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Title:

Paramedic assessment and management of children presenting with head injury: a survey of practice and opinion

Abstract:

Background:

Pressure on hospitals has increased due to rising patient demand, which has resulted in an NHS priority to convey fewer patients to the Emergency Department (ED) by ambulance. Head injury is common in children, and there is a readily identifiable group who gain no clinical benefit from being conveyed to hospital. In the UK, approximately 700,000 children attend the ED with a head injury annually, a third of whom attend via ambulance. Of these, 90% are mild head injuries, requiring no specific treatment aside from assessment and advice. Very few children with head injury who are conveyed to the ED by ambulance need specialist treatment, and the vast majority could be managed safely at scene by paramedics.

Aim:

To investigate the current assessment and management of children with minor head injury by paramedics in pre-hospital care.

Methods:

We conducted a web-based survey of SWASFT (South Western Ambulance Service NHS Foundation Trust) paramedics. The survey was open for one month. An electronic survey platform was used, and simple descriptive analysis was completed by members of the study team.

Findings:

Fifty-nine SWASFT paramedics participated in the survey. Parental anxiety, mechanism of injury, presence of red flags, fear of consequences and safeguarding concerns were the most common reasons that paramedics convey children with head injury to the ED. Paramedics employ a variety of non-validated tools to help them assess and manage a child with head injury, with the head injury guidance issued by the National Institute for Health and Care Excellence (NICE) most used. Many paramedics lack confidence in wound closure, and this was a key barrier to managing patients at scene, along with a perceived inability to manage children more generally, GP availability, lack of training in paediatrics and risk avoidance.

Conclusions:

There are several factors that inhibit the ability of paramedics to manage children with minor head injury at scene, leading to avoidable ED conveyance. 75% of paramedics reported that a clinical decision tool designed to support them in the assessment and management of children with minor head injury would be beneficial. Further qualitative research is needed to explore the factors that influence paramedics when deciding whether to convey a child with a minor head injury to the ED.

Key Words:

Children, Minor Head Injury, Paramedics, Conveyance, Clinical Decision Tool

Key Points:

- Head injury is common in children, and there is a readily identifiable group who gain no clinical benefit from being conveyed to hospital.
- Very few children with head injury who are conveyed to the ED by ambulance need specialist treatment, and the vast majority could be managed safely at scene by paramedics.
- Parental anxiety, mechanism of injury, presence of red flags, fear of consequences and safeguarding concerns were the most common reasons that paramedics convey children with head injury to the ED.
- Many paramedics lack confidence in wound closure, and this was a key barrier to managing patients at scene, along with a perceived inability to manage children more generally, GP availability, lack of training in paediatrics and risk avoidance.
- Paramedics employ a variety of non-validated tools to help them assess and manage a child with head injury, with the head injury guidance issued by the National Institute for Health and Care Excellence (NICE) most used.
- 75% of paramedics surveyed, reported that a clinical decision tool designed to support them in the assessment and management of children with minor head injury would be beneficial.

Background:

The National Health Service (NHS) is under substantial pressure to meet rising patient demand (NHS Long Term Plan, 2019). Emergency Department (ED) attendances have increased by 42% over the past 12 years (CQC, 2018). A significant component of current ED burden is patients attending with injuries that could be managed safely in other settings.

Head injury is common in children, and there is a readily identifiable group who gain no clinical benefit from being conveyed to hospital. In the UK, 1.4 million people attend the ED with a head injury annually, and approximately 50% of these are children under the age of 15 years, most attending via ambulance (NICE, 2014). Of these, 90% are mild in severity, with no underlying structural brain injury; as such they require no specific treatment aside from assessment and advice (NICE, 2014). A national overview of head injury in children (HQIP, 2015) found that a third of children with head injury are transported by ambulance, and 74% of those conveyed were thought to be 'non-serious'. It is not clear why paramedics transport children with minor head injury to the ED, however children and young people are deemed 'high risk' by many paramedics (Drayna et al., 2015).

