Vitamin D Deficiency in Children and Young People with eGFR ≥30ml/min/1.73m² – Diagnosis, Treatment and Prevention Primary Care Pathway

**Vitamin D Deficiency in Children and Young Adults**

Does patient have symptoms of vitamin D deficiency?
- Symptoms and signs of rickets:
  - Progressive bowing of legs.
  - Progressive knock knees.
  - Painful wrist swelling.
  - Rachitic rosary (swelling of the costochondral junctions).
  - Cranial tuberosities.
  - Delayed tooth eruption and enamel hypoplasia.

Does patient have other symptoms or conditions associated with vitamin D deficiency?
- Long-standing (3 months+) unexplained bone pain.
- Muscular weakness.
- Features of hypocalcaemia.
- Cardiomyopathy (in infants).

Does patient have a chronic disease that may increase the risk of vitamin D deficiency OR A bone disease where correcting vitamin D prior to specific treatment would be indicated OR Abnormal investigations?

Children and young people at higher risk of vitamin D deficiency include those with:
- Insufficient exposure to sunlight.
- Darker skin.
- Nutritional deficiency.
- Certain co-morbidities (i.e. malabsorption syndromes).
- Use of certain drugs (i.e. corticosteroids, anti-epileptic drugs).
- Obesity.
- Family history of vitamin D deficiency.

**Consider alternative diagnosis (this list is not exhaustive):**
- Certain cancers.
- Fibromyalgia.
- Fracture.
- Osteomyelitis.
- Paget's disease of the bone.
- Parathyroid disease.
- Rheumatoid arthritis.
- Polymyositis and dermatomyositis.
- Thyroid disease.
- Muscular dystrophies.

**Test for vitamin D deficiency by measuring serum 25-hydroxyvitamin D (25[OH]D) levels**

To aid diagnosis and rule out other concerns consider arranging:
- A radiological assessment, if rickets is suspected. Bone profile (calcium, phosphate, ALP), renal, liver and thyroid function tests, parathyroid hormone (PTH) level (in children, raised PTH levels are usually due to vitamin D or calcium deficiency), FBC including haemoglobin and ferritin levels (to identify other possible vitamin deficiencies), malabsorption screen, rheumatoid and other autoimmune screening and inflammatory markers.

**Refer to secondary care or seek specialist advice if the child or young person:**
- Is suspected to have a serious underlying condition such as cancer.
- Has hypocalcaemia and symptomatic, refer immediately to A&E.
- Has clinical features of rickets.
- Has other musculoskeletal symptoms.
- Has hypocalcaemia and asymptomatic, seek specialist paediatrician advice.
- Has a malabsorption disorder or other condition which causes vitamin D deficiency.
- Is taking a drug that can increase the risk of vitamin D deficiency.

**DO NOT ROUTINELY TEST FOR VITAMIN D DEFICIENCY – ONLY TEST IF:**

- If a child or young person has musculoskeletal symptoms despite adequate level, consider alternative diagnosis.

**DO NOT PRESCRIBE VITAMIN D. ADVISE MEASURES TO PREVENT VITAMIN D DEFICIENCY (see lifestyle advice and table 2).**

All children and young adults living in the UK, including people at increased risk of vitamin D deficiency should take a daily supplement of vitamin D throughout the year, including winter months.

If a child or young person has musculoskeletal symptoms despite adequate level, consider alternative diagnosis.

**Check adequacy of calcium intake.**

**DO NOT PRESCRIBE VITAMIN D. ADVISE MEASURES TO PREVENT VITAMIN D DEFICIENCY (see lifestyle advice and table 2).**

All children and young adults living in the UK, including people at increased risk of vitamin D deficiency should take a daily supplement of vitamin D throughout the year, including winter months.

**Check adequacy of calcium intake.**

**RETESTING IS NOT NORMALLY REQUIRED IF THE CHILD IS ASYMPTOMATIC AND COMPLIANT WITH PREVENTATIVE MEASURES.**

**TREAT FOR DEFICIENCY (PRESCRIBE LOADING DOSE – see table 1)**

Check adequacy of calcium intake.
Check serum calcium levels before treatment and every 4 weeks during high dose vitamin D treatment. Where hypercalcaemia is a concern contact secondary care for advice.

