Appendix A. Data Collection Forms

VA-EPC Male/OP Project Screener

Reviewers:
Assigned on:

Article ID

Citation:

Reviewer: _____

First Author:_____

1. Does the article report original data on the prevalence or incidence of any of the following in men?

(Check all that apply)

Osteopenia .....
Osteoporosis.....
Fractures .....
None of the above .....

2. Does the article report original data on risk factors for osteopenia, osteoporosis, or fractures in men?

(Circle one)

Yes.....1
No.....2

3. Does the article report on a tool to screen for osteoporosis in men?
[tool=radiologic studies, surveys, etc]

(Circle one)

Yes..... 1
No.....2

4. Does the article report associations between BMD levels as determined by DXA and fractures in men?

(Circle one)

Yes..... 1
No.....2

5. Study design

(Circle one)

RCT/CCT..... 1
Cohort/case series 2
Case control 3
Review article: systematic or M-A 4
Review article: not systematic ..... 5 **(STOP)**
Review article: letter, editorial,
other syst review..... 6 **(STOP)**
Other..... 7 **(STOP)**

6. Are any of the subjects identified as veterans?

(Circle one)

Yes..... 1
No..... 2

7. Should this article be saved for background?

(Circle one)

Yes..... 1
No..... 2

NOTES:

VA Male OP Project-Detailed Review Form- Diagnostic Studies

FINAL 09-05-2006

Article ID:_____ Reviewer:_____

First Author: _____
(Last Name Only)

Study Number:
___of____Description:_____
(Enter '1of 1' if only one) (if more than one study)

Do you think that this article might include the same data as another study?
(CIRCLE ONE)

Yes 1
No 2

If YES enter Trial name and/or IDs:

Trial name : _____

ID(s) : _____

If applicable, at what anatomic site was the study test performed?

(CHECK ALL THAT APPLY)

Spine ..... ❑
Femur ..... ❑
Radius ..... ❑

Patella ..... ❑
Calcaneus ..... ❑
Finger ..... ❑

Other: _____ ..... ❑

Not applicable ..... ❑
Not reported ..... ❑

What is the study test?

(CHECK ALL THAT APPLY)

Ultrasound, BUA ..... ❑
Ultrasound, SOS ..... ❑
Ultrasound, QUI ..... ❑

Peripheral bone density, pDXA ..... ❑
Peripheral bone density, SXA ..... ❑
Peripheral bone density, other: _____. ❑

Central DXA ..... ❑
Quantitative CT ..... ❑
Bone markers ..... ❑

Questionnaire, OST ..... ❑
Questionnaire, other: _____ ..... ❑

Other: _____ ..... ❑

Other: _____ ..... ❑

What is the reference test?

(CHECK ALL THAT APPLY)

Ultrasound, BUA ..... ❑
Ultrasound, SOS ..... ❑
Ultrasound, QUI ..... ❑

Peripheral bone density, pDXA ..... ❑
Peripheral bone density, SXA ..... ❑
Peripheral bone density, other: _____. ❑

Central DXA ..... ❑
Quantitative CT ..... ❑

Questionnaire, OST ..... ❑
Questionnaire, other: _____ ..... ❑

Prior fractures ..... ❑
Prior self-reported osteoporosis ..... ❑

Other: _____ ..... ❑

Other: _____ ..... ❑

VA Male OP Project-Detailed Review Form- Diagnostic Studies

If applicable, at what anatomic site was the reference test performed?
(CHECK ALL THAT APPLY)

Spine ❑
Femur ❑
Radius ❑

Patella ❑
Calcaneus ❑
Finger ❑

Other: _____ ❑

Not applicable ❑
Not reported ❑

Who is studied?
(CHECK ALL THAT APPLY)

A. Not reported ❑
B. Unselected population ❑
C. Selected population ❑

Elderly ❑

Nursing home ❑
Referred ❑

Prior glucocorticoid use ❑
COPD ❑
Hypogonadal ❑

Excess alcohol ❑
Malabsorption ❑

Other: _____

What was the male sample size data? (Enter number or 9999 for not reported)

Enrolled: _____ Followed up: _____

What were the characteristics of the patient population?
(CHECK ALL THAT APPLY)

Caucasian ❑
African Ancestry ❑

Hispanic ❑
Asian (non-Filipino) ❑
Filipino ❑

Native American ❑
Eskimo/Inuit ❑

Other (_____ _____) ❑
Veteran ❑
Characteristics not reported ❑

In what region did the study take place?
(CHECK ALL THAT APPLY)

