DOES THE INTRODUCTION OF A STANDARD PAEDIATRIC OBSERVATION CHART (SPOC) AND A TARGETED INTERVENTION IMPROVE PAIN ASSESSMENT AND MANAGEMENT IN CHILDREN WITH LONG BONE FRACTURE IN THE EMERGENCY DEPARTMENTS OF A RURAL LOCAL HEALTH DISTRICT?

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THE INTRODUCTION OF PAIN ASSESSMENT AS PART OF STANDARD PAEDIATRIC OBSERVATIONS IN A RURAL SETTING – DOES IT IMPROVE PAIN MANAGEMENT IN CHILDREN?

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Abbreviations

CNC	Clinical Nurse Consultant
ED	Emergency Department
HNELHD	Hunter New England Local Health District
INF	Intra Nasal Fentanyl
IV	Intravenous
LHD	Local Health District
MRN	Medical Record Number
NHMRC	National Health and Medical Research Council
SPOC	Standard Paediatric Observation Chart
VMO GP	Visiting Medical Officer General Practitioner (also referred to as on-site Medical Officer within this document)
WHO	World Health Organisation

ABSTRACT

AIM:

To determine whether the recording of pain assessment findings increased with the introduction of the Standard Paediatric Observation Chart (SPOC chart) in a rural Local Health District. The study also sought to explore the effect on pain management in children who presented to emergency departments with long bone fracture.

The second part of the study aimed to assess the effects of a targeted intervention for emergency department (ED) clinicians that included pain management education, introduction of new drugs to current practice (Intra Nasal Fentanyl (INF) and Oxycodone), pain management protocols, administration techniques and pain scoring tools.

METHODS:

This study used a pre-post design to evaluate and compare pain assessment and management data at three periods; prior to SPOC introduction (Stage 1), following SPOC introduction (Stage 2) and following a targeted education intervention (Stage 3). All data was collected retrospectively via medical record audit.

Children aged between 0 and 16 years with a discharge diagnosis of long bone fracture during specific time frames were randomly recruited into the study. A total of 300 patient medical records were audited, 20 records from each of 3 time frames at 5 rural emergency departments that treat patients across the entire age continuum.

RESULTS:

Data for each Stage was analysed for a total of 300 participant records with a mean age of 8.72 years (53% male, 47% female).

Baseline data showed 43 of 100 (43%) children had a pain scored recorded. This figure rose to 65 of 100 (65%) after the introduction of the SPOC chart. A further 13% increase in recorded pain scores occurred following the targeted intervention, with 78 of 100 (78%) children having a documented pain score.

Analgesia use did not significantly increase across the three stages of the project ($p = 0.0393$). However there was a significant increase in the use of appropriate analgesia for the level of pain as described by the pain score ($p = 0.000$).

Pain reassessment also increased across the three stages. 24% of children had a second pain score documented after administration of analgesia at Stage 1, which increased to 34% at Stage 2 with a total of 49% of children having a second documented pain score post analgesia at Stage 3.

CONCLUSIONS:

Pain assessment in children improved when a SPOC chart incorporating a pain score was implemented into an emergency department. This had no direct effect on the number of children who received analgesia; however more appropriate analgesia was administered for their level of pain documented using the pain score. Further improvements of both pain assessment and pain management occurred when additional drug options and protocols, techniques and delivery devices were incorporated into a structured education program for clinicians. This study has demonstrated the value of investment in targeted, paediatric specific education and resources to assist ED clinicians to routinely assess children's pain, to provide appropriate and effective analgesia to children and to assess for efficacy by reassessing their pain.

KEYWORDS: paediatric pain assessment, paediatric pain management, SPOC chart, long bone fracture

EXECUTIVE SUMMARY

BACKGROUND

Repeated audits of paediatric pain management the Hunter New England Local Health District's northern sites over a number of years revealed that 1) a large percentage of children did not have pain assessed on presentation to the emergency departments and 2) pain management is either missing, suboptimal or inappropriate throughout their Emergency Department (ED) episode of care.

Inadequate management of children's pain is multifactorial and well documented in both the national and international literature. A major barrier to effective pain management in children is translating theory into practice. All of the hospital emergency departments in the northern region of HNELHD are mixed emergency departments in that they offer services to paediatric and adult patients. This presents several challenges to rural clinicians including the need to remain skilled and knowledgeable in paediatric best practice while only seeing low numbers of ill or injured children and the competing demands of the busy mixed ED often with no on site medical officers.

Stage 1 of the project involved establishing baseline practices around pain assessment and management of children with long bone fracture via medical record audits at five rural health facilities with similar characteristics, including 24 hour emergency departments with no on-site medical officers, VMO GP cover for patients presenting to ED, but always having registered nurse cover 24 hours a day.

In January 2011 NSW Ministry of Health released a suite of five age specific Standard Paediatric Observation Charts (for the purpose of this document the term SPOC chart will be used interchangeably to refer to one or more of these observation charts) with the aim of improving clinical assessment of infants and children in ED and facilitating recognition of the deteriorating patient. Included in the SPOC chart was a pain assessment section with the expectation that a child's level of pain would become part of the routine clinical observations and acted upon accordingly.

An audit was conducted at Stage 2 following implementation of this chart to establish if there was any impact on pain assessment and management. The findings demonstrated improvement in pain assessment with 22% more children having their pain assessed on presentation. There was no demonstrated increase in the number of children being administered pain relief; however the children who did receive analgesia at this stage were almost 20% more likely to receive appropriate analgesia for their level of pain. .

Stage 3 of the project investigated the role of a 'targeted intervention', which included clinician (both nursing and medical staff) education on the principles of pain assessment and management, provision of pain manuals and guidelines for analgesic use, and introduction of "newer" drugs (commonly used elsewhere but new to regular use within the study sites) with instruction on delivery techniques to assist in the timely and safe administration of analgesics to children. Intra Nasal Fentanyl and Oxycodone were introduced into the emergency departments within HNELHD for the management of severe and moderate pain in children and repeated education sessions ensured both nursing and medical staff were competent in their use.

Stage 3 audits demonstrated clear improvement in both numbers of children having pain assessed and in the appropriate management of their pain. At this stage 65% of children received appropriate analgesia from a baseline of 34%.

THE STUDY

This study comprised a pre-post design using medical record audit to establish the effects of two

interventions on pain management; the provision of a SPOC, and a targeted intervention to improve clinician knowledge and practices around pain management. Three hundred participants were included in the study, 100 from each of the three stages across five sites. Medical record audit was conducted to determine practice at each of the interventional points.

The study compared pain assessment and pain management in children with long bone fracture at five rural health facilities at three distinct time points following two interventions.

RESULTS

Three hundred medical records were audited to determine a range of indicators including documentation of pain score, analgesic administration, appropriateness of analgesia and reassessment of pain.

There was no significant difference in age distribution of children between the three stages. 53% were male and 47% were female.

The majority of children (53%) presented with fractures involving the lower arm (radius and or ulna). Other fracture regions included upper arm, lower leg, upper leg and clavicle. There was no significant difference seen in fracture region presentation across the three stages.

This study demonstrated that pain score documentation increased across the three stages, with 43% of children having pain assessed at Stage 1, 65% at Stage 2 following introduction of SPOC chart, and 78% of children having pain scores documented at Stage 3 following targeted intervention χ^2 (2 = 25.07) p = 0.001.

