Patterns of use of the bone mineral density test in Ontario, 1992–1998

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Abstract

Background: There is ongoing controversy about who should be referred for bone mineral density (BMD) testing to estimate fracture risk and diagnose osteoporosis. The purpose of this study was to examine patterns of use of BMD testing in Ontario between 1992 and 1998.

Methods: All physician claims from the Ontario Health Insurance Plan (OHIP) claims database for BMD testing between Jan. 1, 1992, and Dec. 31, 1998, were categorized by age and sex of the patient and the specialty of the physician who ordered the test. Time trends and regional rate variation analyses were also performed. To examine the prevalence of repeat testing, an inception cohort of women who had a BMD test in 1996 was followed for 2 years from the date of first test.

Results: From 1992 to 1998 the number of BMD tests performed per year in women increased from 34 402 to 230 936 and in men from 2 162 to 13 579. In 1998 most tests were being ordered by family physicians (80.2% in 1998 v. 52.1% in 1992). Approximately 1 in 7 women aged 55–69 years had BMD tests done in 1998. Within a 2-year period 29.3% of these women had the test repeated; the mean time between tests was 16 months. Regional rate variation analyses of BMD tests performed in 1996–1998 indicated a 235-fold variation in BMD test rates across counties in Ontario, with a range from 0.2 to 47.1 per 1000 women in the population.

Interpretation: The number of BMD tests performed each year in Ontario is increasing rapidly. However, the significant variation between rates of testing in different regions indicates that the diffusion of this technology may not be taking place according to population need.

Osteoporosis predisposes to bone fractures at the hip, wrist and spine. It affects approximately 1.4 million Canadians, mostly postmenopausal women and elderly people.[1] Osteoporosis-related fractures cause considerable morbidity and an enormous financial burden through the use of health services, at an estimated cost of $1.3 billion in 1993.[1] To prevent osteoporotic fractures, individuals at risk for fractures must first be identified, and then the appropriate interventions to reduce this risk, such as lifestyle modifications and hormone or other drug therapies, must be implemented.[2]

Bone mass is a major determinant of bone strength and has an inverse relationship with fracture risk. Prospective studies[3–6] have shown an increasing gradient of fracture risk with decreasing bone mineral density (BMD), a decrease in density of 1 standard deviation (SD) being associated with a 1.5- to 3.0-fold increase in risk of fracture. However, the use of densitometry for risk assessment remains controversial in Canada. The provincial offices of health technology assessment in both Alberta[7] and British Columbia[8] have concluded that bone densitometry is unsuitable for screening and is not recommended for use in "well women." Yet, clinical practice guidelines published in Canada,[9] the United States,[10] Europe[11] and Australia[12] state that those at greatest risk for osteoporosis-related fractures should be identified on the basis of BMD measurements.

Research

Recherche

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This article has been peer reviewed.

CMAJ 2000;163(9):1139-43

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Given the differing perspectives, the purpose of our research was to examine patterns of use of BMD testing in Ontario. Time trends, the age and sex distribution of the population being tested, specialties of the physicians ordering the test, repeat testing rates and regional rate variations were examined.

Methods

The primary data source was the Ontario Health Insurance Plan (OHIP) Claims Database. To obtain the age and sex of the patient for each test ordered, OHIP files were linked to the Registered Persons Database using a unique identifier.

Currently, dual-energy x-ray absorptiometry (DXA) is the accepted method to measure BMD for estimating fracture risk and diagnosing osteoporosis in the hip and spine.[9–12] Before DXA technology, dual-photon absorptiometry (DPA) was the standard. To calculate time trends, all physician claims for BMD measurement by DPA or DXA between Jan. 1, 1992, and Dec. 31, 1998, were selected from the OHIP database using the following codes: J888 or J688 for a single site (spine, proximal femur, radius, whole body) and J856 or J656 for 2 or more sites.[13] Physicians were categorized as family physicians, obstetrician-gynecologists, internal medicine specialists or "other" (e.g., radiologists). To calculate age- and sex-adjusted rates, the number of BMD tests were standardized using the Ontario population in the year the test was ordered.

To examine repeat testing in women, we created an inception cohort of all women who had BMD testing in 1996 by excluding those who had 1 or more tests between 1992 and 1995. Each patient in the cohort was then followed through record linkage in the OHIP database for 2 years from the date of their 1996 test. We calculated the proportion of women who had the test repeated during the 2-year period and the mean duration between tests. If the patient had a DXA within 1 month of their initial DXA, this was not considered a repeat test — the test was probably done again because of a technical error.

