Vitamin D: A public health priority

Recommendations for health care professionals and researchers
The importance of vitamin D

Vitamin D is essential for bone health. It is required to absorb calcium and phosphorus into the body and regulate the movement of these minerals in and out of the skeleton, ensuring strong bones. A lack of vitamin D can lead to bone deformities, such as rickets.

Although vitamin D is classed as an essential nutrient, it is a hormone and can be produced in the body. In comparison with other essential nutrients, specific requirement levels for vitamin D are complicated because it can be manufactured by the body from the action of sunlight on the skin. In the UK, reference nutrient intake (RNI) levels for vitamin D have been set for those population groups most at risk of deficiency (see Appendix):

- **Children**—the requirement for infants aged 0–6 months is 8.5 μg or 340 international units (IU), while the requirement for children aged >6 months to 5 years is 7 μg (280 IU)
- **Pregnant and breastfeeding women**—the requirement is 10 μg (400 IU)
- **Elderly people**—the requirement for people aged 65 years and over is 10 μg (400 IU).

The RNI is defined as being two standard deviations above the estimated daily average requirement and is, therefore, the intake amount that will satisfy the needs of 97.5% of the population (Department of Health (DH), 1991). The RNI is not the same as the average nutrient requirement.

Vitamin D deficiency is a key public health issue in the UK, with increased identification of deficiency in infants, young children and adolescents in recent years, particularly in Black and minority ethnic groups (Shaw and Pal, 2002; Cashman and Kiely, 2011; Kehler et al, 2013).

**Sources of vitamin D**

About 90% of vitamin D in the body comes from sunlight (Scientific Advisory Committee on Nutrition (SACN), 2007). When the skin is exposed to the ultraviolet B (UVB) contained in sunlight, it converts 7-dehydrocholesterol in the deep epidermal layers of the skin to the provitamin colecalfierol (vitamin D3). Colecalciferol is transported to the liver and converted to 25-hydroxyvitamin D (25(OH)D). This is then metabolised in the kidneys to the active form 1,25-dihydroxyvitamin D (1,25(OH)2D) or calcitriol (De Luca, 2004; Infant and Toddler Forum, 2012).

The amount of UVB radiation needed to make sufficient vitamin D depends on certain factors, such as skin colour: people with fair complexions need less sunlight exposure than is required by those with darker skin (Dawson-Hughes, 2004).

There are some dietary sources of vitamin D. Small amounts are found in oily fish (sardines, salmon, mackerel, pilchards and tuna) and even smaller amounts in egg yolk and red meat. Some foods, such as margarine, infant formula and some breakfast cereals, are fortified with vitamin D (SACN, 2003). Some foods contain colecalfierol (vitamin D3) and ergocalciferol (vitamin D2), which are biologically inactive, but when they are eaten and absorbed they are transported to the liver and follow the same metabolic pathway as vitamin D3 from sunlight.

Exposure to UVB radiation in sunlight is the most efficient way to boost vitamin D supply. More vitamin D is made in direct sunlight than in the shade or on a cloudy day (British Dietetic Association, 2013). However, there are several factors that affect exposure and can therefore have an impact on the body’s production of vitamin D. Environmental factors (Institute of Medicine, 2011; Health Council of the Netherlands, 2012) include:

- **Latitude**: people living above 52° North (which includes most of the UK) are unable to produce sufficient vitamin D from October to March (Pearce and Cheetham, 2010)

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VITAMIN D

 Prevailing weather conditions and the level of air pollution: UVB radiation is less strong on cloudy days or where the air is very polluted (Hosseinpanah et al, 2010)

 Time of year: in the UK, ultraviolet light is only strong enough to make vitamin D on exposed skin in the middle of the day (around 11am–3pm) from April to September (British Dietetic Association, 2013)

 Personal characteristics e.g. skin pigmentation (people with darker skin manufacture less vitamin D) and age (the skin of older people is less able to absorb vitamin D from sunlight)

 Physical exposure to sunlight e.g. the amount of time spent outside, attire, use of sunscreen.

 Deficiency and supplementation

 In the UK, vitamin D insufficiency has been defined as a level of 25(OH)D lower than 50 nmol/l, and deficiency as lower than 25 nmol/l (Davies and Shaw, 2011; Christesen et al, 2012). It is worth noting that a level above 25 nmol/l is not necessarily sufficient; the National Osteoporosis Society (Francis et al, 2013: 14) recommends treatment for people with a serum 25(OH)D of <30 nmol/l.

