differences in clinical parameters between men with and without fragile bone strength.
**Results:** The mean age was 77 (± 7.6 years), and 69% of men were white. Out of 102 men (18.3%) who met criteria for fragile bone strength by BCT, 42 (7.5%) had low FN BMD (T-score between -1.0 and -2.5) and 2 (0.4%) had normal FN BMD (T-score ≥ -1.0). The percentage of men with fragile bone strength and discrepant BMD increased with age (5.4% in age 65–74; 8.2% in age 75–84; 13.0% in age ≥ 85). The average 10-year hip fracture risk by FRAX of men with fragile bone strength was 6.5% (± 4.0%). However, 13 out of 44 men with normal-to-low BMD had 10-year hip fracture risks < 3% despite fragile bone strength presence and did not meet recommendation for osteoporosis pharmacotherapy. Examining men with normal-to-low BMD (n=493), those with fragile bone strength tended to be older, have lower BMI, and of Hispanic ethnicity compared to those with normal-to-low bone strength ($p<0.05$).
**Conclusions:** Our study showed that fragile bone strength is present in older men with normal-to-low BMD, and that inclusion of 10-year hip fracture risk by FRAX may capture some, but not all, men at increased risk of hip fractures. Skeletal fragility measured by BCT may serve as additional data to assist with clinical decision making for men with osteoporosis, though further prospective research is needed.
**Reference:** 1. Watts et al, J Clin Endocrinol Metab. 2012 Jun;97(6):1802–22. 2. Adams et al, J Bone Miner Res 2018 Jul;33(7):1291–1301. 3. Shuhart et al, J Clin Densitom. 2019 Oct-Dec;22(4):453–471.

## Bone and Mineral Metabolism
### FRACTURE PREVENTION AND TREATMENT

***Bone Mineral Density Assessment Following Radiotherapy Related Insufficiency Fractures (RRIFs) of the Pelvis***

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**Background:** Pelvic radiotherapy causes symptomatic Radiotherapy Related Insufficiency Fractures (RRIFs) in around 20% of patients. Pathophysiology and predisposing factors for RRIFs are not well understood. Some studies have determined low BMD/osteoporosis to be a risk factor but only a few utilised DXA assessment of BMD at baseline prior to radiotherapy or at the time of RRIF development. Primary or secondary interventions to prevent/treat RRIFs have not been assessed. **Methods:** Retrospective analysis of patients (n=44; 42F; median age 65.5yrs [IQR 55, 73]) who underwent a DXA (Hologic) scan (Lumbar Spine (LS) (L1-4), Total Hip (TH), Femoral neck (FN) and Trabecular Bone Score (TBS)) following a diagnosis of pelvic RRIF between 2010–2019 at a tertiary referral cancer centre in the UK. Patient characteristics and treatment history were assessed. Osteoporosis (T-score <-2.5), osteopenia (T-score <-1 >-2.5) and normal BMD (T-score >-1) were defined as per WHO classification. **Results:** Cancer diagnoses; cervical (n=17), endometrial (n=9), vaginal (n=6), anal (n=6), other (n=6). Cancer treatments; chemotherapy (n=36), surgery (n=22), brachytherapy (n=26). Conventional risk factors for osteoporosis; previous fragility fracture (n=9, one on bisphosphonate prior to RRIF), smoking (n=7), glucocorticoid use (n=4), parental hip fracture (n=3), alcohol excess (n=3) and hypogonadism (n=2 and 8 on HRT). Median BMI = 25.4 [22.8, 28.5] kg/m$^2$. Median interval between initiation of radiotherapy and RRIF was 9.8 [7.1, 19.3] months and between RRIF and DXA 3.5 [2, 8] months. At the time of the RRIF, 5 had normal BMD, 20 had osteopenia and 16 osteoporosis. Three patients were <40yrs at time of DXA (lowest Z-score -2 at LS in n=1). Median T-scores in LS, FN and TH were -1.8 [-2.8, -0.98], -1.65 [-2.4, -1.18] and -1.25 [-1.68, -0.5] respectively; N=24 had all Z-scores ≥-1. Median TBS T-score was -2.65 [-3.48, -2]. Median 10-yr hip fracture risk (FRAX HF) was 1.8% [0.7–4.1], major osteoporotic fracture risk (FRAX MO) was 8.9% [5.2- 13] (if RRIF included as FRAX risk factor: 2.9% [1–5] and 15% [8.7- 20] respectively). FRAX HF was ≥ 3% in n=14 and FRAX MO ≥ 20% in n=6 (accounting for RRIF: n= 20 and 12 respectively). Most patients therefore fell below the intervention threshold. Pelvic radiotherapy dose was negatively associated with LS BMD (p=0.0228). Body mass index was positively correlated with LS BMD (p=0.002).
**Discussion:** Most patients did not have osteoporosis at the time of RRIF and overall had low fragility fracture risk as defined by FRAX. RRIFs can also occur with normal hip and spine BMD. Low BMD at the spine was however associated with higher pelvic radiotherapy dose. The mechanism of RRIFs is likely different to osteoporotic fragility fractures and whilst low BMD is a probable risk factor, further studies are required to fully understand their pathophysiology and how fracture risk should be best assessed in these patients.

