How to critically appraise a paper

Celia Gregson
Kate Ward
Felicity Fitzgerald
Katharina Kranzer

www.theSAMSON.org

University of BRISTOL

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SAMSON
Sub-Saharan African MuScuIOskeletal Network

Paper 1

Arch Osteoporos (2015) 10: 1
DOI 10.1007/s11657-015-0203-x

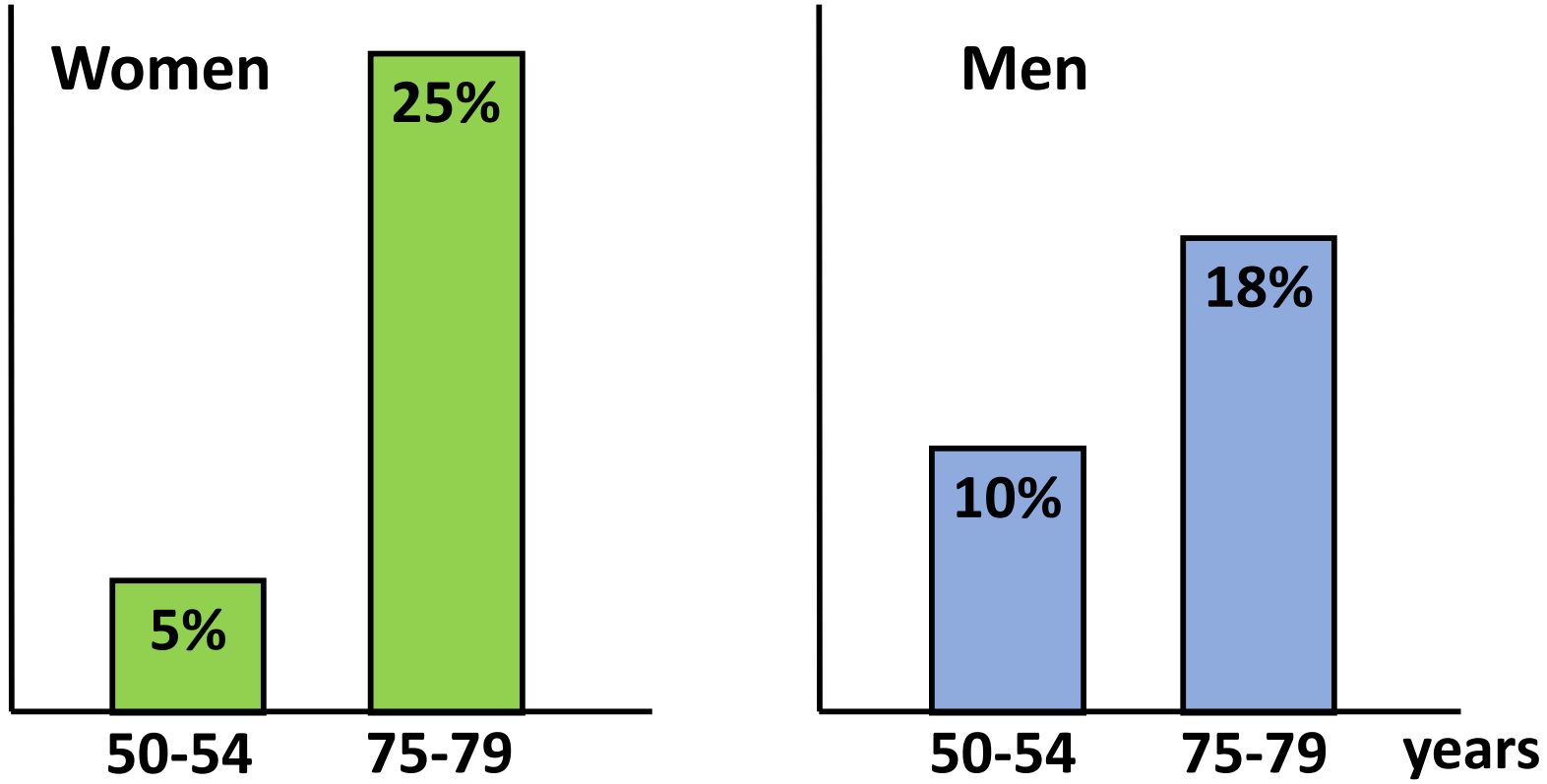
ORIGINAL ARTICLE

Vertebral fracture prevalence in black and white South African women

Magda Conradie · Maria M. Conradie · Alan T. Scher ·
Martin Kidd · Stephen Hough

First paper to estimate prevalence of vertebral fractures in Southern Africa

Prevalence of vertebral fractures in Europe



O'Neill TW et al, J Bone Miner Res, 1996;11:1010-1018

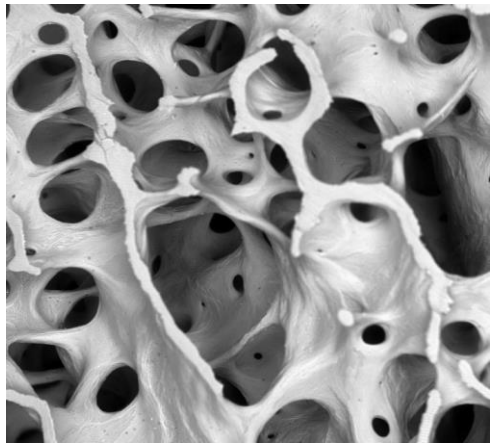
Back Pain and Vertebral Fractures

Amongst 7223 women aged 65+		
No. of fractures	Back pain	Disability by back pain
0	23%	15%
1	41%	28%
2	52%	63%

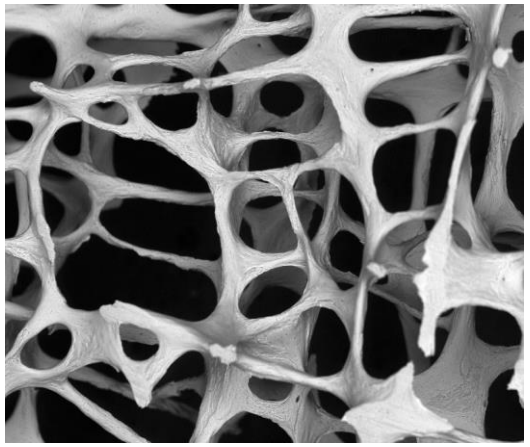
Nevitt et al, Ann Intern Med, May 1998

SOF. US women.

