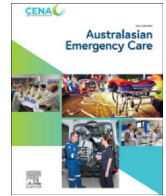




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Research paper

Emergency department assessment and management of children with gastroenteritis

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ABSTRACT

Background: Acute gastroenteritis is a major cause of morbidity and mortality in children. The aim of this study was to explore assessment and management of children aged between 6 and 48 months presenting to the emergency department (ED) with acute gastroenteritis.

Methods: This retrospective cohort study included 340 children aged 6–48 months. Data were collected by medical record audit for children presenting between 1 January and 31 December 2019.

Results: General assessments were appropriate, specific dehydration assessment, blood pressure measurement and fluid balance chart documentation could be improved. Management of children with severe or no/mild dehydration was largely compliant with current recommendations: there was variability in management of children with moderate dehydration. There were no significant differences between Australian Aboriginal and non-Aboriginal children in terms of dehydration severity and pathology abnormalities, however there were differences in management strategies.

Conclusions: ED management of children with gastroenteritis was largely consistent with, or superior to, evidence-based recommendations. There was variability in the management of children with moderate dehydration and Australian Aboriginal children but it is unclear whether this is suboptimal or patient specific care. This study has highlighted areas for further research in this unique context.

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Introduction

Acute gastroenteritis is a common cause of morbidity and mortality in children, posing a significant burden on children, emergency departments (ED), communities and the healthcare system both in Australia and globally [1–5]. In Australia, the rate of gastroenteritis is highest in children under five years (1.6 episodes per person per year), accounting for 13.9% of cases [5]. In the Northern Territory (NT), more than 77% of clinic presentations in children within their first year of life are for gastroenteritis and more than 70% of children present more than once [6]. Rates of infectious causes of diarrhoea amongst all age groups are seventeen times higher in the NT than

elsewhere in Australia [7]. For the purpose of this paper on advice from Aboriginal Liaison Officers at the study site, Aboriginal and Torres Strait Islander People are respectfully referred to as Australian Aboriginal People, taking into consideration the many language groups in the NT and few Torres Strait Islander descendants.

The study took place in a remote location of Australia, home to a high proportion of Australian Aboriginal People. The NT has the highest percentage of Aboriginal People in Australia, representing 26.3% of the population [8]. Australian Aboriginal children have higher morbidity and mortality compared to non-Aboriginal children [9]. Australian rural and remote communities have greater morbidity and mortality compared to urban communities: in children, the disease burden is 1.4 times higher in rural and remote areas than urban areas [10–12]. Australian Aboriginal children in the NT have high rates of recurrent and concurrent ear, skin, respiratory

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and gastrointestinal conditions, and conditions rarely seen elsewhere in Australia, such as rheumatic heart disease [9,13].

There are a number of guidelines to ensure children with gastroenteritis receive appropriate, evidence-based care, including reducing unnecessary interventions and treatments [14–18]. Current Australian guidelines however, do not specifically include Aboriginal and Torres Strait Islander children. The majority of available research regarding management of children with acute gastroenteritis is from studies undertaken overseas with populations very different to that of the NT, raising questions regarding applicability to the unique NT population.

The aim in this study was to explore the assessment and management of children aged between 6 and 48 months who present to the study site ED with acute gastroenteritis. The following objectives were addressed: i) to identify and describe ED assessment and management of children with gastroenteritis, and ii) explore the relationships between children's characteristics, clinical features and ED management and disposition.

Methods

Design

This was a retrospective cohort study.

Setting

This study was conducted in the ED at Alice Springs Hospital. The ED treats on average 40,500 patients per year, with children accounting for over 20% of these presentations. The ED serves as a referral hospital for smaller rural hospitals, remote community health clinics, and cattle stations over an area comprising more than a million square kilometres [19]. Australian Aboriginal People account for 30% of the population in Alice Springs and almost 84% of the patients admitted to the hospital are Australian Aboriginal People [19,20]. The nearest tertiary centre is more than 1500 kilometres away [19].

