PILOT PROJECT TO ASSESS THE IMPACT OF IDENTIFYING PATIENTS AT HIGH RISK OF FRACTURE ON AN ACUTE ONCOLOGY WARD, ENDOCRINOLOGY TEAM

TEAM MEMBERS:

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Background:

Six hip fractures were identified during inpatient admissions during the Christie in 2020/2021. All six patients had an interruption to their oncology management as a result (including transfer to acute hospital, orthopaedic surgery and management) and all died within 12 months of sustaining the fracture. Patients with an oncology diagnosis are likely to be at higher risk of fragility fracture for several reasons. There is a lack of local and national guidance on bone protection in adult oncology patients.

The FRAX assessment tool[1] was developed to evaluate fracture risk of patients. The FRAX algorithm provides a ten-year probability of a major osteoporotic fracture (clinical spine, hip, forearm or humerus) and/or hip fracture and can be used to identify patients at low, intermediate, high or very high risk of fracture. The FRAX online assessment tool is linked to treatment recommendations from the National Osteoporosis Guidelines Group (NOGG) UK[2]. Recommendations range from lifestyle advice to measurement of bone mineral density (BMD) via DXA scan with thresholds for medication treatment and specialist referrals.

On review of the six patients with fracture at the Christie, all had a fracture risk calculated using the FRAX algorithm which placed them into the “measure BMD” group, implying that there may have been an earlier opportunity to identify these patients were at risk and intervene to potentially prevent the fracture, with the aim to allow continuation of oncology treatment and reduce morbidity, mortality and environmental impact.

Specific Aims:

To review the fracture risk in an unselected group of Oncology in-patients using the FRAX questionnaire and determining the workforce/environmental/medication implications of this. Environmental and financial cost of the screening will be compared to the impact of a fracture and its management.

Methods:

A modified FRAX questionnaire (based on the Christie DXA service patient questionnaire) was administered to 11 inpatients on Ward 11 who were able to complete it. Dr Higham reviewed the questionnaires and calculated the FRAX score using the results and information (medications/height/weight) available on The Trusts electronic note system (Clinical Work Portal).

The outcomes of the questionnaire (lifestyle advice/DXA scan recommended/treatment) were evaluated for their workforce/economic and environmental outcomes and compared to the environmental impact of a hip fracture.

For the purposes of this audit, we were looking at potential implications of rolling this out on the wards. It is not currently in any recommendations to screen oncology inpatients and those identified from our audit as requiring treatment were already receiving treatment or under investigation. Therefore, there were no changes made to patient care.

Measurement:

Patient outcomes:

- FRAX score in 13 acute oncology patients was used to extrapolate potential treatment costs for 100 patients.
- The six unselected inpatients on acute Oncology ward at the Christie (ward 11) who experienced a hip fracture during an admission in 2020/2021 were used as a model population in terms of incidence of fracture within the inpatient population at the Christie.
- A larger piece of work would be required to look at a larger population to increase accuracy and applicability of data.

Environmental sustainability:

The results from screening with FRAX were translated into CO2e compared to carbon footprint of a hip fracture.

The carbon emissions associated with the treatment drugs were estimated using an Environmentally Extended Input Output Analysis (EEIOA), In EEIOA, financial spend in a sector is directly converted into kgCO2e. The cost of each treatment drug was collected and converted into kgCO2e using emissions factors taken from the 2020/21 Greener NHS database (pharmaceutical factor 0.1277 kgCO2e/£). Treatment carbon emissions were extrapolated to 5-year patient treatment plan.

Lifestyle advice carbon emissions were estimated based on a two-page patient leaflet. Carbon emissions associated with a Dexa scan was estimated based on energy consumption of one scan (provided by Trust), energy consumption was converted into carbon emissions using electricity carbon conversion factor taken from BEIS 2022 database. A 10-page patient questionnaire and patient travel was also included. Carbon emissions associated with patient travel were estimated based on average patient journey (taken from HOTT), it was then assumed that 20% of patients have additional travel associated with a scan (80% already inpatient).

The minimum care given for a hip fracture was used to determine average CO2e however this is likely a large underestimation of the cost of a fracture.

