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Original Article

Recommendations for Bone Mineral Density Reporting in Canada: A Shift to Absolute Fracture Risk Assessment

Kerry Siminoski,[*,1] *William D. Leslie,*[2] *Heather Frame,*[3] *Anthony Hodsman,*[4] *Robert G. Josse,*[5] *Aliya Khan,*[6] *Brian C. Lentle,*[7] *Jacques Levesque,*[8] *David J. Lyons,*[9] *Giuseppe Tarulli,*[10] *and Jacques P. Brown*[11]

[1]*Department of Radiology and Diagnostic Imaging and Division of Endocrinology and Metabolism, Department of Medicine, University of Alberta, Edmonton, Canada;* [2]*Department of Medicine and Department of Radiology, University of Manitoba, Winnipeg, Canada;* [3]*Department of Continuing Medical Education, University of Manitoba, Winnipeg, Canada;* [4]*Department of Medicine, University of Western Ontario, London, Canada;* [5]*Department of Medicine, University of Toronto, Toronto, Canada;* [6]*Department of Medicine, McMaster University, Hamilton, Canada;* [7]*Department of Radiology, University of British Columbia, Vancouver, Canada;* [8]*Department of Radiology, Le Centre hospitalier universitaire de Quebec, Sainte-Foy, Canada;* [9]*Department of Diagnostic Imaging, Renfrew Victoria Hospital, Renfrew, Canada;* [10]*Department of Medical Imaging, Humber River Regional Hospital, Toronto, Canada; and* [11]*Department of Medicine, Laval University, Sainte-Foy, Canada*

Abstract

In June 2005, new Canadian recommendations for bone mineral density (BMD) reporting in postmenopausal women and older men were published by Osteoporosis Canada (formerly the Osteoporosis Society of Canada) and the Canadian Association of Radiologists. The recommendations were developed by a multidisciplinary working group that included the Canadian Panel of the International Society for Clinical Densitometry and were reviewed and endorsed by multiple stakeholders. Previous Canadian osteoporosis guidelines advised intervention based on an individual's World Health Organization category (normal, osteopenia, or osteoporosis) as a marker of relative fracture risk. In the new approach, an individual's 10-yr absolute fracture risk, rather than BMD alone, is used for fracture risk categorization. Absolute fracture risk is determined using not only BMD results, but also age, sex, fragility fracture history, and glucocorticoid use. A procedure is presented for estimating absolute 10-yr fracture risk in untreated individuals, leading to assigning an individual to 1 of 3 absolute fracture risk categories: low risk (<10% 10-yr fracture risk), moderate risk (10−20%), and high risk (>20%). We propose that an individual's absolute fracture risk category should be the basis for deciding on treatment and frequency of BMD monitoring.

Key Words: Bone mineral densitometry; dual-energy X-ray absorptiometry; fracture; guidelines; osteopenia; osteoporosis.

Introduction

Osteoporosis Canada (OC; formerly the Osteoporosis Society of Canada) is an advocacy and support group similar to the National Osteoporosis Foundation, International Osteoporosis Foundation, and other organizations throughout the world *(1,2)*. One of the activities of OC is to develop osteoporosis care guidelines and recommendations applicable within Canada. Detailed and comprehensive evidence-based osteoporosis guidelines were issued in 1996 and 2002 *(3,4)*. The paradigms in those documents were based on categorizing an individual's fracture risk using World Health Organization (WHO) bone mineral density (BMD) categories of

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*Address correspondence to: Dr Kerry Siminoski, 6628-123 Street, University of Alberta, Edmonton, Alberta, Canada, T6H 3T6. E-mail: kerrygs@telusplanet.net

normal, osteopenia, and osteoporosis, similar to approaches used in many other osteoporosis guidelines *(5–10)*.

OC convened a multidisciplinary working group in association with the Canadian Association of Radiologists to issue updated recommendations for reporting and applying BMD results. These were endorsed by bodies representing key stakeholders within Canada, including the Canadian Panel of the International Society for Clinical Densitometry.

The Canadian recommendations were issued in June 2005, and have altered the fundamental approach to BMD utilization that had been in use over the previous decade, shifting the emphasis from the relative risk conferred by WHO T-score categories to absolute fracture risk based on the 10-yr absolute fracture risk as estimated from an individual's BMD, age, sex, fracture history, and glucocorticoid use *(11)*. Risk estimates were developed from published literature, with interpolation and extrapolation of data as required *(12)*. In view of the broadening discussion about this type of approach, it was felt that these recommendations would be of interest to groups throughout the world that are updating their own osteoporosis care guidelines. Accordingly, an abridged version of the OC document is provided here. It retains the core elements relating to application of absolute fracture risk to individual patients. The complete document can be accessed online (http://www.osteoporosis.ca).

