New insights in osteoporosis management within the Fracture Liaison Service (FLS)

Piet Geusens, MD, PhD

Prof. *Em*. Rheumatology

UMaastricht en UHasselt

Disclosures

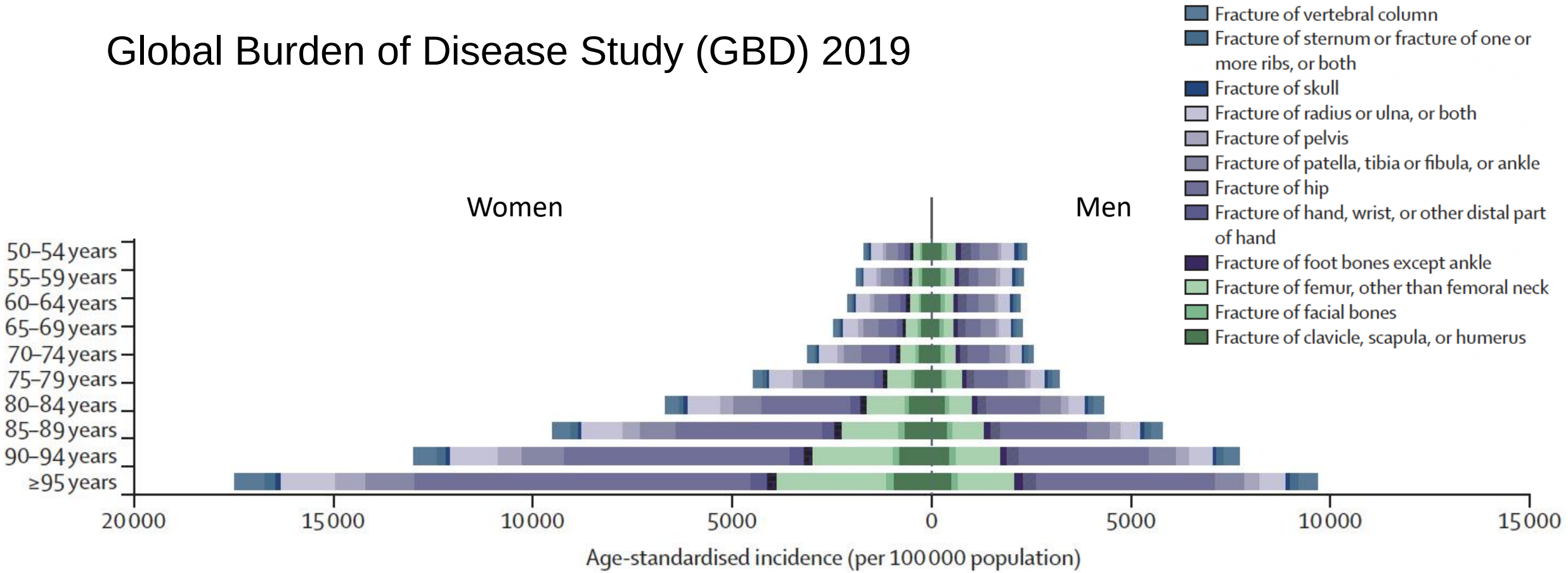
- Grants from Sandoz, Celltrion, Fresenius, MSD, Amgen, Galapagos, Viatrix
- None in the context of this presentation

- Fracture Liaison Service (FLS)
  - Post-Fracture Care (PFC)
  - Secondary fragility fracture prevention services (SFFPS)
- Orthogeriatric Care (OGC) after hip fracture

Javaid, OI, 2023; Akesson, OI, 2020; Singh, BMJ Open Quality, 2023

The burden of clinical fractures in 50+ subjects worldwide

Global Burden of Disease Study (GBD) 2019



33% fracture incidence increase from 1990 to 2019

Wu, Lancet Healthy Longev, 2021

The burden of clinical fractures in 50+ subjects in the EU

Estimated total fracture incidence in EU+2 in 2019

Fracture site	Women	Men	Women and men
Hip fractures	603,967	222,741	826,708
Vertebral fractures	432,479	230,064	662,544
Forearm fractures	528,109	108,596	636,705
Other fractures *	1,293,964	855,626	2,149,591
All fractures	2,858,519	1,417,028	4,275,547

Estimated** annual number of fragility fractures***/1000 of the population of 50+ subjects in EU+2 in 2019

Mean: 20/1000 = 1/50 per year
Range: 14/1000 (Romania) to 38/1000 (Slovakia)

humerus, ribs, tibia, pelvis and other femoral fractures

***when not available, based on nearest country or Swedish relationship between hip and other fractures*
****hip, clinical vertebral, forearm, humerus, ribs, tibia, pelvis, other femoral fracture*

Kanis, Arch Osteoporosis, 2021

The 50+ patients with a recent clinical fracture

What are their perspectives?

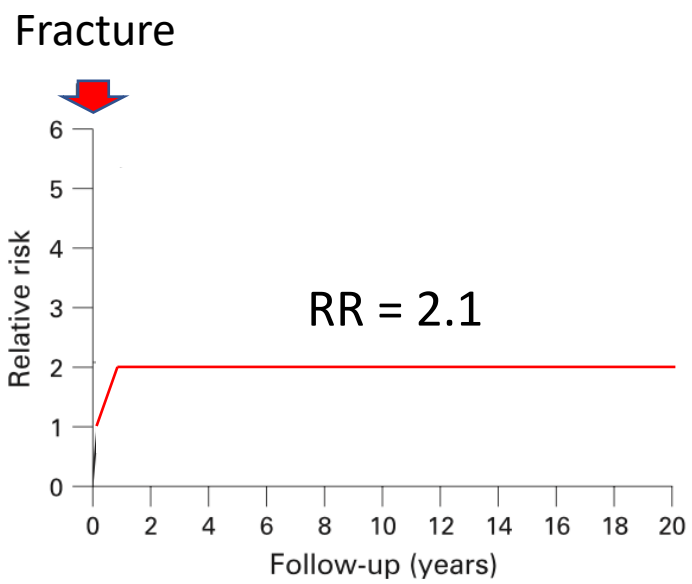
Long-term risk of any recurrent clinical fracture

Study	*n*	Relative Risk (RR)	FU (yrs)	Fractures
Klotzbuecher (2000)		2.2 (women and men, all ages)	1-11	any clinical
Kanis (2004)	*60,000*	1.9 (women and men, age 21-106 yrs)	up to 20	any clinical
Center (2007)	*4,000*	2.0 (60+ women), 3.5 (60+ men)	16	clinical low-trauma
Van Geel (2008)	*4,100*	2.1 (postmenopausal women)	20	any clinical
Kanis (2023)	*2.1MM*	1.9 (women~men, age 20-116 yrs)	~9	any clinical

Excluded: skull, face, hands, feet, ankle, and patella and tibial and fibular fractures in men

These data and analyses suggest that subsequent fracture risk is constant over time

No data on time between first and subsequent fracture

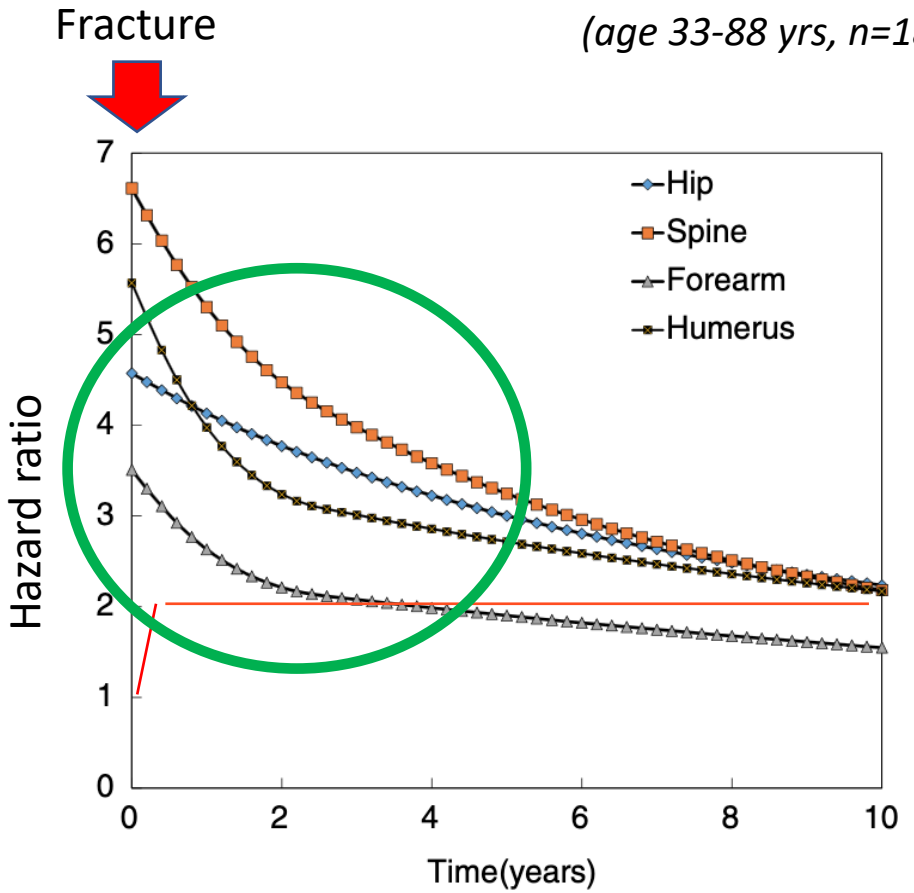


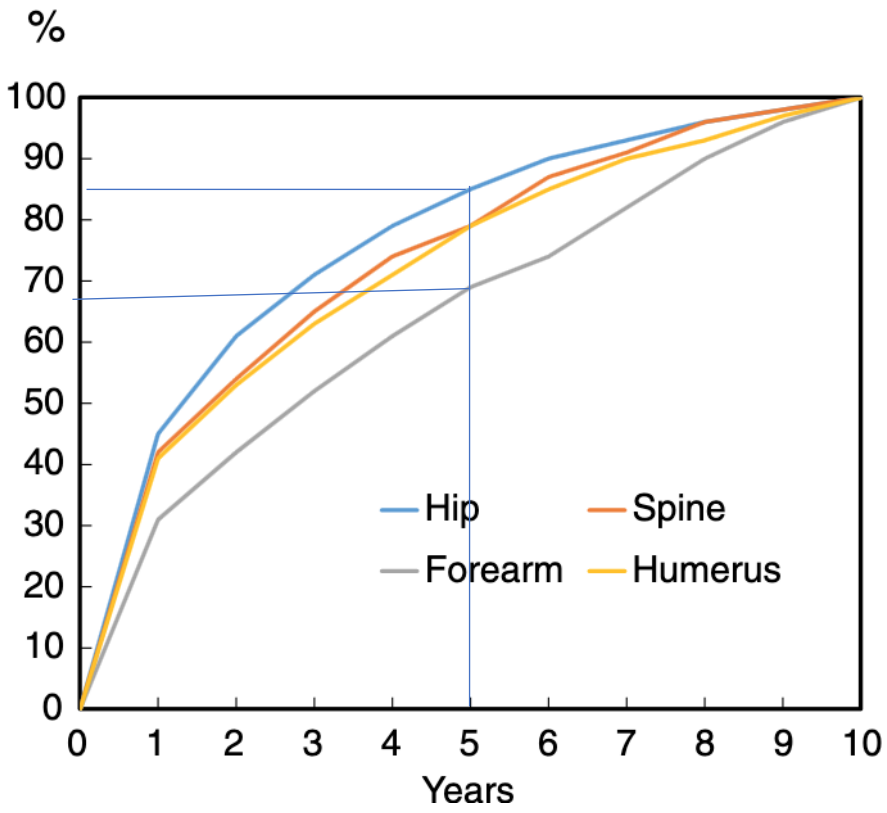
Klotzbuecher, JBMR, 2000
Kanis, Bone, 2004
Center, JAMA, 2007
van Geel, ARD, 2008
Kanis, OI, 2023

Clinical fractures cluster in time: the *imminent* subsequent fracture risk

A window of opportunity for early evaluation and treatment decisions for secondary fracture prevention

Recurrence of major osteoporotic fractures in women and men
(age 33-88 yrs, n=18,872)





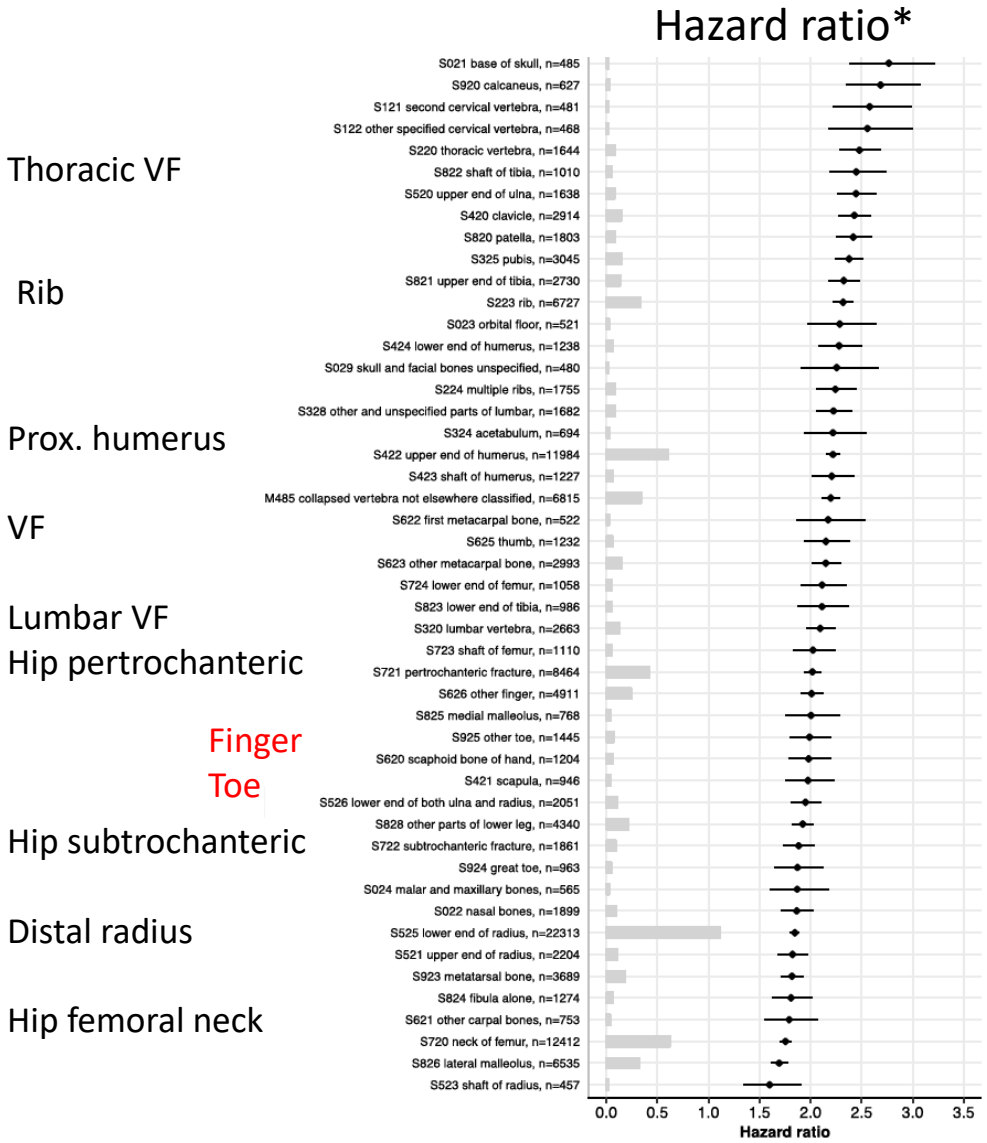
Kanis, OI, 2018

Risk of any subsequent fracture per site of recent (≤ 2 yr) fracture

Nation-wide retrospective cohort study in Sweden
3,423,320 women and men >50 years
>450,000 had a first fracture:
70,254 with a recent MOF (≤2 yrs)
75,526 with a recent non-MOF (≤ 2 yrs)
293,051 with an old fracture (>2 yrs)

} >145,000 with subsequent fracture within 2 years

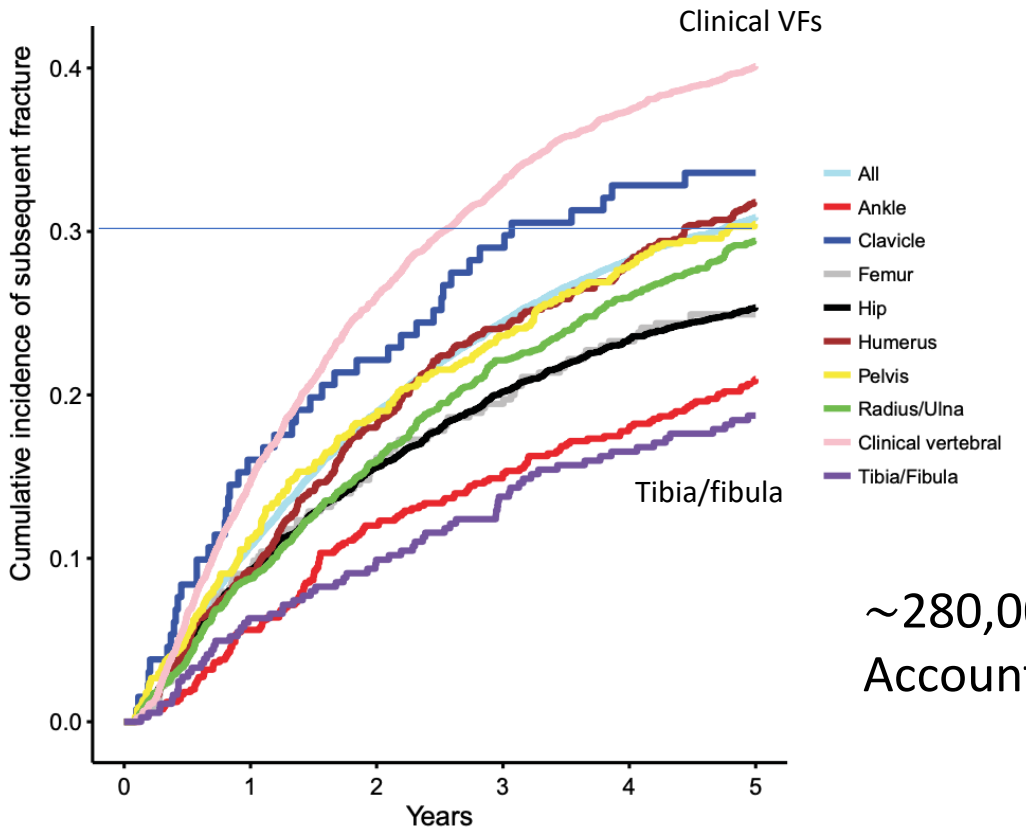
The authors suggested that all patients with a recent clinical fracture should be included in secondary prevention programs such as the FLS



