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ORIGINAL RESEARCH

Paediatric fever management practices and antipyretic use among doctors and nurses in New Zealand emergency departments

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Abstract

Objectives: To assess (i) paediatric fever management practices among New Zealand ED doctors and nurses, including adherence to best practice guidelines; and (ii) the acceptability of a randomised controlled trial (RCT) of antipyretics for relief of discomfort in young children.

Methods: A cross-sectional survey of doctors and nurses across 11 New Zealand EDs. The primary outcome of adherence to paediatric fever management best practice guidelines was assessed with clinical vignettes and defined as single antipyretic use for the relief of fever-related discomfort.

Results: Out of 602 participants (243 doctors, 353 nurses and six unknown; response rate 47.5%), only 64 (10.6%, 95% confidence interval [CI] 8.3–13.4%) demonstrated adherence to best practice guidelines. In a febrile settled child with normal fluid intake, the percentage of participants that would use antipyretics doubled with abnormal vital signs (33.7% *vs* 72.9%, difference −39.2%, 95% CI –44.4% to −34.0%). Most participants would use antipyretics for reduced fluid intake ($n = 494$, 82.1%, 95% CI 78.8–85.0%) in a febrile settled child. Over half ($n = 339$, 57.1%, 95% CI 53.0–61.1%) would advise giving antipyretics to prevent febrile convulsions. Most ($n = 467$, 80.0%, 95% CI 76.5–83.1%) participants agreed that a RCT of antipyretics in febrile children <2 years of age with relief of discomfort as a primary outcome is needed.

Conclusions: Just over 10% of New Zealand ED doctors and nurses demonstrated adherence to paediatric fever management best practice guidelines. A RCT of antipyretics in febrile children <2 years of age specifically

Key findings

- Just over 10% of ED doctors and nurses in New Zealand adhered to best practice guidelines for antipyretic use in febrile children <2 years of age when presented with clinical vignettes.
- Abnormal vital signs, reduced fluid intake and a history of febrile convulsions are key drivers for antipyretic use in febrile children.
- A randomised controlled trial of antipyretics in febrile children <2 years of age specifically addressing relief of discomfort as a primary outcome is strongly supported.

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Key words: *child health, emergency medicine, fever, ibuprofen, paracetamol.*

Introduction

Fever is one of the most common reasons children are taken to the ED for evaluation, representing up to one-third of all paediatric ED visits.[1] Fever in itself is not an illness, but is part of the body's physiological and protective response against infection.[2,3] Despite its immunological benefits, there is a common perception that fever is maladaptive and harmful for children, and fever remains a cause for considerable concern and anxiety. This phenomenon, termed 'fever phobia', has been well-described among caregivers and clinicians over the last four decades.[2,4–7] Fever phobia leads to inappropriate utilisation of healthcare resources, overly aggressive treatment of fever and intensive antipyretic regimens, potentially placing children at undue risk of toxicity and dosing errors.[2,4,7]

To address misconceptions about fever management, best practice guidelines published by the National Institute for Health and Care Excellence (NICE)[8] and the American Academy of Pediatrics (AAP)[3] recommend that antipyretic use in febrile children be for relief of discomfort, rather than for the sole purpose of temperature reduction. Despite dissemination of such guidelines for over a decade, recent studies have shown that non-adherence to guidelines and fever management practice variation remain commonplace among primary care and paediatric doctors[9–12] and nurses,[5,10,13] contributing to caregiver confusion and fever phobia.[13,14]

Reasons for practice variability are likely multifactorial. The lack of a clear definition of discomfort and the subjectivity of such an evaluation are contributory. Further, there is a paucity of evidence regarding the relative efficacy and safety of antipyretics in relieving discomfort from fever.[3,15] Randomised controlled trials (RCTs) of different approaches to managing fever in children <2 years of age that specifically address relief of discomfort as a primary outcome are needed.[15] To determine the feasibility and inform the design of such a trial, it is necessary to understand current practice. Studies of fever management by healthcare professionals in the ED setting are scarce. Most studies involving ED nurses are at least two decades old,[14] well before the availability of best practice guidelines in the literature, and none of the recent studies have included ED doctors,[9–12] highlighting the need to explore this integral aspect of paediatric emergency care.

The objectives of this paper are twofold: (i) describe the fever management practices and antipyretic use among ED doctors and nurses in children <2 years of age and assess adherence to best practice guidelines for fever; and (ii) determine the acceptability of a RCT of paracetamol *versus* ibuprofen in febrile children <2 years of age for relief of discomfort.