Vertebrae are trabecular rich

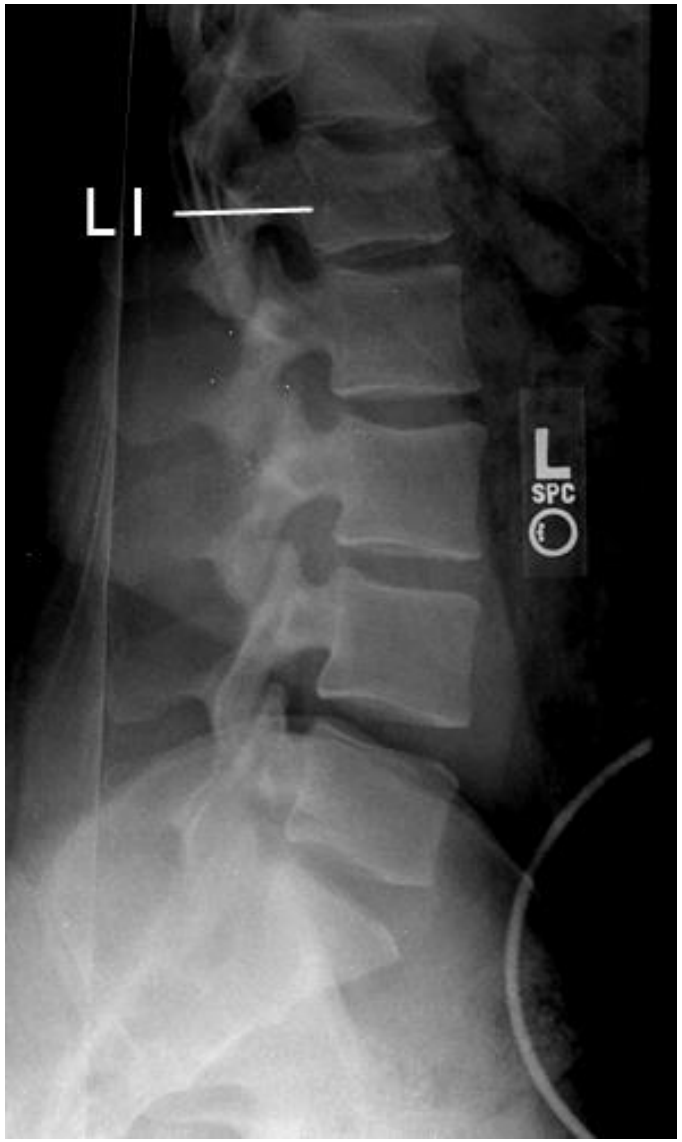


Normal trabecular bone

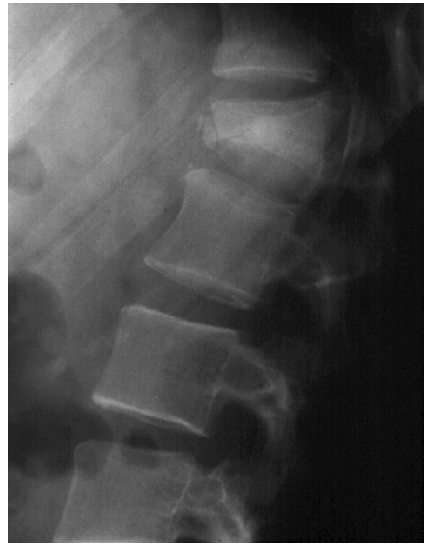


Osteoporotic trabecular bone

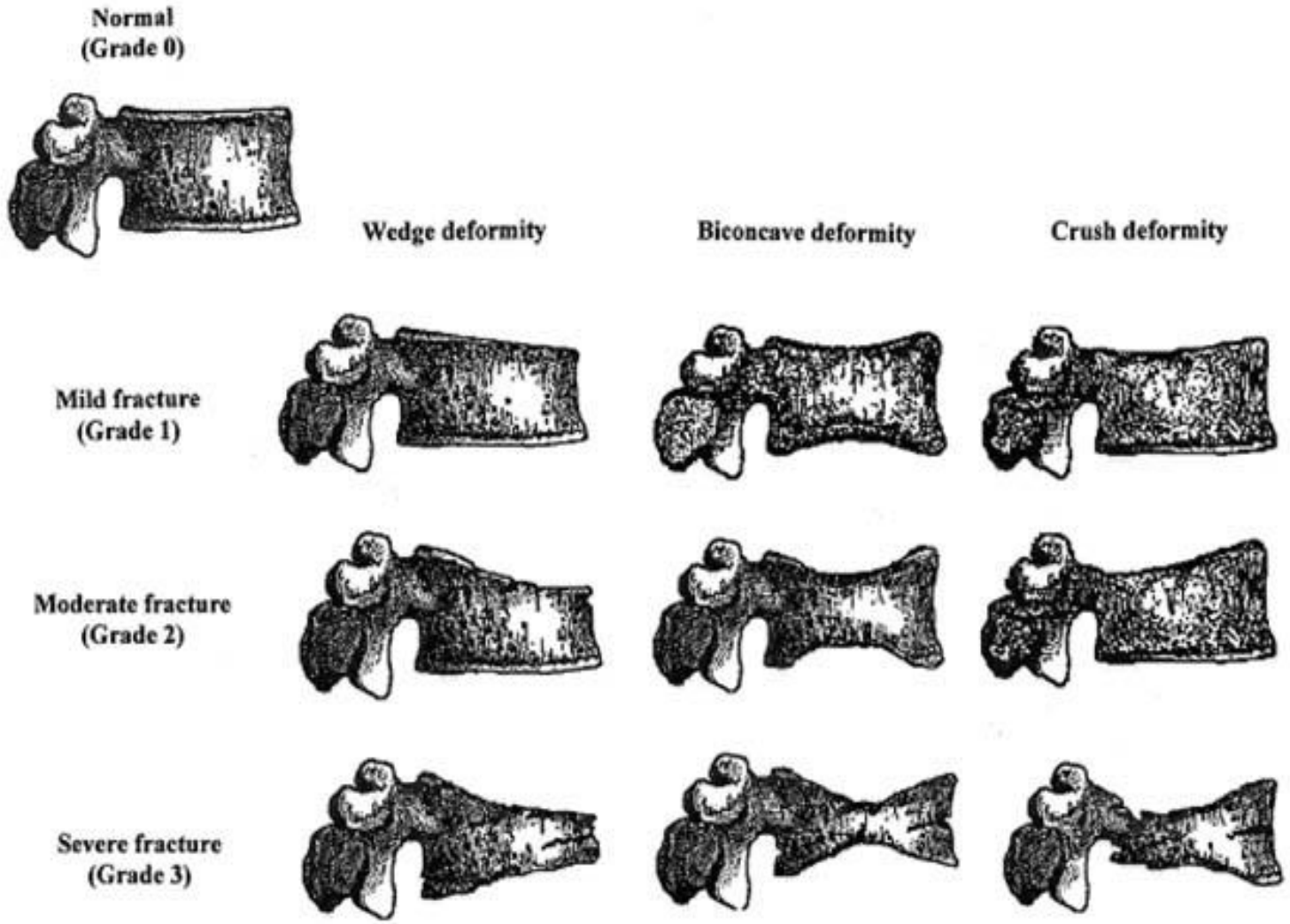
- Attitude: ‘Everyone’ has back pain
- 66% with osteoporotic vertebral #s are ‘asymptomatic’
- Incidental vertebral fractures on imaging studies are common (9.5% to 35%), often unreported (40 to 95%)



1st Lumbar vertebra anterior wedge fracture



Vertebral Fracture Grading



"slight angulation of the superior endplate which may represent a superior endplate fracture“

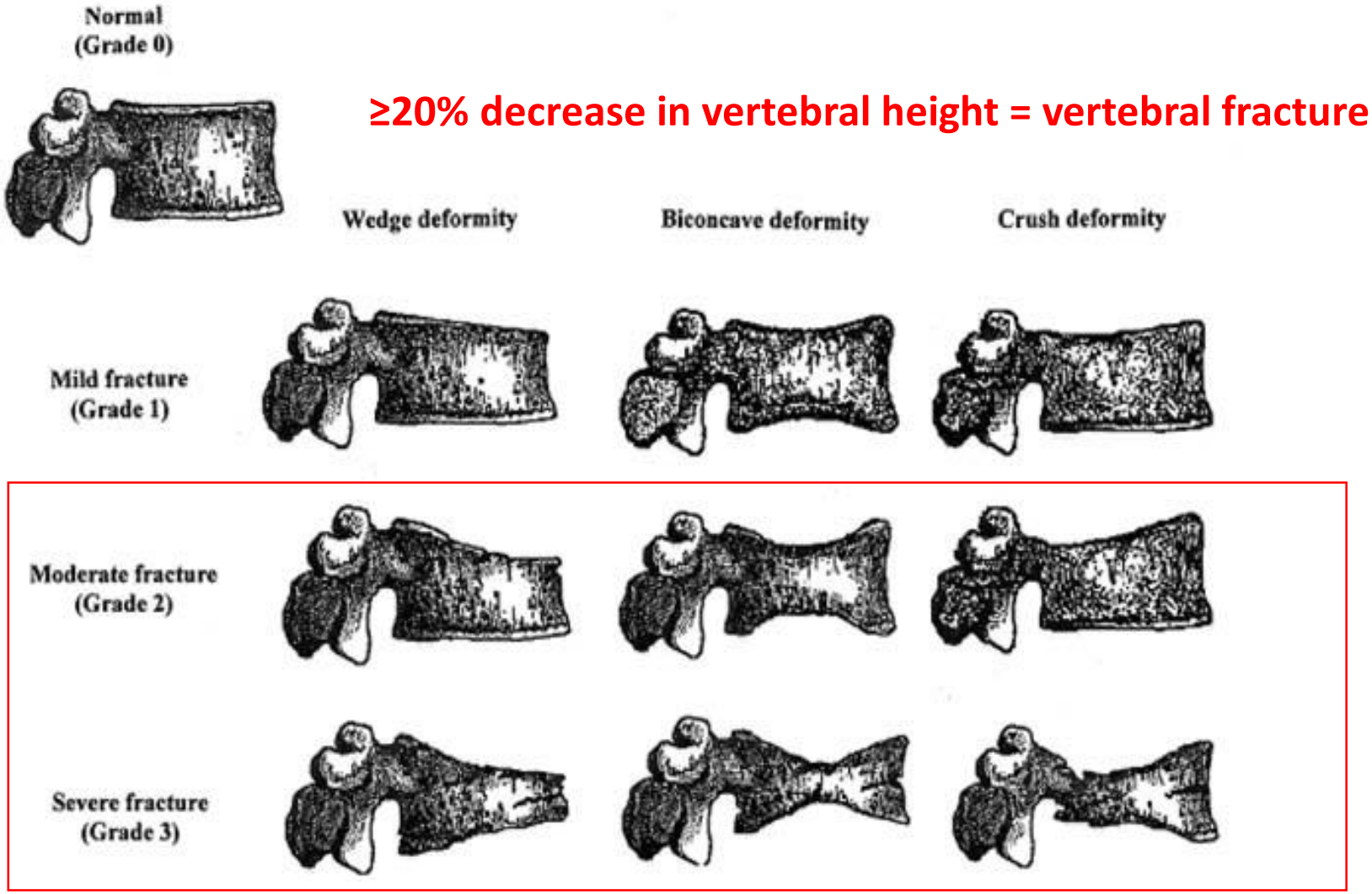
"minor depression of the superior end plate“