*HR were somewhat lower but remained significant after including competing risk for mortality

Axelsson, JBMR, 2023

From relative risk to absolute imminent subsequent fracture risk



~280,000 women, 95% ≥65 yrs
Accounting for competing risk of mortality

Balasubramanian, OI, 2019

Considerations for the FLS

1/ Any clinical fracture is a signal for imminent and long-term subsequent fracture risk

2/ Disturbed microarchitecture is a risk factor for fractures beyond aBMD

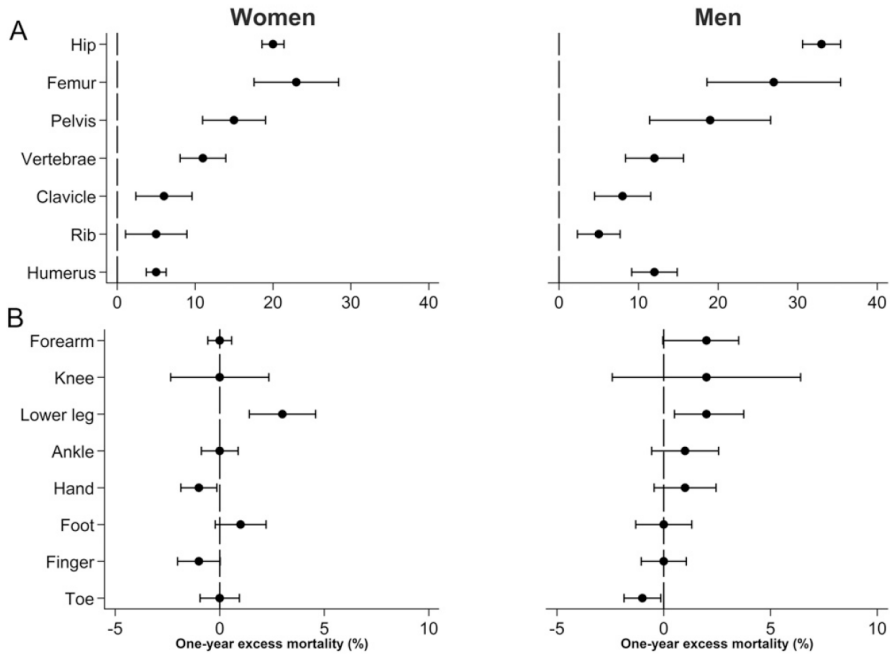
3/ A full fracture history at the FLS includes imaging of the thoracic and lumbar spine

4/ Patients with a recent clinical fracture have frequently associated diseases and extra-skeletal risk factors

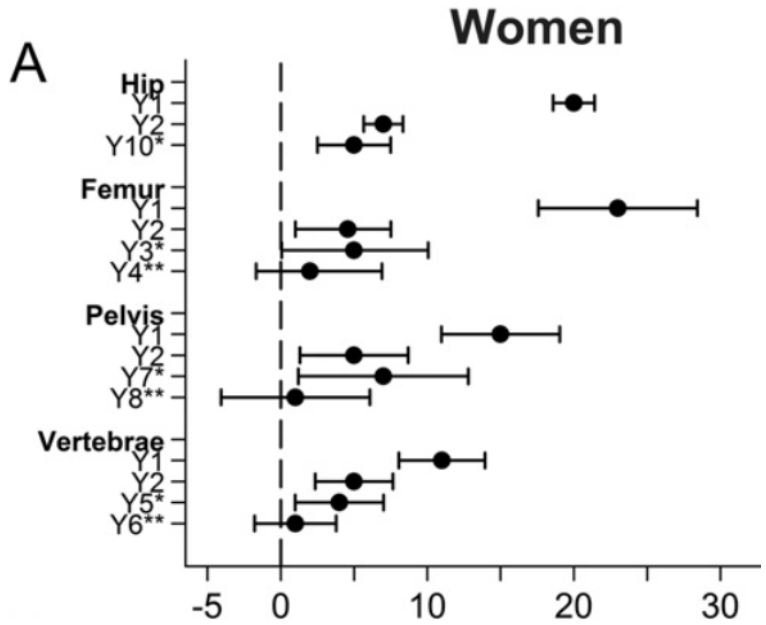
5/ Implementation of the FLS and its effects on subsequent fractures, mortality and falls

Excess mortality after a recent clnical fracture

1-year



Long-term

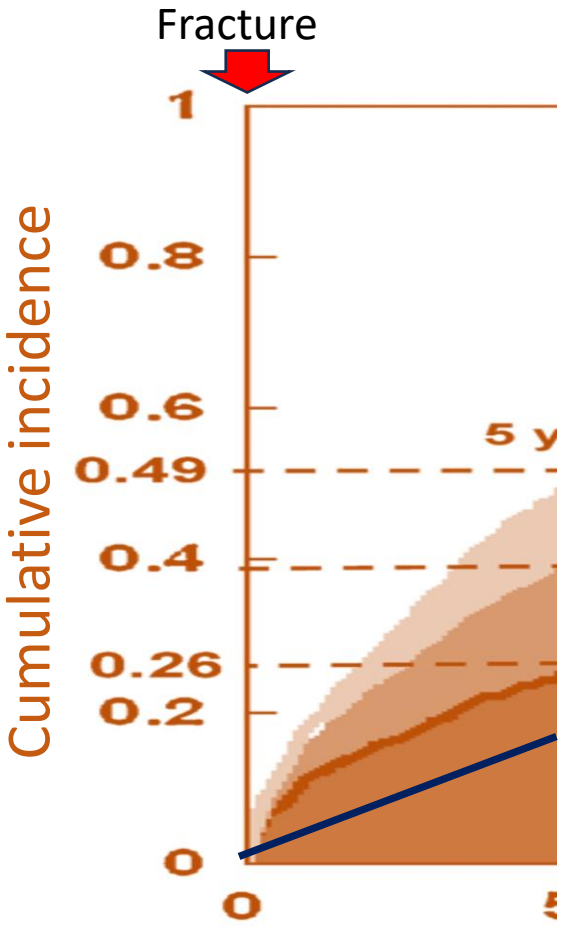


Largest proportion of mortality:
pneumonia, besides dehydration, urinary tract infection and sepsis

Tran, JCEM, 2018; Alarkawi, OI, 2020; Christensen, RMDOpen, 2023

Cumulative incidences of recurrent low-trauma fractures taking into account the competing risk of mortality

Example in 60+ Women (n=952)



Within 5 yrs

Alive and free of refracture	~50%		
Refracture and alive	12%	24% refracture	33% of survivors refractured
Refracture and died subsequently	12%		
Deaths following initial fracture	10%	26% died after fracture	
Expected mortality (in general population)	16%		

Community-dwelling participants aged 60+ years
from Dubbo Osteoporosis Epidemiology Study, Australia

Bliuc, JBMR, 2013

Considerations for the FLS

1/ Any clinical fracture is a signal for imminent and long-term subsequent fracture risk, except when life expectancy is short

2/ Disturbed microarchitecture is a risk factor for fractures beyond aBMD

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Other imminent changes after a recent fracture

Decrease in aBMD, physical perfomance, quality of life (QoL), increase of fear of falling

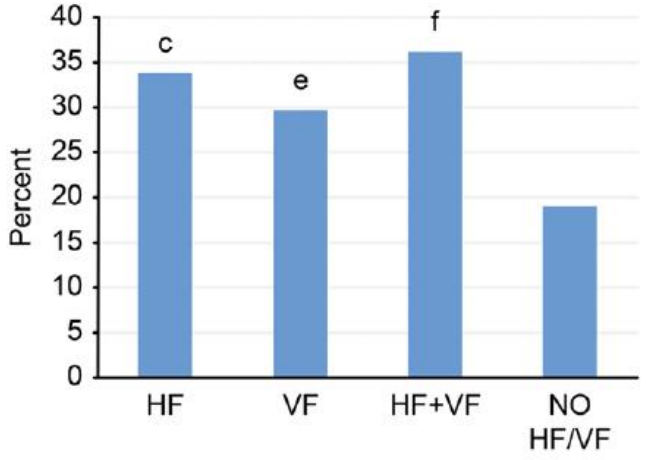
Risk of falls:

After clinical fracture: 15% within 3 months (*n=277*, mean age: 72 yrs)

After hip fracture: 56% within 1 year, one fall: 28%, recurrent falls: 28% (*n=193*, mean age: 81 yrs)

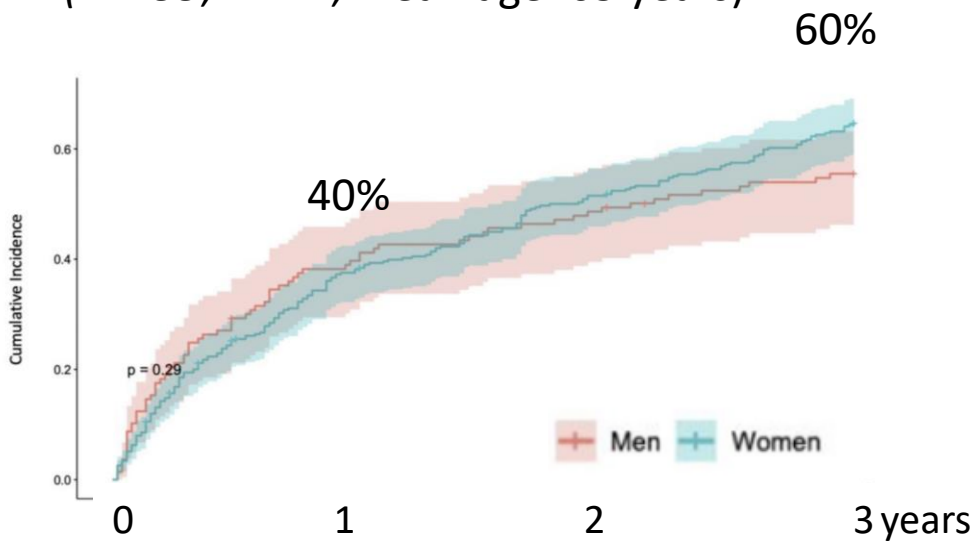
After FLS visit within 1 year

(*n=974*, W+M, mean age: 76 yrs)



After FLS visit within 1-3 years

(*n=488*, W+M, mean age: 65 years)



Gadhvy, BMC Ger, 2023; Orwig, Arch Osteoporosis, 2022; Magaziner, OI, 2006; Boonen, JCEM, 2002; Tran, JCEM, 2018; Center, JAMA, 2009; Svedbom, Quality of Life Research, 2018; Greendale, JAGS, 2000; van Ooijen, BMC Musc, 2016; van Helden, BMC Musc Dis, 2007; Lloyd, J Geront, 2009; Chang, Scient Rep, 2019; Vranken, BMJOpen, 2022

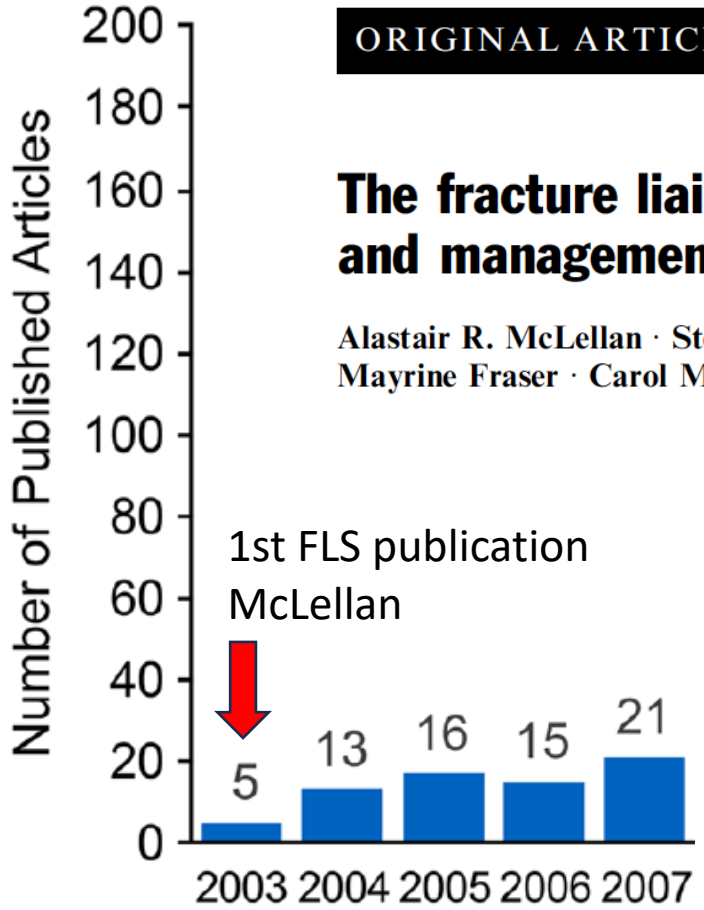
Publications on post-fracture care

Osteoporos Int (2003) 14: 1028–1034
DOI 10.1007/s00198-003-1507-z

ORIGINAL ARTICLE

The fracture liaison service: success of a program for the evaluation and management of patients with osteoporotic fracture

Alastair R. McLellan · Stephen J. Gallacher
Mayrine Fraser · Carol McQuillian

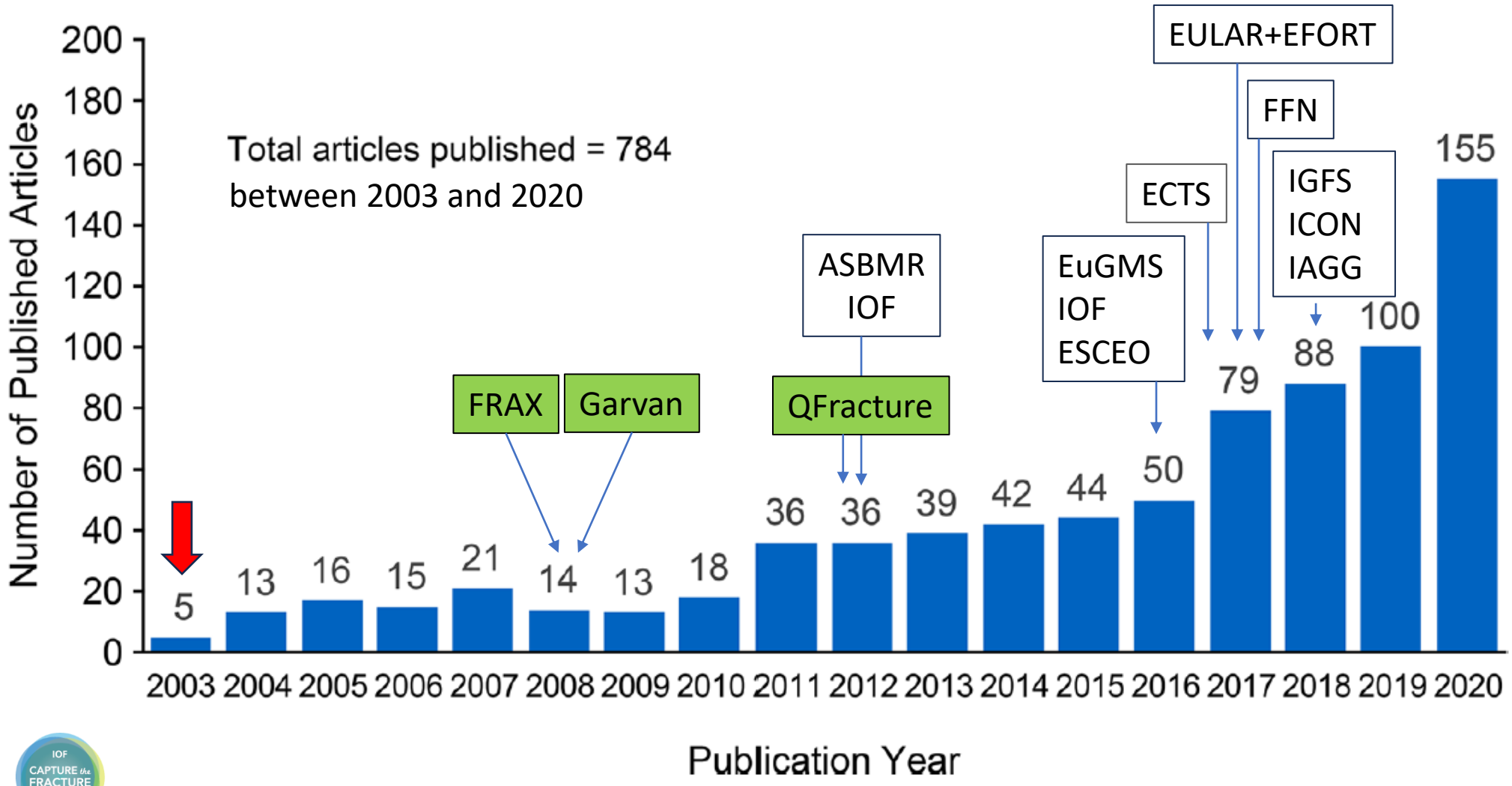


McLellan, OI, 2003; Akesson, OI, 2022

Publications

Care for patients with a recent clinical fracture

International guidelines



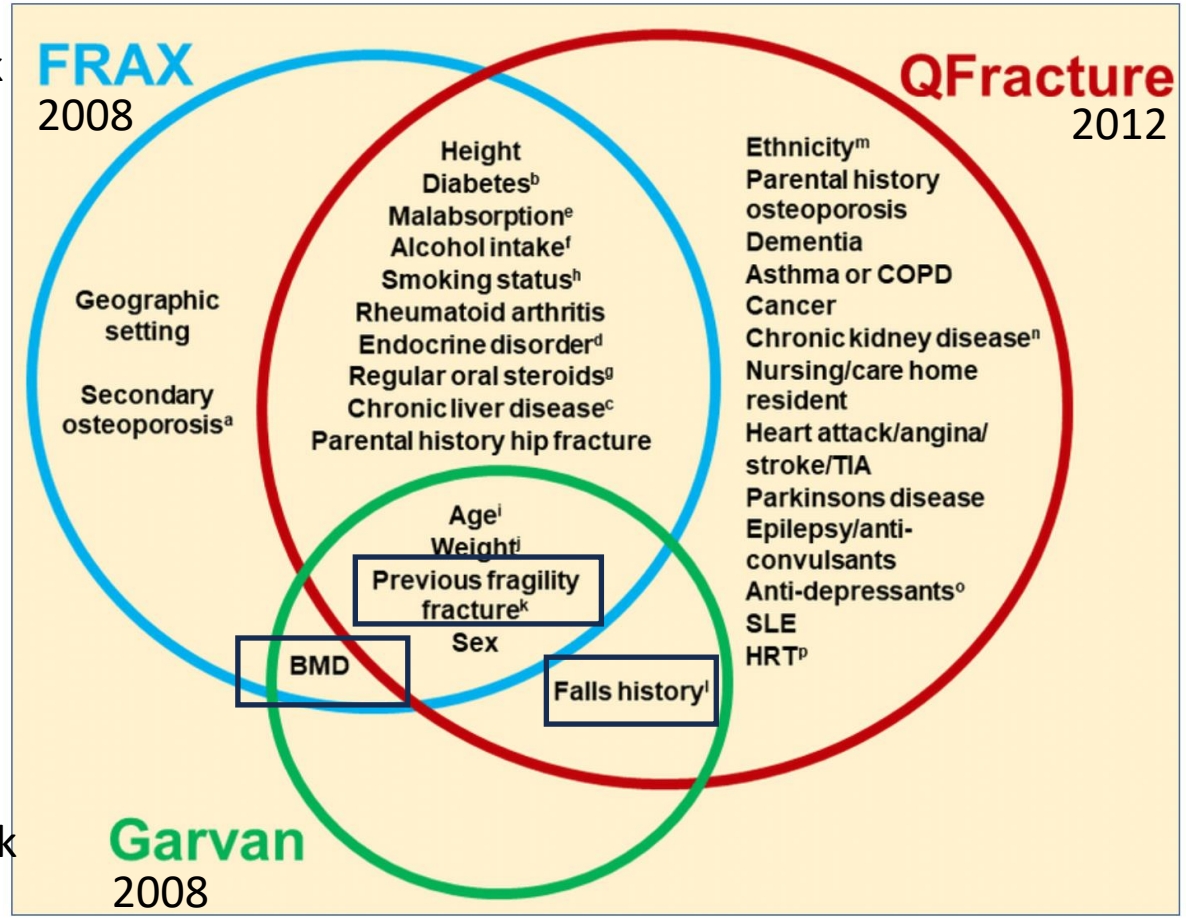
Marsh, OI, 2011; Eisman, JBMR, 2012; Blain, Aging, 2016; Lems, ARD, 2017; Dreinhofer, Injury, 2018; Akesson, OI, 2022

The 50+ patients with a recent clinical fracture

What are their characteristics?

