



BMJ Open 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

Cylie M Williams ¹, Hylton B Menz,² Peter A Lazzarini,^{3,4} Julie Gordon,⁵ Christopher Harrison ⁶

To cite: Williams CM, Menz HB, Lazzarini PA, *et al.* 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. *BMJ Open* 2022;**12**:e062063. doi:10.1136/bmjopen-2022-062063

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2022-062063>).

Received 18 February 2022
Accepted 30 June 2022



© Author(s) (or their employer(s)) 2022. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to

Cylie M Williams;
cylie.williams@monash.edu

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,^{1,2} while the incidence of calcaneal apophysitis ranges from 0.37 to 0.60 per 100 person-years.³ 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,⁴ family burden⁵ and permanent disability.⁶ Primary care providers are commonly the first contact for non-emergency health-care. Therefore, understanding contemporary practice in primary care allows for improved focus for finite health-care resources, training and guidelines, to improve health outcomes,⁷ reduce healthcare waste⁸ and design effective public policies or prevention strategies to minimise long-term impacts.⁹

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.¹⁰ Medicare also provides subsidies for other healthcare services including diagnostic imaging and pathology tests. The Pharmaceutical Benefits Scheme provides subsidies for prescribed medicines.¹¹ 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.¹¹ 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 \$A255m per annum.¹² 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,^{13–16} yet only one of these studies provided data on all children between the ages of 0–18 years.¹⁴ 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.¹⁴ 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.¹⁷ 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,¹⁸ which maps to the Anatomical Therapeutic Chemical Classification System.¹⁹ 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) PLUS²⁰ by the BEACH research team, with automated classification to the ICPC-2.²¹ ICPC-2 is a member of the WHO Family of International Classifications²¹ and is mapped to the International Classification of Disease, Version 10 (ICD-10).²²

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

reported expert consensus process (online supplemental dataset).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)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 100 000 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 <0.05.²⁴

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 229 137 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

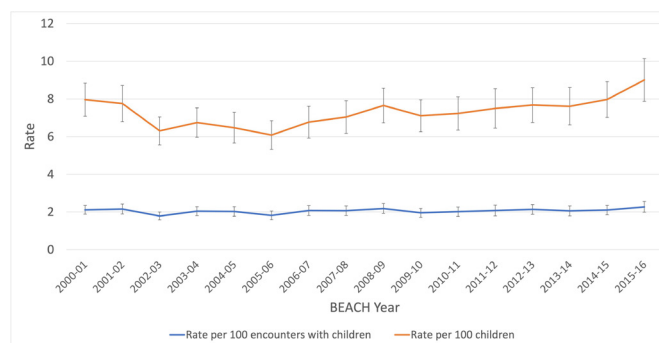


Figure 1 The management rate of children's foot, ankle and leg problems managed by Australian GPs between April 2000 and March 2016 (aged 0–18 years). Blue line represents problems per 100 encounters, orange line represents problems per 100 children (error bars=95% CI). BEACH, Bettering the Evaluation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

(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).

