



# Diagnosis and Management of Vitamin D Deficiency

## Contents

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CCG GP Prescribing Leads and Heads of Prescribing

### Patient information links:

[LMSG leaflets \(information on treatment of deficiency\)](#)  
[NHS Choices](#)

<b>Date written/reviewed:</b>	May 2012 / Sept 2014 / Jul 2016/January 2019
<b>Date of next review:</b>	January 2022
<b>Approved by LMSG:</b>	October 2016
<b>Version:</b>	9.0

## Background information

Vitamin D deficiency is the most common nutritional deficiency in the world and can occur in people of any age, especially if there are risk factors involved, (see table 1). Vitamin D is essential for musculoskeletal health as it helps calcium absorption from the bowel, allows mineralisation of newly formed osteoid tissue in bone and plays an important role in muscle function.

### Vitamin D Physiology

Vitamin D<sub>3</sub> (Colecalciferol) is normally synthesised in the skin through the action of sunlight containing UVB radiation on cholesterol. In the UK, this can only occur from April to September between the hours 11am-3pm. In order to exert its effects on bone metabolism and calcium absorption Vitamin D is converted in the liver to 25-OH vitamin D which is the major storage form and what is measured in the laboratory. Further hydroxylation occurs in the kidney to form 1, 25-OH Vitamin D. Colecalciferol is also available in the diet, although it is unusual to get more than 10% of total requirement from normal food intake (Please see under 'Lifestyle Advice' for dietary sources and recommendations about sunlight exposure).

Colecalciferol is the supplementation of choice as it is the natural vitamin in humans. However dietary supplements of a plant derived sterol (Vitamin D<sub>2</sub> or ergocalciferol) are also available. Vitamin D<sub>2</sub> has equal potency but a shorter half-life

### Risk factors for Vitamin D deficiency (Table 1)

Inadequate UVB exposure	Inadequate Absorption	Metabolic risk	Other
<ul style="list-style-type: none"> <li>• Northern latitude</li> <li>• Winter Season</li> <li>• Air pollution</li> <li>• Occlusive garments</li> <li>• Housebound / Institutionalised e.g. care home living</li> <li>• People with poor mobility e.g. wheelchair bound</li> <li>• Darker skin e.g. people of African, African-Caribbean or South Asian origin, because their bodies are not able to make as much vitamin D.</li> <li>• Routine use of sunscreen (See under lifestyle advice)</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced dietary intake (e.g. Vegetarian or fish-free diet)</li> <li>• Malabsorption (e.g., coeliac disease, Crohn's disease, short bowel etc.)</li> <li>• Cholestatic liver disease, jaundice</li> <li>• Drugs e.g. Cholestyramine / Orlistat</li> </ul>	<ul style="list-style-type: none"> <li>• Older people (Over 65) due to reduced synthesis</li> <li>• Drugs which cause increased metabolism e.g. rifampicin, anticonvulsants, highly active antiretroviral treatment, isoniazid HAART therapy, glucocorticoids</li> <li>• Liver Disease (reduced stores / hydroxylation)</li> <li>• Kidney Disease (reduced hydroxylation)</li> </ul>	<ul style="list-style-type: none"> <li>• Obesity</li> <li>• Family History</li> <li>• Pregnant or breastfeeding women</li> <li>• All breastfed infants from 1 month onwards whose mothers did not take Vitamin D supplements during pregnancy</li> <li>• All infants and young children aged 6 months to 5 years, if receiving less than 500 ml infant formula per day</li> </ul>

## Clinical features of Vitamin D deficiency

Most patients with deficiency are asymptomatic. However, prolonged deficiency states can lead to hypocalcaemia, secondary hyperparathyroidism, bone loss and muscle weakness. There is also an increased risk of falls and fragility fractures in older patients. In severe deficiency the patient may develop osteomalacia which may precipitate or exacerbate osteopenia and osteoporosis. Please see table two for symptoms, signs and biochemistry which may suggest deficiency.

