

RECOMMENDATIONS FOR THE PREVENTION OF OSTEOPOROSIS AND FRAGILITY FRACTURES

International Comparison and Synthesis

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Abstract

Objectives: This review included the following objectives: a) to synthesize recommendations made by public agencies in Western countries concerning screening for osteoporosis; b) to compare these recommendations and sort out the similarities and discrepancies; and c) to propose a strategy for the fight against osteoporosis and fragility fractures.

Methods: Eleven reports published by publicly financed agencies were included in the analysis: three international, four North American and four European agencies. Transcriptions of recommendations and arguments were classified using criteria for evaluation of screening technologies.

Results: Of eight reports that made a recommendation on mass screening, four made a recommendation against the use of densitometry, two remained vague with a conditionally positive recommendation, and two made no recommendation, arguing insufficient scientific evidence. Concerning screening of asymptomatic women in the perimenopause period, recommendations were uniformly opposed to the use of bone densitometry in five of nine reports, and the other four made no recommendation, arguing insufficient scientific evidence. Some of the discrepancies can be explained by the different definitions given to osteoporosis and by the confusion of terms between screening and diagnostic testing. A strategy is proposed to ensure that all women who are at risk of osteoporosis and fragility fracture have

access to preventive measures. This strategy is based on the complementarity and coordination of roles between health promotion interventions and clinical interventions.

Conclusions: Prevention of osteoporosis and fragility fractures is an attainable goal. Existing resources are currently badly targeted. Compromises must be negotiated between the different stakeholders and biomedical disciplines to achieve efficiency and accessibility in the reduction of fragility fractures. A first compromise to reconcile social and scientific realities would be to use a best-evidence synthesis instead of an evidence-based medicine approach in future analyses and recommendations by public authorities. A second compromise would be to recognize the complementary roles of public health and clinical professionals toward the common objective of preventing fragility fractures.

Keywords: Osteoporosis screening prevention

There is international agreement that bone densitometry is not recommended for mass screening for osteoporosis (7). Attempts are currently made to define subgroups of the population at risk and improve the performance of mass screening (3;23). At the same time, there is also general agreement that osteoporosis is a frequent health problem with serious morbidity in the form of fragility fractures (26;27), is very important in the public opinion (9), and produces a rapidly rising utilization of diagnostic and therapeutic resources (14;15). Several interventions, pharmacologic and nonpharmacologic, have shown various degrees of effectiveness to prevent osteoporosis (19) and hip fractures (25). However, public health interventions, when they exist, are usually restricted to one aspect of the problem and not integrated in a coordinated program (4). We hypothesize that a lack of partnership between the public health and clinical stakeholders has been one important limiting factor in the implementation of strategies to fight osteoporosis and fragility fractures in one integrated health priority.

The objectives of this review were a) to synthesize recommendations made by public agencies in Western countries concerning screening for osteoporosis; b) to compare these recommendations and sort out the similarities and discrepancies; and c) to propose a strategy for the fight against osteoporosis and fragility fractures.

METHODS

The search for texts of recommendations was initiated by using keywords on population screening for osteoporosis in the databases of the International Network of Agencies for Health Technology Assessment (INAHTA), the Cochrane library, and the bibliography of the National Library of Medicine (8) on osteoporosis. In addition, an Internet search was done on a continuous basis to identify announcements for osteoporosis meetings and reports. Reports written in French and in English published between 1995 (date of a previous review [17]) and the spring of 2001 were identified. A report prior to 1995 was included because it was the only one representing a Canadian organization, which was one of the mandates of our research group. In order to ensure comparability between the reports, those not produced by publicly financed agencies such as professional or patients' associations and foundations were excluded from this review. Only reports presenting an original content with a description of the methodology used were retained.

The exact text of recommendations and supporting arguments was transcribed. The transcriptions were classified using public health criteria for the assessment of screening technologies (24) (Table 1). Special attention was given to the definition of the target population in each of the recommendations. Inconsistencies and contradictions as well as similarities between the reports were highlighted in order to understand the theoretical models underlying the argumentation and recommendations.