## Bone and Mineral Metabolism
### FRACTURE PREVENTION AND TREATMENT

***Clinical Risk Factors for Osteoporotic Fractures in Men With Non-Metastatic Prostate Cancer on Androgen Deprivation Therapy With or Without Anti-Osteoporosis Treatment***

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**Introduction:** Androgen deprivation therapy (ADT) decreases bone mineral density and increases osteoporotic fracture (OsteoFx) risk.
**Hypothesis:** To assess OsteoFx clinical risk factors (CRF) most predictive of future OsteoFx among men with prostate cancer on ADT.
**Methods:** 4370 electronic medical records were reviewed of adult men with prostate cancer on cancer therapy +/- anti-osteoporosis therapy (Anti-OsteoRx) from 2011–2019. Cancer therapy included ADT (anti-androgens, GnRH agonists & antagonists, orchiectomy) and supplemental cancer therapy (SupplRx) (prostatectomy, brachytherapy, radiation, immunotherapy, and chemotherapy). Anti-OsteoRx included bisphosphonates, denosumab, and parathyroid hormone analogs. Patients with other cancers within 5 years of initial visit, metastasis, and traumatic

fractures were excluded. Retrospective analysis was done to determine baseline characteristics, type and duration of ADT, Anti-OsteoRx, SupplRx, and osteoporosis CRF.
**Results:** 615 men on ADT +/- SupplRx +/- Anti-OsteoRx were included in the study. 10.08% had OsteoFx irrespective of SupplRx or Anti-OsteoRx. Comparing the OsteoFx group to the non-fracture group, the following CRF were found to be statistically significant ($p < 0.05$): age at prostate cancer diagnosis (75.10 +/- 11.80 vs 71.59 +/- 9.80 y), diabetes mellitus (DM) (33.9 vs 19%), pre-existing comorbidities affecting bone (PreCo) (41.9 vs 24.8%), steroid use (11.3 vs 4.0%), and anti-convulsant and proton-pump inhibitor (med) use (45.2 vs 26.8%).
9.89% of 374 men on ADT only without (wo) Anti-OsteoRx fractured. Statistically significant CRF for OsteoFx were age (76.86 +/- 10.55 vs 73.02 +/- 10.06 y), DM (40.5 vs 19.6%), PreCo (45.9 vs. 26.4%), and med use (48.6 vs. 25.5%).
In the following subgroups there were no statistically significant difference in CRF: • 7.64% of 170 men on ADT + SupplRx wo Anti-OsteoRx • 19.23% of 52 men on ADT only + Anti-OsteoRx • 10.52% of 19 men on ADT + SupplRx + Anti-OsteoRx
To increase statistical power, patients on ADT +/- SupplRx were assessed: • Among 71 men on ADT +/- SupplRx + Anti-OsteoRx, there were no statistically significant differences in CRF • Among the 544 men on ADT +/- SupplRx wo Anti-OsteoRx, significant CRF for OsteoFx were age (75.16 + 11.70 vs 71.37 + 9.85 y), DM (38 vs 19.4%), PreCo (38 vs 24.1%), steroid use (12 vs 3.8%), and med use (48 vs 24.3%)
**Discussion:** Men with prostate cancer requiring ADT have a higher incidence of osteoporosis defined by DXA prior to initiating ADT compared to age-matched cohorts (Hussain et al). Our study revealed ADT with CRF is associated with OsteoFx irrespective of SupplRx or Anti-OsteoRx. Limitations include inability to evaluate efficacy of Anti-OsteoRx due to insufficient power.
**Conclusion:** OsteoFx risk assessment utilizing CRF, FRAX, DXA with timely intervention may prevent OsteoFx in these high-risk patients.

