Australian children’s foot, ankle and leg problems in primary care: a secondary analysis of the Bettering the Evaluation and Care of Health (BEACH) data

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ABSTRACT

Objectives To explore children’s foot, ankle and leg consultation patterns and management practices in Australian primary care.

Design Cross-sectional, retrospective study.

Setting Australia Bettering the Evaluation and Care of Health program dataset.

Participants Data were extracted for general practitioners (GPs) and patients ≤18 years from April 2000 to March 2016 inclusive.

Main outcome measures Demographic characteristics: sex, GP age groups (ie, <45, 45–54, 55+ years), GP country of training, patient age grouping (0–4, 5–9, 10–14, 15–18 years), postcode, concession card status, indigenous status, up to three patient encounter reasons, up to four encounter problems/diagnoses and the clinical management actioned by the GP.

Results Children’s foot, ankle or leg problems were managed at a rate of 2.05 (95% CI 1.99 to 2.11) per 100 encounters during 229 137 GP encounters with children. There was a significant increase in the rate of foot, ankle and leg problems managed per 100 children in the population, from 6.1 (95% CI 5.3 to 6.8) in 2005–2006 to 9.0 (95% CI 7.9 to 10.1) in 2015–2016. Management of children’s foot, ankle and leg problems were independently associated with male patients (30% more than female), older children (15–18 years were 7.1 times more than <1 years), male GPs (13% more) and younger GPs (<45 years of age 13% more than 55+). The top four most frequently managed problems were injuries (755.9 per 100 000 encounters), infections (458.2), dermatological conditions (299.4) and unspecified pain (176.3). The most frequently managed problems differed according to age grouping.

Conclusions Children commonly present to GPs for foot, ankle and leg problems. Presentation frequencies varied according to age. Unexpectedly, conditions presenting commonly in adults, but rarely in children, were also frequently recorded. This data highlights the importance of initiatives supporting contemporary primary care knowledge of diagnoses and management of paediatric lower limb problems to minimise childhood burden of disease.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study uses data extracted from the Bettering the Evaluation and Care of Health dataset between 2010 and 2016 to examine the full spectrum of childhood foot, ankle or leg presenting to, and managed by Australian general practitioners (GPs).

⇒ This method allows for a nationally representative sample of presentations for children, and characteristics of GPs who manage these presentations.

⇒ It is not possible to estimate the impact of these conditions on children, how individual cases were managed or the outcome of management with this dataset.

⇒ This study may be limited by how GPs recorded children’s foot, ankle and leg problem presentation and management data.

BACKGROUND

Childhood foot, ankle and leg concerns are thought to be common. But their prevalence and incidence vary widely according to age and are inconsistently reported. For example, the prevalence estimates for flexible flat foot vary from 2% to 44% of children, while the incidence of calcaneal apophysitis ranges from 0.37 to 0.60 per 100 person-years. These wide variations seem to depend on age, developmental stage, sporting participation or differences in epidemiological study setting. Similarly, little is known about the frequencies of conditions relating to the foot, ankle or leg in children that cause pain or functional impact or trouble their parents enough to result in families seeking management in primary care.

Key developmental stages in childhood present opportunities for optimal foot and leg condition management, particularly for conditions relating to musculoskeletal complaints, neurological conditions or inflammatory disease. Early interventions for these higher burden conditions are important.
to reduce long-term disability and prevent chronic pain development. Conversely, delayed diagnosis, delayed access to care, or provision of non-evidence-informed care can be detrimental to long-term outcomes, family burden and permanent disability. Primary care providers are commonly the first contact for non-emergency healthcare. Therefore, understanding contemporary practice in primary care allows for improved focus for finite healthcare resources, training and guidelines, to improve health outcomes, reduce healthcare waste and design effective public policies or prevention strategies to minimise long-term impacts.

In Australia, primary care services are frequently provided by general practitioners (GPs) on a ‘fee for service’ model with fees primarily covered through Medicare, the Australian Government funded medical insurance scheme. Medicare also provides subsidies for other healthcare services including diagnostic imaging and pathology tests. The Pharmaceutical Benefits Scheme provides subsidies for prescribed medicines. GPs can also provide referrals to medical specialists for subsidised medical specialist care, such as to orthopaedic surgeons, and in limited circumstances (eg, for chronic medical conditions) to subsidised allied health professional care, such as to podiatrists. Therefore, GP presentation and management data provides rich information about health problems in Australia.

Despite this, little is known about how GPs manage foot and leg problems in children in Australia, and even less about their management practices. It is important to know the frequencies of children’s foot, ankle and leg problems and how commonly they present to GPs, as highly prevalent specific foot, ankle or leg conditions in childhood may impact on healthcare costs now or in the future. Conservative estimates indicate that management of foot, ankle or leg conditions by GPs in Australia across all ages are estimated to be approximately $A2255m per annum. Also unknown, is how many foot, ankle or leg conditions appear in childhood requiring medical care from GPs. To our knowledge, only four studies have examined presentations for primary care management in children that included lower limb presentations. These studies were in Spain, Australia and the UK, yet only one of these studies provided data on all children between the ages of 0–18 years. While studies have investigated the most frequent presenting conditions by children to GPs, they rarely delineate by body region such as foot, ankle and leg problems. One Australian study reported data on all GP encounters by children aged between 0 and 17 years for any health condition and found frequent presentations for skin concerns and musculoskeletal concerns. Both skin and musculoskeletal concerns are two problems likely to include foot, ankle or leg problems. However, there were no additional data on skin complaints relating to body region, and where musculoskeletal data according to body regions were explored in detail, lower limb concerns were managed at a rate between 0.62 and 5.33 per 100 children encounters.

These insights warrant further detailed exploration given the frequency of presentations.

Therefore, the primary aim of this study was to determine the rate of GP encounters where foot, ankle and leg (defined as below the knee) conditions were managed in children aged between 0 and 18 years. Secondary aims included exploring the patient and GP characteristics associated with these encounters, the rate of these encounters for children in different age groups, and the most frequent management practices for these encounters among the different age groups.