Risk estimation algorithms for calculating fracture risk

10-yr risk



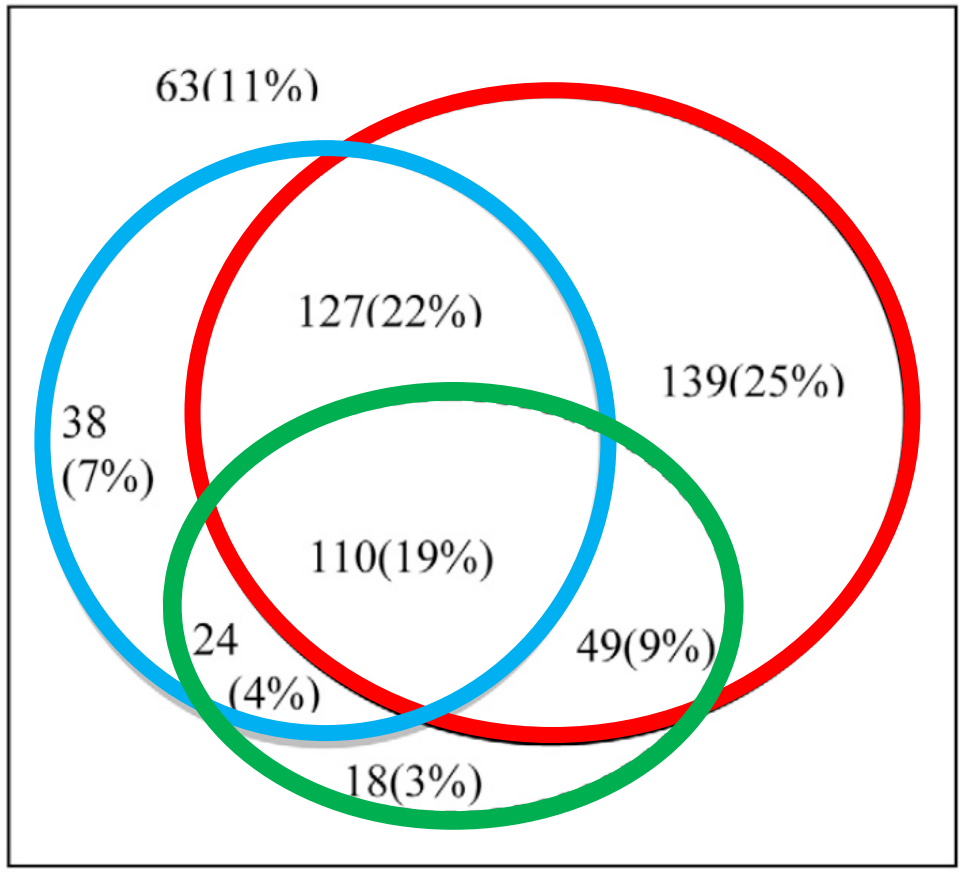
1-10-yr risk

5- and 10-yr risk

Todorov, BMJ Open, 2022

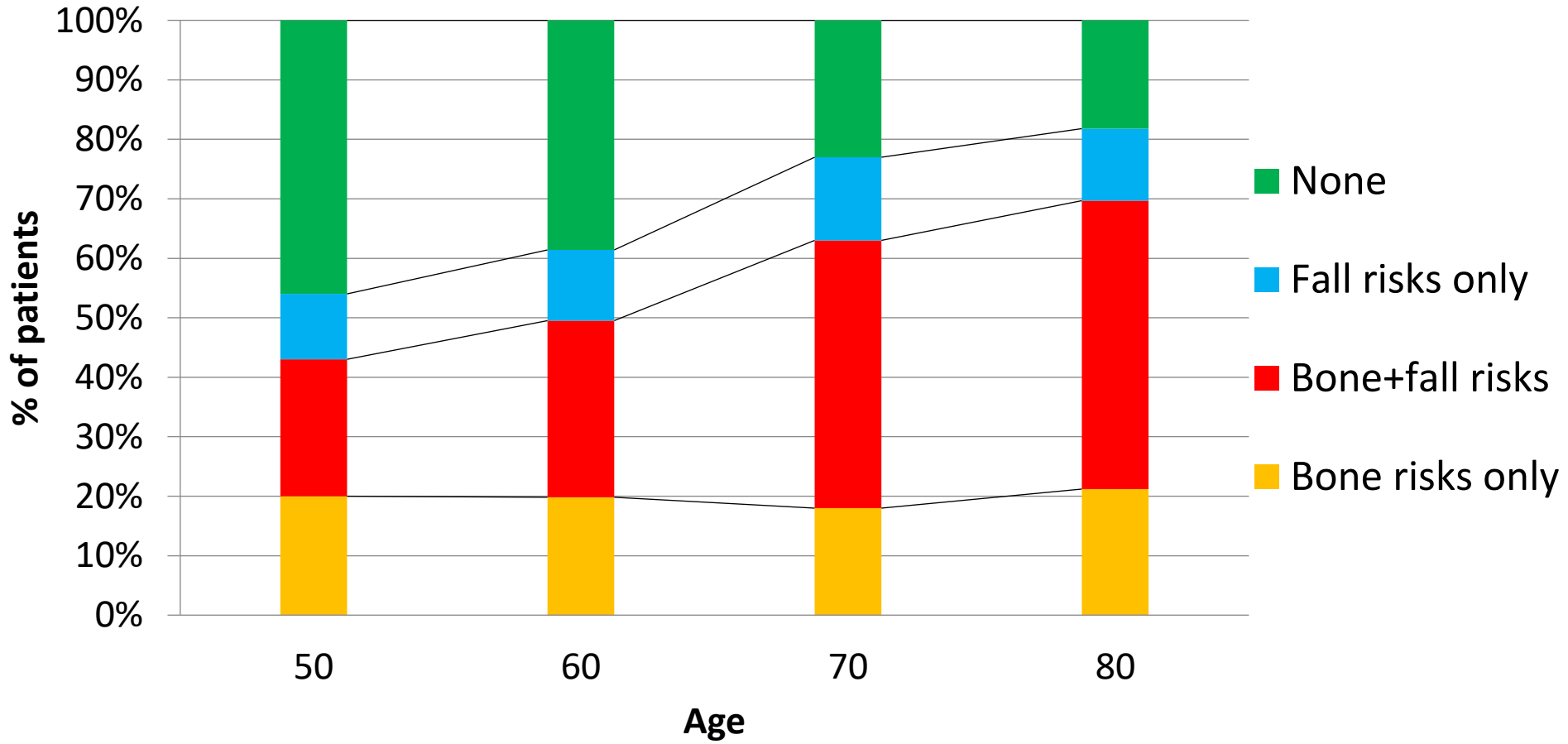
Risk factors in patients with a recent fracture

(n=568, women and men, mean age: 67 yrs)



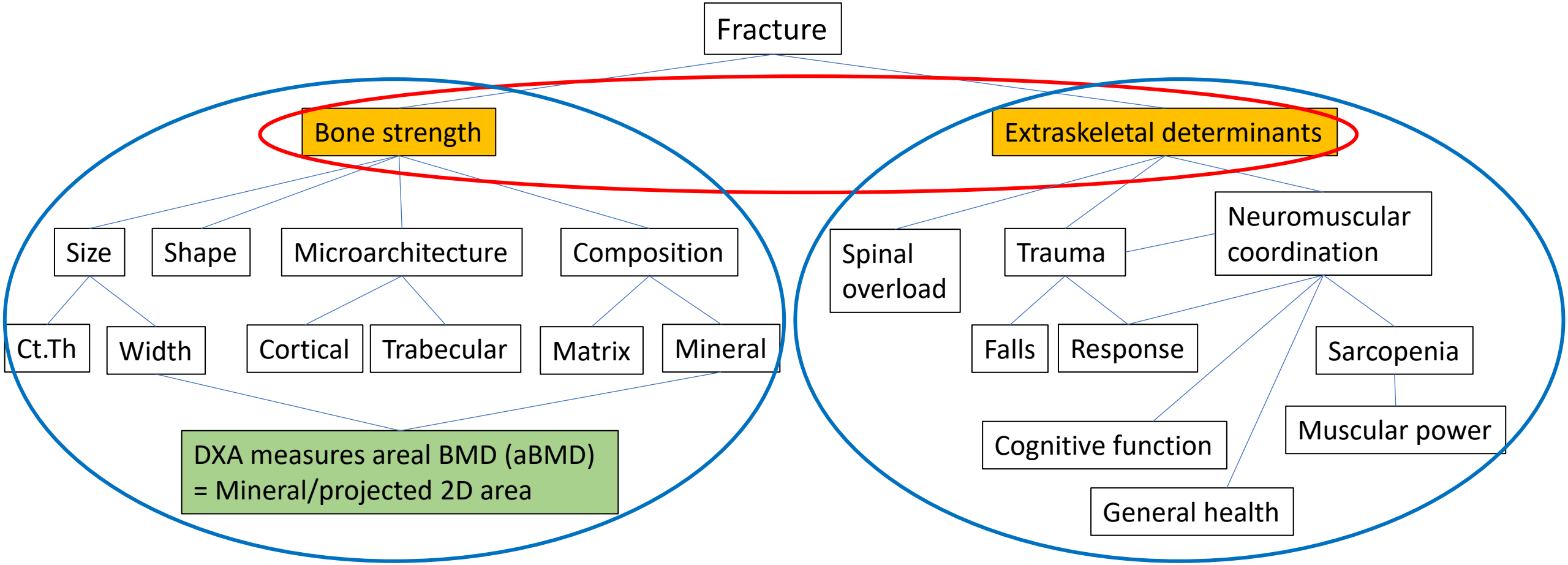
van Helden, JBJS, 2008

Clinical bone- and fall-related comorbidities and medications at the FLS (*n=1282*) based on medical history



Vranken, OI, 2018

The fracture in a wider and deeper context



Boonen, JCEM, 2002

Long-term risk of any recurrent clinical fracture

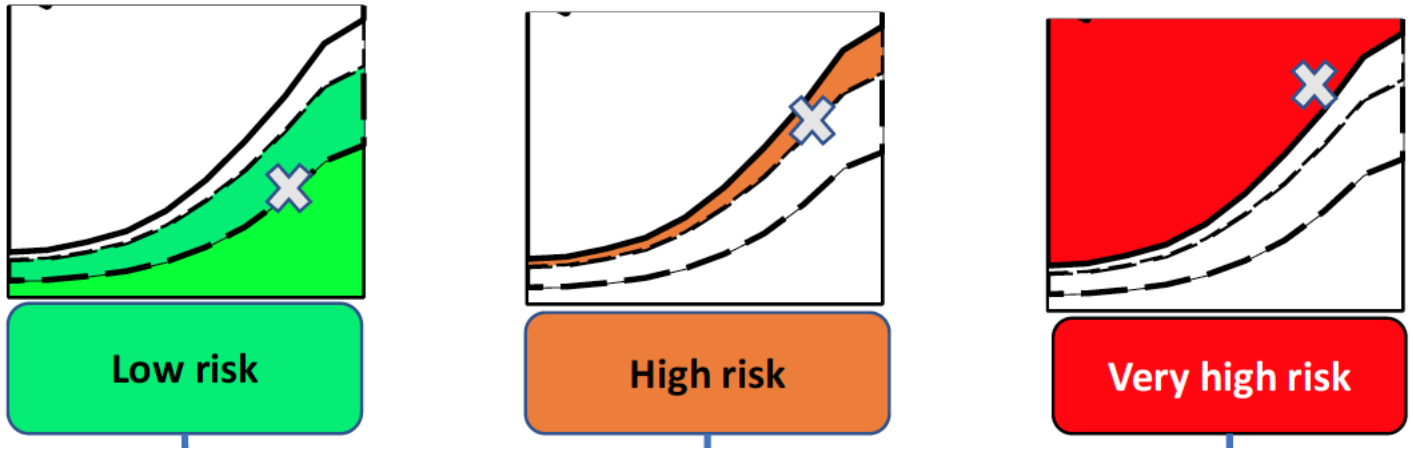
Study	N	Relative Risk (RR)	
Kanis 2023	2.1MM	1.9 (95% CI: 1.7-2.1), women~men	64 prospective cohorts

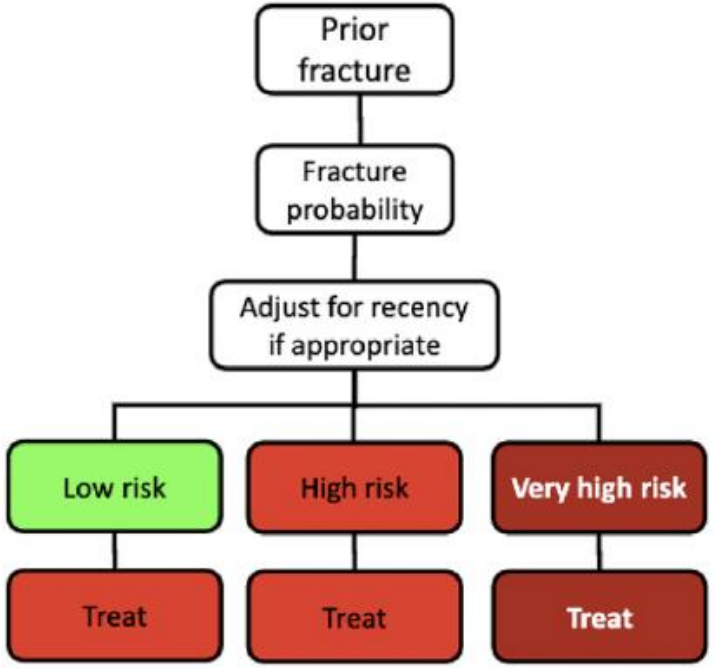
Outcome fracture	Number of cohorts	Unadjusted HR	Unadjusted 95% CI	Adjusted for BMD HR	Adjusted for BMD (95% CI)	Gradient of risk (HR/SD) for BMD	Proportion of risk (%) from BMD
Any	52	1.79	1.67–1.92	1.65	1.53–1.78	1.45	14

proportion of risk from aBMD: 14%

Kanis, OI, 2023

FRAX 10-year risk phenotypes



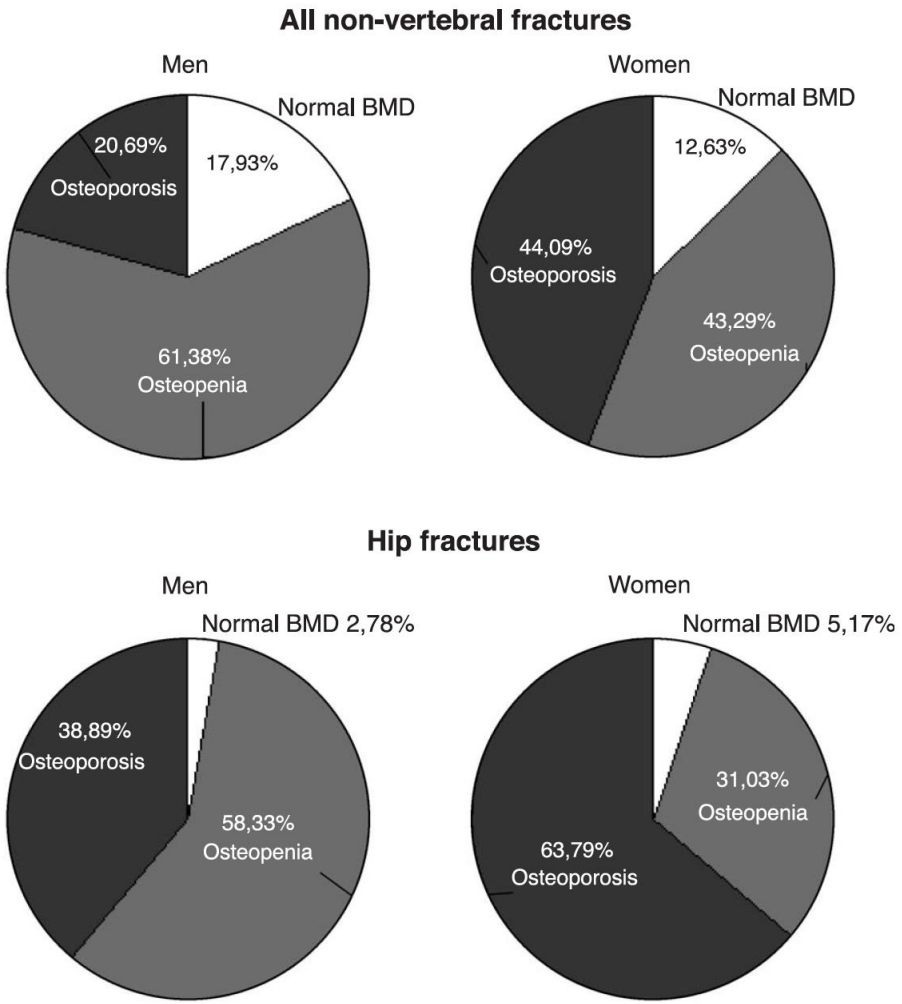


- Fracture risk assessment tools such as FRAX provide a readily available approach for stratifying the population to assess the subsequent fracture risk
  - but is largely beyond aBMD for FRAX
- FRAX cannot provide interpretation into the mechanisms leading to bone fragility

Kanis, OI, 2020
Kanis, OI, 2023
Schini, OI, 2023
Whittier, Curr Osteop Rep, 2023

Fracture incidence and association with aBMD in 55+ men and women: the Rotterdam Study

(*n=7806*, 7 years follow up)



Most patients with
a non-vertebral fracture
do not have
an osteoporotic phenotype
based on aBMD

Schuit, Bone, 2006

aBMD (areal BMD): Diagnostic versus treatment thresholds

- aBMD has a high specificity to predict fractures
  - the osteoporotic phenotype (T-score ≤ -2.5) has a high risk of fractures
- aBMD has a low sensitivity
  - most patients who fracture do not have an osteoporotic phenotype
- This raises the questions:
  - What is the role of other bone-related risks than aBMD?
  - What is the role of extra-skeletal risks?