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 leg or ankle 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 injuries (755.9 per 100 000 encounters), followed by infections (458.2) and dermatological conditions (299.4). The most frequent specific conditions were ankle sprains (310.3 per 100 000 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=229 137)	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 (95% CIs)
Sex (missing)	1734	38			P=<0.001
Male	111 448	2490	53.48 (53.5 to 53.5)	2.23 (2.1 to 2.3)	1.304 (1.215 to 1.399)
Female	115 955	2166	46.52 (46.5 to 46.5)	1.77 (1.8 to 1.9)	Reference group
Age (missing)		–			P<0.001
<1 year	30 722	134	2.85 (2.9 to 2.9)	0.44 (0.4 to 0.5)	Reference group
1–4 years	68 704	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	45 333	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	39 310	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	45 068	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	82 797	1825	39.92 (39.9 to 39.9)	2.20 (2.1 to 3.8)	1.080 (1.000 to 1.166)
Most advantaged	140 481	2747	60.08 (60.1 to 60.1)	1.96 (1.9 to 2.0)	Reference group
Healthcare card (missing)	19 844	410			P=0.1716
Healthcare card	61 166	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	148 127	2991	69.82 (69.1 to 69.8)	2.02 (1.9 to 2.1)	Reference group
Language background (missing)	24 052	502			P=0.1477
Non-English speaking	16 009	273	6.51 (6.5 to 6.5)	1.71 (1.5 to 1.9)	Reference group
English speaking	189 076	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)	339 873	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	183 340	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	135 116	2999	63.89 (63.9 to 63.9)	2.13 (2.1 to 2.3)	1.131 (1.049 to 1.218)
Female	94 021	1695	36.10 (36.1 to 36.1)	1.80 (1.7 to 1.9)	Reference group
GP age (missing)	1319	21			P=0.0076
<45 years	82 041	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	76 784	1524	31.86 (31.9 to 31.9)	1.98 (1.9 to 2.1)	1.027 (0.939 to 1.123)
55+ years	68 993	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	166 932	3264	69.57 (69.6 to 69.6)	1.95 (1.9 to 2.0)	1.007 (0.0894 to 1.133)
Inner regional	39 571	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	22 400	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	157 881	3203	68.35 (68.3 to 68.4)	2.10 (2.0 to 2.2)	1.054 (1.010 to 1.100)
Overseas graduate	70 720	1483	31.65 (31.6 to 31.7)	2.03 (2.0 to 2.1)	Reference group
Year					P=0.0222
					1.010 (1.001 to 1.018)

Continued

Table 1 Continued

Patient characteristics	Sample size (n=229 137)	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)
Total	229 137		100.0%	2.05 (2.0 to 2.1)	

GP, general practitioner.

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 (677.2–1835.7 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 to 594.7), ingrown toenails (525.9–824.2) and infected ingrown toenails (308.4–371.4) being the top three in those 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 medication 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.^{25 26}

Table 2 Management rate of foot/ankle/leg problem groups per 100 000 child encounters, 2000–2016

Specific foot/ankle/leg problem group	N=229 137	Rate per 100 000 encounters (95% CIs) for all ages
Injury	1732	755.9 (718.0 to 793.8)
Ankle sprain	711	310.3 (286.3 to 334.2)
Injury foot/feet	175	76.4 (64.9 to 87.8)
Injury ankle	138	60.2 (49.9 to 70.6)
Fracture metatarsal	138	60.2 (49.5 to 70.9)
Fracture ankle	103	45.0 (36.2 to 53.7)
Fracture toe	93	40.6 (32.4 to 48.8)
Foot/feet sprain	72	31.4 (24.1 to 38.8)
Infection	1050	458.2 (429.5 to 487.0)
Tinea/fungal skin infection	423	184.6 (166.5 to 202.8)
Infected ingrown toenail	313	136.6 (120.8 to 152.4)
Onychomycosis/fungus nail	179	78.1 (66.4 to 89.9)
Cellulitis of the leg	83	36.2 (28.0 to 44.4)
Dermatological	686	299.4 (276.0 to 322.7)
Ingrown toenail	624	272.3 (250.0 to 294.6)
Corns/callosities	60	26.2 (19.5 to 32.9)
Unspecified pain	404	176.3 (158.7 to 193.9)
Pain foot/feet	159	69.4 (58.5 to 80.2)
Pain leg	127	55.4 (45.6 to 65.2)
Pain ankle	90	39.3 (31.1 to 47.5)
Congenital	354	154.5 (135.7 to 173.3)
Pes planus (flat foot)	135	58.9 (45.1 to 72.7)
Musculoskeletal	194	84.7 (72.4 to 96.9)
Plantar fasciitis	64	27.9 (21.0 to 34.9)
Calcaneal apophysitis (Sever's)	52	22.7 (16.3 to 29.1)
Non-specific foot/ankle/leg problem	105	45.8 (36.8 to 54.8)
Management of foot/ankle/leg	42	18.3 (12.8 to 23.9)
Venous/swelling	34	14.8 (9.9 to 19.8)
Ischaemia	30	13.1 (8.4 to 17.8)
Ulceration	27	11.8 (7.3 to 16.2)
Venous/varicose leg ulcer	21	9.2 (5.2 to 13.1)
Leg ulcer	19	8.3 (4.6 to 12.0)
Foot ulcer	6	2.6 (0.5 to 4.7)
Neuropathy	20	8.7 (4.9 to 12.5)
Cramps	15	6.5 (3.2 to 9.9)
Amputation	1	0.4 (0.0 to 1.3)