"superior end plate indentation“

"wedge deformity” "vertebral deformity“

"wedge collapse“ "minimal anterior wedging” "probably a little loss of height”

Vertebral Fracture Grading



≥20% decrease in vertebral height = vertebral fracture

"slight angulation of the superior endplate which may represent a superior endplate fracture“

"minor depression of the superior end plate“

"superior end plate indentation“

"wedge deformity” "vertebral deformity“

"wedge collapse“ "minimal anterior wedging” "probably a little loss of height”

Questions to consider…

1. Did the study address a clear research question?
2. Are the aims clear specified?
3. What is the study design?
4. Are the methods appropriate to answer the study question?
5. Is the approach to study recruitment appropriate?
6. Are the collected data valid?
7. Are any data at risk of measurement error? Are measures reliable and reproducible?
8. How have the authors addressed confounding?
9. What bias could have been introduced by methods used/ what approaches were made to minimise bias?
10. Are case definitions clear and correct?
11. Are the methods sufficiently detailed that you could reproduce this study?
12. Do the results answer the study questions?
13. What are the principal findings?
14. How were those who declined to participate managed?
15. Do you believe the results?
16. Can the results be applied to the local population?
17. Do the results fit with other available evidence?
18. What are the implications of these results?

Paper 1 tables

Table 1 Characteristics of black women and white women by prevalent vertebral fracture status

	Black		White	
	No fracture	Fracture	No fracture	Fracture
N (%)	80 (91 %)	8 (9 %)	96 (95 %)	5 (5 %)
Age (yrs)	55.2±10.7	56.5±7.5***	53.5±11.0	67.0±14.3*
Weight (kg)	86±19.1	75.3±14.1	70.4±15.0**	70.3±18.7
Height (cm)	160±6.3	160±3.9	164.3±6.9	160.8±11.7
BMI (kg/cm^2)	34±7.9	30±6.1	26±5.4**	27±5.7
Waist-hip circumference (cm)	0.87±0.11	0.90±0.15	0.80±0.1**	0.81±0.13
Family history + (%)	1 %	0 %	27 %	20 %
Postmenopausal (yes) *N* (% of cohort)	53 (66 %)	7 (88 %)	57 (59 %)	5 (100 %)
No outdoor physical activity (%)	54 %**	63 %	35 %	80 %*
Smoking (pack-years)	0.9±2.3	0	4.7±11**	0
Parity (*n*)	4.2±2.4**	4.7±2.7	2.5±156	3±3.1
Dietary calcium intake (mg/d)	597±244**	701±232	868±250	908±470
Alcohol intake (U/week)	4.3±10.3	3.8±5.3	2.5±4.1	7±9.9
Any falls last 12 months (%)	17.5 %	38 %	28 %	20 %
Quadriceps strength (kg)	26.3±9.9**	24.3±9.2	31.9±7.5	20±8.2*
Lateral sway (mm)	18.2±12.2**	12.9±8.0	12.5±7.8	24.1±17.7*
Reaction time (ms)	446±211**	450±155	282±56	345±147*

Values reported are the mean±SD or % when stated

*$p \leq 0.05$ for no fracture vs. with fracture within race; **$p \leq 0.05$ for no fracture black women vs. no fracture white women; ***$p \leq 0.05$ for with fracture black women vs. with fracture white women

Table 2 Prevalence of non-vertebral fracture in black women and white women by prevalent vertebral fracture status

	Black		White	
	No fracture	Fracture	No fracture	Fracture
N	80	8	96	5
[a]Total number of fractures	13 (16%)	3 (38 %)	10 (10%)	1 (20%)
Upper limb	2	2	4	0
Humerus	1	0	0	0
Wrist	1	0	3	0
Lower limb	11	1	4	1
Hip	0	0	0	1
Tibia/fibula	5	0	1	0
Ankle	5	1	2	0
Tarsal bones	1	0	1	0
Rib	0	0	1	0
Pelvis	0	0	1	0

[a] Values reported as total number of fractures and percentage of respective cohort in parenthesis

Table 3 BMD data by prevalent vertebral fracture status in black and white women

	Black		White	
	No fracture	Fracture	No fracture	Fracture
N (%)	80 (91 %)	8 (9 %)	96 (95 %)	5 (5 %)
Lumbar spine				
BMD (g/cm^2)	1.015±0.19	0.852±0.18*	1.004±0.17	0.895±0.15
T-score[a]	−0.46±1.96	−1.6±1.6*	−0.76±1.59	−1.38±1.32
Z-score	0.61±1.39	−0.43±1.97*	0.85±1.81	0.50±1.55
Osteopenia[a] *N* (%)	23 (42.1 %)	6 (75 %)	26 (46 %)	3 (60 %)
Osteoporosis[a] *N* (%)	6 (11.1 %)	2 (25 %)	8 (14 %)	1 (20 %)
Femoral neck				
BMD (g/cm^2)	0.867±0.14	0.717±0.06*	0.764±0.13**	0.606±0.05*,***
T-score	−0.04±1.23	−1.22±0.59*	−1.12±1.13**	−2.2±0.46*,***
Z-score	1.21±1.20	−0.07±0.69*	0.18±1.15**	−0.52±0.51
Osteopenia[a] *N* (%)	10 (19 %)	6 (75 %)	33 (58 %)	5 (100 %)
Osteoporosis[a] *N* (%)	0	0	4 (7 %)	2 (40 %)
Total hip				
BMD (g/cm^2)	1.005±0.16	0.808±0.06*	0.907±0.14**	0.742±0.10*
T-score[a]	0.37±1.28	−1.19±0.50*	−0.55±1.18**	−1.64±0.78*
Z-score	1.31±1.23	−0.29±0.66*	0.41±1.14**	−0.25±0.45
Osteopenia[a] *N* (%)	10 (19 %)	6 (75 %)	25 (44 %)	4 (80 %)
Osteoporosis[a] *N* (%)	1 (2 %)	0	1 (2 %)	1 (20 %)

[a] Determined in postmenopausal women only according to WHO criteria. BMD measured against normative NHANES III white reference population [35]