Siris, JAMA, 2001
Kanis, Lancet, 2002
Kanis, Bone, 2002
Schuit, Bone, 2004
Kanis, OI, 2023
Mai, JCEM, 2019

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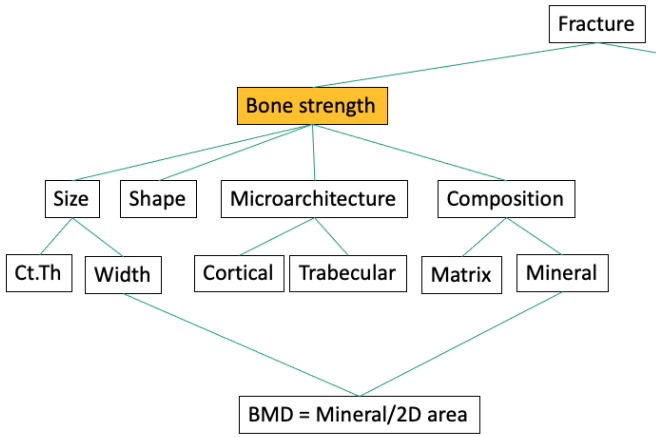
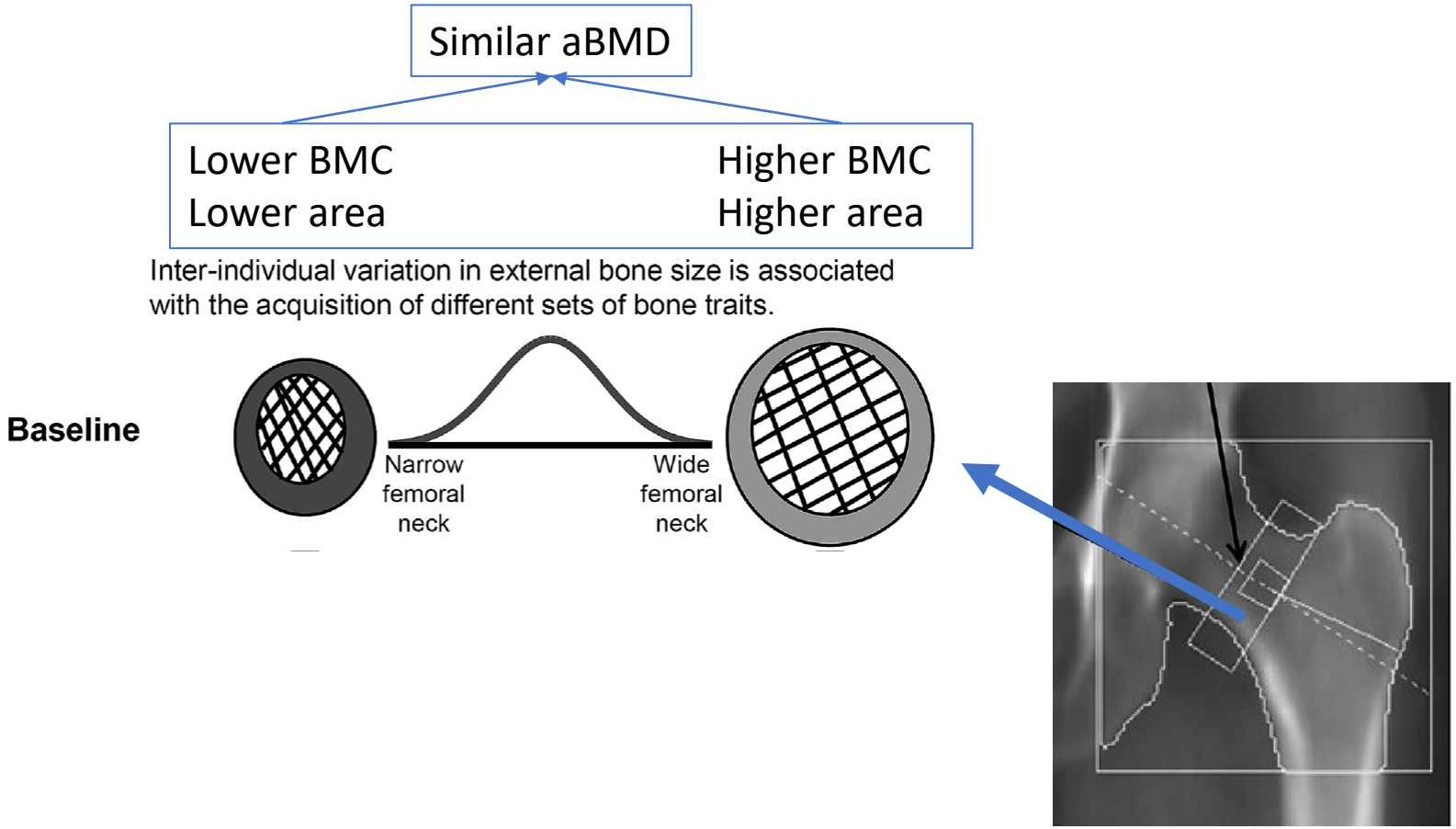
Determinants of fracture



Bone evaluation at the FLS: more than assessment with DXA-aBMD

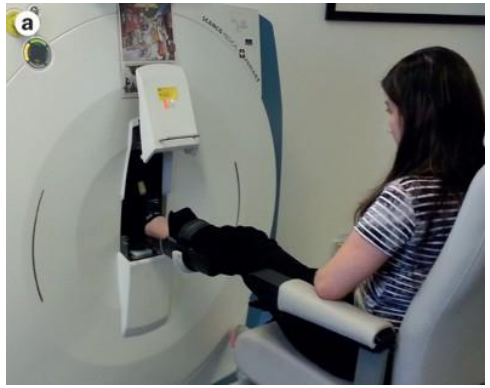
Bone width, micro-architecture and aBMD

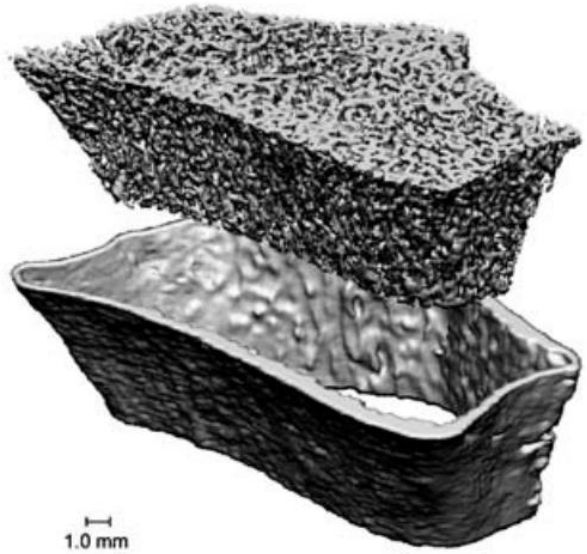


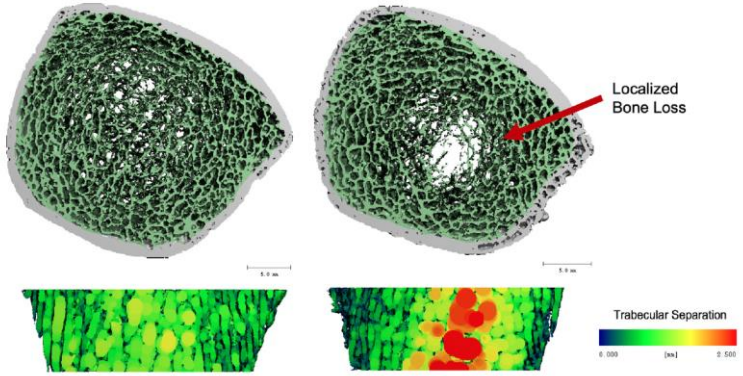
Jepsen, JBMR, 2017
Bigelow, JBMR, 2019
Bolger, J Struct Biol, 2020

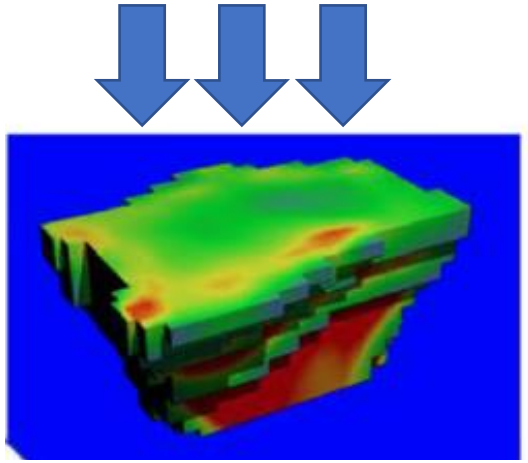
High-resolution peripheral quantitative CT scan (HR-pQCT): measuring microarchitecture *in vivo*

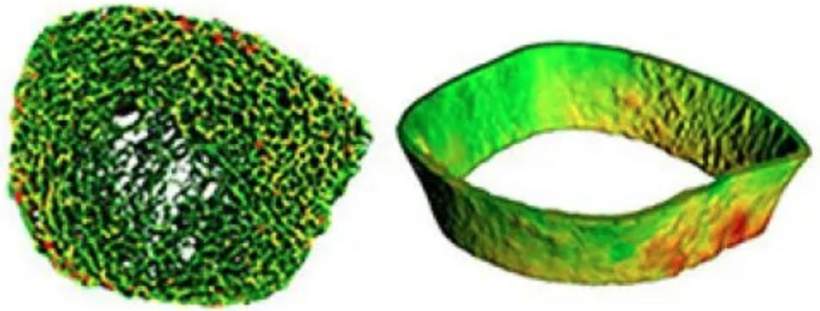
(Xtreme CT1+2 devices, Scanco, Switserland)







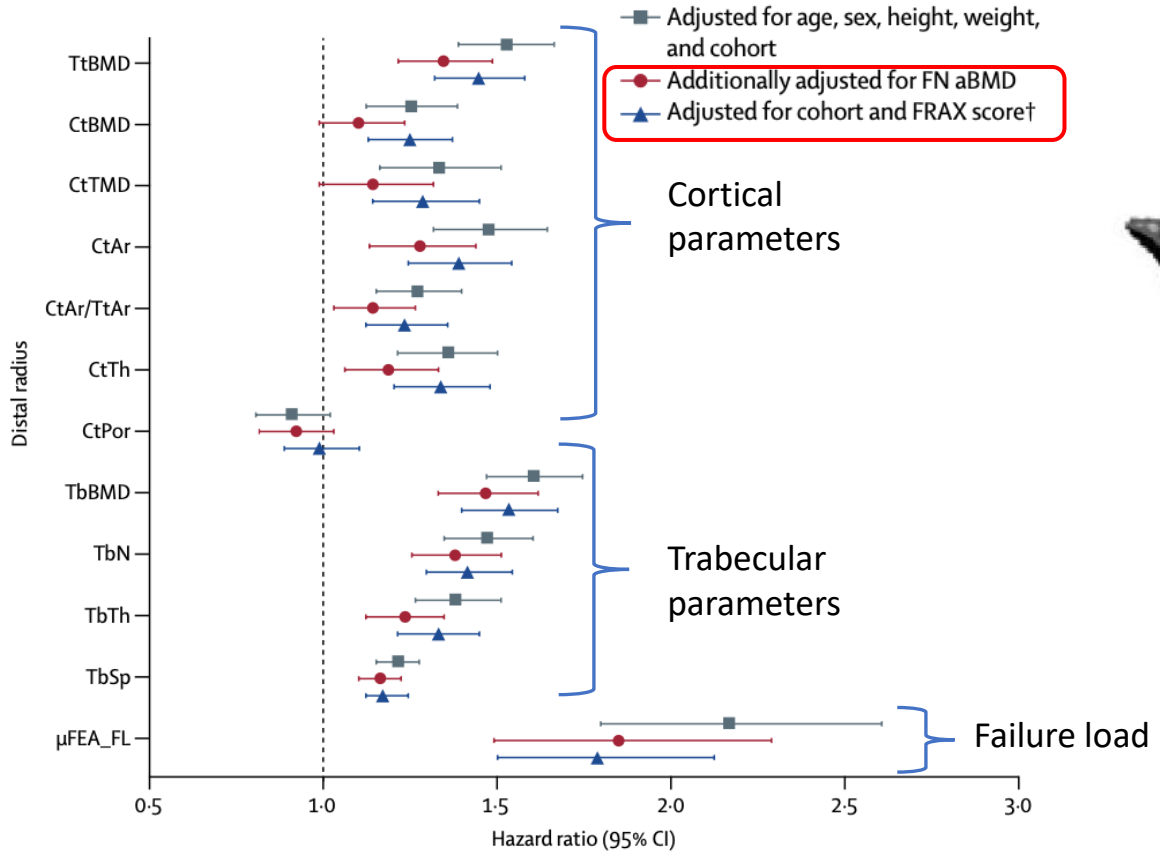




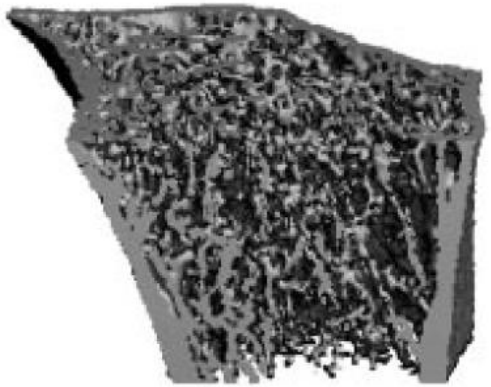
Boutroy, JCEM, 2005
Whittier, OI, 2020
Whittier, Bone, 2021
van den Bergh, OI, 2021

Bone micro-architecture parameters by HR-pQCT are related to risk of clinical fractures, independent of aBMD

Single cortical and trabecular parameters and micro-finit element analysis *(n=7254)*



Hypothesis driven analysis:
Composite of decreased trabecular density and increased cortical porosity predicts imminent fracture risk better than aBMD and FRAX *(n=1539)*



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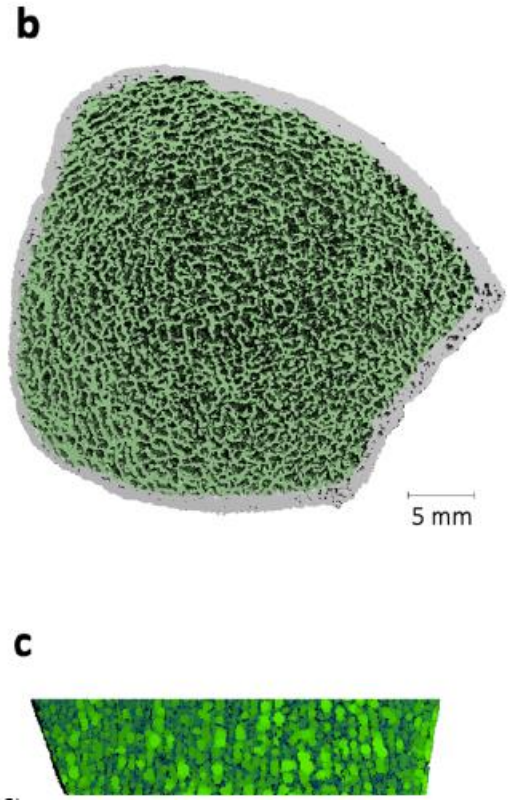
Schaffler, J Biomech, 1988; Zebaze, Lancet, 2010; Chapurlat, JBMR, 2019, Whittier, JBMR, 2021
Whittier, JBMR, 2022; Whittier, OI, 2020; Samelson, Lancet Diab, 2019; van den Bergh, OI, 2021; Stemmler, ARD, 2018, Whittier, Curr Osteop Rep, 2023

AI-driven analysis
Bone Microarchitecture Phenotypes Identified in Older Adults *(n=5873)*

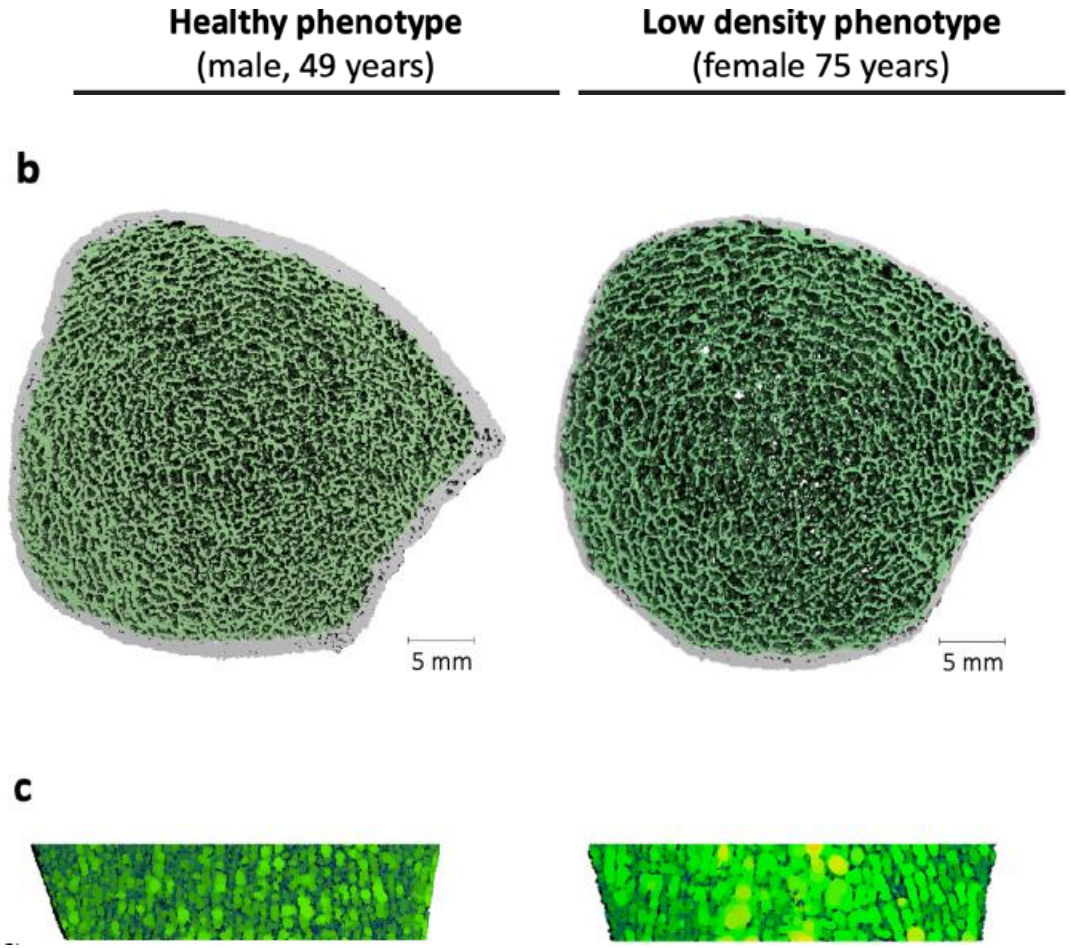
Healthy phenotype
(male, 49 years)