Foot, ankle and leg problems differed across age groupings and in general, increased with age. The presentation 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 osseous 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.^{27–30} 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.³¹

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.³² For example, at the time of data collection, cephalexin 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.³² Similarly, the use of non-opioid pain medications exceeded opioid prescriptions, consistent with recommended actions for pain management practices.³² 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.³³ 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	142.8 (118.4 to 167.3)	307	677.2 (600.3 to 754.1)	772	1836.7 (1693.3 to 1980.0)	561	1244.8 (1138.4 to 1351.2)
Ankle sprain	31	31.2 (19.9 to 42.5)	140	308.8 (256.3 to 361.4)	272	691.9 (605.9 to 778.0)	268	594.7 (521.9 to 667.4)
Injury foot/feet	38	38.2 (25.5 to 51.0)	31	68.4 (44.4 to 92.4)	66	167.9 (127 to 208.3)	40	88.8 (61.3 to 116.2)
Injury ankle	7	7.0 (1.8 to 12.3)	18	39.7 (21.4 to 58.0)	57	145.0 (105.5 to 184.5)	56	124.3 (91.2 to 157.3)
Fracture metatarsal	12	12.1 (5.2 to 18.9)	12	26.5 (11.5 to 41.4)	93	236.6 (184.8 to 288.4)	21	46.6 (25.8 to 67.4)
Fracture ankle	5	5.0 (0.6 to 9.4)	20	44.1 (24.8 to 63.4)	43	109.3 (76.8 to 142.0)	35	77.7 (52.0 to 103.3)
Fracture toe	3	3.0 (0.0 to 6.4)	13	28.7 (13.1 to 44.3)	46	117.0 (83.3 to 150.7)	31	68.8 (44.6 to 93.0)
Foot/feet sprain	6	6.0 (1.2 to 10.9)	23	50.7 (30.0 to 71.4)	30	76.3 (48.2 to 104.5)	13	28.9 (13.2 to 44.5)
Infection	190	191.1 (164.6 to 218.6)	175	386.0 (325.9 to 446.1)	356	905.6 (810.4 to 1000.8)	329	730.0 (649.7 to 810.3)
Tinea/fungal skin infection	117	117 (95.9 to 139.4)	95	209.7 (166.3 to 252.8)	114	290.0 (236.6 to 343.4)	97	215.2 (172.6 to 257.9)
Onychomycosis/fungus nail	56	56.2 (41.1 to 71.6)	39	86.0 (59.1 to 113.0)	34	86.5 (57.5 to 115.5)	50	110.9 (80.3 to 141.6)
Infected ingrown toenail	10	10.1 (3.8 to 16.3)	18	39.7 (21.4 to 58.0)	146	371.4 (310.4 to 432.5)	139	308.4 (254.6 to 362.3)
Cellulitis of the leg	14	14.1 (6.2 to 22.0)	20	44.1 (23.9 to 64.4)	28	71.2 (42.2 to 100.3)	21	46.6 (26.7 to 66.5)
Dermatological	33	33.2 (21.9 to 44.4)	46	101.5 (72.2 to 130.7)	345	877.6 (781.6 to 973.7)	262	581.3 (508.9 to 653.7)
Ingrown toenail	30	30.2 (19.4 to 41.0)	33	72.8 (48.0 to 97.6)	324	824.2 (731.3 to 917.1)	237	525.9 (457.5 to 594.3)
Corns/callosities	2	2.0 (0.0 to 4.8)	13	28.7 (13.1 to 44.3)	21	53.4 (30.6 to 76.3)	24	53.3 (31.1 to 75.4)
Unspecified pain	57	57.3 (42.2 to 72.4)	112	247.1 (199.9 to 294.2)	143	363.8 (304.2 to 423.4)	92	204.1 (161.3 to 247.0)
Pain foot/feet	15	15.1 (7.0 to 23.2)	39	86.0 (59.1 to 113.0)	66	167.9 (127.5 to 208.3)	39	86.5 (59.4 to 113.7)
Pain leg	36	36.2 (24.4 to 48.0)	42	92.6 (63.4 to 121.9)	24	61.1 (36.7 to 85.5)	25	55.5 (32.9 to 78.0)
Pain ankle	4	4.0 (0.1 to 8.0)	22	48.5 (28.3 to 68.8)	37	94.1 (63.9 to 124.4)	27	59.9 (37.3 to 82.5)
Congenital	194	195.1 (167.4 to 222.9)	56	123.5 (90.1 to 157.0)	80	203.5 (147.8 to 259.3)	24	53.3 (27.2 to 9.3)
Pes planus (flat foot)	34	34.2 (22.4 to 46.0)	32	70.6 (45.4 to 95.8)	54	137.4 (87.6 to 187.1)	15	33.3 (10.7 to 55.9)
Musculoskeletal	11	11.0 (4.5 to 17.6)	41	90.4 (62.8 to 118.1)	92	234.0 (183.9 to 284.2)	50	110.9 (80.3 to 141.6)
Plantar fasciitis	2	2.0 (0.0 to 4.8)	15	33.1 (16.4 to 49.8)	35	89.0 (58.8 to 119.3)	12	26.6 (11.6 to 41.7)
Calcaneal apophysitis (Sever's)	–	–	18	39.7 (21.4 to 58.0)	32	81.4 (52.4 to 110.4)	2	4.4 (0.0 to 10.6)
Non-specific foot/ankle/leg problem	34	34.2 (22.4 to 46.0)	18	39.7 (21.3 to 58.0)	32	81.4 (53.3 to 109.6)	21	46.6 (25.8 to 67.4)
Management of foot/ankle/leg	3	3.0 (0.0 to 6.4)	2	4.4 (0.0 to 10.5)	16	40.7 (20.8 to 60.6)	21	46.6 (26.7 to 66.5)
Venous/swelling	6	6.0 (1.2 to 10.9)	5	11.0 (1.4 to 20.7)	11	28.0 (11.5 to 44.5)	12	26.6 (11.6 to 41.7)

