The effectiveness of bone density measurement and associated treatments for prevention of fractures: an international collaborative review


Authors' objectives
To assess the effectiveness of bone density measurement (BDM) screening, when used in conjunction with prophylactic treatments, i.e. hormone replacement therapy (HRT) and calcitonin, in preventing fractures in menopausal women in later life.

Searching
BDM: MEDLINE, SweMed and EMBASE were searched from September 1994 to May 1996 using 'bone and bones', 'bone density', 'densitometry', 'osteoporosis' and the names of the BDM technologies as the main subject headings. Reference lists of review articles were also checked. Publications in English, French, German or Swedish were included.

HRT: MEDLINE was searched from 1993 to May 1996 using the main keywords 'osteoporosis', 'menopause', 'postmenopause', 'bone and bones', 'bone density', 'fractures' and 'estrogen replacement therapy'.

Calcitonin: MEDLINE was searched from 1990 to May 1996 and EMBASE from 1990 to 1994 using the same keywords as for HRT, but with calcitonin as the therapy. Additional studies (HRT and calcitonin) were obtained by checking reference lists from book chapters and review articles. Publications in English, French, Italian and Spanish were included.

The search was supplemented by two surveys of organisations that had produced reports addressing the issues of BDM and HRT. Both surveys asked questions about the process followed in preparing the report, it's main purpose and the conclusions made about the clinical applications of BDM and HRT.

Study selection
Study designs of evaluations included in the review
The analysis is based primarily on systematic reviews of evidence undertaken by health technology assessment agencies and other systematic reviews that were relevant (the references are provided).

Additional primary studies were included as follows:

BDM: trials of screening programmes, prospective cohort studies examining the predictive value of BDM, case-control studies of hip fractures (to September 1994) and studies evaluating or comparing methods of BDM in human patients.

HRT and calcitonin: randomised controlled trials (RCTs), cohort studies and case-control studies.

Specific interventions included in the review

Reference standard test against which the new test was compared
The review did not include any diagnostic accuracy studies that compared the performance of the index test with a reference standard of diagnosis.

Participants included in the review
Primary prevention: women with natural or surgical menopause with normal skeletal status and without a history of fracture. Secondary prevention: women with natural or surgical menopause with one or more non-traumatic fractures,
or whose bone density is more than 1 or 2 standard deviations (SDs) from young adult values or from age-matched controls.

Outcomes assessed in the review
Bone fractures and density. Specifically, the relative risk of fracture for a decrease of 1 SD in bone mineral density below the age-adjusted mean, the percentage of fractures potentially prevented by BDM screening linked to treatments, and the number of individuals who would need to be invited for screening in order to prevent one hip fracture.

How were decisions on the relevance of primary studies made?
The authors do not state how the papers were selected for the review, or how many of the authors performed the selection.

Assessment of study quality
The quality of each study was assessed by strength of evidence, study design and scientific rigour, according to the criteria of Jovell and Navarro-Rubio (see other Publications of Related Interest), using a scale in which the strength of evidence ranged from 'good' (study designs: meta-analysis of RCTs, large sample RCTs) through 'good-to-fair' (study designs: small sample RCTs, non-randomised controlled prospective and retrospective trials), and 'fair' (study designs: cohort studies, case-control studies) to 'poor' (study designs: non-controlled clinical series, descriptive studies, expert committees, consensus conferences, anecdotes or case reports).

The authors do not state how the papers were assessed for quality, or how many of the authors performed the quality assessment.

Data extraction
The authors do not state how the data were extracted for the review, or how many of the authors performed the data extraction.

Methods of synthesis
How were the studies combined?
The reviews, some of which included meta-analyses, were combined with the additional primary studies in a narrative description.

How were differences between studies investigated?
The authors do not state how differences between the studies were investigated.

Results of the review
The authors do not stipulate the number of studies examined. The review was based primarily on systematic reviews undertaken by health technology assessment agencies and other relevant reviews, and supplemented by adding primary studies found through additional literature searches. The systematic reviews and the additional primary studies are included in the reference list at the end of the paper.