Size	normal
Cortex	thick
Trabeculae	well-connected

Whittier, JBMR, 2021

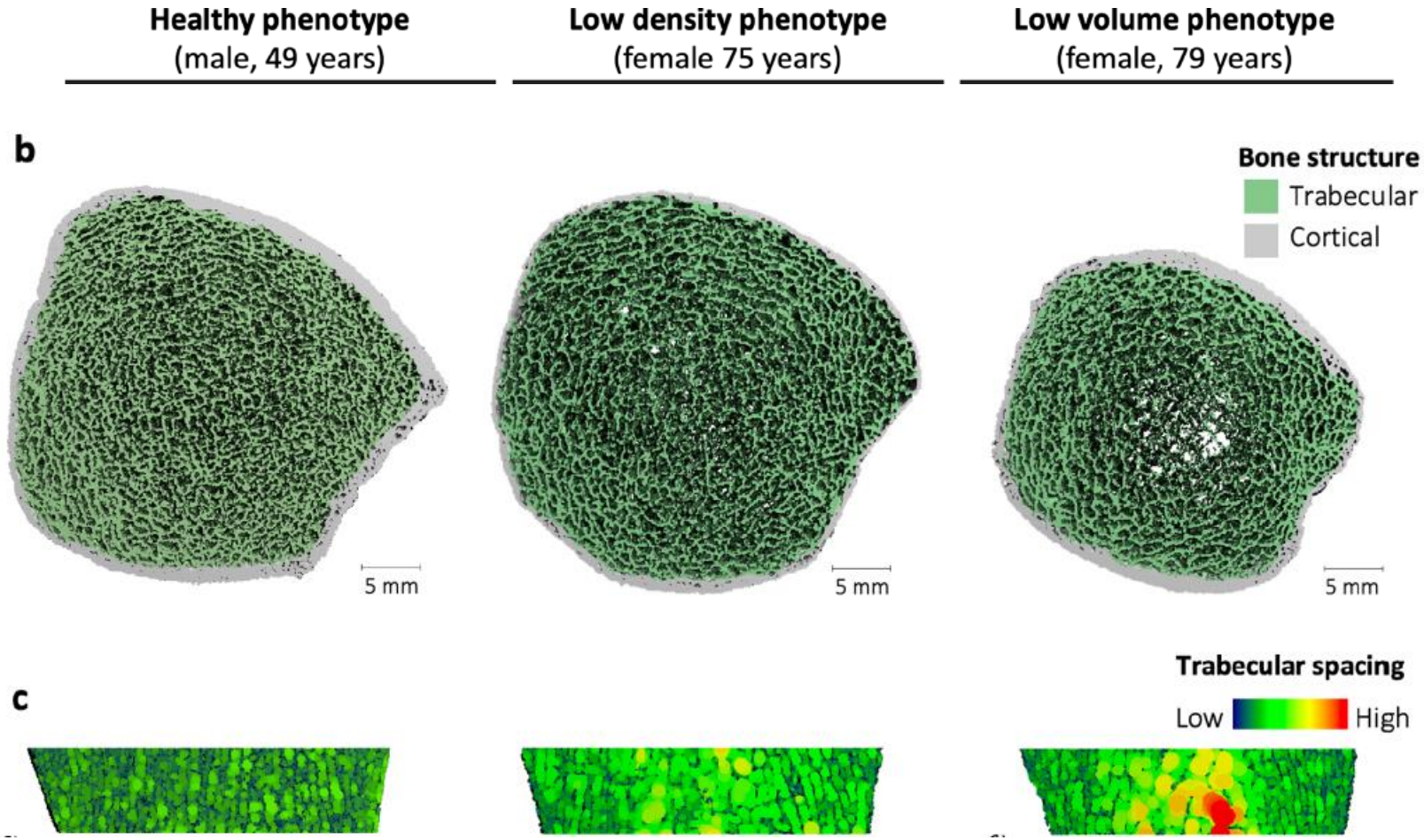
AI-driven analysis
Bone Microarchitecture Phenotypes Identified in Older Adults *(n=5873)*



Size	normal	normal
Cortex	thick	thinning
Trabeculae	well-connected	degradation

Whittier, JBMR, 2021

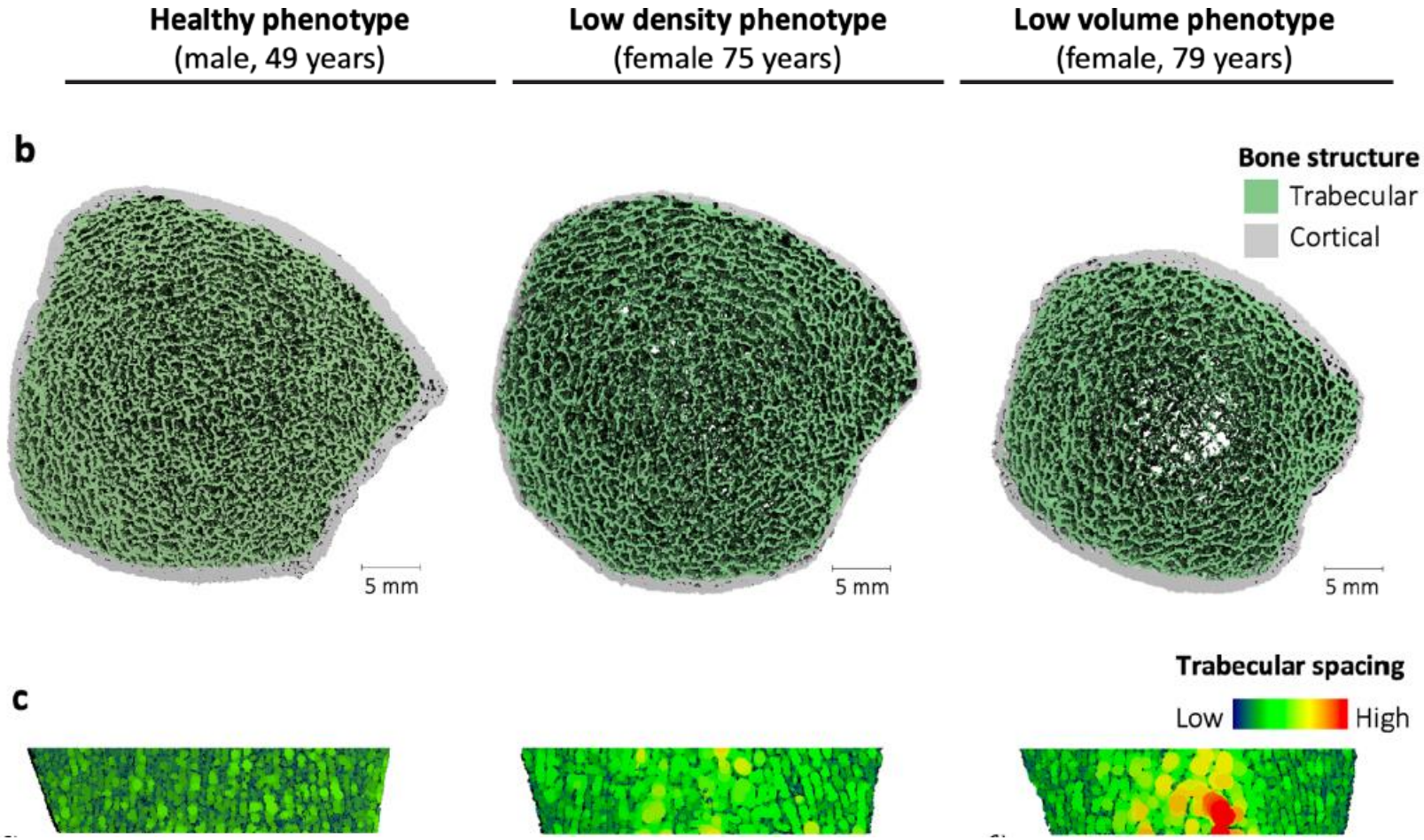
AI-driven analysis
Bone Microarchitecture Phenotypes Identified in Older Adults *(n=5873)*

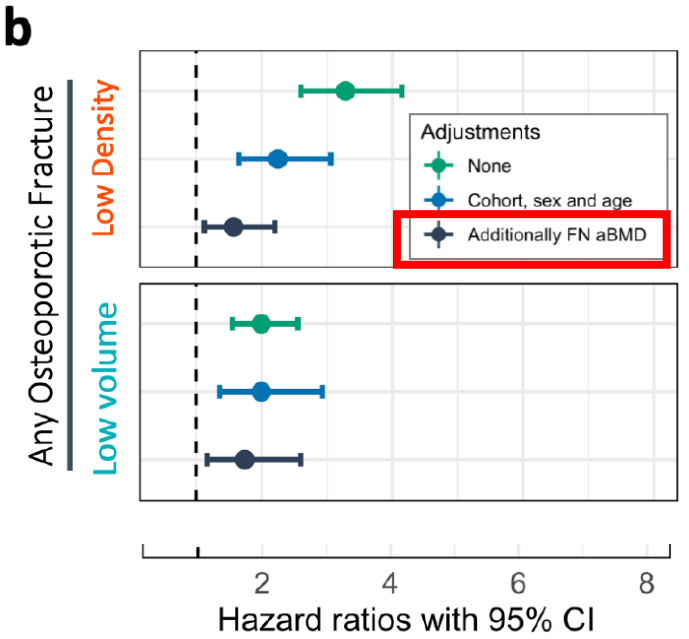


	Healthy phenotype (male, 49 years)	Low density phenotype (female 75 years)	Low volume phenotype (female, 79 years)
Size	normal	normal	smaller
Cortex	thick	thinning	thick and dense
Trabeculae	well-connected	degradation	deficits

Whittier, JBMR, 2021

AI-driven analysis
Bone Microarchitecture Phenotypes Identified in Older Adults *(n=5873)*





Size	normal	normal	smaller
Cortex	thick	thinning	thick and dense
Trabeculae	well-connected	degradation	deficits

Whittier, JBMR, 2021

Considerations for the FLS

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2/ Disturbed microarchitecture is a risk factor for fractures beyond aBMD

3/ A full fracture history at the FLS includes imaging of the thoracic and lumbar spine

4/ Patients with a recent clinical fracture have frequently associated diseases and extra-skeletal risk factors

5/ Implementation of the FLS and its effects on subsequent fractures, mortality and falls

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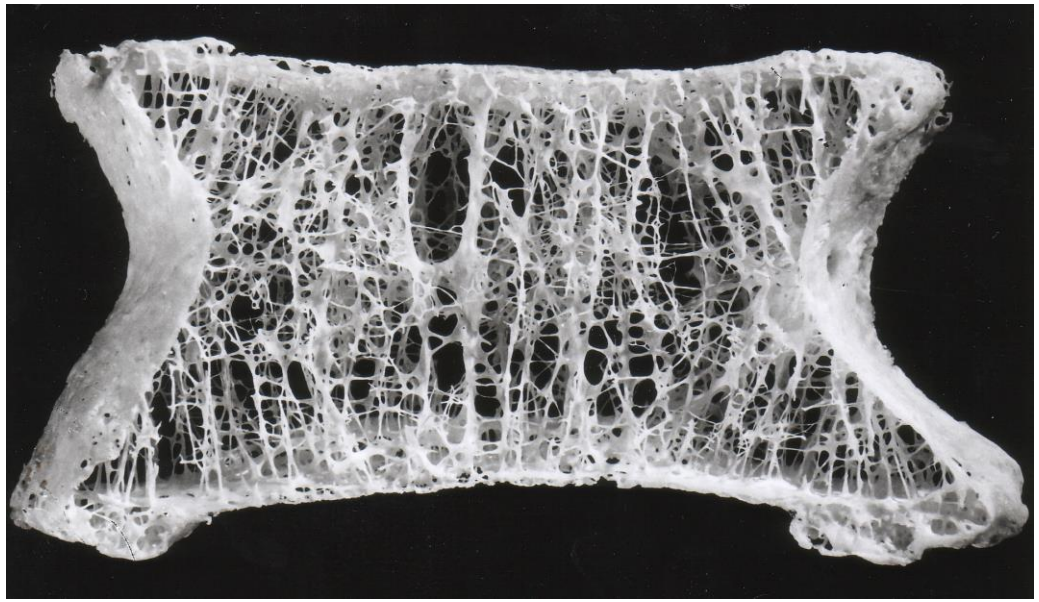
Vertebral fractures (VFs) are a reflection of bone microarchitecture independent of aBMD

- VFs are predictors of VF and non-VF
- Microarchitecture is more disturbed:
  - In subjects with a VF than with a non-VF
  - In postmenopausal women with a recent non-VF with a VF than without a VF



Ross, Ann Intern Med. 1991
McCloskey, JBMR, 2008
Chen, JBMR, 2009
Stein, JCEM, 2012
Vranken, OI, 2019

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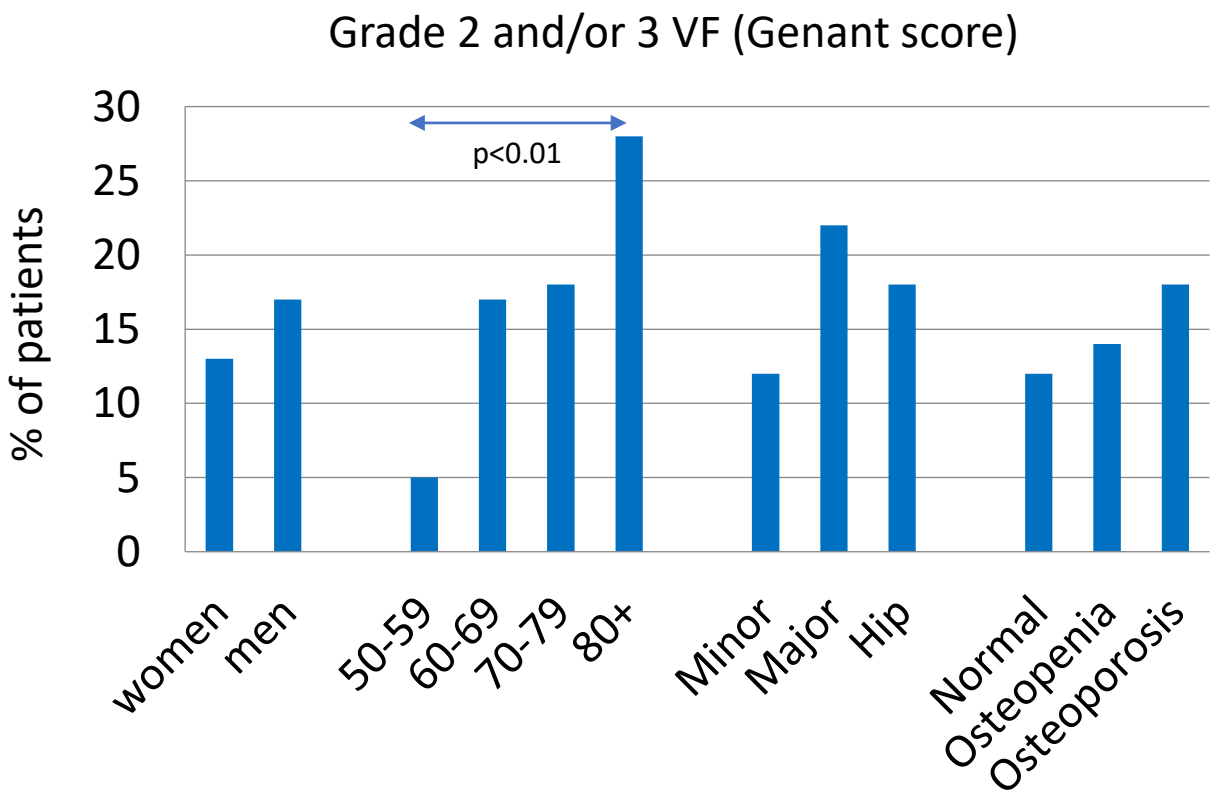
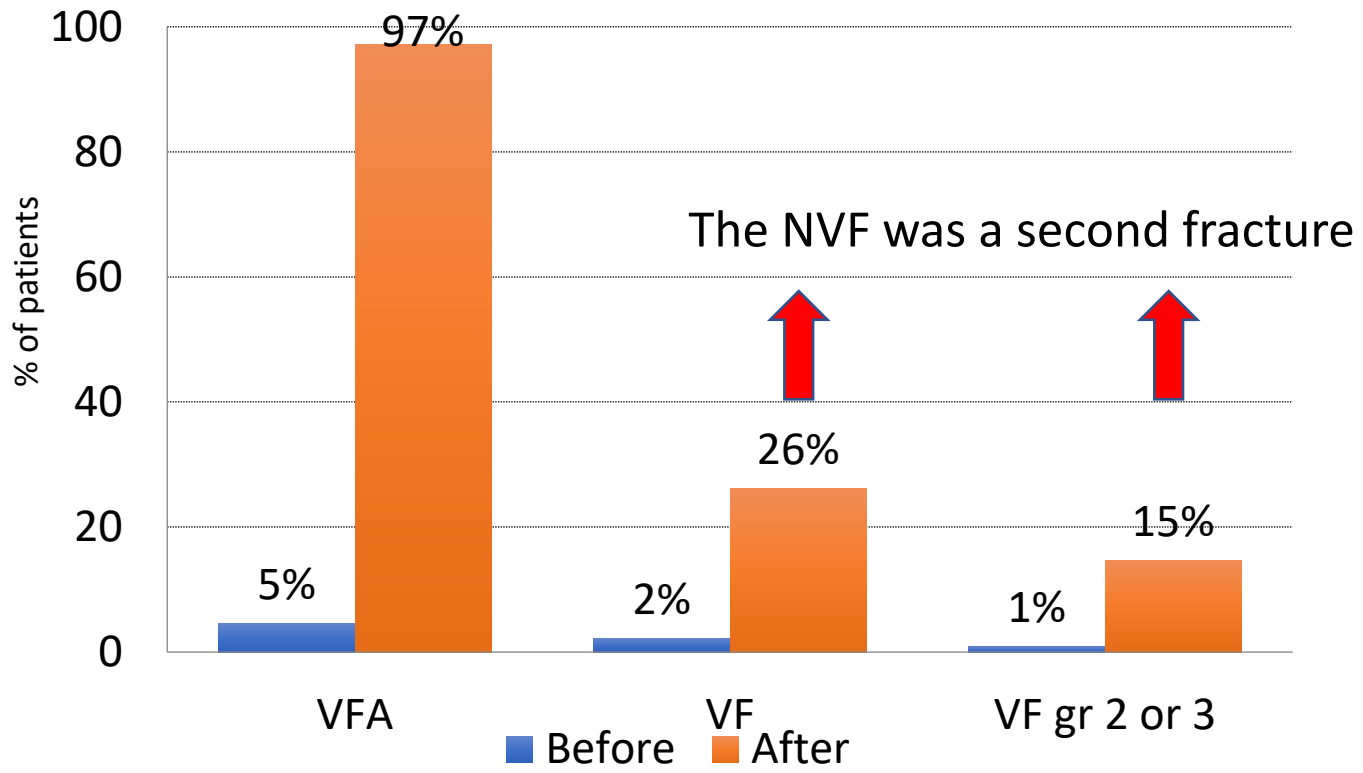
Prevalence of vertebral fractures (VF) in patients with a non-VF at the FLS