To obtain stable rate estimates for the 49 regions in Ontario, the analysis of regional rate variations combined data over 2 time periods: 1992–1995 and 1996–1998. The tests were assigned to each region according to the location of the physician's office. All rates were adjusted to the age and sex distribution of the population.

Three measures were used to quantify regional rate variations: the extremal quotient (EQ), the weighted coefficient of variation (CV) and the systematic component of variation (SCV).[14] The EQ is the ratio of the highest observed proportion to the lowest and measures the relative difference between extremes. The CV measures the ratio of the SD of BMD rates across the various geographic regions to the mean BMD rate, weighted by the number of billings in each region to account for the unequal sizes of the regions, multiplied by 100. The SCV allows for comparison of variation among rates, and it is obtained by subtracting the random component of variation from the estimate of total variance.[15] The EQ and CV are descriptive statistics and cannot be used to test hypotheses. Therefore, we calculated the likelihood ratio χ^2 statistic, which allowed us to test the hypothesis that the rate of BMD testing did not vary between regions. A p-value below 0.05 was considered statistically significant. To determine if the relative ranking of regional rates remained stable over the 2 time periods, we calculated a Spearman's rank-order correlation coefficient. This statistic was also used to determine whether the quantity and location of bone densitometers was associated with regional rates. The data on densitometer quantity and location were provided by the Osteoporosis Society of Canada.

Results

The number of BMD test billings for men and women in Ontario between 1992 and 1998 are presented in Table 1. The annual number of BMD tests increased approximately 6-fold between 1992 and 1998 for both men and women. The rate of increase was largest between 1995

Table 1: Number of bone mineral density (BMD) test billings for men and women in Ontario, 1992–1998

	Number of BMD test billings		
Year	Men	Women	Total
1992	2 162	34 402	36 564
1993	2 632	42 323	44 955
1994	3 182	54 494	57 676
1995	3 792	67 939	71 731
1996	5 690	110 556	116 246
1997	8 675	165 630	174 305
1998	13 579	230 936	244 515

Table 2: Number of BMD tests ordered by physicians in different specialties in Ontario, 1992–1998

	Specialty of physician, no. (and %) of BMD tests ordered				
Year	Family practice	Internal medicine	Obstetrics–gynecology	Other	Total no. of tests
1992	19 037 (52.1)	13 750 (37.6)	3 450 (9.4)	327 (0.9)	36 564
1993	25 064 (55.8)	15 538 (34.6)	4 077 (9.1)	276 (0.6)	44 955
1994	34 319 (59.5)	17 271 (29.9)	5 691 (9.9)	395 (0.7)	57 676
1995	46 246 (64.5)	18 460 (25.7)	6 431 (9.0)	594 (0.8)	71 731
1996	84 352 (72.6)	23 247 (20.0)	7 817 (6.7)	830 (0.7)	116 246
1997	134 237 (77.0)	29 257 (16.8)	9 664 (5.5)	1 147 (0.7)	174 305
1998	196 125 (80.2)	34 281 (14.0)	12 960 (5.3)	1 149 (0.5)	244 515

and 1996, when the number of tests increased by approximately 1.6 times.

The proportion of BMD tests ordered by family physicians increased from 52.1% in 1992 to 80.2% in 1998, whereas the proportion ordered by internal medicine specialists, obstetrician-gynecologists and physicians in other specialties decreased in the same time span (Table 2).

Time trends in age-specific rates of BMD testing are presented in Fig. 1. For all age groups, the number of BMD tests increased each year between 1992 and 1998. The highest rates were seen for women between the ages of 55 and 69 years. In 1998 approximately 1 in 7 women in this age range had a BMD test.

Of the women who had their first test in 1996, 29.3% had a repeat test within 2 years. The average time between tests was 16 months (range 1–24 months).

For the 49 Ontario counties the average age-adjusted rate of BMD testing for the 1992–1995 interval ranged from 0 to 28.9 tests per 1000 women in the population (data not shown), and for the 1996–1998 interval from 0.2 to 47.1 per 1000 women in the population (Table 3). The 5 regions with the highest BMD rates — Hamilton, Toronto, Halton, Durham and Brant (concentrated in south-central Ontario) — were the same for both time intervals. Most of the regions with the lowest BMD rates were in northern Ontario.

Using the 1992–1995 data the EQ, CV and SCV were 564.5, 71.6 and 588.5, respectively. For 1996–1998 these values were 251.7, 48.3 and 355.1, respectively. These statistics indicate significant regional variations in the use of the BMD test in Ontario. The χ^2 test was statistically significant ($p < 0.001$) for both time periods, indicating that the BMD rates were significantly different between regions. The Spearman's rank-order correlation coefficient between region-specific rates for the 2 time periods was 0.7 ($p < 0.001$), indicating regions with high rates of use in 1992–1995 also had high rates in 1996–1998. In 1995 there were 95 bone densitometers in Ontario; in 1998 the total had increased to 212. The regions with more densitometers in 1998 had higher rates of BMD testing ($\rho = 0.8$, $p < 0.001$).