US/Canada ☐
Scandinavia ☐
Australia/NZ ☐

Western Europe ☐
Eastern Europe ☐
Latin America ☐

Middle East ☐
India ☐
Africa ☐

Asia ☐

Other : _____ ☐
Not reported ☐

❑ Does the article report sensitivity, specificity or data to construct 2 X 2 table?
(CHECK ALL THAT APPLY)

Sensitivity ☐
Specificity ☐
Correlation ☐

Other : _____ ☐
Not reported ☐

VA Male OP QUADAS Quality Review Form

FINAL 10-13-06

Article ID:_____ Reviewer:_____

First Author: _____
(Last Name Only)

Study Number:
___of____Description:_____
(Enter '1of 1' if only one) (if more than one study)

1. Was the spectrum of patients representative of the patients who will receive the test in practice?

(CIRCLE ONE)

Yes 1
No 2
Unclear 3

*How to score: Score 'yes' if based on information reported from study's authors, you believe the spectrum of patients included in the study is representative of those in whom the test will be used in practice. Judgment should be based on both method of recruitment and the characteristics of those recruited. Score 'no' if you think the population studied does not fit into what was specified as acceptable. Score 'no' if studies recruit a group of healthy controls and a group known to have the target disorder.

2. Were selection criteria clearly described?

(CIRCLE ONE)

Yes 1
No 2
Unclear 3

*How to score: Score 'yes' if you think all relevant information regarding how participants were selected for inclusion has been provided. Score 'no' if study selection criteria are not clearly reported.

3. Is the reference standard likely to correctly classify the target condition?

(CIRCLE ONE)

Yes 1
No 2
Unclear 3

*How to score: Score 'yes' if you believe the reference standard is likely to correctly classify the target condition or is the best method available. Score 'no' if you do not think the reference standard was likely to have correctly classified the target condition.

4. Is the time period between reference standard and index test short enough to be reasonably sure that the target condition did not change between the two tests?

(CIRCLE ONE)

Yes 1
No 2
Unclear 3

*How to score: For conditions that progress rapidly, should be scored 'yes' if delay between performance of index and ref test if very short. If condition is chronic, longer delay periods may be appropriate. You will have to determine what is 'short enough.' Score 'no' if you think performance of index test and reference standard was sufficiently long that disease status may have changed between the performance of the two tests.

5. Did the whole sample or a random selection of the sample, receive verification using a reference standard?

(CIRCLE ONE)

Yes 1
No 2
Unclear 3

*How to score: Score 'yes' if it is clear that all patients or a random selection of patient who received index test went on to receive verification of disease status using reference standard. Score 'no' if some patients did not receive verification of disease status and selection of patient to receive reference standard was not random.

6. Did patients receive the same reference standard regardless of the index test result?

(CIRCLE ONE)

Yes 1
No 2
Unclear 3

*How to score: Score 'yes' if it is clear that patients received verification of their true disease status using the same reference standard. Score 'no' if some patients received verification using a different reference standard.

7. Was the reference standard independent of the index test (i.e. the index test did not form part of the reference standard)?

(CIRCLE ONE)

Yes 1
No 2
Unclear 3

*How to score: Score 'yes' if it is clear from the study that the index test did not form part of the reference standard. Score 'no' if it appears that the index test formed part of the reference standard.

8. Was the execution of the index test described in sufficient detail to permit replication of the test?

(CIRCLE ONE)

Yes 1
No 2
Unclear 3

*How to score: SEE # 9

9. Was the execution of the reference standard described in sufficient detail to permit its replication?

(CIRCLE ONE)

Yes 1
No 2
Unclear 3

*How to score: Score 'yes' if study reports sufficient details or citations to permit replication of the index test and reference standard. Score as 'no' in other cases.

10. Were the index test results interpreted without knowledge of the results of the reference standard?

(CIRCLE ONE)

Yes 1
No 2
Unclear 3

*How to score: SEE # 11

11. Were the reference standard results interpreted without knowledge of the results of the index test?

(CIRCLE ONE)

Yes 1
No 2
Unclear 3

*How to score: Score 'yes' if study clearly states that the test results (index or reference standard) were interpreted blind to the results of the other test. Score 'no' if it does not appear that test results were interpreted blind to results of the other test.

12. Were the same clinical data available when test results were interpreted as would be available when the test is used in practice?