Economic sustainability:

- Cost of screening dexa scan was taken from Turner et al 2018[3].
- Treatment costs for dxa scan and medications were obtained in paper by Glynn et l (2020)[4].
- The cost of a fracture was taken from a recent paper by Baid et al (2022)[5]

Social sustainability:

We plan to collect qualitative data from patients and staff in future and have detailed anticipated results below.

Results:

Patient outcomes:

13 patients (10 females, 3 males) were evaluated for FRAX score**.** Median age 62 (range 39-77) years.

Risk Factors for fracture:

2 patients had previous fractures (hip, vertebral, pelvic), one on alendronate therapy

1 had history of parental hip fracture

5 were treated with glucocorticoids

2 had history of Rheumatoid Arthritis

FRAX score:

Mean(+/-sd) 10yr risk of hip fracture 3.5(+/-5.6)%

Mean (+/-sd) 10yr risk of Major Osteoporotic Fracture 9.3(+/-6.6)%

NOGG interpretation of the FRAX score:

6/13 Lifestyle treatment

5/13 Bone Mineral Density testing (DXA scan) recommended

2/13 Treatment recommended without need for Bone Mineral Density testing (DXA scan).

Population assessment:

2/13 died

4/13 prognosis of weeks-months

Implementation of an effective screening/surveillance program would have Oncology population level implications.

Environmental sustainability:

Carbon Footprint of FRAX testing in acute Oncology setting for 13 patients:

Interventional treatment option	Carbon footprint (kgCO2e)	Number of patients recommended intervention	CO2e for 5 years
Lifestyle advice	0.0088	6	0.0528
Dex scan (x1)	3.03955	5	15.2
Vitamin D3 tablets* (per patient per week)	0.010546529	0	NA
Bisphosphonate: Alendronic acid (per patient week)	0.086823729	2	45.1483
Bisphosphonate: Adcal (per patient per week)	0.047082721	2	24.48
Total			84.8819

*Patients will be recommended either Vitamin D or Adcal. For the purposes of our audit, the more expensive option (Adcal) was used.

The CO2e for 13 patients based on 5 years of treatment with Alendronic acid and Adcal is 84.9 kgCO2e. Projected to 100 patients this equates to 653 kgCO2e for 5 years, or 129 kgCO2e per year. This is an underestimation as dependant on result of the dexa scan, patients may have required additional treatment with Vitimin D or Alendronic Acid.

The following information was considered when interpreting our patient data into potential reduction in fractures and subsequent environmental and financial impacts.

- Randomised control trials: patients with osteopenia/osteoporosis (post menopausal women generally) have a 40-50% reduced risk of hip fracture at 3 years on Zolendronate and 5 years with Alendronate
- SCOOP trial[3] (screening of a post menopausal women in community using FRAX) showed that at 5 years the screening and following of FRAX recommendations led to a 30% RR reduction for hip fracture at 5 years compared to non-screened population. This study also demonstrated cost-effectiveness to screening.
- bisphosphonates can reduce incidence of hip fractures by 40%

Patients in treat zone without BMD: 2/13

- Risk of hip fracture over 10 years: 25% (12.5% over 5 years)
- Therefore, approximately 13/100 patients in an unscreened population would have hip fracture in 5 years.

Based on evidence bisphosphonates can reduce incidence of hip fractures by 40%, this would reduce from 13 to 8 patients in a screened population over 5 years.

Patients recommended BMD scan: 5/13

- Mean risk of hip fracture over 10 years: 1.76% (0.88% over 5 years). Therefore, an additional 1 hip fracture predicted over 5 years

Based on the above, we estimate that for 100 patients treated, the incidence of hip fractures will reduce by 5-6 fractures over 5 years. We have assumed prevention of 1 fracture per year for 100 patients treated to determine our CO2e saving estimations below.

Carbon Footprint of one hip fracture operation:

Intervention	**Carbon footprint (kgCO2e) per unit**
Surgical procedure (66-132 mins)	35.1-70.2 (Mean 52.65)
Inpatient bed day (low-intensity ward)	37.9
A&E (emergency department visit)	13.8

Based on average 10 day stay following hip surgery for one patient this is a cost of 445.45 kgCO2e. This will be a significant underestimation as it is not including rehabilitation, ongoing pain medications, and additional care and potential complications associated with a hip fracture.

