DXA in UK Biobank: MSK images and multimorbidity

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Outline

• Musculoskeletal disease burden
• Risk assessment
• DXA protocol
• IDPs from DXA
• Multimorbidity
• Conclusions

MRC Lifecourse Epidemiology Unit, University of Southampton
Director: Professor Cyrus Cooper
Impact of MSK disease globally and in UK

**Osteoporosis**
£4.4bn/yr and >500,000 fractures/yr in UK
50% women and 20% men fracture after 50 yrs
20% reduction relative survival after major fracture

**Osteoarthritis**
75,366 THR and 76,497 TKR annually, and total cost £4bn annually to UK

Growing challenge of multimorbidity
NICE NG56 2016

*Hiligsman et al., Semin Arthritis Rheum. 2013 Dec;43(3):303-13*
*Culliford et al., Osteoarthr. Cart. 2015 Apr;23(4):594-600*
*Harvey N, Cooper C. Nat Rev Rheum 2010; 6: 99-105*
*Hernlund et al., Arch Osteoporos 2013; 8:136*
UK Biobank: a cohort for all questions

- **Bone and**
  - Fat
  - Muscle
  - Inflammation
  - Comorbidity
  - Environment
  - Ethnicity

- **Novel IDPs**
  - Bone and joint shape

- **Multisystem assessment**
  - MR brain, heart, abdomen
  - DXA
  - Carotid ultrasound

**Mechanism**
- Genetic
- Biochemical

*Kemp et al., Nat Genet. 2017;49:1468-1475*
*Harvey et al., J Bone Miner Res. 2018;33:803-811*
*Paccou et al., Osteoporos Int 2018 (ePub ahead of print)*
*Walker-Bone, Harvey et al., Arch Osteoporos 2016;11:1*
*Harvey et al., Osteoporos Int 2013;24:2903-5*
UKB DXA Protocol

Whole body
Bone, lean, fat, regional

Both hips
BA, BMC, BMD, dicom image

Both knees
dicom image

AP Lumbar spine
BA, BMC, BMD, dicom image

Lateral thoracolumbar spine
(Vertebral Fracture Assessment)

20 minutes
GE Lunar iDXA
iDXA output

• Numerical data for immediate analysis
  – Bone, lean, fat
• Dicom images
AUGMENT Study

- CI: Prof Jon Tobias, University of Bristol
- Bristol, Southampton, Manchester, Aberdeen, Cardiff
- £1.6m Wellcome Trust Collaborative Award

Baseline data

Automated platforms

Joint shape
Scoliosis
Vertebral Fracture
Hip strength
Trabecular Bone Score

Novel IDPs for UK Biobank
What’s different about UK Biobank?

• DXA numeric data and images
• Size
• Depth
• Breadth

• Permits novel multimodal, multisystem research
UK Biobank
Multi-system epidemiology, imaging, mechanism

Bone and heart
Raisi-Estbragh, Petersen, Paccou
BHF Research Training Fellowship

Baseline data
Food environment
Baird, Vogel

Biochemistry of secondary osteoporosis
Hannan, Javaid, Eastell

DXA image phenotypes
Tobias, Gregson, Aspden, Cootes

Genetics
Tobias, Evans, Richards, Gregson

Imaging Enhancement
£42m MRC, WT, BHF

Incident outcomes

Food environment
Baird, Vogel

Baseline data

Genetics
Tobias, Evans, Richards, Gregson

Inflammatory arthritis and fracture
Dennison, Prieto-Alhambra

Fat, muscle, bone
Ward, Crabtree, Bell

Ethnicity, body composition and health
Kumaran

Kemp et al., Nat Genet. 2017;49:1468-1475
Harvey et al., J Bone Miner Res. 2018;33:803-811
Paccou et al., Osteoporos Int 2018 (ePub ahead of print)
Walker-Bone, Harvey et al., Arch Osteoporos 2016;11:1
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MSK research in UK Biobank

• Breadth, depth and numbers
• Unique multimodal, multisystem opportunities
• Highly relevant: multimorbidity, ageing
• Observational epidemiology, understanding of mechanism, to inform novel interventions
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