Table 1. Categories Used for the Classification of Recommendations and Arguments on Screening for Osteoporosis

<i>The disease</i>	
	Severity, mortality, morbidity
	Prevalence, frequency
	Importance in public opinion
	Economic impact
	Premorbid phase detectable
	Natural history can be modified
<i>The test</i>	
	Sensitivity, specificity
	Accuracy, reliability
	Safety
	Availability, acceptability
	Affordable
<i>Treatment and prevention</i>	
	Efficacy, effectiveness
	Availability, acceptability
	Security, tolerance
	Compliance
<i>Program implementation</i>	
	Efficacy, effectiveness, and predictive values
	Population/patients' outreach
	Social and ethical aspects
	Current practice
	Health services organization and costs

RESULTS

Eleven reports were included in the analysis (Table 2). Three reports were published by international agencies: World Health Organization (WHO) (7), INAHTA (11;12;13), and the European Commission (1). Four were from North America: Canadian Task Force on the Periodic Health Examination (6), British Columbia Office of Health Technology Assessment (BCOHTA) (10), United States Preventive Services Task Force (28), and United States National Institutes of Health (NIH) (20). Finally, there were four reports from European countries: France (*Institut National de la Santé et de la Recherche Médicale* [INSERM]) (2), U.K. Department of Health (21), the Swedish Council of Technology Assessment in Health Care (SBU) (22), and Catalan Agency of Health Technology Assessment (5). All reports specifically addressed the issue of population screening. Among the other topics covered, hormone replacement therapy (HRT) was the most popular and was found in 9 of 11 reports (Table 2). Six of the 11 reports based their analyses of the scientific evidence on specific quality criteria in addition to simply using relevance of studies or types of methodology.

Definition of Osteoporosis

Osteoporosis was defined differently in the reports. Three tendencies were identified. At one end of the spectrum, osteoporosis was defined as a disease. The WHO report took an international leadership in this direction, proposing a threshold value for bone mineral density of 2.5 standard deviations or more below the average for the young healthy population (7). Similar definitions were found in the U.S. Preventive Task Force, U.K. Department of Health, and the SBU reports. At the other end of the spectrum, the BCOHTA promoted an opposite paradigm where osteoporosis was described as a natural process of physiologic changes that occur in bone with aging. In their argument, they emphasized the current absence of both diagnostic accuracy and effectiveness of preventive measures. Between these

Table 2. Description of Reports Used in the Synthesis

Agency	Prevention/treatment of osteoporosis ^a					Methodology			Reference no.	
	Screen	Diagnosis	HRT	Other drugs	Nondrug approach	Prevention of falls	Relevance of study	Study type		Quality of criteria
WHO, 18 countries, 1999	✓	✓	✓	✓	✓	✓	?	?	?	7
INAHTA, 10 countries, 1996	✓		✓	✓		✓	✓	✓	✓	11;12;13
European Commission, 15 countries, 1999	✓	✓	✓	✓	✓	✓	✓	✓	✓	1
Task Force Periodic Health Exam., Canada, 1993	✓		✓			✓	✓	✓	✓	6
BCOHTA, Canada, 1997	✓		✓			✓	✓	✓	✓	10
Preventive Services Task Force, United States, 1996	✓		✓	✓	✓	✓	✓	✓	?	28
NIH, United States, 2000	✓	✓	✓	✓	✓	✓	✓	✓	✓	20
INSERM, France, 1997	✓	✓	✓	✓	✓	✓	✓	✓	✓	2
U.K. Dept. of Health, United Kingdom, 1999	✓	✓	✓	✓	✓	✓	✓	✓	✓	21
SBU, Sweden, 1997	✓	✓			✓	✓	✓	✓	✓	22
CAHTA, Spain, 1999	✓	✓			✓	✓	✓	✓	✓	5

^aDiagnosis and screening of bone mass measurements, HRT, other drugs, and nondrug approaches for prevention and treatment of osteoporosis.

opposite poles, the other reports proposed a systemic approach that focused on fragility fractures as a health problem where osteoporosis is one important risk factor among others (INAHTA, NIH, INSERM, European Commission and Catalan Agency). The Canadian Task Force report did not propose a definition.

