology Group, ICES

[4] Data sources include: Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD); National Ambulatory Care Reporting System (NACRS); Ontario Health Insurance Plan Claims database (OHIP); Ontario Drug Benefit database (ODB) (65 years and older); Registered Persons Database (RPDB); Continuing Care Reporting System-LTC (CCRS-LTC); Continuing Care Reporting System (CCRS: chronic care); Corporate Provider Database, Home Care Database (OACCAC and MOH); ICES Physician Database; National Rehabilitation Reporting System (NRS)

- Follow up and treatment after fracture in seniors
- Treatment persistence
- Cost of hip fracture

This report should replace previous Ontario Osteoporosis Program Reports as the results may not be comparable to previous findings due to refinements to case definitions, updated drug identification number (DIN) list of osteoporosis medications and treatment adherence definitions, the age categories used, and follow up time periods. The current report emphasizes hip fracture trends; fracture rates and management among seniors (80+); and, variability in osteoporosis management by Local Health Integration Network.

Key Findings

Fractures

- The combined age-standardized rate of common osteoporotic type fractures (hip, wrist, shoulder, pelvis and spine) has remained stable over time.
- The standardized rate of hip fracture has decreased by 12.9% between 2005/06 and 2017/18. However, the number of hip fracture has continued to increase, particularly among seniors 80+ years of age and older, as a result of the aging population.
- The crude hip fracture rate remained stable from 2005/06 to 2017/18 in 50-59 and 60-69 year age groups but dropped by 24% in adults 70-79 and 15.6% in the 80+ age group.
- The overall number of other osteoporotic fractures including wrist, shoulder, pelvis and spine, also continue to increase.
- Re-fracture rates remained stable but the number of re-fractures increased 11% between 2005/06 and 2014/15.

BMD Testing

- The overall number of BMD testing remained consistent between 2014/15 and 2017/18.
- The overall number of high-risk tests has remained relatively stable since 2008/09.[5]
- The majority of BMD tests conducted were coded as high risk and represented 68.5% of all BMD tests conducted in 2017/18.

Fracture and Osteoporosis Management among Seniors

- Overall fracture rates increased dramatically with age (from 49/10,000 in 50-59 year olds to 324/10,000 in 80+ year olds in 2017/18).
- Between 2005/06 and 2017/18 there was a significant increase in the number of fractures in seniors 80 years and older (ranging from an increase of 24% for hip to 95% for spine[6]).
- 37% of all fractures were in adults 80+ in 2017/18
- The highest re-fracture rate was in individuals 80 years of age and older.
- When an individual turns 65 years, they are reclassified from low to moderate fracture risk category. Canadian guidelines for osteoporosis recommend they should receive a baseline BMD test. There is a low rate of BMD testing in this population across LHINs (in 2017/18, 85% of eligible men and 68% of eligible women, aged 68-70, had not been tested in the past 5 years).
- 68% of seniors who experienced a hip fracture in 2016/17 were neither investigated nor treated for osteoporosis within 6 months of their fracture.

[5] The fee schedule for BMD testing changed April 1, 2008.
[6] The increase in spine fracture numbers may reflect improved detection.

Hip Fracture - Long Term Care (LTC) and Community Populations

- The rate and number of hip fracture among those living in LTC remained relatively stable between 2014/15 and 2017/18
- The rate of hip fracture in community-dwelling population fell between 2014/15 to 2017/18 however the number of hip fractures per year increased.

Cost of Hip Fracture

- The total cost of treatment for all hip fractures occurring in 2015/16 (in adults aged 66+) was estimated to be $255,773,130 based on direct utilization costs for the episode of care.
- The median cost **per single episode of care** was $25,015 for direct utilization costs.
- Costs were highest in the 80+ age group due to higher numbers of hip fractures.

Local Health Integration Networks

- Hip fracture rates have decreased in all LHINs but there is considerable variation from a 32% reduction in the Mississauga Halton LHIN to 4% in the North West LHIN.
- In 2017/18, there was a more than two-fold difference in the age-standardized rate of BMD testing between the highest rate (10.0/100 in Central LHIN) and the lowest rate (4.2/100 in North West LHIN).
- Standardized hip fracture rates (per 10,000) for those 50+ in 2017/18 ranged from a high of 27.4 (North West) to a low of 16.9 (Mississauga Halton)
- The percent of adults 66+ who received a BMD test and/or treatment in the 6 months following a hip fracture in 2016/17 ranged from a high of 48.4 per 10,000 (Mississauga Halton) to a low of 17.2 (South East).

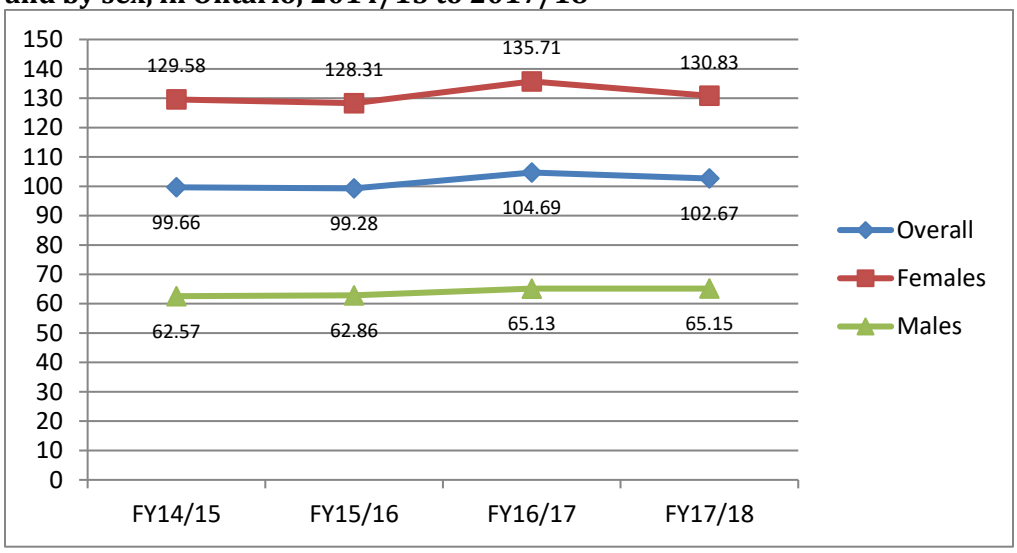
Section 1: Trends in Fracture Rates and Numbers

Indicator: Age-standardized fracture rate (per 10,000) in adults, aged 50 years and older, overall and by fracture type for fractures probably due to osteoporosis (hip; wrist or forearm; ribs, sternum, thoracic or lumbar spine; shoulder or upper arm; and pelvis) (see Appendix A).

Overall Fracture Rates

- There was no evidence of change over time in overall age-standardized rates of fracture between 2014/15 and 2017/18 (see Figure 1).
- Overall fracture rates are approximately two times higher in women than men.
- Overall fracture rate increases dramatically with age (e.g. from 49/10,000 in 50-59 year olds to 324/10,000 in 80+ year olds in 2017/18).
- 37% of all fractures were in adults 80+ in 2017/18.

Figure 1: Age-standardized fracture rates (per 10,000) in adults aged 50 and older, overall and by sex, in Ontario, 2014/15 to 2017/18



Data Sources: Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD); National Ambulatory Care Reporting System (NACRS); Ontario Health Insurance Plan (OHIP)

Rates and Numbers By Fracture Type

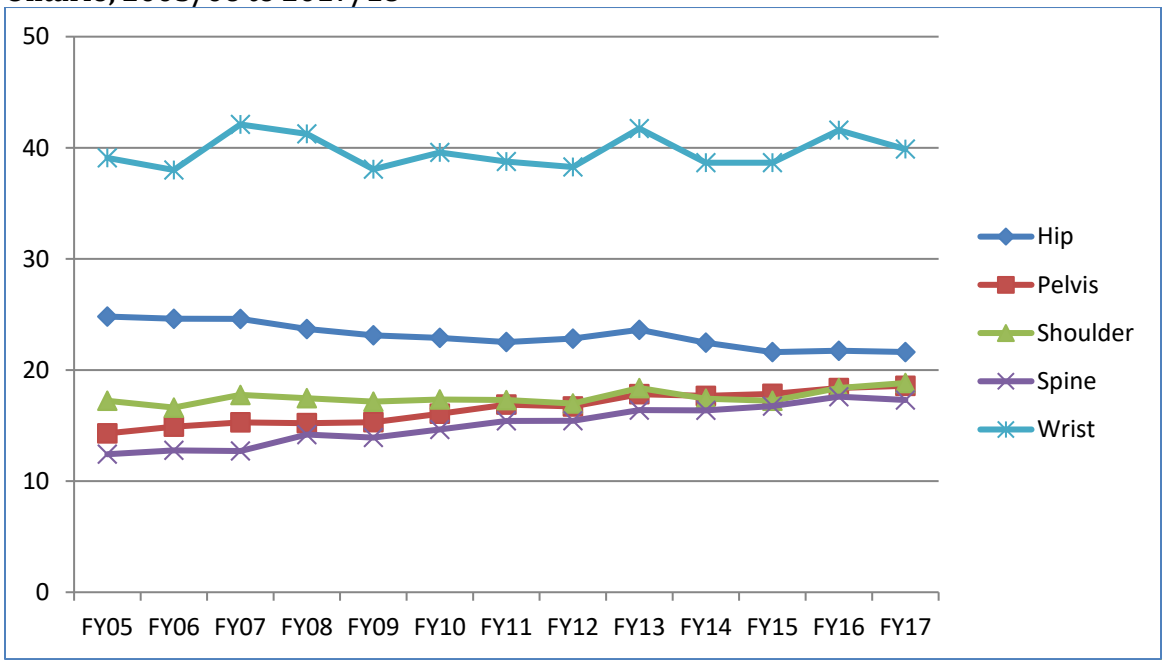
- *Hip* – There has been a 12.9% decrease in the standardized rate of hip fracture from 24.8 per 10,000 in 2005/06 to 21.6 in 2017/18[7] however, the number of hip fractures has increased from 10,099 in 2010/11 to 11,537 in 2017/18 (See Figure 2 and Table 1). There was a reduction in hip fracture rate for all LHINs but there was considerable variation from a 32% reduction in Mississauga Halton to 4% in North West.