*$p \leq 0.05$ for no fracture vs. with fracture within race; **$p \leq 0.05$ for no fracture black women vs. no fracture white women; ***$p \leq 0.05$ for with fracture black women vs. with fracture white women

Table 4 Spinal and femoral neck BMAD, vertebral bone area or ultrasonography by prevalent vertebral fracture status in black and white women

	Black		White	
	No fracture	Fracture	No fracture	Fracture
N (%)	80 (91)	8 (9)	96 (95)	5 (5)
Lumbar spine				
BMAD(g/cm^3)	0.135±0.02	0.115±0.02*	0.130±0.02	0.110±0.01*
Lumbar spine geometry				
Vertebral BA (cm^2)	57±5.3**	55±6.9	59.6±5.2	61.7±8.0
Femoral neck				
BMAD (g/cm^3)	0.163±0.03	0.135±0.01*	0.140±0.02**	0.106±0.01*,***
Calcaneal ultrasonography				
BMD (g/cm^2)	0.555±0.17	0.466±0.1	0.503±0.127**	0.407±0.104
T-score[a]	−0.22±1.50	−1.03±0.89	−0.70±1.13**	−1.56±0.93
BUA (dB/MHz)	76±25	63±16	68±18**	55±14*
SOS (m/s)	1561±42	1539±23	1548±33**	1524±28
QUI	100.1±26.8	85.8±15.6	91.6±20.03**	76.4±16.4

[a] Referring to postmenopausal women only

*$p \leq 0.05$ for no fracture vs. fracture within race; **$p \leq 0.05$ for no fracture black women vs. no fracture white women; ***$p \leq 0.05$ for with fracture black women vs. with fracture white women

Paper 1 - Summary

- Cross-sectional study to establish prevalence
- Prevalence studies need to recruit a representative sample of the underlying popn
- Their case definition for their outcome (vertebral fracture) was incorrect
- No inter-rater or intra-rater agreement was assessed for their outcome
- Also note the p value threshold approach and the tendency to just report p values in the results section rather than point estimates and 95% CIs

Paper 2

J Musculoskelet Neuronal Interact 2014; 14(3):276-285

Original Article

Hylonome

Osteogenic effects of a physical activity intervention in South African black children

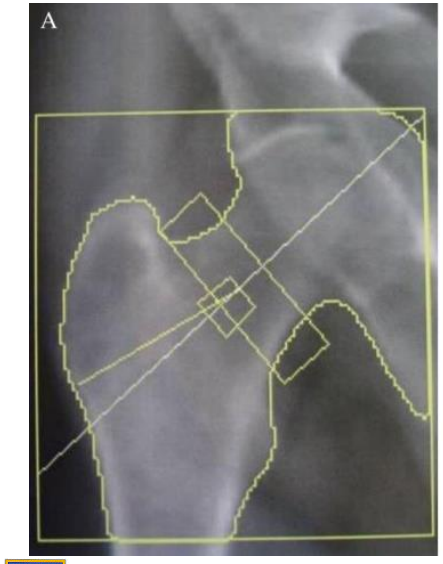
R.M. Meiring[1], L.K. Micklesfield[2], I. Avidon[1], J.A. McVeigh[1]

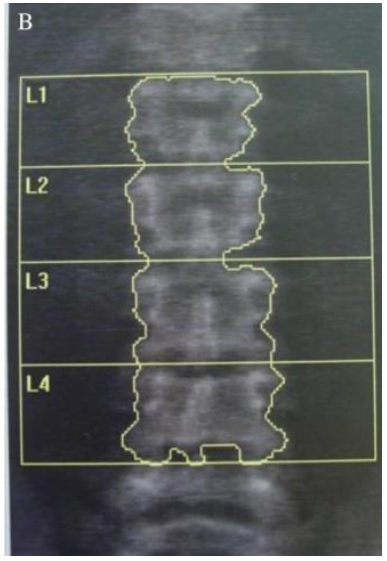
[1]Exercise Laboratory, School of Physiology, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa;
[2]MRC/WITS Developmental Pathways for Health Research Unit, Department of Pediatrics, School of Clinical Medicine, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

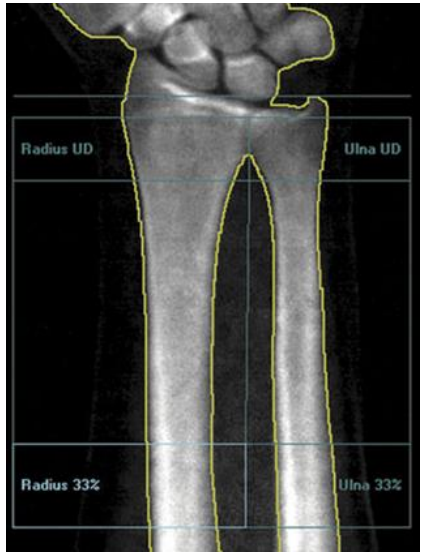
Randomised control of a physical intervention aiming to stimulate osteogenesis i.e. ‘bone growth’

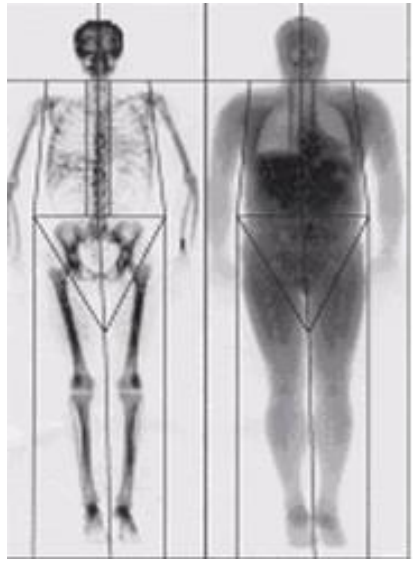
Dual-energy X-ray absorptiometry (DXA)

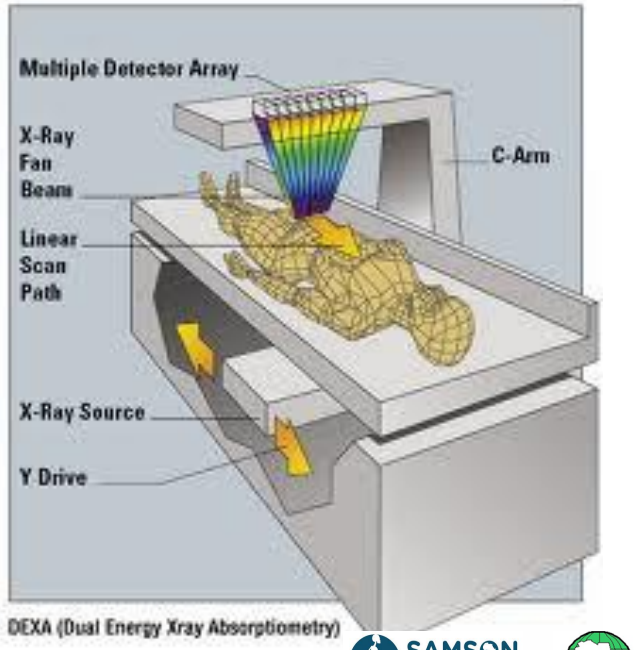
- Takes 1-2 mins per scan
- Very low dose radiation (6.7microSv)
  - Hip, Lumbar Spine, Wrist, Total body
- Reliable & repeatable
- Measure *areal* BMD (bone mineral density)