Recommendations on Screening for Osteoporosis

The reports generally agreed that the bone densitometry technologies that are available to detect osteoporosis are reasonably precise and accurate, are safe and acceptable by the clients, and are under rapid technical evolution, improving still these characteristics. However, there was also agreement that, whether used for mass screening or diagnostic purposes, these technologies give a high rate of false negative for identifying individuals who will have fragility fractures (between 50% and 70%). This limitation, combined with the poor long-term compliance with pharmacologic prevention or treatment of osteoporosis, enters in the calculations of predictive models showing that under the best scenarios, bone densitometry could contribute a 1% to 7% reduction in the number of fragility fractures, a reduction that appears to be realistic but too modest to recommend mass screening.

In the 11 reports included in this review, eight made an explicit recommendation on the use of densitometry for mass screening, nine for screening of women in the perimenopause period and nine for specific groups of patients (Table 3). In the category "mass screening," four of eight reports (European Commission, Canadian Task Force, BCOHTA, and U.K. Department of Health) made a recommendation against the use of densitometry, two remained vague with a conditionally positive recommendation under certain ill-defined clinical considerations (WHO, INSERM), and two made no recommendation, arguing insufficient scientific evidence (SBU and Catalan Agency).

In the category "women in the perimenopause period," recommendations were uniformly opposed to the use of bone densitometry as a screening tool in five of nine reports (INAHTA, European Commission, Canadian Task Force, INSERM, and U.K. Department of Health). The other four reports made no recommendation, arguing insufficient scientific evidence (U.S. Preventive Task Force, NIH, SBU, and Catalan Agency).

In the category "specific groups of patients," one of the nine reports addressing this issue made a recommendation against using bone densitometry (INAHTA), four made a conditionally positive recommendation for its use (U.S. Preventive Task Force, INSERM, SBU, and Catalan Agency), and four made a clear positive recommendation for using bone densitometry in selected groups of patients (WHO, NIH, European Commission, and U.K. Department of Health). The eight reports in favor of screening proposed sets of clinical criteria that all differed in number and content.

Recommendations on Prevention of Osteoporosis

Even if the main focus of the selected reports was on the use of bone densitometry, prevention of fragility fractures through other means than screening of osteoporosis was discussed in 8 of the 11 reports (Table 4). Four of those made recommendations to governments and health authorities and included dietary enrichments in calcium and vitamin D of commercially available food, improvements in the surveillance of the incidence of fractures, education of the public, support of osteoporotic groups, and budgetary allocations for the extension of densitometry facilities (WHO, European Commission, U.K. Department of Health, and Catalan Agency).

Three reports made specific recommendations to physicians for informing their patients on prevention of osteoporosis (WHO, European Commission, and Catalan Agency), and one mentioned the importance of educating physicians on osteoporosis (European Commission).

Table 3. Summary of Recommendations on Bone Density Screening

Source	Target population	Screening procedure	Recommendation
WHO, 2001	General population Physicians	Bone densitometry in a clinical context	An optimal age (for screening) is 65 Make use when available
INAHTA, 1996	Health authorities—for individuals at risk Population of menopausal women or selected group of women	Same Same Opportunistic bone densitometry in the context of HRT	Facilitate access Ensure quality control Does not support the prevention of fractures—not encouraging about potential effectiveness
European Commission, 1999	Population of perimenopausal women	Bone densitometry	Is not recommended
Canadian Task Force, 1993	General population regardless of age	Bone densitometry	Is rather not justifiable
BCOHTA, 1997	Individual patients with known risk factors General population of women	Bone densitometry Bone densitometry in the context of HRT	Should have access and the test be insured Inadvisable at present
U.S. Preventive Task Force, 1996	Population of postmenopausal women	Bone densitometry, all technologies including ultrasounds Bone densitometry	Unsuitable to change clinical course of fragility fracture Insufficient evidence to recommend for or against—recommendation against may be made on other grounds
U.S. NIH, 2000	Women at high risk of osteoporosis or fractures Population of perimenopausal women Patients at high risk of osteoporotic fractures (glucocorticoids, etc.)	Bone densitometry in the context of HRT	May be appropriate to assist treatment decisions to prevent osteoporosis
INSERM, 1996–1997	Population of women 45 to 55 years Population of women 60 to 75 years ...who present a fracture after a simple fall ...with a familial history of fracture or drug treatment susceptible to induce bone loss	Bone densitometry followed with preventive treatment for osteoporotic fractures Systematic screening of osteoporosis — Bone densitometry	Value not established Should be considered when it will help the patient decide Does not seem useful at present Should be considered osteoporotic without test