Loading doses should be followed by daily supplemental doses (see table 2) as self-care where the patient or parents/carers are willing and able.
**Table 1 - Vitamin D Treatment Regimens for Children and Young Adults**

<table>
<thead>
<tr>
<th>Treatment (Check adequacy of calcium intake)</th>
<th>Dose (Vitamin D international units)</th>
<th>Regimen</th>
<th>Formulary choice (Prescribe by brand)</th>
<th>Cost per course</th>
<th>Full quantity to prescribe (Acute prescription)</th>
<th>Considerations correct as of August 2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deficiency &lt;30nmol/L</td>
<td>Age 1 – 5 months; 3,000 IU daily for 8 – 12 weeks.</td>
<td>3,000 units once a day for 8 weeks</td>
<td>Thorens 10,000 I.U./ml oral drops, 15 drops (0.3ml) once daily</td>
<td>£11.70</td>
<td>2 x 10ml</td>
<td>Thorens 10,000 I.U./ml oral drops</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25,000 units weekly for 7 weeks</td>
<td>Invita D3 25,000 I.U. - ONE x 1ml (single dose oral solution unit) as a single dose, once a week</td>
<td>£10.38</td>
<td>7 single-dose units</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age 6 months – 11 years; 6,000 IU daily for 8 – 12 weeks.</td>
<td>6,000 units once a day for 8 weeks</td>
<td>Thorens 10,000 I.U./ml oral drops, 30 drops (0.6ml) once daily</td>
<td>£23.40</td>
<td>4 x 10ml</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>50,000 units weekly for 7 weeks</td>
<td>Invita D3 25,000 I.U. – TWO x 1ml (single dose oral solution unit) as a single dose, once a week</td>
<td>£20.77</td>
<td>14 single-dose units</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age 12 – 17 years 10,000 IU daily for 8 – 12 weeks.</td>
<td>10,000 units once a day for 8 weeks</td>
<td>Thorens 10,000 I.U./ml oral drops, 50 drops (1ml) once daily</td>
<td>£35.10</td>
<td>6 x 10ml</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>75,000 units weekly for 7 weeks</td>
<td>Invita D3 25,000 I.U. - THREE x 1ml (single dose oral solution unit) as a single dose, once a week</td>
<td>£31.15</td>
<td>21 single-dose units</td>
<td></td>
</tr>
</tbody>
</table>

**Considerations**

- The dropper supplied with Thorens 10,000 I.U./ml oral drops is calibrated to deliver a dose in drops only. Please note that a dose administered in millilitres or not delivered using the dropper supplied (i.e. an 1ml oral syringe) would be outside the terms of product license.
- Gelatine free, suitable for patients with soya/peanut allergy and vegetarians/vegans.
- Thorens 10,000 units/ml oral drops are licensed for use in the paediatric population. The SPC states national posology recommendations in the prevention and treatment of vitamin D deficiency can be followed.
- Please note that Thorens 25,000 units/ml oral solution is not licensed in children.

**Administration**

- Either formulation may be mixed with a small amount of milk or cold or lukewarm food immediately before administration.
- Suitable for vegetarians. Free from gelatin, nuts, lactose and soya.

**Allergies**

- If a patient has an allergy it is important this is highlighted to their doctor or pharmacist so the relevant product may be checked for suitability at the point of dispensing (noting that manufacturers can change their formulations at any time).

**Adverse effects**

- Consideration of the patient requires a specific formulation, or the above recommendations are not suitable. Please contact the Medicines Optimisation Team via CAPCCG.prescribingpartnership@nhs.net for further advice and support.

**Please note** the reference ranges slightly differ to NICE due to the way vitamin D levels are reported by our local pathology laboratory.

