physiotherapy is more likely to result in patient initiated cancellation of knee arthroplasty, than standard care. Our data supports the need for further investigation and enables more accurate power estimation for future studies.

Table. Proportion of patients who cancelled surgery from control and treatment groups.

<table>
<thead>
<tr>
<th>Treatment group</th>
<th>Surgery cancelled</th>
<th>Surgery not cancelled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>6</td>
<td>22</td>
</tr>
</tbody>
</table>
| Odds ratio 7.64 (95% CI 0.86 to 68.4)

Disclosure statement: All authors have declared no conflicts of interest.

125. ANATOMICAL ABNORMALITIES IN HAND OSTEOARTHRITIS ARE AFFECTED BY SOCIAL (HOBBIES) BUT NOT OCCUPATIONAL BIOMECHANICAL FACTORS

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Background: Biomechanical stress on joints is known to be a predisposing factor in the development of osteoarthritis (OA). Most of the evidence is based on OA of large joints. In particular, occupation and lifestyle are contributors toward the risk of developing OA of the knee and hip. All these studies looked at either plain radiography or reported joint symptoms, which were unable to identify other structural changes within the hand joints including soft tissue changes like the collateral ligament. MRI studies have shown that abnormalities of the collateral ligaments could predate clinical hand OA and that these changes form the most predominant abnormality found in hand OA. The hypothesis for this study is that anatomical abnormalities in hand OA are related to increased manual use of hands. The aim was to correlate the occupational exposure and social activities (hobbies) involving the use of hands to the development of OA changes in joint structures using high-resolution MRI.

Methods: MRI of distal or proximal interphalangeal (DIP or PIP) joints were performed in 27 subjects: 19 symptomatic OA patients (8 DIP and 11 PIP joints; mean age 52 years old (range 40-70 years); 1 male, 18 females) and 8 normal volunteers (5 DIP, 3 PIP joints; mean age of 37 years old (range 30-47 years); 3 males, 5 females). High-resolution images were obtained with displayed pixel dimensions of 80-100 µm using a 1.5T scanner and 23-mm-diameter surface coil. All joint structures were analysed. Patients’ occupational and hobby exposures were also documented and ranked on a scale according to the physical demand on the hands: occupation - 0 = non-repetitive and non-manual, 1 = non-manual, 2 = non-repetitive, 3 = manual; hobbies - 0 = sedentary, 1 = moderately active, 2 = vigorously active.

Results: OA patients had higher exposure scores than normal controls for hobbies (P = 0.016) but not occupation (P = 0.418). As expected, OA patients had greater abnormalities of the ligaments (84.2% [16/19], tendons (84.2% [16/19]), cartilage (94.7% [18/19]), bone erosions (52.6% [10/19]) and cysts (78.9% [15/19]). The normal controls had no reported joint symptoms, which were unable to identify other structural changes within the hand joints including soft tissue changes like the collateral ligament. MRI studies have shown that abnormalities of the collateral ligaments could predate clinical hand OA and that these changes form the most predominant abnormality found in hand OA. The hypothesis for this study is that anatomical abnormalities in hand OA are related to increased manual use of hands. The aim was to correlate the occupational exposure and social activities (hobbies) involving the use of hands to the development of OA changes in joint structures using high-resolution MRI.

Disclosure statement: All authors have declared no conflicts of interest.

126. SYSTEMATIC SEARCH AND NARRATIVE REVIEW OF RADIOGRAPHIC FOOT OSTEOARTHRITIS IN POPULATION-BASED STUDIES

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Background: Osteoarthritis (OA) is the commonest cause of arthritis and predominantly affects the knees, hips, hands and feet. Foot OA has been relatively understudied yet the 1st metatarsophalangeal (1st MTP) joint is a target joint for OA. Foot pain, the most frequent symptom of foot OA, contributes significantly to physical disability and commonly leads people to consult in primary care. This review aimed to identify the methods used in population-based epidemiological studies to diagnose radiographic foot OA (RFOA) and to estimate the population prevalence of RFOA.

Methods: Medline, Embase, CINAHL and AgeLine (inception to May 2009) were searched using combinations of terms for: radiography, OA, foot and specific foot joints. Two reviewers independently applied selection criteria to all publications identified. References were screened for any additional potentially relevant papers. The following data were extracted from each paper: number of participants, sample population including descriptive demographic data, radiographic views taken, foot joints examined, methods used to grade and define RFOA and prevalence of RFOA.

Results: The initial search yielded 1,035 papers: full texts were obtained for 21. Fifteen satisfied the selection criteria and a further 12 papers were included after screening references. Thus, 27 papers were included in this review. Radiographic views were frequently not specified (n = 16, 59%) but a combination of anteroposterior and lateral views were most commonly used. Weight-bearing views were specified in six publications (22%). The 1st MTP joint was the most commonly examined foot joint (n = 20, 74%) followed by the 2nd-5th MTP joints (n = 7, 26%). Nineteen studies (70%) used the Kellgren and Lawrence (KanLD) grading system, 95% of which defined OA as KanLD grade ≥2 and three studies (11%) used the system developed by Menz et al. The prevalence of 1st MTP joint radiographic OA (KanLD grade ≥2) ranged between 6-39% in seven studies that examined middle-aged to older adults.

Conclusions: Existing studies for RFOA focus on the 1st MTP joint and mainly used the KanLD grading system. Given the paucity of such studies, further studies are needed to quantify the prevalence of radiographic ankle joint at different joint complexes within the foot in different age-groups.

Disclosure statement: All authors have declared no conflicts of interest.