METHODS

Dataset

Data were extracted from the Bettering the Evaluation and Care of Health (BEACH) study. This data set was constructed from a continuous, nationally representative study of GP clinical activity. Details of the BEACH study and methods of data coding and collection are published in detail elsewhere. Each year, a random sample of approximately 1000 Australian GPs completed the BEACH study. These GPs recorded details from 100 consecutive patient encounters on structured paper data collection forms. Data captured included demographic characteristics such as patient’s age, sex, postcode, concession card status, Indigenous status, up to three patient reasons for the encounter, up to four problems/diagnoses managed during the encounter and the clinical management actioned by the GP. Management strategies were coded, such as medications (supplied, advised or prescribed), referrals for pathology or diagnostic imaging, referrals to other health professionals and any procedures provided by the GP during the clinical encounter. Pharmaceutical data were coded using the Coding Atlas of Pharmaceutical Substances, which maps to the Anatomical Therapeutic Chemical Classification System. All other data (including problems managed, non-pharmaceutical treatments, referrals and investigations) were coded using the Australian GP interface terminology known as International Classification of Primary Care, Version 2 (ICPC-2) PLUS by the BEACH research team, with automated classification to the ICPC-2. ICPC-2 is a member of the WHO Family of International Classifications and is mapped to the International Classification of Disease, Version 10 (ICD-10).

Participants and data elements

We initially identified all GP encounters for children and adolescents aged 0–18 years recorded from April 2000 until March 2016 within the dataset. We selected ICPC-2 PLUS terms that primarily related to problems specifically affecting the foot and ankle, but also included conditions that manifest below the knee (such as restless leg syndrome), dermatological conditions (such as tinea pedis) and congenital lower limb conditions (such as pes planus or genu valgum) through a previously coded classification to the ICPC-2. The primary aim of selecting these terms is to ensure the data were not distorted by other problems such as obesity or congenital abnormalities that were not primary presenting conditions.
reported expert consensus process (online supplemental dataset).\textsuperscript{12}

**Statistical analysis**

The BEACH dataset forms a single-stage cluster sample study design. The GP is the sampling unit, and the GP–patient encounter is the unit of inference. We used Survey procedures in SAS V.9.4 to adjust for this cluster in all analyses. We initially extracted data from all encounters where the patient was aged 18 years or less. We then extrapolated the rate of management per encounter recorded in BEACH to the number of annual Medicare Benefits Scheduled GP items of services claimed for children to calculate the total number of foot/ankle/leg problems in children managed that year. We then divided this figure by the number of children in the population (Australian Bureau of Statistics population statistics)\textsuperscript{23} to calculate the rate per child in the population. We calculated the rate of foot, ankle or leg problems managed per 100 encounters for children aged 0–18 years (with the age groups <1, 1–4, 5–9, 10–14 and 15–18 years) and analysed this by both GP and patient characteristics. Patient encounters were then grouped into comparable age clusters. Due to the low numbers of foot, ankle and leg problems managed at encounters, the <1 and 1–4 years ages were combined so that our final age groups were: 0–4, 5–9, 10–14 and 15–18 years. The most common types of foot, ankle and leg problems were examined and reported per 100000 encounters for all ages, and for each age group. We also examined how these foot, ankle and leg problems were managed by GPs. Significant differences were determined through non-overlapping 95% CI. This provided a conservative estimate of significance compared with the traditional alpha of <0.05.\textsuperscript{24}

We used multivariate logistic regression to determine the GP and patient characteristics independently associated with a foot, ankle and leg problem being managed at an encounter. All GP and patient characteristics were included in the model.

**Patient and public involvement**

Patients and the public were not involved in the development of the research question, design or conduct of the study.

**RESULTS**

**GP management rate for foot, ankle and leg problems**

Between April 2000 and March 2016, 15 472 GPs recorded 229137 encounters meeting the extraction criteria (children aged 0–18 years), of which 4694 were related to foot, ankle or leg problems. The foot, ankle and leg problems were managed at a rate of 2.05 (95% CI 1.99 to 2.11) per 100 GP encounters with children. There was a significant increase in the rate of foot, ankle and leg problems managed per 100 children in the population, from 6.1 (95% CI 5.3 to 6.8) in 2005–2006 to 9.0 (95% CI 7.9 to 10.1) in 2015–2016 (figure 1).

**Figure 1** The management rate of children’s foot, ankle and leg problems managed by Australian GPs between April 2000 and March 2016 (aged 0–18 years). Blue line represents problems per 100 encounters, orange line represents problems per 100 children (error bars=95% CI). BEACH, Bettering the Evaluation and Care of Health; GPs, general practitioners.

**GP and child characteristics associated with management of foot, ankle or leg problems**

The highest rate of management was 4.64 (per 100 encounters) in the 10–14 years age group, the lowest was infants <1 year (0.44) (table 1). After adjustment, male patients were 30% more likely to have a foot, ankle or leg problem managed than their female peers at an encounter. Children in age groups 1–4, 5–9, 10–14 and 15–18 years were all more likely to receive care for foot, ankle and leg conditions than children aged <1 year. Those aged 10–14 years were 10.2 times more likely than those aged <1 year. Those most disadvantaged were 8% more likely than those who were most advantaged. Male GPs were 13% more likely to provide care for a foot, ankle or leg condition than female GPs. GPs aged <45 years were 13% more likely than those aged >55 years. Concession card status, being from a non-English-speaking background, Indigenous status, practice location or GP country of training did not have a significant effect on whether a foot, ankle and leg condition was managed.

