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Isolated clubfoot in the Northern Territory of Australia: birth prevalence and population description

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Abstract

Background: Clubfoot prevalence in the Aboriginal and Torres Strait Islander population (hereafter Indigenous population) is reportedly higher than globally. This study enumerates and describes the isolated (also 'idiopathic') clubfoot population in Australia's Northern Territory (NT), where 30% of the population is Indigenous.

Methods: In this retrospective study, medical records were searched to identify all cases in the NT born in 2009–22 inclusive. Birth prevalence was calculated by using established methods. Logistic regression estimated odds ratios (ORs) and 95% confidence intervals (CIs) comparing characteristics of Indigenous with non-Indigenous babies with clubfoot.

Results: The birth prevalence of isolated clubfoot (150 cases/53 591 births) was 2.80/1000 (95% CI: 2.35–3.25). For 109 Indigenous babies, the prevalence was five times higher (5.99, 95% CI: 4.87–7.12) than for non-Indigenous babies (1.16, 95% CI: 0.84–1.56) and three times higher in Indigenous males (4.11, 95% CI: 3.35–4.86) than females (1.42, 95% CI: 0.96–1.88). Among babies with clubfoot, Indigenous babies with clubfoot were more likely to be male (OR = 2.68; 95% CI: 1.22–5.90; $P = 0.014$), from remote or very remote localities (OR = 14.24; CI: 5.98–33.90; $P < 0.001$), and have younger mothers (OR = 13.88; 95% CI: 3.90–49.39; $P < 0.001$).

Conclusion: The prevalence of isolated clubfoot in Australia's NT is higher than global estimates and other Australian reports, and disproportionately affects Indigenous babies. An Australian clubfoot register would be invaluable to improve the national understanding of prevalence patterns. Given the disproportionate prevalence in Indigenous babies, culturally responsive service provision, clinical outcomes, and experiences of their families warrant investigation.

Keywords: clubfoot; prevalence; congenital abnormalities; Northern Territory; Australian Aboriginal and Torres Strait Islander Peoples.

Key Messages

- This study estimated the birth prevalence and determined the characteristics of children in the Northern Territory (NT) born with isolated clubfoot by using multiple data sources.
- Birth prevalence of clubfoot in the NT is high compared with Australian and international reports, and is disproportionately higher for Indigenous babies who were more likely to be male, live in remote or very remote areas, and have younger mothers.
- This work confirms that Indigenous babies are overrepresented among those with clubfoot in the NT; that limitations in existing data sources may affect prevalence estimates; and that both a national clubfoot registry and qualitative, patient-centred research are needed.

Introduction

Clubfoot prevalence in the Australian Aboriginal and Torres Strait Islander population (hereafter respectfully Indigenous) is higher than global estimates.[1–3] In the Northern Territory (NT), where clubfoot prevalence has not been formally reported, Indigenous people comprise 30% of the population compared with 4% Australia-wide.[4] Strong cultural practices serve as a protective force for Indigenous families, with cultural determinants of health fostering resilience despite challenges across health, English-based education, employment, and housing.[5,6] Understanding clubfoot prevalence in the NT, particularly among Indigenous families, will inform service priorities and research in line with Indigenous perspectives and cultural values.

Clubfoot, or congenital talipes equinovarus (CTEV), is the most common congenital orthopaedic condition worldwide, affecting an estimated 176 000 births annually, with males typically affected twice as often as females.[3,7] The majority

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(75%–85%) of clubfoot is isolated (i.e. without an identifiable comorbid condition or syndrome at birth) and is characterized by stiffness in ankle equinus, hindfoot varus, cavus, and adductus of the forefoot.[7–9] Bilateral clubfoot is typically more severe and more common than unilateral cases, and the features of left and right feet are correlated.[10] Although the aetiology of clubfoot is unknown, multifactorial (genetic and environmental) factors appear involved.[7] Unlike positional talipes, which presents similarly but is flexible and resolves soon after birth,[11] untreated clubfoot leads to disability.[12] Further investigation of clubfoot characteristics and the prevalence in Australia is required.