Where a patient is supplied vitamin D deficiency treatment in hospital, the full course length should be supplied by the hospital (please note vitamin D formulations may differ between primary and secondary care and conversion between products should be completed carefully with the patient and their parents/carers counselled fully BEFORE any change is made to avoid any dosing errors.

If you have concerns about compliance with the above regimens, please see specialist advice or refer to secondary care for alternative treatment options to be discussed.
Vitamin D Contraindications and Cautions

- Do not prescribe vitamin D preparations to children and young people with:
  - Hypercalcaemia or hypercalciuria (or diseases or conditions which can cause these problems).
  - Hypervitaminosis D.
  - Nephrolithiasis.
  - Severe renal impairment — vitamin D$_2$ and D$_3$ will not be metabolized normally; other forms of vitamin D should be used.

- Prescribe vitamin D with caution to children and young people:
  - With mild to moderate renal impairment.
  - With a co-existing condition associated with increased sensitivity to vitamin D (such as sarcoidosis, tuberculosis, lymphoma, or primary hyperparathyroidism) — consider seeking specialist advice.
  - Taking certain drugs (see drug interactions).

Vitamin D Adverse Effects

- Vitamin D toxicity rarely occurs unless the vitamin D dose is very high.
- Manifests mainly through chronic hypercalcaemia:
  - Nausea and vomiting.
  - Diarrhoea.
  - Constipation.
  - Anorexia and weight loss.
  - Lethargy.
  - Polyuria and thirst.
  - Sweating.
Headache.
Vertigo.
Raised concentrations of calcium and phosphate in plasma and urine.

- If hypercalcaemia is suspected, check serum calcium levels:
  - If hypercalcaemia is identified, assess the person's state of hydration, and consider admission if the person is dehydrated.
  - If the person is taking a calcium supplement, advise that it should be stopped.

Other adverse effects in the general population that have been linked with high vitamin D intake or high serum 25 (OH) D levels:
- An increased incidence of falls and fractures.
- An increased rate of pancreatic and prostate cancer.
- An increased total mortality (that is, from all causes combined).
- However, evidence for these associations is less robust and consistent than that relating to hypercalcaemia.

Drug Interactions

Seek specialist advice as appropriate during concurrent treatment with these drugs.

- **Antiepileptic drugs (phenytoin or barbiturates)** — can increase the metabolism of vitamin D, leading to a reduction in the effects of vitamin D. *Higher doses of vitamin D may be needed.*
- **Cardiac glycosides** — excessive dosing of vitamin D can induce hypercalcaemia, which may enhance the effects of digoxin and other cardiac glycosides (leading to an increased risk of digoxin toxicity and serious arrhythmias). *Close monitoring (and possibly a dose reduction of vitamin D) is needed during concurrent use.*
- **Corticosteroids** — may increase vitamin D metabolism and elimination. *Higher doses of vitamin D may be needed.*
- **Ion exchange resins (such as colestyramine) or laxatives** — may reduce the gastrointestinal absorption of vitamin D. *Higher doses of vitamin D may be needed.*
- **Miconazole** — the effects of vitamin D are possibly reduced by miconazole. *Higher doses of vitamin D may be needed.*
• **Orlistat** — may prevent the absorption of vitamin D, even in people also taking multivitamins. *Advise that vitamin D preparations should be taken at least 2 hours after taking orlistat. It may be necessary to monitor vitamin D levels, even if multivitamins are given.*

• **Thiazide diuretics (such as Bendroflumethiazide)** — may reduce the urinary excretion of calcium thereby increasing the risk of hypercalcaemia. *Close monitoring (and possibly a dose reduction of vitamin D) is needed during concurrent use.*
Table 2 – Examples of Vitamin D Preparations Available to Purchase for Maintenance Therapy – DO NOT PRESCRIBE

This table is not exhaustive and further options are available to view online on the OTC directory via [http://otcdirectory.pagb.co.uk/](http://otcdirectory.pagb.co.uk/).

