

# Successful public health action to reduce the incidence of symptomatic vitamin D deficiency

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## ABSTRACT

**Background** In response to a resurgence of symptomatic cases of vitamin D deficiency in a high-risk predominantly ethnic minority population, a programme of universal rather than targeted vitamin D supplementation was begun with a public awareness campaign about the importance of vitamin D.

**Objective** To evaluate the effectiveness of this programme in reducing case numbers.

**Methods** Cases of symptomatic vitamin D deficiency in children under 5 years resident in a primary care trust catchment area presenting at local hospitals were identified through laboratory records of low vitamin D levels which were cross-checked against medical records to confirm the diagnosis. Comparisons were made of the case incidence rate, level of public knowledge and vitamin supplement uptake rate at the onset of the programme in 2005 and 4 years later.

**Results** The number of cases of symptomatic vitamin D deficiency in those under 5 years fell by 59% (case incidence rate falling from 120/100 000 to 49/100 000) despite the supplement uptake rate rising only to 17%. Public awareness of vitamin D deficiency rose to near universal levels.

**Conclusions** A programme of universal rather than targeted Healthy Start vitamin D supplementation for pregnant and lactating women and young children has led to a substantial decrease in cases of symptomatic vitamin D deficiency in a high-risk population. Supplementation was also started at a younger age than in the national programme. This approach has implications for the delivery of vitamin D supplementation programmes in similar populations.

## INTRODUCTION

Vitamin D deficiency disease is recognised as a resurgent condition in children in the UK after the publication of case reports from several large cities, particularly those with substantial populations of ethnic minority families.<sup>1–3</sup> A reporting survey by paediatricians in the West Midlands conducted in 2001 identified 24 cases of symptomatic vitamin D deficiency in children under 5 years during a 1-year period (incidence rate 7.5/100 000 children a year with notable differences in incidence according to ethnic group).<sup>4</sup> This number was undoubtedly an underestimate owing to incomplete reporting as a further survey from June 2001 to June 2003 in three hospitals in Birmingham alone found 65 new cases in children (48 cases of rickets and 17 of hypocalcaemic seizures in infancy), all of whom came from the Asian, African or African-Caribbean communities, thereby confirming that vitamin D

## What is already known on this topic

- ▶ Symptomatic vitamin D deficiency is a resurgent condition in the UK, especially in darker-skinned ethnic minority populations.
- ▶ Current targeted public health measures such as the Healthy Start food and vitamin supplementation programme have a low uptake rate and many at-risk pregnant and lactating women and young children are not covered by its provision.

## What this study adds

A universal programme of vitamin D supplementation for pregnant and lactating women and children under 5 years has significantly reduced case incidence.

deficiency was a significant child public health problem in Birmingham.

In response to this increasing number of cases, the Heart of Birmingham Primary Care Trust (HoBtPCT), which provides healthcare for much of the inner city where 75% of the population are from at-risk ethnic minority groups, developed, in 2005, a unique public health policy of universal vitamin D supplementation for all children under the age of 5 years regardless of mode of feeding, and for all pregnant and lactating women resident in the trust area. The campaign initially used Abidec children's vitamin drops and ergocalciferol tablets for pregnant women. These products were replaced by Healthy Start vitamin drops (vitamin D content 7.5 µg daily) for children and vitamin D tablets (vitamin D content 10 µg daily) for women once they became available.

Funding for the programme was provided by the PCT with a refund of the cost of supplements sought for all those eligible under the national Healthy Start programme. Supplements are provided free of charge to all mothers and children at Health Centres, Children's Centres and at some general practitioner practices and pharmacists. Supplementation of infants started from 2 weeks of age when health visitors provided families of newborns with their first bottle of children's drops at the time of the first new baby home visit. The PCT thereby followed the full recommendations of

the committee on medical aspects of food and nutrition policy in their review of the Welfare Food Programme that all pregnant and lactating women and children under 5 years of age should take vitamin D supplements,<sup>5</sup> a recommendation that has recently been restated by the chief medical officers of the UK.<sup>6</sup>

The programme has been led by a multidisciplinary steering group of dieticians, public health nutritionists, paediatricians and public health nurses. The provision of vitamin D supplements has been supported by continuing professional education of health staff including GPs, health visitors, community and hospital midwives, pharmacists, paediatricians and obstetricians about the importance of vitamin D supplementation. Information has also been provided to the public through Asian media networks, posters and flyers in health centres surgeries and pharmacies, logo-branded materials ('My Little Ray of Sunshine') such as shopping bags, supermarket trolley keys, baby sunhats and T-shirts, and through Asian shops.