Participants/Study population

The inclusion criteria for this study were children aged between 6 and 48 months attending the ED with gastroenteritis between 1 January to 31 December 2019. The presenting problems indicative of gastroenteritis were selected by the triage nurse from the dropdown menu in the triage system: "diarrhoea", "diarrhoea and vomiting" and "vomiting". Children were excluded if they were transported via the Royal Flying Doctor's Service as treatment had already been commenced by a medical practitioner prior to the child arriving in the ED.

Data collection

Data were collected via medical record audit using a data collection tool designed specifically for this study. Data collection was guided by a comprehensive data dictionary. Data were collected by a single researcher (KR). To establish reliability of data collection, data were collected for five patients by the first researcher (KR), a second researcher (RS) verified the accuracy of the data entered: agreement was 100%. Dehydration severity data was recorded using one of three categories: none/mild, moderate, and severe, as per current Australian guidelines [15,21]. Severity of dehydration was assessed by the researcher using the patient's documented clinical status and RCH guidelines and if available, clinician descriptions [21]. The specific data variables collected are presented in Table S1.

Data analysis

Descriptive statistics (frequencies, percentages, means, standard deviations, median and interquartile ranges) were used to summarise the study data. Where data were not nominally distributed, non-parametric tests were used. Relationships between variables were examined using Pearson Chi-square for categorical data with Fisher's exact test utilised with values with a frequency less than five. Statistical significance was set at < 0.05.

Ethical considerations

Ethics approval was received from the Human Research Ethics Committee at the study health service (approval number CA-21-4095) and Deakin university (approval number 2021-331).

Results

Children's characteristics

A total of 340 children were included with a median age of 17 months (IQR=10–28) (range 6–47 months). Half the children ($n = 170$; 50%) were male and 66.5% ($n = 226$) were Australian Aboriginal children. Most participants ($n = 237$; 69.7%) lived within 50 kilometres of the hospital. The most common presenting problem was vomiting and diarrhoea ($n = 131$; 38.5%) followed by diarrhoea only ($n = 105$; 30.9%) and vomiting only ($n = 104$; 30.6%). The majority (63.8%) of children were given Australasian Triage Scale (ATS) category 3, followed by ATS category 4 (30.9%) and ATS category 2 (5.3%). No children were triaged as ATS category 1 or 5. Waiting time to be seen by a doctor ranged from 2 to 358 min with a median of 30 min (IQR=12.2–62.75).

Emergency department assessment

Table 1 details the assessments that were documented within 30 min of the child's arrival in the ED. The most frequent documented dehydration assessment was assessment of mucous membranes ($n = 207$; 60.9%), followed by work of breathing ($n = 201$; 59.2%). The most frequent vital sign assessment documented was heart rate with a blood pressure recorded in only 0.6% ($n = 2$) of children. The first full set of vital signs observations was mostly recorded immediately (0 min; $n = 265$; 77.9%), indicating these were recorded during the triage assessment. Dehydration was not assessed using a specific tool in any of the children. Dehydration severity was documented by a clinician in 50.9% of children ($n = 173$). The most common dehydration severity amongst children was no/mild dehydration at 85.6% ($n = 291$), followed by moderate at 13.5% ($n = 46$) and 0.9% had severe dehydration ($n = 3$). Dehydration severity was not re-assessed in any of the children post treatment.

Emergency department management

The majority ($n = 302$, 88.8%) had their weight recorded. Urine output was documented in 24.7% of children ($n = 84$) and a fluid balance chart was initiated for 17.4% ($n = 59$). Imaging occurred for two children (0.6%). An antiemetic medication was administered in 31.8% of children ($n = 108$) (Table 2) and the only type of antiemetic administered was ondansetron (100%). Initial re-hydration (commenced within the first 30 min of the child's presentation) was provided to 26.5% of children ($n = 90$). Oral rehydration was provided to 80.9% of children over the course of their ED care ($n = 275$), 4.7% received NG rehydration ($n = 16$) and 6.8% received IV rehydration ($n = 23$).