(CIRCLE ONE)

Yes 1
No 2
Unclear 3

*How to score: Score 'yes' if clinical data would normally be available when the test is interpreted in practice and similar data were available when interpreting the index test in the study and when clinical data would not be available in practice and these data were not available when the index test results were interpreted. Score 'no' if this is not the case.

13. Were uninterruptible/intermediate test results reported?

(CIRCLE ONE)

Yes 1
No 2
Unclear 3

*How to score: Score 'yes' if it is clear that all test results, including uninterruptible/indeterminate/intermediate results are reported. Score 'no' if you think that such results occurred but have not been reported.

14. Were withdrawals from the study explained?

(CIRCLE ONE)

Yes 1
No 2
Unclear 3

*How to score: Score 'yes' if it is clear what happened to all patients who entered the study, for example if a flow diagram of study participants is reported. Score 'no' if it appears that some of the participants who entered the study did not completed the study (i.e. did not receive both the index test and reference standard and these patients were not accounted for).

VA Male OP Project- RISK FACTOR STUDIES

FINAL 11-02-06

Article ID:_____ Reviewer: Elaine Wong

First Author: _____
(Last Name Only)

Are data in this article reported for MEN for the risk factors listed below?

MODERATE RISK FACTORS

(CHECK ALL THAT APPLY)

Smoking (active) ❑
Low Sunlight Exposure (low or none) ❑
Family History of Osteoporotic Fracture ❑

Low Calcium Intake (<500-850 mg/day) ❑
Hyperparathyroidism (N/S) ❑
Hyperthyroidism ❑

Diabetes mellitus (type II or N/S) ❑
Rheumatoid arthritis ❑

UNCLASSIFIABLE RISK FACTORS

(CHECK ALL THAT APPLY)

Alcohol Intake ❑
Male hypogonadism ❑
Other hormonal factors in men, including

Anti-androgen therapy ❑

Prostaglandin inhibitors (NSAIDs and aspirin) ❑
Anti-ulcer agents ❑
Thyroid disease including replacement therapy ❑

Respiratory diseases – independent of steroid use ❑
Dietary deficiency of Vitamin D ❑
Metabolism and GI absorption disorders ❑

SCI ❑
Hyperhomocysteinemia ❑

❑ This article does not include any of the risk factors listed on this form.

VA Male OP Project-Detailed Review Form- RISK FACTOR STUDIES

FINAL 12/01/06

Article ID: Reviewer:

First Author: _____
(Last Name Only)

STUDY PARTICIPATION

	YES	NO
Was the source population clearly defined?...	❑	❑
Was the study population described?.....	❑	❑
Is the study population representative of the patients of interest (VA)?.....	❑	❑

STUDY DESIGN

4. What is the study design? (Check one)
   - Case- Control ..... ❑
   - Cohort ..... ❑
   - Cross sectional ..... ❑

STUDY ATTRITION

FOR COHORTS ONLY

How many subjects were enrolled?

_____ _____ _____ _____ (ND=9999)

6. How many subjects were included in the data analysis?

_____ _____ _____ _____ (ND=9999)

7. What is the duration of the follow up?

Duration	Units

Units
01. Days 04. Years
02. Weeks 05. NR
03. Months

OR

_____ _____ _____ _____ person-years

FOR CASE CONTROL ONLY

8. How many cases were included?

_____ _____ _____ _____

9. How many controls were included?

_____ _____ _____ _____

FOR CROSS SECTIONAL STUDIES ONLY

10. What is the sample size?

_____ _____ _____ _____

RISRIRISK FACTOR MEASUREMENT

Which of the following risk factors were assessed?

Alcohol Consumption ..... ❑
- If yes, how was alcohol consumption defined:

_____

Diabetes Mellitus, type II or NOS ..... ❑
- If yes, how was the presence of diabetes defined:

_____

Spinal Cord Injury..... ❑
- If yes, how was the presence and location of SCI defined:

_____

VA Male OP Project-Detailed Review Form- RISK FACTOR STUDIES

OUTCOME MEASUREMENT

12. What outcome was assessed?

BMD (cDXA) ..... ❑

If yes answer the following:

- Site (CHECK ALL THAT APPLY)
  - Spine ..... ❑
  - Femur ..... ❑
  - Radius ..... ❑
  - Patella ..... ❑
  - Calcaneus ..... ❑
  - Finger ..... ❑
  - Other: _____ ..... ❑
  - Not applicable ..... ❑
  - Not reported ..... ❑
- T-score: _____
- Reference Standard
  - Male ..... ❑
  - Female ..... ❑
  - Other ..... ❑