Globally, clubfoot prevalence is 1.18/1000 births.[3] In Australia, isolated clubfoot prevalence has been investigated in only two regions. In Western Australian (WA), the prevalence was 1.25/1000 in the general population compared with 3.49/1000 for babies born to Indigenous mothers[1] and Indigenous maternity was a risk factor [odds ratio (OR) 2.82].[13] In South Australia (SA), the prevalence was 1.1/1000, with an Indigenous maternity risk factor (OR 2.0).[2] Anecdotal evidence from NT clinicians who manage clubfoot is consistent with these studies, suggesting over-representation of Indigenous Australians and the need to formally evaluate clubfoot in the NT.

There is limited Australian literature about clubfoot prevalence and formal studies in the NT are lacking. To establish the extent of isolated clubfoot in the NT, the aim of this study was to enumerate and then describe the characteristics of babies with isolated clubfoot. This permitted the first reliable estimate of the birth prevalence of isolated clubfoot for the NT.

Methods

Study design

We conducted a retrospective study under the stewardship of a senior Indigenous community leader, researcher, and health professional (S.T.).

Setting

The NT is a unique geographical and cultural region of Australia. Covering 1.3 million km^2, this sparsely populated region encompasses 17% of Australia's land mass, yet is home to just 1% of the population.[14,15] Of nearly 250 000 people, the NT population includes ~75 000 Indigenous people (30% compared with 4% nationally), who mostly live in remote or very remote areas (73% compared with 15% nationally).[4,15] Remoteness limits access to health services. Remote primary health clinics operated by Aboriginal Community Controlled Health Organisations (ACCHOs) and NT Health (the NT government-funded health service) provide essential care, yet many people, including those with clubfoot, must travel hundreds of kilometres by road, air, or sea to larger centres for specialist care.

Established clinical practice in the NT is that, at birth, babies with clubfoot are referred to NT Health clubfoot physiotherapists to coordinate care. Almost all births (97%) in the NT occur in hospitals and all births have routine screening by medical professionals at the earliest opportunity.[16] Of six hospitals with birthing services, only the two largest NT Health-operated centres provide clubfoot services. Expert physiotherapist assessment is provided at birth in those hospitals or via telehealth with subsequent travel to a larger centre for further management. The gold-standard Ponseti method is standard care, involving initial correction via serial plaster casts and Achilles tenotomy, then maintenance via long-term bracing.[17]

Sources

We examined clinical records of all babies born with clubfoot in the NT during the 14-year period from 1 January 2009 to 31 December 2022. Several sources of information were examined to ascertain potential cases of isolated clubfoot:

- Case-management databases maintained by physiotherapy services were examined for clubfoot cases.
- The NT Midwives Collection (NTMC), which includes the Congenital Anomalies Register, within the NT Perinatal Registry (NTPR) was examined for recorded births in which 'clubfoot', 'talipes', 'CTEV', or derivatives were included within the condition description.
- Hospital admission data were examined for ICD-10-AM codes of 'Q66' (congenital deformities of feet) and all derivatives.[18]

Data from all sources were merged and duplicates removed. Potential cases underwent desktop audit, reviewing available electronic information such as birth admission, discharge summary, letters, operation records, and non-hospital clinic records. A full primary hardcopy medical record audit was undertaken if it was impossible to exclude isolated clubfoot via desktop audit or to differentiate between isolated clubfoot, positional talipes, syndromic clubfoot, and other foot presentations.

Inclusion and exclusion criteria

Isolated clubfoot was defined as a foot with fixed plantarflexion, supination, and adduction in the absence of any known congenital condition or syndrome in the neonatal period.[9] Babies were candidates for the analysis if born to NT residents with a documented diagnosis of clubfoot (confirmed by orthopaedic, paediatric, or physiotherapy consultation) or a sufficient description of the foot that met this definition. Other foot and toe deformities were excluded. Where 'talipes' was recorded in the NTMC yet neither electronic nor full hardcopy records revealed evidence of any foot condition, the case was taken to be transient positional talipes and excluded. Interstate births to NT residents were included if the birth history was available within NT records.

Data compilation, management, and storage

After ascertainment, a custom data-extraction tool was applied to all electronic and hardcopy records of confirmed cases (Supplementary Material). The tool, data-collection guide, and protocol were developed a priori by K.P. (senior physiotherapist), R.B. (physiotherapy researcher), and A.C. (epidemiologist). REDCap (Research Electronic Data Capture)[19,20] was used to record and secure demographic, obstetric, and birth information; clinical measures; outcomes; and events. Clubfoot clinical outcomes will be presented in a separate study. Additional maternal data not available in the medical records of infants were sourced from the NTPR.