Continued

Table 3 Continued

Specific foot, ankle and leg problem group	n=99426	0–4 years encounters (95% CIs)	n=45333	5–9 years encounters (95% CIs)	Rate per 100 000 encounters (95% CIs)	10–14 years n=99310	Rate per 100 000 encounters (95% CIs)	15–18 years n=45068	Rate per 100 000 encounters (95% CIs)
Ischaemia	1	1.0 (0.0 to 3.0)	1	2.2 (0.0 to 6.5)	20.4 (6.3 to 34.4)	20	44.4 (25.0 to 63.8)		
Ulceration	1	1.00 (0.0 to 3.0)	6	13.2 (2.6 to 23.8)	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)	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)	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)	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)	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)	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 4 Management actions used by GPs for paediatric foot/ankle/leg problems, 2000–2016

Management action	n	Rate per 100 problems (95% CIs)
Medication (any)	2205	47.0 (45.2 to 48.8)
Antibiotics for systemic use	824	17.6 (16.4 to 18.7)
Cephalexin	480	10.2 (9.2 to 11.1)
Flucloxacillin	104	2.2 (1.8 to 2.7)
Dicloxacillin	58	1.2 (0.9 to 1.6)
Analgesics	370	7.9 (7.6 to 8.6)
Non-opioid analgesics	311	6.6 (5.9 to 7.4)
Paracetamol	277	5.9 (5.2 to 6.6)
Opioid analgesics	59	1.3 (0.9 to 1.6)
Codeine/paracetamol	55	1.2 (0.9 to 1.5)
Oxycodone	4	0.1 (0.0 to 0.2)
Tramadol	3	0.1 (0.0 to 0.1)
Anti-inflammatory and antirheumatic products	228	4.9 (4.2 to 5.5)
Ibuprofen	163	3.5 (2.9 to 4.0)
Meloxicam	11	0.3 (0.1 to 0.4)
Diclofenac (oral)	26	0.6 (0.3 to 0.8)
Diclofenac (topical)	35	0.8 (0.5 to 1.0)
Antifungals for dermatological use	354	7.5 (6.7 to 8.3)
Terbinafine (oral)	27	0.6 (0.4 to 0.8)
Terbinafine (topical)	67	1.4 (1.1 to 1.8)
Clotrimazole	117	2.5 (2.0 to 2.9)
Corticosteroids for dermatological use	120	2.6 (2.1 to 3.0)
Hydrocortisone	16	0.3 (0.2 to 0.5)
Procedures	997	21.2 (19.9 to 22.6)
Imaging	1185	25.2 (23.8 to 26.7)
Ultrasound	75	1.6 (1.2 to 2.0)
X-ray	1064	22.7 (21.3 to 24.0)
Pathology	272	5.8 (4.6 to 7.0)
Full blood count	38	0.8 (0.5 to 1.1)
C reactive protein	13	0.3 (0.1 to 0.4)
Nail scraping/culture	19	0.4 (0.2 to 0.6)
Skin swab/culture	16	0.3 (0.2 to 0.5)
Fungal scraping/culture	41	0.9 (0.6 to 1.1)
Counselling/advice/education	1192	25.4 (24.0 to 26.8)
Referral	749	16.0 (14.8 to 17.1)
Podiatrist	182	3.9 (3.3 to 4.5)
Orthopaedic surgeon	158	3.4 (2.8 to 3.9)
General surgeon	65	1.4 (1.0 to 1.7)
Physiotherapist	167	3.5 (3.0 to 4.1)

GPs, general practitioners.