Genant, OI, 2003; Gallagher, OI, 2007; Howat, Clin Endo, 2007; Roux, Rheum, 2011; van de Velde, OI, 2017; Malgo, OI, 2017; Ginther, End Pract, 2017; Reniu; Arch Osteop, 2017; Schousboe, JBMR, 2019; Schousboe, Bone, 2019; Aboudiab, OI, 2020; Lems, OI, 2021

% of patients with a non-VF at the FLS, and having at least one vertebral fracture before and after implementation of VFA



Van der Velde, OI, 2017
Gehlbach, JBMR, 2012

Vertebral fracture: epidemiology, impact and use of DXA vertebral fracture assessment in fracture liaison services

W. F. Lems[1] · J. Paccou[2] · J. Zhang[3] · N. R. Fuggle[3] · M. Chandran[4] · N. C. Harvey[3] · C. Cooper[3,5] · K. Javaid[5] · S. Ferrari[6] · K. E. Akesson[7] · International Osteoporosis Foundation Fracture Working Group

- DXA-VFA should be performed in all patients visiting a FLS
  - 2/3 of vertebral fractures are subclinical
  - they reflect the presence of more severe microarchitectural deterioration
  - prevalent vertebral fractures may modify risk category and therapy
  - allows diagnosing incident new vertebral fractures for optimal treatment monitoring

Lems, OI, 2021

Considerations for the FLS

1/ Any clinical fracture is a signal for imminent and long-term subsequent fracture risk, except when life expectancy is short

2/ Disturbed microarchitecture is a risk factor for fractures beyond aBMD

3/ A full fracture history at the FLS includes imaging of the thoracic and lumbar spine

4/ Patients with a recent clinical fracture have frequently associated diseases and extra-skeletal risk factors

5/ Implementation of the FLS and its effects on subsequent fractures, mortality and falls

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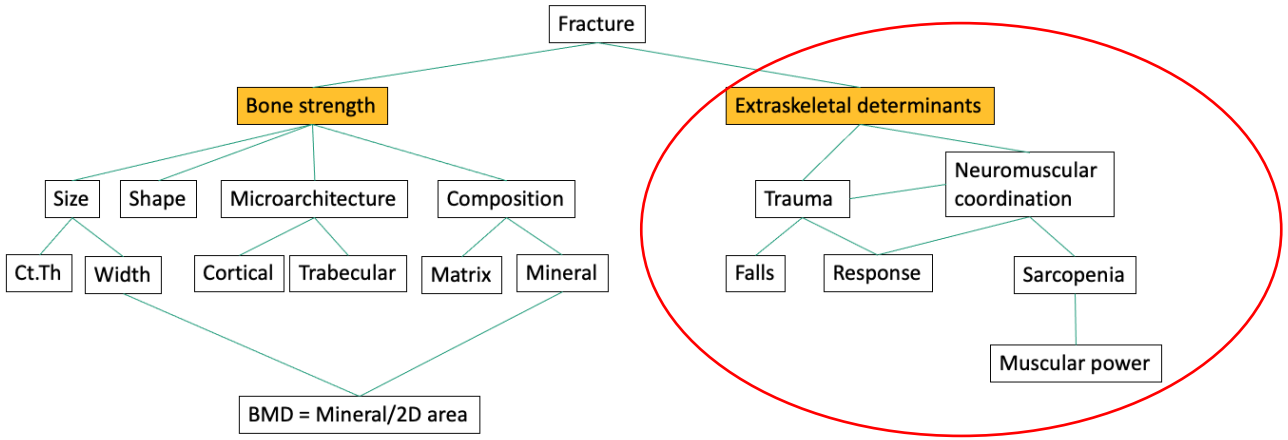
Determinants of fracture



The fracture patient at the FLS needs more than assessment of bone

Prevalence of known and newly diagnosed metabolic bone diseases (after clinical and a limited laboratory examination)

Endocrine Reviews, 2022, Vol. 43, No. 2, 240–313
https://doi.org/10.1210/endrev/bnab028
Review

Review

Secondary Osteoporosis

Peter R. Ebeling,[1,2] Hanh H. Nguyen,[1,2,3] Jasna Aleksova,[2,4] Amanda J. Vincent,[2,5] Phillip Wong,[1,2,4] and Frances Milat[1,2,4]

873. Rolfes MC, Deyle DR, King KS, Hand JL, Graff AH, Derauf C. Fracture incidence in Ehlers-Danlos syndrome - a population-based case-control study. *Child Abuse Negl.* 2019;**91**:95-101.

Multimorbidity clusters and mortality risk at the time of fracture

Nationwide cohort study in 307,870 adults older than 50 years (mean: 75 yrs) with a recent low-trauma fracture in Denmark

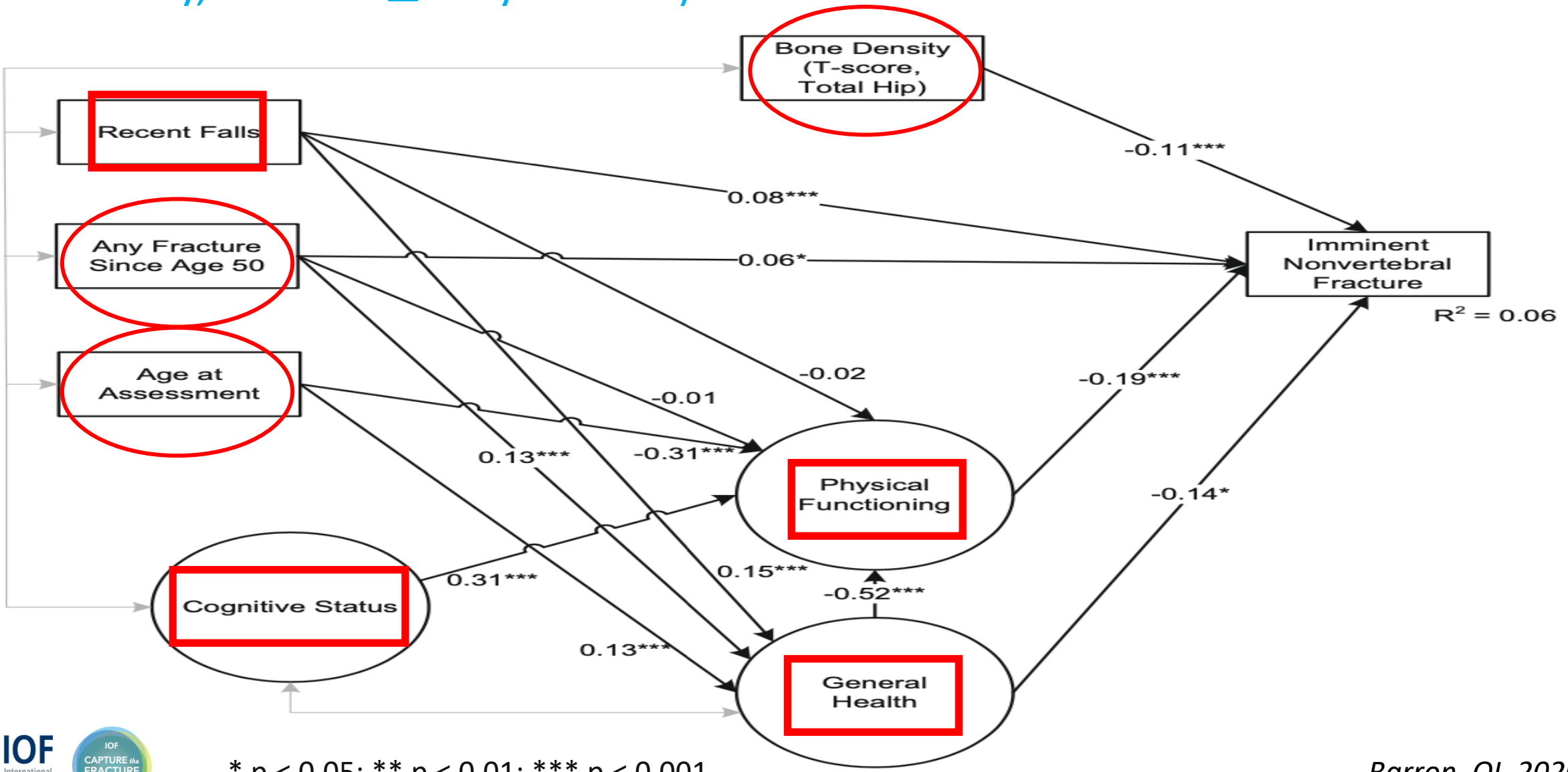
Women *(n=212,498)*:

History of stroke:	7.3%
History of MI:	6.4%

Excluded were face, skull, and digit fractures and high-trauma fractures due to traffic accidents

Tran, JAMA Open, 2022

Risk factors for 1-year imminent non-vertebral fracture (SOF study, women ≥ 65 years old)



* p < 0.05; ** p < 0.01; *** p < 0.001

Barron, OI, 2020

Considerations for the FLS

1/ Any clinical fracture is a signal for imminent and long-term subsequent fracture risk, except when life expectancy is short

2/ Disturbed microarchitecture is a risk factor for fractures beyond aBMD

3/ A full fracture history at the FLS includes imaging of the thoracic and lumbar spine

4/ Patients with a recent clinical fracture have frequently associated diseases, comorbidities and extra-skeletal risk factors and these are related to imminent subsequent fracture risk

5/ Implementation of the FLS and its effects on subsequent fractures, mortality and falls

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How to implement a Fracture Liaison Service (FLS)?

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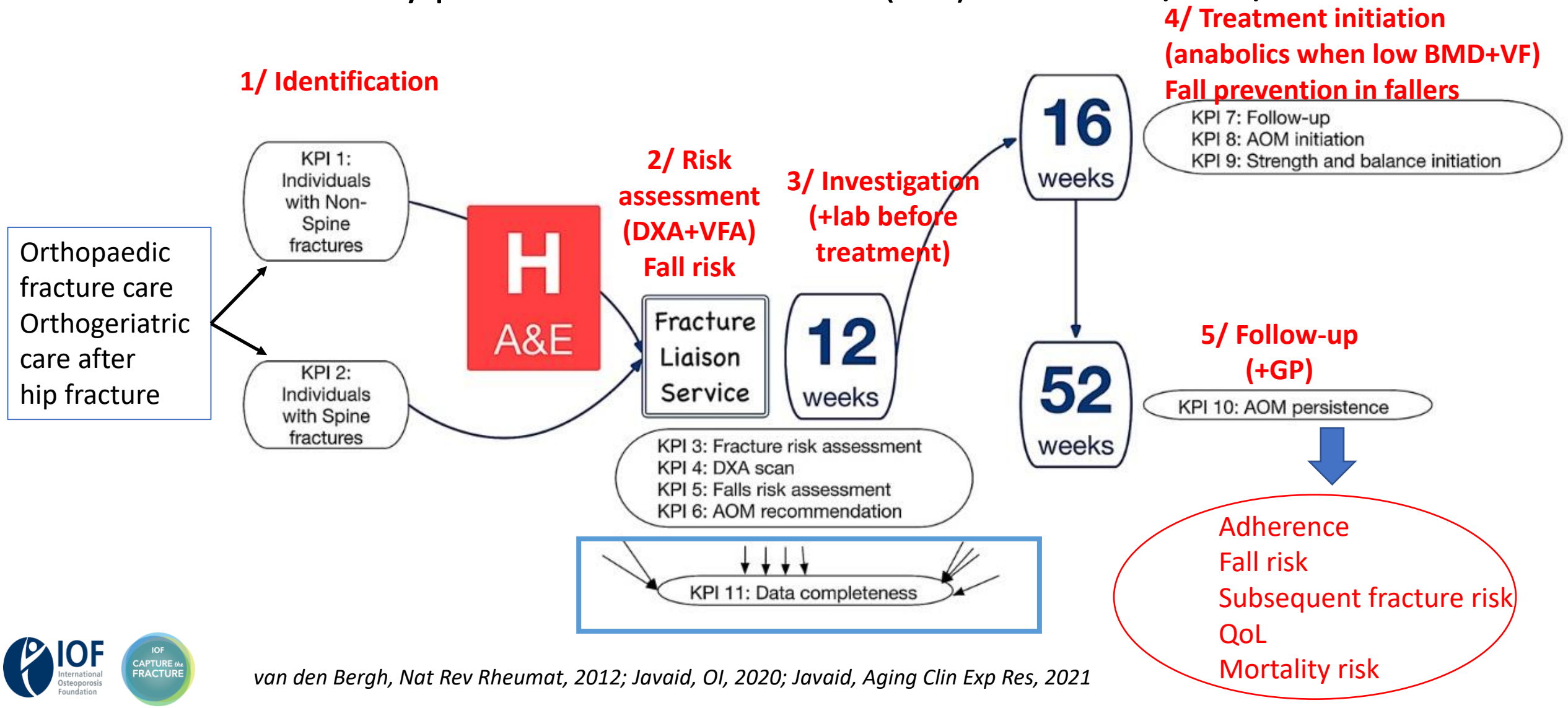
Secondary fracture prevention at the FLS:
a 5-step plan in the Netherlands
and 11 key performance indicators (KPI) of the IOF/FFN/NOF



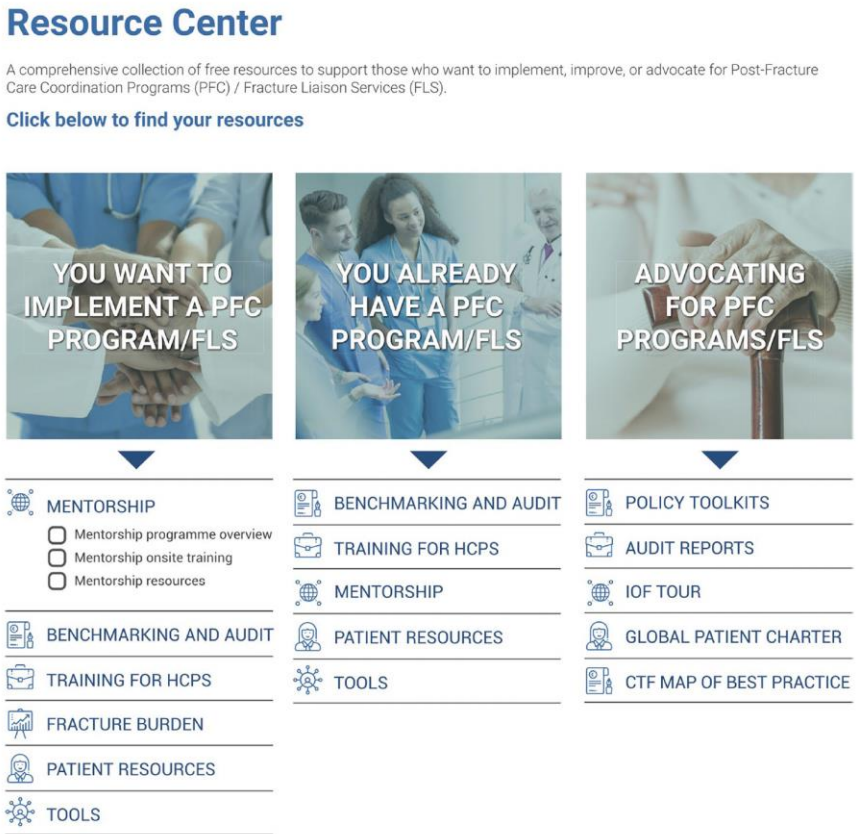
van den Bergh, Nat Rev Rheumat, 2012; Javaid, OI, 2020; Javaid, Aging Clin Exp Res, 2021

Osteoporosis International
https://doi.org/10.1007/s00198-023-06759-x

POSITION PAPER

The Capture the Fracture® Partnership: an overview of a global initiative to increase the secondary fracture prevention care for patient benefit

M. K. Javaid[1] · R. Pinedo-Villanueva[2] · A. Shah[2] · Z. Mohsin[2] · M. Hiligsmann[3] · A. Motek-Soulié[4] · N. R. Fuggle[5] · P. Halbout[4] · C. Cooper[2,5]



Javaid, OI, 2023

Effects of implementation of the bone- and fall-related phenotypes at the FLS

- FLS increases:
  - clinical, DXA+VFA, laboratory and fall risk evaluation
  - diagnosis and treatment of underlying diseases
  - adequate calcium, vitamin D and protein intake
  - treatment initiation based on further specification of very high risk after a recent fracture, taking into account the additional risk factors according to the patient's phenotype
  - persistence of treatment
- FLS care is associated with a significantly lower imminent 2-year probability of:
  - subsequent fractures: -30% (CI: -7% to -48%)
  - mortality (in pre/post FLS studies): -35% (CI: -5% to -56%)
- The quality assessment revealed some important methodological issues

Javaid, OI, 2020
Li, OI, 2021
Pinedo-Villanueva, JBMR, 2023
Silva, Arch Osteop, 2023