Rates of hip fracture have decreased by 12.9% between 2005/06 and 2017/18 but numbers are increasing, particularly in the 80+ age group

[7] Using a rolling average for the first 3 years (24.7% for 05/06/07) and the last 3 years (21.6% for 15/16/17) the change in hip fracture rate was 12.5%

- *Wrist* – Rates of wrist fracture are high (wrist fractures are the most common fracture, with 21,224 in 2017/18). There is no indication of any meaningful trend over time in rates overall or by sex for wrist fractures. There was a 2% increase in wrist fracture rates between 2005/06 and 2017/18. The change varied considerably by LHIN from a 10.5% reduction in Mississauga Halton to a 17% increase in Waterloo Wellington.
- *Pelvis* – Rates increased from 14.3/10,000 in 2005/06 to 18.6 in 2017/18 per 10,000. Numbers also increased from 7,088 in 2010/11 to 9,907 in 2017/18.
- *Spine* – The rate of spine fractures increased appreciably between 2005/06 (12.4 per 10,000) and 2017/18 (17.3 per 10,000) which may suggest better detection.
- *Shoulder* – There is no meaningful trend in rate of shoulder fractures. Overall numbers are increasing.

Figure 2: Age-standardized rate (per 10,000) by fracture type, in adults aged 50 and older, in Ontario, 2005/06 to 2017/18



Data Sources: Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD); National Ambulatory Care Reporting System (NACRS); Ontario Health Insurance Plan (OHIP)

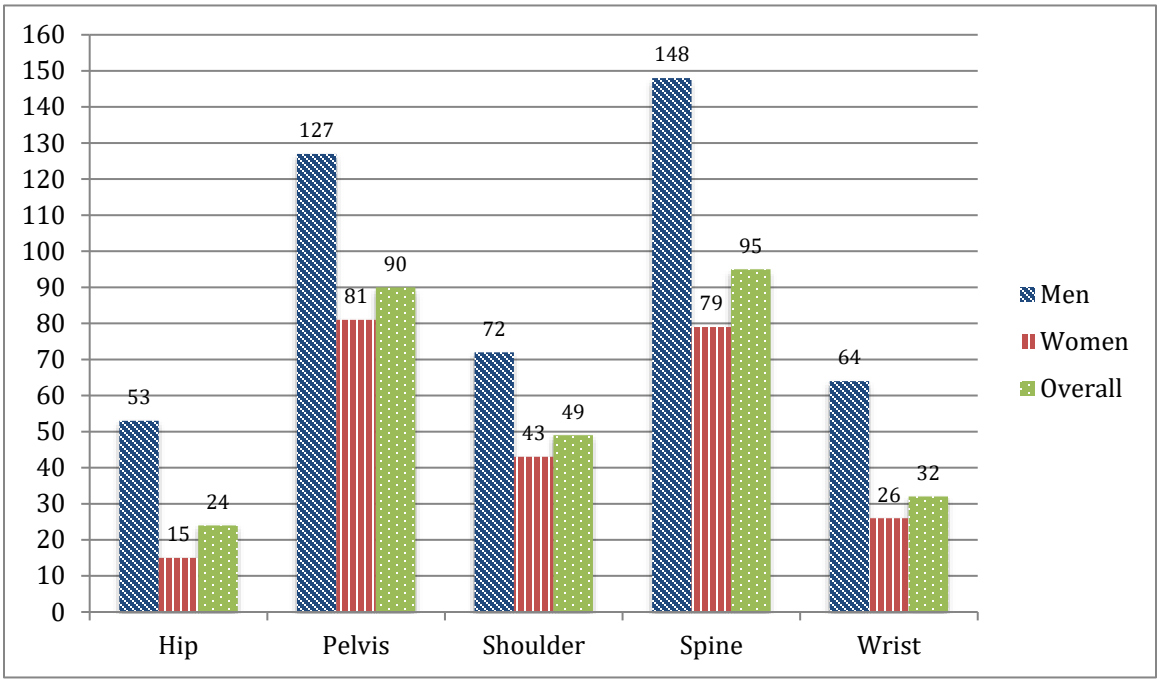
Table 1: Number of fractures by fracture type among adults aged <u>50 and older</u>, 2011/12 to 2017/18

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Wrist	17,599	17,921	20,159	19,194	19,672	21,615	21,224
Hip	10,234	10,704	11,425	11,171	11,016	11,321	11,537
Shoulder	7,856	7,960	8,882	8,653	8,771	9,559	10,025
Pelvis	7,675	7,838	8,616	8,783	9,096	9,559	9,907
Spine	7,017	7,244	7,941	8,159	8,555	9,193	9,249
Total	50,381	51,667	57,023	55,960	57,110	61,247	61,942

Data Sources: Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD); National Ambulatory Care Reporting System (NACRS); Ontario Health Insurance Plan (OHIP)

- Between 2005/06 and 2017/18 there was a large increase in the number of fractures in seniors 80 years and older (ranging from a 24% increase in the overall number of hip fractures to a 95% increase in the number of spinal fractures) (see Figure 3).

Figure 3: Percent increase in number of fractures, by fracture type, overall and by sex, adults 80 years of age and older between 2005/06 to 2017/18



Data Sources: Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD); National Ambulatory Care Reporting System (NACRS); Ontario Health Insurance Plan (OHIP)

The crude rate of hip fracture (per 10,000) dropped from 2005/06 to 2017/18 by 24% in the 70-79 and 15.6% in the 80+ groups while remaining stable for those less than 70 years.

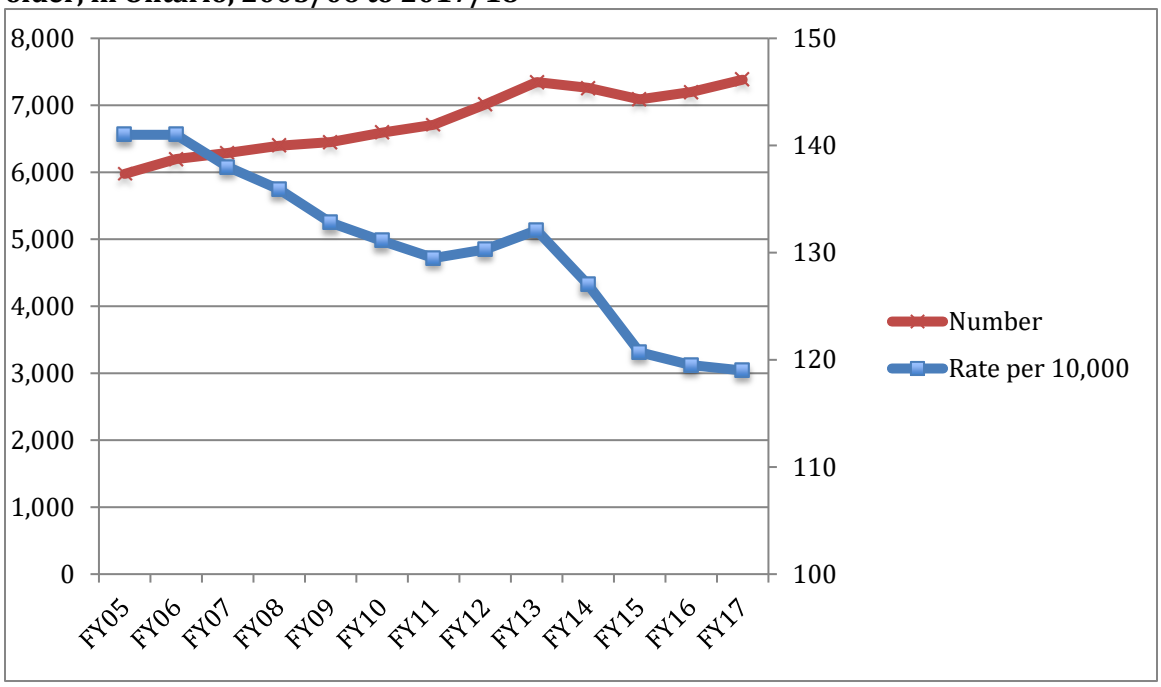
- The crude rate of hip fracture (per 10,000) has remained stable from 2005/06 to 2017/18 in the 50-59 and 60-69 year old groups but has dropped by 24% in adults 70-79 and 15.6% in the 80+ group (see Table 2).
- Figure 4 illustrates the decrease in rate and increase in number of hip fractures between 2005/06 to 2017/18 in adults 80+
- The change in standardized rate of hip fracture for adults between 2005/06 to 2017/18 ranged from an increase of 8.7% in adults 50-59 to a decrease of -24.1% in 70-79 year olds (see Table 3). The decrease was greatest in women (-16.9%) compared to men (-6.4%).
- The standardized rate of hip fracture in adults 50+ decreased in all LHINs between 2005/06 – 2017/18 however there was large variation from a decrease in rate of -4% for North West LHIN to a decrease of -32% in Mississauga Halton (see Table 4).
- The crude rate of wrist fracture (per 10,000) has remained stable from 2005/06 to 2017/18 in the 50-59, 60-69 and 70-79 year old age groups but has dropped by 10% in the 80+ group (see Table 5).
- Figure 5 illustrates the decrease in rate and increase in number of wrist fractures between 2005/06 to 2017/18 in adults 80+

Table 2: Crude rate of hip fractures (per 10,000), in adults aged 50 and older, in Ontario, 2005/06 to 2017/18

Year	50-59	60-69	70-79	80+	80+ (n)	80+ (%)*
2005/06	2.3	7.3	31.6	141.0	5,976	64
2006/07	2.4	7.5	30.0	141.0	6,199	64
2007/08	2.6	7.6	31.0	138.0	6,289	64
2008/09	2.4	7.3	28.5	135.9	6,397	65
2009/10	2.3	7.3	27.7	132.8	6,452	65
2010/11	2.3	7.2	27.5	131.1	6,592	65
2011/12	2.4	7.6	25.8	129.5	6,709	66
2012/13	2.5	7.5	26.3	130.3	7,013	66
2013/14	2.6	8.1	28.0	132.1	7,348	64
2014/15	2.5	7.1	26.6	127	7,261	65
2015/16	2.6	7.3	24.9	120.7	7,088	64
2016/17	2.5	7.7	24.9	119.5	7,198	64
2017/18	2.5	7.4	24.0	119	7,383	64