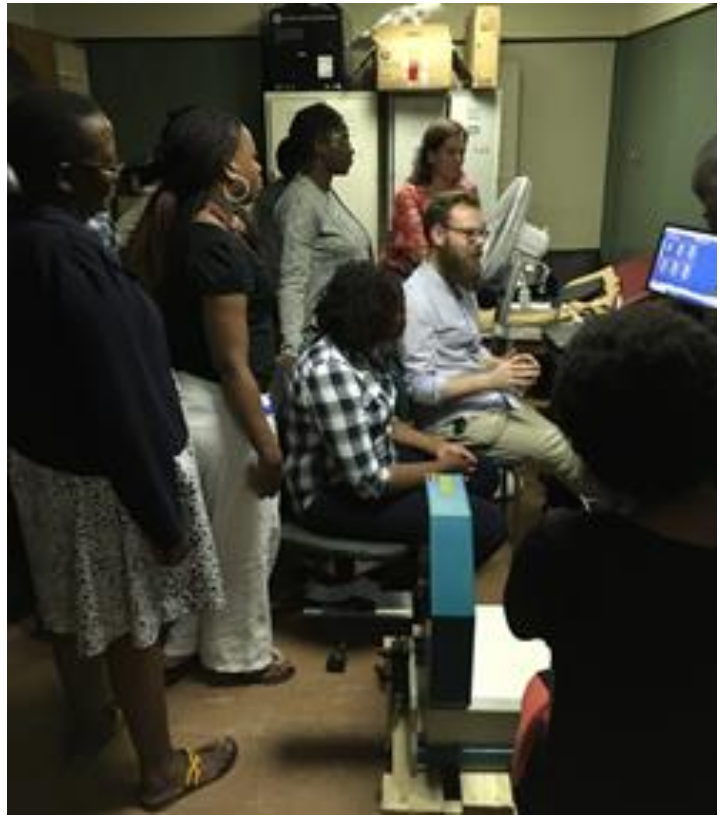


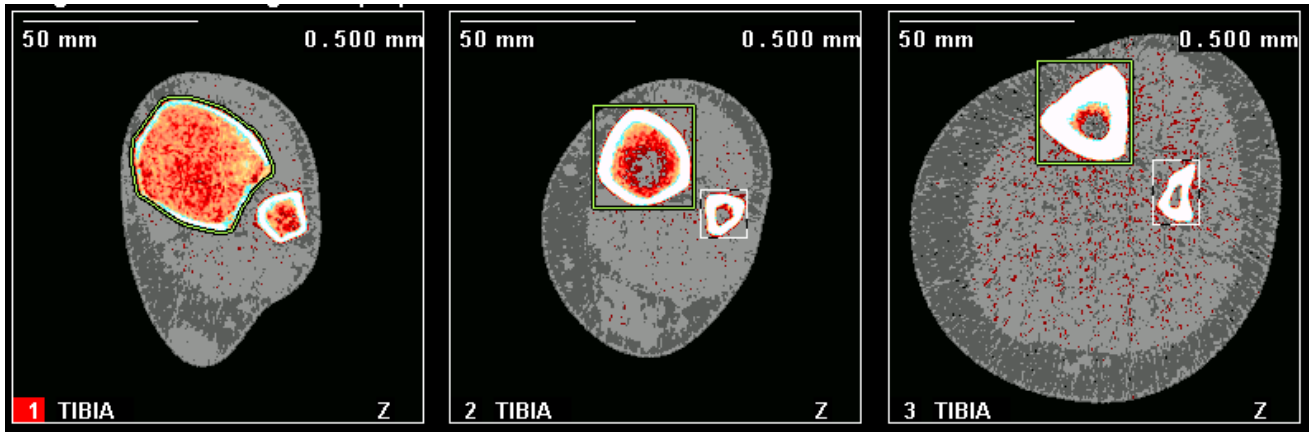




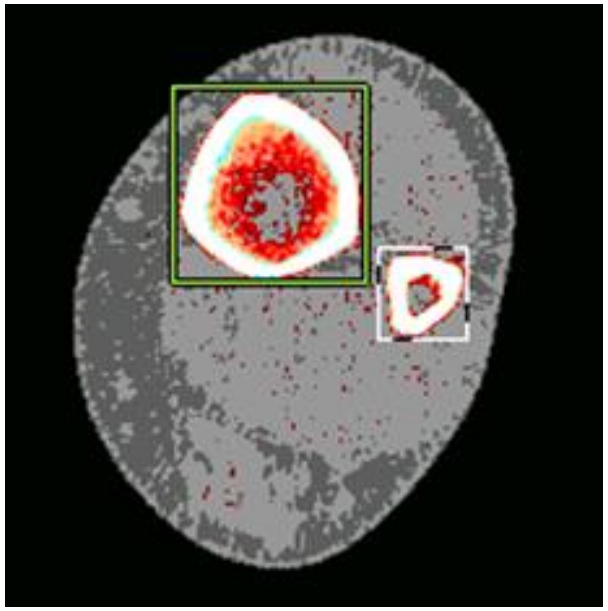
pQCT: peripheral Quantitative Computer Tomography

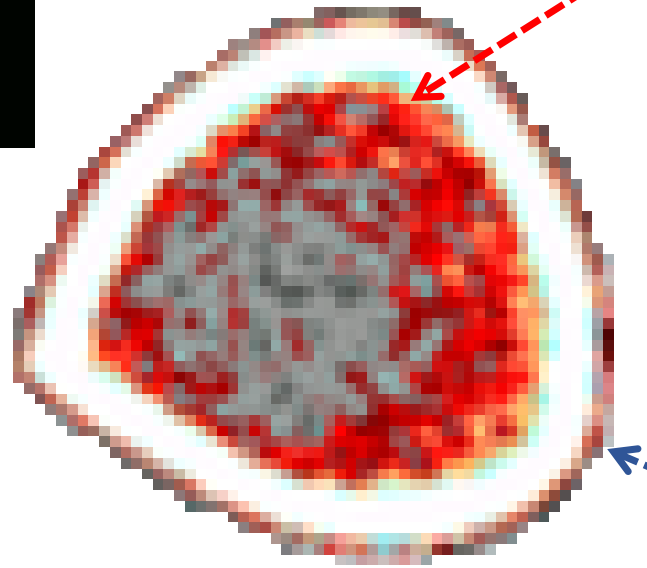
Scan site	Upper and lower limbs
Radiation	Very low
Movement artefact	++
Cost	$$