Osteoporosis and Metabolic Bone Disease

127. OSTEOPOROSIS, FALLS AND FRACTURES: THREE CONFOUNDERS IN ONE EQUATION. DEVELOPMENT AND VALIDITY OF A NEW FORM FOR ASSESSMENT OF PATIENTS REFERRED FOR DXA SCANNING

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Prevalence of 1st MTP joint radiographic OA (K and L grade ≥2) in middle aged and older adults

<table>
<thead>
<tr>
<th>Publication</th>
<th>Population</th>
<th>Age Range (years)</th>
<th>Prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bremner 1968</td>
<td>Jamaica Wesleysdale, UK</td>
<td>35-64</td>
<td>Females 29%, males 17% Females 39%, males 30%</td>
</tr>
<tr>
<td>van Saase 1988</td>
<td>Zoetermeer, NL</td>
<td>45-64</td>
<td>Females 37.6%, males 28.5%</td>
</tr>
<tr>
<td>Bright 1985</td>
<td>South African</td>
<td>40</td>
<td>Females 6.3%, males 19.4%</td>
</tr>
<tr>
<td>Solomon 1989</td>
<td>Rural African</td>
<td>35-60</td>
<td>Females 24.1%, males 15.1%</td>
</tr>
<tr>
<td>Wilder 2005</td>
<td>Zoetermeer, NL</td>
<td>40-80</td>
<td>Females 17.7%, males 25.1%</td>
</tr>
<tr>
<td>Wilder 2006</td>
<td>Clearwater, USA</td>
<td>≥ 40</td>
<td>Overall 26%</td>
</tr>
</tbody>
</table>

Disclosure statement: All authors have declared no conflicts of interest.
Background: To assess the validity of a new referral model for DXA scanning, its impact on patients’ management and whether it meets the targets of the osteoporosis and falls service.

Methods: The referral form was developed including 3 main components: 1. Risk factors for osteoporosis (6 factors), 2. The 8 risk factors identified in FRAX (WHO fracture risk assessment tool) and 3. Risk factors for falls (5 factors). Special icons were used to give clinical hints for vertebral morphometry and tilting table assessment. The model was set up with only ticking the appropriate boxes is required. Validation of the model was done through: 1. comparing the referral form to the medical notes and the patients’ answers to a pre-scanning questionnaire. 2. Each patient was assessed and management plan (guided by the national guidelines) was considered blindly twice based on the data available in the new referral form in comparison to the old referral form. DXA measurements were then analyzed in relation to self-reported incidence of falls, fractures and the calculated 10-years fracture probability (using FRAX).

Results: A total of 264 postmenopausal women (mean age, 68.6 ± 4.73 years) were included in this work. Osteoporosis was found in 113/264 (42.8%) of the patients whereas osteopenia prevalence was 32.1% (86/264). 34.5% (91/264) of the patients had a past history of low trauma fracture and 21.6% (57/264) reported 1 or more falls during the preceding year. Patients treated based on the osteoporosis-falls-FRAX composite were significantly higher (r = 0.633) than those treated based on the old referral form. Most of these patients were suffering from secondary osteoporosis and their DXA scan revealed borderline osteoporosis/osteopenia. Adjusted risk for hip bone density and 10-year fracture probability in the 12 months in patients who reported a fall was 6.0 (95% CI, 3.2-10.5, P = 0.001). Compared with women without osteoporosis and without a fall and 10-year fracture probability < 10%, women with osteoporosis and a fall and fracture probability > 20% had an age- and BMI-adjusted fracture risk of 2.8 (95% CI, 0.7-11.7, P = 0.10) and women with osteoporosis and a fall and fracture probability > 20% had an adjusted-fracture risk of 24.8 (95% CI, 7.1-77.5, P < 0.0001).

Conclusions: The developed form is a valid model for DXA scanning and accurate tool for assessment of osteoporosis, falls risks as well as fracture (using FRAX). Falls are a major contributing factor to the occurrence of symptomatic fractures in postmenopausal women independent of and additive to the risk attributable to age, bone mineral content and 10-year fracture probability. It is important to have the patients stratified and assessed according to the different osteoporosis and falls risk factors rather than relying on fractures as the corner stone for assessment and management.

Disclosure statement: All authors have declared no conflicts of interest.

128. FRAX AIDS IDENTIFICATION OF PRIMARY CARE PATIENTS WITH OSTEOPOROSIS
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1Rheumatology, Queen Elizabeth Hospital, Gateshead, UK; 2Medical School, HUMS, York, UK

Background: Primary Care Trusts (PCTs) in the UK are being encouraged to screen for osteoporosis and protocols for how to screen and who to scan have been devised. However, up to 60% of patients referred for bone densitometry (DXA) from primary care are without clinical risk factors. It has been suggested that the most effective use of DXA is to use it selectively based on clinical risk factors and the recently developed FRAX tool encourages this approach. We have examined the effectiveness of our open access DXA service, which is accessed using FRAX, by assessing all GP referrals over a 12 month period. We wished to assess the correlation between predicted 10 year fracture risk from FRAX and absolute BMD at both hip and spine and to calculate the prevalence of bone disease identified in our population by this approach.

Methods: We reviewed all DXA scans (Hologic discovery C DEXA) from primary care and calculated the absolute BMD, T and Z scores at hip and spine, calculating mean values with reference to the standard normal logistic database. We examined the relationship between the predicted 10 year risk of fracture and the absolute BMD at hip and spine using Spearman rank correlation. We calculated the percentage of patients referred from primary care with osteoporosis (T score ≤ -2.5). We compared data from females in our population to that from a control group of age matched women (mean 65 years) referred for baseline BMD prior to commencing letrozole for breast cancer.

Results: We reviewed DXA results from 340 patients referred from primary care, of whom 288 were female. Rank correlation coefficients of 0.41 and 0.47 were found for 10 year fracture risk score against absolute BMD at hip and spine respectively for primary care referrals [P = 0.001]. The prevalence of osteoporosis was 33% in females and 21% in men, compared with 20% in the female controls. Mean Z scores at hip (0.02 s.e. 0.07) and spine (-0.30 s.e. 0.09) were significantly lower than those in the female controls (0.30 s.e. 0.11 and 0.09 s.e. 0.17) respectively [P < 0.05].

Conclusions: The use of an open access service to identify individuals with osteoporosis is facilitated by the use of 10 year fracture risk data as calculated by FRAX. This model successfully identifies significant numbers of both male and female primary care patients with low bone density and the fracture risk correlates well with BMD results. The use of this model appears to be valid within a primary care population with a high prevalence of low bone density.

Disclosure statement: All authors have declared no conflicts of interest.