 As a result of low UVB levels in sunlight and the fact that only around 10% of required vitamin D comes from dietary sources, many people in the UK need supplementation to ensure adequate intake of vitamin D (Davies et al, 2012). In particular, people in groups at high risk of vitamin D deficiency should be offered information on suitable supplementation. Such groups include:

 Babies and young children, and older children and adolescents who spend little time outside
 Pregnant women and breastfeeding mothers
 People aged 65 years and over
 People of Asian, African, Afro-Caribbean and Middle Eastern descent living in the UK or other northern climates
 People whose skin is not exposed to sunlight e.g. those who cover up for religious or cultural reasons, or people who are housebound.

 Conclusion

 Increased rates of rickets and vitamin D deficiency in recent years suggest that there is a need to raise awareness of the importance of this essential nutrient. Health professionals should advise pregnant women and parents of young children on healthy diet, the need for supplementation and safe sun exposure to ensure adequate intake of vitamin D.


Promoting vitamin D uptake in pregnancy and the puerperium

Vitamin D deficiency in pregnancy is a major public health issue globally, with prevalence varying from 5–50%, despite common usage of antenatal vitamin D supplementation (Mulligan et al, 2010). In the UK, deficiency is reported to be 54.7% in the first trimester of pregnancy (Urrutia and Thorp, 2012), presenting significant risks to mother and infant. The chief medical officers for the UK therefore advise that all pregnant and breastfeeding women have vitamin D supplementation (Davies et al, 2012). The main source of vitamin D is the sun (Engelsen, 2010), with dietary intake providing a far less significant amount.

Optimum levels of vitamin D can protect against a wide spectrum of chronic and acute disorders, making vitamin D a priority of midwives, health visitors and the wider multidisciplinary team (Pludowski et al, 2013). Pregnancy is an optimal time for the delivery of public health messages because pregnant women have regular contact with health professionals. As front-line practitioners during pregnancy and the puerperium, midwives and health visitors are ideally placed to facilitate discussions with women around vitamin D deficiency, including educating women about the risks associated with deficiency, teaching ways in which women and their families can increase endogenous vitamin D levels and advising vitamin D supplementation in line with national guidance (Harvey et al, 2014; National Institute for Health and Care Excellence (NICE), 2014; Royal College of Obstetricians and Gynaecologists (RCOG), 2014). Thus, the midwife and health visitor are key to health promotion, disseminating information to the wider family unit to improve wellbeing.

Risks of vitamin D deficiency
Vitamin D is thought to affect the mother and fetus in various ways. Directly linked to the stimulation of calcium absorption (Collins, 2013; Karras et al, 2014), adequate levels protect against rickets and skeletal development problems such as osteomalacia (bone softening) and suboptimal bone growth (Finer et al, 2011). Vitamin D also regulates phosphate in the blood, playing an important role in bone mineralisation, muscle contraction and nervous system development (Thorne-Lyman and Fawzi, 2012). Ultraviolet B (UVB) exposure of the mother and supplementation correlates to bone mass, with lower amounts of umbilical-

Abstract
Vitamin D deficiency throughout the childbearing continuum is a major public health issue, and supplementation is an arguably cost-effective and simple way of increasing maternal health and ensuring fetal wellbeing (Christesen et al, 2012). The evidence underpinning supplementation needs further exploration to accurately determine safe and appropriate levels of vitamin D to avoid toxicity and prevent harmful effects to mother and baby (World Health Organization, 2012). Despite this, maternity health professionals in the UK should advise routine vitamin D supplementation for all women in line with national guidance (National Institute for Health and Care Excellence, 2014). As key providers of public health information, midwives and health visitors hold an important role in advice and management of vitamin D deficiency and supplementation, including educating women and families around associated risks and how to increase vitamin D uptake.

Key words
› Vitamin D › Supplementation › Pregnancy › Puerperium
› Postnatal › Breastfeeding › Public health › Health promotion
› Midwife › Health visitor

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venous calcium associated with lower bone mass in children (Javaid et al, 2006). Recent research suggests that the link between bone mineral content and vitamin D may be more tenuous than previously understood (Lawlor et al, 2013). Despite this, deficiency has been linked to reduced fetal weight (Scholl and Chen, 2009; Mulligan et al, 2010), affecting birthweight centiles, and increasing risk of small for gestational age (SGA) infants by up to 2.4-fold (RCOG, 2014; Wei et al, 2013). Women taking supplementation showed less likelihood of having a baby weighing less than 2500g, although statistical significance appears borderline (De-Regil et al, 2012). Risk of preterm birth (Dawodu and Nath, 2011) has also been cited in some studies, and it is thought that vitamin D contains immuno-adaptational elements important for appropriate maternal immune responses to the placenta, as well as impacting genes involved in effective placental implantation (Thorne-Lyman and Fawzi, 2012; Shin et al, 2010). Low levels of maternal vitamin D are also associated with poor fetal lung development, potentially leading to neonatal immune conditions and asthma (RCOG, 2014).

