



# FRAX-based intervention and assessment thresholds in seven Latin American countries

Osteoporosis International

pp 1–9 | Cite as

- P. Clark (1) (2)
- E. Denova-Gutiérrez (1) (2) Email author (edenovag@gmail.com)
- C. Zerbini (3)
- A. Sanchez (4)
- O. Messina (5) (6)
- J. J. Jaller (7)
- C. Campusano (8)
- C. H. Orces (9)
- G. Riera (10)
- H. Johansson (11)
- J. A. Kanis (11) (12)

1. Clinical Epidemiology Research Unit, Hospital Infantil de México Federico Gomez, Mexico City, Mexico
2. School of Medicine, Universidad Nacional Autónoma de México (UNAM), Mexico City, Mexico
3. Centro Paulista de Investigação Clínica, São Paulo, Brazil
4. Centro de Endocrinología, Rosario, Argentina
5. Servicio de Reumatología, Hospital Argerich, Buenos Aires, Argentina
6. Unidad de Postgrado en Reumatología, Universidad de Buenos Aires, Buenos Aires, Argentina
7. Centro de Reumatología y Ortopedia, Barranquilla, Colombia
8. Clínica de la Universidad de los Andes, Santiago, Chile
9. Department of Medicine, Laredo Medical Center, Laredo, USA
10. Unidad Metabólica, Universidad de Carabobo, Valencia, Venezuela
11. Institute for Health and Ageing, Catholic University of Australia, Melbourne, Australia
12. Medical School, Sheffield, UK Centre for Metabolic Bone Diseases, University of Sheffield, Sheffield, England

Original Article

First Online: [23 December 2017](#)

Received: 24 October 2017

Accepted: 04 December 2017

[Reprints and Permissions](#)

- [1 Shares](#)
- [3 Downloads](#)

# Abstract

## Summary

Age-specific intervention and assessment thresholds were developed for seven Latin American countries. The intervention threshold ranged from 1.2% (Ecuador) to 27.5% (Argentina) at the age of 50 and 90 years, respectively. In the Latin American countries, FRAX offers a substantial advance for the detection of subjects at high fracture risk.

## Introduction

Intervention thresholds are proposed using the Fracture Risk Assessment (FRAX) tool. We recommended their use to calculate the ten-year probability of fragility fracture (FF) in both, men and women with or without the inclusion of bone mineral density (BMD). The purpose of this study is to compute FRAX-based intervention and BMD assessment thresholds for seven Latin American countries in men and women  $\geq 40$  years.

## Methods

The intervention threshold (IT) was set at a 10-year probability of a major osteoporotic fracture (MOF) equivalent to a woman with a prior FF and a body mass index (BMI) equal to 25.0 kg/m<sup>2</sup> without BMD or other clinical risk factors. The lower assessment threshold was set at a 10-year probability of a MOF in women with BMI equal to 25.0 kg/m<sup>2</sup>, no previous fracture and no clinical risk factors. The upper assessment threshold was set at 1.2 times the IT.

## Results

For the seven LA countries, the age-specific IT varied from 1.5 to 27.5% in Argentina, 3.8 to 25.2% in Brazil, 1.6 up to 20.0% in Chile, 0.6 to 10.2% in Colombia, 0.9 up to 13.6% in Ecuador, 2.6 to 20.0% in Mexico, and 0.7 up to 22.0% in Venezuela at the age of 40 and 90 years, respectively.

## Conclusions

In the LA countries, FRAX-based IT offers a substantial advance for the detection of men and women at high fracture risk, particularly in the elderly. The heterogeneity of IT between the LA countries indicates that country-specific FRAX models are appropriate rather than a global LA model.

## Keywords

Assessment thresholds FRAX Intervention threshold  
Latin American countries Osteoporosis Ten-year fracture probability

## Electronic supplementary material

The online version of this article (<https://doi.org/10.1007/s00198-017-4341-4> (<https://doi.org/10.1007/s00198-017-4341-4>)) contains supplementary material, which is available to authorized users.

## Notes

## Compliance with ethical standards

## Conflicts of interest

None.

## Supplementary material

[198\\_2017\\_4341\\_MOESM1\\_ESM.docx](#) (17 kb)  
[Supplementary figure 1\(DOCX 16 kb\)](#)

## References

1. Hernlund E, Svedbom A, Ivergård M, Compston J, Cooper C, Stenmark J, McCloskey EV, Jönsson B, Kanis JA (2013) Osteoporosis in the European Union: medical management, epidemiology and economic burden. A report prepared in collaboration with the International Osteoporosis Foundation (IOF) and the European Federation of Pharmaceutical Industry Associations (EFPIA). *Arch Osteoporos* 8(1–2):136. <https://doi.org/10.1007/s11657-013-0136-1>. (<https://doi.org/10.1007/s11657-013-0136-1>)  
[CrossRef](#) (<https://doi.org/10.1007/s11657-013-0136-1>)

**PubMed** ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=24113837](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=24113837))

**PubMedCentral**

(<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3880487>)

**Google Scholar** ([http://scholar.google.com/scholar\\_lookup?title=Osteoporosis%20in%20the%20European%20Union%3A%20medical%20management%2C%20epidemiology%20and%20economic%20burden.%20A%20report%20prepared%20in%20collaboration%20with%20the%20International%20Osteoporosis%20Foundation%20%28IOF%29%20and%20the%20European%20Federation%20of%20Pharmaceutical%20Industry%20Associations%20%28EFPIA%29&author=E.%20Hernlund&author=A.%20Svedbom&author=M.%20Iverg%C3%A5rd&author=J.%20Compston&author=C.%20Cooper&author=J.%20Stenmark&author=EV.%20McCloskey&author=B.%20J%C3%B6nsson&author=JA.%20Kanis&journal=Arch%20Osteoporos&volume=8&issue=1&pages=136&publication\\_year=2013&doi=10.1007%2Fs11657-013-0136-1](http://scholar.google.com/scholar_lookup?title=Osteoporosis%20in%20the%20European%20Union%3A%20medical%20management%2C%20epidemiology%20and%20economic%20burden.%20A%20report%20prepared%20in%20collaboration%20with%20the%20International%20Osteoporosis%20Foundation%20%28IOF%29%20and%20the%20European%20Federation%20of%20Pharmaceutical%20Industry%20Associations%20%28EFPIA%29&author=E.%20Hernlund&author=A.%20Svedbom&author=M.%20Iverg%C3%A5rd&author=J.%20Compston&author=C.%20Cooper&author=J.%20Stenmark&author=EV.%20McCloskey&author=B.%20J%C3%B6nsson&author=JA.%20Kanis&journal=Arch%20Osteoporos&volume=8&issue=1&pages=136&publication_year=2013&doi=10.1007%2Fs11657-013-0136-1))