In 2015-2016 approximately 41,000 12-hour ambulance shifts were lost due to handover delays at overcrowded EDs in England (National Audit Office, 2017). These delays, due to an overburdened system, create a poor experience for patients and parents, and significant delays in emergency ambulances becoming available to respond to new 999 calls. Therefore, it is a policy priority for

ambulance trusts to design new clinical pathways and interventions that support the delivery of care outside hospital, where this is both safe and feasible.

Several tools have been designed to support clinical decision-making when a child presents to hospital with a head injury (Khalifa and Gallego, 2019). These tools are intended for use in the ED and are designed to identify patients who may require computed tomography (CT) scanning. There is currently no out-of-hospital clinical decision tool designed for use by paramedics to assess and manage children with head injury at scene, and reduce unnecessary conveyance to hospital. Such an intervention has the potential to reduce ED attendances and hospital admissions, conserve resources and provide better patient and parent experience, whilst ensuring safe and effective clinical care (Pickering et al., 2011). Subsequently, it is important to explore paramedics' views on an intervention for this purpose and to identify the factors that influence them when deciding whether to convey children (under 19 years) with minor head injury to the ED.

Aim:

To investigate the current assessment and management of children with minor head injury by paramedics in pre-hospital care.

Objectives:

- Determine the reasons why paramedics convey children with a minor head injury to the ED
- Investigate how children presenting with a minor head injury are currently assessed and managed by paramedics in pre-hospital care.
- Ascertain potential barriers to safely managing children presenting with minor head injury in the pre-hospital environment by paramedics.
- Consider paramedics' thoughts on the introduction of an intervention to support them to safely assess and manage children presenting with head injury at scene.

Methods:

We conducted an open web-based survey, using Qualtrics software, of SWASFT (South Western Ambulance Service NHS Foundation Trust) paramedics currently responsible for providing care to children with head injury. Paramedics were sent a link to the survey via social media and professional connections, such as Twitter and What's App. They voluntarily completed the survey after reading a participant information sheet and giving their consent, which was made available at the beginning of the survey. Consent was obtained by participants selecting the option to confirm their consent at the end of the online consent form. At the beginning of the survey, paramedics were asked to confirm that they met the eligibility criteria (qualified SWASFT paramedic responsible for providing care to children with head injury). The survey was anonymous and consisted of both closed, pre-populated questions and open questions, to obtain quantitative data on the current assessment and management of children with minor head injury by paramedics in pre-hospital care. The questions were developed by the lead researcher in consultation with other members of the research team. The questionnaire was not piloted; however, it was sent to the Faculty Research Ethics Committee to ensure that it complied with ethical requirements. Participants were assigned a study ID number, which was automatically generated by the online software, after consenting and confirming eligibility. A convenience sampling strategy was adopted; the survey was open for one month between May and June 2020, the sample was the number of responses within that time frame and reminders were not sent. Participants were able to review and change their answers

before submission. Quantitative data analysis was completed using Qualtrics software, version June 2020 (Qualtrics, 2020). All questions were analysed, and results were presented as descriptive data using percentages and frequencies. Results are reported in accordance with the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) (Eysenbach, 2004).

Ethical considerations:

All procedures were performed in compliance with relevant laws and institutional guidelines. Approval was obtained from the University of the West of England research ethics committee. The study did not require HRA approval due to non-generalisable findings from a study of professionals approached via social media and professional networks, and no identifiable patient data was obtained.

Findings:

Description of participants:

Fifty-nine paramedics working for SWASFT consented to take part in the study and met the eligibility criteria.

Survey findings:

Participants were asked about factors that influence them to convey children with minor head injury to the hospital. Participants provided multiple responses which are presented in Table 1.

