

Primary Care Diagnosis & Management of Vitamin D Deficiency in Children

Pathway for Management of Vitamin D Deficiency in Children

10 micrograms of Colecalciferol is equivalent to 400 units (IU)

Does the patient have at least ONE symptom / indicator for testing of vitamin D?
See the 'When to test for vitamin D deficiency in children?' section below.

YES

NO

Do not routinely check vitamin D levels if asymptomatic
Provide lifestyle advice, including dietary sources of vitamin D and OTC supplementation.

Investigations:

Serum 25-OHD, Bone profile (Ca^{2+} , PO_4), U&Es, LFTs and PTH

Vitamin D >50 nmol/L
Adequate

Vitamin D 25-50 nmol/L
Insufficiency

Vitamin D <25 nmol/L
Deficiency

Lifestyle advice

- Provide reassurance and advise on maintaining adequate vitamin D status through regular sunlight exposure, diet and supplements.

OTC vitamin D supplements & lifestyle advice

- Advise oral preparations containing 400-600 units per day for patients aged 1 month to 18 years.
- Ensure dietary calcium intake is adequate.
- Patients with medical conditions requiring specialist input (e.g. malabsorption) may require on-going maintenance treatment via FP10
- Lifestyle advice around regular sun exposure and diet.

Treat deficiency

Refer to specialist.

See tables 1 & 2 below for prescribing guidance:

- **One–five months:** 3,000 units orally daily for eight–12 weeks
- **Six months to 11 years:** 6,000 units orally daily for eight–12 weeks
- **12–17 years:** 10,000 units orally daily for eight–12 weeks.
A single or divided oral dose totalling 300,000 units can be considered if there is concern about compliance.

Maintenance therapy following treatment.

Table 1: Standard treatment doses

The doses given below are as per The National Osteoporosis Society (2018) guidelines; this may vary from doses listed in manufacturers product information - thus constituting off-label use in some cases.

Treatment of vitamin D deficiency		
Age	Colecalciferol dose	Suggested products and dose
1 – 5 months	3,000 units orally DAILY for 8 – 12 weeks	THORENS® oral drops 10,000 units/ml - <i>product licensed from birth</i>
	Alternative weekly dosing: 25,000 units ONCE WEEKLY for 8 weeks	InVita D3® 25,000 unit oral solution (1ml ampoules of 25,000 units) – <i>product licensed from birth</i>
6 months – 11 years	6,000 units orally DAILY for 8 – 12 weeks	THORENS® oral drops 10,000 units/ml - <i>product licensed from birth</i>
	Alternative weekly dosing: 50,000 units ONCE WEEKLY for 8 weeks	InVita D3® 25,000 unit oral solution (1ml ampoules of 25,000 units) – <i>product licensed from birth</i>
12 - 17 years	10,000 units orally DAILY for 8 – 12 weeks.	THORENS® oral drops 10,000 units/ml – <i>product licensed from birth</i>
	Alternative dosing: 50,000 units TWICE WEEKLY for 8 weeks	InVita D3® 25,000 unit capsules – <i>product licensed from 10 years</i>
		Stexerol-D3® 25,000 unit tablets – <i>product licensed from 12 years</i>
		InVita D3® 25,000 unit oral solution (1ml ampoules of 25,000 units) – <i>product licensed from birth</i>

Table 2: THORENS® oral drops for the treatment of vitamin D deficiency.

Treatment for Deficiency using THORENS® 10,000 units/ml oral drops (For THORENS® oral drops 1 drop = 200 units)				
Age	Dose	Dose in mls	Dose in drops	Duration
1 – 5 months	3,000 units daily	0.3ml *	15 drops	8 – 12 weeks
6 months – 11 years	6,000 units daily	0.6ml *	30 drops	8 - 12 weeks
12 – 17 years	10,000 units daily	1ml *		8 - 12 weeks
* To be administered via 1ml oral syringe, which will need to be supplied separately				

Vitamin D Deficiency in Children – supplementary information

Nutritional vitamin D deficiency can lead to health problems in children including rickets, impaired growth, muscle weakness, cardiomyopathy, and seizures due to hypocalcaemia. Daily vitamin D supplements are required for children from birth to 4 years of age; whilst these can be purchased OTC, some families will be eligible for free Healthy Start vitamins.