Methods

Design, setting and participants

We conducted a cross-sectional survey of ED doctors and nurses across 11 EDs within the New Zealand Emergency Medicine Research Network. Full- or part-time ED doctors and nurses who worked at least one shift per week (on average) in an ED treating children <2 years of age were eligible to participate. House officers rotating through ED placement (postgraduate year two or less), temporary nursing agency staff or medical locum tenens were excluded.

Local site investigators at each participating ED were encouraged to use a tailored approach to participant recruitment, including posters, face-to-face recruitment and promotion through emails and social media.

Survey instrument and distribution

The survey consisted of five sections: participant information and consent, demographics, fever management and antipyretic use, factors influencing fever management and antipyretic use, and willingness to participate in a proposed RCT (Appendix S1). To examine fever management practices and assess adherence to best practice guidelines, we constructed clinical vignettes in accordance with recommendations for vignette design and administration.[16,17] To determine willingness to participate in a proposed RCT, we used a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), with secondary questions focusing on key aspects of RCT design. The questionnaire was pilot-tested for applicability, acceptability and clarity by nine doctors and two nurses.

The survey was accessed and completed anonymously by participants using an online link emailed to local site investigators for distribution. The survey required 10–15 min to complete and was open for a period of 8 weeks from the start of recruitment at each site. Survey data were collected and managed using REDCap electronic data capture tools[18] hosted at the University of Auckland.

Outcomes

The primary outcome was adherence to best practice guidelines for antipyretic use in febrile children. Adherence was defined as single antipyretic use for the relief of patient discomfort, rather than for the sole purpose of temperature reduction, in line with published NICE[8] and the AAP[3] guidelines (Appendix S2). Secondary outcomes included antipyretic use for temperature reduction, antipyretic use for reduced fluid intake, alternating antipyretic use, combined antipyretic use, antipyretic use for prevention of febrile convulsions, use of clinical practice guidelines, use of patient information sheets and willingness to participate in a RCT of paracetamol *versus* ibuprofen in febrile children <2 years of age.

Data analysis

Data were analysed using Stata/BE 17 (StataCorp 2021, College Station, TX, USA). Ethnicity was prioritised as per the New Zealand Ministry of Health ethnicity data protocols.[19] Responses to questions using Likert

scales were collapsed such that 'strongly agree' and 'agree', and 'very likely' and 'likely', were treated as a 'positive' response. Differences in demographic characteristics between doctors and nurses were compared using the X^2 test. The absolute difference in the percentage adherence to recommended practice between doctors and nurses was estimated using a two-sample *z*-test of proportions. A *post hoc* logistic regression of the primary outcome of adherence was conducted, adjusted for profession, years of experience, role seniority, paediatric-specific qualifications and ethnicity. A two-tailed $P < 0.05$ was considered statistically significant.

The present study was conducted and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.[20] Ethical approval was granted by the Auckland Health Research Ethics Committee (AH21928).

Results

Between May and September 2021, the survey was sent to 1267 ED doctors and nurses (391 doctors, 876 nurses), of whom 618 completed the survey. Of these, 16 did not have data available for the primary outcome and were excluded. A total of 602 participants (243 doctors, 353 nurses and six unknown) were included in the analysis, with an overall response rate of 47.5% (602/1267; doctors 243/391, 62.1%; nurses 353/876, 40.3%).

Most participants were European ($n = 475$, 78.9%) and worked in a major referral centre ($n = 311$, 51.8%). Only a minority of participants ($n = 105$, 17.5%) had paediatric-specific qualifications. Compared to nurses, fewer doctors identified as Māori (4/243, 1.7% *vs* 16/353, 4.5%) and more doctors identified as Middle Eastern, Latin American, African or other non-European (20/243, 8.2% *vs* 10/353, 2.8%) ($P = 0.01$) (Table 1). Compared to nurses, fewer doctors had less than 5 years of professional experience (27/243, 11.1% *vs* 79/352, 22.4%; $P < 0.01$) and more doctors had a senior clinical role (151/243, 62.1% *vs* 86/353, 24.4%; $P < 0.01$) (Table 1).