Data Sources: Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD); National Ambulatory Care Reporting System (NACRS); Ontario Health Insurance Plan (OHIP)
*Percent of all fractures that are in those 80+

Figure 4: Number and standardized rate of hip fractures (per 10,000), in adults aged 80 and older, in Ontario, 2005/06 to 2017/18



Data Sources: Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD); National Ambulatory Care Reporting System (NACRS); Ontario Health Insurance Plan (OHIP)

Table 3: Change in standardized rate of hip fractures (per 10,000), by age and gender, in adults aged 50 and older, in Ontario, 2005/06 to 2017/18

	Crude Hip Fracture Rate per 10,000 and Number of Hip Fracture by Age				
Age Group	**2005/06 (Rate)**	**2005/06 (N)**	**2017/18 (Rate)**	**2017/18 (N)**	**% Change in Rate**
50-59	2.3	368	2.5	526	8.7
60-69	7.3	744	7.4	1213	1.4
70-79	31.6	2327	24.0	2415	-24.1
80-89	140.9	5976	119.0	7383	-15.5

	Crude Hip Fracture Rate per 10,000 and Number of Hip Fracture by Gender				
Gender	**2005/06 (Rate)**	**2005/06 (N)**	**2017/18 (Rate)**	**2017/18 (N)**	**% Change in Rate**
Female	30.2	6845	25.1	7829	-16.9
Male	17.2	2570	16.1	3708	-6.4

Data Sources: Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD); National Ambulatory Care Reporting System (NACRS); Ontario Health Insurance Plan (OHIP)

Table 4: Change in standardized rate of hip fractures (per 10,000) by LHIN, in adults aged 50 and older, in Ontario, 2005/06 to 2017/18

	Age Standardized Hip Fracture Rate per 10,000		
LHIN	**2005/06**	**2017/18**	**% Change Rate**
Erie St. Clair	25.58	23.79	-7.0
South West	29.61	23.60	-20.3
Waterloo Wellington	26.16	22.99	-12.1
Hamilton Niagara Haldimand Brant	25.97	23.13	-10.9
Central West	22.64	18.96	-16.3
Mississauga Halton	24.86	16.87	-32.0
Toronto Central	24.16	18.96	-21.5
Central	22.90	19.06	-16.8
Central East	22.40	20.97	-6.4
South East	30.09	25.51	-15.2
Champlain	24.04	22.58	-6.1
North Simcoe Muskoka	26.83	25.65	-4.4
North East	25.59	23.79	-7.0
North West	28.54	27.39	-4.0

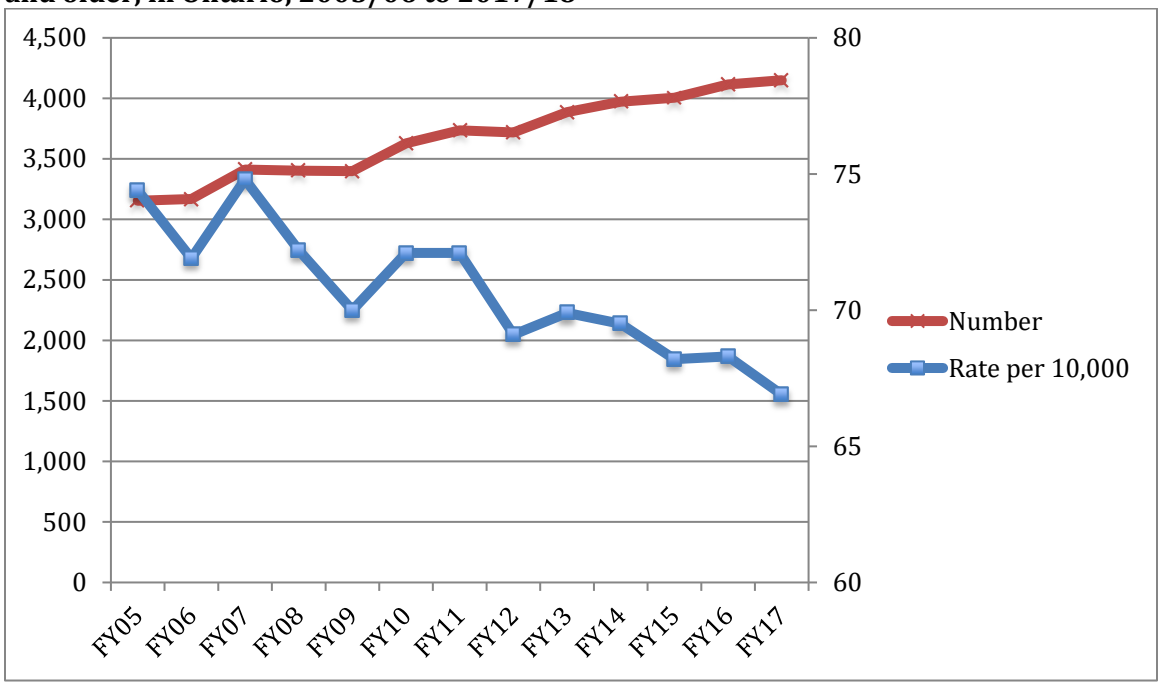
Data Sources: Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD); National Ambulatory Care Reporting System (NACRS); Ontario Health Insurance Plan (OHIP)

Table 5: Crude rate of wrist fractures (per 10,000), in adults aged 50 and older, in Ontario, 2005/06 to 2017/18

Year	50-59	60-69	70-79	**80+**	80+ (n)	80+ (%)*
2005/06	28.4	36.1	46.4	74.4	3,154	21
2006/07	27.8	34.8	45.4	71.9	3,168	21
2007/08	31.8	40.5	47.9	74.8	3,412	20
2008/09	31.4	39.0	47.7	72.2	3,402	20
2009/10	28.3	35.8	43.8	70.0	3,398	21
2010/11	30.1	36.3	45.7	72.1	3,628	21
2011/12	28.7	36.6	43.8	72.1	3,736	21
2012/13	29.1	35.7	43.2	69.1	3,719	21
2013/14	32.8	40.3	45.6	69.9	3,887	19
2014/15	28.8	36.7	43.5	69.5	3,973	21
2015/16	29.0	37.2	42.8	68.2	4,005	20
2016/17	32.7	40.0	45.1	68.3	4,115	19
2017/18	30.0	39.2	43.4	66.9	4,150	20

Data Sources: Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD); National Ambulatory Care Reporting System (NACRS); Ontario Health Insurance Plan (OHIP)
*Percent of all fractures that are in those 80+

Figure 5: Number and standardized rate of wrist fractures (per 10,000), in adults aged 80 and older, in Ontario, 2005/06 to 2017/18



Data Sources: Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD); National Ambulatory Care Reporting System (NACRS); Ontario Health Insurance Plan (OHIP)

Re-Fracture Rate within 3 Years

Indicator: The proportion of adults aged 50 and older who have a fracture and then a subsequent fracture within 3 years.[8]

- Refracture rates remained stable but because the number of fractures increased, so did the number of refractures. The number of refractures increased by approximately 11% from 2011/12 (n=5,501) to 2014/15 (n=6,094).
- Men have a lower re-fracture rate than women (13.8% in men versus 16.4% in women in 2014/15).
- The highest re-fracture rate occurred in individuals 80 years of age and older (12.8% in 50-59 year olds; 14.3% in 60-69 year olds; 15.7% in 70-79 year olds, 19% in 80-89 year olds and 22% in 90+ year olds in 2014/15).

Fracture Rates in Long Term Care and Community

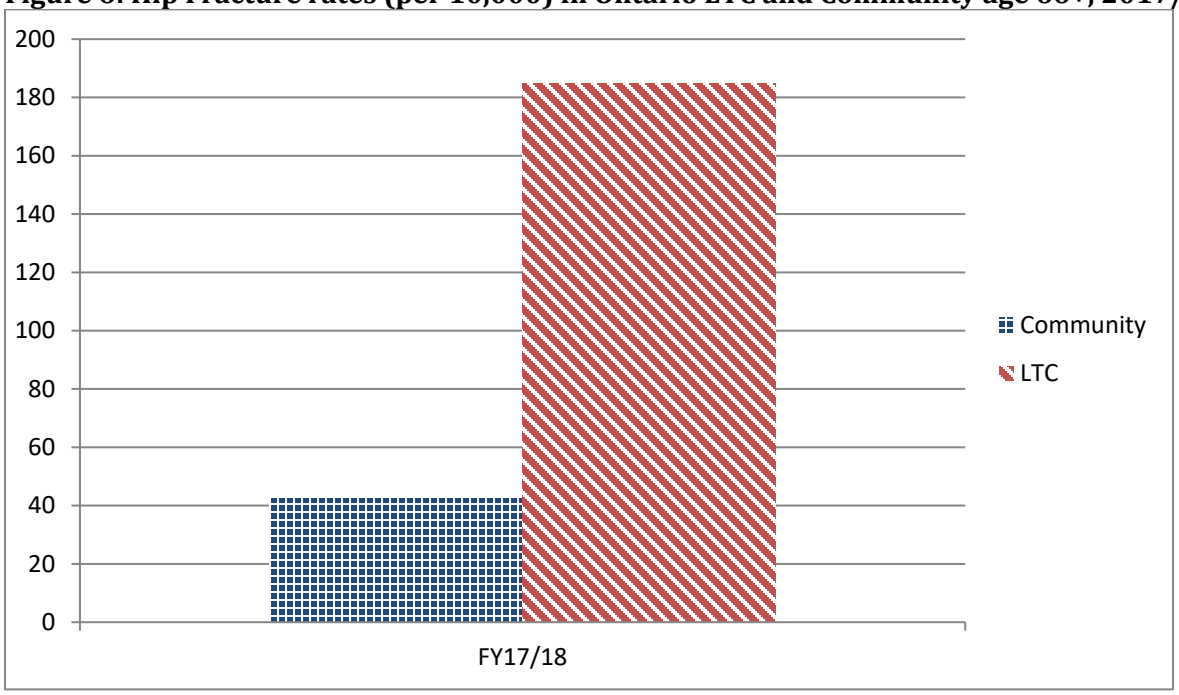
Indicator: Hip fracture outcomes for adults 66 years and older at the time of the fracture, stratified into 2 cohorts: (1) in LTC or chronic care prior to their hip fracture; (2) living in the community at the time of fracture

- Fracture rates, stratified by place of residence prior to the fracture
- Discharge destination after hip fracture, stratified by place of residence prior to the fracture

- Hip fracture rates have remained relatively stable in adults 66+ living in long term care (LTC) but have decreased for adults living in the community at the time of their fracture (see Figure 6 and Table 6).