**Rate of specific foot, ankle and leg problems**

Table 2 presents the child-specific and GP-specific management rate for the most common foot, ankle and leg problem groups and specific conditions. The most frequently managed problem groupings were infections (755.9 per 100000 encounters), followed by infections (458.2) and dermatological conditions (299.4). The most frequent specific conditions were ankle sprains (310.3 per 100000 encounters), ingrown toenails (272.3) or infected ingrown toenails (135.6), tinea or fungal skin infections (184.6), injuries to the foot/feet (76.4) and foot/feet pain (69.4). In general, management rates for problem groups and specific conditions increased with age until the 10–14 years age group, and then reduced in the 15–18 years group, except for the congenital problem groupings.
Table 1  Child and GP-specific management rate of foot/ankle/leg problems per 100 encounters, 2010–2016

| Patient characteristics | Sample size (n=229137) | No of problems managed (n=4694) | Distribution (%) (95% CI) of problems managed by patient and GP characteristics | Characteristic specific rate of problems per 100 encounters | Adjusted ORs of a problem being managed at encounter (95% CIs) |
|-------------------------|-------------------------|---------------------------------|-----------------------------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------------|
| Sex (missing)           | 1734                    | 38                              |                                                                              |                                                          | P<0.001                                                      |
| Male                    | 111448                  | 2490                            | 53.48 (53.5 to 53.5)                                                        | 2.23 (2.1 to 2.3)                                         | 1.304 (1.215 to 1.399)                                       |
| Female                  | 115955                  | 2166                            | 46.52 (46.5 to 46.5)                                                        | 1.77 (1.8 to 1.9)                                         | Reference group                                             |
| Age (missing)           | –                       |                                 |                                                                              |                                                          | P<0.001                                                      |
| <1 year                 | 30722                   | 134                             | 2.85 (2.9 to 2.9)                                                           | 0.44 (0.4 to 0.5)                                         | Reference group                                             |
| 1–4 years               | 68704                   | 543                             | 11.57 (11.6 to 11.6)                                                        | 0.79 (0.7 to 0.9)                                         | 1.746 (1.413 to 2.157)                                      |
| 5–9 years               | 45333                   | 772                             | 16.45 (16.4 to 16.5)                                                        | 1.70 (1.6 to 1.8)                                         | 3.776 (3.073 to 4.640)                                      |
| 10–14 years             | 39310                   | 1824                            | 38.86 (38.9 to 38.9)                                                        | 4.64 (4.4 to 4.9)                                         | 10.244 (8.412 to 12.475)                                   |
| 15–18 years             | 45068                   | 1421                            | 30.27 (30.3 to 30.3)                                                        | 3.15 (3.0 to 3.3)                                         | 7.067 (5.787 to 8.629)                                      |
| Socioeconomic level (missing) | 5859                  | 122                             |                                                                              |                                                          | P=0.0498                                                     |
| Most disadvantaged      | 82797                   | 1825                            | 39.92 (39.9 to 39.9)                                                        | 2.20 (2.1 to 3.8)                                         | 1.080 (1.000 to 1.166)                                      |
| Most advantaged         | 140481                  | 2747                            | 60.08 (60.1 to 60.1)                                                         | 1.96 (1.9 to 2.0)                                         | Reference group                                             |
| Healthcare card (missing) | 19844                  | 410                             |                                                                              |                                                          | P=0.1716                                                     |
| Healthcare card         | 61166                   | 1293                            | 30.18 (29.9 to 30.2)                                                        | 2.00 (2.0 to 2.2)                                         | 1.092 (1.047 to 1.138)                                      |
| No healthcare card      | 148127                  | 2991                            | 69.82 (69.1 to 69.8)                                                        | 2.02 (1.9 to 2.1)                                         | Reference group                                             |
| Language background (missing) | 24052                  | 502                             |                                                                              |                                                          | P=0.1477                                                     |
| Non-English speaking    | 16009                   | 273                             | 6.51 (6.5 to 6.5)                                                           | 1.71 (1.5 to 1.9)                                         | Reference group                                             |
| English speaking        | 189076                  | 3919                            | 93.49 (93.5 to 93.5)                                                        | 2.07 (2.0 to 2.1)                                         | 1.124 (1.051 to 1.201)                                      |
| Indigenous status (missing) | 339873                  | 841                             |                                                                              |                                                          | P=0.9918                                                     |
| Indigenous              | 5924                    | 121                             | 3.14 (3.1 to 3.1)                                                           | 2.0 (1.7 to 2.4)                                         | 0.999 (0.812 to 1.229)                                      |
| Non-indigenous          | 183340                  | 3732                            | 96.86 (96.9 to 96.9)                                                        | 2.04 (2.0 to 2.1)                                         | Reference group                                             |
| GP sex (missing)        | 0                       | 0                               |                                                                              |                                                          | P=0.0013                                                     |
| Male                    | 135116                  | 2999                            | 63.89 (63.9 to 63.9)                                                        | 2.13 (2.1 to 2.3)                                         | 1.131 (1.049 to 1.218)                                      |
| Female                  | 94021                   | 1695                            | 36.10 (36.1 to 36.1)                                                        | 1.80 (1.7 to 1.9)                                         | Reference group                                             |
| GP age (missing)        | 13191                   | 21                              |                                                                              |                                                          | P=0.0076                                                     |
| <45 years               | 82041                   | 1660                            | 32.61 (32.6 to 32.6)                                                        | 2.02 (1.9 to 2.1)                                         | 1.13 (1.033 to 1.237)                                       |
| 45–54 years             | 76784                   | 1524                            | 31.86 (31.9 to 31.9)                                                        | 1.98 (1.9 to 2.1)                                         | 1.027 (0.939 to 1.123)                                      |
| 55+ years               | 68993                   | 1489                            | 35.52 (35.5 to 35.5)                                                        | 2.16 (2.0 to 2.2)                                         | Reference group                                             |
| Practice location (missing) | 234                    | 2                               |                                                                              |                                                          | P=0.1379                                                     |
| Major cities            | 166932                  | 3264                            | 69.57 (69.6 to 69.6)                                                        | 1.95 (1.9 to 2.0)                                         | 1.007 (0.894 to 1.133)                                      |
| Inner regional          | 39571                   | 928                             | 19.78 (19.8 to 19.8)                                                        | 2.36 (2.2 to 2.5)                                         | 1.078 (0.948 to 1.226)                                      |
| Outer regional/remote   | 22400                   | 500                             | 10.7 (10.7 to 10.7)                                                         | 2.25 (2.0 to 2.5)                                         | Reference group                                             |
| Country of graduation (missing) | 536                    | 8                               |                                                                              |                                                          | P=0.7471                                                     |
| Australian graduate     | 157881                  | 3203                            | 68.35 (68.3 to 68.4)                                                        | 2.10 (2.0 to 2.2)                                         | 1.054 (1.010 to 1.100)                                      |
| Overseas graduate       | 70720                   | 1483                            | 31.65 (31.6 to 31.7)                                                        | 2.03 (2.0 to 2.1)                                         | Reference group                                             |
| Year                    |                         |                                 |                                                                              |                                                          | P=0.0222                                                     |