Recognition
It can be challenging for health professionals to recognise those who are deficient in vitamin D, as manifestation often goes undetected. Depression, gastrointestinal disturbances and bone pain may all be signs of vitamin D deficiency (RCOG, 2014), although these may be prevalent in pregnancy irrespective of vitamin D deficiency. There is currently no evidence to support routine screening for vitamin D deficiency in pregnancy either in terms of health benefits or cost-effectiveness (RCOG, 2014). However, those who are hypocalcaemic or symptomatic may be offered vitamin D measurement as part of their management.

In order to detect vitamin D levels in the body, a sample of blood can be analysed to show levels of serum 25-hydroxyvitamin D (25(OH)D). Cut-off levels were initially determined in relation to bone mineralisation (Christesen et al, 2012), with any levels <25 nmol/l (10 ng/ml) showing deficiency, and <50 nmol/l (20 ng/ml) determining insufficiency (Christesen et al, 2012), although there is no general agreement of what constitutes ‘optimal’ amounts (Spiro and Buttriss, 2014). In pregnancy, fetal stores of vitamin D are predominantly determined by maternal 25(OH)D levels (Grant et al, 2014). If women are found to be deficient in vitamin D, then treatment should be initiated, continuing for a duration of 4-6 weeks to ensure appropriate levels are restored, which can then be followed by routine supplementation as per general pregnancy population (RCOG, 2014).

Supplementation
There is currently limited evidence to directly assess the benefits and harmful effects of supplementation (World Health Organization (WHO), 2012), with no general consensus about optimum vitamin D intake (Theodoratou et al, 2014). The WHO (2012) does not recommend routine antenatal supplementation of vitamin D, but UK national guidance does (NICE, 2014; RCOG, 2014). Due to a lack of routine screening, the chief medical officers for the UK (Davies et al, 2012) advise that all pregnant and breastfeeding women supplement their diet with 10 μg or 400 international units (IU) of vitamin D per day. Women who are considered to be at especially high risk of vitamin D deficiency in pregnancy or the puerperium (see below) are advised to take up to 1000IU daily, with women at increased risk of pre-eclampsia or with pre-existing gastrointestinal conditions recommended to take 800 IU daily (RCOG, 2014).

Depending on feeding mode, supplementation advice may vary. Vitamin D deficiency is most common in breastfed infants, although this is dependent on sun-exposure behaviours (Dawodu et al, 2015). Women choosing to breastfeed should be encouraged to supplement with vitamin D in order to ensure adequate levels in breast milk and the maintenance of maternal wellbeing. Where a woman has not had adequate vitamin D during pregnancy, it may also be necessary for the infant to receive vitamin D drops from the age of 1 month, as there is evidence that breast milk alone is not enough to meet requirements (Callaghan et al, 2006). Recent research found that at 45 weeks
postnatally, 17% of mothers were vitamin D deficient (Dawodu et al, 2014). Those choosing to artificially feed therefore may wish to continue with supplementation for their own wellbeing; however, formula milk is fortified with vitamin D (NICE, 2014; Dawodu et al, 2015), so additional supplementation for the infant is not required.

NICE (2014) recommended that local authorities review the accessibility, availability and uptake of Healthy Start vitamin supplements, which are currently available free-of-charge to women who are pregnant or have a child under 4 years old and meet the eligibility criteria, such as being in receipt of income support or other benefits.

Further evidence around safe supplementation levels is advisable, as vitamin D toxicity is associated with weight loss, polyuria, anorexia and heart arrhythmias, with chronic toxicity leading to organ calcification and eventually failure (Collins, 2013). It is therefore key for midwives and health visitors to risk-assess appropriately in order to individualise care plans accordingly.

**Women at high risk**

Women at increased risk of vitamin D deficiency include those who have dark skin, especially those with type VI skin (as classified by the Fitzpatrick (1988) scale), because melanin in the skin affects UV penetration, so these women will require much longer sun exposure to produce adequate vitamin D levels (Engelsen, 2010). Women who spend large amounts of time indoors (Holick, 2004), such as those residing in prisons, hospitals or institutions, are at risk due to a lack of sun exposure. Similarly, women who regularly wear concealing skin coverings for cultural or religious reasons are also at increased risk (Harvey et al, 2014), as well as those who avoid sun exposure for health or cosmetic reasons, such as women at high risk of skin cancer. Occupation may also be significant; those who work predominantly indoors, such as in offices or factories, get little incidental sunlight exposure throughout the day, together with those who do night-shift work. Women who have chronic conditions, such as obesity, liver disease, renal disease and fat malabsorption syndromes (cystic fibrosis, coeliac disease, inflammatory bowel disease), have an increased risk of deficiency due to these being barriers of vitamin D absorption and storage (Engelsen, 2010). Supplementation may be unsuccessful for women with renal disease, and if sarcoidosis (vitamin D sensitivity) presents, then further liaison with the wider multidisciplinary team should be sought to assess appropriateness of supplementation (RCOG, 2014). Women residing in northerly latitudes, including most of the UK, are at risk for low concentrations of vitamin D.