Specify:_____

Osteoporotic fracture ..... ❑

If yes, how was the presence of fracture assessed: (CHECK ALL THAT APPLY)

- X-ray ..... ❑
- Diary/Self Report ..... ❑
- Administrative data ..... ❑
- Medical Record Review ..... ❑

Other Bone Measurements ..... ❑

If yes, please specify: (CHECK ALL THAT APPLY)

- Ultrasound ..... ❑
- Other ..... ❑

Specify:_____

POTEPOTENTIAL CONFOUNDING PROGNOSTIC FACTOR MEASUREMENT

13. Which of the following risk factors were assessed? (CHECK ALL THAT APPLY)

- Age ..... ❑
- Low body weight ..... ❑
- Weight loss ..... ❑
- Physical inactivity/prolonged immobilization (Not SCI) ..... ❑
- Corticosteroid use ..... ❑
- Anticonvulsant use ..... ❑
- Hyperparathyroidism ..... ❑
- Diabetes Mellitus, type I ..... ❑
- Gastrectomy ..... ❑
- Hypogonadism, primary or secondary ..... ❑
- Poor visual acuity ..... ❑
- Previous osteoporotic fracture ..... ❑
- Cigarette smoking ..... ❑
- Vitamin D deficiency ..... ❑
- Low dietary calcium intake ..... ❑
- Family History of Osteoporotic Fracture ..... ❑
- Hyperthyroidism ..... ❑
- Rheumatoid Arthritis ..... ❑
- High bone turnover rate ..... ❑

ANALANALYSIS

14. Does the article present: (CHECK ALL THAT APPLY)

- Bivariate ..... ❑
- Multivariate ..... ❑
- Other ..... ❑

Specify:_____

VA Male OP Project – RISK FACTOR STUDIES, Quality Measurement

FINAL 01/17/07

Article ID:_____ Reviewer:

First Author: _____
(Last Name Only)

STUDY PARTICIPATION

The study sample represents the population of interest on key characteristics, sufficient to limit potential bias to the results.

Yes ..... ❑
Partly ..... ❑
No ..... ❑
Unsure ..... ❑

*Population of interest is adequately described for key characteristics
*Sampling frame and recruitment are adequately described, including methods to identity the sample (number and type used, e.g., referral patterns in health care), period of recruitment, and place of recruitment (setting and geographic location).
*Inclusion and exclusion criteria are adequately described (e.g., including explicit diagnostic criteria or "zero time" description).
* There is adequate participation in the study by eligible individuals.
*The baseline study sample (i.e., individuals entering the study) is adequately described for key characteristics.

STUDY ATTRITION

Loss to follow-up (from sample to study population) is not associated with key characteristics (i.e., the study data adequately represent the sample), sufficient to limit potential bias.

Yes ..... ❑
Partly ..... ❑
No ..... ❑
Unsure ..... ❑

*Proportion of study sample completing the study and providing outcome data is adequate.
*Attempts to collect information on participants who dropped out of the study are described.
*Reasons for loss to follow-up are provided.
*Participants lost to follow-up are adequately described for key characteristics.
*There are no important differences between key characteristics and outcomes in participants who completed the study and those who did not.

PROGPROGNOSTIC FACTOR MEASUREMENT

The prognostic factor of interest is adequately measured in study participants to sufficiently limit potential bias.

Yes ..... ❑
Partly ..... ❑
No ..... ❑
Unsure ..... ❑

*A clear definition or description of the prognostic factor measure is provided (e.g., including dose, level, duration of exposure, and clear specification of the method of measurement.)
*Continuous variables are reported or appropriate (i.e., not data-dependent) cut-points are used.
*The prognostic factor measure and method are adequately valid and reliable to limit misclassification Bias (e.g. may include relevant outside sources of information on measurement properties, also characteristics, such as blind measurement and limited reliance on recall).
*Adequate proportion of the study sample has complete data for prognostic factors.
*The method and setting of measurement are the same for all study participants.
*Appropriate methods are used if imputation is used for missing prognostic factor data.

OUTCOME MEASUREMENT

The outcome of interest is adequately measured in study participants to sufficiently limit potential bias.