## Symptoms and signs of Vitamin D deficiency (Table 2)

Symptoms / Signs / Biochemistry
<b>Signs of Hypocalcaemia</b> <ul style="list-style-type: none"><li>• Muscle Cramps</li><li>• Cardopedal spasm</li><li>• Irritability</li><li>• Numbness</li><li>• Seizures</li><li>• Tetany</li><li>• Low Serum adjusted calcium</li></ul>
<b>Features of Osteomalacia</b> <ul style="list-style-type: none"><li>• Gradual onset and persistent bone discomfort / pain (lower back, pelvis, lower extremities) without mechanical injury</li><li>• Proximal muscle weakness and impaired physical function</li><li>• Waddling gait</li><li>• Severe osteomalacia is associated with raised alkaline phosphate, hypocalcaemia and pseudo-fractures</li></ul>
<b>Low bone density on DEXA scan</b>
<b>Osteopenia / Osteoporosis</b>
<b>Fragility Fractures</b>
<b>Features specific to Children</b> <ul style="list-style-type: none"><li>• Leg Bowing</li><li>• Knock Knees</li><li>• Delayed Walking</li><li>• Irritability</li><li>• Impaired Linear Growth</li></ul>

## **Lifestyle advice**

### **Sunlight**

Vitamin D levels increase when uncovered areas of skin are exposed to UVB sunlight for short periods of time. Prolonged sun exposure leading to burning or tanning does not lead to excessive vitamin D production but increases the risk of skin cancers. Most people can make sufficient Vitamin D between March and October by going out for short periods and leaving only areas of skin that are often exposed uncovered (such as forearms, hands or lower legs). Persons wearing enveloping garments can be advised to have sunlight exposure of face, arms and legs in the privacy of their garden. It is impractical to offer a one-size-fits-all recommendation for the amount of sun exposure that people need to make sufficient vitamin D, because this varies according to a number of environmental, physical and personal factors. Care should be taken to cover up or apply sunscreen before the skin starts to redden or burn. It is important to ensure that sunscreen is applied where appropriate to protect from UVA rays as this is associated with the development of skin cancers including melanoma which is the fastest rising type of cancer in the UK. Sun beds due to the high levels of UVA are not an effective way of increasing Vitamin D synthesis but do increase skin cancer risks.

### **Dietary sources of Vitamin D**

Dietary sources are essential when sunlight containing UVB radiation is limited (e.g. during the winter months) or exposure to it is restricted (e.g. due to lack of time spent outdoors or little skin exposure). Rich sources of vitamin D include cod liver oil (which should be avoided in pregnancy due to vitamin A content) and oily fish (such as salmon, mackerel and sardines). Other sources containing small amounts include egg yolk, meat, offal, milk and mushrooms. Vitamin D-fortified foods are available and include fat spreads and some breakfast cereals and yoghurts. For more information please refer to the following link: [National Osteoporosis Society: A balanced diet for bones](#).

It is difficult to reach daily vitamin D requirements from diet alone and therefore supplementation is recommended. Treatment doses may be prescribed but ongoing supplementation and prevention should be purchased as per [LLR guidance](#). Requirements can vary depending on risk factors – please refer to the relevant flowcharts in the appendices. See below for vitamin D products and supplements that are available.

### **[Public Health England 2016: Advice for Vitamin D supplementation to prevent deficiency](#)**

- All babies under 1 year should have a daily 8.5 to 10 micrograms (340-400 units) vitamin D supplement. (Note formula information below)
- Children aged 1 to 4 years should have a daily 10 microgram (400units) vitamin D supplement.
- Children who have more than 500ml of infant formula a day do not need any additional vitamin D as formula is already fortified
- Children and adults over 5 years should have a daily 10 microgram (400 units) Vitamin D supplement between October and March unless additional risk factors

such as pigmented skin, occlusive clothing in which case consideration should be given to all year round supplementation.

See Appendices 2-4 for treatment doses.