Interpretation

The number of BMD tests performed in Ontario increased at least 6-fold between 1992 and 1998. One in 7 women between 55 and 69 years of age had BMD tests done in 1998, compared with 1 in 50 in 1992. The increase in the proportion of BMD tests ordered by family physicians, from 52.1% in 1992 to 80.2% in 1998, suggests that osteoporosis is primarily being managed by family physicians. Approximately 30% of women had a repeat test within 2 years of their first test. Together, these data suggest that the large increase in the number of tests since

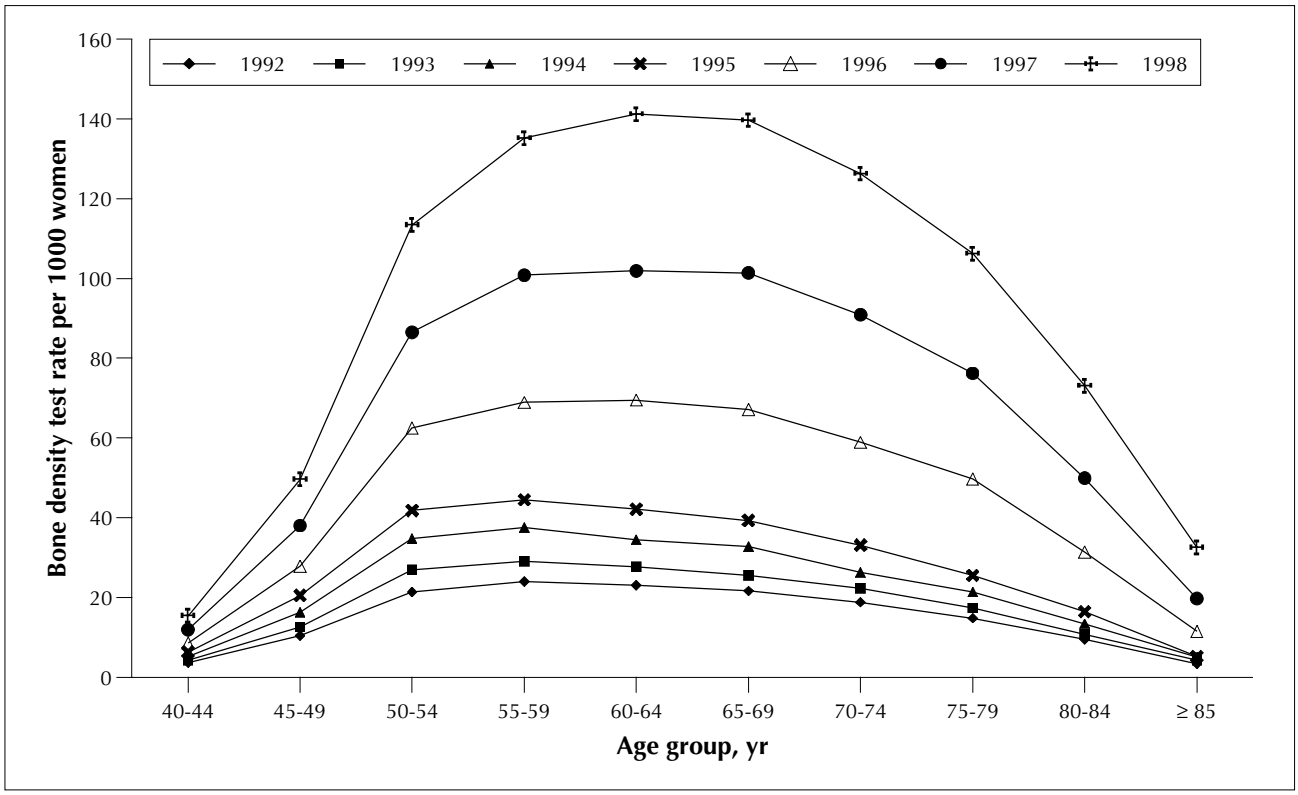

Fig. 1: Age-specific rates for bone mineral density tests per 1000 women in Ontario, 1992–1998.

1996 is not primarily because of repeat testing in a select group of patients, but rather that new patients are being tested.