2. Kanis JA, Borgström F, Compston J, Dreinhöfer K, Nolte E, Jonsson L, Lems WF, McCloskey EV, Rizzoli R, Stenmark J (2013) SCOPE: a scorecard for osteoporosis in Europe. *Arch Osteoporos* 8(1-2):144. <https://doi.org/10.1007/s11657-013-0144-1>  
(<https://doi.org/10.1007/s11657-013-0144-1>)  
**CrossRef** (<https://doi.org/10.1007/s11657-013-0144-1>)  
**PubMed** ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=24030479](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=24030479))  
**PubMedCentral**  
(<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3880480>)  
**Google Scholar** ([http://scholar.google.com/scholar\\_lookup?title=SCOPE%3A%20a%20scorecard%20for%20osteoporosis%20in%20Europe&author=JA.%20Kanis&author=F.%20Borgstr%C3%B6m&author=J.%20Compston&author=K.%20Dreinh%C3%B6fer&author=E.%20Nolte&author=L.%20Jonsson&author=WF.%20Lems&author=EV.%20McCloskey&author=R.%20Rizzoli&author=J.%20Stenmark&journal=Arch%20Osteoporos&volume=8&issue=1-2&pages=144&publication\\_year=2013&doi=10.1007%2Fs11657-013-0144-1](http://scholar.google.com/scholar_lookup?title=SCOPE%3A%20a%20scorecard%20for%20osteoporosis%20in%20Europe&author=JA.%20Kanis&author=F.%20Borgstr%C3%B6m&author=J.%20Compston&author=K.%20Dreinh%C3%B6fer&author=E.%20Nolte&author=L.%20Jonsson&author=WF.%20Lems&author=EV.%20McCloskey&author=R.%20Rizzoli&author=J.%20Stenmark&journal=Arch%20Osteoporos&volume=8&issue=1-2&pages=144&publication_year=2013&doi=10.1007%2Fs11657-013-0144-1))
3. Rubin KH, Friis-Holmberg T, Hermann AP, Abrahamsen B, Brixen K (2013) Risk assessment tools to identify women with increased risk of osteoporotic fracture: complexity or simplicity? A systematic review. *J Bone Miner Res* 28(8):1701–1717. <https://doi.org/10.1002/jbmr.1956>  
(<https://doi.org/10.1002/jbmr.1956>)  
**CrossRef** (<https://doi.org/10.1002/jbmr.1956>)  
**PubMed** ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=23592255](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=23592255))  
**Google Scholar** ([http://scholar.google.com/scholar\\_lookup?title=Risk%20assessment%20tools%20to%20identify%20women%20with%20increased%20risk%20of%20osteoporotic%20fracture%3A%20complexity%20or%20simplicity%3F%20A%20systematic%20review](http://scholar.google.com/scholar_lookup?title=Risk%20assessment%20tools%20to%20identify%20women%20with%20increased%20risk%20of%20osteoporotic%20fracture%3A%20complexity%20or%20simplicity%3F%20A%20systematic%20review))

iew&author=KH.%20Rubin&author=T.%20Friis-Holmberg&author=AP.%20Hermann&author=B.%20Abrahamsen&author=K.%20Brixen&journal=J%20Bone%20Miner%20Res&volume=28&issue=8&pages=1701-1717&publication\_year=2013&doi=10.1002%2Fjbm.1956)

4. Kanis JA, Harvey NC, Cooper C, Johansson H, Odén A, McCloskey EV, Advisory Board of the National Osteoporosis Guideline Group (2016) A systematic review of intervention thresholds based on FRAX: a report prepared for the National Osteoporosis Guideline Group and the International Osteoporosis Foundation. Arch Osteoporos 11(1):25. <https://doi.org/10.1007/s11657-016-0278-z> (<https://doi.org/10.1007/s11657-016-0278-z>)  
CrossRef (<https://doi.org/10.1007/s11657-016-0278-z>)  
PubMed ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=27465509](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=27465509))  
PubMedCentral (<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4978487>)  
Google Scholar ([http://scholar.google.com/scholar\\_lookup?title=A%20systematic%20review%20of%20intervention%20thresholds%20based%20on%20FRAX%3A%20a%20report%20prepared%20for%20the%20National%20Osteoporosis%20Guideline%20Group%20and%20the%20International%20Osteoporosis%20Foundation&author=JA.%20Kanis&author=NC.%20Harvey&author=C.%20Cooper&author=H.%20Johansson&author=A.%20Od%C3%A9n&author=EV.%20McCloskey&journal=Arch%20Osteoporos&volume=11&issue=1&pages=25&publication\\_year=2016&doi=10.1007%2Fs11657-016-0278-z](http://scholar.google.com/scholar_lookup?title=A%20systematic%20review%20of%20intervention%20thresholds%20based%20on%20FRAX%3A%20a%20report%20prepared%20for%20the%20National%20Osteoporosis%20Guideline%20Group%20and%20the%20International%20Osteoporosis%20Foundation&author=JA.%20Kanis&author=NC.%20Harvey&author=C.%20Cooper&author=H.%20Johansson&author=A.%20Od%C3%A9n&author=EV.%20McCloskey&journal=Arch%20Osteoporos&volume=11&issue=1&pages=25&publication_year=2016&doi=10.1007%2Fs11657-016-0278-z))
5. Zanchetta J, Campusano C, Muzzi B (2012) The Latin America regional audit. Epidemiology, costs and burden of osteoporosis in 2012. Report, International Osteoporosis Foundation  
Google Scholar (<https://scholar.google.com/scholar?q=Zanchetta%20J%20Campusano%20C%20Muzzi%20B%202012%29%20The%20Latin%20America%20regional%20audit.%20Epidemiology%20costs%20and%20burden%20of%20osteoporosis%20in%202012.%20Report%20International%20Osteoporosis%20Foundation>)
6. Johansson H, Clark P, Carlos F, Oden A, McCloskey EV, Kanis JA (2011) Increasing age- and sex-specific rates of hip fracture in Mexico: a survey of the Mexican Institute of Social Security. Osteoporos Int 22(8):2359–2364. <https://doi.org/10.1007/s00198-010-1475-z> (<https://doi.org/10.1007/s00198-010-1475-z>)  
CrossRef (<https://doi.org/10.1007/s00198-010-1475-z>)  
PubMed ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=21174191](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=21174191))  
Google Scholar ([http://scholar.google.com/scholar\\_lookup?title=Increasing%20age-%20and%20sex-specific%20rates%20of%20hip%20fracture%20in%20Mexico%3A%20a%20survey%20of%20the%20Mexican%20Institute%20of%20Soci](http://scholar.google.com/scholar_lookup?title=Increasing%20age-%20and%20sex-specific%20rates%20of%20hip%20fracture%20in%20Mexico%3A%20a%20survey%20of%20the%20Mexican%20Institute%20of%20Soci)

al%20Security&author=H.%20Johansson&author=P.%20Clark&author=F.%20Carlos&author=A.%20Oden&author=EV.%20McCloskey&author=JA.%20Kanis&journal=Osteoporos%20Int&volume=22&issue=8&pages=2359-2364&publication\_year=2011&doi=10.1007%2Fs00198-010-1475-z)

