



High prevalence of vitamin D deficiency in 2–17 year olds presenting with acute fractures in southern Australia



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ABSTRACT

Aim: To determine vitamin D deficiency risk and other lifestyle factors in children aged 2–17 years presenting with an acute fracture to Sunshine Hospital.

Methods: A prospective observational study was undertaken using a convenience sample data collected from children aged 2–17 years of age presenting with an acute fracture. Recruitment was undertaken over a 3-month period from February to May 2014. Risk factors for vitamin D deficiency (skin pigmentation, hours spent outdoors, sunscreen use and obesity) were identified. Patients providing consent, had measurements of serum 25-hydroxyvitamin D (25-OHD). Vitamin D deficiency was defined as <50 nmol/L.

Results: Of the 163 patients recruited into this study, 134 (82%) had one or more risk factor(s) for vitamin D deficiency. Of these, 109 (81%) consented to 25-OHD testing, with a median of 53 nmol/l (range 14–110 nmol/l) obtained. A total of 57 (52% at risk, 35% of total participants) were found to be vitamin D deficient. 45 (80%) had mild deficiency (30–50 nmol/l) and 11 (20%) had moderate deficiency (12.5–29 nmol/l).

Conclusions: One third of all participants, and the majority participants who had one or more risk factor(s) for vitamin D deficiency, were vitamin D deficient. Based on our findings we recommend that vitamin D status be assessed in all children with risk factor of vitamin D deficiency living in urban environments at higher latitudes presenting with fractures. The effect of vitamin D status on fracture risk and fracture healing in children and teenagers is yet to be determined, as do the effects of vitamin D supplementation in vitamin D deficient paediatric patients presenting with acute fracture.

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1. What is already known on this topic

1. Vitamin D is important for maintaining bone health. (See Figs. 1–5.) (See Tables 1 and 2.)
2. Prevalence of vitamin D deficiency is high in Australia, particularly in southern states.
3. There is a seasonal variation in vitamin D status in southern regions of Australia with higher serum 25-OHD at the end of summer, and lower levels at the end of winter and in early spring.

2. What this paper adds

1. Prevalence of vitamin D deficiency is high in multiethnic children and teenagers, presenting with an acute fracture at the end of summer and with one or more risk factors of vitamin D deficiency.
2. Children and teenagers with reduced sun exposure or hyperpigmentation have a strong association with vitamin D deficiency.
3. Screening for vitamin D deficiency and assessment of dietary calcium adequacy are recommended when a child or teenager presents with an acute fracture.

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3. Introduction

One of the major public health issues in older Australians is osteoporosis-related fracture (Jones and Cooley, 2002; Jones et al., 2002; Coughlan and Dockery, 2014; Sanders et al., 1999; Cooley and Jones, 2001). Optimizing bone health in childhood may be critical to improving peak bone mass and potentially reducing the future risk of osteoporosis. Osteoporosis is a disease with its genesis in childhood and adolescence, as peak bone mass is achieved several years after growth cessation, and lifestyle habits established in youth tend to persist throughout adult life (Russell et al., 2006; Matkovic et al., 2004).

Childhood fractures are common and the probability of sustaining a fracture from birth to 50 years of age is nearly 50% (Jones et al., 2002; Landin, 1997; Hedstrom et al., 2010). Peak childhood fracture incidence occurs at 12 years in girls and 14 years in boys (Landin, 1997; Hedstrom et al., 2010; Khosla et al., 2003; Cooper et al., 1995; Ryan et al., 2012; Boyce and Gafni, 2011). This period corresponds to the period immediately following the pubertal growth spurt (Boyce and Gafni, 2011), with attainment of peak bone mass by the age of 18 to 20 years.

As the majority of childhood fractures are due to significant trauma (Plumert, 1995; Schwebel, 2004) and the focus is on immediate fracture management, it is often a missed opportunity to assess children and teenagers regarding preventable osteoporosis risk factors such as vitamin D deficiency, poor dietary calcium intake and sedentary behaviour. The incidence of vitamin D deficiency has increased throughout the world, suggesting it is now endemic and has become a disease of the 21st century (Misra et al., 2008; Clarke and Page, 2012). In Australia, this has been attributed to changes in immigration policies within the last 40 years, which has resulted in more highly pigmented individuals

Type of Fracture

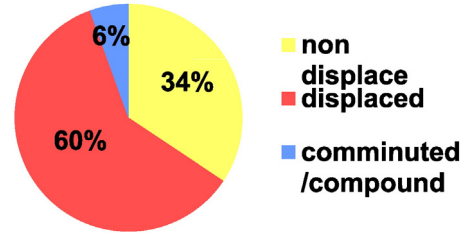


Fig. 2. Type of fracture.

living in Australia; a shift to increasingly indoor lifestyles; and possible overuse of sun screens. Vitamin D deficiency also remains highly prevalent in children in many other countries.