[8] If a person had more than one fracture during a given fiscal year they are included in the denominator more than once.

Figure 6: Hip Fracture rates (per 10,000) in Ontario LTC and Community age 66+, 2017/18



Data Source: Ontario Health Insurance Plan (OHIP), CIHI Discharge Abstract Database (DAD), National Ambulatory Care Reporting System database (NACRS), Continuing Care Reporting System, Ontario Drug Database

Long Term Care (see Table 6)

- The rate and number of hip fracture in LTC remained relatively stable between 2014/15 and 2017/18.
- Rates of any fracture in LTC have also remained relatively stable.

Community (see Table 6)

- The rate of hip fractures among adults 66+ living in the community fell between 2014/15 to 2017/18 from 46 to 42 per 10,000; however, the number of hip fractures increased from 8,446 to 8,722.
- The rate of any fracture among adults 66+ living in the community fell slightly between 2014/15 to 2017/18 from 162 to 161 per 10,000; the number of any fractures increased from 29,834 to 33,077.

Table 6: Hip fracture rate (per 10,000) and number for adults 66 years or older by residence (either community or LTC) in Ontario, any fracture and hip fracture, 2014/15 to 2017/18

Year	Hip Fracture	
	Community Rate (#)	LTC Rate (#)
2014/15	46.0 (8,446)	185.7 (1,337)
2015/16	43.4 (8,277)	189.1 (1,368)
2016/17	42.8 (8,489)	184.3 (1,345)
2017/18	42.4 (8,722)	184.9 (1,348)

Data Source: Ontario Health Insurance Plan (OHIP), CIHI Discharge Abstract Database (DAD), National Ambulatory Care Reporting System database (NACRS), Continuing Care Reporting System

- The increase in hip fracture numbers evident in the overall provincial data are likely the result of fractures occurring in seniors living in the community.
- The number of any fracture has increased in the community but not in LTC.
- There is more LHIN-to-LHIN variation in LTC fracture rates than in fracture rates for adults 66+ living in the community.

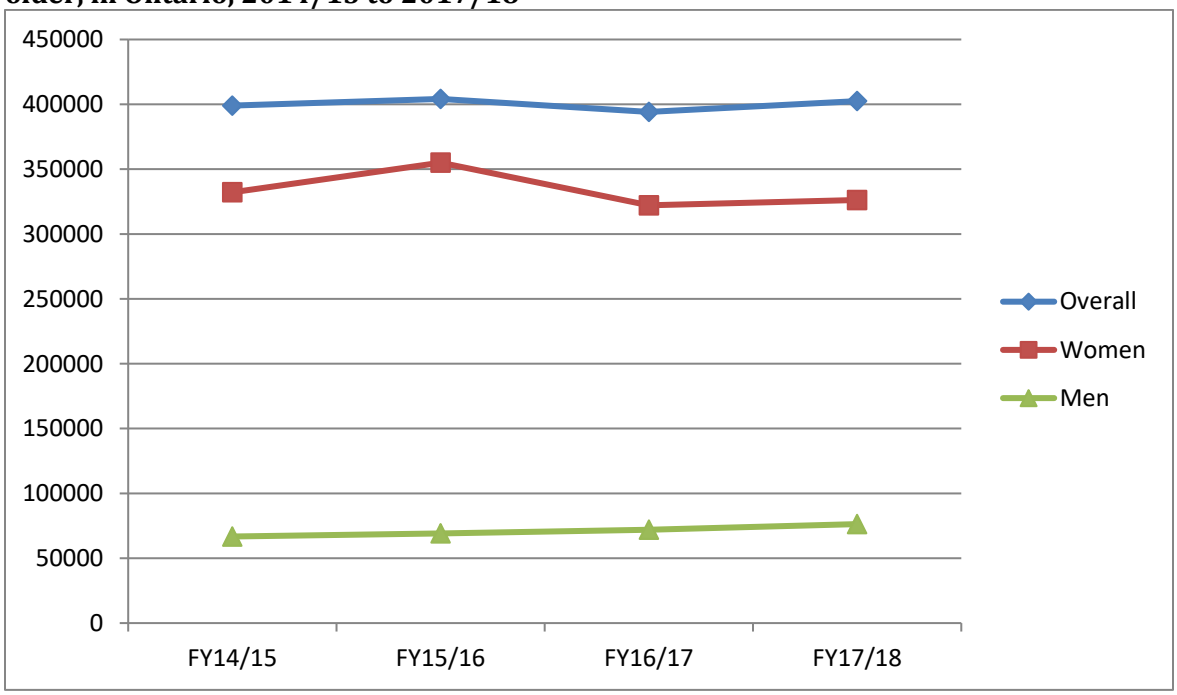
Section 2: Trends in BMD Testing

Indicator: Rate of BMD testing in adults, aged 50 years and older, overall and by type of test (baseline, low risk, high risk)

BMD Testing Overall

- The number of BMD tests has remained consistent between 2014/15 and 2017/18 (see Figure 7).
- The overall age standardized rate decreased slightly from 8.1/100 in 2014/15 to 7.6/100 in 2017/18.
- There is a twofold difference in the age-standardized BMD testing rate between the LHINs with the highest (10.0/100 Central LHIN) and lowest (4.2/100 North West LHIN) testing rates in 2017/18
- The majority of BMD tests were provided to women (11.7 tests/100 women, 3.0 tests/100 men in 2017/18).

Figure 7: Overall number of bone mineral density (BMD) tests among adults 50 years and older, in Ontario, 2014/15 to 2017/18



Data Sources: Ontario Health Insurance Plan (OHIP)

BMD Testing by Type of Test

- The overall number of low risk tests has remained reasonably consistent from 2014/15 to 2017/18 (see Tables 7).

Table 7: Overall Number and Rate (per 100) by type of BMD test (based on OHIP definition[9]) among adults 50+ years in Ontario, 2014/15 to 2017/18

Year	Baseline		Low Risk		High Risk		Total BMD tests
	Number	Rate/100	Number	Rate/100	Number	Rate/100	Number
2014/15	74,249	1.5	51,851	1.1	272,877	5.5	398,977
2015/16	73,222	1.4	55,208	1.1	275,745	5.4	404,175
2016/17	71,174	1.4	50,894	1.0	272,095	5.2	394,163
2017/18	72,761	1.4	53,702	1.0	275,197	5.2	401,660

Data Sources: Ontario Health Insurance Plan (OHIP)

- The majority of BMD tests conducted are coded as high risk; high risk tests represent 69% of all BMD tests conducted in 2017/18.

The majority of tests are coded as high risk (69% in 2017/18)

BMD Testing in Eligible Seniors

Indicator: Rate (per 100) of 'eligible' seniors (aged 68 to 70) who had a BMD test ('eligible' = seniors 68 to 70 who had not had a BMD test in the five years leading up to their 65th birthday)[10]

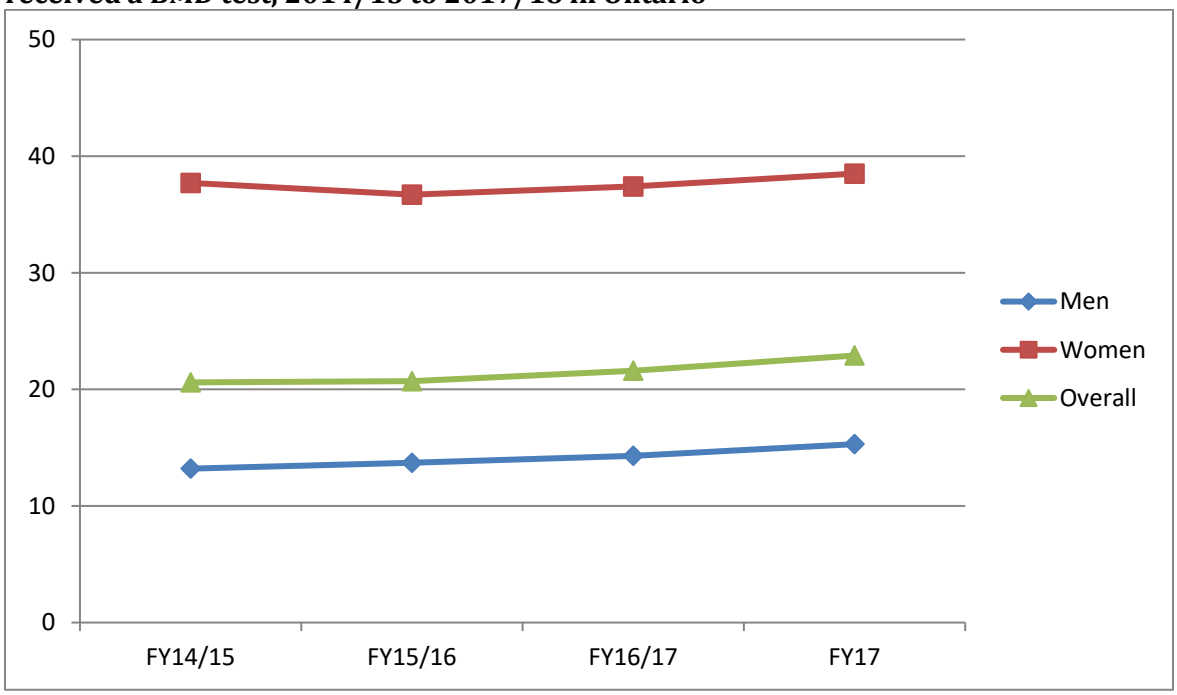
- When an individual turns 65 years of age, they are moved from a low to a moderate fracture risk category. Canadian guidelines for osteoporosis recommend they should receive a baseline BMD test.
- The overall BMD testing rate in this population has increased since 2014/15 (see Figures 8 and 9).
- BMD testing has been steadily increasing among eligible senior men (13% in 2014/15 to 15% in 2017/18) although rates of testing remain low.
- 85% of 'eligible' senior men and 62% of senior women remained untested in 2017/18.
- All LHINs had low testing rates in this population.