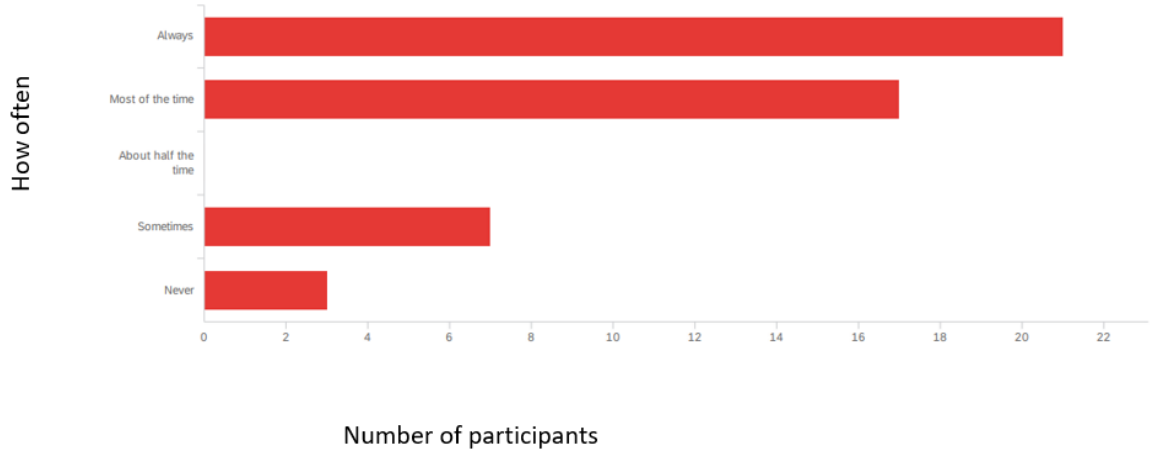
Table 1: Factors that influence paramedics to convey children with minor head injury

Factor	N**umber of responses**
Parental anxiety	14
Presence of red flags	13
Safeguarding concern	13
Mechanism of injury	12
Parental capability	9
Age of the child	7
Wound closure	6
Guidelines/national policy	5
Fear of complaint or 'missing something'	4
Time of day	1

Parental anxiety was the most common reason for conveyance, closely followed by the presence of red flags, mechanism of injury and safeguarding concerns.

Participants were asked whether they use the current National Institute for Health and Care Excellence (NICE) head injury guidance to inform their decision to convey children to the ED. The results are displayed in figure 1.

Figure 1: showing how often participants use the current National Institute for Health and Care Excellence (NICE) head injury guidance to inform their decision to convey children to the ED.



Of the 48 responses to this question, 38 participants (79%) said that they always or often used the NICE guidance when making the decision of whether to convey a child with head injury to hospital. Only three respondents reported that they had never used this guidance.

Following this, participants were asked whether they use other tools or guidelines (instead of NICE) to assess and manage children with head injury, and if so what tools. 60% of participants reported that they used an alternative tool to NICE, compared with 40% who did not. Participants provided multiple answers which can be seen in Table 2.