**Patients receiving at least 500ml or more of formula milk a day do NOT require additional vitamin D supplementation.**

<table>
<thead>
<tr>
<th>Product/ Licensed Status/ Constituents</th>
<th>Approximate price and pack size</th>
<th>Source</th>
<th>Suitability for vegetarians/ vegans and halal/kosher certification</th>
<th>Suitability in peanut/soya allergy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abidec Multivitamin Drops – Suitable from birth to 12 years Each 0.6ml contains retinol (as vitamin A palmitate) 1333IU, ergocalciferol (vitamin D) 400IU, thiamine 0.4mg, riboflavin (vitamin B2) 0.8mg, pyridoxine hydrochloride (vitamin B6) 0.8mg, nicotinamide 8mg and ascorbic acid (vitamin C) 40mg.</td>
<td>25ml £6.00 (42p per 0.6ml dose)</td>
<td>Available for purchase from pharmacies. (<a href="http://www.boots.com">Reference www.boots.com</a>)</td>
<td>Suitable for vegetarians and vegans.</td>
<td>Contains refined peanut oil. Therefore, not suitable for children or young adults with peanut or soya allergy.</td>
</tr>
<tr>
<td>Baby D drops Vitamin D 10 micrograms - Specifically designed for breastfed babies. Colecalciferol 400IU (10 micrograms) per drop.</td>
<td>60 drops £10.00 (17p per drop)</td>
<td>Available for purchase only from pharmacies. (<a href="http://www.boots.com">Reference www.boots.com</a>)</td>
<td>All Ddrops® are classified as vegetarian products, suitable for ‘lacto-ovo’ vegetarian use. Free from preservatives, no artificial flavours and no colouring. Product is halal and kosher approved.</td>
<td>Does not contain peanut. Made from fractionated coconut oil.</td>
</tr>
<tr>
<td>DaliVit Multivitamin Drops – A dose of 14 drops (0.6ml) provides palmitate (vitamin A) 5,000 units, ergocalciferol (vitamin D) 400 units, thiamine (vitamin B1) 1mg, riboflavin (vitamin B2) 0.4mg, pyridoxine (vitamin B6) 0.5mg, nicotinamide (vitamin B3) 5mg and ascorbic acid (vitamin C) 50mg.</td>
<td>Retail prices vary.</td>
<td>Available to purchase from pharmacies. (<a href="http://www.lloydspharmacy.com">Reference www.lloydspharmacy.com</a>)</td>
<td>Suitable for vegetarians and vegans. No added colours.</td>
<td>Does not contain peanut oil (arachis oil). Safe for those allergic to peanut oil or soya.</td>
</tr>
<tr>
<td>Healthy Start Children’s Vitamin Drops Daily dose of five drops contains: vitamin D3 400 IU (10 micrograms), vitamin C 20mg and vitamin A 233 micrograms.</td>
<td>Free of charge where eligible voucher scheme in place from birth until their fourth birthday. Children who are having 500ml or more of formula a day do not need Healthy Start vitamins. Beneficiaries are entitled to one bottle every eight weeks.</td>
<td>Available from midwives, health visitors and children’s centres and also some pharmacies. For more information visit (<a href="http://www.healthystart.nhs.uk">Reference www.healthystart.nhs.uk</a>) Follow the link below to find phone numbers and addresses for local distribution points (<a href="https://www.nhs.uk/Service-Search/Healthy-start-vitamins/LocationSearch/348">https://www.nhs.uk/Service-Search/Healthy-start-vitamins/LocationSearch/348</a>)</td>
<td>Suitable for vegetarians and free from milk, egg and gluten, soya and peanut residues.</td>
<td>Free from soya and peanut residues.</td>
</tr>
</tbody>
</table>

Please note - Manufacturers may change the formulation of their products or the suppliers of the excipients. The current status of the peanut or soya content of the product should therefore be obtained from the manufacturer.
Vitamin D deficiency is the most common nutritional deficiency in the world.