129. COMPARISON OF FRAX AND NICE GUIDANCE FOR MANAGEMENT OF OSTEOPOROSIS
Vipul Vagadia and Stephen Tuck
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Background: NICE osteoporosis guidance suggests using complicated T-score tables broken down by age and clinical risk factors, before they are able to recommend other bisphosphonates such as risedronate and strontium ranelate for primary and secondary prevention of osteoporosis. NICE secondary prevention suggests that patients who are intolerant of alendronate or have a contra-indication to it should show deterioration in T-scores before being moved to an alternative drug. FRAX (WHO fracture risk assessment tool) utilizes several known clinical risk factors rather than BMD alone to calculate a patient’s 10-year risk of major osteoporotic fracture.

Methods: We compared the clinical use of NICE primary and secondary osteoporosis prevention guidelines with FRAX tool in the management of osteoporosis at James Cook University Hospital. We undertook a prospective audit of 50 patients, randomly selected from bone clinic and inpatients during 1st June 09 to 30th September 09. Data was collected using patient questionnaire and clinician’s assessment of osteoporosis. Only patients who had a new initiation or change of osteoporosis treatment during this time were included in the analysis. Information on patient’s hip fracture, h/o rheumatoid arthritis, secondary osteoporosis, smoking, alcohol intake was recorded for each patient. Patients on bisphosphonates or strontium were included.

Results: 92% patients were female. Among them 20% were > 75 years, 24% were < 55 years and 56% were between 56 and 75 years. 18% had been on long term prednisolone. One patient had a parental h/o hip fracture and 14% had been diagnosed to have rheumatoid arthritis. Secondary osteoporosis was found in 44% (n = 22) and the commonest cause was premature menopause 40% (n = 9). DEXA confirmed 80% patients had osteoporosis, 30% were osteopenic and 10% had a normal DEXA. Fracture fragility was found in 56% (n = 28) and common sites were vertebral (n = 9), wrist (n = 8) and hip (n = 2). NICE guidance did not recommend starting or changing treatment in 2 (n = 1) of the patients with a previous fragility fracture but did recommend treatment in 22% (n = 5) with no previous fracture when compared with FRAX (Table).

Conclusions: NICE guidance does not closely accord with FRAX. NICE guidance leads to potential over treatment in patients with no previous fracture. In patients over 75, NICE recommends treatment without DEXA scan. This may not benefit patients who may be needlessly exposed to potential side-effects.

FRAX helps to identify men and steroid treated patients with osteoporosis for whom NICE fails to provide guidance. FRAX is easy to use and is amenable to use by all health professionals.

Disclosure statement: All authors have declared no conflicts of interest.

No fracture (n = 6) - normal BMD and/or osteopenia. Not recommended treatment by either NICE or FRAX.
Overview of Incidence and Type of Frailty Fractures

<table>
<thead>
<tr>
<th>Author / year</th>
<th>No of patients</th>
<th>Results</th>
<th>Distal forearm</th>
<th>Proximal humerus</th>
<th>Proximal Femur</th>
<th>Pelvis</th>
<th>Vertebra</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hooyman (1984)</td>
<td>388/0</td>
<td>RR 1.27 (95% CI 0.71-2.19)</td>
<td>RR 1.35 (95% CI 0.67-2.62)</td>
<td>RR 1.45 (95% CI 0.94-2.21)</td>
<td>RR 2.61 (95% CI 1.23-3.00)</td>
<td>32/388 = 8.52%</td>
<td></td>
</tr>
<tr>
<td>Verstraeten (1986)</td>
<td>104/0</td>
<td>OR 2.1 (95% CI 1.2-3.7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spector (1993)</td>
<td>191/0</td>
<td>Vertebral fractures increased in RA patients compared with controls (12.1% vs 6.2%) (OR 2.1 (95% CI 1.2-3.7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peel (1995)</td>
<td>76/0</td>
<td>OR 6.2 (95% CI 3.2-12.3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooper (1995)</td>
<td>240/60 T300</td>
<td>OR 2.4 (95% CI 1.0-5.4)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Furuya (2005)</td>
<td>1733/0</td>
<td>1/1733 = 0.06%</td>
<td>3/1733 = 0.17%</td>
<td>14/1733 = 0.08%</td>
<td>5/1733 = 0.29%</td>
<td>33/1733 = 1.90%</td>
<td></td>
</tr>
<tr>
<td>Arai (2006)</td>
<td>131/0</td>
<td>Vertebral fractures occurred in 34 (2.0%) any non-vertebral fractures occurred in 33 (1.9%) of total, main non-vertebral fractures occurred in 34 (2.0%) any non-vertebral fracture occurred in 98 (5.7%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

130. FRAGILITY FRACTURES IN RHEUMATOID ARTHRITIS - A SYSTEMATIC REVIEW

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2Rheumatology, Queen Elizabeth Hospital, Woolwich, London, UK

Background: It is widely documented that rheumatoid arthritis (RA) leads to a decrease in bone mineral density (BMD) and an increase in the incidence of osteoporosis. A low BMD translates into a higher fracture risk. The importance of OP to the health economy is well known with costs due to fractures alone of £1.73 billion. With an increasingly ageing population these costs are estimated to double in the coming years. Patients with RA have previously been shown to have a 2- to 3-fold increased risk of vertebral and hip fractures but to date there have been no systematic reviews on this topic. Besides the increased mortality and morbidity of RA itself, RA patients with fractures are at even further risk of disability, dependence and mortality. The objective of the systematic review of the literature was to evaluate the existing evidence on the incidence of fragility fractures in female patients over the age of 45 years with RA and to identify possible factors influencing fracture risk.


Results: 1145 citations were initially identified. After screening all titles and abstracts 67 full text articles were identified for potential selection. Following detailed review of these full text articles, 7 articles were included; 5 on RA patients and 2 were prospective studies. All studies had a level of evidence graded at Level III (as per RCP criteria).

Conclusions: The results of this systematic review of the literature suggest that female patients with RA are at a substantially increased risk of fractures at the hip, pelvis and vertebrae and confirm that RA is an independent risk factor for FF. The increased risk of fracture was larger in patients with decreased ambulation and functional class, lower BMI and increasing age. Controversy remains as to the risk associated with corticosteroid use and further studies will be required to establish this link firmly.

Disclosure statement: All authors have declared no conflicts of interest.