Continued
Table 3 outlines the management rate for foot, ankle and leg problem groupings and specific conditions according to age group. The top three most frequently managed problem groupings were similar for all four age groups, with some exceptions in the younger age groups. Injuries (677.2–1833.7 per 100 000 encounters), infection (386.0–905.6) and dermatological conditions (101.5–877.6) were typically the top three in the older age groups (5–9 years, 10–14 years and 15–19 years), although unspecified pain was the third most common problem group in those aged 5–9 years (247.1). For the youngest age group (0–4 years), the top three problem groupings were congenital (195.1), infection (191.1) and injury (142.8).

The top three specific conditions were also similar for the older age groups (10–14 and 15–18 years) with ankle sprains (594.7–594.7), ingrown toenails (525.9–824.2) and infected ingrown toenails (308.4–371.4) being the top three in these age groups. However, for the 0–4 years age group, the top three specific conditions were tinea or fungal skin infections (117.0), onychomycosis/fungal nail (56.2) and injuries to the foot/feet (38.2), while in the 5–9 years group, they were ankle sprains (308.8), tinea or fungal skin infections (209.7) and leg pain (92.6).

Foot, ankle and leg management strategies

Table 4 reports the most frequently used management strategies by GPs for foot, ankle and leg problems. The top three most frequent action groupings were provision of medication (47.0 per 100 problems), counselling, advice or education (25.4) and imaging (25.2). The most specific actions were referral for X-ray (22.7), prescription of antibiotics for systemic use (17.6) and prescription of analgesics (7.9).

Table 5 outlines the management strategies used according to age group. The top three most frequent management strategies were similar for the 5–9 years and 10–14 years age groups, although both the 0–4 years and 15–18 years exhibited different management patterns. For the 5–9 years and 10–14 years groups, the top three management strategies included medication prescription or advice (43.3 and 45.3 per 100 problems), imaging referral (27.2 and 30.7) and counselling, advice or education (25.8 and 27.7). In the 0–4 years group, the top three management strategies were prescription or advice (38.2), referral to another health professional (23.2) and counselling, advice or education (21.2), whereas in the 15–18 years age group, it was medication prescription or advice (55.3), procedures, 24.4) and imaging referral (24.3). The top specific management strategies were similar for the 5–9 years and 10–14 years age groups. These were referrals for X-rays (24.6–28.4 per 100 problems), prescription of antibiotics for systemic use (11.1–20.4) and analgesics (7.7–9.5). The 0–4 years age group top management strategies were referral for X-ray (15.2), antifungals for dermatological use (12.7) and prescriptions of antibiotics for systemic use (9.0), whereas, in the 15–18 years age group, the top three were prescription of antibiotics for systemic use (21.1), referral for X-ray (20.6) and analgesia (9.1).

DISCUSSION

This study was one of the first to investigate the national management of children’s foot, ankle and leg conditions by GPs. Findings suggest Australian GPs commonly manage children’s lower limb problems, and more frequently, in males and older children. Injury, infection and dermatological conditions presented most frequently to GPs across all ages and medications were the most frequently used management strategy. The frequency of specific problems managed, and the management strategies used, varied across the different age groupings, such as differing rates of congenital problems, or differing prescription or advice of medications. GPs also commonly provided counselling, advice and education for all ages, an appropriate management strategy for concerned parents, and a common first stage management strategy for many benign congenital or undefined foot, ankle or leg problems or while undergoing further testing to refine diagnosis.

Children from more disadvantaged socioeconomic areas had a significantly higher GP management rate of foot, leg and ankle conditions than their peers in more advantaged areas. This presentation is consistent with other studies on children’s healthcare in countries with socialised medicine, and reflects a complex interaction between health literacy of parents or the knowledge or financial ability for parents to seek healthcare information or alternate care providers without a GP recommendation, such as seeing a podiatrist or physiotherapist for their children’s foot, ankle or leg concerns.

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Foot, ankle and leg problems differed across age groupings and in general, increased with age. The presentations patterns extracted from this dataset related to foot, ankle or leg concerns potentially reflect the different key skeletal and developmental stages. Younger children presented more with congenital lower limb concerns, while older children presented with more dermatological (eg, tinea or ingrown toenails) or injury (eg, ankle sprain) concerns. These presentation patterns align with key gross motor or developmental stages and may also align with the different health professional referral patterns. For example, there were higher numbers of congenital foot problems in younger children, and more frequent referrals to orthopaedic surgeons than in older age groups. In contrast, injuries were more common in older children, who were referred more often to podiatrists and physiotherapists. These patterns may reflect the more emergent nature of ensuring right timed surgical care at key osseus stages versus providing rehabilitation during injury recovery or individualised skin or nail care advice.

Injury was the primary problem managed in all ages. This may be due to different mechanisms of injuries occurring across childhood such as those occurring in the playground, or during social or organised sport. Despite how injuries may have occurred, common management strategies extracted from this dataset included frequent medical imaging. Ultrasound and X-rays were the most common imaging methods, with fewer ordered than frequency of injury presentations. This suggests conservative and judicious imaging referrals, and potential use of injury imaging referral guidelines, such as the Ottawa Ankle Rules.

Antibiotic stewardship and pain management medication strategies elicited from this dataset also mirror prescribing guidelines established for general practice relating to childhood presentations involving the lower limb for the timeframe data were extracted. For example, at the time of data collection, cephalaxin was commonly prescribed in a suspension for children to treat mild skin infections (eg, cellulitis) while narrow spectrum antibiotics such as flucloxacillin and dicloxacillin were the recommended antibiotics for infected skin relating to infected ingrown toenail presentations. Similarly, the use of non-opioid pain medications exceeded opioid prescriptions, consistent with recommended actions for pain management practices. We did not undertake direct comparisons between the problem managed and corresponding management strategy during this analysis; however, these patterns suggest that medication management practices align with best practice clinical guidelines.