7. Clark P, Cons-Molina F, Deleze M, Ragi S, Haddock L, Zanchetta JR, Jaller JJ, Palermo L, Talavera JO, Messina DO, Morales-Torres J, Salmeron J, Navarrete A, Suarez E, Pérez CM, Cummings SR (2009) The prevalence of radiographic vertebral fractures in Latin American countries: the Latin American Vertebral Osteoporosis Study (LAVOS). *Osteoporos Int* 20(2):275–282. <https://doi.org/10.1007/s00198-008-0657-4> (<https://doi.org/10.1007/s00198-008-0657-4>)  
[CrossRef](https://doi.org/10.1007/s00198-008-0657-4) (<https://doi.org/10.1007/s00198-008-0657-4>)  
[PubMed](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=18584111) ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=18584111](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=18584111))  
[Google Scholar](http://scholar.google.com/scholar_lookup?title=The%20prevalence%20of%20radiographic%20vertebral%20fractures%20in%20Latin%20American%20countries%3A%20the%20Latin%20American%20Vertebral%20Osteoporosis%20Study%20%28LAVOS%29&author=P.%20Clark&author=F.%20Cons-Molina&author=M.%20Deleze&author=S.%20Ragi&author=L.%20Haddock&author=JR.%20Zanchetta&author=JJ.%20Jaller&author=L.%20Palermo&author=JO.%20Talavera&author=DO.%20Messina&author=J.%20Morales-Torres&author=J.%20Salmeron&author=A.%20Navarrete&author=E.%20Suarez&author=CM.%20P%3A%20Grez&author=SR.%20Cummings&journal=Osteoporos%20Int&volume=20&issue=2&pages=275-282&publication_year=2009&doi=10.1007%2Fs00198-008-0657-4) ([http://scholar.google.com/scholar\\_lookup?title=The%20prevalence%20of%20radiographic%20vertebral%20fractures%20in%20Latin%20American%20countries%3A%20the%20Latin%20American%20Vertebral%20Osteoporosis%20Study%20%28LAVOS%29&author=P.%20Clark&author=F.%20Cons-Molina&author=M.%20Deleze&author=S.%20Ragi&author=L.%20Haddock&author=JR.%20Zanchetta&author=JJ.%20Jaller&author=L.%20Palermo&author=JO.%20Talavera&author=DO.%20Messina&author=J.%20Morales-Torres&author=J.%20Salmeron&author=A.%20Navarrete&author=E.%20Suarez&author=CM.%20P%3A%20Grez&author=SR.%20Cummings&journal=Osteoporos%20Int&volume=20&issue=2&pages=275-282&publication\\_year=2009&doi=10.1007%2Fs00198-008-0657-4](http://scholar.google.com/scholar_lookup?title=The%20prevalence%20of%20radiographic%20vertebral%20fractures%20in%20Latin%20American%20countries%3A%20the%20Latin%20American%20Vertebral%20Osteoporosis%20Study%20%28LAVOS%29&author=P.%20Clark&author=F.%20Cons-Molina&author=M.%20Deleze&author=S.%20Ragi&author=L.%20Haddock&author=JR.%20Zanchetta&author=JJ.%20Jaller&author=L.%20Palermo&author=JO.%20Talavera&author=DO.%20Messina&author=J.%20Morales-Torres&author=J.%20Salmeron&author=A.%20Navarrete&author=E.%20Suarez&author=CM.%20P%3A%20Grez&author=SR.%20Cummings&journal=Osteoporos%20Int&volume=20&issue=2&pages=275-282&publication_year=2009&doi=10.1007%2Fs00198-008-0657-4))
8. Kanis JA, Closkey EV, Johansson H, Strom O, Borgstrom F, Oden A, National Osteoporosis Guideline Group (2008) Case finding for the management of osteoporosis with FRAX-assessment and intervention thresholds for the UK. *Osteoporos Int* 19(10):1395–1408. <https://doi.org/10.1007/s00198-008-0712-1> (<https://doi.org/10.1007/s00198-008-0712-1>)  
[CrossRef](https://doi.org/10.1007/s00198-008-0712-1) (<https://doi.org/10.1007/s00198-008-0712-1>)  
[PubMed](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=18751937) ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=18751937](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=18751937))  
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Case%20finding%20for%20the%20management%20of%20osteoporosis%20with%20FRAX-assessment%20and%20intervention%20thresholds%20for%20the%20UK&author=JA.%20Kanis&author=EV.%20Closkey&author=H.%20Johansson&author=O.%20Strom&author=F.%20Borgstrom&author=A.%20Oden&journal=Osteoporos%20Int&volume=19&issue=10&pages=1395-1408&publication_year=2008&doi=10.1007%2Fs00198-008-0712-1) ([http://scholar.google.com/scholar\\_lookup?title=Case%20finding%20for%20the%20management%20of%20osteoporosis%20with%20FRAX-assessment%20and%20intervention%20thresholds%20for%20the%20UK&author=JA.%20Kanis&author=EV.%20Closkey&author=H.%20Johansson&author=O.%20Strom&author=F.%20Borgstrom&author=A.%20Oden&journal=Osteoporos%20Int&volume=19&issue=10&pages=1395-1408&publication\\_year=2008&doi=10.1007%2Fs00198-008-0712-1](http://scholar.google.com/scholar_lookup?title=Case%20finding%20for%20the%20management%20of%20osteoporosis%20with%20FRAX-assessment%20and%20intervention%20thresholds%20for%20the%20UK&author=JA.%20Kanis&author=EV.%20Closkey&author=H.%20Johansson&author=O.%20Strom&author=F.%20Borgstrom&author=A.%20Oden&journal=Osteoporos%20Int&volume=19&issue=10&pages=1395-1408&publication_year=2008&doi=10.1007%2Fs00198-008-0712-1))
9. Compston J, Cooper A, Cooper C, Francis R, Kanis JA, Marsh D, McCloskey EV, Reid DM, Selby P, Wilkins M, on behalf of the

National Osteoporosis Guideline Group (NOGG) (2009) Guidelines for the diagnosis and management of osteoporosis in postmenopausal women and men from the age of 50 years in the UK. *Maturitas* 62(2):105–108. <https://doi.org/10.1016/j.maturitas.2008.11.022>

(<https://doi.org/10.1016/j.maturitas.2008.11.022>)

**CrossRef** (<https://doi.org/10.1016/j.maturitas.2008.11.022>)

**PubMed** ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=19135323](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=19135323))

**Google Scholar** ([http://scholar.google.com/scholar\\_lookup?title=Guidelines%20for%20the%20diagnosis%20and%20management%20of%20osteoporosis%20in%20postmenopausal%20women%20and%20men%20from%20the%20age%20of%2050%20years%20in%20the%20UK&author=J.%20Compston&author=A.%20Cooper&author=C.%20Cooper&author=R.%20Francis&author=JA.%20Kanis&author=D.%20Marsh&author=EV.%20McCloskey&author=DM.%20Reid&author=P.%20Selby&author=M.%20Wilkins&journal=Maturitas&volume=62&issue=2&pages=105-108&publication\\_year=2009&doi=10.1016%2Fj.maturitas.2008.11.022](http://scholar.google.com/scholar_lookup?title=Guidelines%20for%20the%20diagnosis%20and%20management%20of%20osteoporosis%20in%20postmenopausal%20women%20and%20men%20from%20the%20age%20of%2050%20years%20in%20the%20UK&author=J.%20Compston&author=A.%20Cooper&author=C.%20Cooper&author=R.%20Francis&author=JA.%20Kanis&author=D.%20Marsh&author=EV.%20McCloskey&author=DM.%20Reid&author=P.%20Selby&author=M.%20Wilkins&journal=Maturitas&volume=62&issue=2&pages=105-108&publication_year=2009&doi=10.1016%2Fj.maturitas.2008.11.022))