The use of BDM to predict fractures in individuals: no RCTs were found. There is 'fair' evidence that BDM can predict the risk of fracture in populations of menopausal women (accuracy for individuals is low), but there appears to be no consensus about the appropriate applications of BDM.

Effect of HRT in preventing fractures: one RCT was found. There is 'fair' evidence that: ever-use of HRT is associated with a decrease in fractures of all types; continued long-term use of HRT has a protective effect for fractures; there is no decrease in risk of hip fracture at older ages with ever-use of HRT; and the longer the period since cessation of therapy, the smaller the protective effect of HRT on hip fracture risk. There is 'good' evidence that: HRT, used for primary and secondary prevention alone or in combination with progestogens and/or calcium, has a protective effect against bone mass loss, as measured by various BDM techniques at the forearm, spine and hip; and age does not attenuate the short-term response to treatment. There is 'fair' evidence that the protective effect of HRT on loss of bone
mass may decline over time when therapy is started soon after menopause, and that the protective effect wears off after cessation of treatment. Long-term adherence to HRT is likely to be less than 50% for menopausal women.

Effect of intranasal salmon calcitonin in preventing fractures and preserving bone mass: there is 'fair' evidence to support the efficacy of intranasal salmon calcitonin in decreasing the risk of fractures; and 'good' evidence demonstrating the short-term efficacy of intranasal salmon calcitonin in preserving bone mass in both primary and secondary prevention in postmenopausal women. In addition, there is 'fair' evidence demonstrating the long-term preservation (5 years) of bone mass using intranasal salmon calcitonin, although no data are available about the long-term effect when treatment is started early after menopause.

Potential population health impact of BDM screening. Using various assumptions, a model was developed, which gave the following figures: 393 women would need to be invited for screening, of which 197 need actually attend in order to avoid one fracture. The overall impact of the programme would be to reduce the number of fractures over the remaining lifetime of the cohort of 20,000 women from 3,050 to 2,998 or by 1.7%. When all scenarios are considered, such programmes might prevent between 1 and 7% of fractures.

Authors’ conclusions
There is fair evidence from prospective cohort studies suggesting that BDM can assess the risk of future fracture occurrence in populations over the short term, but not with a high degree of accuracy. There is fair evidence, from low-quality RCTs and observational studies, showing the efficacy of HRT and intranasal salmon calcitonin in preventing fractures while therapy is continued. There is good evidence demonstrating the efficacy of HRT and intranasal salmon calcitonin in preserving bone mass during therapy. There is fair evidence that the protective effect of HRT diminishes and may wear off after cessation of therapy. There is a lack of good quality evidence about the impact of a screening programme.

The currently available evidence does not support BDM screening of menopausal women in combination with HRT or intranasal salmon calcitonin, in the context of population or opportunistic screening for the prevention of fractures.

CRD commentary
This review is primarily a summary of other relevant systematic reviews and, as such, details of primary studies (design, participant characteristics) and of individual systematic reviews (validity assessment, methods of pooling data) are not presented. To comment fully upon the scientific rigour of this review, it would be necessary to obtain the original references.

This is a very useful document in that it brings together and assesses previous work on BDM and associated treatments in the prevention of fractures. The narrative synthesis used is appropriate, as the quality and type of studies included are diverse, and relevant individual studies are described more fully in the text. The search strategy to find supplementary primary studies is given, as are details of the quality criteria used.

It would be impractical to give details of all the primary studies included in the review, but some details of the individual systematic reviews (e.g. number of studies included in each) given in a tabular form may have been helpful in making the review clearer to the reader.

Bibliographic details

PubMedID
9611900

Other publications of related interest

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Administration, Intranasal; Adult; Aged; Bone Density /physiology; Calcitonin /administration & dosage; Densitometry; Estrogen Replacement Therapy; Female; Fractures, Bone /etiology /prevention & control; Humans; Middle Aged; Osteoporosis, Postmenopausal /complications /prevention & control; Predictive Value of Tests; Technology Assessment, Biomedical

**AccessionNumber**
11998008678

**Date bibliographic record published**
31/12/1998

**Date abstract record published**
31/12/1998

**Record Status**
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.