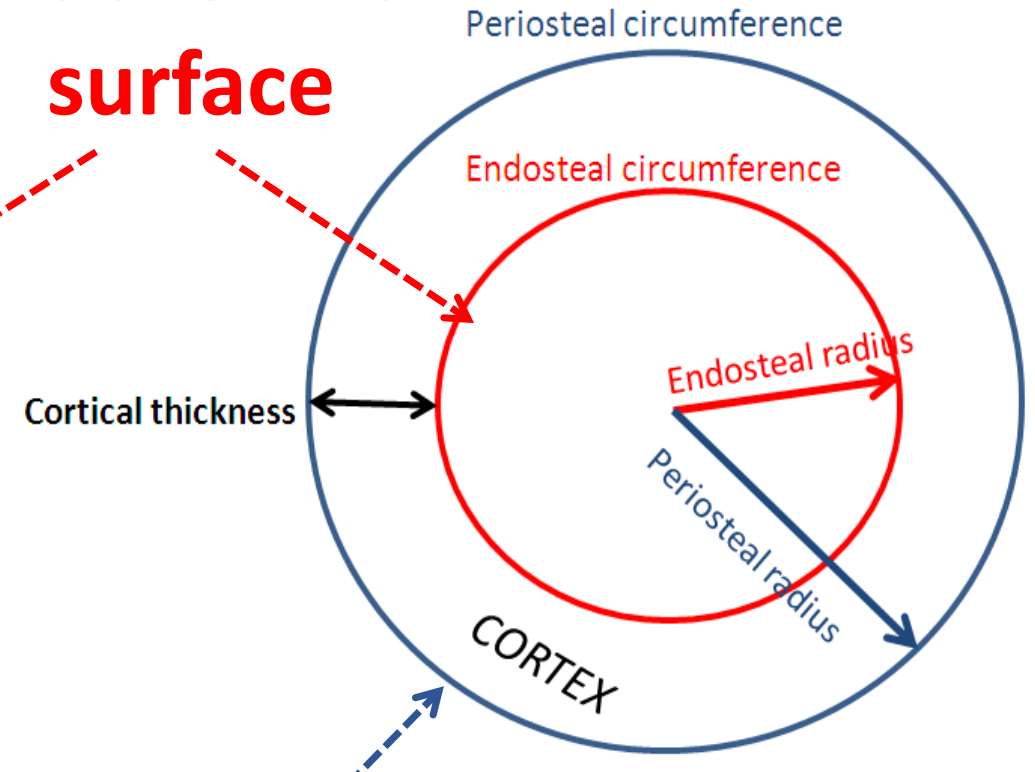




Volumetric BMD (vBMD) can be measured by pQCT

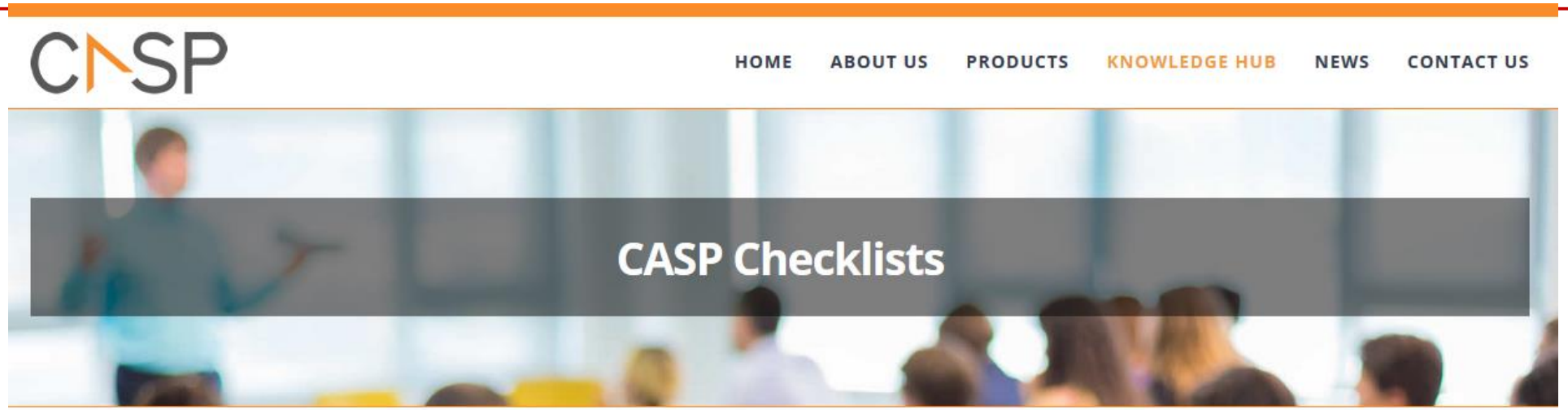






Gregson et al. Bone (2013) 52(1):380-8

CASP Checklist for Randomised Controlled Trials



This set of eight critical appraisal tools are designed to be used when reading research, these include tools for Systematic Reviews, Randomised Controlled Trials, Cohort Studies, Case Control Studies, Economic Evaluations, Diagnostic Studies, Qualitative studies and Clinical Prediction Rule.

These are free to download and can be used by anyone under the Creative Commons License.

CASP Appraisal Checklists

(click to download either a version to print and handfill, or a version to fill in electronically)

Print

(print a paper version to fill in by hand, then file away for future reference)

Edit electronically

(save the file to your computer first, complete your appraisal and then save with the name of the paper)

- KNOWLEDGE HUB
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- GLOSSARY
- USEFUL LINKS
- BIBLIOGRAPHY

CASP Checklist for Randomised Controlled Trials

CASP
Critical Appraisal Skills Programme

www.casp-uk.net
info@casp-uk.net
Summertown Pavilion, Middle Way Oxford OX2 7LG

CASP Checklist: 11 questions to help you make sense of a **Randomised Controlled Trial**

How to use this appraisal tool: Three broad issues need to be considered when appraising a trial:

- Are the results of the study valid? (Section A)
- What are the results? (Section B)
- Will the results help locally? (Section C)

CASP Section A: Are the results of the study valid?

1. Did the trial address a clearly focused issue?
2. Was the assignment of patients to treatment randomised?
3. Were all the children who entered the trial properly accounted for at its conclusion?

Is it worth continuing?

4. Were patients, health workers and study personnel 'blind' to the intervention?
5. Were the groups similar at the start of the trial?
6. Aside from the experimental intervention, were the groups treated equally?

CASP Section B: What are the results?

7. What are the results?
8. How large was the intervention effect?
9. Is the primary outcome clearly specified?
10. How precise was the estimate of the intervention effect?

CASP Section C: Will the results help locally?

11. Can the results be applied to the local population or in your context?
12. Were all clinically important outcomes considered?
13. Are the benefits worth the harms and costs?

Paper 2 Figures and Tables

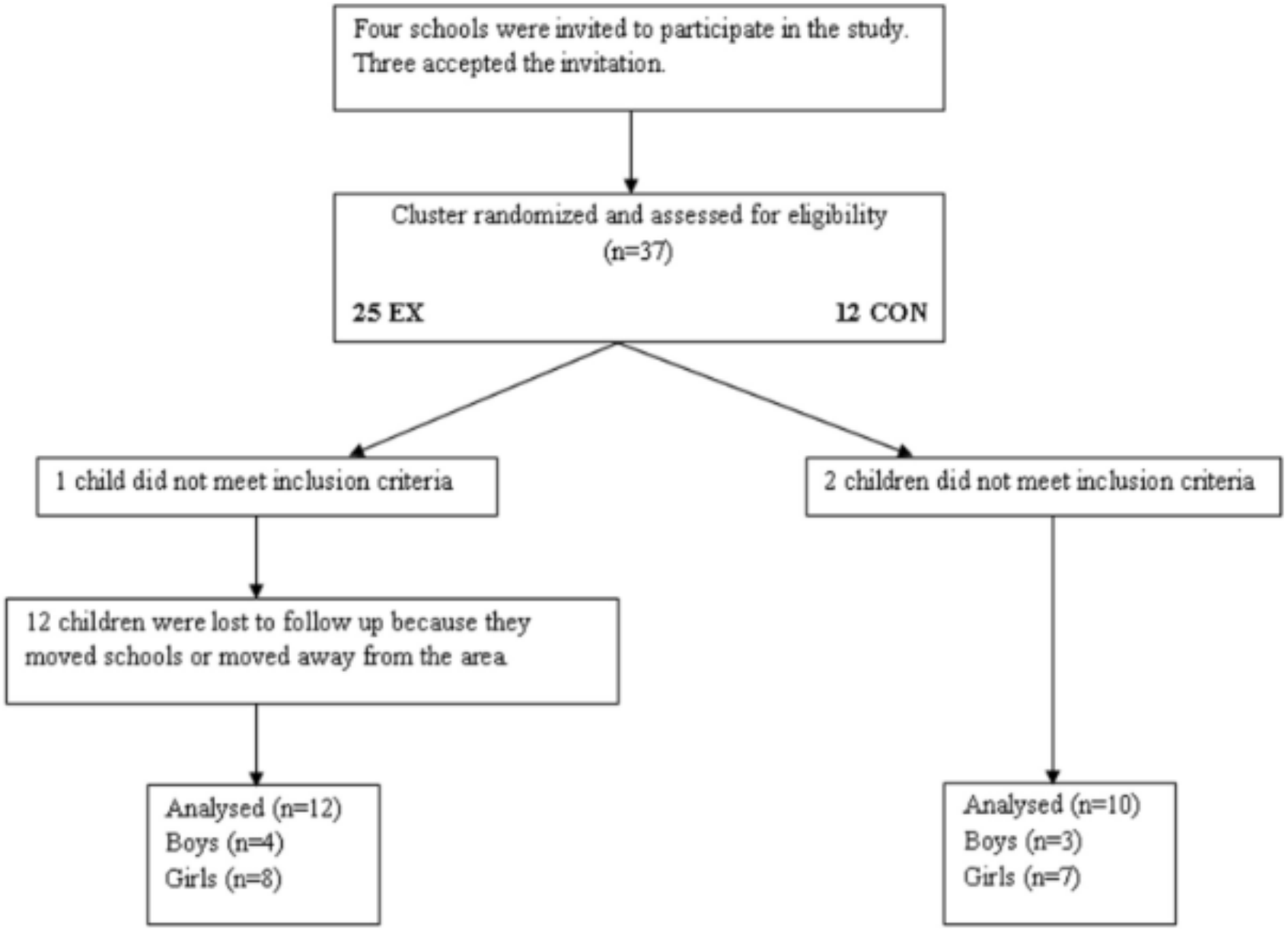

Figure 1. Flow of participants through the study. EX (exercise group), CON (control group).

