Audit of Osteoporosis risk management in patients who received a heart transplant at Royal Papworth Hospital in 2021/2022

Stephen Pettit, Consultant Cardiologist

NHS
Royal Papworth Hospital
NHS Foundation Trust

Case study

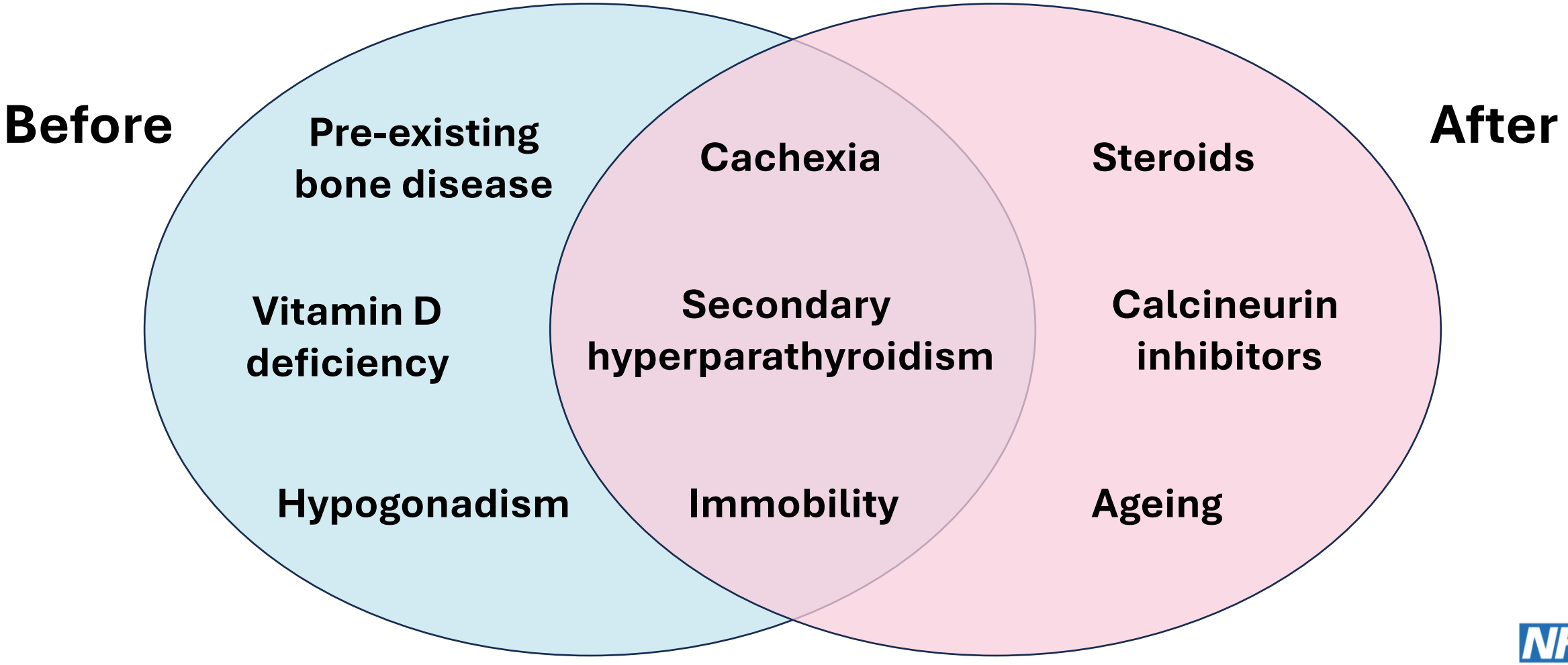
- Female 50s. HCM. Assessed in 2021.
- Osteoporosis. Previous vertebral fracture. BMI 19.
- Secondary hyperparathyroidism (loop diuretics?)
- T score -2.4 left hip, -3.5 lumbar spine on DEXA
- Orthotopic heart transplant (DBD, urgent) Nov 2021
- Calcium, Vitamin D and Denosumab continued
- 2 episodes of ACR in year one and intolerant MMF/Aza, so long-term Prednisolone
- We asked Rheumatologists to consider repeat DEXA
- Traumatic femoral fracture whilst running Feb 2023