Yes ..... ❑
Partly ..... ❑
No ..... ❑
Unsure ..... ❑

*A clear definition of the outcome of interest is provided, including duration of follow-up and level and extent of the outcome construct.
*The outcome measure and method used are adequately valid and reliable to limit misclassification bias (e.g., may include relevant outside sources of information on measurement properties, also characteristics, such as blind measurement and confirmation of outcome with valid and reliable test.)
*The method and setting of measurement are the same for all study participants.

CONFOUNDING MEASUREMENT AND ACCOUNT

Important potential confounders are appropriately accounted for, limiting potential bias with respect to the prognostic factor of interest.

Yes ..... ❑
Partly ..... ❑
No ..... ❑
Unsure ..... ❑

*All important confounders, including treatments (key variables in conceptual model), are measured.
*Clear definitions of the important confounders measured are provided (e.g., including dose, level and duration of exposures).
*Measurement of all important confounders is adequately valid and reliable (e.g., may include relevant outside sources of information on measurement properties, also characteristics, such as blind measurement and limited reliance on recall.)
*The method and setting of confounding measurement are the same for all study participants.
*Appropriate methods are used if imputation is used for missing confounder data.
*Important potential confounders are accounted for in the study design (e.g., matching for key variables, stratification, or initial assembly of comparable groups.)
*Important potential confounders are accounted for in the analysis (i.e., appropriate adjustment).

ANALYSIS

The statistical analysis is appropriate for the design of the study, limiting potential for presentation of invalid results.

Yes ..... ❑
Partly ..... ❑
No ..... ❑
Unsure ..... ❑

*There is sufficient presentation of data to assess the adequacy of the analysis.
*The strategy for model building (i.e., inclusion of variables) is appropriate and is based on a conceptual framework or model.
* The selected model is adequate for the design of the study.
*There is no selective reporting of results.

Appendix B. Evidence Table

Evidence Table 1. Diagnostic Test Studies
Columns 1-10: Article, Population, Characteristics, Sample Size, Study test & site, Reference test & site, QUADAS, Results

Author, Year, Region, Trial Name	Population	Characteristics	Male sample size	Study		Reference		QUADAS*	Results
				Test	Site	Test	Site		
Adler, 2001 [27] US/Canada	Referred for DXA	NR, Veteran	185	Ultrasound BUA & QUI	Calcaneus	Central DXA	Spine, Femur	3,3,1,1,1,1,1, 1,1,3,3,1,1,3	**Central DXA T-score<-1.5** Heel T-score<0: Sens=0.89, Spec=0.40 Heel T-score<-0.5: Sens=0.79, Spec=0.48 Heel T-score<-1.0: Sens=0.65, Spec=0.75 Heel T-score<-1.5: Sens=0.49, Spec=0.84 Heel T-score<-2.0: Sens=0.30, Spec=0.94 Heel T-score<-2.5: Sens=0.07, Spec=0.98 **Central DXA T-score<-2.0** Heel T-score<0: Sens=0.92, Spec=0.35 Heel T-score<-0.5: Sens=0.86, Spec=0.47 Heel T-score<-1.0: Sens=0.71, Spec=0.68 Heel T-score<-1.5: Sens=0.53, Spec=.079 Heel T-score<-2.0: Sens=0.30, Spec=0.89 Heel T-score<-2.5: Sens=0.06, Spec=0.97 **Central DXA T-score<-2.5** Heel T-score<0: Sens=0.91, Spec=0.27 Heel T-score<-0.5: Sens=0.86, Spec=0.38 Heel T-score<-1.0: Sens=0.74, Spec=0.59 Heel T-score<-1.5: Sens=0.60, Spec=0.73 Heel T-score<-2.0: Sens=0.34, Spec=0.86 Heel T-score<-2.5: Sens=0.07, Spec=0.97
Adler, 2003 [19] US/Canada	Pulmonary Clinic	Asian, Veteran	107	Ultrasound BUA, SOS & QUI; questionnaire	Calcaneus	Central DXA	Spine, Femur	1,1,1,1,2,1,1, 1,1,3,3,1,1,3	Central DXA T-score<-2.0, Heel T-score<-1.5: Sens=0.41, Spec=0.77
Adler, 2003 [35] US/Canada	Pulmonary & Rheumatology Clinic	Pulmonary & Rheumatology Clinic, Veteran	181	Questionnaire OST	NA	Central DXA	Spine, Femur	1,1,1,1,1,1,1, 1,1,3,3,1,1,1	**Central DXA T-score<-2.0** OSTA score<1: Sens=0.62, Spec=0.89 OSTA score<2: Sens=0.69, Spec=0.82 OSTA score<3: Sens=0.74, Spec=0.72 **Central DXA T-score<-2.5** OSTA score<1: Sens=0.75, Spec=0.80 OSTA score<2: Sens=0.82, Spec=0.74 OSTA score<3: Sens=0.93, Spec=0.66
Cheng, 1997 [95] Scandinavia	Elderly	NR	205	Peripheral bone density pDXA	Calcaneus	Fracture Occurrence	Multiple Sites	2,1,1,1,2,1,1, 1,1,3,3,1,1,1	Determined that calcaneal BMD can be used as a predictor of fracture occurrence in 75-80 year old men.
De Laet, 1998 [96] Western Europe	Elderly	NR	2778	Central DXA, Hiefy Risk using DCA	Femur, NA	Fracture Occurrence	NA	1,1,1,1,1,1,1, 1,1,3,3,1,1,1	Evaluated a hip fracture risk equation which included age and femoral neck BMD and found that they were able to accurately predict hip fracture over an approximate four year period.
Donaldson, 1999 [72] Western Europe	Elderly	NR	817	Ultrasound BUA	Calcaneus	Fracture Occurrence	NR	1,1,3,1,2,3,1, 1,1,3,3,1,1,2	Found no significant difference between fixed or anatomic BUA values in men with or without a past fracture.