Analgesia use was measured at each of the three stages of the project with no significant difference occurring in the number of children receiving analgesia. An observed change however was in the appropriateness of the type of analgesia administered. At Stage 1 only 28% of children with severe pain had a narcotic analgesia administered. This rose to 48% at Stage 2 with 76% of children having their severe pain managed appropriately. A similar improvement was seen for management of moderate pain where 53% of children received appropriate analgesia at Stage 1 which increased further to 70% at Stage 3.

Pain reassessment increased throughout the study period and stages of intervention. Twenty four percent of children had pain reassessed at Stage 1, 34% at Stage 2 following introduction of the SPOC chart and 49% of children had pain reassessment at Stage 3 following targeted intervention.

CONCLUSIONS AND RECOMMENDATIONS

The introduction of the SPOC chart with pain assessment section improved pain scoring and pain management in children. Analgesia use became more appropriate when pain was assessed and documented. However, further gains and improvements to practice were achieved when clinicians were provided with education and training on the specialised techniques of assessing and managing children's pain, when pain scoring tools, charts and manuals were provided in the emergency department, and when newer and more effective drugs and protocols were made available for use by both nursing and medical staff for managing mild, moderate and severe pain in children.

Ongoing training and support for rural clinicians is essential when treating pain associated with long bone fracture and other painful injury or illness with recognition of the challenges faced in rural mixed emergency departments.

INTRODUCTION

Children with long bone fractures present frequently to rural emergency departments (EDs).It was evident from routine auditing for quality assurance of paediatric pain management in rural EDs in Hunter New England Local Health District (namely in the Tablelands, Mehi and Peel Clusters) that children were under-assessed and under-managed for pain relating to long bone fracture, despite ample literature and evidence to support the safety and efficacy of appropriate analgesia use in children of all ages (Baulch, 2010, Ali et al., 2010, I, 2010, Bauman and McManus, 2005).

NSW Ministry of Health released the Standard Paediatric Observation Chart (SPOC chart) into every health facility across NSW in January 2011. The chart includes assessment of pain as a routine observation along with temperature, heart rate, respiratory rate and effort and oxygen saturations in children. This study was designed to establish if this initiative by NSW Ministry of Health improved rates of assessment of pain, and use of appropriate analgesia in this vulnerable population. A targeted pain management intervention strategy was commenced in 2012 in the same emergency departments, and this study evaluated the impact of this in order to establish the most effective way to improve outcomes for children with acute pain in the rural emergency department setting.

BACKGROUND

The inadequacy of pain assessment and management experienced by children as compared to their adult counterparts is well documented in the literature (Brown et al., 2003, Probst et al., 2005, Herd et al., 2009). This inadequacy is magnified for children who access health care outside of a metropolitan tertiary facility, who are treated in a mixed emergency department, and who are of a younger age (Herd et al., 2009). Despite the widespread understanding that children suffer both short and long term consequences from untreated acute pain (Ali et al., 2010), translating this knowledge into practice is problematic and results in suboptimal treatment of children's pain in rural and regional emergency departments (Doherty et al., 2007, MacLean et al., 2007).

Previous research has demonstrated that the poor assessment of pain in children is a contributing factor to inadequate pain management, along with other identified barriers such as experience of the clinician, lack of knowledge in regard to effect of analgesia, fear of addiction and absence of clinical guidelines and leadership (Williams et al., 2012, Baulch, 2010).

In 2011 NSW Ministry of Health released the "Between the Flags" Program aimed at recognising the deteriorating patient, which uses a track and trigger system to provide a structured escalation plan. As part of this strategy the age specific Standard Paediatric Observation Chart (SPOC chart) was introduced for children from 0-12 years old, with the 12-16 age group utilising the corresponding Standard Adult General Observation (SAGO) chart. Pain assessment was included as part of the standard of observations for all children.

Twelve months after the introduction of the SPOC chart a pain management strategy was developed by the rural Local Health District's Paediatric CNC in collaboration with a Clinical Leadership Program project. This strategy focused on the introduction of previously unused drugs in HNLHD rural sites; Intra Nasal Fentanyl (INF) and liquid Oxycodone for use in paediatric pain in the rural Emergency Departments, as well as education for clinicians and provision of pain scoring tools.

There is little published literature that addresses the unique challenges of managing children's pain in rural facilities where it is often generalist nursing and medical staff that are charged with assessing and treating sick and injured children. Campbell et al (2012) report that nurses often work as "generalist-specialists" in rural communities, taking primary responsibility for pain assessment and management. Lack of specialist trained staff, isolation from tertiary centres, inability to travel and attend professional development opportunities and the multi-focus of care in mixed facilities all contribute to inequities of access to evidence based best practice for many rural children (Doherty et al., 2007, Brown, 2008). NSW Child Health Networks, HETI programs and NSW Kids and Families aim to address this situation through their initiatives, supporting clinicians to provide standardised management of children as close to home as possible, regardless of geographical location.

LITERATURE REVIEW

International literature reports that children are under-assessed, under-medicated and under-managed for pain, particularly those who seek treatment outside a specialty paediatric tertiary facility (Brown et al., 2003). Much is already known about the contributing factors to this situation but translating theory into practice remains problematic and difficult to achieve in the clinical setting (Doherty et al., 2007).

Several main themes emerged from the literature:

Inadequacy of pain scores in children which contributes to poor pain management

Williams et al (2012) described a multicenter ED pain management study (NHMRC pain study), that highlighted deficits in pain assessment in children, as well as timeliness of analgesia and the lack of pain assessment and management guidelines. They identified that improved compliance with pain assessment and use of pain scoring tools as well as raising local awareness in pain management had the potential to improve pain management for children in emergency departments.

Baulch (2010) in an overview of pain in children noted the historical poor assessment and management of children's pain and recognises the situation continues despite adequate knowledge and understanding of the issue. O'Donell et al (2002) noted that only 49% of children studied received analgesia for long bone fracture, highlighting that pain is still under-treated in ED for our paediatric patients.

Eisen et al (2007) provided a report outlining the success of a pain scoring system and corresponding analgesia protocol in improving pain management of children attending the ED.

Analgesia use in children compared to adults

There is literature describing the disparity between analgesia use in children as compared to adults in the ED (Herd et al., 2009, Cimpello et al., 2004, Petrack et al., 1997). Brown and colleagues (2003) noted that paediatric patients were least likely to receive analgesia, especially narcotic analgesia, and further notes additional effort and resources are needed to address the issue of under-treatment of pain in children with fracture in the ED setting.
Probst and colleagues (2005) found that use of pain assessment scales for infants was very limited, and when reviewing different age groups and analgesia use, described far less use in the 0-5 age

group, with more analgesia used in older children and the likelihood of narcotic use for severe pain increasing with age.

Age of child determines likelihood of analgesia use, including narcotics

Some studies describe decreasing levels of analgesia use with decreasing age (Probst et al., 2005). Children are far less likely to receive any analgesia in the 0-5 age group. Pain assessment is poorer in this age group also, with lack of confidence and understanding of pain scoring tools available by clinicians.

Evaluation of SPOC chart in NSW

There is very little literature or published research around evaluation of the SPOC chart and its impact on patient care. Since the implementation in NSW in 2011, there are only two identified papers written by the same author describing another aspect of the implementation of the SPOC chart and associated clinical review – the impact on workload with the application of inpatient clinical review criteria (O'Leary, 2011).