**Increasing endogenous vitamin D**

As well as advising supplementation in line with national guidance, midwives and health visitors are well-placed to educate around ways in which women and their families can increase endogenous vitamin D levels. The main source of vitamin D in adults is synthesis in the skin from sunlight exposure under the influence of UVB radiation (RCOG, 2014).

Thirty minutes of sunlight exposure in an adult Caucasian is believed to deliver 5000IU of vitamin D (Yu et al, 2009). However, women with dark type VI skin produce up...
to six times less vitamin D compared to women with pale type I skin, and thus will need longer sunlight exposure (Engelsen, 2010). The total amount of vitamin D accrued from sunlight depends on a variety of factors, including duration and extent of skin exposure, cloud cover, altitude and solar zenith angles (season and latitude). Using sunscreen with a sun protection factor (SPF) of 8 or above almost entirely prevents formation of vitamin D (Holick and Garabedian, 2006). Seasonal variations in levels of vitamin D include a peak during the summer months and a trough during winter. Holick (2003) found that, at a latitude of 48.5° (Paris, France), the skin is unable to form vitamin D between October and March, therefore the importance of daily exposure to sunlight in summer becomes vital, as it may then be stored in fat for winter months (Holick, 2004).

Dietary intake of vitamin D is relatively small compared to overall vitamin D status, as there are few naturally occurring dietary sources of vitamin D (RCOG, 2014; Wyness, 2014). The average dietary intake in women is 2.6 μg per day, significantly below the recommended 10 μg daily (Wyness, 2014). Oily fish (salmon, mackerel, sardines, tuna, pilchards, trout, kippers and eel) is the richest source of dietary vitamin D, with egg yolks and shiitake mushrooms (Holoss and Wagner, 2004; Holick, 2007; British Dietetic Association (BDA), 2013; Wyness, 2014) also containing vitamin D, alongside meat and milk, depending on season (BDA, 2013). Within these food groups, the amount of vitamin D varies significantly; a 99 g serving of wild salmon contains 600–1000 IU, while farmed salmon only contains a quarter of this amount per serving (Lu et al, 2007). The same size portion of mackerel, sardines or tuna provides 200–300 IU. A teaspoon of cod liver oil provides 600–1000 IU, although this is not recommended in pregnancy (BDA, 2013). Foods fortified with vitamin D, such as margarine, orange juice, milk, yogurt, cheese, cereal and breads, also contribute to intake (BDA, 2013; Holick, 2007).

Discussing ways of increasing vitamin D other than supplementation is an essential aspect of health promotion, although information should be closely paired with guidance around foods and practices that are considered unsafe. Encouraging the consumption of one or two portions of oily fish per week is important for nutritional benefits such as omega-3, especially as reportedly only 28% of women regularly consume this (Bates et al, 2012). However, any more than two portions per week is not recommended in pregnancy due to the potentially harmful effects of methyl mercury and polychlorinated biphenyls (RCOG, 2010). Similarly, women should be encouraged to spend time in natural sunlight while being careful not to allow the skin to burn. Due to skin changes in pregnancy, skin may become more sensitive to sun exposure and so women should exercise caution as vitamin D uptake requires uncovered skin exposure (Patience, 2013). It is important for health professionals to be flexible with advice, individualising this to the woman and her family to provide realistic guidance, taking into account dietary trends and lifestyle.

**Conclusion**

Due to the northerly latitude and an increasingly indoor lifestyle, pregnant and breastfeeding women in the UK are at risk of vitamin D deficiency. Despite national guidance, many women remain deficient throughout pregnancy (Finer et al, 2011) and so it falls to midwives and health visitors to ensure that women and their families are effectively informed and routinely ensuring supplementation. NICE (2008) suggests that health professionals should raise the profile of importance of vitamin D during the childbearing continuum. As midwives and health visitors are front-line providers of health promotion during pregnancy, specific communication about vitamin D within the wider context of health and lifestyle choices should be revisited frequently throughout the antenatal and postnatal period. Thoroughly risk-assessing and individualising care is vital, taking into account ethnicity, cultural diversities and social demographics. Women planning pregnancy, during pregnancy and breastfeeding should have access to supplementation, and this should be ensured by a multidisciplinary team effort (NICE, 2014). Further evidence is required to determine optimal levels of vitamin D, timing of supplementation and the long-term
risk–benefit ratio of perinatal uptake (WHO, 2012). Due to this dearth in the evidence-base, it is advisable for midwives and health visitors to continually revisit the evidence underpinning recommendations, ensuring continued practice development and gold-standard care.