TABLE 1. *Participant characteristics*

	All participants		Doctors†		Nurses†	
	N	*n* (%)	*N*	*n* (%)	*N*	*n* (%)
Ethnicity (prioritised)	602		243		353	
Māori		20 (3.3)		4 (1.7)		16 (4.5)
Pasifika		12 (2.0)		7 (2.9)		5 (1.4)
Asian		65 (10.8)		24 (9.9)		40 (11.3)
MELAA + other non-European		30 (5.0)		20 (8.2)		10 (2.8)
European		475 (78.9)		188 (77.4)		282 (79.9)
Type of ED (ACEM designation)‡	600		242		353	
Major referral		311 (51.8)		136 (56.2)		172 (48.7)
Urban district		120 (20.0)		55 (22.7)		65 (18.4)
Regional referral/other		169 (28.2)		51 (21.1)		116 (32.9)
Years of experience in profession‡	600		243		352	
0–4		107 (17.8)		27 (11.1)		79 (22.4)
5–9		145 (24.2)		57 (23.5)		87 (24.7)
10–14		120 (20.0)		56 (23.1)		63 (17.9)
≥15		228 (38.0)		103 (42.4)		123 (34.9)
Clinical role – senior‡§	596	237 (39.8)	243	151 (62.1)	353	86 (24.4)
Paediatric-specific qualifications‡¶	600	105 (17.5)	243	49 (20.2)	352	56 (15.9)

†Profession was not provided by six participants. ‡Data were missing for the following questions: type of ED ($n = 2$), years of experience in profession ($n = 2$), clinical role ($n = 6$) and paediatric-specific qualifications ($n = 2$). §Senior doctor role includes consultant, fellow, medical officer special scale; senior nurse role includes advanced practice nurse (clinical nurse specialist and nurse practitioner), nurse educator, clinical coach, charge nurse; junior doctor role includes registrars; junior nurse role includes registered nurse, enrolled nurse. ¶Includes Nursing Masters, Diploma of Paediatrics, Fellowship in Paediatrics, subspecialty ACEM training in paediatric emergency medicine. ACEM, Australasian College for Emergency Medicine; MELAA, Middle Eastern, Latin American and African.

TABLE 2. *Fever management practices*

	All participants		Doctors†		Nurses†		Absolute difference between doctors and nurses (%) (95% CI)	*P*
	N	*n* (%, 95% CI)	*N*	*n* (%)	*N*	*n* (%)		
Clinical vignettes								
Adherence to best practice guidelines	602	64 (10.6, 8.3–13.4)	243	24 (9.9)	353	39 (11.0)	−1.2 (−6.1 to 3.8)	0.65
Antipyretic use for temperature reduction	602	445 (73.9, 70.2–77.4)	243	196 (80.7)	353	244 (69.1)	11.5 (4.6–18.5)	<0.01
Antipyretic use for reduced fluid intake	602	494 (82.1, 78.8–85.0)	243	219 (90.1)	353	269 (76.2)	13.9 (8.1–19.7)	<0.01
Alternating antipyretic use‡	593	323 (54.5, 50.4–58.5)	239	135 (56.5)	348	183 (52.6)	3.9 (−4.3 to 12.1)	0.35
Combined antipyretic use	602	168 (27.9, 24.4–31.7)	243	55 (22.6)	353	112 (31.7)	−9.1 (−16.3 to −1.9)	0.02
Uses clinical practice guidelines‡	594	391 (65.8, 61.9–69.6)	241	108 (44.8)	347	281 (81.0)	−36.2 (−43.7 to −28.7)	<0.01
Type of clinical practice guidelines used§	391		108		281			
Local hospital		211 (54.0, 48.9–59.0)		44 (40.7)		165 (58.7)	−18.0 (−28.9 to −7.1)	<0.01
Starship Children's Hospital, Auckland		247 (63.2, 58.2–68.0)		75 (69.4)		172 (61.2)	8.2 (−2.2 to 18.6)	0.13
HealthPathways¶		56 (14.3, 11.0–18.2)		17 (15.7)		39 (13.8)	1.9 (6.1–9.8)	0.64
Royal Children's Hospital, Melbourne		29 (7.4, 5.0–10.5)		15 (13.9)		14 (5.0)	8.9 (1.9–15.9)	<0.01
Other^		15 (3.8, 2.2–6.2)		13 (12.0)		2 (0.7)	11.3 (5.1–17.5)	<0.01
Gives patient information sheet at discharge‡	595	355 (59.7, 55.6–63.6)	241	161 (66.8)	348	189 (54.3)	12.5 (4.6–20.4)	<0.01
Types of patient information sheet given§	355		161		189			
Local hospital		203 (57.2, 51.9–62.4)		88 (54.7)		111 (58.7)	−4.1 (−14.5 to 6.3)	0.44
Starship Children's Hospital, Auckland		183 (51.5, 46.2–56.9)		80 (49.7)		102 (54.0)	−4.3 (−14.8 to 6.2)	0.43
KidsHealth (kidshealth.org.nz)		51 (14.4, 10.9–18.5)		27 (16.8)		23 (12.2)	4.6 (−2.8 to 12.0)	0.22
HealthPathways¶		44 (12.4, 9.2–16.3)		19 (11.8)		24 (12.7)	−0.9 (−7.8 to 6.0)	0.80
Ministry of Health, New Zealand		16 (4.5, 2.6–7.2)		1 (0.6)		15 (7.9)	−7.3 (−11.4 to −3.3)	<0.01
Royal Children's Hospital, Melbourne		34 (9.6, 6.7–13.1)		24 (14.9)		9 (4.8)	10.1 (3.9–16.4)	<0.01
Other^		16 (4.5, 2.6–7.2)		9 (5.6)		7 (3.7)	1.9 (−2.6 to 6.3)	0.40