Vitamin D deficiency is most commonly caused by insufficient exposure to sunlight (which is the main source of vitamin D for most humans. The amount of vitamin D synthesised in the skin depends on skin exposure to solar ultraviolet B rays. Solar UV levels in the UK are highest around midday (between 11am and 3pm) in the summer months (between March and October), but are reduced by cloud cover.

Management of vitamin D deficiency and correction of risk factors (where possible) should restore vitamin D levels and reduce the risks or improve the symptoms of complications such as muscle weakness.

Following treatment for vitamin D deficiency or for those with insufficiency, patients will require lifestyle changes in addition to self-care with daily vitamin D supplement to maintain optimum vitamin D levels.

Patients at higher risk of vitamin D deficiency

The amount of vitamin D synthesised in the skin can be affected by:

- Habit of dressing – wearing clothes that cover the entire body and face reduces skin exposure to sunlight.
  - Spend very little time outdoors (for example those who are disabled).
  - Cover up their skin for cultural reasons (for example Muslim girls) or for health reasons (for example those with skin photosensitivity).
- Having darker skin (for example those of African, African-Caribbean, or Asian or Middle Eastern ethnic origin).

Vitamin D deficiency can also occur in children and young people who:

- Are at increased risk of nutritional deficiency and therefore have inadequate dietary and supplemental vitamin D.
  - Vegans and those who do not eat fish, or generally have a poor diet.
  - Exclusively breast-fed babies from birth, especially if the mother had low vitamin D status during pregnancy.
  - Infants weaning who have not started to take a good range of solid foods.
• Have intestinal malabsorption syndromes (such as coeliac disease, cystic fibrosis and Crohn’s disease).
• Are obese (BMI > 98th BMI for age centile).
• Are taking drugs (such as some antiepileptic drugs) that may increase the risk of vitamin D deficiency. See drug interactions.
• Have a family history of vitamin D deficiency.
• Have severe liver failure associated with fat malabsorption.

Conditions that impair the activation of vitamin D:
• Chronic kidney disease or kidney failure,
• Liver disease,
• Inherited enzyme disorders.

Other conditions that can affect levels of vitamin D:
• Nephrotic syndrome,
• Cancers.

### Dietary Calcium Intake

• Adequate levels of both vitamin D and calcium are needed to ensure optimum serum calcium levels, and it is important to ensure that both are maintained to prevent long-term adverse effects on the bones.
• Use an online calculator i.e. the Institute of Genetics and Molecular Medicine calcium calculator to determine patient’s dietary calcium intake.
• The recommended daily intake of calcium is:
  o **Age younger than 12 months:** 525 mg (13.1 mmol).
  o **Age 1–3 years:** 350 mg (8.8 mmol).
  o **Age 4–6 years:** 450 mg (11.3 mmol).
  o **Age 7–10 years:** 550 mg (13.8 mmol).
  o **Age 11–18 years (boys):** 1000 mg (25.0 mmol).
  o **Age 11–18 years (girls):** 800 mg (20.0 mmol).

• If the child or young person has an inadequate dietary calcium intake, advise on dietary measures to correct this. See appendix 1 for the British Dietetic Association (BDA) factsheet on calcium (available at [www.bda.uk.com](http://www.bda.uk.com)) for information on how the daily calcium intake may be achieved. The child and/or parents/carers can assess the adequacy of their calcium intake using this factsheet via the assessment tool.
• If the child or young person is unable or unwilling to increase their dietary calcium, consider the need for supplemental calcium, in addition to high dose vitamin D – consider seeking specialist advice.
• The current supplemental calcium doses advised in the BNF for children are:
  o **Age 1 month – 4 years:** 0.25 mmol (10 mg) per kg four times daily, adjusted to response.
  o **Age 5 – 12 years:** 0.2 mmol (8 mg) per kg four times daily, adjusted to response.
  o **Age 12–18 years:** 10 mmol (400 mg) four times daily, adjusted to response.
• For advice on formulary choice of calcium supplement in paediatric patients please contact your relevant pharmacy department or Medicines Optimisation Team.