Use of Intra Nasal Fentanyl (INF) in children with acute pain in the ED setting

Finn et al (2010) recommended that INF be the first choice in children presenting to ED with severe pain. This prospective observational study showed that Intra Nasal Fentanyl is a safe, effective alternative to intravenous morphine.

Borland et al are well published on the subject of INF use in children and describes comparison of INF and parenteral Morphine in children, noting significantly reduced time to analgesia, and decrease in IV Morphine and IV access for analgesia in the ED setting (Borland et al., 2008, Borland et al., 2002, Borland et al., 2007).

Borland et al also describe the safety and efficacy of INF in children with acute pain and the appropriateness of its use in the ED, especially in children with long bone fractures (Borland et al., 2002).

Pain management in rural settings

Despite evidence of geographical disparities in health services, relatively little attention has been focused on rural emergency services, which includes pain management in the ED (Brown, 2008) . Paediatric pain services were first established in larger paediatric centres over two decades ago (Kost-Byerly, 2012), however there remains a need for better pain management for those children presenting for emergency care in facilities in geographic locations with fewer resources. The lack of specialty trained professionals in centres with limited resources will require early inclusion of other healthcare providers to assist with education, drafting of treatment protocols, and review of outcomes for quality improvement (Kost-Byerly, 2012).

Several studies looked at analgesic use in children with fracture comparing paediatric ED physician practices with General Physician practices in mixed EDs, concluding that greater than one third of children received no pain medications in either setting and there was similar practices of analgesic administration in both paediatric specific and mixed EDs (Cimpello et al., 2004). This confirms that this issue is widespread; affecting both rural and metropolitan centres, and is not specific to non-paediatric facilities.

WHY IS THIS RESEARCH IMPORTANT?

To date no published literature can be identified which assesses the performance of the SPOC chart with specific reference to pain assessment and management in children in Australia. This study seeks to address this gap in the existing body of knowledge.

Children under the age of 16 years live in all towns and cities and have the potential to present to every health facility within the state and country, with the full range of illness and injury that affect their adult counterparts.

Acute pain is one of the most common adverse stimuli experienced by children, occurring as a result of injury, illness, or necessary medical procedures. It is associated with increased anxiety, avoidance, somatic symptoms, and increased parent distress (Ali et al., 2010, Brown et al., 2002). Despite the effects that acute pain can have on a child, it is often inadequately assessed and treated. Numerous myths, insufficient knowledge among caregivers, and inadequate application of knowledge contribute to the lack of effective management. The paediatric acute pain experience involves the interaction of physiologic, psychological, behavioral, developmental, and situational factors that often have lasting and lifelong effects (Ali et al., 2010).

Every patient has a right to the appropriate assessment and management of pain (Joint Commission on Accreditation of Healthcare Organisations, 2001). All clinicians who care for children are responsible for eliminating or assuaging pain and suffering in children when possible. Ample knowledge about paediatric pain exists to treat children humanely and effectively, but it is not universally applied. Studies such at this can serve to highlight the problem and try to find solutions to effectively improve management practices in this area.

This study will determine whether the introduction of a SPOC chart for use in children who present to emergency department with long bone fracture improved pain assessment. It will also determine if this had any impact on pain management.

The study also looked at the effects of a targeted intervention around pain management and whether this improved pain assessment and management of children with long bone fracture in ED.

RESEARCH QUESTIONS:

Does the introduction of the SPOC chart alone improve pain assessment documentation?

Does the documentation of pain assessment result in increased numbers of children receiving analgesia in ED, or the appropriateness of analgesia used in children in ED

What impact does the addition of a targeted intervention including education, provision of tools and introduction of ‘newer’ drug options and techniques have in relation to improving pain management for children in the rural ED setting?

AIMS

The aims of this study were to:

1. Assess documentation of pain on the Standard Paediatric Observation Chart (SPOC chart)
2. Assess the impact of documentation of pain on SPOC chart on pain management in children who presented to ED with long bone fracture in relation to:
   - Rates of analgesia provided
   - Type of analgesia
   - Reassessment of pain (repeat pain score)
3. To evaluate the impact of a targeted intervention strategy for clinicians which comprised a structured program encompassing education, provision of pain scoring tools, and introduction of INF and other "newer" drugs into use in the ED setting, using the same indicators as above:
   - Rates of analgesia provided
   - Type of analgesia
   - Reassessment of pain (repeat pain score)

METHODS

The study compared pain assessment and pain management in children with long bone fracture at five rural health facilities at three distinct time points following two interventions.

A pre and post intervention design was used to analyse practices around pain assessment and management at baseline (Stage 1) following introduction of SPOC chart (Stage 2), and following a targeted intervention (Stage 3).

The SPOC chart was implemented into every emergency department in NSW simultaneously, which enabled auditing of documentation of pain scores in the times before and after their introduction. Following this a targeted intervention was rolled out across the rural Local Health District with the aim to improve knowledge, understanding and practices around pain assessment and management. This included education sessions, provision of Intra Nasal Fentanyl and liquid Oxycodone as alternate drug options, and pain scoring tools were provided to emergency departments for infants and children of all ages.

An audit of medical record data was undertaken by the principal researcher at each of five rural emergency departments within Hunter New England Local Health District. Medical records for inclusion were selected using Citrix iPM software and database.

The timeline and date range for audit is set out below:

- Prior to the introduction of the SPOC chart into emergency departments – January 1, 2010 to December 31, 2010. Records from this time formed the baseline data (Stage 1)
- Three months post SPOC chart implementation – 1st April 2011 to 31st December 2011 (Stage 2). This data reflected any changes to practice following introduction of SPOC chart. At this point there were no further interventions or significant factors that could affect practice (such as policy release, NSW Ministry of Health advice).

- Three months following a targeted pain management intervention/strategy that was rolled out to each of the Emergency Departments focusing on education, provision of "new" drug options and techniques (including Intra Nasal Fentanyl) and provision of pain scoring tools – 1st October 2012 to 31st December 2013 (Stage 3).

See Figure 1 for visual representation of the timeline.