Potential savings

Therefore, as a rough estimate a carbon saving of **316.45 kgCO2e** for 100 patients screened. This is equivalent to 911.4 miles driven in an average car.

This is likely a significant underestimation based on reasons stated above. These results do also not account for incidence of major osteoporotic fracture (clinical spine, hip, forearm or humerus) which will also reduce with screening and treatment.

Economic sustainability:

The approximate cost for 100 patients screened and treated in one year is £6,500. The approximate cost for 1 hip fracture in year following treatment is £10,000. This indicates a potential saving of **£3,500 per year.** As per our environmental findings, this is likely a significant underestimation.

Social sustainability:

It is very distressing for patients, staff and the Trust to have patients that sustain fractures (particularly hip fracture) during oncology treatment. Prevention of this, or at least a programme for prevention could be beneficial on many levels.

Additional staff time is required to complete the Frax assessment and scoring however longer term this could be supported by integrating the scoring into the Trust electronic system. The initial

admission paperwork for the Trust already captures data required for the majority of the assessment, which would save staff time.

Discussion:

Use of effective screening tests and treatments for Oncology patients (inpatients/outpatients) for fracture risk could have implications for mortality/morbidity and carbon footprint.

Limitations:

- A very short timescale for this project, a covid outbreak and NHS staffing pressures meant that only a small number of questionnaires could be collected.
- Our results are estimated only on 13 patients. We need larger numbers of assessments to determine scale of this and determine more accurate results.
- The estimated reductions in fracture risk are based on post-menopausal population and we do not have the direct evidence for the same efficacy in an unselected Oncology population
- The patients on Ward 11 were of high acuity and poor prognosis at the time of assessment, potentially limiting applicability in the longer-term data – should be performed also in a group
- Collecting FRAX data ideally needs to be automated

Conclusions:

Hip fractures have devastating consequences to the patient and the environment and **t**here are effective screening tests and treatments available that reduce fracture risk. Our study has modelled savings based on a small cohort of inpatients. There would be a large number of outpatients experiencing hip fractures requiring admissions, treatments and surgeries at local hospitals. Implementation of screening and treatment also has potential to reduce incidence of major osteoporotic fracture (clinical spine, hip, forearm or humerus). While these fractures may not require as much treatment (e.g. may not require hospitalisation) the clinical benefits for patient morbidity pain and mortality.

More work is required with a larger patient group of inpatients/outpatients to optimise screening strategy. As an outcome of this project, we have developed relationships with the Trust Frailty team who have also been looking at the use of FRAX assessment. We plan to work together to progress this work.

These pilot data, modelling of sustainability benefits and future quality improvement projects will align with the new Bone Cancer Research Trust (BRC2) Living with and beyond cancer bone health theme; led by Dr Claire Higham; looking at improving bone health and preventing fractures in Oncology patients.

References and Resources

1. https://frax.shef.ac.uk/FRAX/tool.aspx?country=1
2. Full Guideline | NOGG
3. Turner DA et al. *The Cost-Effectiveness of Screening in the Community to Reduce Osteoporotic Fractures in Older Women in the UK: Economic Evaluation of the SCOOP Study.* J Bone Miner Res. 2018 May;33(5):845-851. doi: 10.1002/jbmr.3381. Epub 2018 Feb 22. PMID: 29470854; PMCID: PMC5993187.
4. Glynn J, Hollingworth W, Bhimjiyani A, Ben-Shlomo Y, Gregson CL. *How does deprivation influence secondary care costs after hip fracture?* Osteoporos Int. 2020 Aug;31(8):1573-1585. doi: 10.1007/s00198-020-05404-1. Epub 2020 Apr 2. PMID: 32240332.
5. Baid H, et al *Environmentally sustainable orthopaedics and trauma: systems and behaviour change* Orthopaedics and Trauma, Volume 36, Issue 5, 2022, Pages 256-264