Absolute Fracture Risk Based on Bone Densitometry, Age, and Sex

We recommend using BMD T-scores to determine an individual's 10-yr absolute fracture risk (combined risk for fractures of the proximal femur, spine [clinical vertebral fractures], forearm, and proximal humerus). Figs. 1 and 2 illustrate the stratification into three 10-yr absolute fracture risk zones for each sex. The 3 categories for risk are designated low risk (less than 10% 10-yr absolute fracture risk), moderate risk (10–20%), and high risk (over 20%). Similar absolute risk categories have been used for cardiovascular risk assessment *(13,14)*. The absolute fracture risk categories with corresponding T-score thresholds are listed in Tables 1 and 2 for 5-yr age intervals. These data are derived from the observed incidence of fractures as a function of age, sex, and measured BMD *(12)*. The published data used to develop these guidelines expressed male values in terms of female T-scores *(12)*. These were converted to the equivalent BMD values (g/cm^2) using manufacturer reference data (NHANES III) for mean peak density and standard deviation values for females. BMD values were then converted to male T-scores using manufacturer reference data for male mean peak densities and standard deviation values. This was done for both Hologic and GE Lunar reference values, and T-score results were averaged.

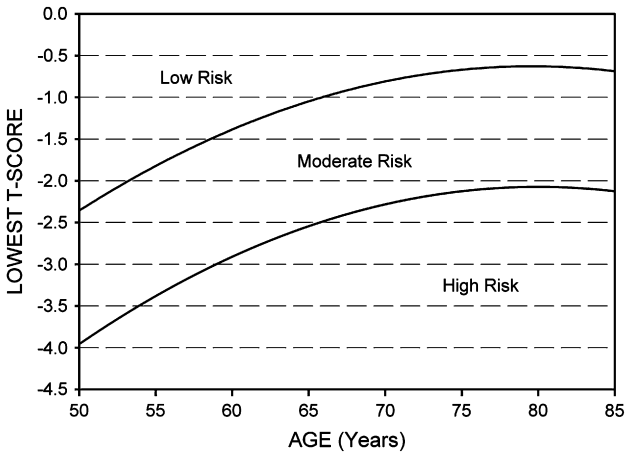

Fig. 1. Zones of 10-yr absolute fracture risk for women. Absolute fracture risk is determined using an individual's lowest T-score from the recommended skeletal sites (lumbar spine, total hip, femoral neck, and trochanter, with forearm 1/3 radius if either spine or hip is not valid). Low risk indicates less than 10% absolute fracture risk over 10 yr; moderate risk means 10–20% absolute fracture risk; and high risk indicates greater than 20% absolute fracture risk.

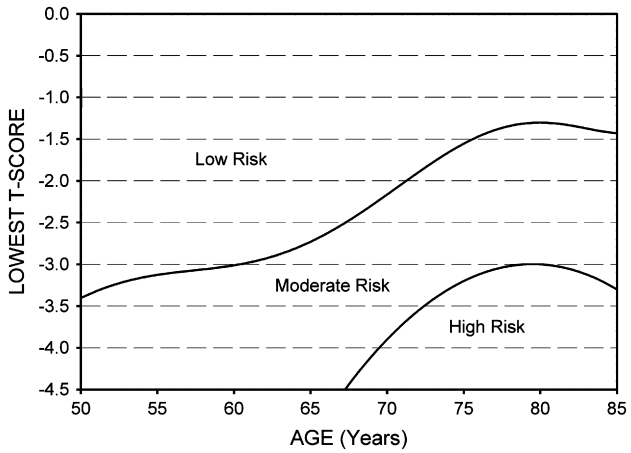

Fig. 2. Zones of 10-yr absolute fracture risk for men. Absolute fracture risk is determined using an individual's lowest T-score from the recommended skeletal sites (lumbar spine, total hip, femoral neck, and trochanter, with forearm 1/3 radius if either spine or hip is not valid). Low risk indicates less than 10% absolute fracture risk over 10 yr; moderate risk means 10–20% absolute fracture risk; and high risk indicates greater than 20% absolute fracture risk.

Clinical Factors that Modify Absolute Fracture Risk

Certain clinical factors increase fracture risk independent of BMD. The most important are the following:

- fragility fractures after 40 yr of age (especially vertebral compression fractures) *(15)*; and
- current systemic glucocorticoid therapy of >3 mo duration *(16,17)*.