	Control (n=10)			Exercise (n=12)		
	Baseline (SD)	Post-intervention (SD)	Δ (95% CI)	Baseline (SD)	Post-Intervention (SD)	Δ (95% CI)
Age	9.3 (0.9)		-	9.7 (1.2)		-
Boys (n)	3	3	-	4	4	-
Tanner stage I/II/III (n)	9/1/0	5/3/2	-	5/7/0	5/6/1	-
Height (cm)	135.1 (8.2)	136.9 (8.6)	1.8 (1.2-2.4)	135.9 (8.7)	139.0 (9.2)	3.1 (2.1-4.2)[a]
Weight (kg)	30.6 (4.7)	31.6 (4.7)	1.0 (0.2-1.7)	30.0 (5.1)	31.6 (5.7)	1.6 (0.7-2.4)
BMI percentile	57.4 (22.4)	52.3 (23.9)	-5.1 (-15.0-4.9)	39.7 (20.1)	36.6 (21.8)	-3.1 (-8.6-2.4)
Fat mass (kg)	7.5 (1.9)	8.0 (2.2)	0.4 (-0.1-1.0)	6.7 (1.8)	7.0 (1.7)	0.3 (0.04-0.7)
Whole body lean mass (kg)	21.4 (3.9)	22.7 (4.1)	1.2 (0.8-1.7)	21.9 (3.8)	23.5 (4.2)	1.6 (0.9-2.3)
% body fat	25.2 (5.4)	25.2 (5.7)	-0.02 (-1.3-1.3)	22.5 (3.8)	22.2 (3.1)	-0.3 (-1.3-0.7)
Leg muscle CSA (mm^2)	3281.0 (432.2)	3298.2 (421.5)	58.1 (-6.4-122.5)	2948.5 (414.9)	3142.4 (494.2)	193.9 (112.8-275.1)[a]
Leg fat CSA (mm^2)	1684.4 (129.1)	1645.8 (172.4)	-5.6 (-13.3-2.0)	1538.0 (222.0)	1534.4 (225.3)	-3.6 (-13.1-5.9)
Tibial length (mm)	313.7 (24.4)	321.6 (22.4)	7.9 (2.3-13.4)	319.3 (28.4)	319.6 (24.5)	0.3 (-4.7-5.4)

[a] Change is significantly greater in the intervention group, $p<0.05$. Cross sectional area (CSA).

Table 1. Baseline and change (where relevant) descriptive characteristics for control and exercising groups.

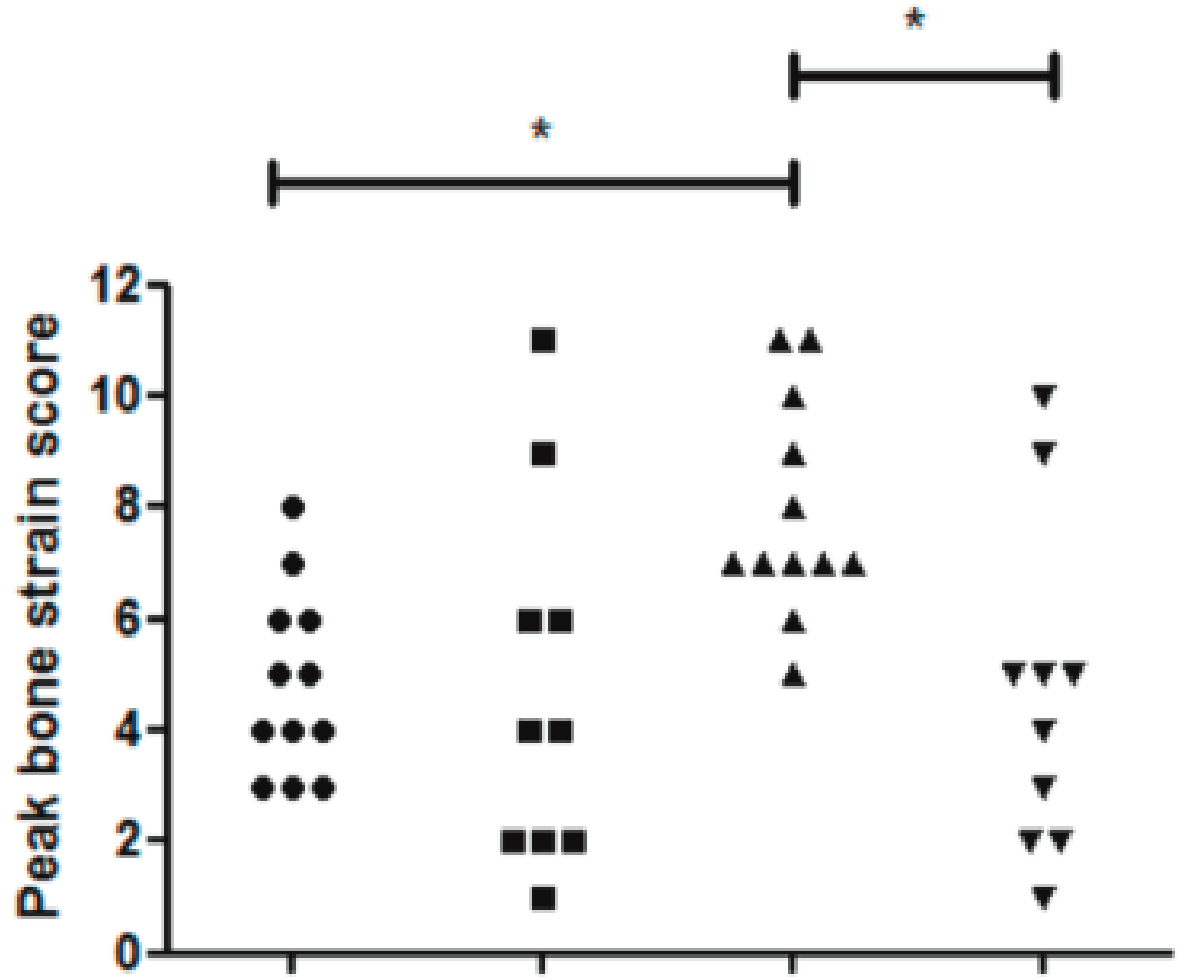

Figure 2. Peak bone strain score (PBSS) for the exercise (EX) and control (CON) groups before and after the 20-week intervention. PBSS was similar before the intervention between groups (p=0.53) but was significantly higher in the exercising group (* p<0.001) after the 20-week intervention. ● = EX baseline, ■ = CON baseline, ▲= EX post-intervention, ▼= CON post-intervention.

	Control			Exercise			Adjusted p-values		
	Baseline	Post-intervention	Δ (95% CI)	Baseline	Post-intervention	Δ (95% CI)	Time	Group	Time*group
Femoral neck BMC (g)	2.7 (0.4)	2.7 (0.3)	-0.01 (-0.1-0.1)	2.9 (0.5)	3.0 (0.5)	0.1 (0.01-0.1)	0.04	0.19	0.25
Hip BMC (g)	16.3 (2.9)	16.5 (3.1)	0.2 (-0.5-1.0)	17.6 (4.9)	18.7 (5.5)	1.0 (-0.01-1.9)	<0.001	0.45	0.04
Spine BMC (g)	23.4 (4.6)	24.4 (4.7)	1.0 (-0.03-2.0)	23.1 (5.5)	24.3 (6.2)	1.3 (0.5-2.1)	<0.001	0.77	0.44
Radius BMC (g)	3.4 (0.5)	3.6 (0.6)	0.2 (0.1-0.2)	3.6 (0.8)	3.8 (0.8)	0.2 (0.1-0.3)	<0.001	0.35	0.69
Ulna BMC (g)	2.3 (0.4)	2.5 (0.4)	0.2 (0.1-0.2)	2.5 (0.6)	2.7 (0.6)	0.2 (0.1-0.2)	<0.001	0.11	0.57
Whole body BMC (g)	753.7 (103.6)	792.9 (116.7)	39.3 (23.2-55.3)	778.4 (164.0)	822.6 (195.5)	35.3 (17.3-53.3)	<0.001	0.62	0.55

Baseline and follow up data are unadjusted mean (SD). DXA change data are represented as mean (95% CI) and are adjusted for sex, Tanner at follow-up and change in bone area.