131. MISSED OPPORTUNITIES: PREVALENCE OF UNTREATED FRACTURES PRIOR TO HIP FRACTURE IN WOMEN

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2Darlington Primary Care Trust, Bishop Auckland, UK

Background: Low trauma fracture is known to be a significant risk factor for further fracture. However, previous data show that many patients sustaining a low trauma fracture do not receive appropriate bone sparing therapy, potentially placing them at an unnecessarily high risk of subsequent fracture. Both the Royal College of Physicians and the National Osteoporosis Guideline Group suggest that post menopausal women who sustain a low trauma fracture should be considered for bone sparing therapy without the need for bone densitometry assessment.

We conducted an audit with two aims 1) to determine the prevalence of prior fracture in women who had sustained low trauma hip fracture and 2) to determine what percentage of patients who had had prior fracture had received appropriate secondary prevention.

Methods: We retrospectively analysed the data of 310 women who had sustained low trauma hip fracture in order to identify which of these patients had had a previous fracture and to ascertain if this previous fracture had been treated with bone sparing therapy. Patients were identified via a search of electronic records from 12 general practices. All incident hip fractures took place between January 2005 and June 2009. Data collated in addition to patient demographics included; date of hip fracture, date and site of any preceding fracture, date that bone sparing therapy was commenced and the type of bone sparing therapy prescribed.

Results: The 310 patients identified had a mean (standard deviation) age of 81 (10.1) years, 138 (45%) had sustained a previous fracture at any site. The site of prior fractures amongst these 138 patients was; 44 (33%) wrist, 30 (21%) hip, 18 (13%) humerus, 14 (10%) ankle and 32 (23%) other. 75 (54%) patients were over 75 years of age at the time of initial fracture. Only 6 (4%) had been investigated with bone densitometry. 25 (18%) of these 138 patients had been prescribed bone sparing therapy following their initial fracture; 3 treated with Calcium / vitamin D alone, 4 with bisphosphonate alone and 18 with bisphosphonate and Calcium / vitamin D.

Conclusions: Nearly half of patients presenting with a low trauma hip fracture, had sustained a prior fracture. The majority of these patients had received no investigation or bone sparing therapy following this initial fracture and we suggest that many of the hip fractures could have potentially been prevented if appropriate investigation and management had been initiated.

Disclosure statement: All authors have declared no conflicts of interest.

132. UNCOVERING HIGH RATES OF HYPOVITAMINOSIS D: IV BISPHOSPHONATE USE IN EVERY DAY PRACTICE

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2Metabolic Medicine and Care of the Elderly, Sunderland Royal Hospital, Sunderland, UK

Background: Bisphosphonates are used widely in the treatment of osteoporosis. IV bisphosphonates are significantly more potent than oral agents and carry an increased risk of side effects, particularly for patients who are vitamin D deplete. High levels of asymptomatic hypovitaminosis D amongst rheumatology outpatients has been recorded.
We undertook an audit of IV bisphosphonate use over 5 months. The aims were to:
1. Assess vitamin D status and prevalence of secondary hyperparathyroidism.
2. Identify changes in calcium and phosphorus.
3. Observe the relationship between calcium, vitamin D, parathyroid hormone (PTH) and bone turnover markers (C-terminal crosslinking telopeptide or CTX and alkaline phosphatase) pre and post infusion.

Methods: Baseline bloods including vitamin D levels, PTH and CTX were checked on the day of the infusion. The patients returned to 4 weeks later, when CTX and routine biochemistry were rechecked.

Results: 20 patients were included. 1 patient was treated with zoledronate for Paget's disease and 1 with pamidronate 60 mg for ankylosing spondylitis. 2 patients had pamidronate 30 mg and 16 patients received ibandronate 3 mg for osteoporosis.

The mean (±SD) vitamin D3 level was 57.8 (25.4) nmol/L (normal range 75-125 nmol/L). 4 (17%) subjects had a raised PTH (≥ 6.9 pmol/L) and, in the 15 patients with low vitamin D (≤ 75 nmol/L), hyperparathyroidism was seen in 20%. There was a statistically significant linear relationship between higher vitamin D levels and lower PTH (P < 0.005).

There was no significant change in bone biochemistry with treatment and no cases of significant hypocalcaemia occurred. In subjects with an initial vitamin D less than 50 nmol/L, corrected calcium decreased by 0.030 mmol/L compared with a rise by 0.017 mmol/L in vitamin D replete subjects. However, this was not statistically significant (P = 0.039). CTX and calcium were decreased by a mean of 24.4% with treatment (P < 0.0001). Baseline vitamin D status had no significant effect on this.

The relative potencies of the agents used are reflected in their effect on CTX, ranging from a 31% decrease for ibandronate, 56% for pamidronate, to a 91% decrease for zoledronate.

Conclusions: We found high rates of vitamin D insufficiency and frequently this was despite prescription of supplements. A number of patients had concomitant hyperparathyroidism, probably secondary to vitamin D insufficiency. Fortunately, occult hypocalcaemia relating to bisphosphonate therapy was not seen. We failed to observe any significant relationships, other than the well-recognized association between vitamin D levels and PTH. Despite small numbers, our data suggest a marked range in potency of the bisphosphonates used.

This audit has highlighted the presence of occult vitamin D insufficiency of which we were unaware. Moreover, we found that routine bone biochemistry failed to predict this. Nor could we be sure that prescription of supplements would ensure adequate levels. Based upon our findings, we have made a number of recommendations.

Disclosure statement: All authors have declared no conflicts of interest.

133. EARLY LIFE MAY INTERACT WITH ADULT DIET TO AFFECT ADULT BONE MASS: THE HERTFORDSHIRE COHORT STUDY
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Background: Several studies have shown that early life factors play a role in the determination of bone mass in later life. Further studies have shown that the early environment may also interact with adult lifestyle factors to determine other aspects of adult health. In this study we have examined how early life and adult diet interact to establish adult bone mass.

Methods: We studied 498 men and 468 women born in Hertfordshire between 1931-39 who were still resident there in adult life. These individuals attended a local clinic where a health questionnaire was completed, detailed anthropometric data, including height, weight and skin fold measurements were recorded and bone densitometry (DXA) performed at the lumbar spine and femoral neck using a Hologic QDR 4500 instrument. Three aspects of bone mass were measured: bone mineral content (BMC); bone mineral density (BMD); and bone mineral apparent density (BMAD). Dietary information was recorded using a food frequency questionnaire and a 24-h food diary. Full ethical approval and patient consent were obtained.