10. National Institute for Health and Care Excellence NICE Clinical Guideline 146 (2014) Osteoporosis: assessing the risk of fragility fracture. NICE UK. <https://www.nice.org.uk/guidance/cg146> (<https://www.nice.org.uk/guidance/cg146>), Accessed 18 May 2015
11. Salud. Diagnóstico y tratamiento de osteoporosis en mujeres posmenopáusicas (2013) DOI:<http://www.cenetec.salud.gob.mx/descargas/gpc/CatalogoMaestro> ([http://www.cenetec.salud.gob.mx/descargas/gpc/CatalogoMaestro/IMSS\\_673\\_13\\_Osteoporosisenpostmenopausia/673GER.pdf](http://www.cenetec.salud.gob.mx/descargas/gpc/CatalogoMaestro/IMSS_673_13_Osteoporosisenpostmenopausia/673GER.pdf)).
12. Secretaria de Salud (2017) Proyecto de Norma Oficial Mexicana PROY-NOM-049-SSA2–2017, para la prevención, detección, diagnóstico, tratamiento, control y vigilancia epidemiológica de la osteoporosis. Diario Oficial de la Federación. [http://www.dof.gob.mx/nota\\_detalle.php?codigo=5496348&fecha=06/09/2017](http://www.dof.gob.mx/nota_detalle.php?codigo=5496348&fecha=06/09/2017) ([http://www.dof.gob.mx/nota\\_detalle.php?codigo=5496348&fecha=06/09/2017](http://www.dof.gob.mx/nota_detalle.php?codigo=5496348&fecha=06/09/2017)), Accessed 11 Sept 2017
13. Kanis JA, Odén A, EV MC, Johansson H, Wahl DA, Cooper C, IOF Working Group on Epidemiology and Quality of Life (2012) A systematic review of hip fracture incidence and probability of fracture worldwide. *Osteoporos Int* 23(9):2239–2256. <https://doi.org/10.1007/s00198-012-1964-3> (<https://doi.org/10.1007/s00198-012-1964-3>) **CrossRef** (<https://doi.org/10.1007/s00198-012-1964-3>) **PubMed** ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=22419370](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=22419370)) **PubMedCentral** (<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3421108>)



**Google Scholar** ([http://scholar.google.com/scholar\\_lookup?title=A%20systematic%20review%20of%20hip%20fracture%20incidence%20and%20probability%20of%20fracture%20worldwide&author=JA.%20Kanis&author=A.%20Od%C3%A9n&author=MC.%20EV&author=H.%20Johansson&author=DA.%20Wahl&author=C.%20Cooper&journal=Osteoporos%20Int&volume=23&issue=9&pages=2239-2256&publication\\_year=2012&doi=10.1007%2Fs00198-012-1964-3](http://scholar.google.com/scholar_lookup?title=A%20systematic%20review%20of%20hip%20fracture%20incidence%20and%20probability%20of%20fracture%20worldwide&author=JA.%20Kanis&author=A.%20Od%C3%A9n&author=MC.%20EV&author=H.%20Johansson&author=DA.%20Wahl&author=C.%20Cooper&journal=Osteoporos%20Int&volume=23&issue=9&pages=2239-2256&publication_year=2012&doi=10.1007%2Fs00198-012-1964-3))

14. Johansson H, Oden A, Johnell O, Jonsson B, de Laet C, Oglesby A, McCloskey EV, Kayan K, Jalava T, Kanis JA (2004) Optimization of BMD measurements to identify high risk groups for treatment—a test analysis. *J Bone Miner Res* 19(6):906–913.

<https://doi.org/10.1359/jbmr.2004.19.6.906>

(<https://doi.org/10.1359/jbmr.2004.19.6.906>)

**CrossRef** (<https://doi.org/10.1359/jbmr.2004.19.6.906>)

**PubMed** ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=15190881](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=15190881))

**Google Scholar** ([http://scholar.google.com/scholar\\_lookup?title=Optimization%20of%20BMD%20measurements%20to%20identify%20high%20risk%20groups%20for%20treatment%E2%80%94a%20test%20analysis&author=H.%20Johansson&author=A.%20Oden&author=O.%20Johnell&author=B.%20Jonsson&author=C.%20Laet&author=A.%20Oglesby&author=EV.%20McCloskey&author=K.%20Kayan&author=T.%20Jalava&author=JA.%20Kanis&journal=J%20Bone%20Miner%20Res&volume=19&issue=6&pages=906-913&publication\\_year=2004&doi=10.1359%2Fjbmr.2004.19.6.906](http://scholar.google.com/scholar_lookup?title=Optimization%20of%20BMD%20measurements%20to%20identify%20high%20risk%20groups%20for%20treatment%E2%80%94a%20test%20analysis&author=H.%20Johansson&author=A.%20Oden&author=O.%20Johnell&author=B.%20Jonsson&author=C.%20Laet&author=A.%20Oglesby&author=EV.%20McCloskey&author=K.%20Kayan&author=T.%20Jalava&author=JA.%20Kanis&journal=J%20Bone%20Miner%20Res&volume=19&issue=6&pages=906-913&publication_year=2004&doi=10.1359%2Fjbmr.2004.19.6.906))

15. Johansson H, Kanis JA, Oden A, Compston J, McCloskey E (2012) A comparison of case-finding strategies in the UK for the management of hip fractures. *Osteoporos Int* 23(3):907–915.

<https://doi.org/10.1007/s00198-011-1864-y>

(<https://doi.org/10.1007/s00198-011-1864-y>)

**CrossRef** (<https://doi.org/10.1007/s00198-011-1864-y>)

**PubMed** ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=22234810](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=22234810))

**Google Scholar** ([http://scholar.google.com/scholar\\_lookup?title=A%20comparison%20of%20case-finding%20strategies%20in%20the%20UK%20for%20the%20management%20of%20hip%20fractures&author=H.%20Johansson&author=JA.%20Kanis&author=A.%20Oden&author=J.%20Compston&author=E.%20McCloskey&journal=Osteoporos%20Int&volume=23&issue=3&pages=907-915&publication\\_year=2012&doi=10.1007%2Fs00198-011-1864-y](http://scholar.google.com/scholar_lookup?title=A%20comparison%20of%20case-finding%20strategies%20in%20the%20UK%20for%20the%20management%20of%20hip%20fractures&author=H.%20Johansson&author=JA.%20Kanis&author=A.%20Oden&author=J.%20Compston&author=E.%20McCloskey&journal=Osteoporos%20Int&volume=23&issue=3&pages=907-915&publication_year=2012&doi=10.1007%2Fs00198-011-1864-y))

16. Leslie WD, Majumdar SR, Lix LM, Johansson H, Oden A, McCloskey E, Kanis JA, Manitoba Bone Density Program (2012) Hip fracture probability with FRAX usually indicates densitometric osteoporosis: implications for clinical practice. *Osteoporos Int* 23(1):391–397.