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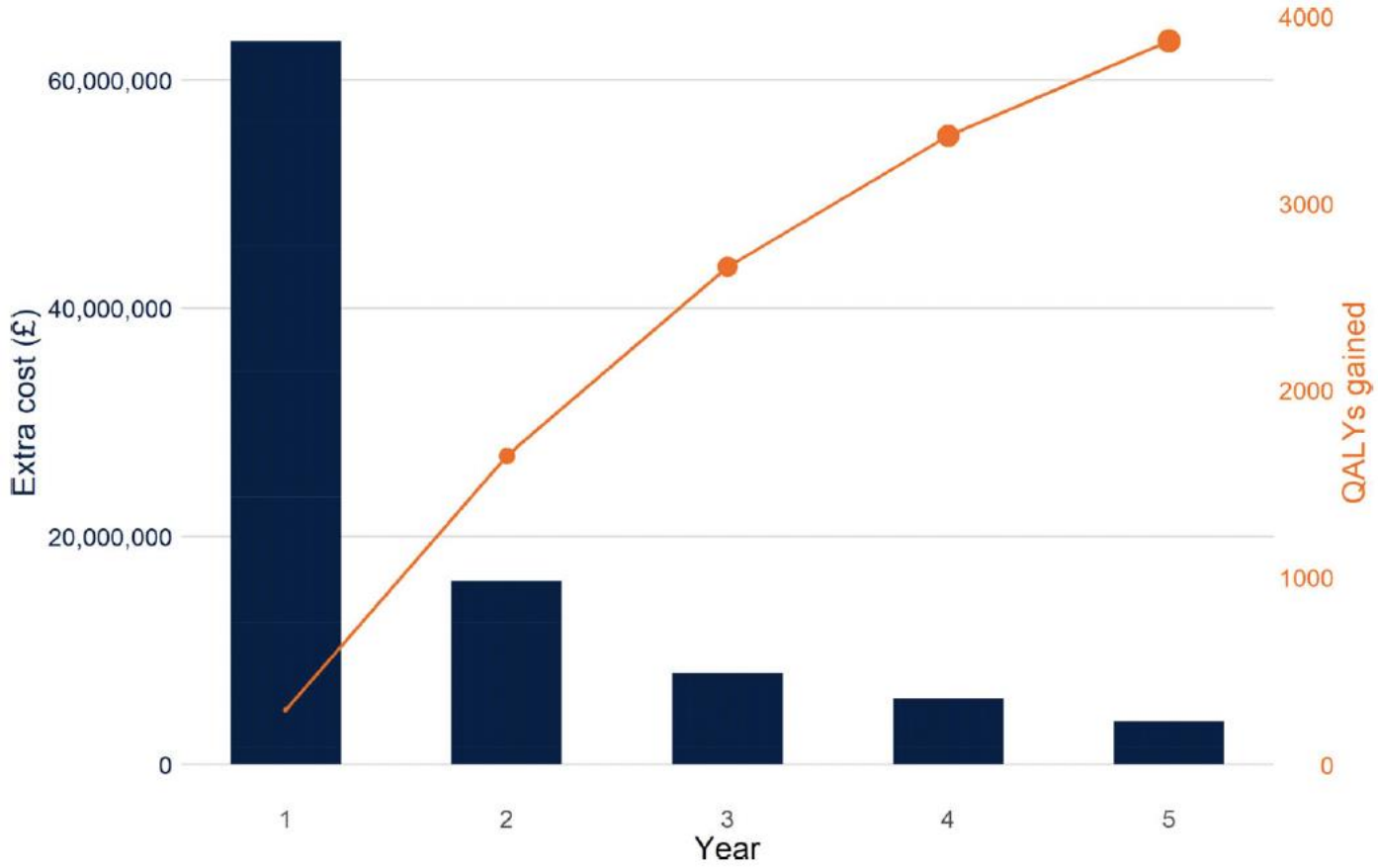
Expected Benefits and Budget Impact From a Microsimulation Model Support the Prioritization and Implementation of FLSs

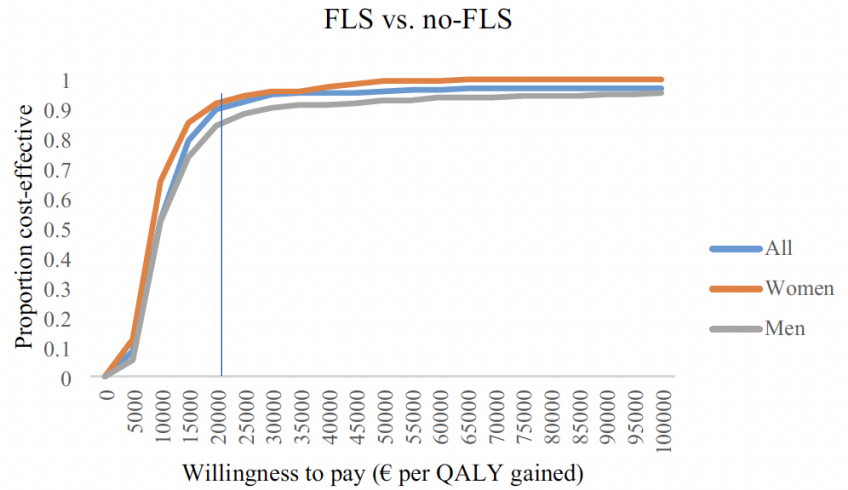


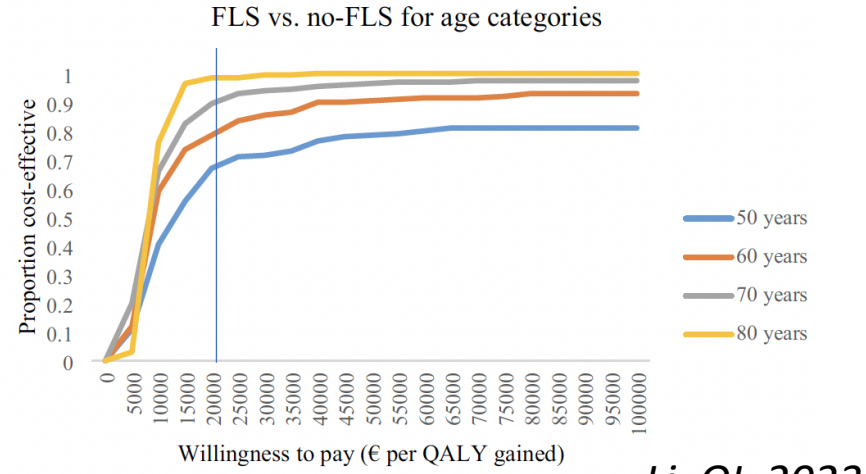
FLSs was highly cost-effective at £8258 per QALY gained over the first 5 years.

Pinedo-Villanueva, JBMR, 2023

Cost-effectiveness analysis of fracture liaison services: a Markov model using Dutch real-world data

- For patients with a recent fracture aged 50 years and older, the presence of an FLS was associated with
  - a lifetime €45 higher cost
  - 0.11 additional QALY gained
  - leading to an ICER of €409 per QALY gained
  - indicating FLS was costefective compared to no-FLS at the Dutch threshold of €20,000/QALY
- The FLS remained cost-effectivene across different age categories
- The higher the treatment initiation rate in FLS, the greater the cost-effectiveness of FLS





Li, OI, 2023

Risk factors for non-attendance at the FLS *(N=2006)*

40% of invited patients did not attend the FLS

	Odds Ratio	
Demographic factors contributing to be a non-attender		
Male	1.67 (1.17; 2.42)	.002
Living alone	1.98 (1.43; 2.74)	<.001
Age > 70 yr.	1.87 (1.35; 2.60)	<.001
Low income	3.03 (2.00; 4.55)	<.001
Low education	3.03 (2.00; 4.55)	<.001
Extrinsic Motivations contributing to be a non-attender		
No advice was perceived to have a DXA and to visit the FLS	9.1 (6.7; 12.5)	<.001
Intrinsic Motivations contributing to be a non-attender		
I am not interested in my bone strength*	2.08 (1.50; 2.94)	<.001
I do not think that my fracture risk is increased after sustaining this fracture**	1.72 (1.08; 2.86)	.024
Frailty: Tilburg Frailty Indicator (TFI)		
Frailty	2.12 (1.51; 2.98)	.002

Role for health care professionals

van den Berg, OI, 2019

Initiatives for implementation of the FLS

Javaid, OI, 2020; Geusens, Best Pract Res Clin Rheumatol, 2022

Osteoporosis International (2024) 35:451–468
https://doi.org/10.1007/s00198-023-06955-9

ORIGINAL ARTICLE

Patients' preferences for fracture risk communication: the Risk Communication in Osteoporosis (RICO) study

Charlotte Beaudart[1,2,3] · Mitali Sharma[4] · Patricia Clark[5] · Saeko Fujiwara[6] · Jonathan D. Adachi[7] · Osvaldo D. Messina[8,9] · Suzanne N. Morin[10] · Lynn A. Kohlmeier[11] · Caroline B. Sangan[12] · Xavier Nogues[13] · Griselda Adriana Cruz-Priego[14] · Andrea Cavallo[8] · Fiona Cooper[12] · Jamie Grier[12] · Carolyn Leckie[7] · Diana Montiel-Ojeda[14] · Alexandra Papaioannou[7] · Nele Raskin[1] · Leonardo Yurquina[15] · Michelle Wall[16] · Olivier Bruyère[2] · Annelies Boonen[1,17] · Elaine Dennison[18] · Nicholas C. Harvey[18,19] · John A. Kanis[20,21] · Jean-François Kaux[22] · E. Michael Lewiecki[23] · Oscar Lopez-Borbon[3] · Zoé Paskins[24,25] · Jean-Yves Reginster[2] · Stuart Silverman[3,26] · Mickaël Hiligsmann[1]

332 subjects in 9 countries, 48% history of fracture

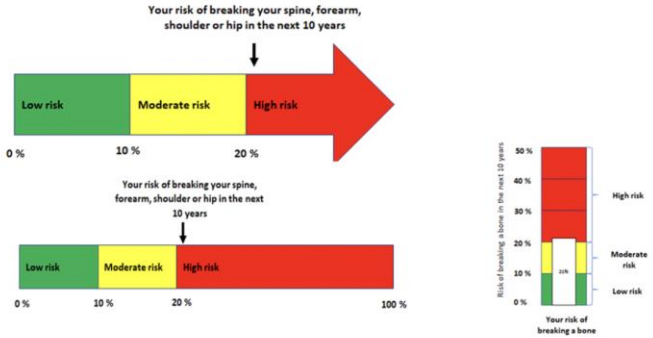
PRESENTATION N°1

This first way to explain your fracture risk is verbal or in writing

Your risk of major osteoporosis-related fracture (e.g. hip, spine, wrist fracture) is 21% over 10 years

PRESENTATION N°2

The presentation is supplemented with a visual presentation of the risk using a coloured graph

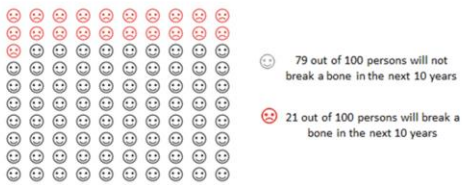


Understand traffic light 61% (range: 7-80%)

Convincing treatment initiation 61% (range: 13-97%)

PRESENTATION N°3

The presentation is supplemented with a visual presentation of the risk using icon array



79 out of 100 persons will not break a bone in the next 10 years

21 out of 100 persons will break a bone in the next 10 years

After a recent clinical fracture FRAX needs adjustment for recency of falls and fractures and number of previous fractures

Beaudart, OI, 2024; Kanis, OI, 2018; Kanis, OI, 2022; Kanis, OI, 2024

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The role of non-physician health professionals EULAR initiatives

Osteoporosis

RMD Open
Rheumatic & Musculoskeletal Diseases

ORIGINAL RESEARCH

Prevention and management of osteoporotic fractures by non-physician health professionals: a systematic literature review to inform EULAR points to consider

Nicky Wilson ,[1] Emailie Hurkmans,[2] Jo Adams ,[1] Margot Bakkers,[3] Petra Balážová,[4,5] Mark Baxter,[6] Anne-Birgitte Blavnsfeldt,[7] Karine Briot ,[8] Catharina Chiari,[9] Cyrus Cooper,[1] Razvan Dragoi,[10] Gabriele Gäbler,[9] Willem Lems,[11] Erika Mosor,[12] Sandra Pais,[13] Cornelia Simon,[10] Paul Studenic,[14] Simon Tilley,[15] Jenny de la Torre,[16] Tanja A Stamm [17]

2019 EULAR points to consider for non-physician health professionals to prevent and manage fragility fractures in adults 50 years or older

Jo Adams ,[1] Nicky Wilson ,[1] Emalie Hurkmans,[2] Margot Bakkers,[3] Petra Balážová,[4,5] Mark Baxter,[6] Anne-Birgitte Blavnsfeldt,[7] Karine Briot ,[8] Catharina Chiari,[9] Cyrus Cooper,[10] Razvan Gabriel Dragoi,[11] Gabriele Gäbler,[12] Willem Lems,[13] Erika Mosor,[12] Sandra Pais,[14] Cornelia Simon,[15] Paul Studenic ,[16] Simon Tilley,[6,17] Jenny de la Torre-Aboki ,[18] Tanja A Stamm [12,19]

Aim is to involve non-physician heatlth professionals in all steps of primary and secondary fracture prevention, including at the FLS

Wilson, RMD Open, 2020
Adams, ARD, 2021

Osteoporosis International (2024) 35:373–389
https://doi.org/10.1007/s00198-024-07014-7

CONSENSUS STATEMENT

Establishing consensus recommendations for long-term osteoporosis care for patients who have attended an Australian fracture liaison service: a Delphi study

Michael J. Bennett[1,2,3,4] · Jacqueline R. Center[4,5] · Lin Perry[6,7]

Clear consensus among experts in many key areas of FLS integration with primary care.

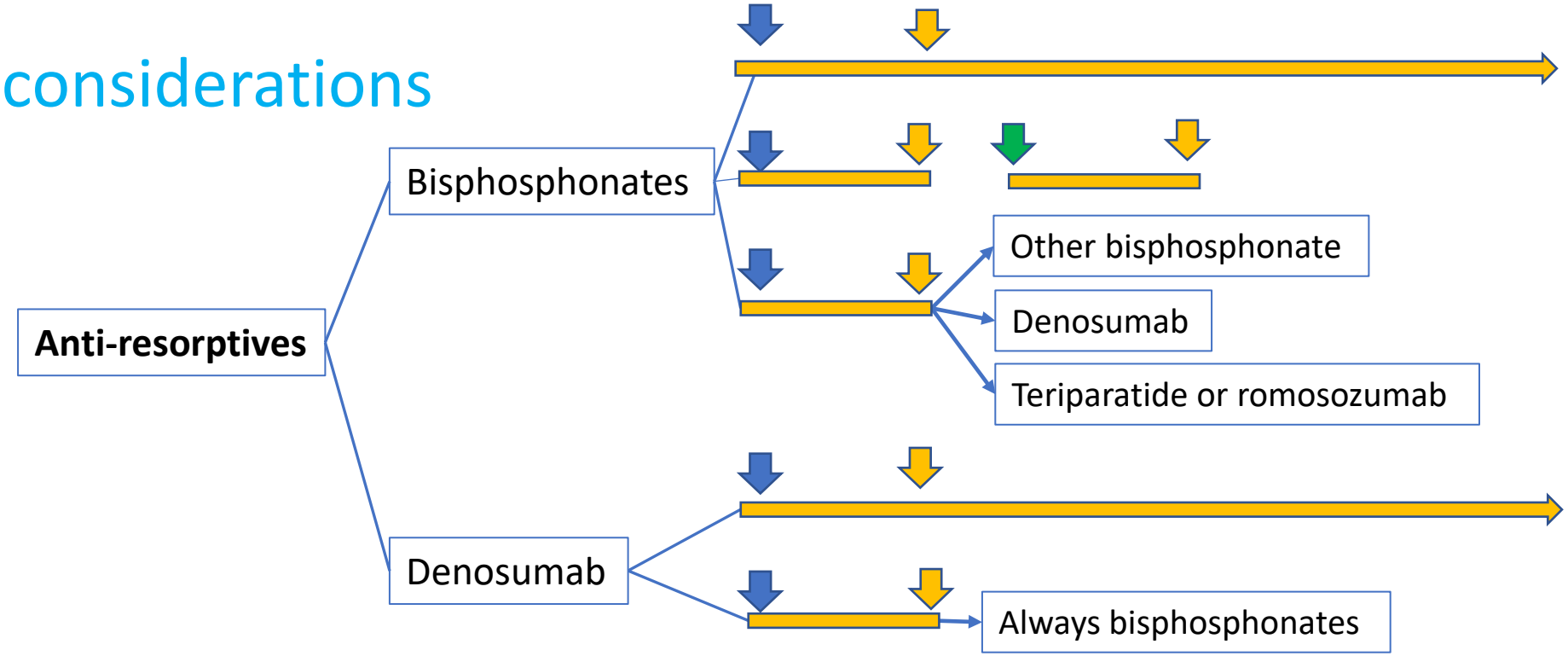
While experts agreed that primary care is the most appropriate setting for long-term osteoporosis care, overall confidence in primary care systems to achieve this was low.

The role of (and responsibility for) adherence monitoring in a resource-limited setting remains to be defined.