There is a low rate of BMD testing in eligible seniors across all LHINs

[9] As of April 1, 2008 the fee schedule for BMD testing was changed and a new fee code for a baseline test was added. Individuals are limited to one baseline test in their lifetime. Low risk BMD tests (i.e. patient is not a high risk patient) are limited to once every 36 months. High-risk tests (e.g. at risk for accelerated bone loss, with diagnosed osteopenia or osteoporosis or with bone loss in excess of 1% per year based on previous BMD testing) are limited to one test every 12 months unless prior authorization is obtained (http://www.health.gov.on.ca/english/providers/program/ohip/bulletins/4000/bul4470a.pdf accessed June 21, 2010)

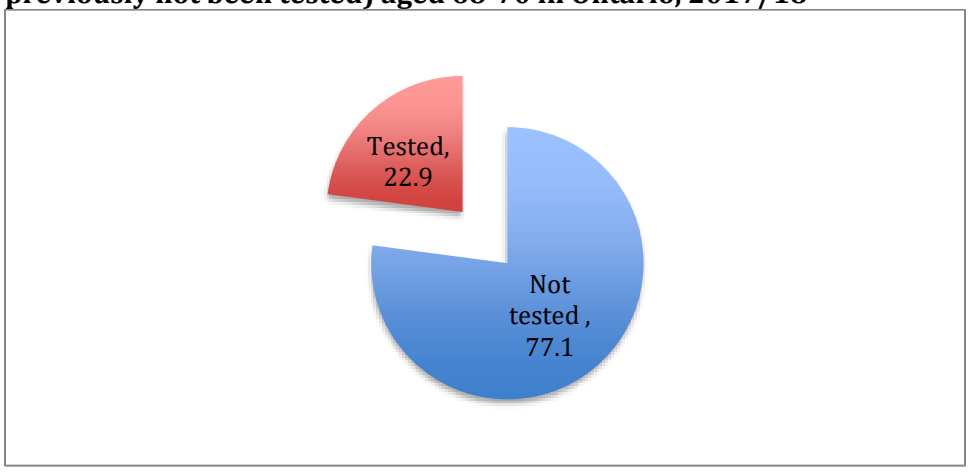
[10] Percent of people aged 68-70 at the start of each fiscal year who had not been tested in the five years leading up to their 65th birthday. For this cohort (i.e., those who had not been tested) we looked to see if they had been tested by the time they turned age 68-70.

Figure 8: Percent of eligible seniors (68 to 70)[11], who previously had not been tested, that received a BMD test, 2014/15 to 2017/18 in Ontario



Data Sources: Ontario Health Insurance Plan (OHIP)

Figure 9: Overall BMD Testing Rates among Seniors who are Eligible (i.e. who have previously not been tested) aged 68-70 in Ontario, 2017/18



Data Source: Ontario Health Insurance Plan (OHIP)

[11] Note that the denominator of 'eligible' seniors has decreased each year as those seniors are tested.

BMD Testing Following Fracture

Indicator: Proportion of adults, aged 50 years and older, who had a fracture that is possibly due to osteoporosis and received a BMD test within 12 months of their wrist fracture.[12]

- Age standardized rates for BMD follow up was 29.2% for wrist (29.2%)
- There is significant variation by LHIN, with a more than two-fold difference between highest and lowest rates for standardized BMD testing one year following a wrist fracture (from a low of 15.1% in the Erie St. Clair LHIN to a high of 33.5% in the Central LHIN, 2016/17).

[12] Individuals were excluded if they had a BMD test in the 12 months before their fracture.

Section 3: Follow up and Treatment after Fracture in Seniors

Indicator: Rates (per 100) of identification (using BMD testing) and/or treatment (medication) of osteoporosis in adults age 66 and older who have had a hip or wrist fracture and were not already taking osteoporosis medication[13], in the 6 months following their fracture. Data show the percentage of fractures that were not followed by either a BMD test or a prescription for osteoporosis medication (i.e., no BMD, no drug).

BMD Testing and Treatment Following Hip Fracture

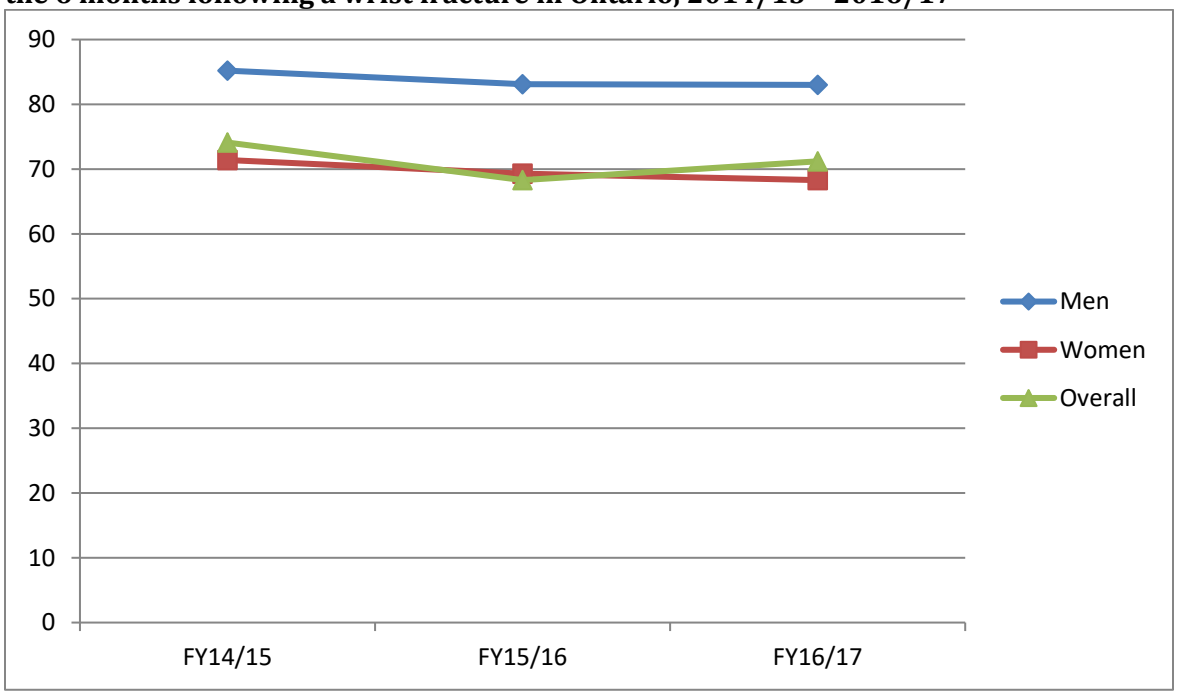
- 68.2% of this high-risk population were not investigated or treated for osteoporosis within 6 months of their hip fracture (2016/17).
- In 2005/06, 72.4% (68.7% for women, 79% for men) were not investigated or treated for osteoporosis so it has improved slightly since then.
- 72.7% of adults 85 years and older were neither investigated nor treated within 6 months following a hip fracture in 2016/17.
- Note that some individuals who did not receive treatment may include those who may have been offered treatment but refused.

BMD Testing and Treatment Following Wrist Fracture

- 71.2% of this high risk population were not investigated or treated for osteoporosis within 6 months of their wrist fracture (2016/17) (see Figure 10). In 2005/06, 79% were not being investigated so this has improved since then.

[13] Seniors are excluded if they had already received a BMD test within 12 months of their fracture or were already taking medication. People need to be at least 66 years old when they have their fracture, because we needed a one-year look-back period to see if they were already taking prescription medication for osteoporosis.

Figure 10: Percent of adults 66 and older, who did not receive a BMD test OR treatment in the 6 months following a wrist fracture in Ontario, 2014/15 – 2016/17



Data Sources: Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD); National Ambulatory Care Reporting System (NACRS); Ontario Health Insurance Plan (OHIP), Ontario Drug Benefit Program (ODB)

Treatment Initiation after Hip Fracture

Indicator: Rates of treatment (medication) of osteoporosis in men and women age 66 and older who have had a low trauma fracture, within one year of the fracture.

There were three outcomes of interest for this indicator:

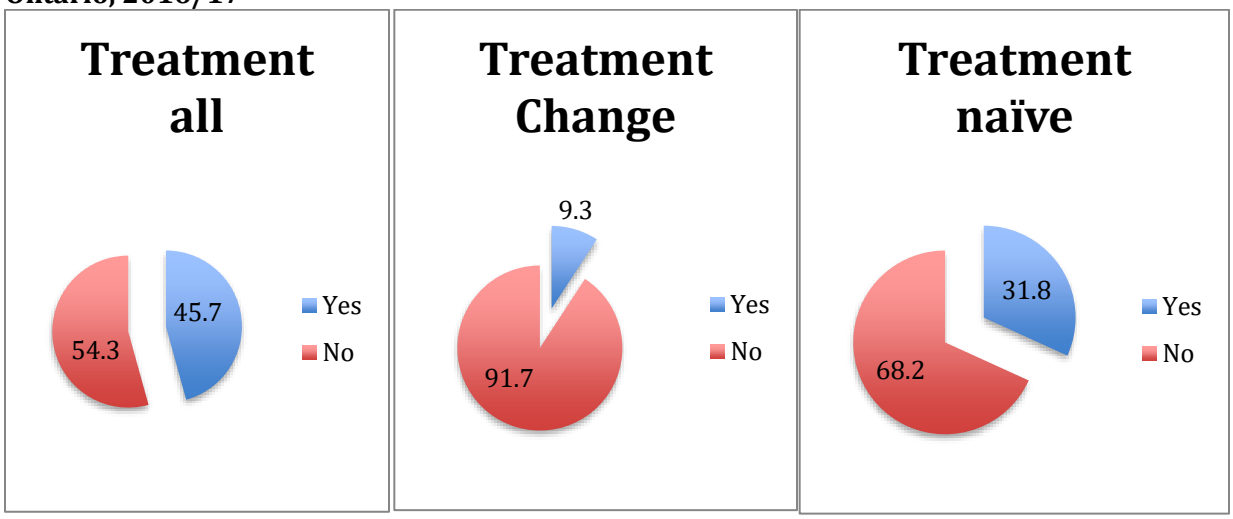
(1) Outcome 1: Treatment adherence *('Treatment all')*
Proportion of people who had a hip fracture who are on medications for OP 12 months following discharge from fracture (all and hip fracture only). The denominator is patients with all fractures within a year following the fracture whether or not they were taking the osteoporosis medication.