*QUADAS 1=Yes, 2=No, 3=Unclear; Order is: Spectrum representativeness, Selection criteria, Reference standard, Time period, Verification bias, Use of same reference test, Independence, Detail of index test, Details of reference test, Blinding #1, Blinding #2, Usefulness in practice, Intermediate results, Withdrawls

NR=Not Reported BUA=Broad-band ultrasound attenuation QUI=Quantitative Ultrasound Index DXA=Dual energy x-ray absorptiometry
SOS=Speed of sound OST=Osteoporosis Screening Tool BMD=Bone Mass Density QUS=Quantitative Ultrasound
SI=Stiffness Index OSTA=Osteoporosis Screening Tool for Asians MOST=Male Osteoporosis Screening Tool AVU=Apparent velocity of ultrasound

Evidence Table 1. Diagnostic Test Studies
Columns 1-10: Article, Population, Characteristics, Sample Size, Study test & site, Reference test & site, QUADAS, Results

Author, Year, Region,	Population	Characteristics	Male sample size	Study		Reference		QUADAS*	Results
				Test	Site	Test	Site		
Gonnelli, 2005 [68] Western Europe	Bone Clinic	NR	407	Ultrasound BUA & SOS; Central DXA	Spine, Femur, Calcaneus	Fracture Occurrence	Spine, Femur, Radius, Pelvis	2,1,1,1,1,1,1, 1,1,3,3,1,1,1	Found that hip BMD (OR 3.4, 2.5-4.8) and QUS stiffness (OR 3.2, 2.3-4.5) had strong associations with fractures and that combining these two parameters resulted in an even stronger association (OR 6.1, 2.6-14.3).
Grampp, 2001 [66] Western Europe	Referred for BMD	NR	501	Ultrasound QUS	Calcaneus	Central DXA	Spine, Femur	2,1,1,1,1,1,1, 1,1,3,3,1,1,1	Insufficient statistics for sensitivity and specificity calculation
Gudmundsdottir, 2005 [20] Scandinavia	Unselected	NR	589	Ultrasound BUA, SOS & SI	Calcaneus	Central DXA	Spine, Femur	2,1,1,1,3,1,1, 1,1,3,3,1,1,2	**Total hip DXA T-score<-2.5** QUS T-score<0: Sens=1.0, Spec=0.14 QUS T-score<-0.5: Sens=0.86, Spec=0.28 QUS T-score<-1.0: Sens=0.82, Spec=0.49 **Femoral neck BMD T-score<=-2.5** QUS T-score<0: Sens=1.0, Spec=0.13 QUS T-score<-0.5: Sens=0.92, Spec=0.28 QUS T-score<-1.0: Sens=0.83, Spec=0.47
Kaptoge, 2004 [17] Western Europe	Unselected	NR	2653	Simple Score Male Multivariate Model	Spine	Fracture Occurrence	Spine, Femur, Radius, Rib, Other	1,1,1,1,1,1,1, 1,1,3,3,1,1,1	Found that the risk for prevalent vertebral fracture significantly increased with age (RR 1.3, 1.2-1.5), height loss (RR 1.1, 1.0-1.1), self-reported spine fractures (RR 5.1, 3.7-6.9), and weight (RR 0.9, 0.8-0.9).