Contrary to this, it was surprising to see fewer musculoskeletal conditions recorded within the dataset, despite epidemiological studies finding that 12% of children report or seek care for leg or foot pain relating to specific musculoskeletal conditions. The low frequency rates we observed within this dataset may be related to several factors. The most likely reason is how these problems were recorded by the GP. Underpinning how problems were recorded may be limited knowledge about less common foot, ankle or leg conditions, lower presentation rates of foot, ankle or leg conditions to GPs compared with hospital outpatients, the single point data collection
Table 3  Management rate of paediatric foot/ankle/leg problem groups per 100 000 encounters, 2000–2016 for age groupings

| Specific foot, ankle and leg problem group | 0–4 years n=99426 Rate per 100 000 encounters (95% CIs) 0–4 years | 5–9 years n=45333 Rate per 100 000 encounters (95% CIs) 5–9 years | 10–14 years n=39310 Rate per 100 000 encounters (95% CIs) 10–14 years | 15–18 years n=45068 Rate per 100 000 encounters (95% CIs) 15–18 years |
|-------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|
| Injury                                    | 142 (118.4 to 167.3)                                          | 307 (200.3 to 754.1)                                          | 772 (190.3 to 1980.0)                                         | 561 (135.1 to 1384.3)                                          |
| Ankle sprain                              | 31 (19.9 to 42.5)                                             | 140 (256.3 to 361.4)                                          | 272 (605.9 to 778.0)                                          | 268 (521.9 to 667.4)                                          |
| Injury foot/feet                          | 38 (25.5 to 51.0)                                             | 31 (44.4 to 92.4)                                             | 66 (127 to 208.3)                                             | 40 (61.3 to 116.2)                                            |
| Injury ankle                              | 7 (1.8 to 12.3)                                               | 18 (21.4 to 58.0)                                             | 57 (105.5 to 184.5)                                           | 56 (91.2 to 157.3)                                            |
| Fracture metatarsal                       | 12 (5.2 to 18.9)                                              | 26 (115.4 to 41.4)                                            | 93 (184.8 to 288.4)                                           | 21 (25.8 to 67.4)                                             |
| Fracture ankle                            | 5 (0.6 to 9.4)                                                | 20 (24.8 to 63.4)                                             | 43 (76.8 to 142.0)                                            | 35 (82.0 to 103.3)                                            |
| Fracture toe                              | 3 (0.0 to 6.4)                                                | 13 (13.1 to 44.3)                                             | 46 (83.3 to 150.7)                                            | 31 (44.6 to 93.0)                                             |
| Foot/feet sprain                          | 6 (1.2 to 10.9)                                               | 23 (30.0 to 71.4)                                             | 30 (48.2 to 104.5)                                            | 13 (13.2 to 44.5)                                             |
| Infection                                 | 190 (164.6 to 218.6)                                          | 175 (325.9 to 446.1)                                          | 356 (905.6 to 1000.8)                                         | 329 (649.7 to 810.3)                                          |
| Tinea/fungal skin infection               | 117 (95.9 to 139.4)                                           | 95 (166.3 to 252.8)                                           | 114 (1836.7 to 1980.0)                                        | 97 (172.6 to 257.9)                                           |
| Onychomycosis/fungal nail                 | 56 (41.1 to 71.6)                                             | 39 (59.1 to 113.5)                                            | 34 (57.5 to 115.5)                                            | 50 (80.3 to 141.6)                                            |
| Infected ingrown toenail                  | 10 (3.8 to 16.3)                                              | 18 (21.4 to 58.0)                                             | 146 (310.4 to 432.5)                                          | 139 (254.6 to 362.3)                                          |
| Cellulitis of the leg                     | 14 (6.2 to 22.0)                                              | 20 (23.9 to 64.4)                                             | 28 (42.2 to 100.3)                                            | 21 (26.7 to 66.5)                                             |
| Dermatological                            | 33 (21.9 to 44.4)                                             | 46 (72.2 to 130.7)                                            | 345 (781.6 to 973.7)                                          | 262 (508.9 to 653.7)                                          |
| Ingrown toenail                           | 30 (19.4 to 41.0)                                             | 33 (48.0 to 97.6)                                             | 324 (731.3 to 917.1)                                          | 237 (457.5 to 594.3)                                          |
| Coms/callosities                          | 2 (0.0 to 4.8)                                                | 13 (13.1 to 44.3)                                             | 21 (30.6 to 76.3)                                             | 24 (31.1 to 75.4)                                             |
| Unspecified pain                          | 57 (42.2 to 72.4)                                             | 112 (199.9 to 294.2)                                          | 143 (304.2 to 423.4)                                          | 92 (161.3 to 247.0)                                           |
| Pain foot/feet                            | 15 (7.0 to 23.2)                                              | 39 (59.1 to 113.5)                                            | 66 (127.5 to 208.3)                                           | 39 (59.4 to 113.7)                                            |
| Pain leg                                  | 36 (22.4 to 48.0)                                             | 42 (63.4 to 121.9)                                            | 24 (36.7 to 85.5)                                             | 25 (32.9 to 78.0)                                             |
| Pain ankle                                | 4 (0.1 to 8.0)                                                | 22 (28.3 to 68.8)                                             | 37 (63.9 to 124.4)                                            | 27 (37.3 to 82.5)                                             |
| Congenital                                | 194 (167.4 to 222.9)                                          | 56 (90.1 to 157.0)                                            | 80 (147.8 to 259.3)                                           | 24 (27.2 to 93.0)                                             |
| Pes planus (flat foot)                    | 34 (22.4 to 46.0)                                             | 32 (45.4 to 95.8)                                             | 54 (87.6 to 187.1)                                            | 15 (10.7 to 55.9)                                             |
| Musculoskeletal                           | 11 (4.5 to 17.6)                                              | 41 (62.8 to 118.1)                                            | 92 (183.9 to 284.2)                                           | 50 (80.3 to 141.6)                                            |
| Plantar fasciitis                         | 2 (0.0 to 4.8)                                                | 15 (16.4 to 49.8)                                             | 35 (58.8 to 119.3)                                            | 12 (11.6 to 41.7)                                             |
| Calcaneal apophysitis (Sever's)           | –                                                             | 18 (21.4 to 58.0)                                             | 32 (52.4 to 110.4)                                            | 2 (0.0 to 10.6)                                               |
| Non-specific foot/ankle/leg problem       | 34 (22.4 to 46.0)                                             | 18 (21.3 to 58.0)                                             | 32 (53.3 to 109.6)                                            | 21 (25.8 to 67.4)                                             |
| Management of foot/ankle/leg             | 3 (0.0 to 6.4)                                                | 2 (0.0 to 10.5)                                               | 16 (20.8 to 60.6)                                             | 21 (26.7 to 66.5)                                             |
| Venous/swelling                           | 6 (1.2 to 10.9)                                               | 5 (1.4 to 20.7)                                               | 11 (11.5 to 44.5)                                             | 12 (11.6 to 41.7)                                             |