<https://doi.org/10.1007/s00198-011-1592-3>

(<https://doi.org/10.1007/s00198-011-1592-3>)

**CrossRef** (<https://doi.org/10.1007/s00198-011-1592-3>)

**PubMed** ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=21365460](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=21365460))

**Google Scholar** ([http://scholar.google.com/scholar\\_lookup?title=Hip%20fracture%20probability%20with%20FRAX%20usually%20indicates%20densitometric%20osteoporosi%3A%20implications%20for%20clinical%20practice&author=WD.%20Leslie&author=SR.%20Majumdar&author=LM.%20Lix&author=H.%20Johansson&author=A.%20Oden&author=E.%20McCloskey&author=JA.%20Kanis&journal=Osteoporos%20Int&volume=23&issue=1&pages=391-397&publication\\_year=2012&doi=10.1007%2Fs00198-011-1592-3](http://scholar.google.com/scholar_lookup?title=Hip%20fracture%20probability%20with%20FRAX%20usually%20indicates%20densitometric%20osteoporosi%3A%20implications%20for%20clinical%20practice&author=WD.%20Leslie&author=SR.%20Majumdar&author=LM.%20Lix&author=H.%20Johansson&author=A.%20Oden&author=E.%20McCloskey&author=JA.%20Kanis&journal=Osteoporos%20Int&volume=23&issue=1&pages=391-397&publication_year=2012&doi=10.1007%2Fs00198-011-1592-3))

17. Kanis JA, Adams J, Borgström F, Cooper C, Jönsson B, Preedy D, Selby P, Compston J (2008) The cost-effectiveness of alendronate in the management of osteoporosis. *Bone* 42(1):4–15.

<https://doi.org/10.1016/j.bone.2007.10.019>

(<https://doi.org/10.1016/j.bone.2007.10.019>)

**CrossRef** (<https://doi.org/10.1016/j.bone.2007.10.019>)

**PubMed** ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=18156107](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=18156107))

**Google Scholar** ([http://scholar.google.com/scholar\\_lookup?title=The%20cost-effectiveness%20of%20alendronate%20in%20the%20management%20of%20osteoporosis&author=JA.%20Kanis&author=J.%20Adams&author=F.%20Borgstr%C3%B6m&author=C.%20Cooper&author=B.%20J%C3%B6nsson&author=D.%20Preedy&author=P.%20Selby&author=J.%20Compston&journal=Bone&volume=42&issue=1&pages=4-15&publication\\_year=2008&doi=10.1016%2Fj.bone.2007.10.019](http://scholar.google.com/scholar_lookup?title=The%20cost-effectiveness%20of%20alendronate%20in%20the%20management%20of%20osteoporosis&author=JA.%20Kanis&author=J.%20Adams&author=F.%20Borgstr%C3%B6m&author=C.%20Cooper&author=B.%20J%C3%B6nsson&author=D.%20Preedy&author=P.%20Selby&author=J.%20Compston&journal=Bone&volume=42&issue=1&pages=4-15&publication_year=2008&doi=10.1016%2Fj.bone.2007.10.019))

18. Kanis JA, EV MC, Johansson H, Cooper C, Rizzoli R, Reginster JY, Scientific Advisory Board of the European Society for Clinical and Economic Aspects of Osteoporosis and Osteoarthritis (ESCEO) and the Committee of Scientific Advisors of the International Osteoporosis Foundation (IOF) (2013) European guidance for the diagnosis and management of osteoporosis in postmenopausal women. *Osteoporos Int* 24(1):23–57.

<https://doi.org/10.1007/s00198-012-2074-y>

(<https://doi.org/10.1007/s00198-012-2074-y>)

**CrossRef** (<https://doi.org/10.1007/s00198-012-2074-y>)

**PubMed** ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=23079689](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=23079689))

**Google Scholar** ([http://scholar.google.com/scholar\\_lookup?title=European%20guidance%20for%20the%20diagnosis%20and%20management%20of%20osteoporosis%20in%20postmenopausal%20women&author=JA.%20Kanis&author=MC.%20EV&author=H.%20Johansson&author=C.%20Cooper&author=R.%20Rizzoli&author=JY.%20Reginster&journal=Osteoporos%20Int&volume=24&issue=1&pages=23-57&publication\\_year=2013&doi=10.1007%2Fs00198-012-2074-y](http://scholar.google.com/scholar_lookup?title=European%20guidance%20for%20the%20diagnosis%20and%20management%20of%20osteoporosis%20in%20postmenopausal%20women&author=JA.%20Kanis&author=MC.%20EV&author=H.%20Johansson&author=C.%20Cooper&author=R.%20Rizzoli&author=JY.%20Reginster&journal=Osteoporos%20Int&volume=24&issue=1&pages=23-57&publication_year=2013&doi=10.1007%2Fs00198-012-2074-y))

19. Kanis JA, Oden A, Johnell O, Johansson H, De Laet C, Brown J, Burckhardt P, Cooper C, Christiansen C, Cummings S, Eisman JA,

Fujiwara S, Glüer C, Goltzman D, Hans D, Krieg MA, La Croix A, McCloskey E, Mellstrom D, Melton LJ 3rd, Pols H, Reeve J, Sanders K, Schott AM, Silman A, Torgerson D, van Staa T, Watts NB, Yoshimura N (2007) The use of clinical risk factors enhances the performance of BMD in the prediction of hip and osteoporotic fractures in men and women. *Osteoporos Int* 18:1033–1046, 8, DOI: <https://doi.org/10.1007/s00198-007-0343-y> (<https://doi.org/10.1007/s00198-007-0343-y>).