Variables

Variables used to describe infant characteristics (Supplementary Table S1) included sex, birthweight,

gestational age, length, head circumference, laterality of clubfoot, and family history of clubfoot. The severity of clubfoot, indicated by the earliest Pirani score, was also recorded.[21] Variables used to describe maternal factors (Supplementary Table S1) included mother's age, remoteness index [Modified Monash Model (MMM)],[22] distance from home to treatment centre, diabetes status, body mass index (BMI), birth parity, birth presentation, and smoking or alcohol use during pregnancy.

Data analysis

The birth prevalence [/1000 live births, 95% confidence interval (CI)] was calculated by following established methods using the isolated clubfoot cases as the numerator and all live births in the NT during the observation period as the denominator.[23] Denominator data were obtained from the NTPR of all live births in the NT by year, ethnicity, and sex. Information was not sourced for fetal deaths or terminations.

Characteristics of Indigenous babies with clubfoot were compared with characteristics of non-Indigenous babies with clubfoot by using IBM SPSS.[24] For categorical variables, ORs and 95% CIs were calculated by using binary logistic regression. For numeric variables, comparisons were made by using independent *t*-tests or Mann–Whitney *U* tests for normally and non-normally distributed data, respectively.

Results

Case identification

Sources were combined to identify cases of isolated clubfoot in the NT (Fig. 1). Physiotherapy case-management databases contained 191 potential cases, the NTMC contained 152 potential cases, and ICD-10-AM coding data contained 1222 potential cases. After duplicates were removed, 1051 records were screened. Desktop audit excluded 277 cases, then 774 underwent full medical record audit. This confirmed 150 babies with isolated clubfoot in the observation period (Fig. 1).

Clubfoot diagnosis was not easily confirmed within the NTMC or coding sources due to the use of ambiguous terminology and umbrella codes. Within the NTMC, the term 'talipes' was the most common label used (57%), but was applied to both clubfoot and positional talipes (45% and 40% of uses, respectively). 'Clubfoot' was used infrequently, although usually (92%) correctly (Supplementary Table S2A). Within the coding data, seven different ICD-10-AM codes were used for isolated clubfoot cases. Umbrella codes, which include but are not exclusive to clubfoot, were used most (50% of codes overall), with 24% of umbrella codes applied to cases of clubfoot and 64% to positional talipes. The single specific clubfoot code for both isolated and syndromic cases was used for 9% of clubfoot cases (Supplementary Table S2B). The non-specific terminology within the NTMC and the use of umbrella ICD-10-AM codes meant that neither source alone could accurately ascertain all cases of isolated clubfoot.

Characteristics of clubfoot cases

Among 150 babies with isolated clubfoot (hereafter 'clubfoot'), 109 (73%) were Indigenous, 113 (75%) were male, 85 (57%) were unilateral cases [of them, 49 (58%) right-sided], and the gestational age ranged from 30 to 41 weeks (median: 39 weeks), including 25 (17%) preterm babies. The mean maternal age was 27 years (range: 13–44 years, SD: 6.1 years), 49 (33%) babies were the mother's firstborn, 11 (7%) were breech at delivery, and 31 (21%) had a first- or second-degree relative with clubfoot. Most (73%) were from remote or very remote areas, with a mean direct distance from home to clubfoot management of 222 km (Table 1).

Prevalence

During the study period, 53 591 live births were recorded. For 150 clubfoot cases, the overall birth prevalence for the period was 2.80/1000 (95% CI: 2.38–3.27). The prevalence was five times higher for Indigenous (5.99/1000, 95% CI: 4.95–7.20) compared with non-Indigenous (1.16/1000, 95% CI: 0.84–1.56) babies. The prevalence in males compared with females was 3 times greater, 1.5 times greater for non-Indigenous males, and 4 times greater for Indigenous males. The subgroup prevalence is detailed in Table 2. No trend in the numbers of clubfoot births over the observation period was evident (Supplementary Fig. S1).