We now report an evaluation of the effectiveness of this universal vitamin D supplementation programme.

## METHODS

The effectiveness of the programme has been measured in various ways:

1. Identification of any change in the incidence rate of symptomatic vitamin D deficiency by two enumerations of the number of symptomatic cases seen in children under 5 years resident in the HoBtPCT area attending three Birmingham hospital paediatric departments or community paediatric clinics over 2 years. The first was between January and December 2005 at the start of the programme, and then 4 years later between March 2009 and February 2010. Rather than relying on the previous system of passive reporting of cases by local paediatricians, cases were actively identified through laboratory records of children <5 years with 25-hydroxyvitamin D levels of <25 nmol/l (<10 µg/l) detected by tandem mass spectrometer. This cut-off level was chosen as being linked to a high risk of rickets.<sup>7</sup> Case notes or electronic records were then retrieved to confirm the diagnosis of symptomatic vitamin D deficiency with rickets, hypocalcaemia or muscular weakness and to exclude cases with low vitamin D levels due to chronic renal or hepatic disease or where it was a coincidental asymptomatic finding. It was assumed that general practitioners were unlikely to diagnose and treat symptomatic cases themselves and would refer to hospital clinics. Residential postcodes were used to exclude cases resident in other PCT areas where the universal supplementation programme had not been implemented. The number of new cases of symptomatic vitamin D deficiency in this population were then expressed as incidence rates using population statistics derived from the 2001 census.
2. An assessment of any change in public knowledge of the importance of vitamin D supplementation by three rounds of an awareness survey. These were conducted in convenience samples of mothers of young children attending the same or similar SureStart Children's Centres and Health Visitor clinics in the HoBtPCT area conducted by University of Birmingham medical students as their third year public health projects in 2007, 2009 and 2011.

**Table 1** Reduction in total numbers and incidence rate of symptomatic vitamin D cases

	2005	2009–10
Total cases	29	12
Cases per 100 000 children under 5 years	120	49

3. A record of the uptake of vitamin D supplements by monitoring the number of bottles (each containing 8 weeks' supply) issued to families.

## RESULTS

Twenty-nine cases of symptomatic vitamin D deficiency were identified in the 12 months during 2005 (incidence rate of 120/100 000 for children under the age of 5 years resident in the HoBtPCT area). During the 12 months between 2009 and 2010 only 12 cases were identified, of which 10 were rickets and two hypocalcaemic seizures (incidence rate of 49/100 000), which represents a 59% decrease in absolute numbers (table 1).

The public awareness surveys conducted by medical students show an increase in knowledge about vitamin D among mothers of young children (table 2).

Uptake data showed that there was a year-on-year increase in the proportion of pregnant women and young children receiving the supplements, which in 2010 reached 17% for both women and children.

## DISCUSSION

Although not conducted as a randomised trial, this intervention has documented a considerable reduction in the incidence of symptomatic vitamin D deficiency in a defined child population served by a central Birmingham primary care trust over a 4-year period. As far as we know, the only previously published evidence for success of a public health campaign to tackle vitamin D deficiency in children was reported from Glasgow over 25 years ago.<sup>8</sup> This followed the launch of a campaign against rickets in Asian children in 1979 which was based on the issue of free vitamin D supplements on demand to children up to 18 years of age. Unsupplemented children showed a threefold increased incidence of biochemical rickets and a fourfold increased incidence of radiological rickets. The numbers of children discharged from hospitals in Glasgow with rickets fell from an incidence of 2.7 per 1000 in 1978 to 0.3 per 1000 in 1983.