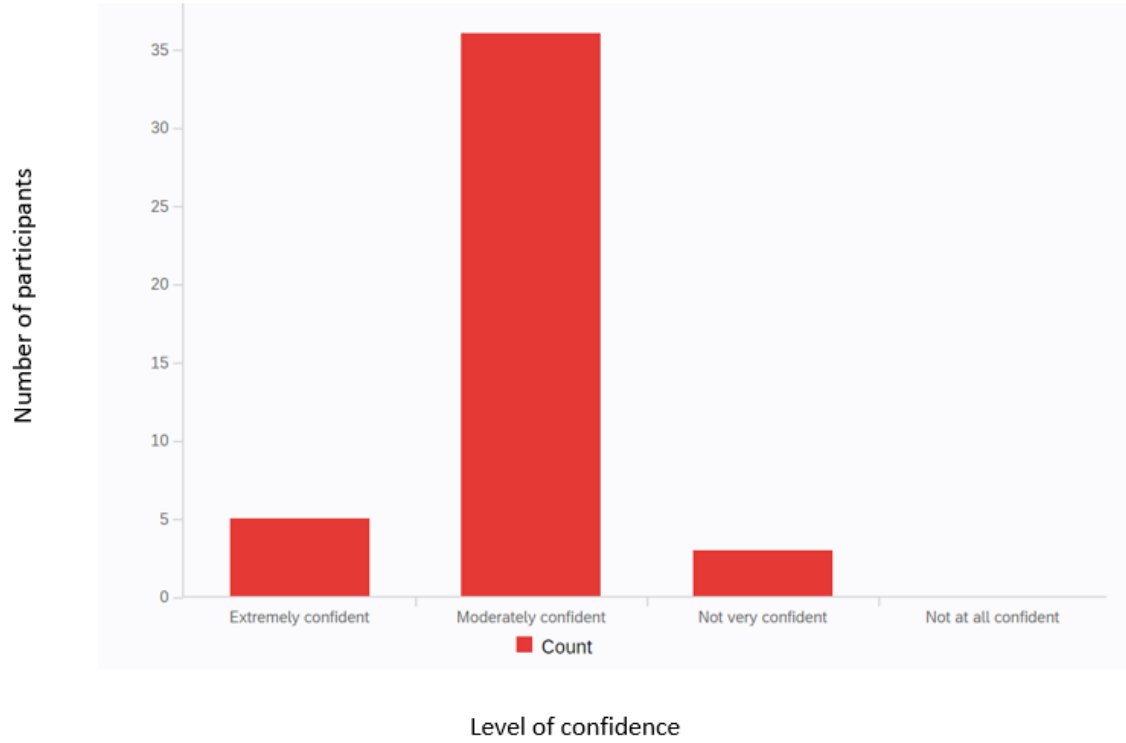
Table 2: Tools used by paramedics for the assessment and management of head-injured children

Tool	**Number of responses**
SWASFT Guidelines	14
JRCALC (Joint Royal Colleges Ambulance Liaison Committee)	5
Paediatric assessment triangle	2
Handi Paediatric App	2
Paediatric big 6	2
Paediatric telephone advice line	2
CHALICE	1
College of paramedics neurology guidelines	1
3-minute tool kit for top to toe	1
PECARN (Paediatric Emergency Care Applied Research Network)	1

- The most frequent response with 14 responses was for SWASFT head injury guidance. This table demonstrates the variety of alternative tools paramedics are

Participants were asked how confident they feel attending to children presenting with a head injury. Results are displayed in Figure 2.

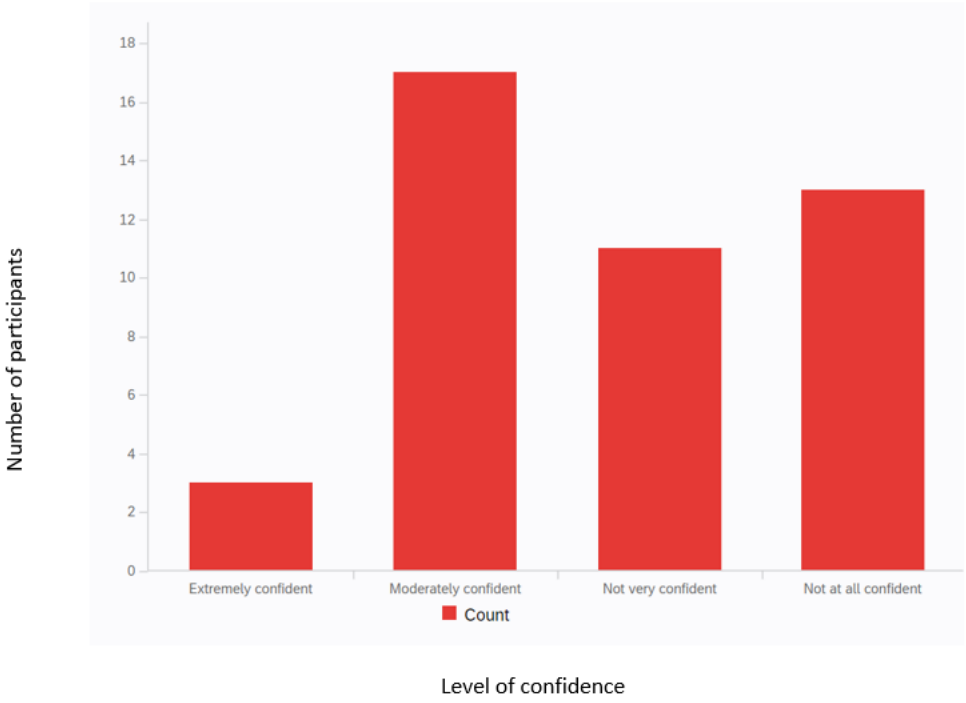
Figure 2: showing how confident participants feel attending to children with head injury



