



Policies, Procedures, Guidelines and Protocols

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4		

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1 Introduction

Vitamin D is essential for the absorption and utilisation of calcium in the body needed for healthy bones. Vitamin D deficiency impairs the absorption of dietary calcium and phosphorus, which can impair growth, give rise to bony deformity (including rickets), muscle weakness at any age and severe vitamin D deficiency may cause hypocalcaemic seizures.

2 Purpose

The purpose of this document is to guide the clinician who is involved in treating children with vitamin D deficiency in the community to improve appropriate prescribing of Vitamin D and to prevent Vitamin D deficiency in all groups of children.

3 Definitions / Glossary

TB	Tuberculosis
UVA	Ultraviolet A
UVB	Ultraviolet B
AEDS	Anti-epileptic Drugs
BMD	Bone mineral density
µg	Micrograms

4 Duties**4.1 Chief Executive**

The chief executive has ultimate accountability for the strategic and operational management of the Trust, including ensuring there are effective and appropriate processes in place for the medical management of Vitamin D in childhood and availability of Vitamin D supplementation through the Governments Healthy Start Scheme.

4.2 Director of Nursing and Medical Director

The Director of Nursing and Medical Director have responsibility for ensuring the children with Vitamin D Deficiency and Insufficiency and groups at risk of developing these conditions are offered appropriate medical management and support patient safety at all times.

4.3 Service Managers

Service managers are responsible for the day-to-day operational management and coordination of the medical management of children with Vitamin D Deficiency and Insufficiency and groups at risk of developing these conditions in line with the clinical guidelines.

4.4 All Clinical Staff

Clinical staff are key essential members of the multi-disciplinary team in ensuring that children with Vitamin D Deficiency and Insufficiency and groups at risk of developing these conditions are managed appropriately as per national/local guidelines. All clinical staff are encouraged to use this clinical guideline and to report any adverse care related issues to their line manager and to complete a Datix incident report in line with the Trust's incident reporting policy.

5 Guideline for the Prevention, Diagnosis and management of Vitamin D deficiency in childhood

5.1 Sources of Vitamin D

Sun exposure is the main source of vitamin D, however it is also found in some foods both naturally and when fortified.

Vitamin D can only be made in the skin by exposure to sunlight when the sun is high in the sky; therefore, in most of England from November to February we cannot make enough Vitamin D from sunlight.

Vitamin D is found in but not exclusive to a number of foods naturally:

- Oily fish – such as salmon, sardines, herring and mackerel
- Red meat
- Liver (should be avoided when pregnant)
- Egg yolks
- Fortified foods – such as some fat spreads, plant milks and breakfast cereals

5.2 Mode of action

There are two types of Vitamin D: Ergocalciferol (Vitamin D2) a plant product, and Colecalciferol (Vitamin D3) which is a fish or mammal product. They are regarded as interchangeable.

Whether ingested orally or made in the skin through sun exposure, Vitamin D is converted to 25 hydroxy Vitamin D in the liver and then on to 1.25-dihydroxy Vitamin D in the kidney. This is the biologically active form of Vitamin D which has potent metabolic effects.

5.3 Groups at Risk of Vitamin D Deficiency

Certain groups of people are particularly at risk of developing Vitamin D deficiency (refer to Table 1). Children and Young people will need to be assessed as to whether they fall into a risk group.

Although sunshine is the usual source of Vitamin D, diet is the source of Calcium. It is particularly important to prevent Vitamin D deficiency in children with limited Calcium intake.

Table 1 Groups of people particularly at risk of developing Vitamin D deficiency

Increased Need	Pregnant and breastfeeding women Infants Twin and Multiple Pregnancies Adolescents Obesity Drugs: anti epileptics (see below), anti TB drugs
Reduced Sun Exposure	Northern Latitude, especially above 50 degrees latitude (includes the UK) Asian and African people – dark skin needs more sunshine to make Vitamin D Wearing concealing clothing Immobility, for example in patients with conditions such as cerebral palsy Excessive use of sun block- most block UVB more than UVA

Limited Diet/absorption	Vegetarians and vegans Prolonged breastfeeding – even if the mother has sufficient Vitamin D Self-restricted or limited diets Exclusion diets, for example milk allergy Malabsorption Liver disease Renal disease
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Vitamin D and epilepsy:

Epilepsy is a very common neurological disease in childhood, with a high prevalence of vitamin D deficiency. In paediatric epileptic population, treatment with antiepileptic drugs influence bone metabolism, reducing bone mass and levels of serum vitamin D. Vitamin D deficiency may cause rickets and osteomalacia, resulting in a higher fracture risk and an increased incidence of osteoporosis in adult life. Vitamin D monitoring and supplementation is important in the management of epileptic children on long-term antiepileptic drugs.