Results: Spinal BMAD in males was significantly associated with birth weight and dairy intake such that those men of low birth weight who had high intake had a BMD 0.03 g/cm² higher than those with low birth weight and low dairy intake (P = 0.035, adjusted for age, BMI, smoking status, alcohol use, activity). Similar relationships were observed in women; in those individuals of low birth weight, femoral neck BMD increased by 0.02 g/cm² from low to high dairy intake (P = 0.001). Similar values were seen when birth weight was substituted with weight at one year or conditional growth in the first year. These results were little affected by adjustment for age, BMI, smoking status, alcohol use, activity, years since menopause and HRT use. Analyses that substituted calcium or vitamin D intake for dairy intake were generally non-significant.

Conclusions: In this study there was an interaction between birth weight and adult diet in determining adult bone mass. These analyses suggest that early and adult life factors may interact to determine adult bone mass. Our finding that the interaction was significant where calcium intake was not may suggest a role for milk proteins in this relationship.

Disclosure statement: All authors have declared no conflicts of interest.

134. BISPHOSPHONATE USE IN ATYPICAL FEMORAL FRACTURES: A CASE -CONTROL STUDY
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Background: Recent case series have suggested an association between bisphosphonates and atypical low velocity femoral fractures. The proposed mechanism is an increased propensity to stress fractures in the context of severely suppressed bone turnover (SSBT). This potentially important association is unproven however further investigation is required.

Methods: We conducted a retrospective cohort study comparing bisphosphonate use in patients who presented with femoral shaft, subtrochanteric and comminuted intertrochanteric hip fractures (atypical) between July 2007 and September 2009, with a control group of patients who presented sequentially with neck of femur fractures (typical). Past drug and fracture history were obtained from the medical notes and primary care records. Results were analysed with the Fisher’s Exact and Mann Whitney tests.

Results: We identified 21 patients with atypical fractures of which all were low velocity and 3 were excluded as being subsequent to metastatic deposits. Thirty sequential patients with typical fractures were selected but a drug history was only available for 21. There was no difference between the atypical and typical group in terms of age, history of prior fractures or use of proton-pump inhibitors (Table). Prior use of bisphosphonates did not differ between groups. In the atypical subgroup comprising subtrochanteric fractures (n = 8), 2 were taking bisphosphonates (P = 0.18 compared with typical group). Both of these had multiple risk factors for osteoporotic fracture.

Conclusions: We have not demonstrated an association between atypical femoral fractures and bisphosphonate use. Although our study is underpowered to detect a rare association, our findings are supported by a recent large register-based cohort study in which subtrochanteric fractures shared the epidemiology and treatment response of typical hip fractures. However, given the widespread use of bisphosphonates, further study is warranted.

Disclosure statement: All authors have declared no conflicts of interest.

135. SEASON OF BIRTH IS A DETERMINANT OF BONE MASS IN LATE ADULTHOOD: THE HERTFORDSHIRE COHORT STUDY
Gareth M. Hynes, Karen Jameson, Nick Harvey, Avan Ahie Sayer, Cyrus Cooper and Elaine Dennison
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Background: Maternal vitamin D concentration has been shown to be a determinant of offspring bone mass at age 9 years. Exposure to ultraviolet B radiation in late pregnancy was a major determinant of circulating vitamin D concentration at term. Here we investigated whether season of birth (and hence probable maternal UVB exposure) was a predictor of bone mass in late adulthood.

Methods: We studied 498 men and 488 women born in Hertfordshire between 1931-39 who were still resident there in adult life. These individuals attended a local clinic where a health questionnaire was completed, detailed anthropometric data, including height, weight and skin fold measurements were recorded and bone densitometry (DXA) performed at the lumbar spine and femoral neck using a Hologic QDR 4500 instrument. Three aspects of bone mass were measured: bone mineral content (BMC); bone mineral density (BMD); and bone mineral apparent density (BMAD). Dietary information was recorded using a food frequency questionnaire and a 24-h food diary. Full ethical approval and patient consent were obtained.

Results: Spinal BMAD in males was significantly associated with birth weight and dairy intake such that those men of low birth weight who had high intake had a BMD 0.03 g/cm² higher than those with low birth weight and low dairy intake (P = 0.035, adjusted for age, BMI, smoking status, alcohol use, activity). Similar relationships were observed in women; in those individuals of low birth weight, femoral neck BMD increased by 0.02 g/cm² from low to high dairy intake (P = 0.001). Similar values were seen when birth weight was substituted with weight at one year or conditional growth in the first year. These results were little affected by adjustment for age, BMI, smoking status, alcohol use, activity, years since menopause and HRT use. Analyses that substituted calcium or vitamin D intake for dairy intake were generally non-significant.

Conclusions: In this study there was an interaction between birth weight and adult diet in determining adult bone mass. These analyses suggest that early and adult life factors may interact to determine adult bone mass. Our finding that the interaction was significant where calcium intake was not may suggest a role for milk proteins in this relationship.

Disclosure statement: All authors have declared no conflicts of interest.

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completed, detailed anthropometric data, including height, weight and skin fold measurements were recorded and bone densitometry (DXA) was performed at the lumbar spine and femoral neck using a Hologic QDR 4500 instrument. Full ethical approval and patient consent were obtained.

Results: The seasons of birth were coded as follows: winter = Dec, Jan, Feb; spring = Mar, April, May; summer = Jun, Jul, Aug; and autumn = Sep, Oct, Nov. For women, those born in the summer had a significantly higher total femur BMD than those born in winter (B = 0.036, P = 0.03). This relationship remained significant after adjustment for age, body mass index, social class, smoking, alcohol, activity, parity, HRT use, but became non-significant after adjustment for years since menopause. For men, those born in the autumn had a significantly lower total femur BMD than those born in winter (B = -0.041, P = 0.02); this relationship became non-significant after adjustment.

Conclusions: Season of birth was a predictor of bone mass in late adulthood in UK men and women, although these relationships were weakened by adjustment for body mass index in men and years since menopause.