Only 9% (n=4) of paramedics reported that they were 'extremely confident' in attending children with head injury, however most (84%, n=37) of paramedics felt at least 'moderately confident'. None of the paramedics reported that they were 'not at all confident.'

Paramedics were then asked about how confident they are in their ability to close scalp/facial wounds. The results are presented in Figure 3.

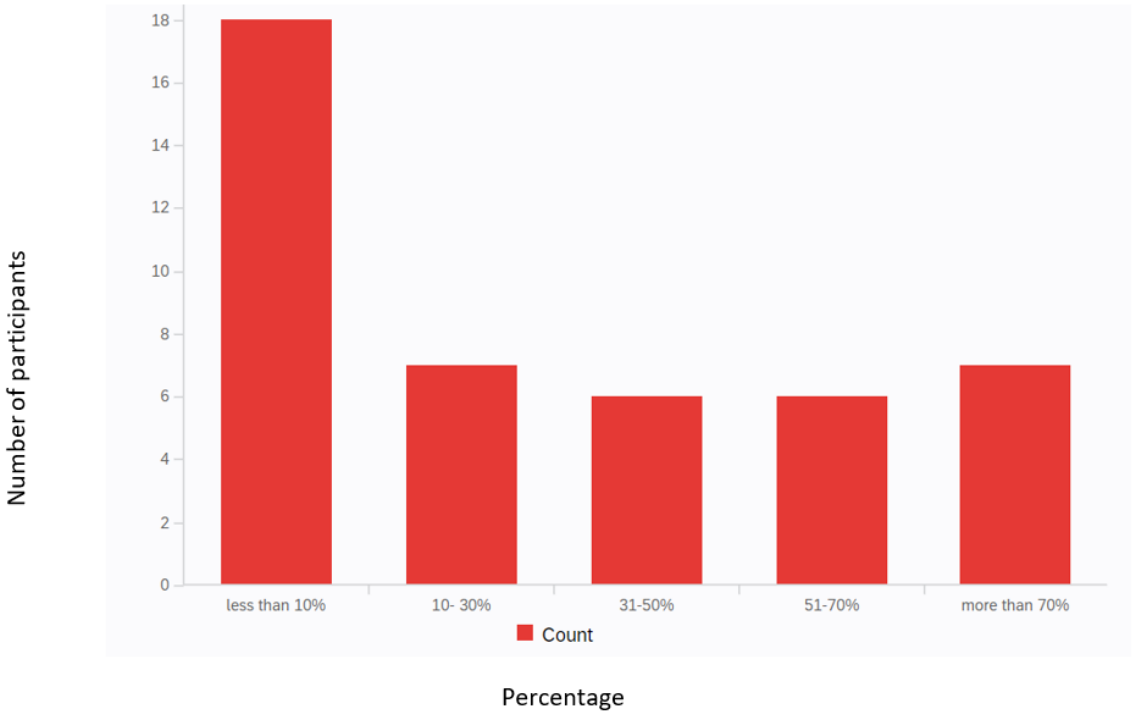
Figure 3: showing participants' confidence in their ability to close scalp/facial wounds



In contrast to general head injury management, approximately half of paramedic respondents (55%, n=24) reported feeling 'not at all confident' or 'not very confident' with wound closure. This correlates with the first question in the survey; paramedics reported that wound closure is a common reason for conveyance.