Pathology tests were performed in 35% of children ($n = 119$) (Table 3). Of the children who had pathology tests attempted, 25.2%

Table 1
Assessments Performed Within the First Thirty Minutes of ED Presentation.

Variable	n	%
Airway and breathing		
• Respiratory rate	314	92.35
• Work of breathing		
No increase	192	56.5
Mildly increased	8	2.4
Moderately increased	1	0.3
Severely increased	0	0.0
Not assessed	139	40.9
Circulation		
• Heart rate	320	94.12
• Blood pressure	2	0.6
• Skin colour		
Pink/usual/normal	34	10.0
Pale	18	5.3
Mottled	0	0.0
Flushed	1	0.3
Not assessed	287	84.4
• Extremities		
Hot	9	2.6
Warm	100	29.4
Cold	1	0.3
Not assessed	230	67.6
• Peripheral Pulses		
Present	46	13.5
Weak	0	0.0
Absent	0	0.0
Not assessed	294	86.5
• Eyes and fontanelle		
Not sunken	7	2.1
Sunken	13	3.8
Deeply sunken	0	0.0
Bulging	0	0.0
Not assessed	320	94.1
• Skin turgor		
Instant recall	20	5.9
Mildly decreased	0	0.0
Decreased	0	0.0
Not assessed	320	94.1
• Capillary refill time		
Normal	103	30.3
Prolonged	38	11.2
Markedly prolonged	0	0.0
Not assessed	199	58.5
• Mucous membranes		
Moist	172	50.6
Dry	35	10.3
Not assessed	133	39.1
Disability		
• Formal conscious state		
Alert	212	62.4
Voice	2	0.6
Pain	0	0.0
Unresponsive	0	0.0
Not assessed	126	37.1
Exposure		
• Temperature	316	92.24

(n = 30) were failed attempts and venepuncture or IV cannulation were not reattempted for a successful outcome. A full blood evaluation (FBE) occurred for 61 children (17.9%), urea and electrolytes for 59 children (17.3%), creatinine reactive protein (CRP) for 45 children (13.2%) and a venous blood gas (VBG) or capillary blood gas performed for 107 children (31.5%). The median time it took for a pathology test to be performed was 142.5 min (IQR=96–227) and ranged from 22 to 720 min (SD=117.5). Of the 107 children who had VBG performed, 80.8% (n = 76) were normokaleamic and 17.0% (n = 16) were hypokalaemic (Table 3). Urea was raised in four children (6.9%), creatinine was raised in two children (2.4%) and three children (3.2%) were hyponatraemic. Lactate was raised in 25.8% (n = 24) of children, 30.5% (n = 29) were acidotic and 3.2% (n = 3) were alkalotic. Bicarbonate was low in 10.8% (n = 10) of children.

Table 2
Rehydration Strategies.

Variable	n	%
Initial rehydration	90	26.5
Rehydration type		
Oral	275	80.9
NG	16	4.7
IV	23	6.8
Oral Rehydration type		
Water	63	24.7
ORS/hydrolyte icy pole	192	75.3
Breast milk/formula	110	43.1
Juice or cordial	19	7.5
Antiemetic given	108	31.8
Ondansetron	108	31.8
Metoclopramide	0	0.0
Ondansetron route		
Oral	107	99.1
NG	0	0.0
IV	1	0.9
Ondansetron administered		
Once	107	99.1
Twice	1	0.9
Ondansetron given for presenting problem		
Vomiting (n = 104)	58 *	55.8
Vomiting and diarrhoea (n = 131)	46 *	35.1
Diarrhoea (n = 105)	4 *	3.8

Note: IV = intravenous; NG = nasogastric; ORS = oral rehydration solution.
* p < .001. Pearson Chi Square.