Combined calcium and vitamin D preparations are available; however, they are not recommended for people on high-dose vitamin D treatment because they contain very low levels of vitamin D and may result in high dosing of calcium, thereby increasing the risk of hypercalcaemia.

Advise the child and/or the parents/carers:
To seek medical advice if they develop any adverse effects during treatment with high-dose vitamin D, such as nausea and vomiting. Also advise on lifestyle measures to reduce the risk of recurrence.

Check serum calcium levels 1 month after starting calcium supplements (and as clinically indicated thereafter). If hypercalcaemia is detected, stop the calcium supplement and investigate the cause of hypercalcaemia.

### Arranging referral or seeking specialist advice

If the child or young person:
• **Is suspected to have a serious underlying cause such as cancer** refer immediately.
• **Has clinical features of rickets (such as bone deformities)** refer to a paediatrician.
• **Has other musculoskeletal symptoms (such as muscle pain or weakness)**
• **Has hypocalcaemia:**
  o **If symptomatic (irritability, tetany, seizures or other neurological abnormalities), refer immediately to A&E.**
  o If asymptomatic, seek specialist advice from a paediatrician.
• **Has a malabsorption disorder (e.g. Crohn’s disease) or other condition that is known to cause vitamin D deficiency.** Children and young people with malabsorption disorders or chronic liver disease need higher doses of vitamin D. Children and young people with kidney disease that is
severe enough to impair the hydroxylation of vitamin D may require treatment with a short-acting, potent vitamin D analogue such as alfacalcidol or calcitriol.

- Is taking a drug that can increase the risk of vitamin D deficiency (such as some antiepileptics or oral corticosteroids).
- Has a fragility fracture, documented osteoporosis, or high fracture risk, or is being treated with an antiresorptive drug for bone disease.
- Has raised parathyroid hormone levels.
- Has a co-existing condition associated with increased sensitivity to vitamin D (such as sarcoidosis, tuberculosis, lymphoma or primary hyperparathyroidism). These patients are associated with an increased risk of vitamin D toxicity and therefore need lower doses of vitamin D and more frequent monitoring.

### Lifestyle Advice – MUST BE GIVEN TO ALL PATIENTS AND THEIR PARENTS/CARERS

Advise that all children and young people living in the UK, including those at risk of vitamin D deficiency, should take a daily vitamin D supplement throughout the year, including in the winter months.

- For children and young people aged 1 year and older – 400 international units (IU) equivalent to 10micrograms of vitamin D.
- For children aged 0 to 1 year (including exclusively and partially breast-fed infants, from birth) – 340 to 400 IU equivalent to 8.5 to 10micrograms of vitamin D. **Patients receiving at least 500ml or more of formula milk a day do NOT require additional vitamin D supplementation.**
- Children eligible for the NHS Healthy Start scheme can obtain free vitamin drops by taking their coupons to a local distribution point.
- For children and young people who are not eligible for the NHS Healthy Start scheme, multivitamin preparations and individual vitamin D preparations are available containing 400IU of vitamin D from pharmacies. Allergies and dietary restrictions should be considered before buying these preparations to ensure that their content is safe and appropriate.

Provide the following advice to all patients and/or their parents/carers with vitamin D deficiency or insufficiency.

- **Safe sun exposure:**
  - Exposing commonly uncovered areas of the skin (such as forearms and hands) for short periods when in strong sunlight provides vitamin D. Longer periods of exposure may be needed for those with darker skin.
  - Many young people will have experienced sunburn. They can use this experience to know what their skin looks like normally, how it reacts to sunlight, how long they can be exposed without risking sunburn, and how to protect their skin accordingly.
  - Advise that skin that is not usually exposed to sunlight (for example the back, abdomen and shoulders) is particularly likely to burn, so extra care is needed.
• Prolonged exposure to strong sunlight (for example leading to burning or tanning) **DOES NOT** lead to excess production of vitamin D, as a regulation mechanism exists to destroy excess vitamin D but increases the risk of skin cancer.

• Children younger than 6 months of age should be kept out of direct strong sunlight.