There was significant variation in the use of BMD tests across Ontario. The difference between the highest area rates and the lowest area rates was 235-fold. This suggests that there may be both under- and over-utilization of this diagnostic test;[15–16] patients in low-utilization areas may not be getting tests they need, whereas patients in high-utilization areas may be having too many (or inappropriate) tests ordered.[17] The steady increase in rates over the 7-year period with little change in regional rate variations supports the premise that the increases are occurring in an uncoordinated fashion.

There was large regional variation in the access to and availability of bone densitometers. We noted that area rates were correlated with the location of bone densitometers, suggesting that access to technology was driving utilization. The increase in the use of densitometry services is not only happening in Ontario but also in the United Kingdom, where there were over 100 hospital-based osteoporosis clinics in operation in 1997, compared with only a handful 10 years ago.[18] The number of densitometers in Ontario grew from 95 in 1997 to 212 in 1998, yet regional variation was still significant. This may be because areas with high rates in the earlier period simply continued to add more densitometers to their existing complement.

Although hormone replacement therapy remains the treatment of choice for skeletal protection, there has been much effort devoted to alternative treatments for the prevention of osteoporosis because of the possible increase in the risk for breast cancer and the side effects (bleeding, weight gain and breast tenderness) associated with hormone therapy. The sharp jump in BMD testing rates after 1995 might be explained by the introduction of the bisphosphonate family of medications to the marketplace in 1995 as an alternative to hormone replacement therapy.

This study is limited by the information available in the administrative databases. We do not know why the tests were ordered (i.e., risk factors for osteoporosis, secondary osteoporosis or to monitor treatment effects) or what the results of the tests were.

Although BMD testing has been increasing rapidly in Ontario, the significant variation between regional rates of BMD testing indicates the diffusion of this technology may not be taking place according to population need.

Competing interests: None declared.

Table 3: Mean age-adjusted rates of BMD tests per 1000 women in 1996–1998 and the number of densitometers available in 1998 in each of 49 regions in Ontario

Region	Age-adjusted 1998 rate per 1000 women	No. of densitometers available	Region	Age-adjusted 1998 rate per 1000 women	No. of densitometers available
Hamilton–Wentworth Reg. Mun.	47.1	17	Frontenac County	12.6	2
Toronto Metropolitan Mun.	33.6	88	Sudbury Region Municipality	12.2	2
Halton Reg. Mun.	33.5	11	Stormont, Dundas and Glengarry United Counties	11.5	1
Durham Reg. Mun.	31.6	7	Thunder Bay District	11.2	0
Brant County	29.7	5	Bruce County	10.7	1
Peel Reg. Mun.	28.0	15	Northumberland County	10.6	0
Wellington County	26.6	3	Lanark County	9.8	1
York Reg. Mun.	34.4	8	Prince Edward County	8.8	0
Dufferin County	22.8	1	Parry Sound District	7.7	0
Peterborough County	20.9	1	Manitoulin District	6.1	0
Ottawa–Carleton Reg. Mun.	20.5	12	Oxford County	4.9	1
Niagara Reg. Mun.	19.0	6	Leeds and Grenville United Counties	4.5	1
Grey County	18.1	1	Nipissing District	4.0	1
Essex County	16.3	4	Kent County	4.0	1
Waterloo Reg. Mun.	15.9	6	Lennox and Addington Counties	2.5	0
Middlesex County	15.8	3	Huron County	2.5	0
Haldimand–Norfolk Reg. Mun.	15.5	2	Sudury District	2.4	0
Victoria County	14.8	1	Elgin County	2.2	1
Hastings County	14.8	3	Algoma District	2.2	1
Muskoka District Mun.	14.2	1	Prescott and Russell United Counties	2.2	1
Cochrane District	14.1	1	Perth County	2.0	1
Lambton County	13.8	3	Timiskaming District	1.7	0
Haliburton County	13.7	0	Kenora District	0.5	0
Renfrew County	13.7	3	Rainy River District	0.2	0
Simcoe County	12.9	7			

Note: Reg. Mun. = Regional Municipality.

Contributors: Drs. Jaglal and McIsaac were the lead investigators and developed the idea for the study objective and contributed to the study design, data analysis and writing of the results. Drs. Chan and Jaakkimainen and Ms. Cadarette contributed to the execution of the study, the data analysis and the writing of the article. Dr. Hawker contributed to the interpretation of the data and the writing of the results and discussion sections. All authors take responsibility for defending the manuscript.

Acknowledgements: We acknowledge Dr. J.I. Williams for his helpful comments and Keyi Wu for assistance with data analysis.

Dr. Jaglal is a Career Scientist supported by the Ontario Ministry of Health, and Dr. Hawker is a Medical Research Council of Canada Scientist.

This research was supported by a grant from the Institute for Clinical Evaluative Sciences, Toronto, Ont.

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