### **Available Products and supplements**

- Vitamin D supplements can be bought from pharmacies, health food shops and over the internet by patients in various doses.
- Colecalciferol (Vitamin D<sub>3</sub>) is the preparation of choice as it is the natural vitamin in humans.
- Licensed products should be recommended where available – please see BNF. Unlicensed options (limited guarantee of quality) or food supplements (no guarantee of quality) may be suitable following a proper consideration of potentially increased risks associated with such products as well as what may be substantial costs. When prescribing in primary care (treatment doses only) please use the NHS drug tariff to help choose appropriate products. A variety of formulations are available which may suit people who are unable to take tablets or capsules. For example, chewable tablets, dispersible tablets, oral drops and oral solutions.
- Ergocalciferol injections are not recommended however they are an option for patients who are unable to take oral supplements e.g. post bariatric surgery. Please refer to the summary of product characteristic (SPC) at [www.medicines.org.uk](http://www.medicines.org.uk) for dosing information. Parental usage is associated with unpredictable bioavailability, slower onset of repletion and the additional administration burden in comparison to oral preparations. Parenteral vitamin D is therefore a last line option, primarily due to significant inter-individual variability in absorption.
- The Specialist Pharmacy Service has Medicines Q&As about different options for patients with [peanut or soya allergies](#) as some products contain these ingredients. They also contain advice on which preparations are suitable for a [vegetarian or vegan diet](#).

### **Dietary Sources of Calcium**

It is important to promote adequate dietary calcium intake alongside vitamin D supplementation. Calcium is prevalent in dairy products such as milk, yoghurt and cheese and is present in nuts, meat, fish and vegetables (such as broccoli, carrots) etc. Consider use of 'calcium calculators' to help patients and primary-care clinicians ensure adequate calcium intake (e.g.. <https://www.iofbonehealth.org/calcium-calculator>).

If adequate calcium intake cannot be achieved from diet alone then supplementation can be considered. Calcium supplementation is associated with poor adherence due to side effects such as constipation therefore multivitamins and mineral products can be considered which may be better tolerated

## References

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16. [UHL LRI Children's Hospital Vitamin D deficiency and rickets March 2019](#)
17. [UHL Vitamin D in pregnancy 2018](#)

## Appendix 1

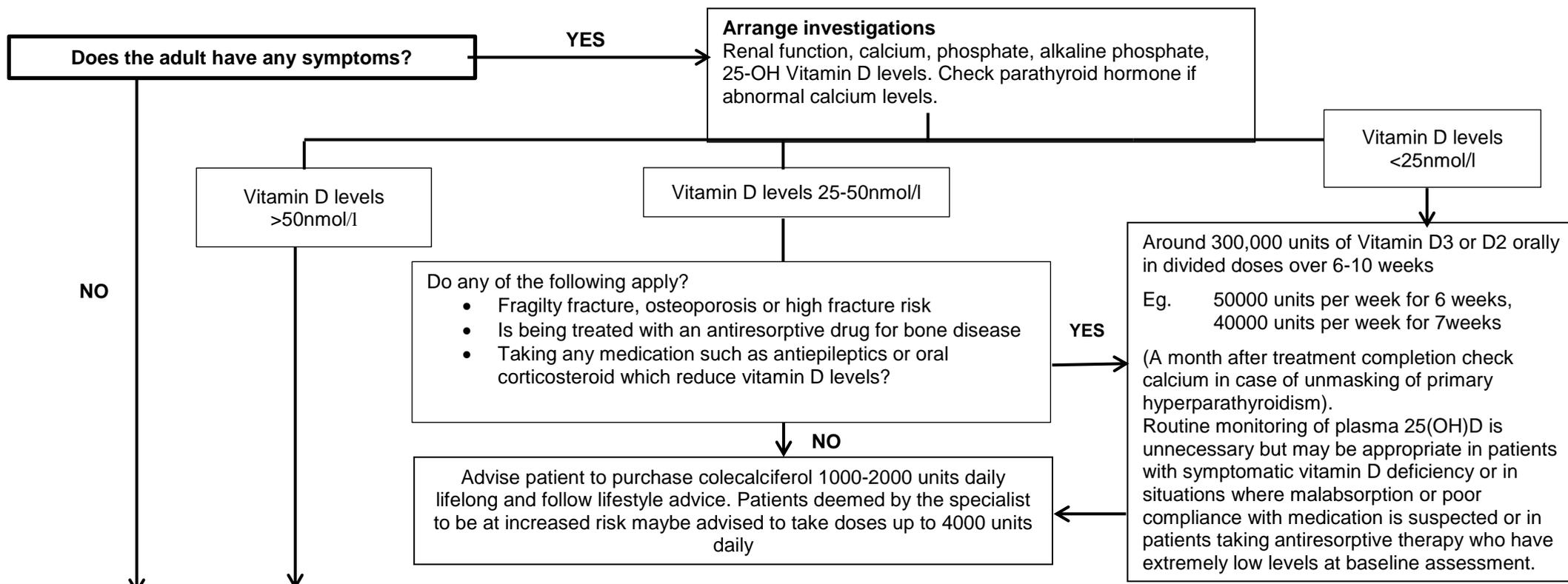
### Strengths of colecalciferol preparations quoted in this guidance