When to test for vitamin D deficiency in children?

National Osteoporosis Society (2018) guidance states clearly that **routine screening is not recommended**.

Indications for testing vitamin D status include:

1. Symptoms and signs of rickets;
 - progressive bowing of legs (this can be a normal finding in toddlers)
 - progressive knock knees
 - wrist swelling
 - rachitic rosary (swelling of the costochondral junctions)
 - craniotables (skull softening with frontal bossing and delayed fontanelle closure)
 - delayed tooth eruption and enamel hypoplasia.
2. Other symptoms or conditions associated with vitamin D deficiency;
 - unexplained bone pain for more than 3 months
 - muscular weakness (e.g. difficulty climbing stairs, waddling gait, difficulty rising from a chair or delayed walking)
 - tetany due to low plasma calcium
 - seizures due to low plasma calcium (usually in infancy)
 - infantile cardiomyopathy
3. Abnormal investigations
 - low plasma calcium or phosphate, high alkaline phosphatase
 - radiographs – showing osteopenia, rickets or pathological fractures
4. Chronic disease that may increase risk of vitamin D deficiency:
 - chronic renal disease, chronic liver disease
 - malabsorption syndromes (e.g. coeliac disease, Crohn's disease, cystic fibrosis)
5. Treatment with bone-targeted drugs that require vitamin D sufficiency such as bisphosphonates

In the absence of any of the above indicator's measurement of vitamin D is not indicated.

How is vitamin D deficiency defined in children?

The National Osteoporosis Society (2018) guidelines suggest that vitamin D deficiency in the paediatric population is defined as:

- $\leq 25\text{nmol/L}$ = vitamin D deficient
- 25 to 50nmol/L = may be inadequate in some people
- $\geq 50\text{nmol/L}$ = sufficient for most of the population

Prevention

Public Health England recommends daily vitamin D supplements as follows:

- All babies from birth to one year should consume 8.5 to 10micrograms (equivalent to 340 – 400 units) daily
- Babies receiving infant formula do not require supplements if receiving more than 500ml per day
- Children from one to four years should consume 10micrograms per day.

Groups at high risk of vitamin D deficiency

Vitamin D supplements should also be considered in other groups at high risk of vitamin D deficiency, (see below), especially if they do not adhere to lifestyle advice:

- Infants and young children under 5 years of age
- Children and young people with diets insufficient in calcium (e.g. vegan or low dairy intake)
- Children and young people with limited sun exposure and who spend very little time outdoors.
- Children and young people who have dark skin, for example people of African, African-Caribbean or South Asian origin.
- Children and young people taking anticonvulsants that induce liver enzymes such as phenytoin, carbamazepine, primidone or phenobarbitone
- Children and young people with family members with vitamin D deficiency.

Indications for referral to secondary care

The following circumstances indicate that referral to secondary care is warranted:

- Repeated low plasma calcium concentration with or without symptoms (irritability, brisk reflexes, tetany, seizures or other neurological abnormalities)
 - symptomatic: requires immediate referral to A&E if outpatient
 - asymptomatic: discuss treatment with paediatrician
- Underlying complex medical disorders (e.g. liver disease, intestinal malabsorption, primary hyperparathyroidism, chronic kidney disease)
- In children, deformities or abnormalities probably related to rickets
- Poor response to treatment despite good adherence (defined as a level of 25(OH)D < 50 nmol/L after eight to 12 weeks of adherent therapy)
- Persisting low plasma phosphate or low/high alkaline phosphatase.