Hypoglycaemia was present in 11.6% (n = 16) and ketosis occurred in 60.4% of children (n = 29) who had the test performed.

Disposition

In total, 80% of children were discharged home from the ED (n = 270) whilst 20% were admitted to the paediatric ward (n = 68). Discharge advice was provided to 86.9% (n = 232) of families, the majority of advice was verbal (n = 233; 98.3%). The median length of ED stay was 215 min (IQR = 145.2–305.7): admitted children had a median ED LOS of 316.5 min (IQR = 268.3–427) whilst discharged children had a median ED LOS of 189.5 min (IQR=133.7–257.7). For admitted children, the median hospital stay was 52 h (IQR = 23–91). A paediatric specialist reviewed 27.9% of children in the ED (n = 95). Emergency department re-presentation within 72 h of discharge for the same illness occurred in 10.9% of children (n = 37).

The relationship between children’s characteristics, ED management and hospital admission or ED representation within 72 h were examined. Australian Aboriginal children were significantly more likely to be admitted to hospital (n = 58; 85.2%) than non-Aboriginal children (n = 10; 14.7%; p = <0.001). Children triaged as ATS category 2 were more likely to be admitted to hospital (n = 12/18; 66.7%; p = <0.001) compared with children triaged as ATS category 3 (n = 49/217; 22%; p = <0.001) or 4 (n = 7/105; 6.7%; p = <0.001). A significantly higher proportion of children who were admitted to hospital lived within 50 km from of the hospital (n = 36; 52.9%) or more than 200 km (n = 23; 33.8%) (p = 0.004). The majority of children admitted presented with both vomiting and diarrhoea (n = 33; 48.5%; p = <0.001), followed by diarrhoea only (n = 29; 42.6%; p = <0.001) and vomiting only (n = 6; 8.8%; p = <0.001). Rehydration was provided to 27.9% (n = 19; p = 0.759) of admitted children within 30 min of their arrival and 27.9% (n = 19; p = 0.449) received an antiemetic. The majority of admitted children received oral rehydration (n = 53; 77.9%; p = 0.490), whilst 23.5% (n = 16; p = <0.001) received NG rehydration and 32.4% received IV rehydration (n = 22; p = <0.001).

There was no significant difference in ED re-presentations within 72 h when Australian Aboriginal children (n = 21; 56.8%) were compared with non-Australian Aboriginal children (n = 16; 14%)

Table 3
Pathology Results.

Variable	n (%)	median	range	IQR	normal n (%)	< normal n (%)	> normal n (%)
U&E results							
Sodium	59 (17.3)	139	129 – 155	138 – 140	55 (93.2)	1 (1.6)	3 (5.0)
Potassium	57 (16.8)	4.0	2.8–6.2	3.6–4.4	47 (82.4)	9 (15.8)	1 (1.7)
Urea	58 (17.0)	3.5	0.8–7.8	2.3–4.6	40 (67.0)	14 (24.1)	4 (6.9)
Creatinine	58 (17.0)	22.5	13–38	19–27.2	58 (100)	0	0
VBG/ABG/Capillary Gas results							
Sodium	94 (27.6)	139	127 – 148	137 – 140	88 (93.6)	3 (3.2)	3 (3.2)
Potassium	94 (27.6)	3.9	2.6–6.3	3.5–4.2	76 (80.8)	16 (17.0)	2 (2.1)
pH	95 (27.9)	7.38	7.23 – 7.57	7.33 – 7.40	63 (66.3)	29 (30.5)	3 (3.2)
Creatinine	84 (24.7)	22	11–45	18.2–27	78 (92.8)	4 (4.8)	2 (2.4)
Lactate	93 (27.3)	1.5	0.9–4.9	1.2 – 2.1	69 (74.1)	0	24 (25.8)
Bicarbonate	92 (27.0)	19.5	13–23	17.7–20.9	82 (89.1)	10 (10.8)	0
Glucose	138(40.9)	4.9	2.5 – 9.0	4.4–5.5	115(83.3)	16 (11.6)	7 (5.1)
Ketones	48 (14.1)	0.8	0 – 6.6	0.1–2.2	19 (39.6)	n/a	29 (60.4)

Note: ABG = arterial blood gas; IQR = interquartile range; SD = standard deviation; U&E = urea and electrolytes; VBG = venous blood gas.