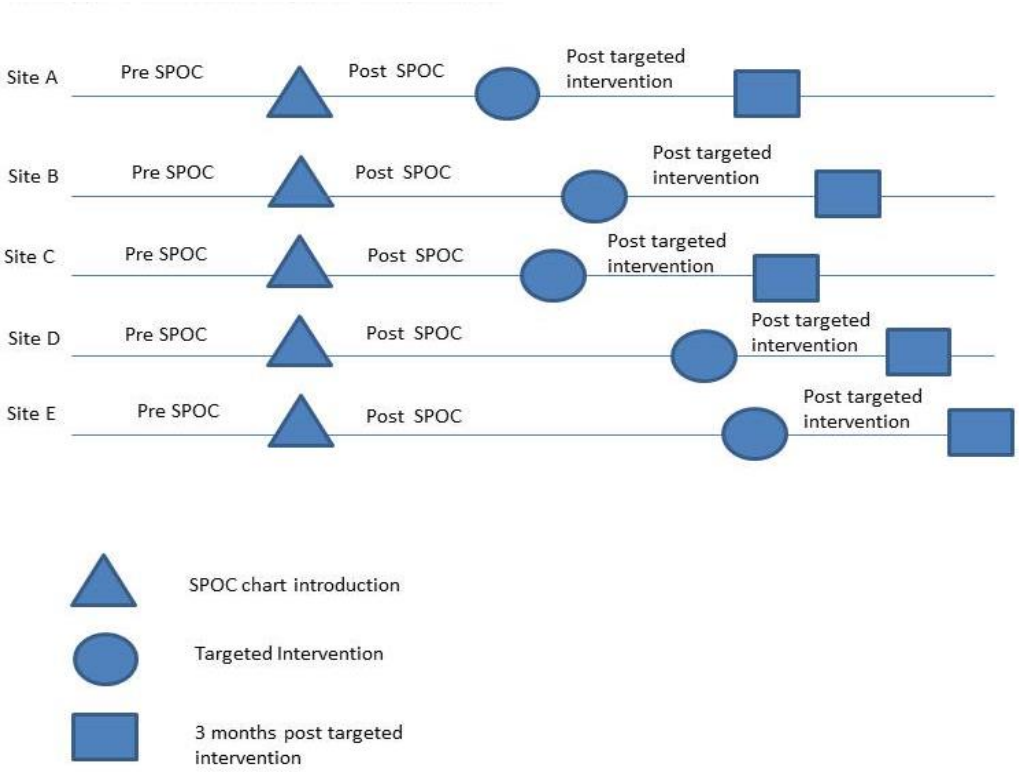

FIGURE 1. TIMELINE OF MEDICAL RECORD CHART AUDIT

The data collection was achieved through manual audit of selected medical records of children sustaining a long bone fracture and presenting to the EDs during each time phase, i.e. before SPOC, post SPOC and Post intervention. Data collected included: documented pain score, documented analgesia and documented reassessment of pain score, outlining the ED patient occasion of service and treatment provided. The data was analysed using descriptive statistics to establish baseline practices, followed by analysis of the impact of the introduction of the SPOC chart on both pain assessment and documentation and management, then again following a targeted intervention to establish any further change in practice.

Inclusion Criteria

Selection criteria for participants from each of the five study sites were identified by a manual iPM search using the report code RH_ED0079 (treatment outcomes). Due to the limited presentation numbers of children with long bone fracture a convenience sample size of 20 was selected, which represented the majority of children who fitted the following criteria:

Less than or equal to 16 years (up to their 17th birthday)

Presentation to ED within one of each of the three identified date periods:

- 1/1/2010 – 31/12/2010 (Pre SPOC chart introduction)
- 1/4/2011 – 31/12/2011 (Six months post SPOC chart implementation)
- 1/10/2012 – 31/12/2013 (Six months post targeted intervention at each site)

Patients with a discharge diagnosis of long bone fracture. Long bone fracture is defined as fracture involving any one of the following anatomical regions:

- Lower arm: radius, ulna or both
- Lower leg: tibia, fibula or both

Exclusion Criteria

Patients who re-presented to the emergency department for review or repeated management of a fracture were excluded.

Sample Size

5 rural emergency departments within the northern region of HNELHD were used to collect data:

- Inverell;
- Gunnedah;
- Glen Innes;
- Narrabri;
- Moree

These sites were selected on the basis of them having similar characteristics, these being

- GP/ VMO serviced ED's with no 24hr on site medical cover
- Rural health facilities with no specialist paediatric or orthopaedic clinicians
- Mixed adult and paediatric emergency departments

The collection of MRNs suitable for audit were then selected using the iPM data base with search sorting on child equal to or less than 16 years, date and discharge diagnosis of long bone fracture.

Twenty charts were audited from the three time periods for every site, totaling 60 medical records at each of the five sites. Total number of charts audited was 300.

Instruments

A medical record chart audit tool was developed for this study. Data collected using this paper-based tool was then transcribed into a computer database for analysis.

The following data was collected:

MRN	**Age**
Triage Time	Triage Score
Time seen by medical officer	Presenting problem
Observations at triage (yes/no)	Pain Score or Pain Severity documented
Any analgesia received (yes/no)	Type of Analgesia received
Time to Analgesia	Repeat pain Score
Weight recorded (yes/no)	Drugs recorded and signed as per legislation
Discharge time	

TABLE 1: DATA COLLECTED AT MEDICAL RECORD AUDIT

Ethics

A Low/Negligible Risk ethics application was approved by the HNELHD Human Research Ethics Committee (HREC) on 28/2/2013 - NSWHREC Reference No. LNR/13/HNE/44.

Data Analysis

Data was entered into an Excel Spread sheet™ and exported to SPPS for statistical analysis. Margaret Rolfe, a biostatistician from NSW Rural HETI assisted with data analysis.

Appropriateness of analgesia was interpreted according to the World Health Organisation (WHO) published categorisation of pain and appropriate analgesia guidelines (World Health Organisation, 1986). If a pain score was not documented the analgesia appropriateness was categorised ‘Unable to Determine’.

Conflict of Interest

The Principal Researcher, an employee of HNELHD who provides paediatric services to the study hospitals, conducted both the intervention and the audits, but was not involved in the clinical care of any of the patients involved in the study.

RESULTS

Demographics

Table 2. summarises the demographics of the group by intervention status. There were 100 participants in the combined Pre SPOC group, 100 in the Post SPOC group and 100 in the post intervention group. The one way ANOVA test to compare age revealed no significant difference in age distribution of children between the three stages $F(2,297)=1.583$, ($p=.207$). 158 of 300 (53%) were male and 142 (47%) female.

The majority of children across all sites who presented with long bone fracture were aged in the 6-12 year age group (55%) with an all group mean age of 8.72 years (Figure 2.)

Demographics	Pre SPOC Group n (%)	Post SPOC group n (%)	Post Intervention group n (%)
Gender			
Male	53 (53%)	55 (55%)	50 (50%)
Female	47 (47%)	45 (45%)	50 (50%)
Age			
Mean	8.840	9.130	8.200
Std Deviation	3.909	3.702	3.730
Age Categories			
0-2	6 (6%)	5 (5%)	4 (4%)
3-5	19 (19%)	14 (14%)	25 (25%)
6-12	54 (54%)	57 (57%)	54 (54%)
13-16	21 (21%)	24 (24%)	17 (17%)

TABLE 2. DEMOGRAPHIC DISTRIBUTION OF PARTICIPANTS

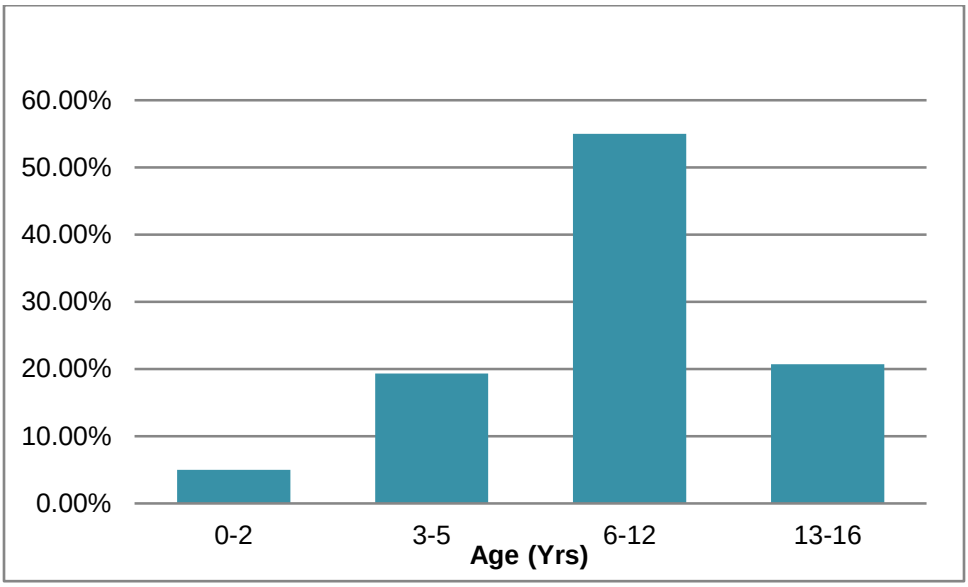

FIGURE 2. AGE DISTRIBUTION OF PARTICIPANTS ACROSS ALL SITES AND STAGES WITH LONG BONE FRACTURE (N = 300)