Participants were asked what percentage of the time they leave children with head injury at home, results are displayed in Figure 4.

Figure 4: showing the percentage of the time participants leave children with head injury at home, with no onward referral



41% (n=18) of paramedic respondents reported that they made no onward referral less than 10% of the time, demonstrating that children were often referred to some kind of alternative care pathway. On the other hand, a smaller percentage (15%, n=7) of paramedics said that they managed children with head injury at scene more than 70% of the time.

Participants were asked what barriers there are to safely managing children presenting with minor head injury in the pre-hospital setting. Participants each provided multiple responses which can be seen in Table 3.

Table 3: Barriers to managing children with minor head injury at scene:

Barriers	**Number of responses**
Parental capability	8
Parental anxiety/perception	7
Wound closure	7
Time of day- out of hours more of an issue due to difficulty accessing a GP	6
Lack of confidence managing paediatrics	5
Risk/ fear of missing something	4
Lack of training	4
Trust policy	4
Lack of ability in managing paediatrics	3
Unable to observe the child	2
Safeguarding	1
Fear of blame culture	1

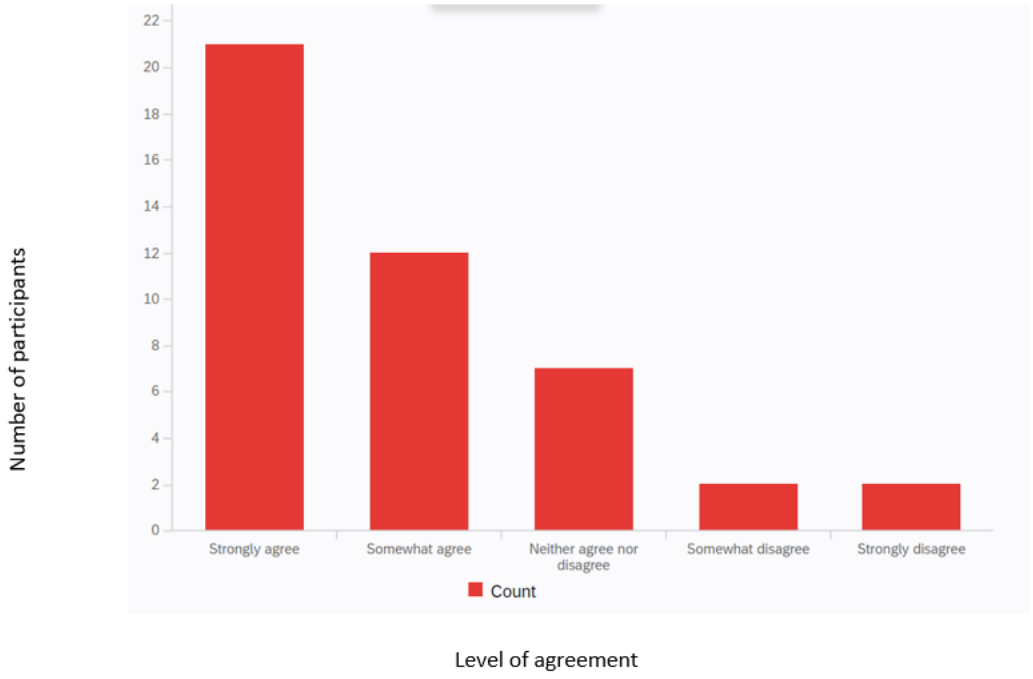
These themes correlate with the first question in the survey when paramedics were asked their reasons for conveying a child with head injury to the hospital. The most frequent response was again parental capability/family circumstances (n=15), followed by the lack of ability to close wounds (n=7). Time of day and ability to access the GP also affected whether paramedics would be more likely to convey (n=6).