($p = 0.185$). The majority of children who re-presented to ED within 72 h had initially been triaged with ATS category 3 ($n = 20$; 54.1%) followed by ATS category 4 ($n = 15$; 40.5%) ($p = 0.390$). The majority of children who re-presented had initially presented with both diarrhoea and vomiting ($n = 18$; 48.5%) compared with vomiting only ($n = 12$; 32.4%) and diarrhoea only ($n = 7$; 18.9%) ($p = 0.215$). Rehydration was provided to 21.6% ($n = 8$; $p = 0.479$) of children who re-presented within 30 min of their arrival and 48.6% ($n = 18$; $p = .019$) received an antiemetic. The majority of children who re-presented received oral rehydration ($n = 32$; 86.5%; $p = 0.358$), whilst 2.7% ($n = 1$; $p = 0.999$) received NG rehydration and 8.1% received IV rehydration ($n = 3$; $p = 0.727$).

Dehydration severity

The relationships between dehydration severity and other variables are shown in Table 4. Children with severe dehydration were more likely to be triaged to ATS 2 than children with no/mild or moderate dehydration (66.7% vs 1.3% vs 26.1%, $p < 0.001$). Children with moderate dehydration were significantly more likely to have a pathology test than children with no/mild or severe dehydration (79.9% vs 28.5% vs 66.7%, $p < 0.001$). Children with severe dehydration were significantly more likely to have IV rehydration than children with no/mild or moderate dehydration (66.7% vs 3.1% vs 26.1%, $p < 0.001$).

Australian Aboriginal status

The relationships between Australian Aboriginal status and other variables are shown in Table 5. Compared to non-Aboriginal children, Australian Aboriginal children were significantly less likely to present by private vehicle (58.1% vs 100%, $p < 0.001$), and less likely to live within 50 km of the hospital (58% vs 93%, $p < 0.001$). Australian Aboriginal children presented more often with diarrhoea than non-Aboriginal children (40.3% vs 12.3%) and less often with vomiting compared with non-Aboriginal children (19.0% vs 53.5%) ($p < 0.001$). Australian Aboriginal children received an antiemetic less often (23.5% vs 48.2%, $p < 0.001$) and received pathology testing more often (45.6% vs 14.0%, $p < 0.001$) than non-Aboriginal children.

Discussion

This study had four major findings: i) ED management was largely consistent with evidence-based recommendations; ii) the greatest degree of variability was in management of children with moderate dehydration (compared to severe or no/mild dehydration), iii) there were not as many children with severe manifestations of dehydration as previous studies, and iv) Australian Aboriginal children were more likely

to have pathology testing and hospital admission, and less antiemetic administration than non-Aboriginal children.

Emergency department management

ED management of children with gastroenteritis was largely consistent with evidence-based recommendations. However, the areas for improvement identified in this study were dehydration assessment, blood pressure measurement, fluid balance charting, initiation of rehydration and discharge advice. Dehydration indicators including assessment of formal conscious state (63%), mucous membranes (60.9%), work of breathing (59.2%) and capillary refill time (41.5%) occurred most frequently however, slightly less than in a previous Australian study [4]. Further dehydration specific assessments were documented infrequently including skin colour (15.6%), peripheral pulses (13.5%) and eyes and fontanelle (5.9%) which contrast significantly with previous studies (fontanelle assessment 55.8%) [4]. The low frequency of documentation of skin colour may be influenced by the number of Australian Aboriginal children in this study (66.5%). Clinicians may be unsure of how to document a skin colour that indicates good circulatory volume in children with dark toned skin, or be unable to detect when there has been a decrease in circulatory volume as pallor may be harder to detect and there is little published literature available advising how to document usual skin colour for children of colour [22–25].