Comparison of Indigenous with non-Indigenous babies

Indigenous babies with clubfoot compared with non-Indigenous babies with clubfoot were more likely to be male (OR = 2.68; 95% CI: 1.22–5.90; $P = 0.014$), live in remote or very remote areas (OR = 14.24; CI: 5.98–33.90; $P < 0.001$), and have younger mothers (OR = 13.88, 95% CI: 3.90–49.39; $P < 0.001$). Mothers of Indigenous babies with clubfoot were younger [mean age = 25 years (SD = 5.8 years) and 30 years (SD = 5.7 years), respectively; $|t|(148) = 4.42$; $P < 0.001$)] and more likely to report smoking (OR = 17.41; 95% CI: 3.93–77.08; $P < 0.001$) or alcohol use (OR = 4.63; 95% CI: 1.03–20.89; $P = 0.046$) during pregnancy. No differences were found between groups for birthweight, gestational age, birth length, head circumference, bilateral/unilateral clubfoot, maternal diabetes, BMI, firstborn, breech presentation, or family history (Table 1).

Severity

No difference in the severity of clubfoot between Indigenous and non-Indigenous groups was seen. The median Pirani score for all 215 feet was 5.0 overall and for both subgroups. The Pirani score ranged from 1.0 to 6.0 for non-Indigenous and 1.5 to 6.0 for Indigenous babies, and, in both groups, ~60% scored ≥5.0 (Supplementary Fig. S2). No difference in severity between the feet of babies with bilateral clubfoot was seen (Related Samples Sign Test $P = 0.648$).[25,26]

Discussion

This is the first study to describe the birth prevalence and characteristics of isolated clubfoot in the NT. The overall birth prevalence was 2.80/1000, with a five times higher prevalence for Indigenous babies (5.99/1000) than for non-Indigenous babies (1.16/1000). Among babies with clubfoot, Indigenous babies were more likely to be male, live in remote areas, and have younger mothers who reported smoking or alcohol use during pregnancy. These findings—among the highest prevalence rates globally—warrant further investigation.

We have identified that the NT has the highest prevalence of clubfoot reported in Australia, particularly for Indigenous Australians. While interstate non-Indigenous rates are comparable, rates for Indigenous babies are five times higher than