Reduction of bone mineral density [BMD] has been observed in most epileptic patients and 25% of patients with epilepsy suffer from osteoporosis. Moreover, BMD of epileptic children is remarkably lower compared with healthy children who require closer follow up and management.

Epilepsy daily treatment with anti-epileptic drugs (AEDs) used for seizure prevention, is an identified factor effecting in bone turnover. Polytherapy, as well as treatment with AEDs for a long time, is shown to be correlated with low levels of vitamin D, having a negative effect in bone health.

With the bone physiology in children being different from that of the adults because of the existence of growth plates that are important for bone development; AEDs, such as valproate acid, can have a direct negative impact on bone growth plates. AEDs influence bone mineral status in children receiving AEDs for more than 6 months, altering both biochemical and radiologic markers. Administrations for more than 2 years have severe side effects on BMD.

Healthy Start Vitamins

Women and children from families who are eligible for the Government's Healthy Start scheme can get free vitamin supplements which include vitamin D, in the form of tablets for women (pregnant and breastfeeding) and drops for children until 4 years old.

Parents can apply online if they receive universal credit if meet the income threshold on the healthystart.nhs.uk website. There is also a help line 0300 330 7010 and they can apply by email. Parents will be given a Healthy Start money card with which they will be able to get free vitamins. Midwives and Health Visitors can direct parents where to get them.

It is the statutory responsibility of Trusts to make Healthy Start vitamins available locally to women and children on the scheme.

Women qualify for Healthy Start from the 10th week of pregnancy or if they have a child under four years old, and if she or her family receive various specified allowances. All pregnant women who are under 18 qualify.

Alternatively, Vitamin D supplements are available for purchase or can be prescribed for those who are not eligible for the scheme. When purchasing multivitamins, parents should be advised to ensure that the product contains 10µg (400 IU) of vitamin D.

Indications for vitamin D supplements

Public Health England recommends daily vitamin D supplements as follows:

- Breast fed babies from birth to one year need 8.5 µg - 10µg vitamin D per day
- Formula Fed babies do not require supplements if receiving more than 500ml/day
- Children from one to four years should consume 10µg per day
- Adults, including pregnant and breastfeeding women, need 10µg per day

10µg = 400IU

Treatment

The Department of Health recommends a dose of approximately 400 IU for all children with no underlying health condition children from 6 months to 5 years of age.

Vitamin D insufficiency is common to all paediatric epileptic populations, leading to rickets and osteomalacia. It does not only carry with it the risk of suboptimal skeleton health but also provokes several extra skeletal consequences, especially in a long-term treatment on AEDs.

There is still a lack of consensus regarding optimal doses, assessment and monitoring of vitamin D levels.

5.4 Clinical Features in Children of Vitamin D Deficiency

Low levels of vitamin D are common in the UK. It is therefore important to consider whether the child's symptoms or signs could be related to vitamin D deficiency before requesting the measurement of vitamin D. **Routine screening is not recommended.**

Indications for testing Vitamin D deficiency:

1. Symptoms and signs of rickets: *see Appendix 1*
 - Progressive bowing of legs (bowing of legs can be a normal finding in toddlers)
 - Progressive knock knees
 - Painful wrist swelling
 - Rachitic rosary (swelling of the costochondral junctions)
 - Craniotabes (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:
 - Impaired linear growth
 - Delayed walking
 - Long-standing (> three months), unexplained bone pain
 - Muscular pain or 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
 - Proximal myopathy
3. Abnormal investigations:
 - Low plasma calcium or phosphate, high alkaline phosphatase (greater than the local age-appropriate reference range)
 - 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 (used in conditions affecting bones such as osteoporosis due to steroids, immobility or inflammatory disorders).

In the absence of the above indicators or suspicion, measurement of vitamin D is not indicated.

5.5 An Assessment for Vitamin D Deficiency

An assessment of the patient will need to be carried out taking into account the Risk Factors and Clinical Features of Vitamin D deficiency which will determine the management.