20. Qaseem A, Forcica MA, RM ML, Denberg TD, Clinical Guidelines Committee of the American College of Physicians (2017) Treatment of low bone density or osteoporosis to prevent fractures in men and women: a clinical practice guideline update from the American College of Physicians. *Ann Intern Med* 166(11):818–839. <https://doi.org/10.7326/M15-1361> (<https://doi.org/10.7326/M15-1361>)  
[CrossRef](https://doi.org/10.7326/M15-1361) (<https://doi.org/10.7326/M15-1361>)  
[PubMed](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=28492856) ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=28492856](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=28492856))  
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Treatment%20of%20low%20bone%20density%20or%20osteoporosis%20to%20prevent%20fractures%20in%20men%20and%20women%3A%20a%20clinical%20practice%20guideline%20update%20from%20the%20American%20College%20of%20Physicians&author=A.%20Qaseem&author=MA.%20Forcica&author=ML.%20RM&author=TD.%20Denberg&journal=Ann%20Intern%20Med&volume=166&issue=11&pages=818-839&publication_year=2017&doi=10.7326%2FM15-1361) ([http://scholar.google.com/scholar\\_lookup?title=Treatment%20of%20low%20bone%20density%20or%20osteoporosis%20to%20prevent%20fractures%20in%20men%20and%20women%3A%20a%20clinical%20practice%20guideline%20update%20from%20the%20American%20College%20of%20Physicians&author=A.%20Qaseem&author=MA.%20Forcica&author=ML.%20RM&author=TD.%20Denberg&journal=Ann%20Intern%20Med&volume=166&issue=11&pages=818-839&publication\\_year=2017&doi=10.7326%2FM15-1361](http://scholar.google.com/scholar_lookup?title=Treatment%20of%20low%20bone%20density%20or%20osteoporosis%20to%20prevent%20fractures%20in%20men%20and%20women%3A%20a%20clinical%20practice%20guideline%20update%20from%20the%20American%20College%20of%20Physicians&author=A.%20Qaseem&author=MA.%20Forcica&author=ML.%20RM&author=TD.%20Denberg&journal=Ann%20Intern%20Med&volume=166&issue=11&pages=818-839&publication_year=2017&doi=10.7326%2FM15-1361))
21. Scottish Intercollegiate Guidelines Network (SIGN) (2015) Management of osteoporosis and the prevention of fragility fractures. Edinburgh: SIGN; 2015. SIGN publication. <http://www.sign.ac.uk> (<http://www.sign.ac.uk>), 2015. Accessed 11 Sept 2017
22. Kanis JA, McCloskey E, Johansson H, Oden A, Leslie WD (2012) FRAXs with and without BMD. *Calcif Tissue Int* 90(1):1–13. <https://doi.org/10.1007/s00223-011-9544-7> (<https://doi.org/10.1007/s00223-011-9544-7>)  
[CrossRef](https://doi.org/10.1007/s00223-011-9544-7) (<https://doi.org/10.1007/s00223-011-9544-7>)  
[PubMed](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=22057815) ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=22057815](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=22057815))  
[Google Scholar](http://scholar.google.com/scholar_lookup?title=FRAXs%20with%20and%20without%20BMD&author=JA.%20Kanis&author=E.%20McCloskey&author=H.%20Johansson&author=A.%20Oden&author=WD.%20Leslie&journal=Calcif%20Tissue%20Int&volume=90&issue=1&pages=1-13&publication_year=2012&doi=10.1007%2Fs00223-011-9544-7) ([http://scholar.google.com/scholar\\_lookup?title=FRAXs%20with%20and%20without%20BMD&author=JA.%20Kanis&author=E.%20McCloskey&author=H.%20Johansson&author=A.%20Oden&author=WD.%20Leslie&journal=Calcif%20Tissue%20Int&volume=90&issue=1&pages=1-13&publication\\_year=2012&doi=10.1007%2Fs00223-011-9544-7](http://scholar.google.com/scholar_lookup?title=FRAXs%20with%20and%20without%20BMD&author=JA.%20Kanis&author=E.%20McCloskey&author=H.%20Johansson&author=A.%20Oden&author=WD.%20Leslie&journal=Calcif%20Tissue%20Int&volume=90&issue=1&pages=1-13&publication_year=2012&doi=10.1007%2Fs00223-011-9544-7))
23. McCloskey EV, Johansson H, Oden A, Harvey NC, Jiang H, Modin S, Fitzpatrick L, Kanis JA (2017) The effect of abaloparatide-SC on fracture risk is independent of baseline FRAX fracture probability: a

post hoc analysis of the ACTIVE Study. *J Bone Miner Res* 32(8):1625–1631. <https://doi.org/10.1002/jbmr.3163>  
(<https://doi.org/10.1002/jbmr.3163>)  
**CrossRef** (<https://doi.org/10.1002/jbmr.3163>)  
**PubMed** ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=28474780](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=28474780))  
**Google Scholar** ([http://scholar.google.com/scholar\\_lookup?title=The%20effect%20of%20abaloparatide-SC%20on%20fracture%20risk%20is%20independent%20of%20baseline%20FRAX%20fracture%20probability%3A%20a%20post%20hoc%20analysis%20of%20the%20ACTIVE%20Study&author=EV.%20McCloskey&author=H.%20Johansson&author=A.%20Oden&author=NC.%20Harvey&author=H.%20Jiang&author=S.%20Modin&author=L.%20Fitzpatrick&author=JA.%20Kanis&journal=J%20Bone%20Miner%20Res&volume=32&issue=8&pages=1625-1631&publication\\_year=2017&doi=10.1002%2Fjbmr.3163](http://scholar.google.com/scholar_lookup?title=The%20effect%20of%20abaloparatide-SC%20on%20fracture%20risk%20is%20independent%20of%20baseline%20FRAX%20fracture%20probability%3A%20a%20post%20hoc%20analysis%20of%20the%20ACTIVE%20Study&author=EV.%20McCloskey&author=H.%20Johansson&author=A.%20Oden&author=NC.%20Harvey&author=H.%20Jiang&author=S.%20Modin&author=L.%20Fitzpatrick&author=JA.%20Kanis&journal=J%20Bone%20Miner%20Res&volume=32&issue=8&pages=1625-1631&publication_year=2017&doi=10.1002%2Fjbmr.3163))

24. Shepstone L, Lenaghan E, Cooper C, Clarke S, Fordham R, Gittoes NJ, Harvey IM, Harvey NC, Heawood A, Holland R, Howe A, Kanis J, Marshall T, O'Neill TW, Peters TJ, Redmond NM, Torgerson DJ, McCloskey EV (2017) A randomized controlled trial of screening in the community to reduce fractures in older women—the SCOOP Study. *Lancet*, in press

**Google Scholar** (<https://scholar.google.com/scholar?q=Shepstone%20L%2C%20Lenaghan%20E%2C%20Cooper%20C%2C%20Clarke%20S%2C%20Fordham%20R%2C%20Gittoes%20NJ%2C%20Harvey%20IM%2C%20Harvey%20NC%2C%20Heawood%20A%2C%20Holland%20R%2C%20Howe%20A%2C%20Kanis%20J%2C%20Marshall%20T%2C%20O%27Neill%20TW%2C%20Peters%20TJ%2C%20Redmond%20NM%2C%20Torgerson%20DJ%2C%20McCloskey%20EV%20%282017%29%20A%20randomized%20controlled%20trial%20of%20screening%20in%20the%20community%20to%20reduce%20fractures%20in%20older%20women%20E2%80%94the%20SCOOP%20Study.%20Lancet%2C%20in%20press>)

25. McCloskey EV, Johansson H, Oden A, Austin M, Siris E, Wang A, Lewiecki EM, Lorenc R, Libanati C, Kanis JA (2012) Denosumab reduces the risk of all osteoporotic fractures in postmenopausal women, particularly in those with moderate to high fracture risk as assessed with FRAX®. *J Bone Miner Res* 27(7):1480–1486.

<https://doi.org/10.1002/jbmr.1606>  
(<https://doi.org/10.1002/jbmr.1606>)  
**CrossRef** (<https://doi.org/10.1002/jbmr.1606>)  
**PubMed** ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=22431426](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=22431426))  
**Google Scholar** ([http://scholar.google.com/scholar\\_lookup?title=Denosumab%20reduces%20the%20risk%20of%20all%20osteoporotic%20fractures%20in%20postmenopausal%20women%2C%20particularly%20in%20those%20with%20moderate%20to%20high%20ofracture%20risk%20as%20assessed%20with%20FRAX%C2%AE&a](http://scholar.google.com/scholar_lookup?title=Denosumab%20reduces%20the%20risk%20of%20all%20osteoporotic%20fractures%20in%20postmenopausal%20women%2C%20particularly%20in%20those%20with%20moderate%20to%20high%20ofracture%20risk%20as%20assessed%20with%20FRAX%C2%AE&a))

uthor=EV.%20McCloskey&author=H.%20Johansson&author=A.%20Oden&author=M.%20Austin&author=E.%20Siris&author=A.%20Wang&author=EM.%20Lewiecki&author=R.%20Lorenz&author=C.%20Libanati&author=JA.%20Kanis&journal=J%20Bone%20Miner%20Res&volume=27&issue=7&pages=1480-1486&publication\_year=2012&doi=10.1002%2Fjbm.1606)