(2) Outcome 2: Treatment initiation in treatment naïve group *("Treatment Naïve")*
Proportion of the treatment naïve group who got treatment within one year (all and hip fracture only). The denominator is patients with all fractures within a year following the fracture excluding the patients who were taking osteoporosis medication prior to the fracture.

(3) Outcome 3[14]: Treatment change within 12 months of fracture ('*Treatment Change*')
Proportion of patients with hip fracture who had a change in medications within 12 months (all and hip fracture only). The denominator is patients with all fractures within a year following the fracture whether or not they were taking the osteoporosis medication.

The rates for all three outcomes have been reasonably stable since 2013/14 (see Figure 11).

Figure 11: Percent of adults 66 and older by drug treatment following hip fracture in Ontario, 2016/17



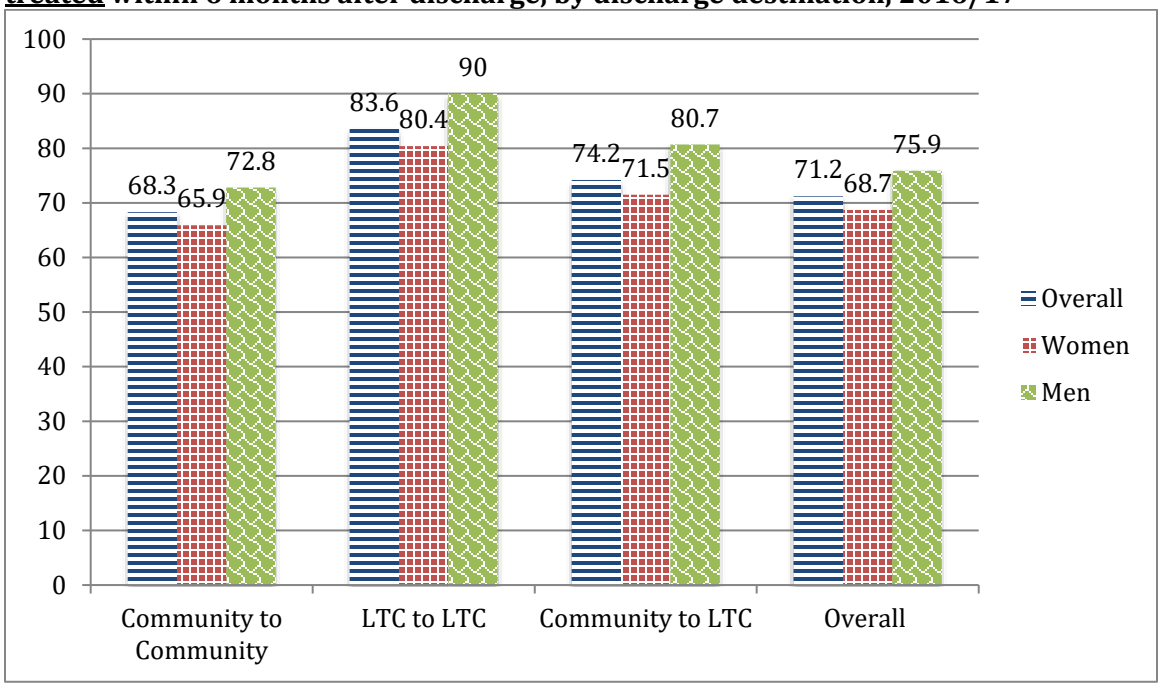
Data Sources: Canadian Institute for Health Information Discharge Abstract Database (CIHI-DAD); National Ambulatory Care Reporting System (NACRS); Ontario Health Insurance Plan (OHIP), Ontario Drug Benefit Program (ODB)

BMD Testing and Treatment Following Hip Fracture for Adults 66+ by Location of Residence

Indicator: Hip fracture outcomes for adults 66 years and older at the time of the fracture[15] stratified by 3 cohorts: (1) in LTC or chronic care both prior to and after their hip fracture; (2) in community at time of fracture and discharged to LTC; and, (3) in community before and after hip fracture
Treatment outcome – proportion not treated (osteoporosis medication) or tested (BMD test) within 6 months after discharge

[14] To capture the change of the medication we compared the drug ingredients within a year. We are aware of the fact that, if a patient filled a prescription towards the end of the previous year for a shorter period then we are not capturing this change. For example, if someone fills a 30-day prescription for drug A on March 15 and for drug B on April 10. We assume that most of the people do not change their drugs all that often. We also assume that the proportion of prescription change just prior to a year will not change our result drastically, it may move our result by a decimal point.
[15] Individuals were included if they lived for at least 7 days after discharge so that their discharge destination could be determined. Individuals were excluded if they filled a prescription for an osteoporosis medication during the one-year period prior to admission or if they did not live for 6 months after discharge.

Figure 12: Percent of hip fracture patients aged 66 and older who were <u>neither tested nor treated</u> within 6 months after discharge, by discharge destination, 2016/17



Data sources: Discharge Abstract Database (DAD), National Ambulatory Care Reporting System database (NACRS), Ontario Health Insurance Plan Claims database (OHIP), Registered Persons Database, Ontario Drug Benefit Plan Database, Continuing Care Reporting System

Section 4: Treatment Persistence

Indicator: Rate (per 100) of adults, 66 years and older, in each fiscal year, who were initiated on pharmacological treatment for osteoporosis during the year and were still taking their medication 1 year later[16,17]

- There was higher persistence in the 80+ age group compared to the 66-79 age group (55.9% compared to 53.3%) in 2016/17.
- Overall treatment persistence has remained reasonably consistent from 2014/15 to 2016/17 (53% to 54%)
- The overall number of individuals 66+ getting new prescriptions increased each year (43,904 in 2014/15 to 45,881 in 2016/17).
- In 2016/17 overall treatment persistence was 54%.

[16] Some OP medications are taken only once a week, once a month or once per year (for this drug once they take it once they are automatically considered to be on the drug for a full year). Adjustments have been made in the programming to account for these different dosing patterns.

[17] People were examined if they filled a new prescription at any time during a given fiscal year. The first prescription filled during the year was called the 'index prescription' and it was said to be 'new' if the person had not filled a prescription for any of the osteoporosis medications in the year prior to the index date. People were followed for one year past the index date to see if they persisted in filling prescriptions for the next year. Look back period is 12 months prior to index date.

Section 5: Direct Cost of Hip Fracture Episode[18]

- The impact of hip fractures on health system utilization and cost is significant.
- The total cost of treatment for all hip fractures occurring in 2015/16 (in adults aged 66+) was estimated to be $255,773,130 based on direct utilization costs for the episode of care.
- The median cost **per single episode of care** was $25,015 for direct utilization costs (see Table 8).
- The impact of hip fractures is also significant if total costs incurred one-year pre-fracture ($200,732,327) are compared with total costs incurred one year post-fracture ($348,985,225) - a difference of $148,252,898 which is expected to be largely due to the impact of the hip fracture (see Table 8).
- Costs were highest in the 80+ age group because of the higher numbers of hip fracture in that age group.

Table 8: Cost estimates associated with hip fracture episode of care, based on direct utilization costs, in adults 66 years or older in Ontario, 2015/16

Age	1 Year Prior		Cost of Treatment		1 Year Post Discharge		Post-Pre Change	
	Cost	Median	Cost	Median	Cost	Median	Cost	Median
66-79	$58,399,292	$6,457	$73,097,566	$23,804	$93,323,850	$16,723	$34,924,558	$3,814
80+	$142,333,035	$9,629	$182,675,564	$25,888	$255,661,375	$29,448	$113,328,340	$10,005
Overall	$200,732,327	$8,576	$255,773,130	$25,015	$348,985,225	$25,386	$148,252,898	$7,648

Data Source: Ontario Health Insurance Plan (OHIP), CIHI Discharge Abstract Database (DAD), National Ambulatory Care Reporting System database (NACRS), Registered Persons Database, Ontario Drug Benefit Plan Database, Client Agency Program Enrolment (CAPE) database, National Rehabilitation Reporting System (NRS) database

[18] Study population was individuals aged 66 years or older at the time of their hip fracture who were discharged from their hip fracture episode of care (including inpatient rehabilitation, if any) between April 1, 2015 and March 31, 2016. Only the first hip fracture was included for those who had more than one hip fracture. Total costs were calculated for the hip fracture episode of care, and for the 1-year period prior to admission and the 1-year period after discharge.

Section 6: Local Health Integration Network (LHIN) Data

Table 9: Hip and Wrist Fracture – Rate, Change over Time and Follow up after Fracture, by LHIN

Region	Local Health Integration Network (LHIN)	Standardized Hip fracture rates (per 10,000) aged 50+ years (2017/18	Number of Hip Fractures aged 50+ years (2017/18)	Percent Change in Hip Fracture Rate 2005/06 to 2017/18 (- represents a reduction in rate)	Percent of adults 66+ years who did receive a BMD test OR treatment in the 6 months following a hip fracture (2016/17)	Standardized wrist fracture rates (per 10,000) aged 50+ years (2017/18)	Percent Change in Wrist Fracture Rate 2005/06 to 2017/18 (- represents a reduction in rate)	Percent of adults 66+ years who did receive a BMD test OR treatment in the 6 months following a wrist fracture (2016/17)
West	Erie St. Clair	23.8	662	-7.0	39.5	35.4	3.8	16.2
	South West	23.6	994	-20.3	23.0	46.1	9.1	30.3
	Waterloo Wellington	23.0	611	-12.1	43.1	40.6	17.0	42.5
	Hamilton Niagara Haldimand Brant	23.1	1493	-10.9	34.4	41.8	3.8	28.3
Central	Central West	19.0	472	-16.3	29.0	33.3	-8.4	23.2
	Mississauga Halton	16.9	656	-32.1	48.4	36.0	-10.5	25.5
	Central	19.1	1250	-16.8	42.2	37.8	-5.3	31.4
	North Simcoe Muskoka	25.7	540	-4.4	39.5	42.3	2.8	27.0
Toronto	Toronto Central	19.0	931	-21.5	47.1	42.0	0.7	34.4
East	Central East	21.0	1324	-6.4	27.1	37.7	-0.7	29.7
	South East	25.5	613	-15.2	17.2	42.3	12.0	11.9
	Champlain	22.6	1126	-6.1	32.3	40.9	-2.1	23.2
North	North East	23.8	613	-7.0	28.4	41.6	10.9	20.0
	North West	27.4	252	-4.0	32.3	40.5	8.0	30.2
PROVINCIAL AVERAGE		**21.6**	**--**	**-12.9**	**31.8**	**39.9**	**2.0**	**28.8**