†Profession was not available for the following questions: clinical scenarios ($n = 6$), use of clinical practice guidelines ($n = 6$), gives patient information sheet ($n = 6$), types of clinical practice guidelines used ($n = 2$) and types of patient information sheet given ($n = 5$). ‡Data were missing for the following questions: alternating antipyretic use ($n = 9$), using clinical practice guidelines ($n = 8$) and giving patient information sheet ($n = 7$). §Can choose more than one option. ¶HealthPathways is an online resource designed for primary healthcare practitioners offering clinicians best practice, condition-specific guidelines at the point of care. ^Other clinical practice guidelines include National Institute for Health and Care Excellence, American Academy of Paediatrics, Best Practice Advocacy Centre New Zealand; other patient information sheets include Plunket New Zealand, Patient.info, UpToDate, Queensland Children's Hospital. CI, confidence interval.

TABLE 3. *Antipyretic use based clinical vignettes with variable levels of patient discomfort, fluid intake and vital signs*

(a) Proportion of participants who would give a single antipyretic agent (either paracetamol or ibuprofen) in the clinical vignette

Clinical vignette	*N*	Vital signs		Absolute difference (%) (95% CI)	*P*
		Normal HR and RR, *n* (%)	Elevated HR and RR, *n* (%)		
Settled, drinking usual amount	602	182 (30.2)	365 (60.6)	−30.4 (−35.8 to −25.0)	<0.01
Settled, drinking 2/3 usual amount	601	351 (58.4)	395 (65.7)	−7.3 (−12.8 to −1.8)	0.01
Crying intermittently, drinking usual amount	602	386 (64.1)	417 (69.3)	−5.2 (−10.5 to 0.1)	0.06

(b) Proportion of participants who would give single (either paracetamol or ibuprofen) or combined (both paracetamol and ibuprofen simultaneously) antipyretic agents in the clinical vignette

Clinical vignette	*N*	Vital signs		Absolute difference (%) (95% CI)	*P*
		Normal HR and RR, *n* (%)	Elevated HR and RR, *n* (%)		
Settled, drinking usual amount	602	203 (33.7)	439 (72.9)	−39.2 (−44.4 to −34.0)	<0.01
Settled, drinking 2/3 usual amount	601	388 (64.6)	479 (79.7)	−15.1 (−20.1 to −10.1)	<0.01
Crying intermittently, drinking usual amount	602	435 (72.3)	518 (86.1)	−13.8 (−18.3 to −9.3)	<0.01

CI, confidence interval; HR, heart rate; RR, respiratory rate.

Primary outcome

Overall, only 10.6% (n = 64, 95% confidence interval [CI] 8.3–13.4%) of participants demonstrated adherence to best practice guidelines (Table 2). In multiple logistic regression, profession, years of experience, role seniority, paediatric-specific qualifications or ethnicity were not associated with adherence.

Table 3 shows participants' antipyretic use based on clinical vignettes with variable levels of patient discomfort, fluid intake and vital signs. Given the same level of patient discomfort and fluid intake, a greater percentage of participants would give antipyretics when vital signs were abnormal. In the scenario of a febrile child with no discomfort and normal fluid intake, the proportion of participants that would use antipyretics doubled in the presence of abnormal vital signs (33.7% *vs* 72.9%, difference −39.2%, 95% CI –44.4% to −34.0%; P < 0.01) (Table 3b).

Secondary outcomes

Antipyretic use for temperature reduction and reduced fluid intake

In a febrile but settled child, the majority of participants would use antipyretics for temperature reduction (n = 445, 73.9%, 95% CI 70.2–77.4%) and for reduced fluid intake (n = 494, 82.1%, 95% CI 78.8–85.0%). Compared to nurses, more doctors would use antipyretics for temperature reduction (196/243, 80.7% *vs* 244/353, 69.1%; difference 11.5%, 95% CI 4.6–8.5%; P < 0.01) or reduced fluid intake (219/243, 90.1% *vs* 269/353, 76.2%; difference 13.9%, 95% CI 8.1–19.7%; P < 0.01) (Table 2).