<b>Strength in units</b>	<b>Equivalent strength in micrograms</b>
400 units	10 micrograms
1000 units	25 micrograms
2000 units	50 micrograms
20,000 units	500 micrograms
25,000 units (oral solution unit dose ampoules available)	625 micrograms

## Appendix 2 Flowchart for Adults (excluding pregnancy and breastfeeding) with Suspected D Deficiency

Refer to specialist (Metabolic Bone Clinic or renal clinic) or seek advice from specialist as appropriate if:

- abnormal serum calcium,
- already on alfacalcidol or calcitrol,
- symptoms of osteomalacia (more likely if vitamin D levels are <15nmol/l),
- co-existing condition with sensitivity to vitamin D e.g. sarcoidosis, tuberculosis, lymphoma or primary hyperparathyroidism,
- malabsorption disorder
- eGFR less than 30mls/min/1.73m<sup>2</sup>



### Lifestyle Advice

Public Health England 2016 advises that all adults take a vitamin D supplement of 400 units daily between October and March unless additional risk factors such as dark skin, occlusive clothing, care home patients and housebound people in which case supplementation should be considered all year round. Patients may be advised to purchase a higher dose by a clinician as above.

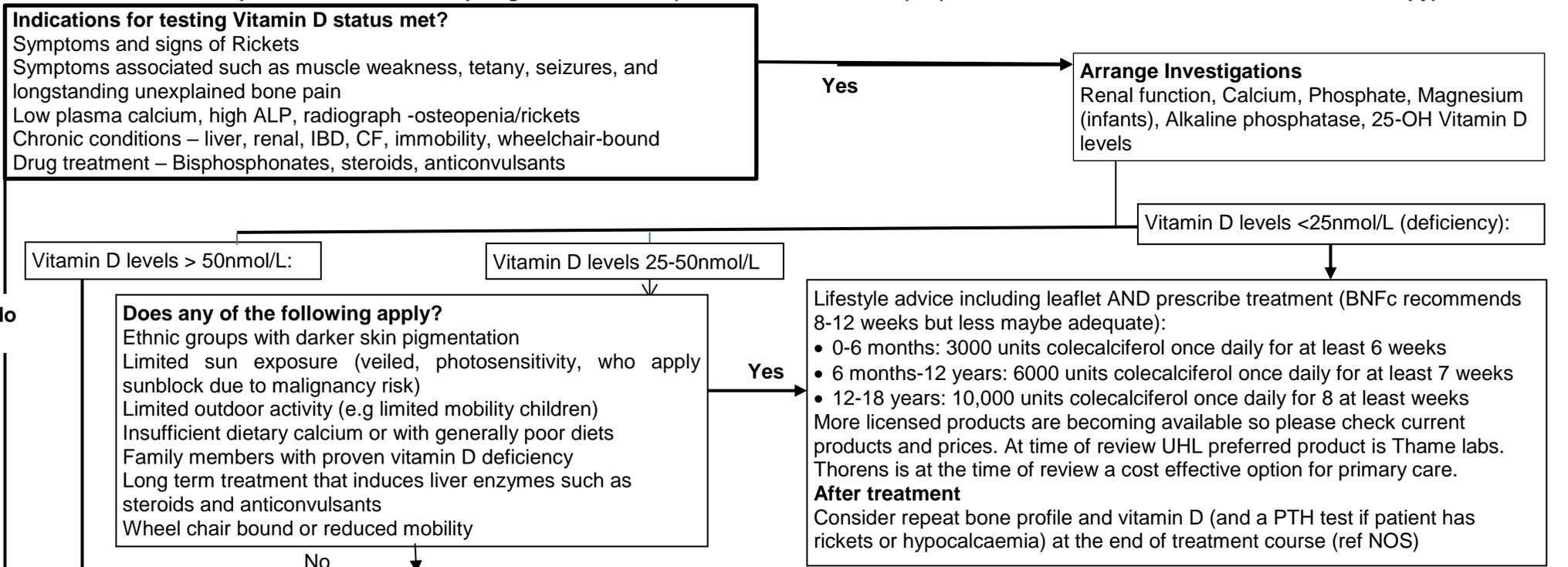
Most people can make sufficient vitamin D between March and October by going out for short periods and leaving only areas of skin that are often exposed uncovered (such as forearms, hands or lower legs) without sunscreen. The skin should be covered or sunscreen applied before the skin starts to go red or burn.