The vast majority of vitamin D is synthesised by skin exposure to UVB, with only a small contribution by dietary intake (Norris, 2001). It is well documented that the prevalence of vitamin D insufficiency is greater in winter and spring because of decreased daily sunlight exposure generally in colder months and reduced or absent UVB wavelength 288 nm which is specifically required for vitamin D synthesis in the skin (van der Mei et al., 2007). People with darker skin pigmentation may require up to 6-times longer UVB exposure compared with fair skinned individuals in order to maintain adequate vitamin D levels because the skin pigment melanin interrupts UVB absorption (Paxton et al., 2013; Clemens et al., 1982; Thomas and DeMay, 2000). Excessive use of sun protection including sunscreen as well as covering due to religious or cultural practices also reduces UVB absorption (Clemens et al., 1982). An inverse relationship between obesity and circulating 25-OHD concentrations has also been reported (Wortsman et al., 2000; Arunabh et al., 2003; Kamycheva et al., 2003; Lagunova et al., 2011; Rajakumar et al., 2011; Khor et al., 2011).

To our knowledge this is the first study to examine the prevalence of vitamin D deficiency in otherwise healthy children and adolescents with fractures in an ethnically and culturally diverse population, with a high proportion of highly pigmented individuals. This prospective study examined the prevalence of vitamin D deficiency in children and adolescents aged 2–17 years presenting to Sunshine Hospital with a fracture during the 3-month study period during summer-autumn 2014.

4. Patients and methods

4.1. Subjects and assessment of risk factors for vitamin D deficiency

A convenience sample of 163 of the total of 628 paediatric patients who presented to Sunshine Hospital with a fracture during the 3-month study period between February and May 2014 were recruited for this study. Subject recruitment was practically limited as it was

Fractured Limb

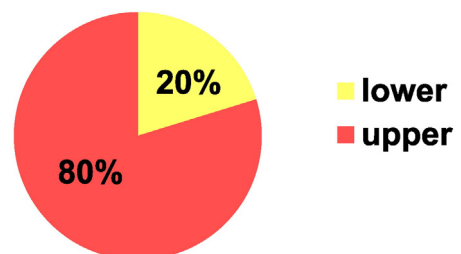


Fig. 3. Fracture involved limb.

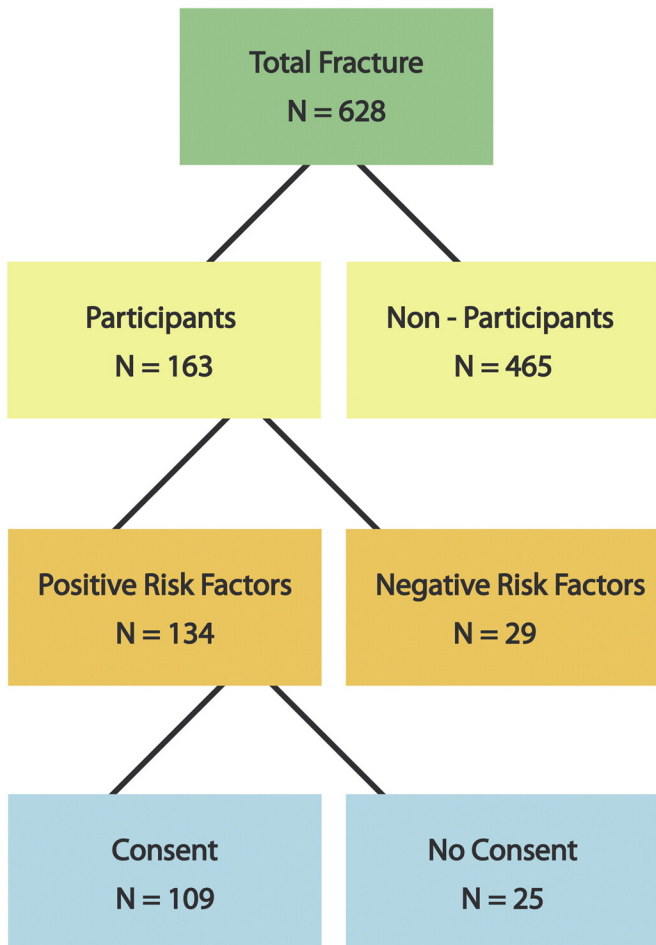


Fig. 1. Overall recruitment scheme.

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