Presentations

Long bone fracture region is described in figure 3. The majority of children (53.3%) presented with fractures involving the lower arm (radius and or ulna). Other fracture regions included upper arm (humerus), lower leg (tibia and or fibula), upper leg (femur) and clavicle.

Time of day of presentation was predominately in the afternoon with 59.9% of children presenting to ED between the hours of 1200 to 1800. (Figure 4)

Less frequently children presented in the morning or evening, with no children presenting overnight between 2300 and 0600 hours.

There was no significant difference seen in fracture region presentations across the three stages χ^2 (*8)*= 3.653 *p* = .894

Presentation Time of day did not significantly differ across the three stages χ^2 (6)=4.965 *p* = .569.

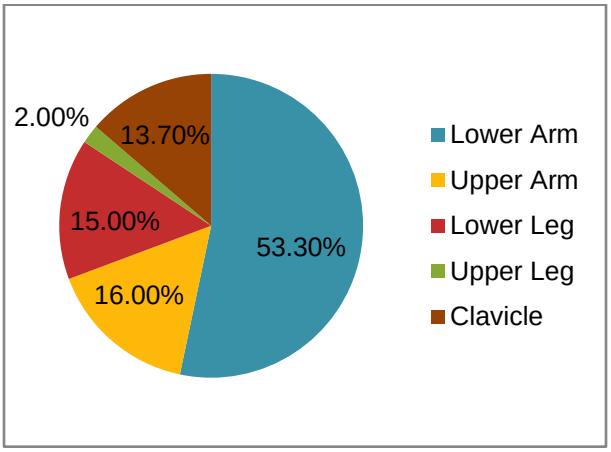

FIGURE 3. FRACTURE DISTRIBUTION BY REGION

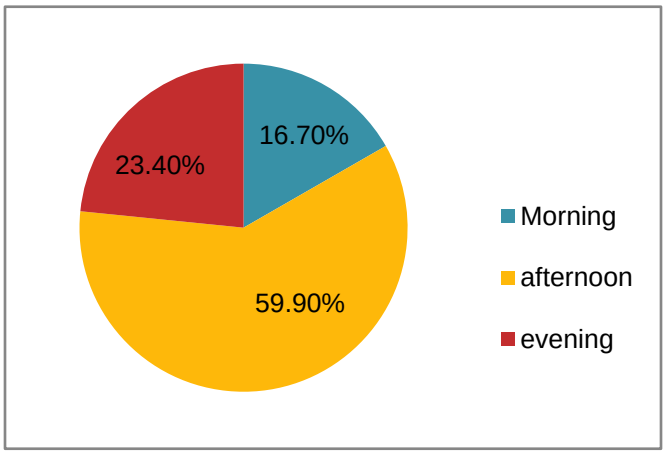

FIGURE 4. PRESENTATION TIME OF DAY

Pain Scores

Pain score documentation was assessed at each of the three stages. See figure 5. 43 of 100 (43%) children received pain scores at baseline, with this figure increasing with the introduction of SPOC chart, then again following the targeted intervention. The greatest increase in pain score documentation occurred between baseline and introduction of the SPOC chart (22% increase). Overall, there was a 35% increase in the documentation of pain scores during the study period, with 78% of children having pain scores recorded following the targeted intervention at Stage 3. χ^2 (2 = 25.07) *p* = 0.001

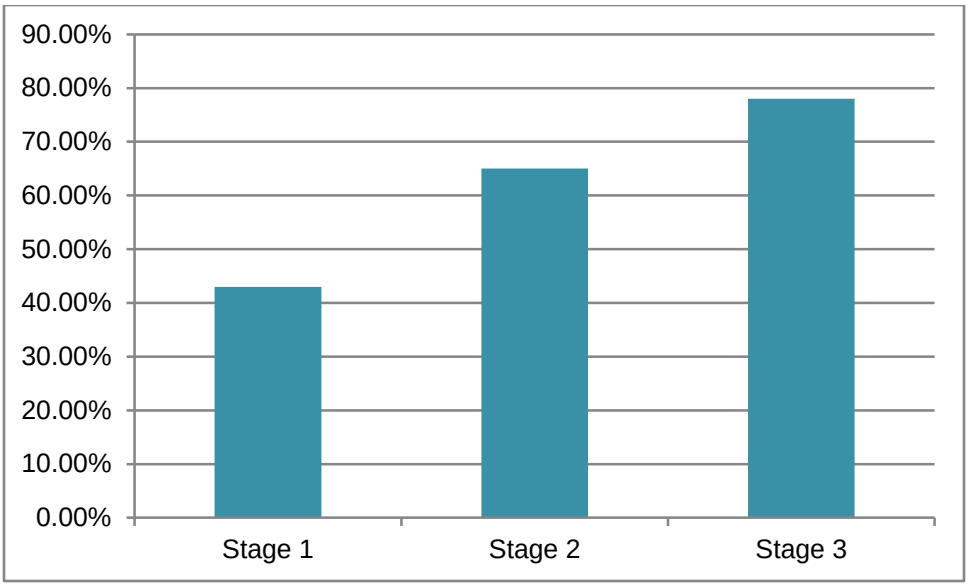

FIGURE 5. RATES OF DOCUMENTED PAIN SCORE ACCORDING TO STAGE.

Analgesia use

Analgesia use was measured at each of the three stages of the project with no significant difference occurring in the number of children receiving analgesia. χ^2 (*2*= 1.94) *p* = 0.0393. 70 of 100 (70%) children received analgesia at Stage 1, 62% at Stage 2 and 70% at Stage 3. This did not take into account whether the analgesia was appropriate or not and reflected any drug administered. See figure 6.