Continued
Ischaemia & 1 & 1.0 (0.0 to 3.0) & 1 & 2.2 (0.0 to 6.5) & 8 & 20.4 (6.3 to 34.4) & 20 & 44.4 (25.0 to 63.8) & 10-14 years & n=39310 & Rate per 100000 & encounters (95% CIs) & 10-14 years & n=39310 & Rate per 100000 & encounters (95% CIs) & 15-18 years & n=45088 & Rate per 100000 & encounters (95% CIs) & 15-18 years & n=45088 & Rate per 100000 & encounters (95% CIs) \\

Ulceration & 1 & 1.00 (0.0 to 3.0) & 6 & 13.2 (2.6 to 23.8) & 12 & 30.5 (13.3 to 47.8) & 8 & 17.8 (5.5 to 30.0) & \\

Leg ulcer & 1 & 1.0 (0.0 to 3.0) & 3 & 6.6 (0.0 to 14.1) & 9 & 22.9 (7.9 to 37.8) & 6 & 13.3 (2.7 to 24.0) & \\

Venous/varicose leg ulcer & 1 & 1.0 (0.0 to 3.0) & 4 & 8.8 (0.18 to 17.5) & 9 & 22.9 (7.9 to 37.8) & 7 & 15.5 (4.0 to 27.0) & \\

Foot ulcer & – & – & 2 & 4.4 (0.0 to 10.5) & 3 & 7.6 (0.0 to 16.3) & 1 & 2.2 (0.0 to 6.6) & \\

Neuropathy & 1 & 1.0 (0.0 to 3.0) & 1 & 2.2 (0.0 to 6.5) & 4 & 10.2 (0.2 to 20.1) & 14 & 31.1 (14.8 to 47.3) & \\

Cramps & 3 & 3.0 (0.0 to 6.4) & 2 & 4.4 (0.0 to 10.5) & 3 & 7.6 (0.0 to 16.3) & 7 & 25.5 (4.0 to 27.0) & \\

Amputation & 1 & 6.0 (1.2 to 10.9) & – & – & – & – & – & – &

**Table 3** Continued

| Specific foot, ankle and leg problem group | 0–4 years n=99426 | Rate per 100000 encounters (95% CIs) | 5–9 years n=45333 | Rate per 100000 encounters (95% CIs) | 10–14 years n=39310 | Rate per 100000 encounters (95% CIs) | 15–18 years n=45088 | Rate per 100000 encounters (95% CIs) |
|------------------------------------------|-----------------|-------------------------------------|------------------|-------------------------------------|------------------|-------------------------------------|------------------|-------------------------------------|

**Table 4**

| Management action | Rate per 100 problems (95% CIs) |
|-------------------|----------------------------------|