Osteoporosis is reduced bone mineral density that leads to a risk of fragility fractures

- Risk factors include **age**, **sex**, **post-menopausal status**, **low BMI**, previous fracture, parental hip fracture, **steroid use**
- Diagnosis may be based on
  - Presence of fragility fracture (irrespective of bone mineral density)
  - **T score ≤-2.5 by DEXA, usually femoral neck or lumbar spine**
  - T score between -1.0 and -2.4 with high estimated fracture risk (by FRAX)
- **Fragility fractures** may be **spontaneous** or result from **low-force trauma** that would not be expected to cause fracture
- Most common fractures: spine, hip, wrist, humerus, rib, pelvis

Adapted from www.uptodate.com, accessed 16 August 2024

Many risk factors combine to increase risk of osteoporosis in transplant recipients



Adapted from Kim JK *et al. Endocrinol Metab* 2024;**39**:267-82

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Prevalence of osteoporosis was up to 70% in historical studies of transplant recipients

Organ	Prevalence of osteoporosis	Prevalence of fracture
Lung	Overall: 73%	Fracture rate 18-37%
Heart	Overall: 50%	Vertebral fracture 33-36%
Liver	Overall: 46%	Fracture rate 24-65%
Kidney	Lumbar spine: 17-49% Femoral neck: 11-56%	Overall 7-44%

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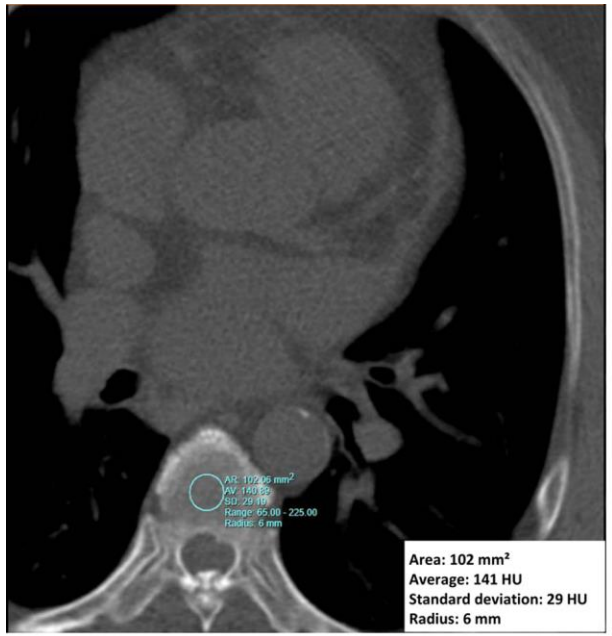
But osteoporosis is less common in transplant recipients with use of Bisphosphonates



- Prevalence of osteopenia was 31% and osteoporosis was 12% at median of 11.1 years after heart transplantation
- 8% of patients had a fragility fracture between HTx and CTCA

Roest S *et al. Clin Radiol* 2023;**78**:P772-778

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Protocol for osteoporosis risk management in heart transplant recipients described in DN828

Immediate post-transplant

Calcium and vitamin D supplement	Approximately equivalent to 1g elemental calcium and 20 microgram colecalciferol daily
Zoledronic acid	5mg IV as a single dose in the post-operative period
A single dose of Zoledronic acid provides around one year of bone protection. Calcium supplementation alone may be appropriate in patients who are already receiving adequate vitamin D supplementation	

Long-term follow-up

- Offer lifestyle advice to all patients, including recommendations about mobility, and consider the use of hormone replacement therapy in post-menopausal females.
- After one year, assess fracture risk (consider using a tool such as FRAX®), consider the need for a DEXA scan and apply clinical judgement in treatment decisions.
- If fracture risk is low, discuss stopping bone protection.
- If fracture risk is high, prescribe Alendronic acid 70mg weekly and continue continue calcium and vitamin D supplement approximately equivalent to 1g elemental calcium and 20 micrograms colecalciferol daily. If patients cannot tolerate Alendronic acid, or compliance is a concern, annual doses of Zoledronic acid may be recommended.
- Reassess fracture risk after 3-5 years of bisphosphonate therapy. Consider DEXA scan. Patients at highest risk of fracture (previous fragility fracture, T score ≤ -2.5 at femoral neck, prednisolone dose ≥ 7.5mg/day) should continue bisphosphonate treatment and specialist referral should be considered. Patients at lower risk should be offered a bisphosphonate holiday. Calcium and vitamin D supplementation should be continued.
- Reassess fracture risk after 1.5-3 year bisphosphonate treatment holiday (3 years for Zoledronic acid) and restart treatment if indicated. It may be helpful to involve a local bone mineral metabolism specialist.