Alternating and combined antipyretic use

Over half (n = 323, 54.5%, 95% CI 50.4–58.5%) of participants would use alternating antipyretics for a febrile child with persistent discomfort. Over one-quarter (n = 168, 27.9%, 95% CI 61.9–69.9%) of participants would use combined antipyretics when treating a febrile child (Table 2).

Antipyretic use for febrile convulsions

Over half (n = 339, 57.1%, 95% CI 53.0–61.1%) of participants would advise giving antipyretics to prevent febrile convulsions during the current illness. Compared to nurses, fewer doctors would advise giving antipyretics to prevent febrile convulsions during the current illness (87/242, 36.0% *vs* 249/346, 72.0%; difference −36.0%, 95% CI –43.7% to −28.3%; P < 0.01) (Table 4).

Use of clinical practice guidelines and patient information sheets

Only two-thirds (n = 391, 65.8%, 95% CI 61.9–69.6%) of participants reported following clinical practice guidelines when using antipyretics for febrile children in the ED. Compared to nurses, fewer

TABLE 4. *Discharge advice regarding antipyretic use after febrile convulsion*

	All participants		Doctors†		Nurses†		Absolute difference between doctors and nurses (%) (95% CI)	*P*
	N	*n* (%, 95% CI)	*N*	*n* (%)	*N*	*n* (%)		
Prevention of febrile convulsions during current illness‡	594		242		346			<0.01
Give medications to prevent febrile convulsions		339 (57.1, 53.0–61.1)		87 (36.0)		249 (72.0)	−36.0 (−43.7 to −28.3)	<0.01
Regularly		49 (8.2, 6.2–10.8)		18 (7.4)		30 (8.7)	−1.3 (−5.7 to 3.1)	0.57
As needed if there is a fever		290 (48.8, 44.7–52.9)		69 (28.5)		219 (63.3)	−34.8 (−42.4 to −27.2)	<0.01
Paracetamol and/or ibuprofen not needed to prevent febrile convulsions		255 (42.9, 38.9–47.0)		155 (64.0)		97 (28.0)	36.0 (28.3–43.7)	<0.01
Management of fever during current illness‡	596		242		348			0.14
Give medications regularly to prevent fever		27 (4.5, 3.0–6.5)		14 (5.8)		13 (3.7)	2.1 (−1.5 to 5.7)	0.23
Give medications as needed if there is a fever		105 (17.6, 14.6–20.9)		35 (14.5)		70 (20.1)	−5.6 (−11.7 to 0.5)	0.08
Give medications as needed if there is a fever and the infant is distressed		304 (51.0, 46.9–55.1)		119 (49.2)		183 (52.6)	−3.4 (−11.6 to 4.8)	0.42
Give medications as needed if the infant is distressed, regardless of fever		155 (26.0, 22.5–29.7)		72 (29.8)		79 (22.7)	7.1 (−0.2 to 14.4)	0.05
Paracetamol and/or ibuprofen not needed at this time		5 (0.8, 0.3–1.9)		2 (0.8)		3 (0.9)	−0.1 (−1.6 to 1.4)	0.90

†Profession was not provided by six participants. ‡Data were missing for the following questions: prevention of febrile convulsions during current illness ($n = 8$), management of fever during current illness ($n = 6$). CI, confidence interval.

TABLE 5. *Readiness to participate in a randomised controlled trial (RCT) of paracetamol* vs *ibuprofen in febrile children <2 years of age*