## Bone and Mineral Metabolism
### FRACTURE PREVENTION AND TREATMENT

***Diagnostic Accuracy of Different Screening Tools for Identifying Osteoporosis Risk Among Post-Menopausal Filipino Women Aged 45–65 Years***

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Early screening of osteoporosis decreases fracture risk. Several identified clinical risk factors led to the development of screening tools to estimate osteoporosis risk. Bone Mineral Densitometry (BMD) as a diagnostic tool for screening is not practical because of high cost and poor availability. The extensively studied osteoporosis screening tools are: Simple Calculated Osteoporosis Risk Estimation (SCORE), the Osteoporosis Risk Assessment Instrument (ORAI), the Age Bulk One or Never Estrogen (ABONE), body weight (WEIGHT), and the Osteoporosis Risk Index (OSIRIS). These tools were developed and validated in Caucasians. Validation of these tools for specific populations is necessary because of the observed variations in BMD across geographic and ethnic groups. To date, the utility of these screening tools in the Philippines is unknown. We conducted a cross-sectional analysis of all patients who underwent BMD screening for osteoporosis in a tertiary hospital from January 2015 to September 2020. The study participants were postmenopausal Filipino women aged 45 to 65 years. The subjects had no history of osteopenia, osteoporosis, hip or spine fractures, use of osteoporosis medications, renal insufficiency, bilateral oophorectomy, hysterectomy, or early menopause. We identified demographic and clinical risk factors. These risk factors were used to calculate the risk score of five osteoporosis risk assessment tools: ORAI, ABONE, WEIGHT, OSTA, and ORISIS. Using the DEXA T-score as an external criterion, the sensitivity, specificity, positive and negative predictive values, positive and negative likelihood ratios, and diagnostic accuracy for each tool were calculated. Included were 1869 subjects with a mean age of 57.9 + 4.3 years old. Osteoporosis, with a T-score of <-2.5 at the lumbar or femoral neck area, was seen in 665 (35.58%). Risk factors such as weight, height, BMI, menopausal years, history of previous fractures, and intake of oral calcium supplements correlated significantly with a higher risk (OR=1.025, 95%CI: 0.974–1.079; OR=1.059, 95%CI: 0.84–1.338; OR=1.063, 95%CI: 0.817–1.383; OR=1.74, 95%CI: 1.198–2.528; and OR=1.088, 95%CI: 0.869–1.319), of having osteoporosis in the said population. ORAI and WEIGHT have the highest probability of identifying patients with a sensitivity of 88.42% and 91.28%, and accuracy of 85.71% and 87.98%. Both performed equally in screening for osteoporosis in this setting. However, ABONE, OSTA, and ORISIS underestimated the number of high-risk osteoporosis patients, because of their low sensitivity and diagnostic accuracy. Both ORAI and WEIGHT are simple and easy to calculate and can serve as an initial screening tool to identify Filipino postmenopausal women who are at high risk for osteoporosis. A prospective study with a correlation of fracture occurrences may provide evidence for the value of these tools as a screening test.

## Bone and Mineral Metabolism
### FRACTURE PREVENTION AND TREATMENT

***Effect of Statin Use on the Risk of Osteoporotic Fracture in Patients With Metabolic Syndrome: A Nested Case-Control Study***

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Statins may have advantageous pleiotropic effects on bone metabolism, however, the clinical evidence about the association is still unclear. Although many studies have already