Theodoratou E, Tzoulaki I, zgaga L, Ioannidis JP (2014) Vitamin D and multiple health outcomes: umbrella review of systematic reviews and meta-analyses of observational studies and randomised trials. BMJ 348: g2035. doi: 10.1136/bmj.g2035


Promoting vitamin D uptake in infants and children

Abstract

Despite it being thought of as a disease of the past, children in the UK, particularly those from high-risk groups, are at risk of rickets. The latest National Diet and Nutrition Survey estimated that 7.5% of 1½–3-year-olds were deficient in vitamin D (Bates et al, 2014). Vitamin D deficiency presents with skeletal and non-skeletal manifestations. With the sun being the main source of vitamin D, there is a reliance on supplementation across most of the UK. This article looks at manifestations of vitamin D deficiency, the identification of at-risk groups and recommendations for supplementation.

Key words
• Vitamin D
• Supplementation
• Deficiency
• Infant
• Rickets
• Hypocalcaemia
• Health promotion
• Midwife
• Health visitor

Health professionals in contact with new parents—including midwives, health visitors and the wider multidisciplinary team—are well-placed to identify children at risk of vitamin D deficiency, advise on supplementation and raise awareness of the importance of vitamin D. The Department of Health (DH, 2015) has mandated five core contacts for health visitors to have with families during the first 2½ years of a child’s life; this provides an ongoing opportunity to deliver public health messages such as the benefits of vitamin D. This article looks at how vitamin D deficiency may manifest in infants and children, how to identify those most at risk and how to ensure children up to 5 years old are vitamin D sufficient.

Vitamin D deficiency in children

The prevalence of vitamin D deficiency has been highlighted in National Diet and Nutrition Surveys (NDNS), with 7.5% of 1½–3-year-olds being vitamin D deficient (Bates et al, 2014).

A deficiency in vitamin D affects the absorption of calcium and phosphorus, which leads to poor bone mineralisation. This can manifest as bone pain and/or skeletal deformity (Scientific Advisory Committee on Nutrition (SACN), 2007). Skeletal manifestations include increased risk of fracture and poor growth, caused by a failure of the skeleton to properly develop (NHS Choices, 2013).

Despite nutritional rickets being considered a disease of the past, there have been increasing numbers of infants and children diagnosed with rickets in the UK according to reports from paediatricians (Pearce and Cheetham, 2010). Children of South Asian origin are particularly at risk (Callaghan et al, 2006). The classic ‘bowed leg’ presentation of rickets occurs as a child begins to bear weight on soft bones. As the child gets older, he or she may be reluctant to walk and complain of pain and muscle weakness. In cases where there is hypocalcaemia, the child may have twitching, tingling, cramps and fits (NHS Choices, 2013; Shaw and Mughal, 2013).

Hypocalcaemia is the presence of low serum calcium levels in the blood. Basatemur and Sutcliffe (2014) estimated there were 91 cases of hypocalcaemic seizures secondary to vitamin D deficiency in the UK and Ireland between 2011–13. In a study on children with rickets by Ladhani et al (2004), 17 of 65 children had hypocalcaemic symptoms but no radiological evidence of rickets. The study authors speculate that this non-skeletal presentation of rickets is more likely during periods of rapid growth such as that experienced by infants, toddlers or adolescents.

Children are usually vitamin D deficient for many months before rickets is diagnosed (Greer, 2008) and, therefore, may be in pain...
for some time prior to diagnosis. Other signs and symptoms of vitamin D deficiency may include dental problems, with delay in tooth eruption and increased risk of cavities (NHS Choices, 2013).

**Ensuring vitamin D intake**

To ensure adequate vitamin D intake in children, various factors need to be considered, including maternal vitamin D status, whether the child and family are at higher risk of vitamin D deficiency, exposure to sunlight, diet and supplementation.

The main source of vitamin D is the sun, which provides 80–90% of the body’s requirement (Holick 2014; Poole et al, 2014). It is also found in limited foods such as oily fish and fortified foods such as margarine and some cereals, but vitamin D requirement cannot be met through diet alone (Cribb et al, 2014).