Fontanelle assessment may not have been performed as the median age of children was 17 months and anterior fontanelle closure typically occurs at nine months of age however, this does not explain why an assessment of eye sockets were not then documented instead [26]. The program used for triage documentation could be a contributor to low documentation as the triage assessment field only accepts 150 characters, limiting the information that can be written. Triage nurses may therefore only be documenting abnormal assessments however, this does not explain why dehydration signs were not documented when a more thorough assessment was undertaken by the treating nurse or medical doctor. A dehydration severity category was documented in only 50.9% of children which is less than in a previous study (74.5%) [4]. A specific clinical dehydration scale was not used for any child which may contribute to the low documentation of dehydration severity as these have greater accuracy in diagnosing dehydration severity compared to unstructured clinical assessments, whilst an assessment of a combination of signs improves diagnosis of dehydration severity accuracy [21,27].

Blood pressure was assessed in only two children in the first 30 min of ED care in this study. The reasons for this finding are unclear. Nurses' may have limited understanding that hypotension is a late sign of deterioration in children thus do not recognise its importance [28]. Further, blood pressure assessment in children can

Table 4
Relationships between Dehydration Severity and ED assessment and management of gastroenteritis.

Variable	None/mild dehydration n = 291		Moderate dehydration n = 46		Severe dehydration n = 3		p*
	n	%	n	%	n	%	
Age							
< 24 months (n = 222)	192	66.0	28	60.9	2	66.7	.781 ^e
> 24 months (n = 118)	99	34.0	18	39.1	1	33.3	
Australian Aboriginal	191	65.6	33	71.7	2	66.7	.778 ^e
ATS category							
one	0	0	0	0	0	0	< .001 ^e
two	4	1.3	12	26.1	2	66.7	
three	185	63.6	31	67.4	1	33.3	
four	102	35.0	3	6.5	0	0	
five	0	0	0	0	0	0	
Mode of arrival							.379 ^e
Private vehicle	235	80.7	35	76.1	2	66.7	
Ambulance	31	10.6	10	21.7	1	33.3	
Usual residence distance from hospital							.094 ^e
< 50 km	207	71.1	29	63.0	1	33.3	
50–100 km	3	1.0	1	2.2	0	0	
100–200 km	24	8.2	3	6.5	0	0	
> 200 km	54	18.5	12	26.1	1	33.3	
visitor	3	1.0	1	2.2	1	33.3	
Presenting problem							
vomiting	94	32.3	9	19.5	1	33.3	.308 ^e
vomiting and diarrhoea	107	36.8	23	50.0	1	33.3	
diarrhoea	90	30.9	14	30.4	1	33.3	
Rehydration within 30 min	73	25.1	15	32.6	2	66.7	.122 ^e
Rehydration strategy							
oral	231	79.4	41	89.1	3	100	.263 ^e
NG	9	3.1	7	15.2	0	0	.009 ^e
IV	9	3.1	12	26.1	2	66.7	< .001 ^e
Antiemetic given	88	30.2	19	41.3	1	33.3	.245 ^e
Pathology test performed	83	28.5	34	73.9	2	66.7	< .001 ^e
Disposition							
home	248	85.2	21	45.6	1	33.3	< .001 ^e
admitted	41	14.1	25	54.3	2	66.7	< .001 ^e
re-present	30	10.3	6	13.0	1	33.3	.240 ^e

Note: * Chi Square; ^e Fisher's exact test

ATS = Australasian triage scale; IV = intravenous; NG = nasogastric.

be challenging or distressing, so the logistical difficulty in blood pressure measurement may also influence nurses' decisions not to measure blood pressure [29]. Nevertheless, BP measurement is important as hypotension in children is a late and ominous sign of inadequate systemic perfusion and must be treated aggressively [28]. A formal fluid balance chart occurred for only 17.4% children in this study, significantly lower than in previous studies (87.8%) [4]. Globally, only 14–50% of fluid balance charts are completed correctly in general hospital populations [30–33]. Factors influencing incomplete or inaccurate fluid balance charts include poorly designed charts, increased workload, poor time management, incorrect identification of patients in need of fluid balance assessment and missing guidelines [31, 34–37]. Further investigation regarding the reasons for poor documentation of fluid input and output at this site is required to inform tailored solutions.