Disclosure statement: All authors have declared no conflicts of interest.

136. ARE WE MEASURING THE BONE HEALTH OF EPILEPSY PATIENTS?
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Background: Long-term treatment with anti-epileptic drugs (AEDs), especially enzyme-inducing AEDs have been associated with low serum levels of vitamin D. Vitamin D deficiency is implicated in metabolic bone disease and increased risk of fractures. Injury and bone health are major concerns of individuals with epilepsy. Guidelines from the UK’s National Institute for Health and Clinical Excellence suggest that vitamin D levels should be measured every two to five years in patients taking enzyme-inducing AEDs.

Methods: Three follow-up patients attending specialist epilepsy outpatient clinics in London between April and July 2009 were identified retrospectively. AED regime was established through clinic correspondence detailing the use of enzyme-inducing AEDs (phenytoin, phenobarbital, carbamazepine, oxcarbazepine, primidone). The hospital’s electronic patient record was used to identify whether measurements of serum vitamin D, parathyroid hormone (PTH) or bone densitometry had been performed. If the serum vitamin D level was measured to be less than 75 nmol/L, it was noted whether vitamin D and calcium supplementation had been recommended.

Results: 655 patients were identified. 401 (61%) were on at least one enzyme-inducing AED. Serum vitamin D levels were measured in 158 (24%) of patients (115 [29%] of those on enzyme-inducing AEDs and 43 [17%] of those not on enzyme-inducing AEDs). Furthermore, of the patients on enzyme-inducing AEDs, 65 (16%) had a serum PTH level measured and 21 (31%) had bone densitometry performed. 123 (31%) of patients receiving enzyme-inducing AEDs had at least one of the three investigations performed. Of patients in whom serum vitamin D level was measured, 142 (90%) had levels below 75 nmol/L and 97 (68%) of those received a follow-up letter to perform the test.

Conclusions: Overall, we found a measurement of bone health is made in only approximately 30% of patients on enzyme-inducing AEDs. Where investigations were performed, few patients subsequently go on to receive advice about bone protection or further assessment regarding bone health. When measurements of Vitamin D levels are made, they are found to be low independent of type of AED prescribed (enzyme-inducing or non enzyme-inducing), although this finding may represent a biased sample where only patients with other risk factors for vitamin D deficiency were tested as the majority of patients did not undergo blood testing. Recommendations include increased awareness amongst staff and patients regarding the assessment between epilepsy, AEDs and decreased vitamin D levels. Liaison with laboratory staff to reduce turnaround times for relevant investigations and clearer protocols for management of bone health in epilepsy.

Disclosure statement: All authors have declared no conflicts of interest.

137. GENETIC VARIATION IN WDR77 GENE IS ASSOCIATED WITH CALCANEAL BONE ULTRASOUND PARAMETERS: RESULTS FROM THE EUROPEAN MALE AGEING STUDY
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Background: Quantitative ultrasound (QUS) measurements including broadband ultrasound attenuation (BUA) and speed of sound (SOS) at the calcaneus are associated with an increased risk of hip and spine fracture. A number of single nucleotide polymorphisms (SNPs) have been associated with BUA and SOS in the Framingham 100K genome-wide association study (GWAS), the first GWAS of bone phenotypes; but these findings have yet to be validated. The aim of this study was to determine if these SNPs are associated with QUS measures in a large independent population of European middle-aged and elderly men.

Methods: Men aged 40-79 years were recruited from population registers in seven European centres for participation in an observational study of male ageing, the European Male Ageing Study (EMAS). Subjects had blood taken for genetic analysis and also calcaneal ultrasound measurements (Sahara Clinical Sonometer [Hologic; Bedford, Massachusetts, USA]) performed. SNPs with minor allele frequency (MAF) ≥ 5%, call rate ≥ 95% and Hardy-Weinberg equilibrium (HWE) (P > 10-4 associated with BUA or SOS measured by calcaneal QUS in the Framingham study based on generalized estimating equations (GEE) test with p < 10-4, were selected for genotyping. SEQUENOM technology was used for genotyping the SNPs. SNPs with call rate ≥ 90% and HWE p ≤ 0.05 were included in the analysis. Linear regression was used to test the association between SNPs and BUA and SOS under an additive genetic model adjusting for centre conducted in PLINK (1.05). The same direction of effect and P < 0.05 indicated replication.

Results: Thirty-eight SNPs were selected for genotyping and 34 were included in the analysis. 2377 subjects, mean (± S.D.) age of 60 ± 11 years, contributed data to the analysis. The mean (± S.D.) of BUA and SOS were 80.09 (± 19.12) dB/MHz and 155.89 (± 34.33) m/s, respectively. Both were correlated (r2 = 0.87; P < 0.001). Evidence of replication was observed for a single SNP, rs3754032, which was associated with a higher SOS in EMAS (β coefficient = 2.38; 95% CI 0.21; 4.55; P = 0.032), but not BUA (β coefficient = 0.41; 95% CI -0.79; 1.60; P = 0.509). This SNP was associated with both BUA (P = 8.75 x 10-5) and SOS (P = 0.01) in the Framingham study. The SNP rs3754032 is located 19 KB downstream of WDR77 (WD repeat domain 77) also known as androgen receptor cofactor p44.

Conclusions: Most of the SNPs identified in the recent Framingham GWAS of bone phenotypes were not associated with calcaneal ultrasound parameters in EMAS. We did, however, confirm a significant association with a SNP located near WDR77.

Disclosure statement: All authors have declared no conflicts of interest.

138. BONE MINERAL DENSITY AND FRACTURE RISK AMONG A UK COHORT OF HIV-POSITIVE MEN
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Background: HIV is a global pandemic. The advent of highly-active antiretroviral therapy (HAART) has transformed the life expectancy of HIV infected patients but recent data suggest that treatment-controlled HIV is associated with age-related metabolic diseases including possibly osteopenia and osteoporosis. To date however,
there are scanty data to suggest increased fracture rates in this population. We investigated the prevalence and risk factors for low bone mass among a cohort of HIV infected men and explored fracture rates in the same population.