	All participants		Doctors†		Nurses†		Absolute difference between doctors and nurses (%) (95% CI)	*P*
	N	*n* (%, 95% CI)	*N*	*n* (%)	*N*	*n* (%)		
RCT is needed‡§	584	467 (80.0, 76.5–83.1)	236	171 (72.5)	342	290 (84.8)	−12.3 (−19.2 to −5.5)	<0.01
Minimum age for trial enrolment‡	582		235		341			
From birth (chronological age if preterm)		68 (11.7, 9.2–14.6)		30 (12.8)		38 (11.1)	1.7 (−3.7 to 7.1)	0.53
From birth (corrected age if preterm)		72 (12.4, 9.8–15.3)		29 (12.3)		43 (12.6)	−0.3 (−5.8 to 5.2)	0.91
1 month		100 (17.2, 14.2–20.5)		45 (19.1)		53 (15.5)	3.6 (−2.7 to 9.9)	0.26
3 months		342 (58.8, 54.6–62.8)		131 (55.7)		207 (60.7)	−5.0 (−13.2 to 3.2)	0.23
Likely to enrol a patient with:‡¶								
Fever with no focus	580	487 (84.0, 80.7–86.9)	235	204 (86.8)	339	278 (82.0)	4.8 (−1.2 to 10.8)	0.12
Febrile seizure	580	480 (82.8, 79.4–85.7)	236	192 (81.4)	338	282 (83.4)	−2.1 (−8.4 to 4.3)	0.52
Diarrhoea/vomiting	567	290 (51.1, 46.9–55.3)	231	146 (63.2)	330	139 (42.1)	21.1 (12.9–29.3)	<0.01
Cough/coryza	575	434 (75.5, 71.7–78.9)	234	196 (83.8)	335	232 (69.3)	14.5 (7.7–21.3)	<0.01
Wheezing	566	285 (50.4, 46.2–54.5)	230	138 (60.0)	330	142 (43.0)	17.0 (8.7–25.3)	<0.01
Chickenpox	571	312 (54.6, 50.5–58.8)	231	140 (60.6)	334	169 (50.6)	10.0 (1.7–18.3)	0.02
Cellulitis	570	377 (66.1, 62.1–70.0)	230	161 (70.0)	334	212 (63.5)	6.5 (−1.3 to 14.4)	0.11
Fever and not weight-bearing	574	392 (68.3, 64.3–72.1)	231	137 (59.3)	337	250 (74.2)	−14.9 (−22.7 to −7.0)	<0.01
Fever and non-specific rash	574	473 (82.4, 79.0–85.4)	234	191 (81.6)	334	278 (83.2)	−1.6 (−8.0 to 4.8)	0.62
Primary outcome of interest‡	583		234		343			
Relief of distress/discomfort		355 (60.9, 56.8–64.9)		122 (52.1)		229 (66.8)	−14.6 (−22.7 to −6.5)	<0.01
Reduction of fever		43 (7.4, 5.4–9.8)		13 (5.6)		30 (8.8)	−3.2 (−7.4 to 1.0)	0.15
Length of stay in ED		77 (13.2, 10.6–16.2)		47 (20.1)		29 (8.5)	11.6 (5.7–17.6)	<0.01
Length of stay in hospital		11 (1.9, 0.9–3.4)		6 (2.6)		4 (1.2)	1.4 (−0.9 to 3.7)	0.21
Safety		81 (13.9, 11.2–17.0)		36 (15.4)		45 (13.1)	2.3 (−3.6 to 8.1)	0.44
Parent satisfaction		15 (2.6, 1.4–4.2)		9 (3.9)		6 (1.8)	2.1 (−0.7 to 4.9)	0.12
Other		1 (0.2, 0–1.0)		1 (0.4)		0 (0)	0.4 (−0.4 to 1.3)	0.22
Other outcomes of interest‡^	581		233		342			
Relief of distress/discomfort		550 (94.7, 92.5–96.3)		217 (93.1)		327 (95.6)	−2.5 (−6.4 to 1.4)	0.20
Reduction of fever		353 (60.8, 56.7–64.8)		108 (46.4)		240 (70.2)	−23.8 (−31.9 to −15.8)	<0.01

(*Continues*)

TABLE 5. *Continued*

	All participants		Doctors†		Nurses†		Absolute difference between doctors and nurses (%) (95% CI)	P
	N	n (%, 95% CI)	N	n (%)	N	n (%)		
Length of stay in ED		483 (83.1, 79.8–86.1)		204 (87.6)		274 (80.1)	7.4 (1.4–13.4)	0.02
Length of stay in hospital		290 (49.9, 45.8–54.1)		105 (45.1)		180 (52.6)	−7.6 (−15.9 to 0.7)	0.07
Safety		428 (73.7, 69.9–77.2)		183 (78.5)		239 (69.9)	8.7 (1.5–15.8)	0.02
Parent satisfaction		375 (64.5, 60.5–68.4)		154 (66.1)		216 (63.2)	2.9 (−5.0 to 10.9)	0.47
Other#		24 (4.1, 2.7–6.1)		12 (5.2)		11 (3.2)	1.9 (−1.5 to 5.3)	0.25