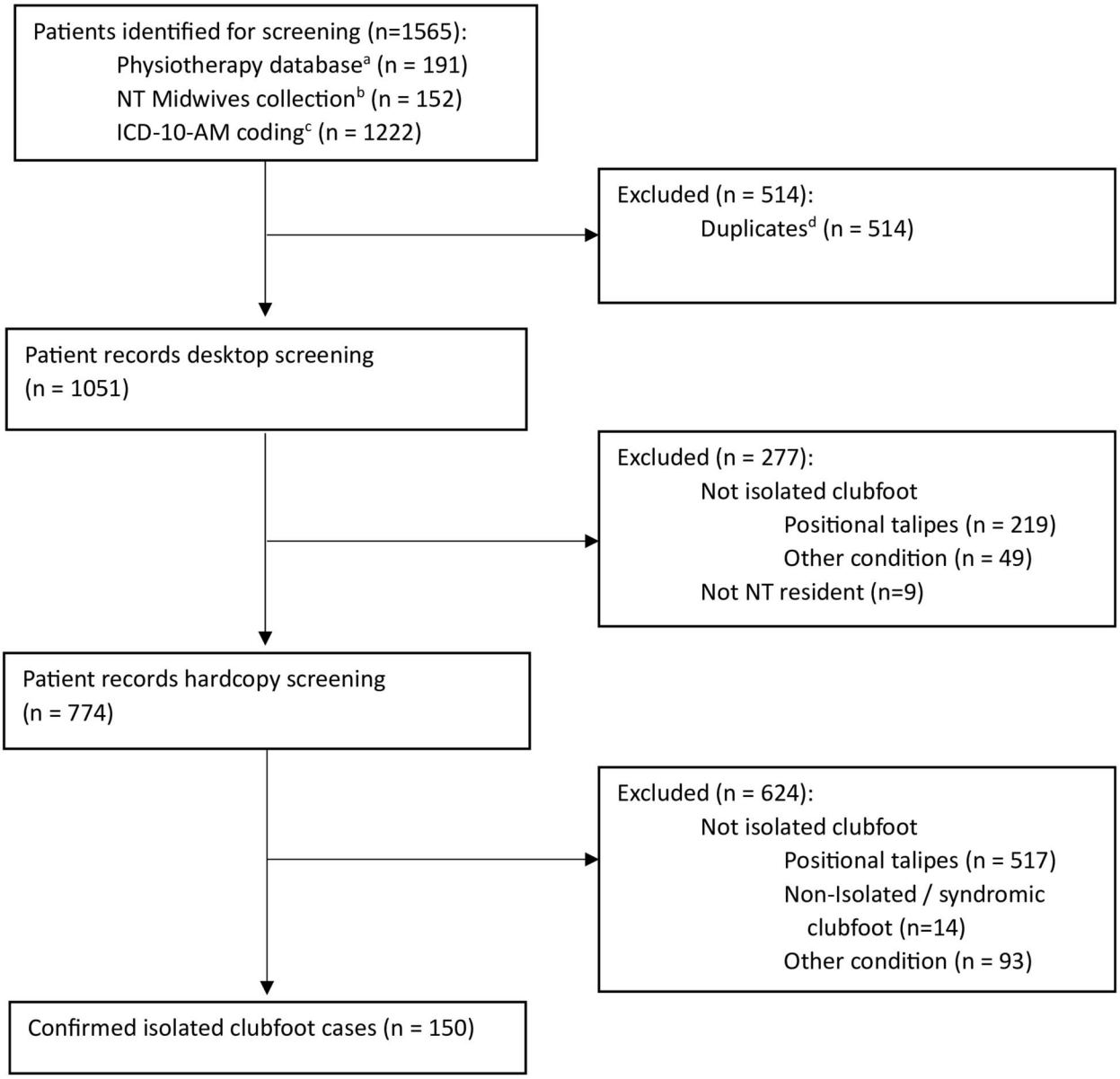

Figure 1. Isolated clubfoot case ascertainment screening flowchart. [a]Physiotherapy databases include all patients treated with serial casting for congenital abnormalities, not just clubfoot. [b]NT Midwives Collection includes the Congenital Anomalies Register within the NTPR. Entries were included that recorded 'clubfoot', 'talipes', 'CTEV', or related terms within the condition description. [c]Coding data for admissions during the study period in NT Health hospitals according to ICD-10-AM 6th–12th editions. [d]Repeated admissions for individuals resulted in duplicates within the coding data.

those for non-Indigenous babies in the NT (5.99 vs 1.16), three times higher than those in WA (3.46 vs 1.11),[1] and twice as high as those in SA (2.1 vs 1.0)[2] (calculations shown in Supplementary Tables S3–S5). Given that 73% of babies with clubfoot in the NT are Indigenous and the disproportionate rate of clubfoot prevalence, consultation with Indigenous people and communities regarding further research in the NT and throughout Australia is warranted.

We found that, in the NT, like WA, clubfoot was four times more common in Indigenous males than in Indigenous females.[1] Typically, clubfoot shows a 2:1 male-to-female ratio, suggesting a stronger-than-typical tendency in Indigenous males compared with non-Indigenous males.[7] While there could be genetic explanations for this, given the controversial history of genetic testing with Indigenous people,[27] an important next step in the NT will be to collaborate with Indigenous people to understand the importance of clubfoot itself before that of potential inheritance patterns, and for that to guide future research directions.

Some findings reflect the characteristics of the NT population overall and should be interpreted cautiously. Indigenous babies with clubfoot predominantly live in remote areas, reflecting the NT population distribution.[28] Consequently, access to care requires long-distance travel and separation from family, community, and culture. With 76 remote communities and ~600 homelands in the NT,[29,30] remote clubfoot services warrant exploration with ACCHOs and government services. Additionally, Indigenous people, including expectant mothers, report higher smoking and alcohol rates compared with non-Indigenous counterparts, especially in remote areas.[5,31–33] Similarly, Indigenous mothers are younger throughout Australia, the NT, and in our study (mean age 27, 26, and 25 years, respectively) than non-Indigenous mothers (mean age 31, 31, and 30 years,

Table 1. Maternal and infant characteristics of NT isolated clubfoot in 2009–22 comparing Indigenous and non-Indigenous subgroups