Dietary sources of vitamin D

Consumption of vitamin D rich foods can contribute to improving vitamin D status. Foods rich in vitamin D include:

- oily fish such as sardines, pilchards and mackerel
- eggs, meat and milk (in small and varying amounts)
- margarine, some breakfast cereal, some yoghurt and infant formulas which are fortified with vitamin D.

Treatment

The National Osteoporosis Society (2018) guidelines recommend the following regimens for treating vitamin D deficiency related bone disease in children.

- 1–5 months: 3,000 units orally once daily for 8–12 weeks
- 6 months to 11 years: 6,000 units orally once daily for 8–12 weeks
- 12–17 years: 10,000 units orally once daily for 8–12 weeks. a single or divided oral dose totalling 300,000 units can be considered if there is concern about compliance.

It is also recognised by the National Osteoporosis Society (2018) that equivalent weekly or fortnightly dosing is likely to be effective in treating vitamin D deficiency. In **Table 1** alternate dosing is also given, which provides an appropriate cumulative dose of vitamin D to correct deficiency in children.

Treatment doses should be followed by a maintenance prevention daily dose of vitamin D long term (certainly until growth completed)

Monitoring

Monitoring is important to ensure that patients receiving pharmacological doses of Vitamin D are treated safely and effectively. When colecalciferol is used for the treatment of vitamin D deficiency the BNFC recommends monitoring of plasma-25-hydroxyvitamin D concentration and bone profile after the last loading dose. The BNFC also states that **all patients** receiving pharmacological doses of vitamin D should have their plasma-calcium concentration checked at intervals as clinically indicated, and whenever nausea or vomiting occur.

The [SPS article](#) 'Safety considerations when using Vitamin D' highlights that dosage of vitamin D should be individualised for each patient based on indication, patent specific parameters and response.

Bone profile and vitamin D tests (and a PTH test if the patient has rickets or hypocalcaemia) are recommended to be repeated at the end of the course of treatment.

If the 25(OH)D level is greater than 50 nmol/L and the bone profile is normal:

- advise multivitamins containing vitamin D 400– 600 units per day. Continue unless there is a significant lifestyle change to improve vitamin D status.

If 25(OH)D is below 50 nmol/L:

- consider poor compliance, drug interactions and underlying disease such as renal disease, liver disease and malabsorption.
- if poor compliance is suspected, a high-dose treatment may be considered if the patient is aged 12–18 years (e.g. 300,000 units as a single or divided dose).

Please note: If a child's symptoms/signs have not improved despite a satisfactory 25(OH)D concentration, they are unlikely to be related to vitamin D deficiency.

Calcium supplementation

Many children with vitamin D deficiency will have a depleted calcium status and/or a poor calcium intake and may therefore benefit from advice about dietary calcium intake. In some cases, consider the need for calcium supplementation.

The recommended daily calcium intake for children to prevent rickets is:

- Birth to 6 months: 200 mg a day.
- 6–12 months: 260 mg a day.
- Over 12 months: more than 500 mg a day.

Sun exposure

It is difficult to obtain sufficient vitamin D from food sources alone. Over 90% of the body's vitamin D is produced from the action of sunlight on the skin. Sun exposure, without sunscreen, between 10am to 3pm from April to October for 5-15mins should be sufficient to improve vitamin D status. Infants under 6 months should be kept out of strong direct sunlight. Most people can make sufficient vitamin D by going out for short periods in strong sunlight, and leaving only areas of the skin uncovered that are often exposed, such as hands, forearms and lower legs. Longer periods of sun exposure may be needed for people with dark pigmented skin. Prolonged exposure to strong sunlight that leads to tanning or burning is unlikely to provide any additional benefit and should be avoided. The use of sunbeds is ineffective for vitamin D synthesis and is potentially harmful so should be avoided.