used in the BEACH dataset that captures a problem as a symptom with as yet unknown diagnosis (eg, waiting test results for confirmation) and relevant management guidelines of the time.

Table 5 Management actions used by GPs for paediatric foot/ankle/leg problems, 2000–2016 for age groupings

Management action	0–4 years n=677		5–9 years n=772		10–14 years n=1824		15–18 years n=1421		Rate per 100 problems (95% CIs) or 15–18 years
	n	Rate per 100 problems (95% CIs)	n	Rate per 100 problems (95% CIs)	n	Rate per 100 problems (95% CIs)	n	Rate per 100 problems (95% CIs)	
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)	
Cephalixin	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)	
Flucloxacillin	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)	
Dicloxacillin	–	–	–	–	30	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 0.4)	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 (1.2 to 6.4)	138	17.9 (14.8 to 20.9)	452	24.8 (22.5 to 27.1)	347	24.4 (21.8 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

Table 5 Continued

Management action	0–4 years n=677		5–9 years n=772		10–14 years n=1824		Rate per 100 problems (95% CIs) for 10–14 years		Rate per 100 problems (95% CIs) for 15–18 years or 15–18 years	
	n	Rate per 100 problems (95% CIs)	n	Rate per 100 problems (95% CIs)	n	Rate per 100 problems (95% CIs)	n	Rate per 100 problems (95% CIs)	n	Rate per 100 problems (95% CIs)
Nail scraping/culture	2	0.3 (0.1 to 0.7)	3	0.4 (0.0 to 0.8)	4	0.4 (0.0 to 0.4)	10	0.2 (0.0 to 0.4)	10	0.2 (0.3 to 0.4)
Skin swab/culture	1	0.1 (0.0 to 0.4)	1	0.1 (0.0 to 0.4)	11	0.6 (0.2 to 1.0)	3	0.1 (0 to 0.5)	3	0.1 (0 to 0.5)
Fungal scraping/culture	8	1.2 (0.4 to 2.0)	8	1.0 (0.3 to 1.8)	16	0.9 (0.4 to 1.3)	9	0.6 (0.2 to 1.0)	9	0.6 (0.2 to 1.0)
Counselling/advice/education	179	21.2 (19.9 to 22.6)	214	27.7 (24.4 to 31.1)	471	25.8 (23.6 to 28.0)	328	23.1 (20.7 to 25.4)	328	23.1 (20.7 to 25.4)
Referral	157	23.2 (19.8 to 26.6)	112	14.5 (11.9 to 17.2)	277	15.2 (13.4 to 16.9)	203	14.3 (12.4 to 16.2)	203	14.3 (12.4 to 16.2)
Podiatrist	18	2.7 (1.3 to 4.1)	39	5.1 (3.5 to 6.6)	85	4.7 (3.7 to 3.1)	40	2.8 (2.0 to 3.7)	40	2.8 (2.0 to 3.7)
Orthopaedic surgeon	51	7.5 (5.5 to 9.5)	23	3.0 (1.8 to 4.2)	44	2.4 (1.7 to 3.1)	40	2.8 (1.9 to 3.7)	40	2.8 (1.9 to 3.7)
General surgeon	1	0.1 (0.0 to 0.4)	3	0.2 (0.0 to 0.8)	32	1.8 (1.1 to 2.4)	29	2.0 (1.3 to 2.8)	29	2.0 (1.3 to 2.8)
Physiotherapist	26	3.8 (2.4 to 5.3)	21	2.7 (1.5 to 3.9)	61	3.3 (2.5 to 4.2)	59	4.2 (3.1 to 5.2)	59	4.2 (3.1 to 5.2)