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Audit standards

Before	Risk factors for Osteoporosis should be explored during assessment
Before	Patients with risk factors should have DEXA scan before transplant
Year 1	All transplant recipients should receive bone protection in year 1
Year 1	Inform GP about risk of Osteoporosis in year 1
Year 2	Bone mineral density should be assessed by DEXA scan in year 2
Year 2	Need for calcium and vitamin D supplements revisited in year 2
Year 2	Patients with Osteoporosis should be offered treatment in year 2

Methods

Before
All HTx 2021/2022
N=36

Year 1
3 deaths on ICU
N=33

Year 2
No further deaths
N=33

- All data taken from directly from electronic medical records and recorded on dedicated Excel spreadsheet
- Analysis performed using R version 4.4.1 and the packages tidyverse and gt summary

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Audit standard 1: Osteoporosis risk factors were assessed in all heart transplant recipients

Characteristic	Overall N = 36[1]	diagnosis of osteoporosis	
		yes N = 4[1]	no N = 32[1]
female age >50 years	5 (14%)	1 (25%)	4 (13%)
previous_fracture	5 (14%)	3 (75%)	2 (6.3%)
previous_steroids	3 (8.3%)	1 (25%)	2 (6.3%)
bmi less than 19	1 (2.8%)	0 (0%)	1 (3.1%)
smoker_current	0 (0%)	0 (0%)	0 (0%)
alcohol >3U/day	0 (0%)	0 (0%)	0 (0%)
rheumatoid_arthritis	0 (0%)	0 (0%)	0 (0%)
parent_hip_fracture	0 (0%)	0 (NA%)	0 (0%)
Unknown	35	4	31
any risk factor	9 (25%)	3 (75%)	6 (19%)

[1] n (%)

4/36 (11%) patients had an established diagnosis of osteoporosis at assessment

Of patients without a diagnosis of osteoporosis, 6/32 (19%) had 1 or more risk factors for osteoporosis

Most common risk factors: female age >50 years, previous fracture and steroid use

Parental history of hip fractures and menopausal status not asked or not documented in most patients

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Audit standard 2: Only 22% of patients with a risk factor for osteoporosis underwent DEXA scan before transplant

Characteristic	Overall N = 36[1]	any risk factor for osteoporosis	
		yes N = 9[1]	no N = 27[1]
dexa before listing	3 (8.3%)	2 (22%)	1 (3.7%)

[1] n (%)

All pre-transplant DEXA scans were performed in patients with an established diagnosis of osteoporosis and all showed a T score >-2.5 at femoral neck.