Management variability

Children with severe dehydration or no/mild dehydration were identified quickly and managed appropriately. However, there was variability in ED management of children with moderate dehydration. There was also wide variability in time taken to successfully collect pathology. The reasons for widespread use of pathology tests and management variability in this study is likely due to clinicians' understanding that Australian Aboriginal children with gastroenteritis have historically been very unwell [38,39]. The reasons for variability in length of time for pathology to be performed was not explored in this study, however, it could be due to the child's level of dehydration, age of the child or clinician skill level. This would be an

interesting area for further research including exploring alternatives to rehydration (NGT) and pathology collection (sub cutaneous BSL and ketones). Particularly as in several cases, documentation suggested that clinicians were so focused on obtaining a pathology test that oral or NG rehydration administration was delayed. Despite triage to ATS categories two or three, rehydration was only provided to 32.6% of children with moderate dehydration within 30 min. This may indicate that nurses appropriately identify urgent assessment and treatment needs but there are barriers to commencing treatment. ED re-presentations occurred for 10.9% (n = 37) of children in this study which is higher than comparable studies (3.4%; n = 2323) [40]. Discharge advice may influence ED re-presentations as the majority of parents in this study received only verbal discharge advice, most likely in English. Within the catchment area of this study there are multiple different languages spoken by Australian Aboriginal People with English sometimes not spoken at all or not spoken fluently and language barriers decrease patient safety and quality of healthcare communication [41,42]. It may be proposed that ED re-presentation rates could be improved if parents were provided with both verbal and written discharge advice in their own language, and this warrants further research. Studies have shown that when the majority of ED patients and parents receive only verbal discharge advice they are unable to comprehend and recall the advice, and this is confounded when language barriers also exist [43–46].

Manifestations of dehydration

Previous research performed more than 20 years ago has shown significantly more Australian Aboriginal children had hypokalaemia

Table 5
Relationship between Australian Aboriginal Status and ED assessment and management of gastroenteritis.

	N	Australian Aboriginal (n = 226)		Non-Aboriginal (n = 114)		p*
		n	%	n	%	
ATS						
One	0	0	0	0	0	.595
Two	18	13	5.6	5	4.4	
Three	217	147	65.0	70	61.4	
Four	105	66	29.2	39	34.2	
five	0	0	0	0	0	
Mode of arrival						
Walking	16	16	7.1	0	0	< .001 ^e
Private vehicle	272	158	58.1	114	100	
Ambulance	42	42	18.6	0	0	
Community/ public transport	7	7	3.1	0	0	
Clinic road transfer	1	1	0.4	0	0	
Taxi	2	2	0.9	0	0	
Usual residence distance from hospital						
< 50 km	237	131	58.0	106	93.0	< .001 ^e
50–100 km	4	4	1.8	0	0	
100–200 km	27	25	11.1	2	1.8	
> 200 km	67	65	28.8	2	1.8	
Visitor	5	1	0.4	4	3.5	
Presenting problem						
Vomiting	104	43	19.0	61	53.5	< .001
Vomiting and diarrhoea	131	92	40.7	39	34.2	
Diarrhoea	105	91	40.3	14	12.3	
Rehydration within 30 min	90	57	25.2	33	28.9	.462
Antiemetic given	108	53	23.5	55	48.2	< .001
Pathology performed	119	103	45.6	16	14.0	< .001
Rehydration strategy						
Oral	275	180	79.6	95	83.3	.414
NG	16	14	6.2	2	1.8	.068
IV	23	19	8.4	4	3.5	.090

Note: *chi-square. ^e Fisher's exact test.