†Profession was not provided by six participants. ‡Data were missing for the following questions: RCT needed ($n = 18$), minimum age for RCT enrolment ($n = 20$), fever with no focus ($n = 22$), febrile seizure ($n = 22$), diarrhoea/vomiting ($n = 35$), cough/coryza ($n = 27$), wheezing ($n = 36$), chickenpox ($n = 31$), cellulitis ($n = 32$), fever and not weight-bearing ($n = 28$), fever and rash ($n = 28$), primary outcome of interest ($n = 19$) and other outcomes of interest ($n = 21$). §Table shows proportion of participants who 'agree' or 'strongly agree' that a RCT is needed. ¶Table shows proportion of participants who are 'likely' or 'very likely' to enrol a patient with specified presenting complaint. ^Can choose more than one option. #Other outcomes of interest include vital signs, hydration/fluid intake, re-presentation, staff satisfaction and febrile convulsions. CI, confidence interval.

doctors followed clinical practice guidelines in their day-to-day practice (108/241, 44.8% *vs* 281/347, 81.0%; difference −36.3%, 95% CI –43.7% to −28.7%; $P < 0.01$). Only 59.7% ($n = 355$, 95% CI 55.6–63.6%) of participants reported giving caregivers an information sheet about fever when discharging febrile children from the ED (Table 2).

Willingness to participate in a proposed RCT

Most ($n = 467$, 80.0%, 95% CI 76.5–83.1%) participants agreed that a RCT of paracetamol *versus* ibuprofen in febrile children <2 years of age specifically addressing relief of discomfort as a primary outcome is needed, and almost two-thirds ($n = 342$, 58.8%, 95% CI 54.6–62.8%) stated the minimum age for trial enrolment should be 3 months. Relief of distress/discomfort was the most commonly identified primary outcome of interest ($n = 355$, 60.9%, 95% CI 56.8–64.9%), and secondary outcomes of interest included ED length of stay ($n = 483$, 83.1%, 95% CI 79.8–86.1%), safety ($n = 428$, 73.7%, 95% CI 69.9–77.2%) and parent satisfaction ($n = 375$, 64.5%, 95% CI 60.5–68.4%) (Table 5).

Discussion

Fever management is an integral aspect of paediatric emergency care. Best practice guidelines recommend antipyretic use for relief of discomfort in febrile children, rather than for the sole purpose of temperature reduction. Our study found that only 10.6% of ED doctors and nurses in New Zealand adhered to best practice guidelines for antipyretic use in febrile children when presented with clinical vignettes. Deviation from best practice and inappropriate practice variation contributes to unnecessary healthcare costs, patient dissatisfaction and undesirable clinical outcomes, with implications for patient safety and healthcare quality.[17] As fever is one of the most common reasons for children to present to the ED, our

findings are likely to be of relevance to ED clinicians, educators and researchers particularly in the field of knowledge translation.

Previous studies have found similarly low levels of adherence to best practice guidelines. Antipyretic use based on the presence of discomfort rather than for a specific cut-off of body temperature was recommended by only 15% of primary care physicians in Turkey,[9] and 38% of Italian paediatricians.[12] Our findings were consistent with the literature, with almost three-quarters of participants using antipyretics for temperature reduction. Two-thirds of paediatric ED nurses in Portugal[11] and three-quarters of Turkish physicians[9] believed that a febrile child must always be treated, regardless of general appearance and symptoms. Over one-quarter of our participants would use combined antipyretics. Although there is weak evidence that combined antipyretics are more effective for temperature reduction than monotherapy, the evidence for combined antipyretics improving discomfort remains inconclusive, and there are safety concerns with this approach.[3] Thus, this practice is not recommended.[3,8] Because of caregivers consider ED doctors and nurses as a key information source about fever management,[4,7] deviation from best practice may worsen caregiver fever phobia and promote inappropriate antipyretic treatment of febrile children.

Non-adherence to fever guidelines in our study occurred irrespective of profession, years of experience, role seniority or paediatric-specific qualifications which is in keeping with previous studies.[5,13] Fever management practice variation has persisted despite dissemination of best practice guidelines over a decade ago.[3,8] Although local guidelines used by participants were largely consistent with international best practice guidelines published by the AAP and NICE (Appendix S3), only two-thirds of participants reported following local clinical practice guidelines when using antipyretics for febrile children in the ED. These observations suggest that continuing education alone may be insufficient to change entrenched fever management practices. Approaches to address adherence to best practice should consider both ED doctors and nurses, be theory-based[21] and target facilitators of and barriers to evidence-based practice using appropriate knowledge translation strategies.