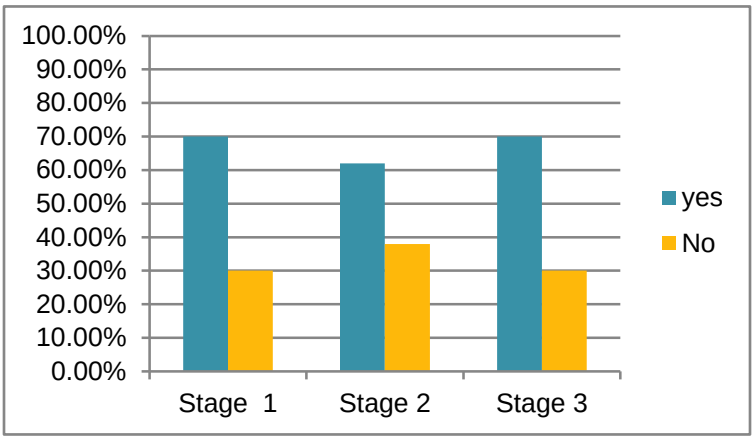

FIGURE 6. RATES OF ANY ANALGESIA ADMINISTERED AT EACH OF THE THREE STAGES

Appropriate Analgesia use

Appropriate analgesia refers to analgesia administered that is considered effective for the level of pain it is treating and can only be determined where a pain score has been documented. The World Health Organisation have categorised pain and the appropriate analgesia use and this remains the international referral point for pain management (Ripamonti et al., 2011). Figure 7 demonstrates rates of appropriate analgesia use throughout the three stages of the project. The rate of appropriate

analgesia administered increased throughout the stages of intervention, and the rate of 'unable to be determined' fell simultaneously. This indicates that more children were receiving pain scores, which has a direct relationship on the rate of appropriate analgesia administered (χ^2 *(4)*= 27.29, p = 0.000).

It is evident from this study that pain score and appropriate analgesia are directly related, (correlation coefficient r =0.99)

Figure 8 demonstrates this finding across the three stages.

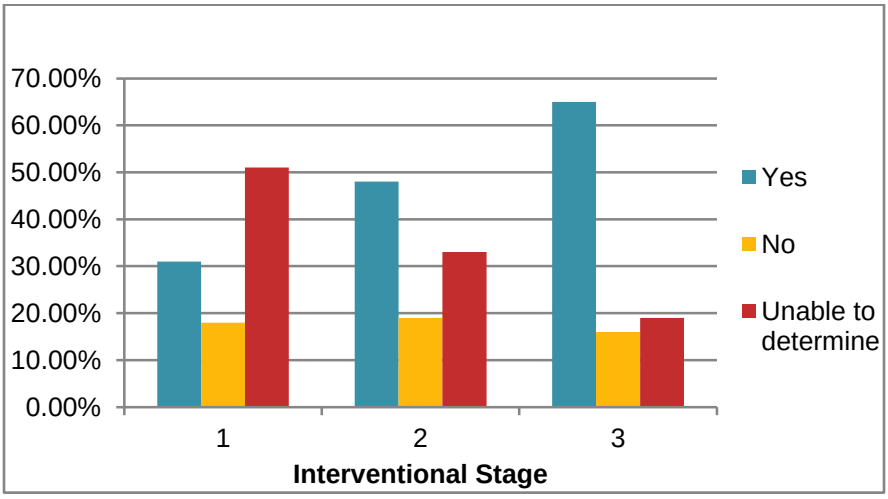

FIGURE 7. RATES OF APPROPRIATE ANALGESIA USE THROUGHOUT THE THREE INTERVENTIONAL STAGES.

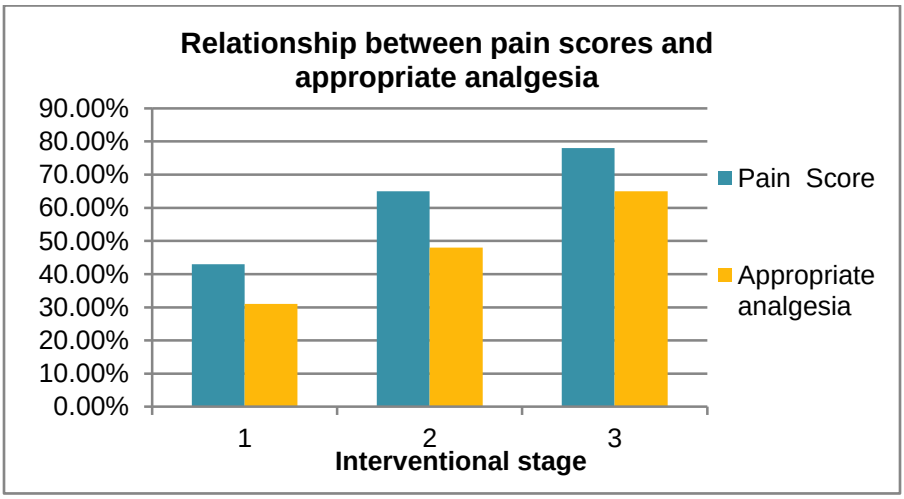

FIGURE 8. RELATIONSHIP BETWEEN PAIN SCORES AND APPROPRIATE ANALGESIA ACROSS 3 STAGES

At Stage 1, 20% (1/5) of children with severe pain received a narcotic analgesia. This rose to 48% (14/29) at Stage 2, with 76% (16/21) of children having their severe pain managed appropriately. A similar improvement is seen for moderate pain, where only 53% (9/17) of children received appropriate analgesia at Stage 1, 50% (10/20) at Stage 2 with an increase to 70% (17/24) at Stage 3 following intervention.

Table 3 reflects the WHO drug class recommendations for treatment of mild, moderate and severe pain and the medication recommendations (WHO, 1986). This table outlines medications used throughout the study period throughout all three stages of the project and does not reflect changes to practice throughout the stages. It is evident that a large number of patients are treated with simple analgesics for mild pain (41%) despite there being only 12% of children who had pain assessed as mild.

Drug	Frequency of use	Combined frequency	Pain Zone Prevalence
Mild Pain			
Paracetamol	29.7%	41%	12%
Neurofen	11.3%		
Moderate Pain			
Painstop	13%	21.7%	23%
Codeine	1.7%		
Oxycodone	4.0%		
Panadeine	3.0%		
Severe Pain			
Panadeine Forte	4.0%	24%	24%
Intra Nasal Fentanyl	9.3%		
IV Morphine	5.7%		
IMI Morphine	5.0%		
Other	3.0%	3.%	Not documented 39%

TABLE 3. FREQUENCY OF DRUGS USED THROUGHOUT THE PROJECT IN RELATION TO PAIN SEVERITY.

Age and Appropriate Analgesia Use

Table 4 indicates appropriate analgesia according to age increased across all age groups throughout the three stages, with the largest increase occurring in the 0-2 age group, however this group still had the lowest overall appropriate analgesia use at Stage 3.

Small improvement was seen in appropriate analgesia use following the introduction of SPOC chart, which is not surprising considering there was no analgesia direction or information provided on this observation chart. Analgesia use did significantly improve at Stage 3 following the targeted intervention.

Figure 9 demonstrates these changes to practice.