	Non-Indigenous (n = 41)	Indigenous (n = 109)	Total (n = 150)	Unadjusted OR	95% CI	*P*-value
Infant factors						
Sex						
Female	16	21	37	1.00		
Male	25	88	113	2.68	1.22, 5.90	**0.014**
Birthweight (g) ($n = 149$)						
≥2500	38	89	127	1.00		
<2500	3	19	22	2.70	0.76, 9.68	0.126
Gestational age (weeks) ($n = 149$)						
Term	36	88	124	1.00		
Preterm	5	20	25	1.64	0.57, 4.69	0.360
Birth length[a] (cm)						
Median (min–max)	49 (43.5–54)	49 (39–55)	49 (39–55)	|z|= –0.547	–	0.585
Head circumference[a] (cm)						
Median (min–max)	34.5 (31.2–38.5)	34.5 (27–37)	34.5 (27–38.5)	|z|= –1.132	–	0.258
Laterality						
Bilateral	18	47	65	1.00		
Unilateral	23	62	85	0.97	0.47, 2.00	0.931
Maternal factors						
Mother's age[b] (years)						
<24	6	53	59	13.88	3.90, 49.39	**<0.001**
25–29	15	31	46	3.25	1.05, 10.06	**0.041**
30–34	9	18	27	3.14	0.91, 10.86	0.070
≥35	11	7	18	1.00		
Remoteness[c]						
Regional or rural	27	13	40	1.00		
Remote or very remote	14	96	110	14.24	5.98, 33.90	**<0.001**
Distance[a] (km)						
Median (min–max)	18 (0.5–657)	256 (1.2–685)	222 (0.5–685)	|z|=5.14	–	**<0.001**
Diabetes ($n = 149$)						
No	33	80	113	1.00		
Yes	8	28	36	1.44	0.60, 3.50	0.416
Mother's BMI						
Mean (SD)	27.20 (5.87)	26.13 (7.27)	26.49 (6.82)	|t|= 0.726	–1.86, 4.01	0.469
Firstborn						
No	24	77	101	1.70	0.81, 3.59	0.161
Yes	17	32	49	1.00		
Breech ($n = 148$)						
No	37	100	137	1.00		
Yes	4	7	11	0.65	0.18, 2.34	0.507
Family history						
None, unknown, or distant	33	86	119	1.00		
First- or second-degree	8	23	31	1.10	0.45, 2.71	0.830
Smoking during pregnancy ($n = 121$)						
No	34	42	76	1.00		
Yes	2	43	45	17.41	3.93, 77.08	**<0.001**
Alcohol during pregnancy ($n = 140$)						
No	39	80	119	1.00		
Yes	2	19	21	4.63	1.03, 20.89	**0.046**

[a] Not normally distributed, Mann–Witney *U* test, |z| reported.
[b] Australian Institute of Health and Welfare categories,[41] collapsed as needed to ensure $n > 5$.
[c] MMM;[28] note that the NT does not have any regions classified as MMM 1, 3, or 4.

respectively).[34,35] Although this study does not investigate the risk factors for clubfoot itself, it is noteworthy that maternal smoking and Indigenous maternity are recognized risk factors, whereas alcohol use and maternal age lack association.[13,36] The potential impact of these characteristics and other social determinants of health on clubfoot prevalence needs careful attention.

The high prevalence of clubfoot among First Nations groups has been previously reported. Studies reporting Māori[37] and Hawaiian[38] prevalence groups (8 and 7/1000, respectively) are frequently cited, but the primary evidence is equivocal, minimal, and dated. In other ethnically diverse groups, prevalence patterns are unclear. A US study that pooled birth defect registry (BDR) data from 10 states found a slightly lower prevalence for African American, Hispanic, and Asian people and no difference for Native American people compared with non-Hispanic White people.[39] In other North American studies, no differences or a lower prevalence

Table 2. Cases, total births, and calculated birth prevalence of isolated clubfoot in the NT by ethnicity and sex

Group	Cases (C)	Births (B)	Prevalence per 1000 births (C/B × 1000)	95% CI
NT total	150	53 591	2.80	2.38–3.72
Indigenous	109	18 187	5.99	4.95–7.20
Non-Indigenous	41	35 378	1.16	0.84–1.56
Males total	113	27 521	4.11	3.40–4.92
Indigenous	88	9531	9.23	7.46–11.31
Non-Indigenous	25	17 990	1.39	0.92–2.02
Females total	37	26 064	1.42	1.02–1.93
Indigenous	21	8980	2.34	1.49–3.51
Non-Indigenous	16	17 084	0.94	0.56–1.48

was found between ethnic groups.[40–42] The prevalence for Black South Africans was 1.5–3.5/1000, varying between tribal groups and between urban and rural areas.[43–45] The paucity of contemporary, comparable, quality data suggests a need to explore clubfoot with ethnically diverse and Indigenous populations.