Activated vitamin D

'Activated vitamin D' preparations such as calcitriol or alfacalcidol should **not** be used for the routine management of vitamin D deficiency. They should only be used for the treatment of complex cases by specialists. They are ineffective in treating simple vitamin D deficiency and can cause severe adverse effects, particularly hypercalcaemia.

References

National Osteoporosis Society. Vitamin D and Bone Health: A Practical Clinical Guideline for Patient Management in Children and Young People. Version 2. December 2018. Available from: <https://theros.org.uk/media/54vpzzaa/ros-vitamin-d-and-bone-health-in-children-november-2018.pdf>

Coventry & Warwickshire Area Prescribing Committee. Vitamin D Prescribing for Children. Version 2. March 2023. Available from: <https://www.covwarkformulary.nhs.uk/docs/chapter09/RD027-Vitamin%20D%20Supplementation%20paediatrics.pdf>

Summary of Product Characteristics. InVita D3 25,000 unit oral solution. Last updated May 2017. Available from: <https://mhraproducts4853.blob.core.windows.net/docs/3c03fe0861440d384957d3d04d0f7ce7d936a8ee>

Summary of Product Characteristics. Stexerol-D3 tablets. Last updated January 2019. Available from: <https://www.medicines.org.uk/emc/product/5062>

Specialist Pharmacy Service. Safety Consideration when using vitamin D. Last updated September 2022. Available from: [Safety considerations when using Vitamin D – SPS - Specialist Pharmacy Service – The first stop for professional medicines advice](#)

BNF for Children. Available from: www.medicinescomplete.com

Department of Health joint advice on Vitamin D supplements for at risk groups (Feb 2012). Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/213703/dh_132508.pdf

The Scientific Advisory Committee on Nutrition (SACN) recommendations on vitamin D (July 2016). Available from: <https://www.gov.uk/government/publications/sacn-vitamin-d-and-health-report>

NICE Clinical Knowledge Summaries. Vitamin D deficiency in children: Summary. 2022. Available from: <https://cks.nice.org.uk/topics/vitamin-d-deficiency-in-children/>

Summary of Product Characteristics. THORENS® 10,000 IU/ml oral drops, solution. Last updated January 2022. Available from: <https://www.medicines.org.uk/emc/product/7044/smpc>

Guy's & St.Thomas' NHS Foundation Trust. Paediatric Formulary: Colecalciferol (Vitamin D3). 2023. Available from: <https://app.clinibee.com/articles/493c451d-eda0-43b5-8019-3667b747c053>

Version Control (To be completed by policy owner)

Version	Date	Author	Status	Comment
1.2	August 2023	N.Cunningham	Medicines Optimisation Pharmacist	InVita D3 oral solution removed as no longer on EMC. Addition of version control box.
2	January 2024	N.Cunningham	Medicines Optimisation Pharmacist	Document restarted. THORENS 10,000 units/ml oral solution removed as licensing is different to THORENS 10,000 units/ml oral drops. Addition of alternative dosing option with recommended product/s. Addition of InVita D3® 25,000 unit oral solution as a treatment option for all ages updated for treatment of vitamin D deficiency. Addition of InVita D3® 25,000 unit capsules and Stexerol-D3® 25,000 unit tablets as treatment options for patients aged 12 years and over with vitamin D deficiency. Reference list.
2.1	Jan 2026	NC	MO Team	A line has been added to the flowchart on page 1 to align with the adult vitamin D guidance: Patients with medical conditions requiring specialist input (e.g. malabsorption) may require on-going maintenance treatment via FP10. In table 2 the reference to Thorens® oral solution has been removed. The following wording has also been included at the bottom of Table 2: <i>'To be administered via 1ml oral syringe, which will need to be supplied separately'</i> .
2.2	Jan 2026	NC	MO Team	Reference to sun exposure added to the green and orange boxes on page 1.

Originally adapted, with permission, from July 2016 guidance by the Medicines Management Team, IESCCG and Ipswich Hospital.