(continued)

Table 3. (Continued)

Source	Target population	Screening procedure	Recommendation
U.K. Department of Health, 1999	...without apparent or identifiable risk factor Population of women 75 years and over	Osteoporosis screening in the context of offering preventive treatment against fracture —	Could be considered —half can be considered osteoporotic
U.K. Department of Health, 1999	High-risk patients and patients with fragility fracture	Dual-energy x-ray absorptiometry (DXA)	Recommends the use in the context of a case-finding strategy rather than for population screening—Health Authorities: purchase equipment and give opportunity to access
U.K. Department of Health, 1999	Population of postmenopausal women	Other bone density measurements including ultrasounds	Does not preclude the use for diagnosis but Should NOT institute mass population screening
SBU, 1997	General population, population of postmenopausal women, and patients asymptomatic for osteoporosis	Bone densitometry	Scientific evidence insufficient to recommend
	Patients with vertebral fracture, with a condition that increases the risk of osteoporosis or fracture, or who are treated for osteoporosis	Bone densitometry	May be indicated...should include factors other than bone density alone
CAHTA, 1999	General population including the population of menopausal women	Bone densitometry	Scientific evidence insufficient to recommend
	Individuals at high risk of fracture	Bone densitometry	More appropriate in these groups. Clinical utility...in these groups should be determined

Table 4. Summary of Recommendations on the Prevention and Treatment of Osteoporosis and the Prevention of Fragility Fractures

Source	Target population	Prevention/treatment procedure	Recommendation
WHO, 2001	Health authorities—for individuals at high risk	Calcium and vitamin D supplementation Education of health professionals and patients Risk factors	Enrich widely Support Raise awareness
	Physicians	National programs Malnutrition during growth Vitamin D supplementation for elderly people Fall prevention programs Hip protectors for very high-risk individuals	Support Identify and address Provide Develop programs Consider Maintain
	General population	Physical activity, sunlight exposure, sufficient dietary calcium intake, sufficient body mass index Smoking and high alcohol intake	Avoid No recommendation Should be a major priority
INAHTA, 1996 European Commission, 1999	Governments	Prevention of osteoporosis: education and information to the public and healthcare professionals, surveillance of incidence rates of fractures Budgetary allocations to respond to healthcare demand and insure optimum treatment strategies Support associations of osteoporotic persons Adequate training HRT	Recommended Financial help should be given Should be a priority Counseling recommended Poor evidence to include or exclude
Canadian Task Force, 1993	Physicians Population of perimenopausal women General population of women at time of periodic health examination	Identification of risk factors by history taking and physical examination	No recommendation Should be counseled and advised
BCOHTA, 1997 U.S. Preventive Task Force, 1996	Population of postmenopausal women	Hormone prophylaxis, smoking, exercise, calcium, and vitamin D intake	No recommendation Should be counseled and advised
U.S. N.I.H., 2000	Population of elderly people	Prevention of falls and fall-related injuries	Should receive counseling No recommendation

(continued)

Table 4. (Continued)