GPs, general practitioners.

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.³⁴ 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 apophyseal injuries are most prevalent.³ 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.³⁵ 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.³⁶

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.³⁷ Simple assessments and screening tools have been implemented to support general practice, such as the paediatric Gait, Legs and Spine screen³⁸ and free online generic health professionals training to improve paediatric musculoskeletal condition diagnoses.³⁹ These resources have been developed in acknowledgement of limited exposure to paediatric musculoskeletal conditions during medical training,⁴⁰ 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,⁴¹ knowledge deficits of the types of common paediatric musculoskeletal presentations⁴² and serious long-term consequences of some musculoskeletal conditions missed or misdiagnosed.³⁷ 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 2015,⁴³ 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-10,²² 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.

Author affiliations

¹School of Primary and Allied Health Care, Faculty of Medicine, Nursing and Health Sciences, Monash University, Frankston, Victoria, Australia

²Discipline of Podiatry, School of Allied Health, Human Services and Sport, La Trobe University, Bundoora, Victoria, Australia

³School of Public Health and Social Work, Queensland University of Technology, Brisbane, Queensland, Australia

⁴Allied Health Research Collaborative, The Prince Charles Hospital, Brisbane, Queensland, Australia

⁵WHO-CC for Strengthening Rehabilitation Capacity in Health Systems, School of Health Sciences, Faculty of Medicine and Health, The University of Sydney, Sydney, New South Wales, Australia

⁶Menzies Centre for Health Policy, School of Public Health, Faculty of Medicine and Health, University of Sydney, Parramatta, New South Wales, Australia

Twitter Cylie M Williams @cyliepaedspod

Acknowledgements We would like to thank the GPs who participated in the BEACH project for their generosity. We would also like to thank the BEACH team for collecting the data over the years. The BEACH study was conducted by the University of Sydney, and from April 1998 to March 2000, this was in collaboration with the Australian Institute of Health and Welfare.

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

Funding The BEACH project was funded through arm's length research agreements with the following organisations: Abbott Australasia, Award number: Not applicable (N/A); AbbVie, Award number: N/A; AstraZeneca (Australia)—Award number: N/A; Australian Government Department of Health, Award number: N/A; Australian Government Department of Veterans' Affairs, Award number: N/A; Aventis Pharma, Award number: N/A; Bayer Australia, Award number: N/A; bioCSL (Australia), Award number: (N/A); GlaxoSmithKline Australia, Award number: N/A; Janssen-Cilag, Award number: N/A; Merck, Sharp and Dohme (Australia), Award number: N/A; National Prescribing Service, Award number: N/A; Novartis Pharmaceuticals Australia; Pfizer Australia, Award number: N/A; Roche Products, Award number: N/A; Sanofi-Aventis Australia, Award number: N/A; Wyeth Australia, Award number: N/A. PAL is currently a National Health and Medical Research Council Early Career Research Fellow (ID: 1143435).