**Children at high risk**

Some children are considered to be at greater risk of vitamin D deficiency (SACN, 2007; National Institute for Health and Care Excellence (NICE), 2014):

- Those who cover their skin for religious or cultural reasons
- Those who are housebound or confined indoors for long periods
- Those with darker skin pigmentation e.g. children of African, African-Caribbean or South Asian family origin.

NICE (2014) has made a number of recommendations to increase supplement use, including increasing awareness of the importance of vitamin D, improving local availability and access to the Healthy Start scheme, and encouraging manufacturers of multivitamin supplements to include the recommended reference nutrient intake for vitamin D in their preparations.

**Maternal vitamin D status**

The vitamin D status of an infant is linked to the status of the mother during pregnancy, so infants born to mothers deficient in vitamin D may need supplementation from 1 month of age. Exclusively breastfed babies are at greater risk of deficiency (Wagner et al, 2008). Health professionals should consider the mother’s vitamin D status and feeding method when assessing the child’s risk of vitamin D deficiency.

If a midwife or health visitor suspects a child may have rickets, they should refer them immediately to the GP for an urgent appointment and onward referral to a paediatrician. Treatment would include vitamin D supplementation, the level of which would be guided by the degree of deficiency. It is likely that further investigations will be required to identify the underlying cause of vitamin D deficiency (Pearce and Cheetham, 2010).

**Supplementation**

It is recommended that all children aged 6 months to 5 years are given vitamin D supplements (NHS Choices, 2015). If the mother has taken daily supplements of 10 µg vitamin D throughout pregnancy, babies should not need a supplement until they are aged 6 months. Consideration needs to be given to earlier supplementation for high-risk mothers and babies.
babies do not require additional vitamin D supplementation until they are having less than 500 ml of formula per day. Breastfed babies under 6 months may benefit from supplementation earlier—from 1 month of age—particularly if the mother did not take vitamin D throughout her pregnancy or if the family are at high risk of deficiency. The requirement for daily vitamin D supplements is 8.5 μg for infants aged up to 6 months and 7 μg for children aged >6 months to 5 years (DH, 1991; NHS Choices, 2015).

SACN (2015) is currently reviewing reference nutrient intakes of vitamin D (including the contribution of foods, fortifications and supplements). It is likely that further recommendations will follow.

Healthy Start is the government means-tested scheme to provide vouchers for milk, fruit and vegetables, infant formula and vitamins (Healthy Start, 2015). Midwives and health visitors should encourage eligible families to apply for vouchers and give information on how the vouchers can be exchanged. The uptake of Healthy Start is low; a study by McFadden et al (2015) identified an uptake of Healthy Start vitamins at less than 10% of those eligible. Vitamin supplementation is available on prescription for those families who are not eligible for Healthy Start. Vitamin products can also be purchased in pharmacies and supermarkets but these dietary supplements are considered foods rather than drugs, so they are not subject to stringent regulation. Health professionals should ensure that pregnant women and children have access to vitamin D supplementation on prescription to ensure that they receive the recommended dose, as there have been instances of vitamin D toxicity from unregulated products (Kara et al, 2014).

Sun exposure
The main source of vitamin D is exposure to the sun. However, this can be affected by a number of factors, such as cloudiness or air pollution. In the UK, adequate vitamin D is available only from the sun in the summer months (April to September) during the day between 11am and 3pm. It is necessary for the skin to be exposed to the sun without sun protection for 5–30 minutes—but never long enough to burn—two to three times a week (Holick, 2004; SACN, 2007; Yu et al, 2009).

The ability to produce vitamin D from the sun can be affected by skin colour, with darker skins needing increased exposure to the sun. Sunscreen also reduces the skin’s ability to produce vitamin D, with SPF 8 reducing vitamin D synthesis by >95% (Holick, 2014).

Prolonged sun exposure does not result in vitamin D toxicity (SACN, 2007) but does risk sunburn and related skin damage. The British Association of Dermatologists (2010) has cautioned that sun exposure is the main cause of skin cancer, and that the amount of sun required for vitamin D synthesis is less than it takes to burn. NICE guidelines for safe sun exposure are in development, due for release in July 2015. Currently, the NHS advises that children under 6 months of age should not be placed in direct sunlight, and that older children should play in the shade, wear sunscreen of at least SPF 15 and cover their skin with T-shirts and hats (NHS Choices, 2014). Practitioners should advise parents on sun safety alongside promoting uptake of vitamin D.

Conclusion
Vitamin D deficiency is a serious public health problem, with increasing numbers of infants and children experiencing deficiency and related disease, including rickets.

Midwives and health visitors have a role in educating families about the need for vitamin D and the risks associated with deficiency, and promoting the uptake of vitamin D supplementation for all mothers and children, particularly those at high risk. They are also well-placed to educate other members of multi-professional teams and colleagues in children’s centres or nurseries, to ensure that children at risk of vitamin D deficiency do not slip through the net.