Age	Stage 1	Stage 2	Stage 3	Cumulative Increase
0-2 (n = 15)	26.7%	0%	50%	23%
3-5 (n = 58)	56.1%	42.9%	76%	20%
6-12 (n = 165)	47.6	52.6%	61%	13%
13-16 (n =62)	46.8	50%	64.7%	18%

TABLE 4. APPROPRIATE ANALGESIA USE ACCORDING TO AGE AND STAGE

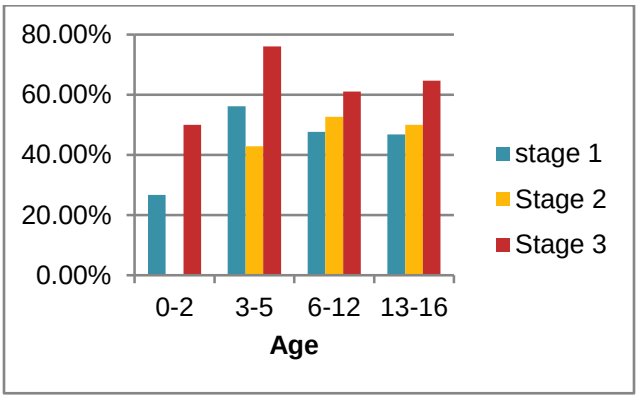

FIGURE 9. APPROPRIATE ANALGESIA ACCORDING TO AGE AND STAGE

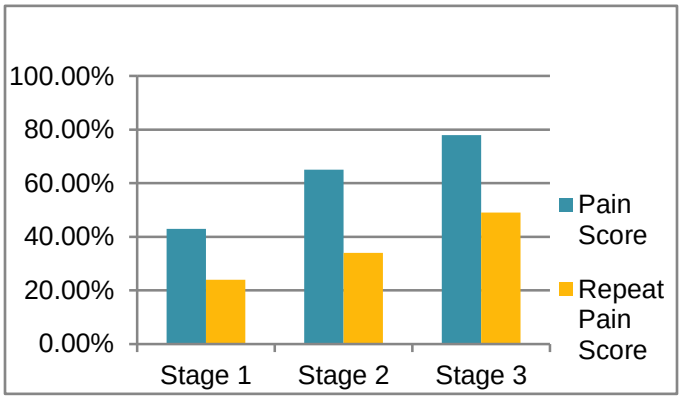

FIGURE 10. PAIN SCORES AND DOCUMENTED PAIN REASSESSMENT

Reassessment of pain

Pain reassessment increased throughout the study period and stages of intervention. At baseline, the percentage of all children who had pain reassessed was 24%, at Stage 2 following SPOC chart introduction this rose to 34% and at Stage 3 with a total of 49% of children have reassessment following the targeted intervention at Stage 3 (Figure 10). This represented an improvement of 25% which is significant but remains lower than what would be considered best practice χ^2 (*2*)= 13.8 *p* = 0.001.

DISCUSSION

Long bone fracture is considered a painful injury (Gourde and Damian, 2012) and was used in this study to assess pain management of children less than 16 years in emergency departments. The findings of this study support what is already known about children receiving suboptimal analgesia in ED and the poor rates of pain assessment that contribute to this problem (Fein et al., 2012, Gourde and Damian, 2012). The identified changes to practice have been analysed in relation to the impact of two interventions that took place over a specified time period.

Pain Scoring

After analysis of the data, it is evident that the introduction of SPOC chart at Stage 2 has had a significant impact on clinician practice of pain assessment and documentation. Pain assessment increased across all age groups and all fracture types, with the overall rates of pain scoring increasing from 43% at Stage 1 to 65% at Stage 2 following the introduction of the SPOC chart. This further increased at Stage 3 to 78% of children having pain scores recorded. Increases were evident across all five sites, with some sites achieving better results than others. The provision of a formal chart, and policy and procedure to support its use in all EDs resulted in a great improvement of observation in general in children, and specifically on pain assessment. The increased number of children who were having pain assessed following Stage 3 is attributed to the effects of the targeted intervention. Children were more likely to receive repeat pain assessment also, as evidenced by an increase in reassessment rates, which went from 24% at Stage 1 to 49% at Stage 3.

An improvement in all measurable parameters of the project occurred at Stage 3 following a targeted intervention.

Appropriate Analgesia

The interpretation of 'appropriate analgesia' is reliant on accurate pain assessment and documentation of pain score, or pain zone (mild, moderate or severe). In over 50% of cases at Stage 1, appropriateness of analgesia was unable to be determined due to no pain assessment being recorded.

At Stage 1 it was identified that approximately 70% of children received some form of analgesia when presenting with a long bone fracture to the ED. On further analysis, it was revealed that of that 70%, less than half, only 31% had received appropriate analgesia for their level of pain. This is supported by the literature that addresses in depth the reasons why children are under-medicated, which are complex and varied, and appear to be wide reaching across both metropolitan and regional or rural settings (Brown, 2008).

Paracetamol was the most frequently administered drug across all stages, with almost 30% of children who received analgesia receiving Paracetamol. Ibuprofen was administered in 11% of instances, with both these drugs being indicated for mild pain. Only 12% of children who presented had pain assessed as mild, however 41% of children received either Paracetamol or Ibuprofen alone, which represents under-treatment of their pain.

Paracetamol is a nurse initiated medication that can be given without a medical officer order, is easily accessible in the emergency department, and is generally well accepted by children and parents, and has a relatively low risk profile. In short, it is an easy and quick option that is often the preferred method of pain management by nursing and medical staff looking after children. Repeat pain assessment was only performed in 24% of cases at Stage 1 so under-treated pain was not being identified in the majority of instances.

At Stage 2 following introduction of the SPOC chart, appropriate analgesia use increased from 31% to 48%, representing a 17% increase. Interestingly, this correlates with the 17% increase in pain scoring noted at this stage. This supports the knowledge that children are more likely to receive analgesia if they have their pain assessed and stratified, showing a direct link to increased pain scoring.

Following Stage 3 targeted interventions, the use of appropriate analgesia further increased to 65% of cases. Again, this follows the trend of further increases in pain scoring at Stage 3 (13%) and can also be attributed to greater knowledge about pain management, access to tools, protocols and availability of other drugs options. This increase represented a further 17% improvement in the number of children receiving appropriate analgesia and showed an overall improvement from Stage 1 of 34%.

Severe pain (pain score 7 to 10) is most effectively treated with a strong opioid (World Health Organisation, 1986) and rate of opioid administration increased throughout the three stages, particularly at Stage 3 following the intervention. 28 of 100 (28%) children with severe pain received an opioid at Stage 1, 48 of 100 (48%) at Stage 2 and 76 of 100 (76%) at Stage 3. The provision of INF as a treatment choice for severe pain at Stage 3 resulted in the ability of nursing staff to administer this drug without the need for a medical officer to insert an intravenous cannula to deliver IV narcotics. As there are no on-site medical officers, this provides an excellent alternative for rapid, safe and effective analgesia for children with severe pain. The rate of intravenous or intramuscular injection of Morphine dropped throughout the study from 8% at Stages 1 and 2 to only 2% of children requiring a secondary painful procedure for narcotic administration. 10% of all children had oral or intranasal narcotic at Stage 3 compared to 2% at Stages 1 and 2.

Age and Appropriate Analgesia Use

Many studies have identified a relationship between age of the child and analgesia use, with younger children less likely to have pain assessed and analgesia administered (Probst et al., 2005, Brown et al., 2003). This study showed mixed findings on this, with a definite spike in the 'unable to be determined' category for the 0-2 age group. This can be interpreted that this age group is often perceived as difficult to assess and score, due to their nonverbal status and other difficulties in pain assessment in the infant. There is often reluctance by the clinician to administer narcotics to this age group regardless of pain score due to concerns around respiratory depression, and other myths and misconceptions about pain in young children (Fein et al., 2012). This age group had the lowest use of appropriate analgesia, as well as the highest 'unable to be determined', following the internationally recognised trend of infants less than two years least likely to have their pain assessed and appropriately managed. (Probst et al., 2005)

An infant pain scale formed part of the SPOC chart introduced at Stage 2 of the project. Interestingly, no education or explanation on how to use this pain scoring tool accompanied the roll out, and the results of appropriate analgesia use for this age group at Stage 2 were none out of five infants (0%). The Neonatal and Infant Pain Scale (NIPS) was not previously used in any of the study facilities, so was a new scale for many clinicians. Following education and training on infant pain scales and assessment provided to facilities during Stage 3 there was an increase in appropriate analgesia use in the 0-2 age group of 50% (two out of four infants) from Stage 2 to Stage 3.