Methods: We identified a cohort of HIV+ men who had received a DEXA scan as part of usual care between 1/1/1999 and 1/1/2009. For each subject, medical records, DEXA reports and the Trust imaging database were reviewed. Data were collated as to absolute bone mineral density (BMD) (total body, lumbar and total hip); established risk factors for male osteoporosis; HIV-related factors; use of HAART and fracture history (high or low-impact) since diagnosis.

Results: We identified 100 HIV+ male subjects who had received a DEXA scan (median age 48, range 22-69 years). 95% were Caucasian. The mode of transmission of HIV was predominantly (93%) men who have sex with men. The median duration of HIV infection was 11.25 years. Using World Health Organization definitions of osteopenia and osteoporosis, 63% had a reduced bone density (44% osteopenia, 19% osteoporosis). The highest prevalence of low bone mass was seen at the lumbar spine.

A high prevalence of established risk factors for male osteoporosis was shown in this population: 58% had treated or untreated hypogonadism; 55% had smoked cigarettes for >15 pack-years; 39% were heavy alcohol drinkers; 33% had medicated depression and 18% had ever used glucocorticoids. Despite this, an independent statistically significant effect was seen for ever exposure to HAART \( P = 0.019 \). Current use of Tenofovir was also significantly associated \( P = 0.003 \). Additionally a novel risk factor, exposure to chemotherapy within 12 months prior to DEXA scan was identified as a significant risk factor \( P = 0.002 \).

Amongst those for whom fracture data were available \( n = 40 \), 22.5% had experienced a fracture since HIV diagnosis and 67% of these were fragility fractures.

Conclusions: We identified a high prevalence of low BMD and fragility fracture amongst a UK cohort of HIV+ men. Among these subjects, we demonstrated a high prevalence of recognized risk factors for male osteoporosis (hypogonadism; alcohol; cigarette smoking; anti-depressants). However we also found that HAART was significantly associated. History of chemotherapy exposure within 12 months of DEXA was identified as a novel risk factor. Our data suggest that the high risk of low bone mass is accompanied by an associated increase in fracture risk. Given the significant healthcare and psychosocial cost of osteoporosis, there is need to raise physician awareness of the risk of low bone mass amongst treatment-controlled HIV populations.

Disclosure statement: All authors have declared no conflicts of interest.

139. HAS THE INTRODUCTION OF FRAX CHANGED THE PATTERN OF PRIMARY CARE REFERRAL FOR DIRECT ACCESS DXA SCANNING?

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Background: The World Health Organization Fracture Risk Assessment Tool (FRAX) has been developed to assist in the prediction of fracture risk in patients (www.shef.ac.uk/FRAX). In the UK, the National Osteoporosis Guideline Group (NOGG) have proposed interventional thresholds based on the 10 year risk estimates for patients being referred for DEXA scanning and for commencing treatment. FRAX came online from September/October 2008 and we wished to explore whether the availability of this tool in primary care had affected the referral pattern of patients for DDXA.

Methods: We analysed all GP referrals for a first DDXA scan made to the Metabolic Bone Unit in September 2008 (Pre-FRAX) and compared this to referrals made in September 2009 (post-FRAX). We included men and women in the age range 40 to 90 years. Patients could not have received prior treatment for osteoporosis.

Results: 12 months prior to DDXA scanning, we further categorized our patients, according to these thresholds, into three groups; 1) those patients who have peripheral BMD above the 90% sensitivity threshold to identify normal Bone density at the hip or spine, (T-score >-1.7), 2) Those patients who have peripheral BMD reading between the two thresholds, (T-score < 1.8 but > -2.7) and 3) those patients that have peripheral BMD below the 90% specificity threshold to identify osteoporosis at the hip or spine (T-score <-2.8). 25 (18%) women had T-score >-1.7 and 70 (49%) women had T-score < -2.8. 47 (33%) of the women had T-score between the two thresholds and in these women it is not possible to predict with accuracy whether or not they had osteoporosis at the axial skeleton.

Conclusions: Consistent with other data, less than half (49%) of our patients presenting with a low trauma fracture can be reliably said to have axial osteoporosis on the basis of their heel DEXA result. A significant proportion (18%) of them are unlikely to have osteoporosis and may therefore be taking medication from which they are deriving no proven benefit. We feel, therefore, that peripheral or axial bone densitometry should be considered in women aged over 75 years who have sustained a low trauma fracture.

Disclosure statement: All authors have declared no conflicts of interest.

140. PERIPHERAL BONE DENSITOMETRY IN WOMEN OVER 75 YEARS WHO HAVE SUSTAINED A LOW TRAUMA FRACTURE

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Background: Neither National Institute of Clinical Excellence (NICE) technology appraisals, nor National Osteoporosis Guideline Group guidelines advocate the use of bone densitometry in women over 75 years of age who have sustained a low trauma fracture, both suggesting that bone sparing therapy can be initiated without knowledge of bone mineral density (BMD). This is despite recent evidence showing that the majority of these patients do not have osteoporosis, as assessed by axial DEXA scanning. We therefore retrospectively analysed peripheral bone density measurements in a group of women over 75 years who had attended our fracture liaison service.

Methods: Data were analysed on 142 women over 75 years of age who had attended our community fracture liaison service after sustaining a low trauma fracture over an 18 month period. Along with assessment of clinical risk factors for fracture, it is standard practice for these patients to undergo heel DEXA scanning (Caltican, Demetech), though patients are usually treated regardless of BMD result, in accordance with NICE guidelines.

Results: The 142 women had a mean age (standard deviation) of 80 years (4.5), 82 (58%) had a T-score < -2.5. Since the National Osteoporosis Society now advocates the use of 90% sensitivity and specificity device specific thresholds when using peripheral bone densitometry, we further categorized our patients, according to these thresholds, into three groups, 1) those patients who have peripheral BMD above the 90% sensitivity threshold to identify normal Bone density at the hip or spine, (T-score >-1.7). 2) Those patients who have peripheral BMD reading between the two thresholds, (T-score < 1.8 but > -2.7) and 3) those patients that have peripheral BMD below the 90% specificity threshold to identify osteoporosis at the hip or spine (T-score <-2.8). 25 (18%) women had T-score >-1.7 and 70 (49%) women had T-score < -2.8. 47 (33%) of the women had T-score between the two thresholds and in these women it is not possible to predict with accuracy whether or not they had osteoporosis at the axial skeleton.