| Medication | 2005 |
|-----------|------|
| Diclofenac | 47.0 (46.2 to 48.8) |
| Paracetamol | 480 |
| Ibuprofen | 982 |
| Cefalexin | 176.8 (164 to 188) |
| Metronidazole | 102.9 (92 to 111) |
| Norfloxacin | 480 |
| Cefuroxime | 982 |
| Cefadroxil | 176.8 (164 to 188) |
| Ciprofloxacin | 102.9 (92 to 111) |
| Ceftriaxone | 480 |
| Cefuroxime | 982 |
| Cefadroxil | 176.8 (164 to 188) |
| Ciprofloxacin | 102.9 (92 to 111) |
| Clindamycin | 480 |
| Cefuroxime | 982 |
| Cefadroxil | 176.8 (164 to 188) |
| Ciprofloxacin | 102.9 (92 to 111) |
| Clindamycin | 480 |
| Cefuroxime | 982 |
| Cefadroxil | 176.8 (164 to 188) |
| Ciprofloxacin | 102.9 (92 to 111) |
| Clindamycin | 480 |
| Cefuroxime | 982 |
| Cefadroxil | 176.8 (164 to 188) |
| Ciprofloxacin | 102.9 (92 to 111) |
| Clindamycin | 480 |
| Cefuroxime | 982 |
| Cefadroxil | 176.8 (164 to 188) |
| Ciprofloxacin | 102.9 (92 to 111) |
| Clindamycin | 480 |
| Cefuroxime | 982 |
| Cefadroxil | 176.8 (164 to 188) |
| Ciprofloxacin | 102.9 (92 to 111) |
| Clindamycin | 480 |
| Cefuroxime | 982 |
| Cefadroxil | 176.8 (164 to 188) |
| Ciprofloxacin | 102.9 (92 to 111) |
| Clindamycin | 480 |
| Cefuroxime | 982 |
| Cefadroxil | 176.8 (164 to 188) |
| Ciprofloxacin | 102.9 (92 to 111) |
| Clindamycin | 480 |
| Cefuroxime | 982 |
| Cefadroxil | 176.8 (164 to 188) |
| Ciprofloxacin | 102.9 (92 to 111) |
| Clindamycin | 480 |
| Management action | 0–4 years n=677 | Rate per 100 problems (95% CIs) for 0–4 years | 5–9 years n=772 | Rate per 100 problems (95% CIs) for 5–9 years | 10–14 years n=1824 | Rate per 100 problems (95% CIs) for 10–14 years | 15–18 years n=1421 | Rate per 100 problems (95% CIs) for 15–18 years |
|------------------|-----------------|---------------------------------------------|-----------------|---------------------------------------------|-------------------|---------------------------------------------|-------------------|---------------------------------------------|
| Medication (any) | 259             | 38.2 (34.0 to 42.5)                         | 334             | 43.3 (39.0 to 47.5)                         | 826               | 45.3 (42.5 to 48.1)                         | 786               | 55.3 (52.0 to 58.6)                         |
| Antibiotics for systemic use | 61 | 9.0 (6.8 to 11.2) | 86 | 11.1 (8.9 to 13.4) | 373 | 20.4 (18.5 to 22.4) | 304 | 21.4 (19.2 to 23.6) |
| Cephalexin | 36             | 5.3 (3.6 to 7.0)                        | 45 | 5.8 (4.2 to 7.5)                        | 216 | 11.8 (10.3 to 13.3)                        | 183 | 12.9 (11.1 to 14.7)                        |
| Fluconacinil | 6              | 0.9 (0.2 to 1.6)                     | 14 | 1.8 (0.9 to 2.8)                       | 48 | 2.6 (1.8 to 3.4)                         | 36 | 2.5 (1.7 to 3.4)                          |
| Dicloacinil | –               | –                                        | –              | –                                          | –                 | 1.6 (1.0 to 2.2)                         | 28 | 2.0 (1.2 to 2.7)                          |
| Analgesics | 27             | 4.0 (2.5 to 5.5)                       | 73 | 9.5 (7.3 to 11.6)                       | 140 | 7.7 (6.4 to 9.0)                         | 130 | 9.1 (7.6 to 10.7)                         |
| Non-opioid analgesics | 26 | 3.8 (2.4 to 5.3) | 71 | 9.2 (7.0 to 11.4) | 123 | 6.7 (5.6 to 7.9) | 91 | 6.4 (5.1 to 7.7) |
| Paracetamol | 22             | 3.2 (1.9 to 4.6)                       | 62 | 8.0 (6.1 to 10.0)                       | 114 | 6.3 (5.1 to 7.4)                         | 79 | 5.6 (4.3 to 6.8)                         |
| Opioid analgesics | 1 | 0.1 (0.0 to 0.4) | 2 | 0.3 (0.0 to 0.6) | 17 | 0.9 (0.5 to 1.4) | 39 | 2.7 (1.9 to 3.6) |
| Codeine/paracetamol | 3 | 0.4 (0.00 to 0.9) | 1 | 0.1 (0.0 to 0.4) | 16 | 0.9 (0.4 to 1.3) | 35 | 2.5 (1.6 to 3.3) |
| Oxycodone | –               | –                                        | –              | –                                          | 1                 | 0.1 (0.0 to 0.2)                         | 2 | 0.1 (0.0 to 0.3)                          |
| Tramadol | –               | –                                        | –              | –                                          | 1                 | 0.1 (0.0 to 0.2)                         | 2 | 0.1 (0.0 to 0.3)                          |
| Anti-inflammatory and antirheumatic products | 10 | 1.5 (0.6 to 2.4) | 32 | 4.1 (2.7 to 5.6) | 86 | 4.7 (3.7 to 5.7) | 100 | 7.0 (5.7 to 8.4) |
| Ibuprofen | 6              | 0.9 (0.2 to 1.6)                     | 31 | 4.0 (2.6 to 5.4)                       | 69 | 3.8 (2.9 to 4.7)                         | 57 | 4.0 (3.0 to 5.0)                         |
| Meloxicam | 1              | 0.1 (0.0 to 0.4)                     | –              | –                                          | –                 | –                                          | 8 | 0.6 (0.2–1.0)                              |
| Diclofenac (oral) | 1 | 0.1 (0.0 to 0.4) | – | – | – | 10 | 0.5 (0.2 to 0.9) | 15 | 1.1 (0.5 to 1.6) |
| Diclofenac (topical) | 2 | 0.3 (0.0 to 0.7) | 5 | 0.6 (0.1 to 1.2) | 15 | 0.8 (0.4 to 1.2) | 13 | 0.9 (0.4 to 1.4) |
| Antifungals for dermatological use | 86 | 12.7 (10.2 to 15.3) | 73 | 9.5 (7.3 to 11.6) | 97 | 5.3 (4.2 to 6.4) | 98 | 6.9 (5.5 to 8.3) |
| Terbinafine (oral) | 5 | 0.7 (0.1 to 1.4) | 5 | 0.6 (0.1 to 1.2) | 10 | 0.5 (0.2 to 0.9) | 7 | 0.5 (0.1 to 0.9) |
| Terbinafine (topical) | 6 | 0.9 (0.2 to 1.6) | 19 | 2.5 (1.4 to 3.6) | 19 | 1.0 (0.6 to 1.5) | 23 | 1.6 (1.0 to 2.3) |
| Clotrimazole | 42 | 6.2 (4.4 to 8.0) | 21 | 2.7 (1.6 to 3.9) | 31 | 1.6 (1.1 to 2.3) | 8 | 1.6 (1.0 to 2.3) |
| Corticosteroids for dermatological use | 38 | 5.6 (3.8 to 7.4) | 30 | 3.8 (2.5 to 5.3) | 26 | 1.4 (0.9 to 2.0) | 26 | 1.8 (1.1 to 2.6) |
| Hydrocortisone | 9 | 1.3 (0.5 to 2.2) | 4 | 0.5 (0.01 to 1.0) | – | – | – | 1 | 0.1 (0.0 to 0.2) |
| Procedures | 60 | 8.9 (12.6 to 6.4) | 138 | 17.9 (14.8 to 20.9) | 452 | 24.8 (22.5 to 27.1) | 347 | 24.4 (21.9 to 27.0) |
| Imaging | 107 | 15.8 (12.8 to 18.8) | 236 | 30.7 (27.8 to 34.3) | 496 | 27.2 (24.9 to 29.5) | 346 | 24.3 (21.9 to 26.8) |
| Ultrasound | 4 | 0.6 (0.01 to 1.2) | 10 | 1.3 (0.5 to 2.1) | 33 | 1.8 (1.2 to 2.4) | 25 | 2.0 (1.2 to 2.7) |
| X-ray | 103 | 15.2 (12.3 to 18.2) | 219 | 28.4 (24.8 to 31.9) | 449 | 24.6 (1.1 to 26.8) | 293 | 20.6 (18.6 to 22.8) |
| Pathology | 41 | 6.1 (2.8 to 9.3) | 61 | 7.9 (4.4 to 11.4) | 86 | 4.7 (3.0 to 6.5) | 84 | 5.9 (3.8 to 8.0) |
| Full blood count | 6 | 0.8 (0.4 to 1.6) | 13 | 1.0 (0.8 to 2.6) | 10 | 0.5 (0.2 to 0.9) | 9 | 0.6 (0.2 to 1.0) |
| C-reactive protein | 4 | 0.6 (0.01 to 1.2) | 3 | 0.4 (0.0 to 0.8) | 3 | 0.2 (0.0 to 0.4) | 3 | 0.2 (0.0 to 0.4) |