Table 2 Assessment and management of Vitamin D Deficiency

Characteristics	Management
Risk factors and Clinical Features	Blood tests and/or Xray, treatment, lifestyle advice and long-term prevention
Risk Factors, suspicion of Clinical Features	Consider Blood tests, give lifestyle advice
Risk factors, no Clinical Features	Give lifestyle advice and prevention daily supplementation
No risk factors	Give lifestyle advice

See Table 1 on page 4 for risk factors

5.6 Blood Test Investigations

25 hydroxy Vitamin D is the standard blood test and is an excellent marker of body stores. This should be tested prior to commencing treatment when there are risk factors and clinical features (or suspicion) of Vitamin D deficiency. Blood bone biochemistry (calcium, phosphate and alkaline phosphatase) should be tested.

5.7 Blood Levels of Vitamin D and Bone Biochemistry

Vitamin D Plasma Level	Treatment Advised
<25 nmol/L	Treatment recommended (see section 6)
25-50 nmol/L	Give advice on dietary sources of vitamin D and encourage dietary calcium intake. Advise oral preparations containing vitamin D 400 IU per day for patients aged one month to 18 years. Continue unless there is a significant lifestyle change to improve vitamin D status Retesting is not normally required if the individual is asymptomatic and compliant with multivitamin supplements
>50 nmol/L	Provide reassurance and give advice on maintaining adequate vitamin D status through diet and supplements

Indications for referral to secondary care:

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
2. Underlying complex medical disorders (e.g. liver disease, intestinal malabsorption)
 3. In children, deformities or abnormalities probably related to rickets
 4. 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) with persisting low plasma phosphate or low/high alkaline phosphatase.

6 Management of Vitamin D Deficiency

As there is data to show that vitamin D3 is more bioavailable than vitamin D21, the current recommendation, is to use vitamin D3 (cholecalciferol) as the preferred treatment.

It is recognised that equivalent weekly or fortnightly dosing is likely to be effective in treating vitamin D deficiency.

Age Group	Treatment Advised (As per BNFC and Shropshire/Telford Guidelines)
1-5 months	3,000 IU orally daily for 8-12 weeks
6 months – 11 years	6,000 IU orally daily for 8-12 weeks
12-17 years	10,000 IU orally daily for 8-12 weeks Or single divided oral dose totalling 300,000 IU can be considered if there is a concern about compliance
Alternative:	
InVita D3 25,000 IU/ml oral solution (cholecalciferol) is licensed in children (from birth). The dose for 0-18 year olds is 25,000 IU (1 ampoule of oral solution) every 2 weeks for 6 weeks.	
InVita D3 can be mixed with a small amount of the child's <u>cold or lukewarm</u> foods, yogurt, milk, cheese or other dairy products.	

It is worth noting that 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.

6.1 Long Term Management

After treatment, children who were deficient or insufficient should continue with standard maintenance prevention dose supplementation until completion of growth unless lifestyle changes (diet/sun exposure) are assured.

Monitoring

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 IU 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 diseases 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 IU as a single or divided dose).
- 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.

6.2 Prevention and Supplementation during Winter in adults

The latest government guidance (the consensus statement from Public Health England and NICE guideline 187) recommends supplementation during winter for all adults. When outdoors during the spring and summer most people make enough vitamin D from sunlight on the skin but in the UK. However, between October and early March we can't make vitamin D from sunlight because the sun is too low in the sky and it is difficult to get enough vitamin D from food. Hence its best to take a vitamin D supplement during the autumn and winter.

6.3 Adverse Effects of Vitamin D

Adverse effects of Vitamin D overdose are rare but care should be taken with multivitamin preparations as vitamin A toxicity is a concern. Multivitamin preparations often contain a surprisingly low dose of vitamin D.

Overdose of Vitamin D causes Vitamin D toxicity and significant hypercalcaemia. When prescribing weekly or monthly preparations instead of daily, caution must be advised and treatment regimens made as simple as possible to avoid errors and prevent harm.

6.4 Lifestyle Advice (Lifestyle Advice: Vitamin D and the Sun Consensus statement)

The consensus statement represents the unified views of the British Association of Dermatologists, Cancer Research UK, Diabetes UK, the Multiple Sclerosis Society, the National Heart Forum, the National Osteoporosis Society and the Primary Care Dermatology Society.