Disclaimer These funding organisations had no influence on the conceptualisation, design or conduct of the research, nor on the preparation of this paper.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval Ethical approvals for ongoing BEACH dataset research purposes were provided by the Human Research Ethics Committee of the University of Sydney (Ref: 2012/130) and (from 2000 to 2010) the Ethics Committee of the Australian Institute of Health and Welfare. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

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 This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Cylie M Williams <http://orcid.org/0000-0002-0223-9141>

Christopher Harrison <http://orcid.org/0000-0002-8769-6877>

REFERENCES

- 1 Pfeiffer M, Kotz R, Ledl T, *et al.* Prevalence of flat foot in preschool-aged children. *Pediatrics* 2006;118:634–9.
- 2 García-Rodríguez A, Martín-Jiménez F, Carnero-Varo M, *et al.* Flexible flat feet in children: a real problem? *Pediatrics* 1999;103:e84
- 3 Haines M, Pirlo L, Bowles K-A, *et al.* Describing frequencies of lower-limb Apophyseal injuries in children and adolescents: a systematic review. *Clin J Sport Med* 2022;32:433–9.
- 4 World Health Organization. *Guidelines on the management of chronic pain in children*, 2020.
- 5 Williams C, Robson K, Pacey V, *et al.* American and Australian family experiences while receiving a diagnosis or having treatment for idiopathic toe walking: a qualitative study. *BMJ Open* 2020;10:e035965.
- 6 Minden K, Niewerth M, Listing J, *et al.* Long-term outcome in patients with juvenile idiopathic arthritis. *Arthritis Rheum* 2002;46:2392–401.
- 7 National Collaborating Centre for Cancer. *Suspected cancer: recognition and referral*, 2015.
- 8 Baker A, Chen L-C, Elliott RA, *et al.* The impact of the 'Better Care Better Value' prescribing policy on the utilisation of angiotensin-converting enzyme inhibitors and angiotensin receptor blockers for treating hypertension in the UK primary care setting: longitudinal quasi-experimental design. *BMC Health Serv Res* 2015;15:1–15.
- 9 Forster AS, Doodhia H, Booth H, *et al.* Estimating the yield of NHS health checks in England: a population-based cohort study. *J Public Health* 2015;37:234–40.
- 10 Australian Government. Health and disability, Canberra. services Australia, 2021. Available: <https://www.servicesaustralia.gov.au/health-and-disability>
- 11 Services Australia. Medicare - What's covered, Cancerra. Australian Government, 2021. Available: <https://www.servicesaustralia.gov.au/whats-covered-medicare?context=60092>
- 12 Menz HB, Williams CM, Lazzarini PA, *et al.* Foot, ankle, and leg problems in Australian primary care: consultation patterns, management practices and costs 2022.
- 13 De Inocencio J. Epidemiology of musculoskeletal pain in primary care. *Arch Dis Child* 2004;89:431–4.
- 14 Henschke N, Harrison C, McKay D, *et al.* Musculoskeletal conditions in children and adolescents managed in Australian primary care. *BMC Musculoskelet Disord* 2014;15:1–8.
- 15 Prathivadi Bhayankaram N, Lacey RJ, Barnett LA, *et al.* Musculoskeletal consultations from childhood to adulthood: a longitudinal study. *J Public Health* 2020;42:e428–34.
- 16 Tan A, Strauss VY, Protheroe J, *et al.* Epidemiology of paediatric presentations with musculoskeletal problems in primary care. *BMC Musculoskelet Disord* 2018;19:1–6.
- 17 Britt H, Miller G. Beach program update. *Aust Fam Physician* 2015;44:411–4.
- 18 Family Medicine Research Centre. CAPS - Coding Atlas for Pharmaceutical Substances, Bettering the Evaluation and Care of Health (BEACH); 2018. Available: <http://sydney.edu.au/medicine/fmrc/caps/index.php>
- 19 World Health Organization Collaborating Centre for Drug Statistics Methodology. *Anatomical therapeutic chemical classification index with defined daily doses*. Oslo: World Health Organization, 2009.