Source	Target population	Prevention/treatment procedure	Recommendation
INSERM, 1996–1997	Population during growth Osteoporotic women 65 to 75 years	Calcium and vitamin D Treat osteoporosis (HRT, biphosphonates, etc. . .).	See to sufficient intake Engage in strategy integrating prevention and treatment of fractures Fight risk factors for falls
U.K. Department of Health, 1999	Population of women 75 years and over Public health authorities	Sufficient calcium and vitamin D intake, screen and treat visual, hearing, and balance problems, minimize polymedication Health promotion programs to reduce the prevalence of modifiable risk factors for osteoporosis and falls	Should recognize that osteoporosis is a significant public health issue
SBU, 1997 CAHTA, 1999	Individuals at high risk for osteoporosis Youths during skeleton growth Governments Public health authorities Health professionals	Prophylaxis (HRT, calcium and vitamin D supplements biphosphonates) counseling on smoking and physical activity Promotion of physical activity Coordinate intersector efforts toward reduction of risks of falling at home Health promotion programs on lifestyle Develop clinical practice guidelines Information to patients on the risks of fracture, such as a history of fracture and the use of psychoactive drugs	Should have the opportunity to receive Essential to direct preventive efforts Apply intersectorial measures Preventive measures. . . should be encouraged Would be very valuable to involve clinicians Should inform the patient

The five reports addressing lifestyle counseling in the general population and in patients remained vague in their recommendations, stating general principles. Two of those five mentioned prevention in children (INSERM and SBU).

Four reports made recommendations to improve the availability of drug therapy (including HRT) in all perimenopausal women (Canadian Task Force and U.S. Preventive Task Force), in people at high risk of osteoporosis (U.K. Department of Health), and in individuals with established osteoporosis (INSERM).

Finally, three reports emphasized the importance of intersector coordination between programs aimed at reducing osteoporosis and falls (INSERM, U.K. Department of Health, and Catalan Agency), and one the development of clinical practice guidelines (Catalan Agency).

DISCUSSION

Publication Bias

All reports graded the evidence primarily using the evidence-based approach, where randomized controlled trials (RCTs) are considered as providing the highest scientific evidence. This approach favored pharmacologic interventions compared with other types of intervention where randomization or blinding are not possible. Currently, there is no RCT of densitometry screening or lifestyle intervention to prevent osteoporosis and limited RCT evidence in the prevention of falls and fractures (20). In osteoporosis, it would be more appropriate to use the best available synthesis approach, where grading of the evidence allows a broader spectrum of methodologies for the evaluation of interventions (16;18).

Another aspect of publication bias is the non-independence often noted between the authors of the scientific papers and the participants to the evaluation of scientific evidence in the panels that prepared the reports and their recommendations. Even if this seems inevitable in topics such as osteoporosis, no report mentioned this issue or discussed its potential influence on the recommendations.

Imprecise Semantic

The words used in the recommendations on densitometry screening borrowed to various shades of gray between “in favor of” and “recommended against.” Examples of expressions used in the recommendations for mass screening were “could be considered” (INSREM), “recommends for . . . rather than for population screening” (U.K. Department of Health), “inadvisable at present” (Canadian Task Force), “rather not justifiable” (European Commission), “unsuitable” (BCOHTA), and “should not institute” (U.K. Department of Health). Sometimes, two or more of these terms were used in different sections of the same report.

A similar impression came from the recommendations concerning screening of perimenopausal women with expressions such as “not encouraging” (INAHTA), “does not seem useful at present” (INSERM), “should not institute” (U.K. Department of Health), “inadvisable at present” (Canadian Task Force), and “not recommended” (European Commission). In contrast, not making a recommendation due to a lack of scientific evidence (U.S. Preventive Task Force, NIH, Swedish Council and Catalan Agency) can be interpreted as a hesitation to make such a negative statement.

We found no systematic relationship between the definition of osteoporosis used in the reports (disease, risk factor for fractures, or natural process of aging) and the degree of precision in the language used in the recommendations. On the other hand, the term *screening* was used sometimes to mean clinical diagnosis, which made the interpretation of the recommendations difficult.

Definitions of Screening

Part of the disagreement observed in the recommendations concerning mass screening stemmed from the different uses of the term *screening*. In most reports, mass screening corresponded to the use of densitometry in a population of asymptomatic individuals without recognized risks. In the WHO and INSERM recommendations, the term *mass screening* was used with a slightly different meaning that corresponded to a definition of either opportunistic screening (i.e., screening in environments such as the clinical periodic health examination or in nursing home populations) or clinical screening (i.e., the use of densitometry for patients that are asymptomatic for osteoporosis, but present specific risk factors for osteoporosis, such as the chronic use of glucocorticoids). Both cases can be considered particular cases of screening where the test is performed in clinically defined populations and does not contribute to identification of osteoporotic individuals who are not in direct contact with a clinician.