Participants were asked what would help them to manage a child presenting with a head injury at scene. Responses included:

- **Additional training in managing children**
- **Decision making aid/validated tool/clinical decision tool specific to paramedics**
- **Paediatric advice line**
- **A CT scanner on the ambulance...!**
- **Specific guidance for parents**
- **Better support and protection from ambulance trusts**
- **Wound closure skills**

Lastly, participants were asked whether a clinical decision tool specifically designed to support paramedics in safely assessing and managing children presenting with head injury in the pre-hospital setting would beneficial:

Figure 5: showing whether participants felt a clinical decision tool specifically designed to support paramedics in safely assessing and managing children presenting with head injury in the pre-hospital setting would be beneficial.



Of the 44 responses, 33 participants (75%) agreed that a clinical decision support tool for this purpose would be beneficial. A small percentage (9%, n=4) disagreed and the remaining 16% (n=7) neither agreed nor disagreed. This suggests that most paramedics that responded to the survey are likely to utilise a clinical decision support tool for this purpose.

Discussion:

This study investigated the current assessment and management of children with minor head injury by paramedics in pre-hospital care in one ambulance trust in the UK. Findings show that the reasons why paramedics in this survey convey children with minor head injury to hospital are multifactorial. Equally, from a paramedic perspective, there are several barriers to discharging head-injured children at scene.

Overall, three quarters (75%, n=33) of paramedics who responded felt that a clinical decision tool would help in their decision making on whether to convey a child with minor head injury to the ED, or an alternative care pathway. This is in keeping with previous studies where paramedics have found clinical decision tools useful to identify alternative patient pathways for other patient groups, such as older adults following a fall (Oosterwold *et al.,* 2018). Clinical decision tools have been at the forefront of digital health solutions for more than ten years (Mann *et al.,* 2019). In pre-hospital care they are used by paramedics to manage risk and support the referral of suitable patients to community-based care, instead of ED conveyance, which reflects the emerging role of paramedics as effective clinical decision-makers (Porter *et al.,* 2018). The use of clinical decision tools can significantly reduce the opportunity for human error, (Yeats, 2018) with outcomes that may be better suited to the patient's situation. Data from Aldridge *et al.* (2020) showed that 50% of children with a head injury were discharged on ED arrival by nurses using a newly developed application of a paediatric head injury clinical decision tool. This supports the concept that a clinical tool for use by paramedics may have the potential to safely reduce conveyance of children presenting with minor head injury. Additionally, when asked in the survey whether the participants used the NICE head injury guidance or other tools, only three of the respondents said they did not use any kind of guidance or tool, suggesting that paramedics find these resources useful in practice. The results of the survey imply that paramedics are using a variety of tools/rules/guidance to support their decision making when considering whether to convey a child with minor head injury to hospital, none of which are validated for this purpose.

One factor reported by the participants' as influencing conveyance was ambulance service policy. For example, some ambulance services stipulate that a child under the age of two should be seen in the ED, no matter how well they appear (YAS, 2020). This is designed to mitigate risk, however arguably this could have the reverse effect by prolonging ambulance waiting times at hospital and creating crowded EDs which are themselves associated with adverse patient outcomes (Eduardo, 2016). Attending the ED can be a stressful experience for all concerned, heightened by the disruption to the family unit and the need to plan care for any siblings during an ED visit. It is therefore important that these policies are revisited to ensure patients are treated safely, since delivering the 'right care in the right place at the right time' results in improved clinical outcomes (NHS Confederation, 2013). Additionally, adjusting these policies may help with the 'fear of consequences' and 'lack of support' culture that paramedics reported in this survey. Six participants stated that attending to this patient group out-of-hours presents further challenges because there are less available alternative care pathways, limited access to GPs and patient notes. This is reflected by the findings of O'Hara *et al.* (2014) who identified that even though paramedics consistently feel

that the ED is not considered the best option for many of their patients, lack of access to alternative options meant that conveyance to the ED was the only option.