The presence of either of these factors substantially elevates fracture risk. Such factors effectively increase risk categorization to the next level: from low risk to moderate risk, or from

Table 1
Ten-yr Absolute Fracture Risk for Women

Age (yr)	Lowest T-score: lumbar spine, total hip, femoral neck, trochanter		
	Low risk (<10%)	Moderate risk (10–20%)	High risk (>20%)
50	>−2.3	−2.3 to −3.9	<−3.9
55	>−1.9	−1.9 to −3.4	<−3.4
60	>−1.4	−1.4 to −3.0	<−3.0
65	>−1.0	−1.0 to −2.6	<−2.6
70	>−0.8	−0.8 to −2.2	<−2.2
75	>−0.7	−0.7 to −2.1	<−2.1
80	>−0.6	−0.6 to −2.0	<−2.0
85	>−0.7	−0.7 to −2.2	<−2.2

moderate risk to high risk. When both factors are present, the patient should be considered to be at high fracture risk regardless of the BMD result. This approach assumes that each of these variables approximately doubles fracture risk and that the 2 variables act independently *(15–17)*.

How to Determine an Individual's 10-yr Absolute Fracture Risk

1. Begin with the table appropriate for the patient's sex.
2. Identify the row that is closest to the patient's age.
3. Determine the individual's absolute fracture risk category by using the lowest T-score from the recommended skeletal sites (lumbar spine, total hip, femoral neck, and trochanter, with forearm 1/3 radius if either spine or hip is not valid).
4. Evaluate clinical factors that may move the patient into a higher fracture risk category (fragility fractures after 40 yr of age and current systemic glucocorticoid therapy >3 mo raise the patient to the next higher risk category; if both factors are present, move to high risk).
5. Determine the individual's absolute fracture risk category.

Table 2
Ten-yr Absolute Fracture Risk for Men

Age (yr)	Lowest T-score: lumbar spine, total hip, femoral neck, trochanter		
	Low risk (<10%)	Moderate risk (10–20%)	High risk (>20%)
50	>−3.4	≤−3.4	NA
55	>−3.1	≤−3.1	NA
60	>−3.0	≤−3.0	NA
65	>−2.7	≤−2.7	NA
70	>−2.1	−2.1 to −3.9	<−3.9
75	>−1.5	−1.5 to −3.2	<−3.2
80	>−1.2	−1.2 to −3.0	<−3.0
85	>−1.3	−1.3 to −3.3	<−3.3

Recognized Limitations of This Approach

Absolute fracture risk predicted for an individual by this system applies only for a finite period of time, and that risk will change with advancing age or with the development of new clinical risk factors. The absolute fracture risk prediction applies directly only to untreated individuals, but where the treatment effect on fracture probability has been documented, it may be possible to calculate current risk status in treated individuals *(4)*.

A number of assumptions have been made in producing the fracture risk tables. Fracture risk estimates are to be derived using the lowest T-score from the spine, the total hip, the trochanter, and the femoral neck, but are based on published data for only the femoral neck. The fracture data are European, as Canadian figures are not yet available. The proposed method applies only to adults over age 50 yr, as there are insufficient data in younger age groups relating to 10-yr fracture risk, and only for BMD results using central DXA, not to other densitometric techniques. The body of literature on osteoporosis and fracture prediction is much greater in women than in men, and fracture estimates in men may be associated with greater uncertainty. It is reassuring to note that meta-analyses have not found any significant difference in the gradient of risk between men and women for BMD, corticosteroid use, or prior fracture *(12,15,17)*. It is also appreciated that the risk categories are arbitrary and may need to be adapted to the level of fracture risk in a particular region and in relation to resources available for health care.

Conclusion

It is anticipated that these BMD reporting guidelines will have an impact on clinical practice. A comparison of BMD categories and absolute fracture risk prediction on risk status in an unselected clinical population is presented elsewhere in this issue *(18)*. That analysis supports the concept that there will be a shift in the nature of the patient group chosen for therapeutic intervention. Because these are the first Canadian recommendations integrating clinical risk factors in an absolute fracture risk assessment, they should be considered a work in progress. It is anticipated that they will be updated periodically to accommodate advances in this field. One anticipated area of change is in the choice of skeletal sites used for determining absolute fracture risk status, and another will be the probable addition of further clinical variables in the determination of the absolute fracture risk estimate. Research studies will need to be undertaken to evaluate the effects of such changes on the proportion of the population falling in each risk category, which may in turn lead to changes in absolute fracture thresholds.

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