Encourage adequate calcium intake – consider calcium supplementation if daily intake is less than 700mg suggest dietary changes and if not possible to do this a calcium supplement may be required, link to calculator <https://www.iofbonehealth.org/calcium-calculator>

### Appendix 3 Flowchart for Children with suspected Vitamin D Deficiency

Refer to specialist if:

- Renal impairment
- Atypical biochemistry (persistent hypophosphataemia despite correction of Vitamin D levels, elevated creatinine)
- Failure to reduce alkaline phosphatase levels within 3 months of starting treatment
- Family history (parent, siblings) with severe rickets
- Infants under one month with calcium < 2.0 mmol/l at diagnosis due to risk of seizure. Check vitamin D level of mothers in this group immediately and treat, particularly if breast feeding.
- Poor response to treatment despite good adherence (defined as a level of 25(OH)D <50nmol/L after 8-12 weeks of adherent therapy)



Provide lifestyle advice and leaflet regarding sun exposure, dietary advice for calcium and Vitamin D and advice on Vitamin D supplements. Public Health England 2016 advice for all children regarding Vitamin D supplements is:

- Children aged 1 to 4 years should have a daily 400units vitamin D supplement. (Note formula information below)
- All babies under 1 year should have a daily 340-400 units vitamin D supplement. (Note formula information below)
- Children who have more than 500ml of infant formula a day do not need any additional vitamin D as formula is already fortified.
- Children over 5 years should have a daily 400 units Vitamin D supplement between October and March unless additional risk factors such as dark skin, occlusive clothing in which case consideration should be given to all year round supplementation.

Examples of over the counter products which meet the 2016 advice for younger children and are also suitable for vegetarians include [BabyDdrops®](#) and [WellbabyVitDdrops®](#). Parents should be advised not to mix products or double up products to try and achieve these units as this could result in overdose of other components in a multivitamin. The community pharmacist can help pick a suitable product. Healthy Start children's vitamins drops now provide a dose of 400 units.

## Appendix 4 Vitamin D in Pregnancy and Breastfeeding

A summary of the UHL Vitamin D in Pregnancy Guideline June 2018; review due June 2021. These recommendations apply to both pregnant and breastfeeding women.

- Referral to the relevant specialist clinic via the foetal medicine midwife or advice from the relevant antenatal specialist clinic is required for women with sarcoidosis, renal disease, inflammatory bowel disease or other conditions causing fat malabsorption. Please note women with sarcoidosis or renal disease should not take a supplement until advised by the obstetric consultant.
- Referral to the relevant specialist clinic or advice from the relevant clinic is also recommended if there is high risk of pre-eclampsia, history of hypertension, Type 1 or Type 2 diabetes or autoimmune disease such as systematic lupus erythematosus or antiphospholipid syndrome. The obstetrician may recommend 400 units Vitamin D combined with calcium twice a day e.g. Adcal D3 chewable tablets.