IV = intravenous; NG = nasogastric.

(70% vs 10%), acidosis (75% vs 29%) and moderate to severe dehydration (52% vs 19%) than non-Australian Aboriginal children when these children presented with diarrhoea [39]. Our study did not find such significant between group differences (hypokalaemia 6.6% vs 0.9%; acidosis 3.9% vs 0.8%; moderate to severe dehydration 15.5% vs 12.3%). Reasons for the lower frequency of gastroenteritis complications in our study are likely due to the widespread uptake of the rotavirus vaccine in 2006; the NT has seen a decrease in severe acute gastroenteritis hospitalisations since the introduction of this vaccine, as well as improvements in health and welfare for Australian Aboriginal People during this time [9,47].

Australian Aboriginal status

When compared to non-Aboriginal children, Australian Aboriginal children had significantly higher rates of pathology testing and hospital admission, and were less likely to be administered antiemetics. Increased pathology testing and hospital admissions may be due to clinician's awareness of the poorer health outcomes and higher rates of concurrent illnesses amongst Australian Aboriginal children, especially those from rural and remote areas, than non-Aboriginal children [9, 10, 12]. Further, it is possible that clinicians decided to perform more investigations and

more invasive treatments in Australian Aboriginal children as they have been historically more likely to have electrolyte imbalances and higher degrees of dehydration [38,39]. The reason for Australian Aboriginal children receiving an antiemetic less often compared with non-Aboriginal children is unclear. Perhaps Australian Aboriginal parents are less likely to request an antiemetic or intervention compared to non-Aboriginal parents which influences the clinician's decision. Australian Aboriginal parents may be less likely to request an antiemetic for a variety of reasons such as language barriers, low health literacy or previous negative experiences that make them unaware of available treatments or less likely to speak up [48].

Limitations and strengths

This study was conducted at a single site with a very specific population of children so the results may not be generalisable to children in other Australian EDs. However, there are few published studies of ED care of Australian Aboriginal children, so this research may be useful for similar clinical settings. Further, the study was a retrospective audit relying on clinical documentation to be accurate and comprehensive, and there was no way to validate data accuracy. Additionally, there were only three children in this study who were identified as having severe dehydration, which limits the assessment of management strategies in this group.

Strengths were the rigorous protocol including the use of a detailed data dictionary. A single researcher undertaking data collection reduced the risk of bias as well as enlisting a second researcher to ensure 100% inter-rater reliability. A sample size of 340 children and data collected over a 12-month period reflects a broad selection of children across all seasons.

Conclusion

Despite inconsistent assessments of dehydration, ED management of children with gastroenteritis is largely consistent with, or superior to, evidence-based recommendations. However, major areas for improvement included dehydration assessment and documentation, blood pressure measurement, fluid balance chart documentation, discharge advice and timely initiation of rehydration strategies. In children with severe or no/mild dehydration, management was evidence-based and unnecessary investigations and treatments were uncommon. However, there was variability in the management of children with moderate dehydration, particularly related to pathology investigations. There is little difference regarding dehydration severity and gastroenteritis complications between Australian Aboriginal children compared with non-Aboriginal children, however there is a difference between management strategies with Australian Aboriginal children receiving more pathology tests, less antiemetic administration and more admissions to hospital. That Australian Aboriginal children and non-Aboriginal children are managed differently or exposed to unnecessary tests may indicate gaps in care but could also indicate patient specific care so warrants further investigation. This study has highlighted a need for further research regarding ED assessment and management in the unique context of the Northern Territory.

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Declaration of Competing Interest

There were no competing or conflicts of interests for this study. Professor Considine had no role in the peer review or editorial decision-making of this paper whatsoever, and was blinded to it as a

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.auec.2023.09.001](https://doi.org/10.1016/j.auec.2023.09.001).

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