Table 2. Site-specific baseline and 20-week change in bone mineral content (BMC) measures by DXA.

	Control			Exercise			Adjusted p-values		
	Baseline	Post-intervention	Δ (95% CI)	Baseline	Post-intervention	Δ (95% CI)	Time	Group	Time*group
4% Tibia									
ToA	738.5 (86.8)	741.3 (99.7)	2.8 (-7.1-12.7)	802.0 (136.9)	847.8 (146.3)	48.8 (37.0-60.5)[a]	0.13	0.22	0.34
ToD	319.6 (46.7)	306.2 (41.2)	-13.4 (-19.5- -7.3)	304.6 (22.1)	306.2 (19.7)	2.3 (-5.5-10.2)[a]	0.10	0.23	0.004
TrbD	291.4 (59.1)	264.1 (54.1)	-27.3 (-36.9- -17.6)	270.2 (29.2)	277.2 (24.6)	8.9 (-2.8-20.6)[a]	0.13	0.23	0.003
BSI	7685.4 (2470.6)	7095.6 (2270.7)	-589.8 (-828.0- -351.6)	7503.6 (1753.1)	7978.2 (1688.1)	545.6 (209.2-882.1)[a]	0.82	0.61	0.006
38% Tibia									
CoA	160.9 (17.5)	170.1 (17.2)	9.1 (6.6-11.6)[b]	165.7 (26.1)	170.2 (25.0)	5.2 (2.2-8.2)	0.001	0.44	0.055
CoD	1071.1 (27.0)	1071.1 (23.6)	0.004 (-3.8-3.8)	1059.8 (51.4)	1073.1 (44.4)	11.1 (6.9-15.3)[a]	0.02	0.74	0.003
SSI	761.6 (77.3)	808.5 (99.0)	46.9 (34.6-59.2)	840.9 (180.7)	888.7 (187.1)	45.0 (31.9-58.2)	<0.001	0.21	0.46
ToA	269.2 (19.0)	279.4 (21.6)	10.2 (7.7-12.7)	294.9 (48.8)	304.1 (48.2)	9.8 (6.9-12.8)	<0.001	0.19	0.23
PC	59.6 (1.8)	60.2 (1.6)	0.6 (0.3-1.0)	59.4 (3.3)	60.7 (3.8)	1.2 (0.8-1.6)[c]	<0.001	0.90	0.99
EC	38.8 (1.1)	39.2 (1.0)	0.4 (0.1-0.6)	38.3 (2.7)	39.1 (3.0)	0.7 (0.4-0.9)	<0.001	0.79	0.93
CT	3.3 (0.1)	3.4 (0.1)	0.04 (0.03-0.06)	3.4 (0.2)	3.4 (0.3)	0.08 (0.06-0.10)[c]	<0.001	0.27	0.28

Baseline and follow-up data are unadjusted mean (SD). Change data are represented as mean (95% CI) and are adjusted for sex, Tanner stage at follow-up, change in height and change in muscle CSA. ToD, total density; TrbD, trabecular density; ToA, total area; BSI, trabecular bone strength index, CoD, cortical density; CoA, cortical area; SSI, strength strain index, PC, periosteal circumference, EC, endosteal circumference, CT, cortical thickness. [a]change is significantly greater in exercise group, $p<0.01$. [b]change is significantly greater in control group, $p<0.05$. [c]change is significantly greater in intervention group, $p<0.05$.

Table 3. Trabecular (4%) and cortical (38%) baseline and 20-week change in tibial bone measures by pQCT.

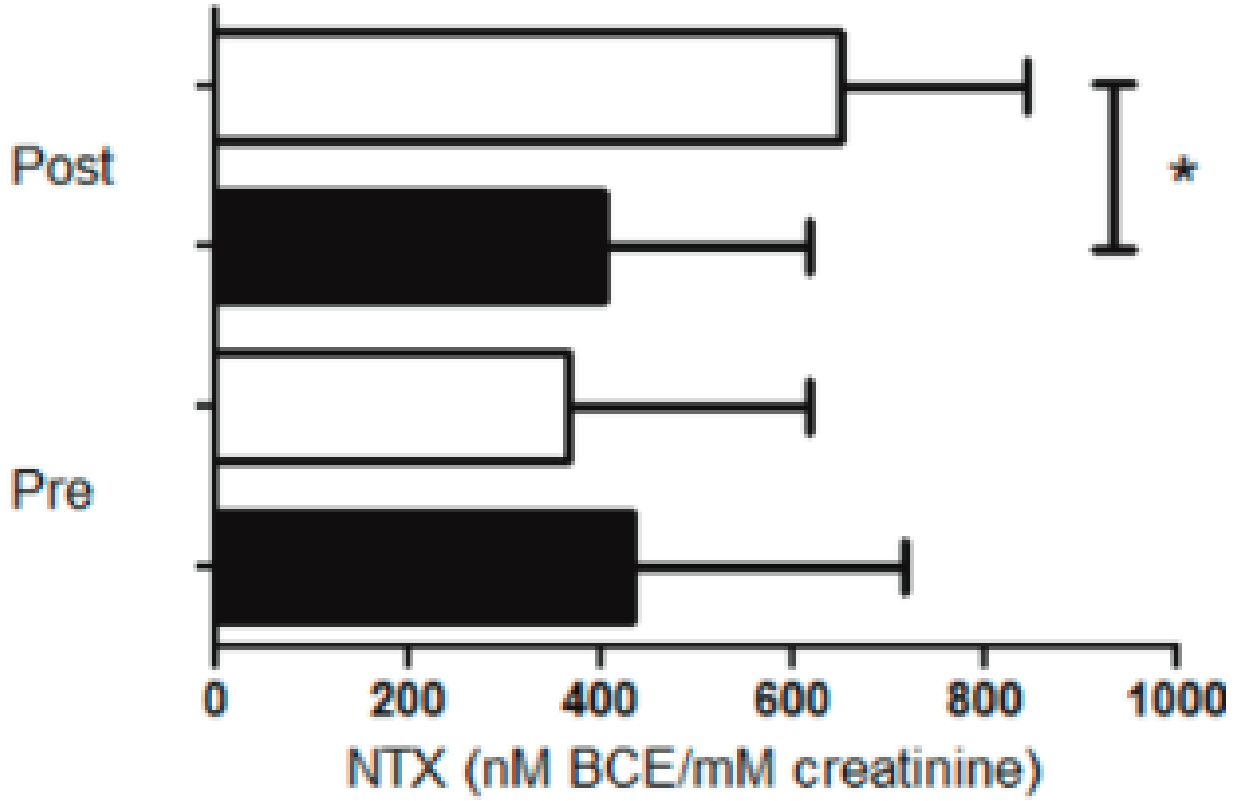

Figure 3. Urinary concentrations of cross-linked N-telopeptides of Type I collagen (NTX) before and after the 20-week intervention. White bars are CON, black bars are EX. *p=0.04. Pre= before intervention, post= after intervention.

Paper 2 - Summary

- Non-blinded cluster randomized trial of physical activity intervention, but with just two clusters
- Analyses could have been blinded
- Substantial loss to follow up with a per protocol analysis
- The study was under powered to detect the effect sizes they set out to
- Some small effects on bone architecture were detected
- There is not sufficiently strong evidence here to change practice

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