Appendix A: Ontario Osteoporosis Strategy Performance Indicators and Definitions

Fracture Rates	***Definition***
a) Fracture rates: Age-standardized fracture rate (per 10,000) in adults, aged 50 years and older, overall and by fracture type for fractures probably due to osteoporosis • Hip • Wrist or forearm • Ribs, sternum, thoracic or lumbar spine • Shoulder or upper arm • Pelvis	*Data sources:* NACRS (ED visits and same day surgery), CIHI-DAD (inpatient), OHIP (physician claims), population denominator databases (see below) *Denominator:* from RPDB population files each year[19] *Numerator:* • Case definitions based on PHAC (see codes below) • If a person is seen more than once in a physician office, the ED and/or hospital within 13 weeks (91 days) for the same type of fracture, we will assume these are due to the same fracture (to avoid double counting) • In order to be included, a fracture identified only in an OHIP record must be followed by at least one additional OHIP record dated within 91 days of the first record • If someone has more than 1 fracture they will contribute more than once to the rate (i.e. If someone has more than one event in which they break a bone, the person is in the numerator more than once). However, if someone has more than one fracture treated at the same time, it is counted only once in the overall rate but counted separately in the rates by type of fracture.) **Hip:** *ICD-10 codes (inpatient hospitalization only)* S72.0 Fracture of neck of femur S72.1 Pertrochanteric fracture S72.2 Subtrochanteric **Wrist** *ICD-10 codes (CIHI, NACRS, OHIP)* Diagnosis code S52 Fracture of forearm: S52.0 to S52.6 Multiple fractures of forearm: S52.7 Fracture of other parts of forearm: S52.8 Fracture of forearm, part unspecified: S52.9 *OHIP* dxcode 813 (fracture of radius or ulna) 814 **Spine:** *ICD-10 codes (CIHI, NACRS, OHIP)* S22.0 Fracture of thoracic vertebra

[19] RPDB: everyone in this file has a valid IKN; valid sex; valid Ontario residence code; excluded those aged <50 and <105 on October 1 of the fiscal year; excluded individuals not eligible for OHIP coverage at any time during the fiscal year

	S22.1 Multiple fractures of thoracic spine S32.0 Fracture of lumbar vertebra *OHIP* dxcode 805 (vertebral fracture without spinal code damage) **Shoulder:** *ICD-10 codes (CIHI, NACRS and OHIP)* S42.2 Fracture of upper end of humerus S42.3 S42.4 *OHIP* dxcode 812 (fracture of humerus) **Pelvis:** *ICD-10 codes (CIHI, NACRS and OHIP)* S32.1 Fracture of sacrum S32.3 Fracture of ilium S32.4 Fracture of acetabulum S32.5 Fracture of pubis *OHIP* dxcode 808 (fracture of the pelvis)
b) Subsequent fracture: Proportion (per 100) of adults aged 50 and older who have a fracture and then a subsequent fracture within 3 years	*Data sources:* NACRS (ED visits and same day surgery), CIHI-DAD (inpatient), OHIP (physician claims), population denominator databases (see below) *Denominator:* • Excluded anyone who did not live for the full 3 years after discharge from their index fracture; • If someone had more than one fracture during a given fiscal year, they are included in the denominator more than once • Excluded anyone who became ineligible for OHIP in the 3 years post index fracture *Numerator:* • People in the denominator who had another fracture within 3 years after their discharge from their original fracture • Look forward for a second fracture starts after discharge from the original episode of care • If someone had more than one fracture recurrence following index fracture, only count one recurrence • This indicator was measured only up to FY 2014/15 since 3 years of follow up data are required
Follow-up after Fracture	***Definition***
Rates (per 100) of identification (receipt of a BMD test) and/or treatment (medication) of osteoporosis within 12 months of the fracture, in adults age 66 and older who have had a fracture and were not already taking osteoporosis medication. The indicator rate is expressed as no follow-up: the rate	*Data sources:* OHIP, ODB, CIHI-DAD, and NACRS *Denominator - Excluded:* 1. People who were not at least 66 years old at the time of their admission fracture (noting that the fracture might have been treated in the ED or in a doctor's office) (due to the need for 1 year of look-back in the

of fractures followed neither by identification (BMD) nor treatment (medication) This indicator is reported for individuals who had a hip fracture and for individuals who had a wrist fracture.	ODB database) 2. Those who have already had a BMD test within 12 months before their fracture 3. Those who filled a prescription for osteoporosis medication in the 12 months before their fracture 4. People who died within 12 months after the fracture discharge 5. Anyone who was already taking one of the non-osteoporosis drugs indicative of another bone disease in the year prior to their fracture 6. Anyone whose final discharge date is > September 30, 2014 (not enough data for a one year follow-up) • Only the first fracture for a person in a given fiscal year was included *Numerator:* • Anyone aged 66 years and older at the time of their fracture, who <u>neither</u> had a bone mineral density test <u>nor</u> filled a prescription for one of the drugs used to treat osteoporosis, any time between the date of their fracture (the admission date for the fracture) and 12 months after discharge following their fracture.
Rate of treatment (medication) of osteoporosis in men and women age 66 and older who have had a low trauma fracture, within one year of the fracture.	*Data sources:* OHIP, ODB, CIHI-DAD, and NACRS *Three outcomes:* **(1) Outcome 1: Treatment adherence *('Treatment all')*** Proportion of people who had a hip fracture who are on medications for OP 12 months following discharge from fracture (all and hip fracture only). The denominator is patients with all fractures within a year following the fracture whether or not they were taking the osteoporosis medication. **(2) Outcome 2: Treatment initiation in treatment naïve group *("Treatment Naïve")*** Proportion of the treatment naïve group who got treatment within one year (all and hip fracture only). The denominator is patients with all fractures within a year following the fracture excluding the patients who were taking osteoporosis medication prior to the fracture. **(3) Outcome 3[20]: Treatment change within 12 months of fracture ('*Treatment Change*')** Proportion of patients with hip fracture who had a change

[20] To capture the change of the medication we compared the drug ingredients within a year. We are aware of the fact that, if a patient filled a prescription towards the end of the previous year for a shorter period then we are not capturing this change. For example, if someone fills a 30-day prescription for drug A on March 15 and for drug B on April 10. We assume that most of the people do not change their drugs all that often. We also assume that the proportion of prescription change just prior to a year will not change our result drastically, it may move our result by a decimal point.

	in medications within 12 months (all and hip fracture only). The denominator is patients with all fractures within a year following the fracture whether or not they were taking the osteoporosis medication.
BMD Testing	***Definition***
Trends in BMD testing: Rate (per 100) of BMD testing in adults, aged 50 years and older, overall and by type of test (baseline, low risk, high risk)	*Data sources:* OHIP *Denominator:* • From the RPDB population files for each year (population denominator) *Numerator:* • Everyone who received a BMD test during the year • Each person is counted only once in a given year. If there is more than one OHIP record for the same person in the same year, they were classified according to the highest risk that is indicated by their tests (i.e. if they had a low risk and high risk test in the same year they were classified based on the high risk test).
BMD OHIP Fee Schedule[21,22] *Baseline Test* X145 - one site X146 - two or more sites *Second test - low risk patient* X152 - one site X153 - two or more sites *Subsequent test - low risk patient* X142 - one site X148 - two or more sites *Subsequent test - high risk patient* X149 - one site X155 - two or more sites	

[21] Changes to the OHIP fee schedule that may have influenced testing rates and patterns: (http://www.health.gov.on.ca/english/providers/program/ohip/bulletins/4000/bulletin_4000_mn.html accessed June 21, 2010):
a) As of October 1, 1999, BMD screening of low risk patients for osteoporosis, previously allowed annually, was limited to once in any 24-month period. High-risk patients continued to receive unrestricted access to medically necessary testing. (www.health.gov.on.ca/english/providers/program/ohip/bulletins/4000/bul4346.html accessed June 10, 2010)
b) As of April 1, 2008 the fee schedule for BMD testing was changed and a new fee code for a baseline test was added. Individuals are limited to one baseline test in their lifetime. BMD tests for low-risk patients (i.e. a patient who is not a high risk patient) are limited to once every 36 months. High-risk patients (defined in the fee code as 1. at risk for accelerated bone loss (in the absence of other risk factors, patient age is deemed not to place a patient at high risk for accelerated bone loss); 2. with osteopenia or osteoporosis on any previous BMD testing; or 3. with bone loss in excess of 1% per year as demonstrated by previous BMD testing) are limited to one test every 12 months unless prior authorization is obtained (http://www.health.gov.on.ca/english/providers/program/ohip/bulletins/4000/bul4470a.pdf accessed June 21, 2010)

Definition of Codes for Dual-energy X-ray Absorptiometry (DXA) Testing

- *Baseline:* one baseline test in person's lifetime
- *Low-risk:* a patient who is not a high risk patient - limited to once every 36 months for first 'low risk' test and every 60 months for subsequent tests
- *High-risk:*
  - at risk for accelerated bone loss (in the absence of other risk factors, patient age is deemed not to place a patient at high risk for accelerated bone loss);
  - with osteopenia or osteoporosis on any previous BMD testing; or
  - with bone loss in excess of 1% per year (as demonstrated by previous BMD testing) are limited to one test every 12 months unless prior authorization is obtained

Current recommendations by the Ontario Health Technology Advisory Committee (OHTAC) do not support the need for low risk individuals to be tested more often than every three to five years after baseline and at later intervals of seven to ten years when previous testing has shown a rate of bone loss of less than 1%. High risk patients (determined by the physician) will continue to receive annual access.
(http://www.health.gov.on.ca/en/public/publications/ohip/bone.aspx)

BMD testing in 'eligible' seniors: Rate (per 100) of 'eligible' seniors (68 to 70) who had a BMD test ('eligible' = seniors 68 to 71 who had not had at least a baseline BMD test between the ages of 60 and 65)	*Data sources:* OHIP, RPDB, 2006 census
	
	Current OHIP guidelines allow people who are not at high risk to receive one BMD test each 3 years. When someone turns 65 they are moved from low to moderate risk for osteoporosis and should receive a baseline BMD if they have not already had one.
	