British Association of Dermatologists (2010) Vitamin D Consensus
Appendix. Reference nutrient intakes for vitamin D in the UK

<table>
<thead>
<tr>
<th>Age group</th>
<th>Vitamin D requirement (daily)</th>
<th>Meeting the requirement</th>
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<tbody>
<tr>
<td></td>
<td>Micrograms (µg)</td>
<td>International units (IU)</td>
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<tr>
<td>All pregnant and breastfeeding women</td>
<td>10</td>
<td>400</td>
</tr>
<tr>
<td>0–6 months</td>
<td>8.5</td>
<td>340</td>
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<td></td>
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<tr>
<td>&gt;6 months to 5 years</td>
<td>7</td>
<td>280</td>
</tr>
<tr>
<td>6–64 years</td>
<td>No requirement set</td>
<td></td>
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<tr>
<td>65+ years</td>
<td>10</td>
<td>400</td>
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Over the last few years, the UK has experienced an increase in vitamin D deficiency among at-risk groups: under-5s and pregnant and breastfeeding mothers (Davies et al, 2012). This article will review the features and benefits of Fultium-D3 Drops in countering this, highlighting the product’s necessity in the health professional’s prescribing armoury, specifically for the pregnancy-to-preschool sector.

**Why use Fultium-D3 Drops?**

Vitamin D deficiency from pregnancy to preschool is a growing concern. With 40% of UK children having inadequate levels of vitamin D, and a quadrupling of rickets over the last 15 years, the need for a solution is becoming ever more important (Shaw and Pal, 2002; Royal College of Paediatrics and Child Health (RCPCH), 2012; Whiteman, 2014).

Fultium-D3 Drops is a licensed vitamin D product that has been introduced for the prevention and treatment of vitamin D deficiency (electronic Medicines Compendium (eMC), 2015a).

In February 2012, the Chief Medical Officers (CMOs) for all the UK regions wrote to medical and health care personnel about recommending vitamin D products in several high-risk groups, including all pregnant and breastfeeding women, as well as infants and children under 5 years old (Davies et al, 2012).

The CMOs’ recommendation is that all pregnant and breastfeeding women should take a daily supplement containing 10μg (400IU) of vitamin D, to ensure the mother’s requirements are met and to build adequate fetal stores for early infancy. They also said all infants and young children aged 6 months to 5 years should take a daily supplement in the form of vitamin drops of 7–8.5μg (280–340IU) of vitamin D per day (Davies et al, 2012).

Similar opinions were voiced in guidelines issued by the RCPCH (2012).

A recent survey carried out by Mumsnet showed that, currently, 77% of mothers do not give their child a vitamin D supplement on a regular basis; and of those who do, 53% buy an unregulated food supplement over the counter—worrying percentages for a vitamin essential to good bone health (Internis Pharmaceuticals, unpublished observations).

Fultium-D3 Drops (eMC, 2015a) contains colecalciferol, with each drop containing 66.7 IU. The average pregnant woman would need to take just 6 drops daily to gain the optimum amount (400 IU) of vitamin D; this would cost just 6p per day. For infants aged 6 months to 5 years, 4–5 drops daily is recommended. Fultium-D3 Drops can therefore provide patients with the recommended allowance of vitamin D. In addition, where a higher dose is needed in pregnancy and breastfeeding, there is also an 800 IU and 3200 IU capsule form in the Fultium-D3 range, which is also licensed during pregnancy (eMC, 2015b; 2015c).

**Product features and compliance**

With the importance of vitamin D leading to the CMOs and National Institute for Health and Care Excellence (NICE, 2014) recommending its use in the mother and child at-risk groups, it is essential that licensed products are available to those in need.

Administration of Fultium-D3 Drops via a dropper gives an accurate dose of 66.7 IU per drop, allowing 200IU in 3 drops and 400IU in 6 drops and upwards, as required (eMC, 2015a).

With the availability of Fultium-D3 Drops, clinicians can give a licensed vitamin D monotherapy for the recommended doses in pregnancy, breastfeeding and for preschool children (Davies et al, 2012; eMC, 2015a).
Fultium-D3 Drops is an oil-based product, allowing for higher bioavailability than a tablet form (Grossmann and Tangpricha, 2010), while catering to a range of patients by being peanut oil-free, suitable for vegetarians and having a taste-free formulation.

**Taking Fultium-D3 Drops**
The product is geared towards increasing compliance in the younger age groups. It can be taken with or without food, put directly onto foods or mixed with breast milk—all easing compliance for infants and young children (eMC, 2015a). Drops must not be mixed into a bottle of milk or container of soft foods, in case the child does not consume the whole portion and therefore does not receive the full dose.