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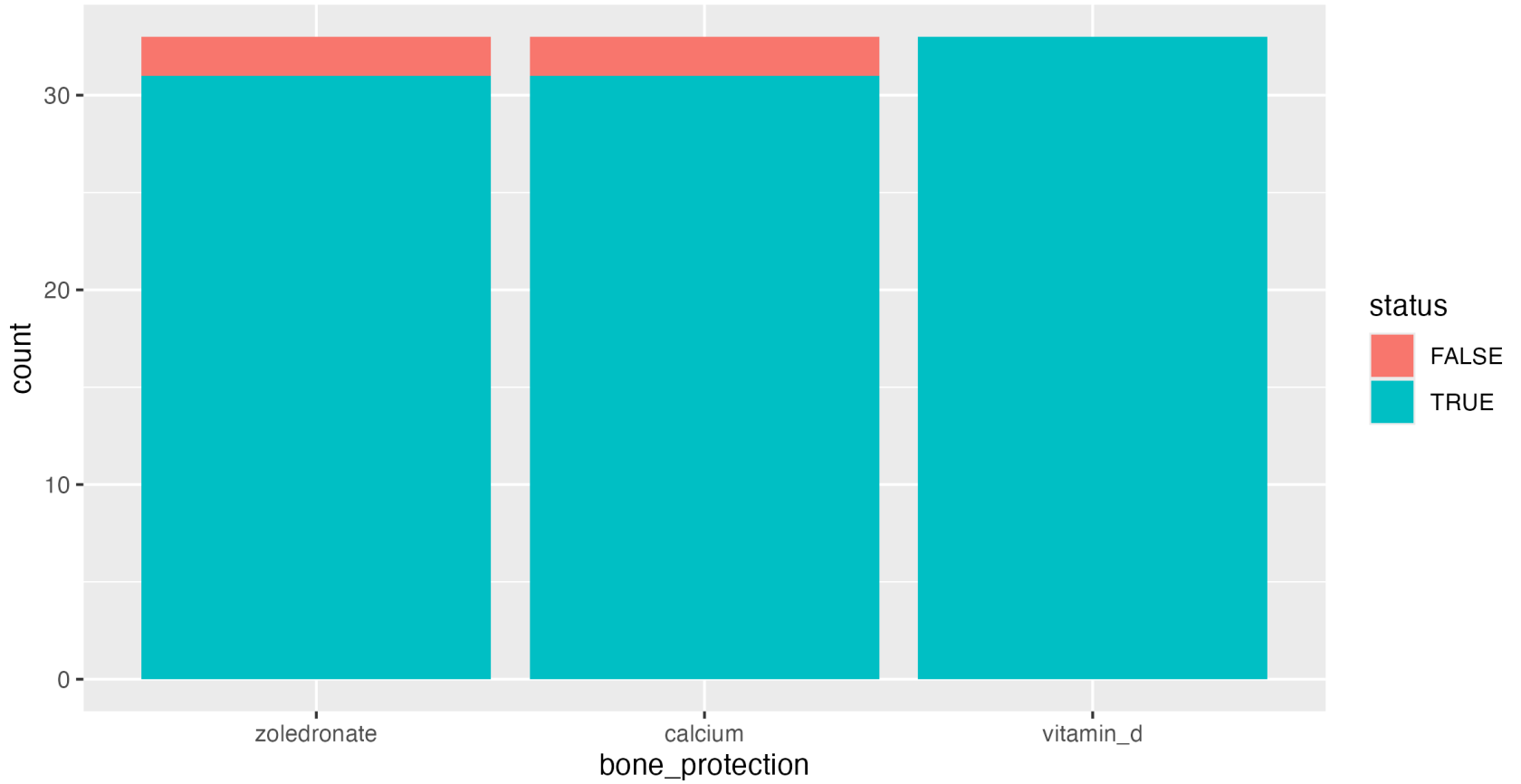
Audit standard 3: All patients without contraindication received Zoledronate, Calcium and Vitamin D



Two patients did not receive Zoledronate (CKD5=1, on Denosumab=1)
Two patients did not receive calcium (CKD5=1, renal stones=1)

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Audit standard 4: All patients had “at risk of Osteoporosis” communicated to GP in their OP clinic letters

Characteristic	N = 33[1]
risk_osteoporosis_gp_letter	33 (100%)

[1] n (%)

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Audit standard 5: DEXA scan requested in 88% patients and report received in 76% patients at end of year two

Characteristic	N = 33[1]
dexa scan requested	29 (88%)
dexa report received	25 (76%)
t-score nof	-1.00 (-1.60, -0.50)
Unknown	8
osteoporosis	4 (12%)

[1] n (%); Median (Q1, Q3)

4 patients had osteoporosis on DEXA scan. Of these;