- 20 Britt H. A new coding tool for computerised clinical systems in primary care-ICPC plus. *Aust Fam Physician* 1997;26 Suppl 2:S79–82.
- 21 Classification Committee of the World Organization of Family Doctors (WICC). *ICPC-2: International classification of primary care*. Geneva: World Health Organization, 1998.
- 22 World Health Organisation. *ICD-10: international statistical classification of diseases and related health problems*. Geneva: World Health Organisation, 2004.
- 23 Australian Bureau of Statistics. *Australian demographic statistics, Sep 2008 (3101.0)*. Canberra: Australian Bureau of Statistics, 2009.
- 24 Austin PC, Hux JE. A brief note on overlapping confidence intervals. *J Vasc Surg* 2002;36:194–5.
- 25 Saxena S, Majeed A, Jones M. Socioeconomic differences in childhood consultation rates in general practice in England and Wales: prospective cohort study. *BMJ* 1999;318:642–6.
- 26 Bouche G, Migeot V. Parental use of the Internet to seek health information and primary care utilisation for their child: a cross-sectional study. *BMC Public Health* 2008;8:1–9.
- 27 Jadhav SP, Swischuk LE. Commonly missed subtle skeletal injuries in children: a pictorial review. *Emerg Radiol* 2008;15:391–8.
- 28 McAdams RJ, Swidarski K, Clark RM, *et al.* Bicycle-related injuries among children treated in US emergency departments, 2006-2015. *Accid Anal Prev* 2018;118:11–17.
- 29 Rössler R, Junge A, Chomiak J, *et al.* Risk factors for football injuries in young players aged 7 to 12 years. *Scand J Med Sci Sports* 2018;28:1176–82.
- 30 Hotfiel T, Golditz T, Wegner J, *et al.* A cross-sectional study on foot loading patterns in elite soccer players of different ages. *J Back Musculoskelet Rehabil* 2020;33:939–46.
- 31 Venkatadass K, Sangeet G, Prasad VD, *et al.* Paediatric ankle fractures: guidelines to management. *Indian J Orthop* 2021;55:35–46.
- 32 Therapeutic Guidelines [digital]. Melbourne: therapeutic guidelines limited, 2021. Available: <https://tgldcdp.tg.org.au/etgcomplete>
- 33 King S, Chambers CT, Huguet A, *et al.* The epidemiology of chronic pain in children and adolescents revisited: a systematic review. *Pain* 2011;152:2729–38.
- 34 Omev ML, Micheli LJ. Foot and ankle problems in the young athlete. *Med Sci Sports Exerc* 1999;31:S470–86.
- 35 Malanga GA, Ramirez-Del Toro JA. Common injuries of the foot and ankle in the child and adolescent athlete. *Phys Med Rehabil Clin N Am* 2008;19:347–71.
- 36 Stinson J, Connelly M, Kamper SJ, *et al.* Models of care for addressing chronic musculoskeletal pain and health in children and adolescents. *Best Pract Res Clin Rheumatol* 2016;30:468–82.
- 37 Foster HE, Scott C, Tiderius CJ, *et al.* The paediatric global musculoskeletal task force - 'towards better MSK health for all'. *Pediatr Rheumatol* 2020;18:1–3.
- 38 Foster HE, Jandial S. pGALS – paediatric gait arms legs and spine: a simple examination of the musculoskeletal system. *Pediatric Rheumatology* 2013;11:1–7.
- 39 Newcastle University and Northumbria University. Paediatric musculoskeletal matters International (pmm), 2022. Available: <https://www.pmmonline.org/doctor>
- 40 Al Maini M, Al Weshahi Y, Foster HE, *et al.* A global perspective on the challenges and opportunities in learning about rheumatic and musculoskeletal diseases in undergraduate medical education. *Clin Rheumatol* 2020;39:627–42.
- 41 Jandial S, Myers A, Wise E, *et al.* Doctors likely to encounter children with musculoskeletal complaints have low confidence in their clinical skills. *J Pediatr* 2009;154:267–71.
- 42 Fallatah S, Felemban M, Farran A, *et al.* Awareness of common paediatric orthopaedic problems among paediatricians and family medicine physicians. *J Taibah Univ Med Sci* 2018;13:338–43.
- 43 Department of Health. VOPN paediatric orthopaedic referral guidelines, Melbourne. Victorian Government, 2015. Available: <https://www.health.vic.gov.au/patient-care/referrals-to-specialist-paediatric-orthopaedic-services>