26. Johnell O, Kanis JA, Oden A, Johansson H, De Laet C, Delmas P, Eisman JA, Fujiwara S, Kroger H, Mellstrom D, Meunier PJ, Melton LJ 3rd, O'Neill T, Pols H, Reeve J, Silman A, Tenenhouse A (2005) Predictive value of BMD for hip and other fractures. *J Bone Miner Res* 20:1185–1194, 7, DOI: <https://doi.org/10.1359/JBMR.050304> (<https://doi.org/10.1359/JBMR.050304>).
27. Kanis JA, Johnell O, Oden A, Jonsson B, De Laet C, Dawson A (2000) Risk of hip fracture according to the World Health Organization criteria for osteopenia and osteoporosis. *Bone* 27(5):585–590. [https://doi.org/10.1016/S8756-3282\(00\)00381-1](https://doi.org/10.1016/S8756-3282(00)00381-1) ([https://doi.org/10.1016/S8756-3282\(00\)00381-1](https://doi.org/10.1016/S8756-3282(00)00381-1))  
[CrossRef](https://doi.org/10.1016/S8756-3282(00)00381-1) ([https://doi.org/10.1016/S8756-3282\(00\)00381-1](https://doi.org/10.1016/S8756-3282(00)00381-1))  
[PubMed](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=11062343) ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=11062343](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=11062343))  
[Google Scholar](http://scholar.google.com/scholar_lookup?title=Risk%20of%20hip%20fracture%20according%20to%20the%20World%20Health%20Organization%20criteria%20for%20osteopenia%20and%20osteoporosis&author=JA.%20Kanis&author=O.%20Johnell&author=A.%20Oden&author=B.%20Jonsson&author=C.%20Laet&author=A.%20Dawson&journal=Bone&volume=27&issue=5&pages=585-590&publication_year=2000&doi=10.1016%2FS8756-3282%2800%2900381-1) ([http://scholar.google.com/scholar\\_lookup?title=Risk%20of%20hip%20fracture%20according%20to%20the%20World%20Health%20Organization%20criteria%20for%20osteopenia%20and%20osteoporosis&author=JA.%20Kanis&author=O.%20Johnell&author=A.%20Oden&author=B.%20Jonsson&author=C.%20Laet&author=A.%20Dawson&journal=Bone&volume=27&issue=5&pages=585-590&publication\\_year=2000&doi=10.1016%2FS8756-3282%2800%2900381-1](http://scholar.google.com/scholar_lookup?title=Risk%20of%20hip%20fracture%20according%20to%20the%20World%20Health%20Organization%20criteria%20for%20osteopenia%20and%20osteoporosis&author=JA.%20Kanis&author=O.%20Johnell&author=A.%20Oden&author=B.%20Jonsson&author=C.%20Laet&author=A.%20Dawson&journal=Bone&volume=27&issue=5&pages=585-590&publication_year=2000&doi=10.1016%2FS8756-3282%2800%2900381-1))
28. Grigorie D, Sucaliuc A, Johansson H, Kanis JA, McCloskey E (2013) FRAX-based intervention and assessment thresholds for osteoporosis in Romania. *Arch Osteoporos* 8(1–2):164. <https://doi.org/10.1007/s11657-013-0164-x> (<https://doi.org/10.1007/s11657-013-0164-x>)  
[CrossRef](https://doi.org/10.1007/s11657-013-0164-x) (<https://doi.org/10.1007/s11657-013-0164-x>)  
[PubMed](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=24390553) ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=24390553](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=24390553))  
[Google Scholar](http://scholar.google.com/scholar_lookup?title=FRAX-based%20intervention%20and%20assessment%20thresholds%20for%20osteoporosis%20in%20Romania&author=D.%20Grigorie&author=A.%20Sucaliuc&author=H.%20Johansson&author=JA.%20Kanis&author=E.%20McCloskey&journal=Arch%20Osteoporos&volume=8&issue=1&E2%80%93&pages=164&publication_year=2013&doi=10.1007%2FS11657-013-0164-x) ([http://scholar.google.com/scholar\\_lookup?title=FRAX-based%20intervention%20and%20assessment%20thresholds%20for%20osteoporosis%20in%20Romania&author=D.%20Grigorie&author=A.%20Sucaliuc&author=H.%20Johansson&author=JA.%20Kanis&author=E.%20McCloskey&journal=Arch%20Osteoporos&volume=8&issue=1&E2%80%93&pages=164&publication\\_year=2013&doi=10.1007%2FS11657-013-0164-x](http://scholar.google.com/scholar_lookup?title=FRAX-based%20intervention%20and%20assessment%20thresholds%20for%20osteoporosis%20in%20Romania&author=D.%20Grigorie&author=A.%20Sucaliuc&author=H.%20Johansson&author=JA.%20Kanis&author=E.%20McCloskey&journal=Arch%20Osteoporos&volume=8&issue=1&E2%80%93&pages=164&publication_year=2013&doi=10.1007%2FS11657-013-0164-x))
29. Kanis JA, Compston J, Cooper C, Harvey NC, Johansson H, Odén A, McCloskey EV (2016) SIGN guidelines for Scotland: BMD versus FRAX versus QFracture. *Calcif Tissue Int* 98(5):417–425.

<https://doi.org/10.1007/s00223-015-0092-4>

(<https://doi.org/10.1007/s00223-015-0092-4>)

**CrossRef** (<https://doi.org/10.1007/s00223-015-0092-4>)

**PubMed** ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=26650822)

[cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=26650822](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=26650822))

**Google Scholar** ([http://scholar.google.com/scholar\\_lookup?](http://scholar.google.com/scholar_lookup?title=SIGN%20guidelines%20for%20Scotland%3A%20BMD%20versus%20FRAX%20versus%20QFracture&author=JA.%20Kanis&author=J.%20Compston&author=C.%20Cooper&author=NC.%20Harvey&author=H.%20Johansson&author=A.%20Od%27C3%A9n&author=EV.%20McCloskey&journal=Calcif%20Tissue%20Int&volume=98&issue=5&pages=417-425&publication_year=2016&doi=10.1007%2Fs00223-015-0092-4)

[title=SIGN%20guidelines%20for%20Scotland%3A%20BMD%20versus%20FRAX%20versus%20QFracture&author=JA.%20Kanis&author=J.%20Compston&author=C.%20Cooper&author=NC.%20Harvey&author=H.%20Johansson&author=A.%20Od%27C3%A9n&author=EV.%20McCloskey&journal=Calcif%20Tissue%20Int&volume=98&issue=5&pages=417-](http://scholar.google.com/scholar_lookup?title=SIGN%20guidelines%20for%20Scotland%3A%20BMD%20versus%20FRAX%20versus%20QFracture&author=JA.%20Kanis&author=J.%20Compston&author=C.%20Cooper&author=NC.%20Harvey&author=H.%20Johansson&author=A.%20Od%27C3%A9n&author=EV.%20McCloskey&journal=Calcif%20Tissue%20Int&volume=98&issue=5&pages=417-425&publication_year=2016&doi=10.1007%2Fs00223-015-0092-4)

[425&publication\\_year=2016&doi=10.1007%2Fs00223-015-0092-4](http://scholar.google.com/scholar_lookup?title=SIGN%20guidelines%20for%20Scotland%3A%20BMD%20versus%20FRAX%20versus%20QFracture&author=JA.%20Kanis&author=J.%20Compston&author=C.%20Cooper&author=NC.%20Harvey&author=H.%20Johansson&author=A.%20Od%27C3%A9n&author=EV.%20McCloskey&journal=Calcif%20Tissue%20Int&volume=98&issue=5&pages=417-425&publication_year=2016&doi=10.1007%2Fs00223-015-0092-4))

30. Johansson H, Azizieh F, Al Ali N, Alessa T, Harvey NC, McCloskey E, Kanis JA (2017) FRAX vs. T-score-based intervention thresholds for osteoporosis. *Osteoporos Int* 28(11):3099–3105.