	The indicator examines people who are between the ages of 68 and 71 as of the "indicator" date and who have not already been tested between the ages of 60 and 65. These people should all have had a BMD test between the time they turned 65 and the "indicator" date.
	
	Denominator:
	• People who were between the ages of 68 and 71 on the "indicator date" (i.e. April 1 of the fiscal year)
	• Denominator from RPDB for each year
	• Exclusions:
	  ○ Anyone who already had a BMD test between the date of their 60th birthday and one day before the date of their 65th birthday. These people already had at least one baseline test, and therefore do not necessarily require another test when they turn 65.
	  ○ Thus, the denominator is everyone who is aged 68-71 at the start of the fiscal year (April 1) and who should have had a BMD test after turning 65 (because they had not had one prior to turning 65).
	
	Numerator:
	• Everyone in the denominator who received a BMD test any time between the date of their 65th birthday and the start of the fiscal year in question.

	• Unless they die, a given person will appear in the analyses for up to 3 years: the year they are 68, the year they are 69, and the year they are 71. • If they have a BMD test when they are 69, they will *not* be in the denominator when they are 68, but they will be in the denominator when they are 69 and again when they are 71.
BMD assessment within one year of wrist fracture: Proportion of adults, aged 50 years and older, who have a fracture that is possibly due to osteoporosis and receive a BMD test within 12 months of their wrist fracture	*Data sources:* OHIP, NACRS (ED visits and same day surgery), CIHI–DAD (inpatient) *Denominator:* A wrist fracture during a given fiscal year. Use only the first fracture during the year for each person. Exclusions: • Exclude those who have already had a BMD test within 12 months before their fracture • Exclude those who died within 12 months after their fracture For 2016/17, we retained only those fractures with a final discharge date on or before September 30, 2017 as we required 1 year of follow up data. *Numerator:* • Everyone who underwent a BMD test any time between the date of fracture (the admission date for the fracture) and 1 year after discharge following wrist fracture
Treatment Persistence	***Definition***
Proportion of adults, 66 years and older in each fiscal year, who were newly initiated on prescription drug treatment for osteoporosis during the year and were still taking their medication a year later	*Data source:* ODB *Denominator:* For each year between 2005/06 to 2017/18 (new use considered up to January 31, 2017), identified people who: *(1)* Filled a prescription for an osteoporosis medication during that fiscal year *(2)* Were at least 66 years old at the time they filled the prescription (in order to allow a one-year look-back period) *(3)* Had not filled a prescription in the 12 months prior to their first prescription during the year • Exclude anyone who died within 1 year after the date of their first prescription in the year • Exclude anyone who had already filled a prescription for an osteoporosis medication in the year prior to the prescription date. *Numerator:* • Everyone who took their medication continuously for one year

	• Based on detailed algorithms for drugs taken daily, weekly, monthly, drugs with a 90-day cycle, yearly injections and semi-annually (i.e. Denosumab) • Someone who is 'newly' taking medication in one year could also be newly taking medication in a later year because if they stop taking their medication they will appear to be a new user the next time they start to take it. **<u>Measures of Persistence using claims data:</u>** ○ Measured by the total days of drug coverage before experiencing a maximum gap of 60 days without drug coverage. ○ Apply same overlap and censoring as described above ○ Conduct sensitivity analysis using a 120 day gap without drug coverage to identify discontinuation.
Hip Fracture and Long Term Care	***Definition***
To describe time trends in incidence of hip fracture in LTC residents	*Data sources:* Population denominator files, ODB, OHIP, CCRS, CCRS-LTC, MNS, DAD, SDS, ED, RPDB *Denominator:* • Population denominator files and the following databases to determine who was in LTC: ODB, OHIP, CCRS, CCRS-LTC. The MNS was used to differentiate between chronic care and long term care residents. • People were assigned to the LTC or community group based on their history in the 1-year period prior to the start of the fiscal year. People were identified as being in LTC based on a flag in the ODB or a fee code and institution number in an OHIP billing. • Individuals who were alive at the start of each fiscal year (April 1st) and were aged 66 years and older. *Numerator:* • People who had a hip fracture during the fiscal year using the algorithm described above.
Hip fracture outcomes for adults 66 years and older at the time of the fracture stratified by 3 cohorts: (1) in LTC or chronic care both prior to and after their hip fracture; (2) in community at time of fracture and discharged to LTC; and, (3) in community before and after hip fracture Treatment outcome – proportion not treated (osteoporosis medication) or tested (BMD test) within 6 months after discharge	*Data sources:* CIHI-DAD, ODB, OHIP *Denominator:* Individuals who were treated in a hospital for a hip fracture with a discharge date during each fiscal year who were aged 66+ at the time of their *admission*. **Applied the following exclusions** 1. First hip fracture for a given person in a given fiscal year. 2. Remove individuals who were in the hospital for more than 1 year 3. Exclude those where the difference between the admission date and the date of the treatment for the hip fracture is >= 7 days after admission. These individuals were probably

	very sick at the time of admission (the delay in surgery is presumed to be because they are too sick for surgery). 4. Exclude if the hip fracture was not treated (i.e. if there are no procedure codes of 1.VA or 1.VC). 5. Delete people discharged after Sept 30, 2017 due to lack of follow-up data 6. Delete people younger than age 66+ at the time of admission (due to insufficient information on their status at the time of admission) 7. Exclude people who died during their hip fracture episode of care and up to 1 week after discharge (to give them time to enter LTC). *8.* Delete those who filled a prescription for a non-osteoporosis bone medication 1 year prior to admission and 12 months after discharge *9.* Exclude those who were in chronic care in the year prior to their admission (because they do not belong in either the LTC group or the community living group) After applying the exclusions, divide the remaining people into 3 groups: 1. In LTC at any time in the 1-year period prior to admission for their hip fracture = from LTC. 2. Not in LTC prior to admission, but entered LTC within 1 week after discharge = to LTC. 3. Not in LTC in the year prior to admission, and not discharged to LTC = community. *Numerator:* • All men and women aged 66 years and older at the time of their fracture, who neither had a bone mineral density test nor filled a prescription for one of the drugs used to treat osteoporosis, any time between the date of their fracture (the admission date for the fracture) up to 6 months after discharge following their fracture. • People who had received a BMD test in the year prior to their hip fracture admission are excluded. People who filled a prescription for an osteoporosis medication in the year prior to their hip fracture are excluded.
Cost of Hip Fracture	***Definition***
Health care utilization cost of hip fracture in adults 66+ at the time of their fracture (one-year look ahead and one-year look back) 1) The cost post discharge vs. the cost pre admission (this excludes the cost of treating the hip fracture). Look at how many health services they used after the hip was treated vs. what they used prior to the fracture. Post-discharge costs include rehabilitation. Included all costs in the costing macro.	*Data sources:* Costs are based on all health care utilization including CIHI-DAD, NACRS (SDS, ED, renal dialysis and cancer care clinics), ODB, OHIP, CAPE, NRS, CCRS, CCRS-LTC, OMHRS, HCD, IPDB, GAPP Decision Support Systems (to identify the funding model used to pay primary care physicians) *Denominator:* • People with a hip fracture in the most recent year of data (CIHI-DAD) • Discharges were excluded if the patient was discharged to an inpatient rehabilitation program but the discharge date

2) The cost of the episode of care for the hip fracture including hospital and inpatient rehabilitation.	from rehabilitation was missing; if the total length of stay for the hip fracture episode of care was greater than 365 days; if the patient was not discharged alive from the inpatient component of the episode of care; or if the individual was not aged 66 years or older at the time of their hip fracture (allowing a 1-year look-back for prescription drug use in the ODB) *Numerator:* • For 1 – included all health care costs • For 2 – costs associated with the hip fracture inpatient and rehabilitation episode of care • Costs are stratified based on LTC residence
Population Denominators	**Definition**
Population denominators	• RPDB (age, sex, place of residence (LHIN)) • LHIN population files • Contact files: OHIP, ODB, CIHI inpatient DAD, NACRS, CCRS, CCRS-LTC, NRS, HCD, OMHRS) • CAPE • The Postal Code Conversion File Plus (PCCF+)[23], version 5E, was used to assign income quintile and rural flag to postal codes • Definition of an urban area is an area with a population of at least 1,000 and a density of 400 or more people per square kilometre. All territory outside an urban area is defined as rural area.
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Drug Identification List (DIN)

Disease	ATC	Active Ingredient	Reference
Osteoporosis	**G03XC**	**Selective estrogen receptor modulators**	http://www.whocc.no/atc_ddd_index?code=G03X
	G03XC01	Raloxifene	
	H05AA	**Parathyroid hormones and analogues**	http://www.whocc.no/atc_ddd_index?code=H05A
	H05AA02	Teriparatide	
	H05BA	**Calcitonin preparations**	http://www.whocc.no/atc_ddd_index?code=H05B
	H05BA01	Calcitonin (salmon synthetic)	
	M05BA	**Bisphosphonates**	http://www.whocc.no/atc_ddd_index?code=M05B
	M05BA04	Alendronic acid	Exclude 40mg tab (for Paget's disease)
	M05BA07	Risedronic acid	Exclude 30mg tab (for Paget's disease)
	M05BA08	Zoledronic acid	Exclude 4mg/5ml (for oncology)

[23] PCCF+ Version 5E User's Guide. Russell Wilkins, Health Information and Research Division, Ottawa, July 2001, Catalogue no. 82F0086-XDB.

M05BB	**Bisphosphonates, combinations**		
M05BB01	Etidronic acid and calcium, sequential		
M05BB02	Risedronic acid and calcium, sequential		
M05BB03	Alendronic acid and Cholecalciferol		
M05BB04	Risedronic acid, Calcium and Cholecalciferol, Sequential		
M05BX	**Other drugs affecting bone structure and mineralization**		
M05BX04	Denosumab	Exclude 120mg/1.7ml (for oncology)	