Karlsson, 1996 [14] Scandinavia	Unselected	NR	33	Central DXA; X-ray	Femur	Fracture Occurrence	Femur	1,1,1,1,1,1,1, 1,1,3,3,3,1,1	Found a significant correlation between age and femoral shaft width (r=0.4), cervical width (r=0.4); no significant correlation was found between radiographic signs of osteoporosis and DXA hip values.
Kroger, 1999 [97] Scandinavia, Western Europe	Referred – PCP	NR	68	Central DXA; Quantitative CT	Spine, Femur	Fracture Occurrence	Spine, Femur	3,2,1,3,3,3,1, 1,1,3,3,3,3,3	Found that axial and peripheral quantitative CT performed comparably to DXA in spinal osteoporosis assessment.
Kung, 2005 [63] Asia	Elderly	Asian	776	Ultrasound BUA; SOS & QUI; OSTA	Calcaneus NA	Central DXA	Spine, Femur	2,1,1,1,1,1,1, 1,1,3,3,1,1,3	**Femoral neck BMD T-score<=-2.5** OSTA score <=-1.0: Sens=0.71, Spec=0.68 QUI T-score<-1.2: Sens=0.76, Spec=0.72
Li-Yu, 2005 [15] Asia	Unselected	Filipino	132	OSTA	NA	Central DXA	Femur	2,1,1,1,1,1,1, 2,1,3,1,1,3,3	**Femoral neck BMD T-score<=-2.5** OSTA score <-1.0: Sens=0.91, Spec=0.66
Lynn, 2005 [65] Asia	Elderly	Asian	2000	Ultrasound QUI; MOST	NA	Central DXA	Spine, Femur	2,1,1,1,3,1,1, 1,1,3,3,1,1,3	**Central BMD T-score <-2.5** MOST score > 3: Sens=0.94, Spec=0.46
Melton, 2005 [98] US/Canada	Unselected	NR	348	Bone Structural Parameters	Femur	Central DXA, Fracture Occurrence	Femur	1,1,1,1,1,1,2, 1,1,3,3,1,1,2	Found that the best predictors of osteoporotic fractures in a multivariate in men included age (OR per 10 years, 1.5; 1.1-2.1), femoral neck section modulus (OR, 1.6; 1.1-2.5), and intertrochanteric buckling ratio (OR 1.6; 1.3-2.0).
Montagnani, 2001 [67]Western Europe	Unselected	NR	182	Central DXA; Ultrasound	Spine, Femur, Finger	Fracture Occurrence	NR	1,2,1,1,1,1,1, 1,1,3,3,1,1,1	Evaluated usefulness of ultrasound of the phalanx and in regression analysis found that only one parameter, bone transmission time (BTT), was comparable to DXA parameters in determining fracture risk.

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NR=Not Reported BUA=Broad-band ultrasound attenuation QUI=Quantitative Ultrasound Index DXA=Dual energy x-ray absorptiometry
SOS=Speed of sound OST=Osteoporosis Screening Tool BMD=Bone Mass Density QUS=Quantitative Ultrasound
SI=Stiffness Index OSTA=Osteoporosis Screening Tool for Asians MOST=Male Osteoporosis Screening Tool AVU=Apparent velocity of ultrasound

Evidence Table 1. Diagnostic Test Studies
Columns 1-10: Article, Population, Characteristics, Sample Size, Study test & site, Reference test & site, QUADAS, Results