<https://doi.org/10.1007/s00198-017-4160-7>

(<https://doi.org/10.1007/s00198-017-4160-7>)

**CrossRef** (<https://doi.org/10.1007/s00198-017-4160-7>)

**PubMed** ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=28782072)

[cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=28782072](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=28782072))

**Google Scholar** ([http://scholar.google.com/scholar\\_lookup?](http://scholar.google.com/scholar_lookup?title=FRAX%20vs.%20T-score-based%20intervention%20thresholds%20for%20osteoporosis&author=H.%20Johansson&author=F.%20Azizieh&author=N.%20Ali&author=T.%20Alessa&author=NC.%20Harvey&author=E.%20McCloskey&author=JA.%20Kanis&journal=Osteoporos%20Int&volume=28&issue=11&pages=3099-3105&publication_year=2017&doi=10.1007%2Fs00198-017-4160-7)

[title=FRAX%20vs.%20T-score-based%20intervention%20thresholds%20for%20osteoporosis&author=H.%20Johansson&author=F.%20Azizieh&author=N.%20Ali&author=T.%20Alessa&author=NC.%20Harvey&author=E.%20McCloskey&author=JA.%20Kanis&journal=Osteoporos%20Int&volume=28&issue=11&pages=3099-](http://scholar.google.com/scholar_lookup?title=FRAX%20vs.%20T-score-based%20intervention%20thresholds%20for%20osteoporosis&author=H.%20Johansson&author=F.%20Azizieh&author=N.%20Ali&author=T.%20Alessa&author=NC.%20Harvey&author=E.%20McCloskey&author=JA.%20Kanis&journal=Osteoporos%20Int&volume=28&issue=11&pages=3099-3105&publication_year=2017&doi=10.1007%2Fs00198-017-4160-7)

[3105&publication\\_year=2017&doi=10.1007%2Fs00198-017-4160-7](http://scholar.google.com/scholar_lookup?title=FRAX%20vs.%20T-score-based%20intervention%20thresholds%20for%20osteoporosis&author=H.%20Johansson&author=F.%20Azizieh&author=N.%20Ali&author=T.%20Alessa&author=NC.%20Harvey&author=E.%20McCloskey&author=JA.%20Kanis&journal=Osteoporos%20Int&volume=28&issue=11&pages=3099-3105&publication_year=2017&doi=10.1007%2Fs00198-017-4160-7))

31. Kanis JA, McCloskey EV, Harvey NC, Johansson H, Leslie WD (2015) Intervention thresholds and the diagnosis of osteoporosis. *J Bone Miner Res* 30(10):1747–1753. <https://doi.org/10.1002/jbmr.2531>

(<https://doi.org/10.1002/jbmr.2531>)

**CrossRef** (<https://doi.org/10.1002/jbmr.2531>)

**PubMed** ([http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=26390977)

[cmd=Retrieve&db=PubMed&dopt=Abstract&list\\_uids=26390977](http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Abstract&list_uids=26390977))

**Google Scholar** ([http://scholar.google.com/scholar\\_lookup?](http://scholar.google.com/scholar_lookup?title=Intervention%20thresholds%20and%20the%20diagnosis%20of%20osteoporosis&author=JA.%20Kanis&author=EV.%20McCloskey&author=NC.%20Harvey&author=H.%20Johansson&author=WD.%20Leslie&journal=J%20Bone%20Miner%20Res&volume=30&issue=10&pages=1747-1753&publication_year=2015&doi=10.1002%2Fjbmr.2531)

[title=Intervention%20thresholds%20and%20the%20diagnosis%20of%20osteoporosis&author=JA.%20Kanis&author=EV.%20McCloskey&author=NC.%20Harvey&author=H.%20Johansson&author=WD.%20Leslie&journal=J%20Bone%20Miner%20Res&volume=30&issue=10&pages=1747-](http://scholar.google.com/scholar_lookup?title=Intervention%20thresholds%20and%20the%20diagnosis%20of%20osteoporosis&author=JA.%20Kanis&author=EV.%20McCloskey&author=NC.%20Harvey&author=H.%20Johansson&author=WD.%20Leslie&journal=J%20Bone%20Miner%20Res&volume=30&issue=10&pages=1747-1753&publication_year=2015&doi=10.1002%2Fjbmr.2531)

[1753&publication\\_year=2015&doi=10.1002%2Fjbmr.2531](http://scholar.google.com/scholar_lookup?title=Intervention%20thresholds%20and%20the%20diagnosis%20of%20osteoporosis&author=JA.%20Kanis&author=EV.%20McCloskey&author=NC.%20Harvey&author=H.%20Johansson&author=WD.%20Leslie&journal=J%20Bone%20Miner%20Res&volume=30&issue=10&pages=1747-1753&publication_year=2015&doi=10.1002%2Fjbmr.2531))

## Copyright information

## About this article

Cite this article as:

Clark, P., Denova-Gutiérrez, E., Zerbini, C. et al. Osteoporos Int (2017).  
<https://doi.org/10.1007/s00198-017-4341-4>

- DOI (Digital Object Identifier) <https://doi.org/10.1007/s00198-017-4341-4>
- Publisher Name Springer London
- Print ISSN 0937-941X
- Online ISSN 1433-2965
- [About this journal](#)



- Published in cooperation with

[The International Osteoporosis Foundation](#)



- Published in cooperation with

[The National Osteoporosis Foundation](#)

## Personalised recommendations

1. [FRAX- vs. T-score-based intervention thresholds for osteoporosis](#)  
Johansson, H.... Kanis, J. A.  
*Osteoporosis International* (2017)
2. [Beyond bone mineral density, FRAX-based tailor-made intervention thresholds for therapeutic](#)  
Yu, Shan-Fu... Cheng, Tien-Tsai  
*Medicine* (2017)
3. [Cost-Effectiveness of Intervention Thresholds for the Treatment of Osteoporosis Based on FRAX® in](#)  
Marques, Andréa... da Silva, José António P.  
*Calcified Tissue International* (2015)

Want recommendations via email? [Sign up now](#)

Powered by: **Recommended** 

**SPRINGER NATURE**

© 2017 Springer International Publishing AG. Part of [Springer Nature](#).

Not logged in Not affiliated 190.17.115.146