The presence of abnormal vital signs was a key driver of antipyretic use among our participants. Abnormal vital signs in febrile children are not considered an indication for antipyretic use *per se*.[3,8] However, fever in young children can be a diagnostic challenge. Although most febrile illnesses are due to self-limiting viral infections, fever may also be a presenting feature of serious bacterial infections. Vital signs are included in several risk-stratification tools to identify febrile children at risk of serious bacterial infections in the ED setting.[8,22] Moreover, persistently abnormal vital signs have been associated with undesirable ED process outcomes (e.g., revisits) in paediatric patients.[23] There may be a perceived need to intervene and normalise vital signs as reassurance for caregivers and clinicians alike, even though reliance on normalisation of fever and other vital signs to differentiate between serious and non-serious illness is not recommended.[8] Indeed, the NICE recommends future studies be conducted to determine whether re-examination after a dose of antipyretic medication is of benefit in differentiating children with serious illness from those with other conditions.[8]

The lack of a clear definition of discomfort may be a factor in non-adherence to best practice guidelines.[24] Evaluation of discomfort in young children remains a challenge, and there is a discrepancy between excessive treatment of fever and under-treatment of pain in the ED.[25] Physiological measures such as vital signs are incorporated into several paediatric pain scales, particularly for pre-verbal children.[26] ED doctors and nurses may view elevated heart rate and respiratory rate as a proxy for discomfort. Febrile children often have altered sleep and activity including decreased oral intake.[3] Over 80% of our participants would use antipyretics for reduced fluid intake. Our participants may be using antipyretics with the belief that it would result in improved comfort and fluid intake.[3] The extent to which antipyretics improve discomfort in febrile children remains unclear. In our systematic review of 19 studies involving 241 138 children <2 years of age,[15] discomfort was not universally recorded as an inclusion criterion, and none of the studies reported fever-related discomfort outcomes within 4 h of treatment. The majority of ED doctors and nurses in our study agreed that a RCT of antipyretics in febrile children <2 years of age with discomfort as a primary outcome is needed.

Over half (57%) of our participants recommend giving antipyretics to prevent febrile convulsions during the current illness. Our findings were similar to previous studies, with 40–86% of primary care physicians,[9] paediatricians[12] and nurses[11,13] taking such an approach. Twice as many nurses than doctors (72.0% *vs* 36.0%) in our study recommend giving antipyretics to prevent febrile convulsions, highlighting an area for knowledge translation. Previous studies have found that the attitude towards febrile convulsions differed among professional groups, with nurses citing febrile convulsions as the main reason for giving antipyretics more often than doctors.[5,6,10,11] Antipyretic use in the context of febrile convulsions remains controversial. Previous systematic reviews have found insufficient evidence to support antipyretic use for preventing febrile convulsions in distant febrile episodes;[27] thus, best practice guidelines recommend against this practice.[3,8] However, a recent RCT found that regular antipyretics was associated with reduced febrile convulsion recurrence during the current fever episode.[28] The role of regular antipyretics in preventing febrile convulsions in the current fever episode warrants further investigation.

Strengths of our study include our relatively large sample size and the inclusion of both doctors and nurses across multiple EDs with a mix of ED census and type. Inevitably, there were some limitations. Our response rate of 47.5% may introduce a degree of responder bias and limit the generalisability of our findings. A frequently cited concern about vignettes

is that responses may not reflect actual clinical practice and be subject to social desirability bias, where participants may respond based on their knowledge of best practice recommendations.[16] However, vignettes have been validated and used extensively in various clinical settings,[17] including emotionally charged scenarios[29] and complex emergencies,[30] commonly found in the ED. They are cost-effective, easily administered on a large scale, and are particularly useful for examining individual practice variation within and between sites,[16] making vignettes ideally suited for our study objectives.

Conclusion

Just over 10% of New Zealand ED doctors and nurses demonstrated adherence to paediatric fever management best practice guidelines. Abnormal vital signs, reduced fluid intake and a history of febrile convulsions appear to be key drivers for antipyretic use. Factors influencing adherence to best practice guidelines and practice variation warrant further exploration, with targeted knowledge translation required to improve guideline adherence. A RCT of antipyretics in febrile children <2 years of age specifically addressing relief of discomfort as a primary outcome is strongly supported.

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Competing interests

AR and SRD are section editors for *Emergency Medicine Australasia*.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Supporting information

Additional supporting information may be found in the online version of this article at the publisher's web site:

Appendix S1. Questionnaire.
Appendix S2. Primary outcome measure of adherence.
Appendix S3. Comparison of local site clinical practice guidelines and international best practice guidelines.