In recommendations concerning specific groups of patients, screening was also confused with diagnostic testing (European Commission, INSERM, U.K. Department of Health, SBU, and Catalan Agency) or case finding (U.K. Department of Health). In the reports, diagnostic testing would correspond to the use of densitometry to confirm a clinical suspicion that exists in the form of signs and symptoms of osteoporosis, and case finding would correspond to the use of densitometry in individuals with or without signs and symptoms to rule out osteoporosis for specific medical or personal reasons.

These distinctions between the different uses of the term *screening* were not found in any report. The analysis of the performance of densitometry should be based on different criteria, whether it is used for screening or diagnostic purposes (24). This lack of clarification led to the application of evaluation criteria that did not fit well in every situation and may explain in part the ambiguity of the language used in the recommendations.

Toward Recommendations for Public Health Authorities

Inconsistencies in the recommendations of publicly financed reports concerning the use of bone densitometry mostly come, in our opinion, from the interchangeable use of two paradigms that pursue different objectives. On one hand, the *clinical approach* of osteoporosis leads to a logic where a patient consults, receives a diagnostic test, and is counseled about prevention and treatment of osteoporosis (Figure 1). In this context, the patient actively seeks medical attention for osteoporosis or a health problem that can be related to it, such as menopause. Bone densitometry, when used in this context, is performed for confirmatory or diagnostic purposes. In contrast, the *systemic approach* is primarily concerned with the occurrence of fragility fractures. The population, rather than consulting patients, constitutes the starting point (Figure 2). Bone densitometry, in that context, is a tool that can be used to confirm the diagnosis in individuals that have been screened by other means,

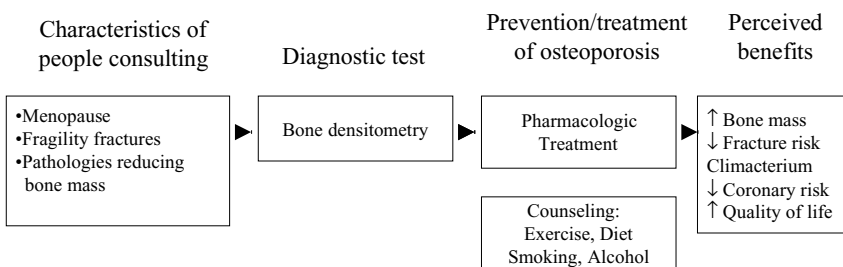


Figure 1. Clinical screening for osteoporosis.

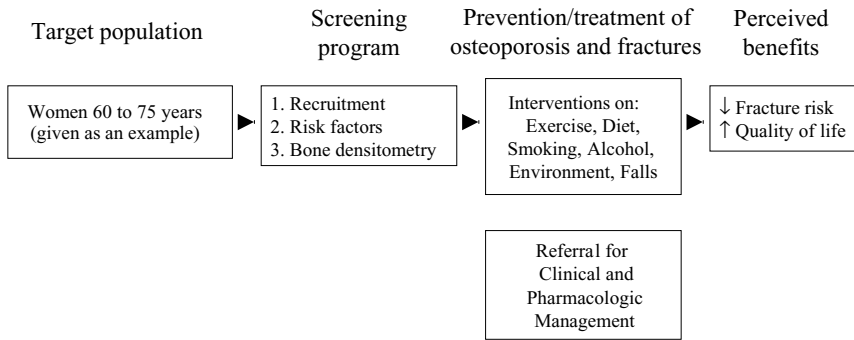


Figure 2. Public health screening for osteoporosis.