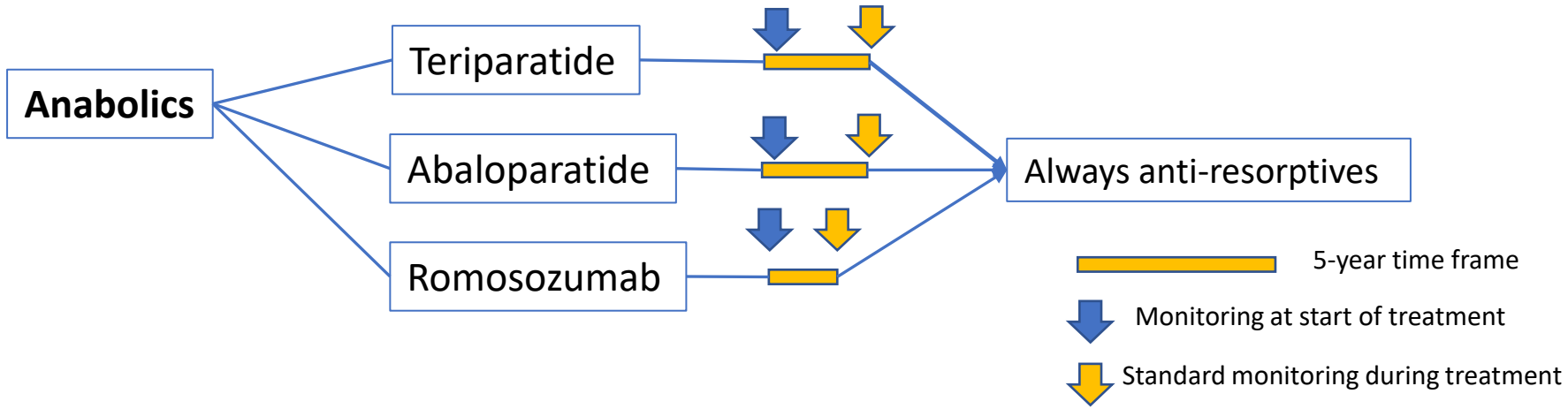
Bennett, OI, 2024

Drug treatment considerations

In high-risk patients



In very high-risk patients



Geusens, Best Pract Res Clin Rheumatol, 2022

Pivotal RCTs on fracture prevention *(since 2003)*

low BMD, prevalent VF and/or recent fracture

Versus placebo:				Inclusion criteria			
				Low BMD		**Vertebral fracture**	**Other**
Alendronate	Black	1996	Lancet			≥1	
	Cummings	1998	JAMA	Low BMD			
Risedronate Reginster	2000	OI				>1	
	Harris	1999	JAMA			≥1	
	McClung	2001	NEJM				low BMD + clinical risks
Raloxifene	Siris	2002	OI	low BMD	and/or	prevalent VF	
Zoledronate	Lyles	2007	NEJM				**recent hip fracture**
Denosumab	Cummings	2009	NEJM	low BMD			
Teriparatide	Neer	2001	NEJM			>1 (or <2 + low BMD)	
Romosozumab	McClung	2014	NEJM	low BMD			
Superiority above risedronate:							
Teriparatide	Kendler	2017	Lancet	low BMD	+	VF	
	Geusens	2018	JBMR	low BMD	+	**recent VF**	
Superiority above alendronate:							
Romosozumab	Saag	2017	NEJM	low BMD	+	VF	**or recent hip fracture**

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Subsequent fractures within 3 years in patients attending the FLS *(n=488)* after extensive examination of the phenotype and treatment according to Dutch guidelines according to prevalent VFs at baseline

53 patients with 60 fractures

Baseline moderate or severe VF: 14%

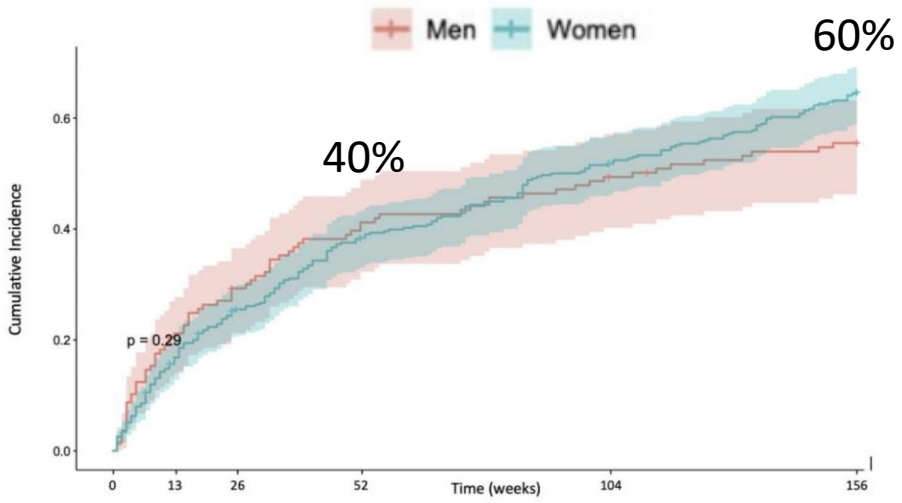
Cumulative incident fractures within 3 years after FLS visit:
After moderate to severe VF: 24%
After no or mild VF: 9%

Table 2 Predictors of refracture: results of the Cox's proportional hazard model

Predictor	Unit of comparison	HR and 95% CI	P value
Gender	Women vs men	1.39 (0.68 to 2.83)	0.362
Age	+5 years	0.97 (0.82 to 1.13)	0.662
Index fracture	Major or hip vs all other	0.68 (0.35 to 1.33)	0.263
BMD	−0.12 g/cm^2	1.30 (0.95 to 1.78)	0.101
Prevalent vertebral fracture	Yes vs no	3.88 (2.07 to 7.27)	<0.0001

Vranken, BMJ Open, 2022

Incidence of falls after FLS *(n=488)*



959 falls (weekly diary)
40% had one fall
5% of falls resulted in a fracture
78% of fractures were fall-related
(half of them after a first fall)

Incidence of fractures (in 53 patients with 60 fractures) after FLS visit *(n=488)*

Table 2 Predictors of refracture: results of the Cox's proportional hazard model

Predictor	Unit of comparison	HR and 95% CI	P value
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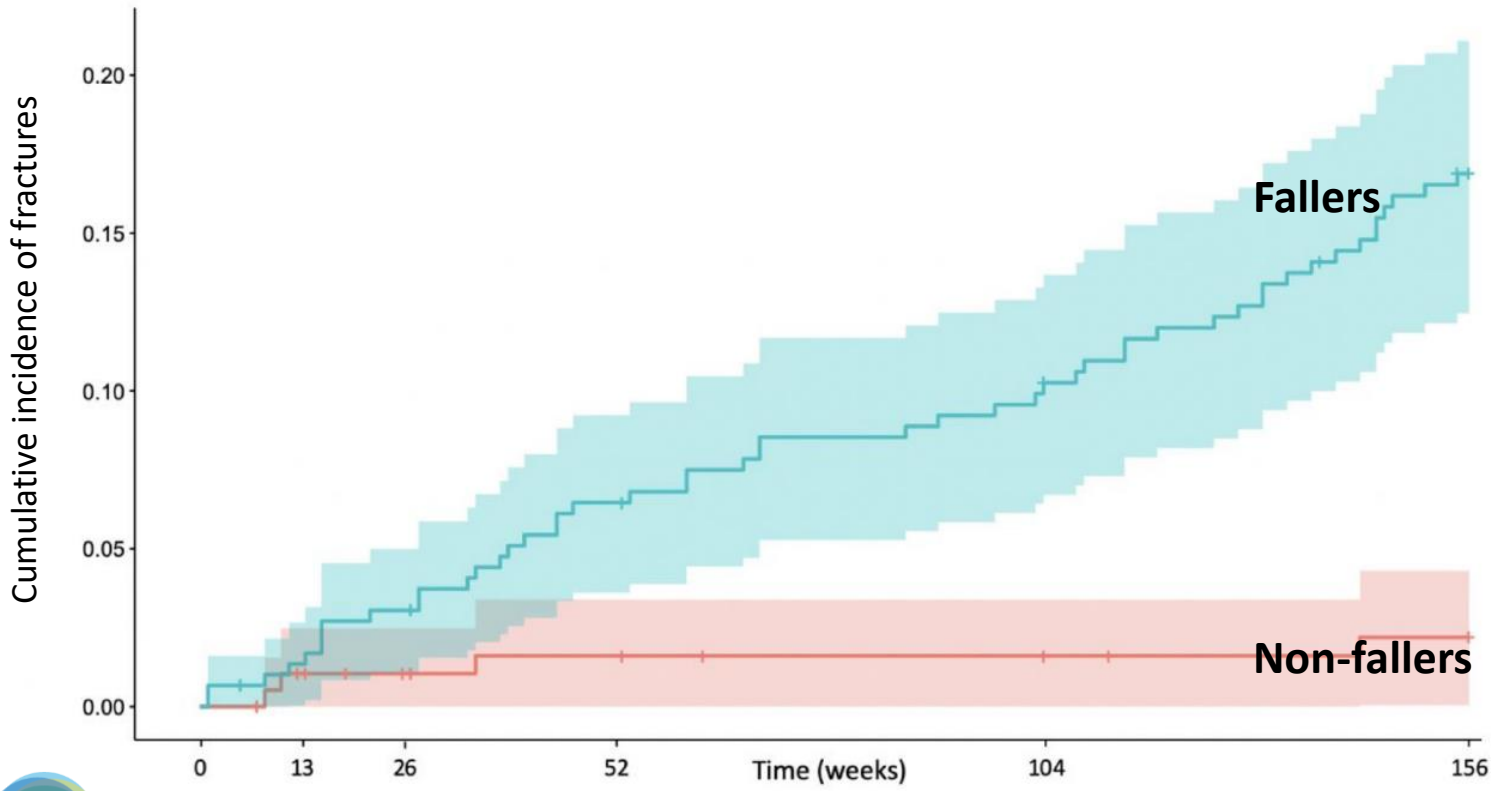
Index fracture	Major or hip vs all other	0.68 (0.35 to 1.33)	0.263
BMD	–0.12 g/cm^2	1.30 (0.95 to 1.78)	0.101
Prevalent vertebral fracture	Yes vs no	3.88 (2.07 to 7.27)	<0.0001
Fall	Yes vs no	8.58 (3.09 to 23.8)	<0.0001

Vranken, BMJ Open, 2022

Incident falls and subsequent fractures in patients attending the FLS
after extensive examination of the phenotype and treatment according to Dutch guidelines



% of patients with an incident fracture:

16.6%

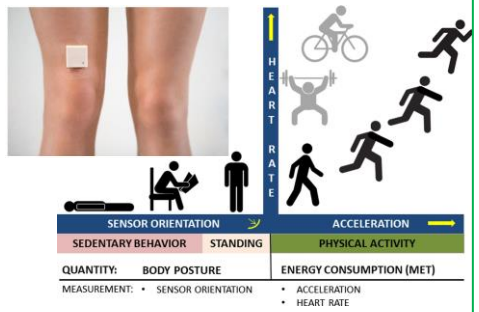
HR: 8.6 (3.1-23.8)

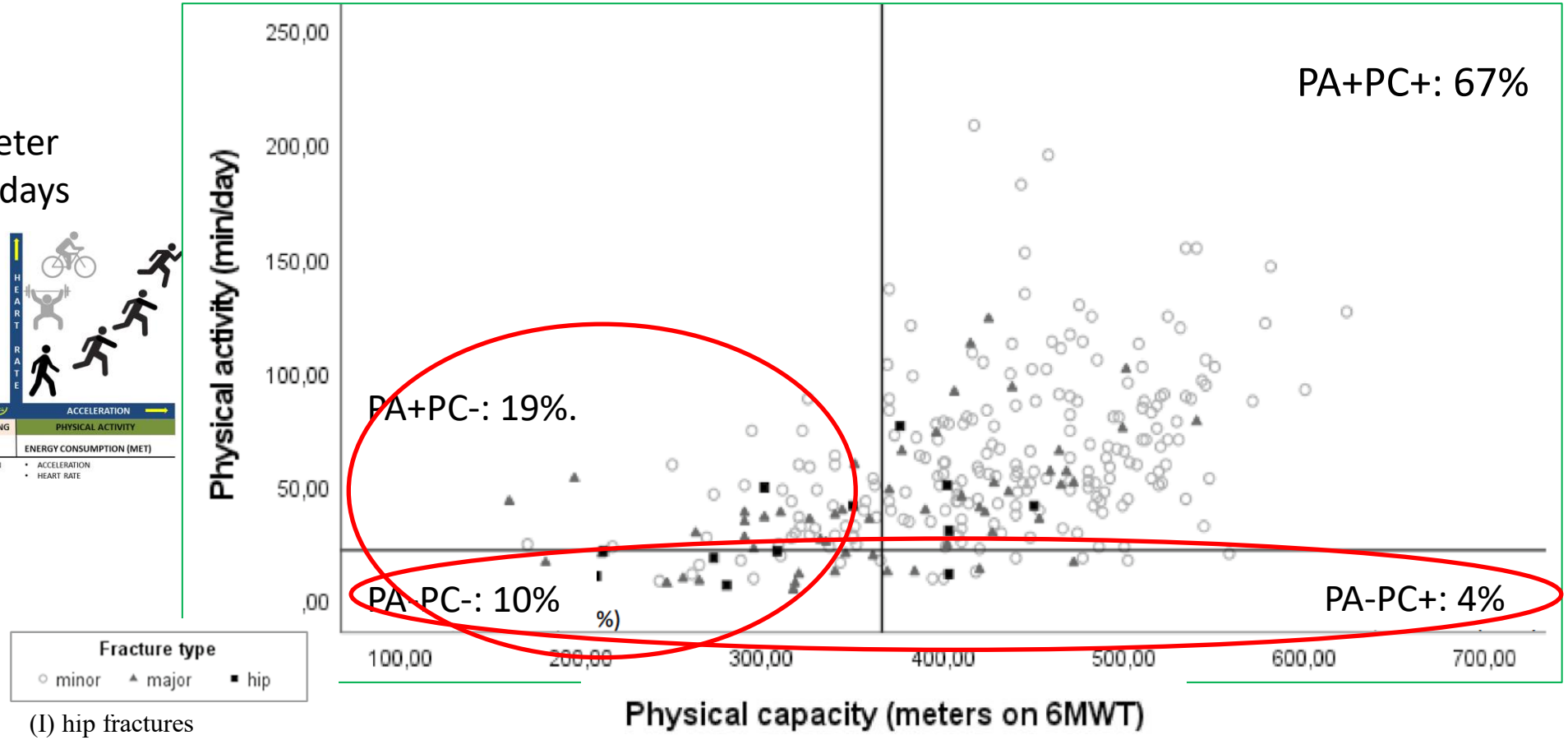
2.1%

Vranken, BMJ Open, 2022

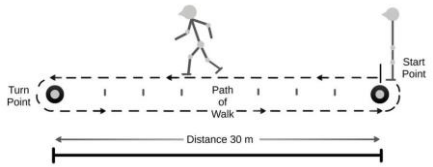
Physical capacity and activity in women after recent clinical fracture at the FLS *(mean age: 65 yrs, n=~400)*

Accelometer during 6 days





(I) hip fractures
(II) major fractures; vertebra, multiple rib, humerus, pelvis, distal femur and proximal tibia,
(III) minor fractures: all other fractures (including finger and toe fractures).

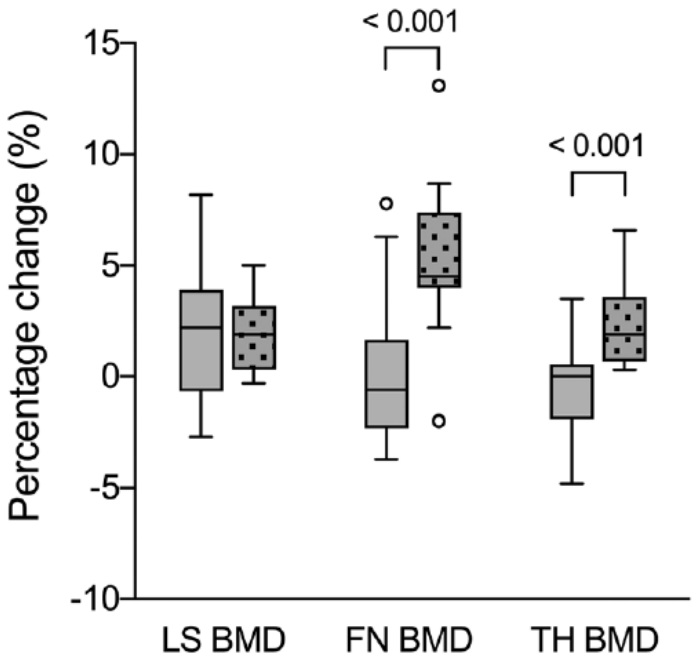


Schene, CTI, 2023

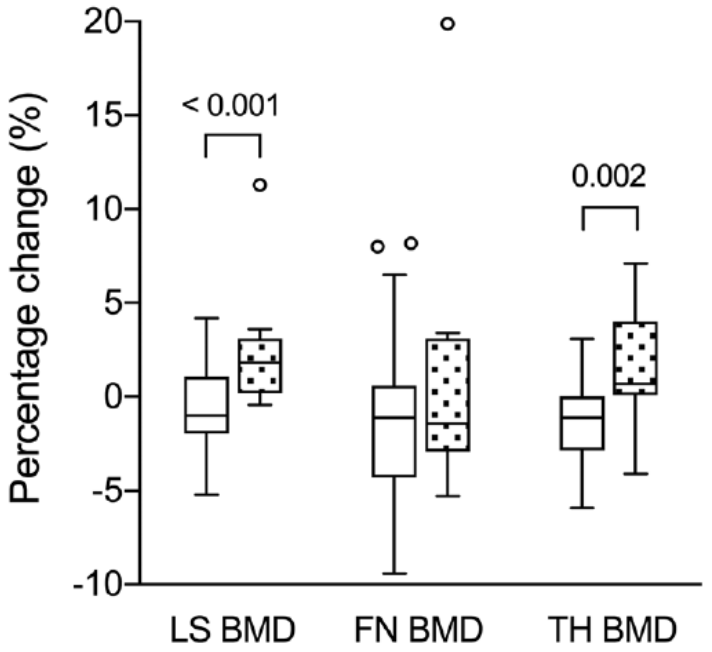
Antiresorptive medication may enhance exercise efficacy on BMD at the proximal femur and lumbar spine

(exploratory analyses)

High-intensity resistance and impact training (HiRIT) versus HiRiT + medication



Low-intensity exercise (Buff Bones® [BB]) versus BB + medication



Chotiyarnwong, JBMR, 2020
Kistler-Fischbacher, JBMR, 2021

Knowledge gaps at the FLS and research agenda

- Fracture risk evaluation
  - Need for refined imminent fracture risk prediction algorithms
  - Need for better prediction of fall risk
  - Role of new evaluation techniques (QCT and other imaging techniques)
- Need for long-term observational studies with adequate methodology
  - Studies about the intensity and sequence of drug treatment after a recent fracture
  - Fall prevention and exercise combined with drug treatment
- Patient preferences and how to approach and treat non-attenders

Considerations for the FLS

1/ Any clinical fracture is a signal for imminent and long-term subsequent fracture risk

2/ Disturbed microarchitecture is a risk factor for fractures beyond aBMD

3/ A full fracture history at the FLS includes imaging of the thoracic and lumbar spine

4/ Patients with a recent clinical fracture have frequently associated diseases and extra-skeletal risk factors

5/ Implementation of the FLS and its effects on subsequent fractures, mortality and falls

Bone Staff

Visiting Professors

Scientific advices

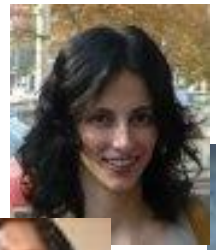
Heads of department

KULeuven

UMaastricht

UHasselt

PhD's



PhD candidates

CAPHRI
Care and Public Health Research Institute

NUTRIM
School of Nutrition and Translational Research in Metabolism

TU/e
Technische Universiteit Eindhoven University of Technology

Thank you

universiteit hasselt
KNOWLEDGE IN ACTION

DE MAASTRICHT STUDIE
uitdaging voor een gezonde leefstijl

Stichting De Weijerhorst

VieCuri
Medisch Centrum voor Noord-Limburg