3 did not have existing osteoporosis

2 did not have pre-transplant risk factors for osteoporosis

None had pre-transplant DEXA

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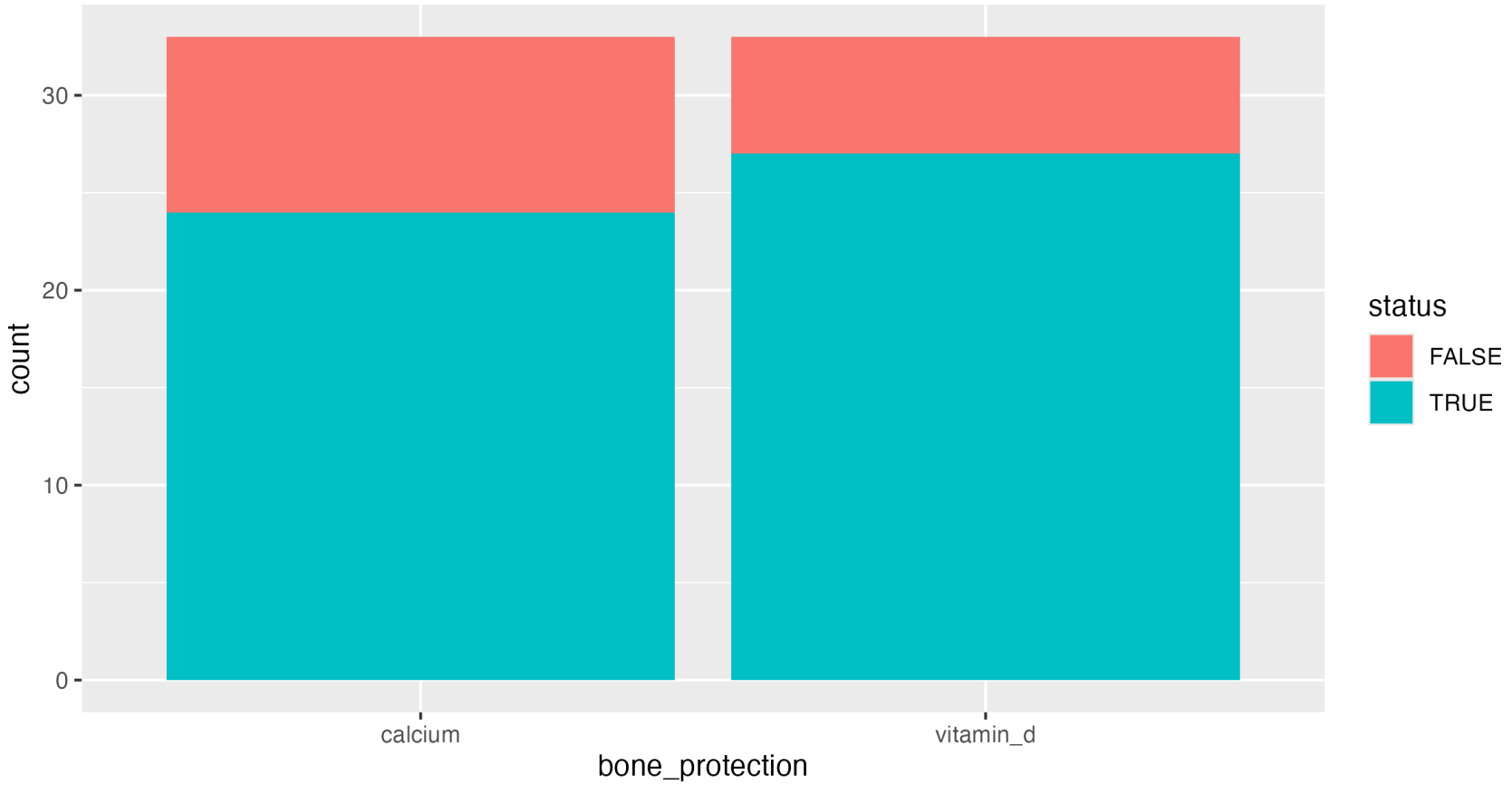
Audit standard 6: 73% and 82% of patients received Calcium and Vitamin D respectively at end of year two



Impossible to know whether calcium supplementation needed but UK guidance suggests **all adults** consider vitamin D supplement

Most adults meet their calcium requirement from balanced diet and don’t need supplements

Sources of calcium

Sources of calcium include:

- milk, cheese and other dairy foods
- green leafy vegetables – such as curly kale, okra but not spinach (spinach does contain high levels of calcium but the body cannot digest it all)
- soya drinks with added calcium
- bread and anything made with fortified flour
- fish where you eat the bones – such as sardines and pilchards

How much calcium do I need?

Adults aged 19 to 64 and over need 700mg of calcium a day.