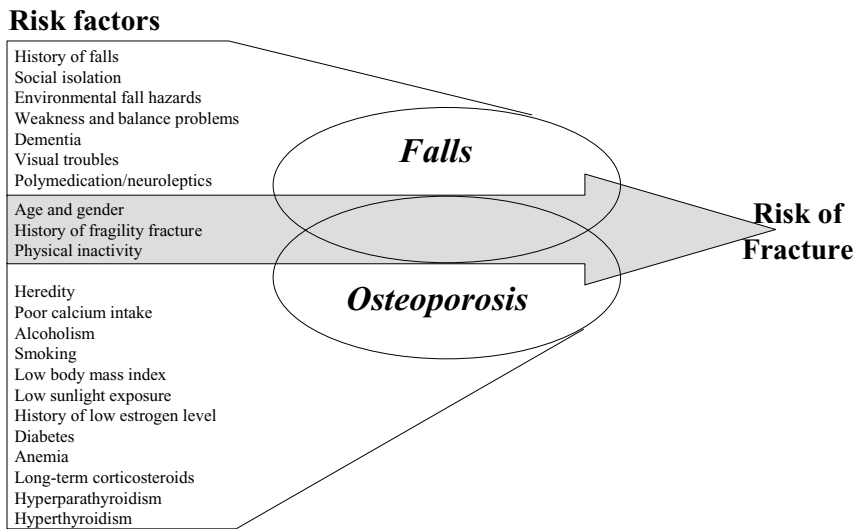


Figure 3. Model for the prevention of fragility fractures.

such as a personal medical history, as being at risk for osteoporosis, fragility fractures, or both. The two paradigms need not be in competition and, with some compromises, can be complementary to one another.

Traditionally, the scope of public health recommendations concerning screening remains with the concept of mass screening, defined previously as the use of a technology on a population of asymptomatic individuals. An example is screening for high blood pressure. However, osteoporosis shares with high blood pressure the difficulties of reaching the population and bringing confirmed cases to durable treatment. Also similar to high blood pressure, osteoporosis competes with other independent risk factors for fractures, some of which do not require osteoporosis to cause their morbid outcome (Figure 3).

A compromise between the relatively small capacity of densitometry to prevent fractures and the rapid evolution and spread of its technology would be to recognize and reinforce the complementary roles of public health and clinical interventions toward the prevention of osteoporosis and fragility fractures. Whereas clinicians have a responsibility to recognize risk factors and propose a management plan to individual patients, public health organizations could take a responsibility to ensure that every citizen who should consult a physician for risk factors has the opportunity to do it. This complementarity of roles implies that

physicians agree on principles for the efficient management of patients who seek advice for osteoporosis, and public health agencies finance health promotion activities with a content that is compatible with the clinical practice guidelines adopted for a region.

It is our opinion that the ambiguity in the current wording of recommendations can only amplify the inequalities observed with accessibility to health services in osteoporosis and increase the costs for suboptimal health benefits.

CONCLUSION

In the 11 publicly financed reports retained for this study on bone densitometric screening, mass screening was generally not recommended either for the general population or the population of perimenopausal women. For screening of selected groups of patients (clinical screening), the recommendations were mixed, a result partly explained by the confusion between screening and diagnostic purposes of testing.

Differences in the definition of a basic paradigm for osteoporosis and variations in primary interest, public health versus clinical, might also explain in part the differences observed between and within reports' recommendations. These differences were not identified in the reports and were often bridged by an artistic semantic that led to a vague, nonaffirmative terminology and to contradictions within many reports. The public health and clinical visions of the prevention of osteoporosis and fragility fractures differ in goals and in nature, so that different criteria should have been used in the analysis of performance of bone densitometric testing, depending on the context.

A first compromise to reconcile social and scientific realities would be to use a best-evidence synthesis instead of an evidence-based medicine approach in future analyses and recommendations by public authorities (18). This would allow the adaptation of the recommendations to the social, geographic, and health services realities of a region. It would also provide a more effective analysis for interventions that are not technology-based and cannot easily be evaluated in RCTs.

A second compromise would be to recognize the complementary roles of public health and clinical professionals toward the common objective of preventing fragility fractures. This complementarity implies not only an agreement on what are the efficient interventions, but also on the social and medical principles that explain the current inequalities in the prevention of osteoporosis and fragility fractures, and on the best way to fight these inequalities for the benefit of the population.

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