Disclosure statement: All authors have declared no conflicts of interest.

141. PREDICTORS OF FALLS RISK AMONG PATIENTS REFERRED FOR DEXA SCANNING: A PREDICTION MODEL

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Proportion of women eligible for BMD and for treatment, according to the algorithms proposed for women from the UK.

<table>
<thead>
<tr>
<th>N Prior fracture (%)</th>
<th>&gt; AT and &lt; IT (n, %)</th>
<th>At least 1 Risk Factor (a)</th>
<th>Total eligible for assessment (n; %)</th>
<th>&gt; IT after DXA (n; %)</th>
<th>&gt; IT Total eligible for treatment (n; %)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Major</td>
<td>Hip</td>
<td>Major</td>
<td>Hip</td>
<td>Major</td>
</tr>
<tr>
<td>50-54 years</td>
<td>173</td>
<td>28 (16.0%)</td>
<td>4 (2.3%)</td>
<td>36 (24.5%)</td>
<td>24 (14.0%)</td>
</tr>
<tr>
<td>55-59 years</td>
<td>204</td>
<td>45 (17.4%)</td>
<td>2 (0.8%)</td>
<td>43 (20.2%)</td>
<td>17 (6.6%)</td>
</tr>
<tr>
<td>60-64 years</td>
<td>277</td>
<td>71 (25.6%)</td>
<td>6 (2.2%)</td>
<td>25 (12.1%)</td>
<td>11 (4.0%)</td>
</tr>
<tr>
<td>65-69 years</td>
<td>25 (58.5%)</td>
<td>3 (1.5%)</td>
<td>9 (5.8%)</td>
<td>18 (6.3%)</td>
<td>17 (6.3%)</td>
</tr>
<tr>
<td>70-74 years</td>
<td>177</td>
<td>42 (23.0%)</td>
<td>30 (17.2%)</td>
<td>12 (6.9%)</td>
<td>57 (32.8%)</td>
</tr>
<tr>
<td>75-79 years</td>
<td>183</td>
<td>71 (37.6%)</td>
<td>58 (32.4%)</td>
<td>4 (2.4%)</td>
<td>69 (38.5%)</td>
</tr>
<tr>
<td>80 years</td>
<td>97</td>
<td>47 (46.1%)</td>
<td>47 (46.1%)</td>
<td>3 (3.1%)</td>
<td>97 (46.1%)</td>
</tr>
</tbody>
</table>

(a) Excludes women with a prior fracture.

Background: Osteoporotic fractures and falls are as heads and tails of a coin. Among the elderly, the greatest risk of fracture comes from falls, rather than osteoporosis, hence, bone mineral density measurement should not be used alone to estimate fracture risk or guide treatment decisions. Evidence shows that at least 15% of falls in older people can be prevented, with individual trials reporting relative reductions of up to 50%. We developed a model that predicts the falls risk among patients referred for bone mineral density using variables that are easily assessed in clinical practice.

Methods: As part of the integrated osteoporosis and falls service, patients admitted to the hospital with low trauma fracture had their bone mineral density assessed. In addition to DXA scanning, falls and fracture risk assessment using FRAX (before and after the occurrence of the fracture), as well as falls risk factors were analyzed. The independent predictive value of the different risk factors for the occurrence of falls was assessed using logistic regression analysis. A prediction scoring system was developed using data from a cohort of 106 patients. 102 osteoporotic patients without history of falls or fracture were also assessed as control group. The diagnostic performance of the prediction model was evaluated using the area under the curve (AUC). The developed prediction model was internally validated.

Results: Falls risk was significantly higher among the osteoporotic patients who sustained fractures in comparison to the control group (P < 0.01). The risk factors significantly correlated with an increased risk of falls were: history of > 1 fall in the last 12 months (recession coefficient 2.2), slowing of the walking speed/ change of the gait (1.6), impaired vision (1.2), weak grip strength (1.1), loss of balance (1.2). Cut off point of 3.5 achieved the best sensitivity and specificity (0.918 and 0.86 respectively, PPV85.9) and was indicative of high falls risk. A score of 2.0-3.5 was indicative of moderate risk.

Conclusions: The findings indicate that evaluation of falls risk based on risk factor profiles of individual patients can help physicians identify high risk osteoporotic patients and assist with decisions concerning falls prevention and patient management. Also, these results emphasize the importance of performing a falls risk assessment for all osteoporotic patients, in parallel with bone mineral density measurement, on regular basis as part of their assessment and management.

Disclosure statement: All authors have declared no conflicts of interest.

Paediatric and Adolescent Rheumatology

143. KNEE JOINT IN JIA: A PROSPECTIVE EVALUATION OF CLINICAL EXAMINATION, ULTRASOUND AND MRI ASSESSMENT. A NEWLY DEVELOPED KNEE MRI SCORING SYSTEM IN JIA

Laura Pascoli1, Noel J. Napier1, Maria Wray1, Maura Mc Carron1, Catherine Mc Allister1 and Madeleine E. Rooney1

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Background: We prospectively compared agreement between clinical, ultrasound (US) and MRI assessments of the knee joints in children with juvenile idiopathic arthritis (JIA).

Methods: Three hundred and thirty one knees from 48 children over a period of 2 years, affected by JIA with knee arthritis, were assessed clinically and ultrasonographically on the same day, using a semi-quantitative scoring system from 0 to 3 (0: normal; 1: mild; 2: moderate; 3: marked) for swelling and effusion, respectively. A subgroup of these children (25) with a total of 40 knees had matching MRI scans obtained within 0 to 14 days from clinical and US examinations. For those, US and MRI scans (T1 weighted images) were scored 0-3 for effusion, synovial hypertrophy, bone oedema and bone erosions, using for the first time our newly developed knee MRI scoring system.

Results: A moderate agreement for effusion was found between the 331 knees assessed clinically and ultrasonographically (linear weighted Kappa: 0.54). Out of the 260 clinical normal knees, 30 (11.5%) had mild to moderate effusion on US and 89 (34.2%) had trace

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**Paediatric and Adolescent Rheumatology**

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