You should be able to get all the calcium you need from your daily diet.

What happens if I take too much calcium?

Taking high doses of calcium (more than 1,500mg a day) could lead to stomach pain and diarrhoea.

https://www.nhs.uk/conditions/vitamins-and-minerals/calcium/

But vitamin D supplements should be used in autumn/winter and all year in those ‘at risk’

Should I take a vitamin D supplement?

Advice for adults and children over 4 years old

During the autumn and winter, you need to get vitamin D from your diet because the sun is not strong enough for the body to make vitamin D.

But since it's difficult for people to get enough vitamin D from food alone, everyone (including pregnant and breastfeeding women) should consider taking a daily supplement containing 10 micrograms of vitamin D during the autumn and winter.

Between late March/early April to the end of September, most people can make all the vitamin D they need through sunlight on their skin and from a balanced diet.

You may choose not to take a vitamin D supplement during these months.

People at risk of vitamin D deficiency

Some people will not make enough vitamin D from sunlight because they have very little or no sunshine exposure.

The Department of Health and Social Care recommends that adults and children over 4 take a daily supplement containing 10 micrograms of vitamin D throughout the year if they:

- are not often outdoors – for example, if they're frail or housebound
- are in an institution like a care home
- usually wear clothes that cover up most of their skin when outdoors

If you have dark skin – for example you have an African, African-Caribbean or south Asian background – you may also not make enough vitamin D from sunlight.

You should consider taking a daily supplement containing 10 micrograms of vitamin D throughout the year.

Recommended daily dose is 10mcg (400iU)
https://www.nhs.uk/conditions/vitamins-and-minerals/vitamin-d/

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Audit standard 7: All patients with evidence of osteoporosis on DEXA scan in year 2 received appropriate treatment

Characteristic	Overall N = 33[1]	osteoporosis on dexa scan: yes N = 4[1]	osteoporosis on dexa scan: no N = 29[1]
bisphosphonate	4 (12%)	3 (75%)	1 (3.4%)
denosumab	1 (3.0%)	0 (0%)	1 (3.4%)
teriparatide	1 (3.0%)	1 (25%)	0 (0%)
any treatment	6 (18%)	4 (100%)	2 (6.9%)

[1] n (%)

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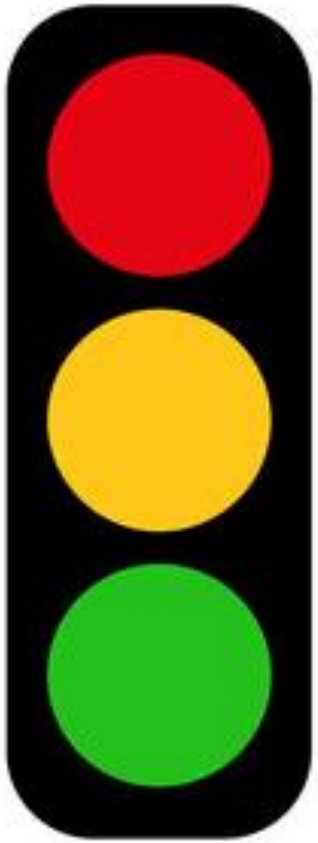

- Patients with risk factors should have DEXA scan before transplant
- Risk factors for Osteoporosis should be explored during assessment
- Bone mineral density should be assessed by DEXA scan in year 2
- Need for calcium and vitamin D supplements revisited in year 2
- All transplant recipients should receive bone protection in year 1
- Inform GP about risk of Osteoporosis in year 1
- Patients with Osteoporosis should be offered treatment in year 2

Potential areas for quality improvement

- Add osteoporosis risk assessment to 2-day assessment proforma and request DEXA scan for patients with risk factors
  - Have you broken bones or been diagnosed with Osteoporosis?
  - Has either of your parents had a hip fracture?
  - For female patients: do you have regular menstrual periods?
- Advise vitamin D supplements during autumn/winter for all patients and all year-round in patients of black/Asian ethnicity
- Avoid calcium supplements in year 2 unless dietary deficiency
- Standard letter requesting local DEXA scan in year 2 and referral for specialist assessment if T score <-2.5 at any site

Questions and comments