Another reason for the paramedics surveyed to convey children with minor head injury to hospital was parental capacity and parental anxiety. One consistent finding from behavioural science is that a person's emotional states can influence how much risk they are prepared to tolerate (Holden *et al.,* 2017). Parents who feel significant anxiety about their child's head injury are likely to perceive it as more serious, and parental concern should not be underestimated when considering conveyance to hospital. Parents have a legal right to participate in decision-making about their child's healthcare to ensure that care is provided in accordance with the child's and the families' preferences (Thompson, 2007).

Another factor listed by participants in the survey for influencing conveyance was safeguarding. Paramedics are in a unique position to identify non-accidental injury in a child, since they are invited into private households, and they play an increasingly significant role in recognising and reporting abuse (Mcdonald, 2015). It is not known how paramedics themselves perceive their role in child protection or how confident they are in carrying it out, and their training in safeguarding is limited (Brady, 2018).

This survey showed that 79% (n=38) of the participating paramedics refer to the NICE head injury guidance when determining whether to convey a child with head injury. However, NICE guidance is not wholly applicable to paramedics because there is a lack of validation in pre-hospital care, use of patient "observation" is not always appropriate or available, and there is limited research evidence on which to base recommendations relating to ambulance non-conveyance. This latter problem is specifically recognised by NICE, which identifies existing pre-hospital head injury research as level 5, grade D (low). Data from the survey showed that paramedics perceived that they managed children at scene without onward referral less than 10% of the time, which further highlights the opportunities that exist for substantial improvement if effective evidence-based tools to support paramedic decision-making are developed and implemented.

One reported barrier to managing children with head injury at scene reported by participants was lack of knowledge, confidence and skills to safely assess children. This is reflected in a study by Hetherington and Jones (2021) which aimed to explore what factors influence clinical decision making for paramedics when attending to paediatric emergencies. The authors concluded that education and training is a critical factor in decision making, and that a broadening of paediatric education would be welcome. Similarly, Fowler and Williams (2017) identified in their scoping review that ambulance calls involving children often evoke anxiety and discomfort in paramedics. Subsequent feelings of low confidence and self-efficacy have been linked with a reluctance to initiate treatment and poorer care and unnecessary conveyance. (Fowler and Williams (2017). This survey did not ask about whether the age of the child matters, (for example under 1's generally pose more risk) which needs to be explored in further work.

Another barrier reported by paramedics was the inability to close wounds. Wound care is an integral part of the role of the paramedic, however training in wound closure (suturing, glue, etc.) is often not incorporated into a standard paramedic degree, and is a skill obtained by specialist paramedics further into their career (Woollard, 2007). Therefore, with limited exposure and training in wound management, it is not surprising that some patients with head wounds are taken to the ED, particularly if there is no specialist paramedic available to refer to.

Limitations:

Responses were received from a convenience and volunteer sample of 59 paramedics working in one ambulance service and this therefore limits the generalisability and transferability of the findings. No data were obtained about the characteristics or demographics of the participants, e.g., gender, experience, or role within the ambulance service, and it is likely that paramedic opinions and experiences vary according to demographic characteristics. Additionally, it is possible that some answers, such as the question asking whether paramedics use the NICE head injury CKS, could have been impacted by the Hawthorn Effect (McCambridge, Witton and Elbourne, 2014) given that they have been specifically asked about the NICE guidance, and therefore this result should be analysed with caution.

Conclusion:

There are several factors that inhibit the ability of paramedics to manage children with minor head injury at scene, potentially leading to avoidable ED conveyance. 75% (n=33) of paramedics reported that a clinical decision tool to support them in the assessment and management of children with minor head injury would be of benefit in the pre-hospital setting. Further qualitative research is needed to explore the factors that influence paramedics when deciding whether to convey children with minor head injury to the ED.

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