As well as clear patient benefits and better compliance, there are also benefits for health professionals. Fultium-D3 is a licensed prescription-only medication accompanied by a medical information line, pharmacovigilance reporting and having the guarantee of pharmaceutical quality, efficacy and safety that a licensed product offers (Royal Pharmaceutical Society of Great Britain, 2007; Medicines and Healthcare Products Regulatory Agency, 2012; General Medical Council, 2013).

It also offers a variety of dosage regimens for deficiency and maintenance (eMC, 2015a). Fultium-D3 Drops should not be prescribed for patients with a known allergy or to patients with existing kidney stones or other illnesses that result in an elevated level of blood or urinary calcium. Vitamin D supplementation should also be used in caution in patients with existing kidney disease.

One bottle lasts for up to 6 months once opened, reducing the prescription burden; it can be prescribed on an FP10, allowing practitioners to prescribe for patients in their care; and, being available from all wholesalers across the UK, prescriptions can be filled easily at all pharmacies.

**Summary**
The research gathered in relation to Fultium-D3 Drops has demonstrated that the product complies with the recommendations from the CMOs and NICE. Not only does it meet current guidelines, but it also presents a real benefit to those at risk throughout the UK.

Today, we need a vitamin D product for the under-5s, pregnant and breastfeeding mothers; Fultium-D3 Drops offers a licensed prescription product to fulfil that need.

*Prescribers should always use care when prescribing in pregnancy, as high doses of colecalciferol may affect the fetus.*

**Key points**
- Suitable for mothers during pregnancy and breastfeeding, and children from birth to 5 years of age
- Variable dosage regimen for deficiency and maintenance
- Can be prescribed on an FP10, allowing you to prescribe for patients in your care
- Flavourless formulation; can be given in or on foods or mixed with breast milk, for ease of compliance in young children
- One 25 ml bottle lasts for up to 6 months once opened, reducing the prescription burden
- Suitable for vegetarians
- At only 6p per day based on a 400 IU daily dose, it allows health professionals to treat patients in line with the chief medical officers’ required dosage regimen and National Institute for Health and Care Excellence guidance
All for One & One for all their Futures

Protection against vitamin D deficiency for mother & child
Vitamin D deficiency isn’t just about rickets. Both mum and baby face consequences. New Fultium-D₃ Drops help protect them through pregnancy, breastfeeding and the toddler years with the quality guarantee of a licensed, pharmaceutical product.

NEW
Fultium®-D₃ Drops
Colecalciferol
Mother & Child Drops
From pregnancy to preschool

Fultium-D₃ Drops. Abbreviated prescribing information. Please refer to the appropriate Summary of Product Characteristics (SmPC) before prescribing Fultium-D₃. Use care when prescribing in pregnancy, at high doses of colecaclicferol may affect the fetus. Fultium-D₃ Drops 1 ml of oral solution contains 250 IU (6.65 μg per ml) colecaclicferol, 3 drops contains 300 IU colecaclicferol. Indications: Prevention and treatment of vitamin D deficiency. As an adjunct to specific therapy for osteoporosis in patients with vitamin D deficiency or in cases of vitamin D insufficiency. Design and administration: Patchy, Treatment of deficiency: 0.25 μg (2.5 μl) 1-3 times a week, 0.5 μg (5 μl) daily. Treatment of deficiency: 0.25 μg (2.5 μl) 5-7 times a week, 0.5 μg (5 μl) daily. Maintenance or prevention of deficiency: 0.25 μg (2.5 μl) 1-3 times a week, 0.5 μg (5 μl) daily. Treatment of deficiency: 0.25 μg (2.5 μl) 5-7 times a week, 0.5 μg (5 μl) daily. Maintenance or prevention of deficiency: 0.25 μg (2.5 μl) 1-3 times a week, 0.5 μg (5 μl) daily.

Adverse reactions: Hypocalcaemia and hyperparathyroidism, nausea, vomiting, abdominal pain. Serious adverse reactions include hypercalcaemia, nephrocalcinosis, and pancreatitis. Rare adverse reactions include death and severe liver, heart, and bowel problems. Onset of action is 2-3 hours. Do not take with milk, juice, or other dairy products.

Fultium-D₃ Drops are not recommended for use in pregnancy without the advice of a healthcare professional. Fultium-D₃ Drops are not recommended for use in pregnant women without the advice of a healthcare professional. Fultium-D₃ Drops are not recommended for use in pregnant women without the advice of a healthcare professional. Fultium-D₃ Drops are not recommended for use in pregnant women without the advice of a healthcare professional.