It was encouraging to see the reduction in incidence of symptomatic vitamin D deficiency in young children in central Birmingham despite the uptake of the Healthy Start vitamin supplements being no greater than 17% in both children and pregnant women. It is conceivable that other factors such as increased public awareness of vitamin D demonstrated by the medical student surveys contributed to this reduction. Possibly, also, informed and motivated families had obtained vitamin D supplements from over-the-counter sources as was found in a

**Table 2** Results of public awareness surveys about vitamin D 2007–11

	2007	2008	2011
Number of respondents	100	108	76
Had heard about vitamin D (%)	61	73	89
Knew that vitamin D was essential for bone health (%)	21	41	79
Knew that sunlight was the main source of vitamin D (%)	20	56	85

survey from Wigan where nearly all pregnant women taking vitamin D had obtained them through this route.<sup>9</sup>

Free Healthy Start multivitamin supplements containing vitamin D were made universally available to pregnant women and children under 5 years of age from the age of 2 weeks onwards. Although national recommendations are to start vitamin D supplementation at 6 months of age or from 1 month if the mother had not taken vitamin D supplements throughout pregnancy, this younger age for starting supplementation was chosen for operational reasons to coincide with health visitor's first obligatory home visit to the new baby, there being no universal Healthy Child Programme appointment at 6 months. During this visit a bottle of Healthy Start vitamin drops would be issued and health education provided on the importance of vitamin D supplementation. The younger age of supplementation is also supported by the finding of cases of hypocalcaemic seizures in early infancy despite these infants being given vitamin D-fortified formula.

The national Healthy Start scheme is accessible only by families in receipt of state benefits. A considerable number of families at particular risk of vitamin D deficiency by virtue of ethnicity, skin pigmentation or lifestyle would be excluded from receiving free supplements. Furthermore, low levels of healthcare professional awareness about the importance of vitamin D supplementation in pregnancy and early childhood have been shown to lead to a lack of advice given to carers.<sup>9 10</sup> Although a number of over-the-counter vitamin supplements for pregnant women and young children are widely available, some are costly, others contain only minimal amounts of vitamin D.

Statistics provided by the Department of Health Healthy Start Unit indicate an estimated 80% registration rate amongst those eligible for the scheme. Yet the estimated uptake of the vitamin D supplement component is extremely low with no more than 2–4% of those eligible receiving the supplements (unpublished data made available to primary care trusts).

A number of factors have acted as barriers to the smooth implementation of the scheme. Multiple issuing sites were established across the PCT area so that there would be one within easy walking distance of most families. Nevertheless, issuance of the free vitamin supplements was restricted by opening hours and availability of trained staff. There have been considerable problems at a national level with the supply of Healthy Start vitamin supplements through the NHS supply chain, thereby causing shortages at health centres and SureStart children's centres which might have deterred families from returning for additional bottles of vitamins.

The HoBtPCT programme of universal vitamin D supplementation for all children under 5 years and all pregnant and lactating women has therefore substantially reduced the burden of cases of symptomatic vitamin D deficiency in a high-risk population, despite only achieving 17% coverage for women and children. Nevertheless, this level of coverage is substantially higher than that achieved by the targeted national Healthy Start programme which would exclude a significant proportion of those at risk of vitamin D deficiency.

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**Contributors** The authors were all members of the HoBtPCT vitamin D supplementation programme steering committee. RM devised the methodology and collected the data. RM and NS supervised the medical student surveys. EM provided the supplementation uptake data. IM led the early implementation of the programme. All authors contributed to writing of the paper.

**Competing interests** RM has received financial support from the Feeding for Life Foundation to write a report on vitamin supplementation and to speak on this topic at various conferences.

**Ethics approval** The South Birmingham Research Ethics Committee reviewed the study protocol and declared it a service evaluation and hence full research ethical committee approval was not required.

**Provenance and peer review** Not commissioned; externally peer reviewed.

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