• Between March and October in the UK, children and young people should be supported to protect their skin from burning by covering up with suitable clothing (such as long-sleeved tops, a broad-brimmed hat, or long skirts and trousers); seeking shade (especially between 11am and 3pm); and applying sunscreen, which should:
  ▪ Meet minimum standards for ultraviolet A (UVA) protection — the label should have the letters ‘UVA’ in a circle logo and should preferably state that it provides good UVA protection (for example at least ‘4-star UVA protection’).
  ▪ Provide at least sun protection factor (SPF) 15 to protect against UVB.
  ▪ Be applied liberally and frequently, according to the manufacturer’s instructions. If the sunscreen is applied too thinly, the amount of protection it gives is reduced.

• Sunbeds are **NOT** an effective method of protecting against vitamin D deficiency because they emit high levels of UVA, which do not contribute to vitamin D synthesis but increase the risk of skin cancer.

• **Dietary intake of vitamin D:**
  o It is important to maintain dietary intake of vitamin D by taking vitamin D supplements (available to purchase over the counter), especially during the winter months, as it is difficult to obtain sufficient vitamin D from food sources alone because they are limited.
  o Pregnant women should discuss appropriate sources of vitamin D with their midwife or community pharmacist.
  o Rich sources include cod liver oil (this also contains vitamin A which can be harmful in high doses and should be avoided in pregnancy), oily fish (such as salmon, mackerel, and sardines). Egg yolk, meat, offal, milk, mushrooms, and fortified foods (such as fat spreads and some breakfast cereals, yoghurts and formula milk for infants and toddlers) contain small amounts.

• **Dietary intake of calcium:**
  o It is also important to maintain dietary intake of calcium, as both calcium and vitamin D are needed to prevent long-term adverse effects on the bones.
  o Rich sources of calcium include dairy foods (milk, cheese, and yoghurts) and tinned sardines with bones.

• **Adherence to long-term supplementation** and where necessary with calcium, in order to prevent recurrence of deficiency and to maintain bone health. *Please see useful links for patients’ and their parents/carers section.*
Follow Up

- **At the end of treatment with high-dose vitamin D check adjusted serum calcium levels.**
- Consider checking serum calcium levels more regularly (for example every 1–2 weeks in the first months of treatment) in children and young adults receiving calcium supplements in addition to high-dose vitamin D treatment.
- **If hypercalcaemia is identified, consider referral:**
  - Assess the person's state of hydration and consider admission if the person is dehydrated.
  - If the person is taking calcium supplements, advise them to stop taking them.
- **If calcium levels are normal:**
  - Do not recommend long-term calcium supplements.
  - If the person is taking calcium supplements, advise them to stop taking them.
- **If hypocalcaemia is identified:**
  - Refer immediately to A&E if the person is symptomatic (irritability, tetany, seizures or other neurological abnormalities) or seek specialist advice from a paediatrician if the person is asymptomatic.
- Check serum phosphate and alkaline phosphatase (ALP) levels – refer to secondary care if there is persisting low serum phosphate or low/high ALP.
- **After 3 – 6 months following completion of treatment course with high-dose vitamin D, check serum 25(OH)D levels.**
  - If compliance confirmed and serum 25(OH)D levels are below 50 nmol/L - refer to secondary care for consideration of possible causes, including, drug interactions, or an underlying disease, such as renal disease, liver disease, or malabsorption.
  - If compliance confirmed and serum 25(OH)D levels are greater than 50 nmol/L and bone profile (calcium, phosphate and ALP) is normal – Recommend patients and/or their parents/carers to purchase a daily vitamin D supplement through the year. Examples of available preparations can be found in table 2.
  - If compliance confirmed and symptoms and signs have not improved despite satisfactory 25(OH)D levels, consider an alternative diagnosis.
- **If patient was unable to comply with the formulary choices of high dose vitamin D deficiency or these formulations are unsuitable:**
  - Please contact the Medicines Optimisation Team via CAPCCG.prescribingpartnership@nhs.net for further advice and support.
References