Continued
The low frequency of musculoskeletal concerns recorded within this dataset may also reflect different health literacy in parents and its association with not seeking care from GPs or misdiagnosis. One potential example of this was the frequency of plantar fasciitis diagnoses recorded across younger ages (33.1 per 100,000 in the 5–9 years group and 89.0 per 100,000 in the 10–14 years group). Plantar fasciitis is rarely reported in contemporary paediatric orthopaedic literature, and if diagnosed on ultrasound, associated with being an older and highly athletic adolescent than the ages in this dataset.44 Heel pain in older children is more likely to be calcaneal apophysitis. This diagnosis was recorded as 39.1 per 100,000 encounters in 5–9 years grouping and 81.4 in 10–14 years grouping, and at a less frequent rate than plantar fasciitis in the 10–14 years age grouping, despite this being the age when foot apophysial injuries are most prevalent.45 Other conditions also resulting in childhood plantar heel pain include inflammatory disease, infection (including osteomyelitis) or postviral joint pain, all presenting more commonly than plantar fasciitis in younger age groupings.46 Management strategies of these heel pain conditions differ significantly, making it imperative for timely and accurate diagnosis to minimise healthcare wastage and prevent development of chronic pain.47

Recently, there has been a global call to action on improving primary care diagnosis and assessment of musculoskeletal conditions in childhood to minimise misdiagnosis and reduce the development of disability and chronic pain.48 Simple assessments and screening tools have been implemented to support general practice, such as the paediatric Gait, Legs and Spine screen49 and free online generic health professionals training to improve paediatric musculoskeletal condition diagnoses.50 These resources have been developed in acknowledgement of limited exposure to paediatric musculoskeletal conditions during medical training,51 less common presentations in childhood compared with other childhood complaints such as ear infections or upper respiratory tract infection leading to low confidence in diagnostic skills of musculoskeletal conditions,52 knowledge deficits of the types of common paediatric musculoskeletal presentations53 and serious long-term consequences of some musculoskeletal conditions missed or misdiagnosed.54 Our findings of GPs reporting unspecified pain or conditions known to be more prevalent in adults than children suggests that Australian GPs may require additional support to diagnose and manage musculoskeletal conditions in childhood. Future research may include development of guidelines and supporting models of care for children’s foot, ankle or leg problems to determine if these improve health outcomes, reduce the progressive nature of many musculoskeletal conditions and pain syndromes and if these are cost-effective.

This study is the first to our knowledge, to examine the full spectrum of childhood foot, ankle or leg presentations in primary care and how these are managed. The
data extracted from a large and representative sample of Australian GPs provides an extensive snapshot of practice to guide future directions for education, guideline development and models of care for childhood foot, ankle or leg conditions. A limitation of this study is the historical nature of the data, and that education, practice and models of care may have evolved between the 2016 end date of BEACH and data analysis. Known paediatric model of care and referral changes in some Australian state and territories occurred in late 2015, which may have resulted in improved management of conditions through several guidelines, recommended assessments and when to refer to orthopaedic surgeons for several specific musculoskeletal conditions. The way in which conditions were recorded by the GP, then coded and classified, presents a broad representation of the conditions, as ICPC-2 PLUS and ICPC-2 do not contain sufficient specificity to capture severity. Even in ICD-10, for example, the code for congenital pes planus combines benign, and often asymptomatic paediatric flexible flat foot with other types of flat foot. We acknowledge that asymptomatic flat foot rarely requires treatment and is often managed by providing reassurance to families. However, the ICD-10 inclusion also captures the rigid flat foot, which is commonly symptomatic, or flat foot due to spasticity, both requiring conservative or surgical management by allied health or medical specialists. As a result of the methodology, this paper did not allow for detailed analysis of care trajectories and outcomes. Also, the single point in time data collection method means that the diagnosis may have changed with results of tests or following specialist referral. Regardless, this dataset of encounters and management strategies provides a robust baseline on which future guidelines and implementation studies can measure the outcomes of practice change over time.

CONCLUSION
Childhood foot, ankle and leg conditions are a common reason parents bring their children to a GP in Australia. Frequencies of presentations vary according to developmental stage with potential under reporting of musculoskeletal conditions. Future studies should consider how to support GPs in managing childhood musculoskeletal conditions to minimise disability and development of chronic pain. These actions have the potential to reduce long-term burden of disease.

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Contributors
CMW and PAL conceived this study with authors HBM, JG and CH contributing to data extraction plan. CH undertook data extraction and analysis; CMW developed the first draft of the manuscript with all authors providing critical review. All authors approved the final draft for submission. CMW is the guarantor of the study.

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Data availability statement
Data are available on reasonable request. Data may be obtained from a third party and are not publicly available. The data that support the findings of this study are available from BEACH, but restrictions apply to the availability of these data, which were used under licence for the current study, and so are not publicly available. Data are however available from the authors on reasonable request and with permission of BEACH.

Supplemental material
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