"Vitamin D is essential for good bone health and for most people sunlight is the most important source of Vitamin D. The time required to make sufficient Vitamin D varies according to a number of environmental, physical and personal factors, but is typically short and less than the amount of time needed for skin to redden and burn. Enjoying the sun safely, while taking care not to burn, can help to provide the benefits of Vitamin D without unduly raising the risk of skin cancer. Vitamin D supplements and specific foods can help to maintain sufficient levels of Vitamin D, particularly in people at risk of deficiency."

7 Information resource for parents

- NHS Website – Vitamin D (www.nhs.uk)
- National Osteoporosis Society: A balanced diet for bones www.theros.org.uk
- Royal National Orthopaedic Hospital: FAQs about Vitamin D in childhood www.rnoh.nhs.uk
- Royal College Obstetrics and Gynaecologists: Healthy eating and vitamin supplements in pregnancy www.rcog.org.uk
- BDA food fact sheet on Vitamin D www.bda.uk.com
- Healthy Start - <https://www.healthystart.nhs.uk/getting-vitamins/>

8 Consultation

The guideline has been presented to and has been discussed with the community doctor's team (Dr S Bush, Dr G Minnaar, Dr H Unsworth, Dr Ogilvie, Dr Mushtaq, Dr Postings, Dr Raveendran, Dr D Short and N Kaur).

The guideline has been discussed with Medicines Management Team for NHS Shropshire, Telford and Wrekin ICB and the 0-19 Service professional development lead.

9 Dissemination and Implementation

These guidelines will be disseminated by the following methods:

- Managers Informed via DATIX system who then confirm they have disseminated to staff as appropriate
- Staff via Team Brief
- Published to the staff zone of the trust website

10 Monitoring Compliance

Adherence to these guidelines will be monitored through DATIX reporting and intermittent audit.

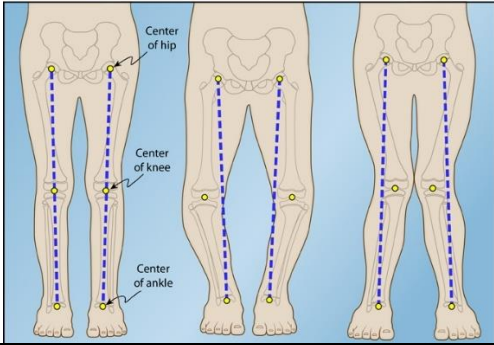
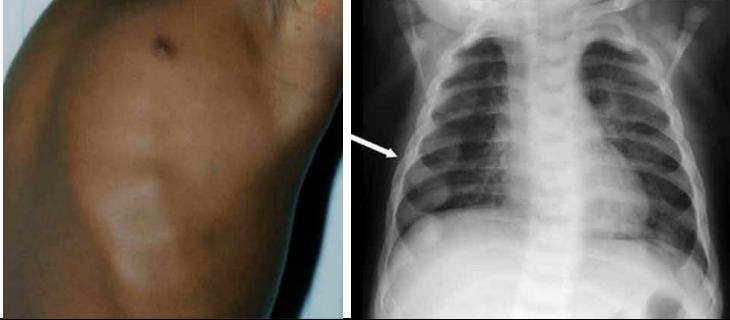



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- Vitamin D testing and treatment: a narrative review of current evidence: (Stefan Pilz¹, Armin Zittermann², Christian Trummer¹, Verena Theiler-Schwetz¹, Elisabeth Lerchbaum¹, Martin H Keppel³, Martin R Grüber⁴, Winfried März^{5,6,7} and Marlene Pandis¹)
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12 Associated Documents

- Shropshire Community Health NHS Trust Consent to Examination and Treatment Policy
- Shropshire Community Health NHS Trust Records Management Policy
- COVID-19 rapid guideline: vitamin D
- NICE guideline [NG187] Published: 17 December 2020

Appendix 1: Signs of Vitamin D deficiency

Manifestation	Description
	<p>Progressive bowing of legs</p> <p>Progressive knock knees</p>
	<p>Rachitic Rosary</p> <p>Bulbous enlargement of the costochondral junction – especially of the middle ribs</p>
	<p>Craniotabes</p> <p>Softening of the skull at suture lines</p>
	<p>Wrist swelling which can be painful</p>
	<p>Enamel hypoplasia</p>