This further supports the finding that the SPOC chart alone is not as effective in increasing pain assessment and management in infants and children without providing clinicians with the appropriate education and training and additional drug options to effectively undertake this task.

Reassessment of Pain

Stage 1 re-assessment of pain was identified at 24% of presentations. Improvement in pain reassessment was seen across all three stages of the project. Best practice standards identify that the severity of pain moves through various levels dependent on a number of factors, including analgesia use, immobilisation, distraction, and other treatment options. It is important to assess the effects of treatments provided, including drug treatments to assess efficacy and need for ongoing management. This aspect of pain management has been poorly attended as identified at Stage 1 of this study.

Gains were made in rates of pain reassessment across Stages 2 and 3, and followed the same trend as the other improvements seen. A 10% improvement occurred at Stage 2 with the introduction of the SPOC chart, and a further 15% gain was made in number of children who received pain re-assessment after the targeted intervention at Stage 3 they resulted in 25% more children having pain reassessment from baseline but the rate overall remains lower than what is clinically acceptable practice. All children should have pain reassessed while in the emergency department and this will continue to be addressed via ongoing audit and feedback and reinforcement of expected standards of practice.

Implications for Practice

It is evident from this data that it is possible to improve assessment and management of children's pain in ED with the provision of a SPOC chart that incorporate pain score into the document. The implementation of SPOC charts into EDs in this LHD has produced a modest improvement across all five sites studied, at a relatively consistent rate. However, rates of pain assessment and management remained sub-optimal and not to the standard expected by the population in general, the LHD or the Ministry of Health and other governing bodies. This study has demonstrated it is more effective in achieving further improvements to practice to provide targeted interventions with clinicians that involve education, protocols for management, tools for scoring pain in children and instruction on use of newer and more effective drug options. The SPOC chart alone has not been sufficient in addressing the identified under-assessment and under-management of children's pain in the ED, but has resulted in improved documentation of pain, which has been demonstrated in this study to influence pain management practices.

Nursing staff who work in rural mixed emergency departments are required to manage many competing demands across the whole age continuum and acuity of patient presentations. They do not always have access to on-site medical officers 24 hours a day, specialist physicians or paediatricians to guide their clinical practice as well as providing expert clinical advice. This results in the need to ensure that clinicians have the appropriate supports, structures and systems in place to achieve best practice for their patients, and this is particularly so for paediatric patients who may be seen infrequently in some rural areas (Jennissen et al., 2011). This study highlights the need for ongoing monitoring of ED practices around paediatric pain management in line with new developments in pain management strategies, techniques and drugs.

Limitations

The design of this study was retrospective with the potential for missing data. The large number of patients whose pain was unable to be determined due to not having their pain severity documented may have influenced some of the study findings. However, as documentation forms part of the legal requirements for the medical record, it is important to report the finding of pain assessment as 'not documented'.

The relatively small sample size for the 0-2 age group reflects the physiology of the infant's supple bones and the reduced likelihood of them sustaining long bone fracture. This is reflected by the small sample size and may impact on the interpretation of findings for this age group.

No assessment of non-pharmacological adjunct therapies was recorded during the study, such as RICE (rest, ice, compression, elevation), splinting or distraction, which could have impacted pain management strategies.

This research was conducted by the same person who completed the educational intervention prior to Stage 3. To mitigate a risk of bias random sampling of records and independent analysis by a biostatistician external to the LHD reduce the risk of sampling or interpretation bias.

Strengths

To the best of the author's knowledge, this is the first study to report the impact of the introduction of the SPOC chart) on pain assessment and management in children in NSW.

The strengths of this study lie in the ability to control the interventions at Stages 2 and 3 due to the timing of the statewide rollout of the SPOC chart. Each site began using this chart at the same time with the same implementation conditions, thus minimizing potential bias around its use. There was an expectation from the NSW Ministry of Health, as well as the rural LHD, that level of pain and other clinical observations would be assessed and documented for every patient and this was inherent in the commencement of this standardised chart.

The intervention at Stage 3 was conducted by the Principal Investigator in her role as a Paediatric Clinical Nurse Consultant who applied a consistent approach across the 5 sites and provided standardised pain scoring tools, charts and drugs throughout all study sites, ensuring consistency of information, support and transfer of knowledge to clinicians.

At each of the five sites key medical personnel were engaged in the process especially at Stage 3 to ensure that any changes to practice reflected both medical and nursing management. This was provided to the medical officers by both a skilled and experienced Paediatrician and Paediatric CNC from within the LHD.

CONCLUSION

This study describes the prevalence of under-assessment and under-management of children's pain in 5 rural emergency departments within Hunter New England Local Health District.
The assessment and documentation of children's pain was improved by the introduction of the NSW Ministry of Health Standard Paediatric Observation Chart. However this alone did not influence the number of children who were administered an analgesic in the ED; but appeared to result in an improvement in the appropriateness of analgesia administered.
A targeted intervention on paediatric pain management in the ED occurred at Stage 3 and demonstrated further improved outcomes for children with pain assessment and management. The appropriateness of analgesia also increased again at this point which highlights the benefit of specific and targeted programs.
The challenge remains to sustain the improvements made and to ensure that pain continues to be identified and appropriately treated for this vulnerable age group. This will need to focus on clinician attitudes to children's pain management, continuous audit and feedback to ensure the barriers to effective pain assessment and management continue to be addressed.

RECOMMENDATIONS

The demonstrated value of the Standardised Paediatric Observation Chart (SPOC chart) in improving documented pain assessment in children should be communicated to the Clinical Excellence Commission and NSW Kids and Families. It is recommended that there be ongoing evaluation of the observation charts to ensure these improvements are sustained and built upon. Local managers need to ensure that every child is assessed using this chart on presentation to emergency departments, with all observations completed.

Education and training is vital for clinicians to keep abreast of changes to practice such as, drugs available for use, emerging techniques for delivery, new developments in the field of distraction and adjuncts for use in managing a child experiencing pain. Parental expectations of their child's experience in emergency departments needs to be taken into consideration and addressed.

Where a child does not receive appropriate analgesia it is recommended that this be recorded into the Incident Information Monitoring System (IIMS) for follow up and action, rather than this currently being an accepted and tolerated practice within our emergency departments.

With the imminent release of the NSW Health Acute Pain Management Clinical Practice Guideline for Infants and Children there is an opportunity to embrace standardised management of children with acute pain across NSW.

Ongoing support for rural and generalist clinicians is recommended in caring for sick and injured children, as this is often a challenging situation for those who manage children infrequently, and are not specialty trained in the area of paediatrics. The isolation and lack of medical backup often influences drug choices made by clinicians in trying to juggle the competing demands of safety, efficacy and appropriateness of pain management in a paediatric patient who may need to travel great distances to receive definitive care. However, with the right protocols, drugs and training for clinicians, this can be achieved.

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