1. CKS – Vitamin D deficiency in children, last revised December 2016
4. NICE evidence [PH56] Vitamin D: supplement use in specific population groups, last updated August 2017.
7. UKMI What vitamin D preparations are suitable for a vegetarian or vegan diet? Last revised August 2017. Available at: https://www.sps.nhs.uk/articles/which-vitamin-d-preparations-are-suitable-for-a-vegetarian-or-vegan-diet/
Useful links for patients and their parents/carers

- The British Dietetic Association has useful factsheets on Vitamin D and Calcium (available at www.bda.uk.com).
- The NHS choices website has a useful publication on Vitamins and minerals - Vitamin D (available at www.nhs.uk).
- The Met Office (www.metoffice.gov.uk) provides information on the UV index, which is an indicator of the sun’s strength for a given location, date and time. This information, combined with skin type and behaviour, can be used to assess someone's risk of sunburn.

Vitamin D Deficiency in Children and Young Adults

Sunshine, not food, is where most of your vitamin D comes from. So even a healthy, well balanced diet, that provides all the other vitamins and goodness you need, is unlikely to provide enough vitamin D. Read on to find out the best ways to get enough vitamin D safety.

What is vitamin D? You make vitamin D under your skin when you are outside in daylight, which is known as vitamin D synthesis. Your body makes vitamin D when your skin is exposed to sunlight. If you are not getting enough sunlight from the sun, you will need to take vitamin D supplements.

Calcium is important at all ages for strong bones and teeth. This Food Fact Sheet lists the recommended amounts of calcium for different groups of people and the foods and drinks that are rich in calcium. It also gives you some ideas on how you might achieve your recommended intake.

Healthy lifestyle advice for healthy bones
- Be active - weight bearing activities are best e.g. walking, swimming, cycling and tennis. Aim for at least 20 minutes of activity three times a week.
- Spending time outside should be associated with an increased risk of osteoporosis, have bone density and increased risk of hip fracture. Capping sunlight prevents further events bone loss.

Vitamin D and calcium
- Vitamin D helps the absorption of calcium from foods. Most of our vitamin D is made by the action of sunlight on the skin. Between April and September, going outside for 15 minutes, or three times a week between 10am and 3pm, without sunscreen should be enough to produce sufficient vitamin D.
- All adults and children over the age of one should consider taking a daily supplement containing 10ug vitamin D, especially during autumn and winter. A daily supplement is recommended at younger age for those who are at risk of low vitamin D including all pregnant and breastfeeding women, babies and young children, people aged 65 years and over and people with chronic diseases.

Foods rich in vitamin D include oily fish, eggs, fortified breakfast cereals and spreads but you cannot get enough vitamin D from food alone. You may need to take a supplement if you do not get enough sunlight.

Calcium supplements
- Calcium supplements are available from chemists, pharmacies, supermarkets and health food shops. If you are unable to meet your daily requirements from food, these supplements can be of use, but still ask your doctor for advice.
- Calcium supplements are available free of charge to women and children who are eligible for vitamin D vouchers. Ask your health visitor about this.

Milk is often described as “the food for life” and is a rich source of calcium. However, it is important to note that calcium is only one of the nutrients we need to be healthy. Eating a balanced diet is key to maintaining good health.

Sun safety
- It is the sun’s ultraviolet rays that allow vitamin D to be made in the body. You do not have to sunbathe to make vitamin D. In the UK, ultraviolet light is only strong enough to make vitamin D on exposed skin (on the face, arm and arm area) during May and June. However, even on bright sunny days, we need to balance making vitamin D with being safe in the sun. Take care to move to or protect your skin with sunscreen before you get red. It is important to check the SPF of your sunscreen on the NHS Choices website: http://www.nhs.uk/sonewksk/AJpYt5PeXyvF2Kt6F0Wb/.

During the autumn and winter, we get vitamin D from our body’s stores and from fish sources but the SAD report says there are insufficient to keep levels up. This can be a problem especially for the older population. However, the best way to ensure a Healthy vitamin D status is to take a supplement.