Author, Year, Region,	Population	Characteristics	Male sample size	Study		Reference		QUADAS*	Results
				Test	Site	Test	Site		
Mulleman, 2002 [#1274] Western Europe	Referral	NR	102	Ultrasound BUA, SOS & SI	Calcaneus	Central DXA, Fracture Occurrence	Spine, Femur	2,1,3,1,1,1,1, 1,1,3,3,1,1,1	Quantitative ultrasound (QUS) is associated with low-trauma fracture (OR 2.3 and 2.1 for SOS and SI respectively), although sensitivity is less than when results are compared with BMD at the lumbar spine (OR 2.8) and hip (OR=3.4) with an area under the curve in ROC analysis for BMD of Lumbar spine = 0.80 and BUA 0.69 (P<0.05). **Lumbar spine DXA T-score<=-2.5** QUS T-score <=-2.5: Sens=0.56, Spec=0.84; **Femoral neck DXA T-score<=-2.5** QUS T-score <=-2.5: Sens=0.64, Spec=0.74; **Hip DXA T-score<=-2.5** QUS T-score <=-2.5: Sens=0.41, Spec=0.93; **Stiffness index DXA T-score <=-2.5** QUS T-score <=-2.5: Sens=0.60, Spec=0.78;
Odvina, 1988 [99] US/Canada	Referral for Osteoporosis	NR, Veteran	38	Quantitative CT	Spine	Fracture Occurrence		2,1,1,1,1,1,1, 1,1,3,3,1,1,1	Employed trabecular vertebral body density by CT to determine fracture threshold in men and women. Although fracture threshold was not well defined in men, the values obtained by different methods were in close agreement to those noted in women. Fracture threshold was higher in men than women (123 ±7 vs. 101 ±2 mg/cm^3, p<0.001).
Robinson, 1987 [100] Australia	Referred by Hospital Staff	NR	31	Linear Photon Absorptiometry	Spine, Radius	Quantitative CT, Fracture Occurrence	Spine	2,2,1,1,3,3,1, 1,1,3,3,1,1,3	Found that men with vertebral fractures has significantly lower mean forearm osteodensitometry and spinal mineral content than age matched men without a history of fractures (16 point difference in "arbitrary units," p<0.02; 65 mg equivalent K^2HPO_4/cm^3, p<0.0025, respectively).
Rothenberg, 2004 [70] US/Canada	Unselected	NR	301	Ultrasound Bone Density	Calcaneus	Fracture Occurrence	Spine, Femur, Radius, Shoulder, Ribs	1,1,3,1,1,1,1, 1,1,3,3,1,1,1	Estimated that the Hologic T-score of -0.2 corresponds to a BMD of 0.57 gm/cm^2 which corresponds to an increase in relative risk of fracture of 1.4.
Shin, 2005 [101] Asia	Unselected, Elderly	Asian	1225	Ultrasound BUA, SOS & Stiffness	Calcaneus	Peripheral bone density pDXA	Radius, Calcaneus	2,1,1,1,1,1,1, 1,1,3,3,1,1,2	Found that correlations between QUS and BMD were 0.41 to 0.73 in men, with peak mean values for QUS occurring in men aged 20-29 years old.
Stewart, 1995 [73] Western Europe	Unselected	NR	247	Ultrasound BUA; Central DXA	Spine, Femur, Calcaneus	Fracture Occurrence	Spine	1,3,1,1,1,1,1, 1,1,3,3,1,1,1	No statistically significant relationship between BUA or DXA at any site and fractures in men in bivariate analyses.
Travers-Gustafson, 1995 [74] US/Canada	Elderly	NR	529	Peripheral Bone Density other; AVU	Radius, Patella	Fracture Occurrence	NR	1,1,3,1,1,1,1, 1,1,3,3,1,1,1	Apparent velocity of ultrasound (AVU) is highly associated with low trauma fractures in both women (OR 1.46, 95% CI=1.18,1.81) and men (OR 1.69, 95% CI=1.24,2.32).

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				Test	Site	Test	Site		
Varenna, 2005 [69] Western Europe	Unselected	NR	4832	Ultrasound BUA, SOS, & SI	Calcaneus	Fracture Occurrence	Femur, Non-spinal	1,1,3,1,1,1,1, 1,1,3,3,1,1,1	Found that each SD reduction in QUS measurement resulted in a significant approximate 2X increase in risk of hip fracture, independent of age and other clinical variables, consistent with findings found in elderly women.
Welch, 2004 [71] Western Europe	Unselected	NR	6860	Ultrasound BUA	Calcaneus	Fracture Occurrence	Spine, Femur, Radius	1,1,3,1,1,1,1, 1,1,3,3,1,1,1	Found differences sex differences in relationship between osteoporosis risk factors and BUA. Age, weight, and height explained 27% of the variance of BUA in women, but only 3% in men.
Bauer, 2006 [75] US/Canada	Elderly	NR	5608	Ultrasound BUA, Central DXA	Femur, Calcaneus	Fracture Occurrence	Femur	1,1,1,1,1,1,1, 3,3,1,1,1,1,3	Each SD decrease in calcaneal ultrasound BUA was associated with an increased rate of hip (RH= 1.97, CI: 1.32, 3.54) and non-spine (RH=1.65, CI: 1.38,1.96) fracture. Ultrasound predicted hip and non-spine fractures almost as well as femoral BMD, and the combination of these tests was not better than either test alone.

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