A comparison of clubfoot prevalence estimates nationally and globally is difficult due to differing methodologies and therefore requires caution. For example, prevalence estimates in WA and SA identified cases through a BDR and included stillbirths and late terminations, which we deemed unnecessary.[23] The SA study confirmed cases with medical record review, leading to the exclusion of 15% of the cases.[2] We have demonstrated that, without multiple sources and full record reviews, many true cases would have been missed and hundreds of false cases could have been included (Supplementary Tables S2A and S2B). A recent global estimate of clubfoot prevalence included 35 studies, although none was from Australia.[3] Only four included studies (India[46–48], Nigeria[49]) reported a prevalence that was comparable to or higher than that in the NT (2.79–4.23/1000). However, these were single-hospital BDR studies that were not exclusive to clubfoot, lacked detail regarding ascertainment, and did not report the differentiation of isolated from non-isolated cases, and thus could have been overestimates. We have shown that, without rigorous ascertainment processes, single-source BDR studies may report the prevalence of clubfoot inaccurately. In our study, with careful ascertainment processes, utilizing all conceivable sources to confirm cases, our confidence is high that the clubfoot prevalence has been accurately established for the NT.

Limitations

Limitations have largely arisen from the challenges of retrospective medical record audits and from sourcing data that were not collected for our research purposes.[50] Non-specific diagnostic terminology and the use of umbrella rather than precise ICD-10-AM codes for clubfoot have reduced the confidence in these datasets, requiring verification through full medical audit. Correctly applied umbrella codes, while not incorrect, are imprecise. Consistent, accurate nomenclature (e.g. eliminating the ambiguous term 'talipes' from the paediatric lexicon) and use of the available specific codes for clubfoot could reduce the need for a record audit to obtain accurate data. Generalizing our prevalence findings requires caution given the unique cultural setting, small population, and small absolute number of cases ($n = 150$) in the NT. Additionally, some cases classified as isolated clubfoot at birth may later have been diagnosed with comorbidities that would have then excluded them from our analysis. Social determinants are important confounders of health outcomes[5,51] (e.g. socioeconomic status) but were not available. More importantly, cultural determinants of health must be considered in the future, as Indigenous cultural practices and traditional lifestyles are common in the NT and are a protective force for families and communities.[6,52,53] The mismatch between Indigenous cultural values and the delivery of mainstream Australian healthcare must be acknowledged and addressed.[54–56]

Strengths

The principal strength of our study is its meticulous ascertainment process. We reviewed electronic records for every potential case and, despite the vast regional coverage, audited complete medical records across the NT to confirm cases and gather data. Combining coding, registry, and clinical data strengthened our findings compared with studies using only one source, and we have shown that code- or registry-based data alone may incorrectly inform prevalence estimates.

Further research

Further systematic epidemiological studies would be invaluable for service mapping and addressing areas of need. Identifying modifiable factors associated with the risk of clubfoot among Indigenous people would be valuable, but, most importantly, research with Indigenous families who have experienced clubfoot will ensure that service providers can recognize and meet the needs of this population.

Establishing a high-quality clubfoot-specific registry across Australia with comprehensive demographic and clinical data would enhance data quality, linkage, evaluation, and interpretation. It would also facilitate high-quality Australia-wide clubfoot research, which is lacking. To achieve this, collaboration across clinical, coding, and data-management fields to standardize terminology, measures, and reporting processes is required. In the absence of such a registry, our ascertainment methodology could serve as a template for accurately determining clubfoot prevalence.

Conclusion

Clubfoot prevalence in the NT, especially for Indigenous people, is disproportionately high compared with national and global data. Clinically, this highlights the need to align clubfoot services with the needs of recipients—in this case, developing and embedding culturally responsive care. The establishment of a national clubfoot registry and qualitative research to understand the implications of clubfoot for Indigenous people in the NT is recommended.

Ethics approval

The Human Research Ethics Committee of NT Health and Menzies School of Health Research provided approval (HREC 2021-3989).

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Author contributions

K.P., R.B., A.C., and S.T. designed the study. R.B. and A.C. directed the study implementation. K.P. conducted data collection. K.P. and A.C. designed the analytical strategy, analysed the data, and drafted the manuscript with revisions and input from R.B. and S.T. K.P. is the guarantor for the integrity of this work.

Supplementary data

Supplementary data are available at *IJE* online.

Conflict of interest: None declared.

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Data availability

Data are available upon request to the corresponding author.

Use of artificial intelligence (AI) tools

AI was not used in the design, data collection, or analysis of the data, or for the generation of the written material. AI (Copilot) was used minimally to aid in concision and grammar.

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