

## REVIEW ARTICLE

# Developing a pediatric pain service

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### Summary

Pediatric pain services were first established in larger pediatric centers over two decades ago. Children's acute pain was poorly managed at the time owing to misconceptions, safety concerns, and variability in practice. While many larger pediatric centers now have acute pain services, there remains a need for better pain management in facilities and geographic locations with fewer resources. Institutional acknowledgement and desire to change, appropriate staffing, and funding are major obstacles. Better recognition and assessment as well as safer and more efficacious treatment of pain are the principal objectives when establishing a pain service. It is important to determine whether the proposed service intends to treat acute, chronic, procedural, and/or cancer and palliative pain as each requires different skills and resources. An ideal and comprehensive pediatric pain service should be equipped to diagnose and treat acute, persistent (chronic), procedural, and cancer/palliative pain. It is not feasible or necessary for every hospital to manage all. Establishing the scope of practice (based on case mix and caseload) in any given hospital will determine which resources are desired. Country-specific standards, local staffing, and fiscal constraints will influence which resources are available.

### Introduction

Pediatric pain services were first established in larger pediatric centers over two decades ago (1,2). Children's acute pain was poorly managed at the time owing to misconceptions (3,4), safety concerns (5,6), and variability in practice (7). Simultaneously, pulse oximetry and more effective and specialized analgesic techniques such as patient-controlled analgesia (PCA) (8) and continuous epidural analgesia were introduced, resulting in dedicated teams of pain management experts to administer them safely. While many larger pediatric centers now have acute pain services, there remains a recognized need for better pain management in facilities and geographic locations with fewer resources (9). Institutional acknowledgement and desire to change, appropriate staffing, and funding are major obstacles.

Better recognition and assessment as well as safer and more efficacious treatment of pain are the principal

objectives when establishing a pain service. It is important to determine whether the proposed service intends to treat acute, chronic, procedural, and/or cancer and palliative pain as each requires different skills and resources. Acute pain management most often falls into the domain of the (pediatric) anesthesiologist and is arguably the easiest place to start. The lack of similarly trained professionals in centers 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.

### Fundamentals of pain service provision

An ideal and comprehensive pediatric pain service should be equipped to diagnose and treat acute, persistent (chronic), procedural, and cancer/palliative pain. It is not feasible or necessary for every hospital to manage all. Establishing the scope of practice (based on case mix

and caseload) in any given hospital will determine which resources are desired. Country-specific standards, local staffing, and fiscal constraints will influence which resources are available.

The first part of this article describes the scope of practice and the clinical and administrative responsibilities that the ideal acute pain service includes in a tertiary pediatric hospital. The second part focuses on service delivery and funding models.

### Establishing scope of practice and clinical responsibilities

The first step in introducing a pediatric pain service is an evaluation of current pain management practices. When and how is pain assessed? Who assesses pain? How is pain treated? Who is responsible for prescribing analgesia? Does analgesia prescription vary markedly between prescribers? Who is responsible when analgesia is inadequate? What are the chains of communication? Are there any treatment protocols? What are the greatest perceived obstacles to better pain management? (10) Past audits typically demonstrated that many children either did not receive analgesia (11) or received less than adults undergoing similar surgery (12). Contributing factors included outmoded beliefs and safety concerns, which in turn led to variability in prescribing practices (Table 1) (7).

Some acute pain services routinely review only those patients receiving PCA or epidural analgesia. This approach trivializes the assessment and treatment of pain in the most vulnerable children, those that are unsuitable for PCA, the very young, and the cognitively impaired. All patients prescribed non-oral analgesia and those requiring titration or weaning of strong analgesia should be reviewed by the acute pain service.

**Table 1** Barriers to effective pain management

Outmoded beliefs
Newborn infants do not experience pain
Children rarely require analgesia
Pain is merely a symptom and not necessarily harmful in itself
Effective analgesia
Is dangerous
Makes diagnosis difficult or impossible
Delays discharge
Variability in practice
Postoperative analgesia
Not prescribed
Prescribed in doses too low or too infrequent
Not administered because
Pain not assessed
Pain denied because children preferred to suffer pain than receive i.m. analgesics

There is also an argument for pain services to be more involved in prescribing discharge analgesia. There is evidence that children experience significant pain at home after 'minor' day-stay procedures (13). Contributing factors include variability in practice (amount and type of analgesia prescribed and who prescribes it), regulatory barriers to prescription, misconceptions regarding opioid analgesia, inaccurate parental advice and inadequate follow-up after discharge.

### The ideal acute pain service

#### Clinical service provision

##### *Availability*

Acute pain service staff must be available 24 h per day, 7 days per week to provide timely response to problems, including inadequate analgesia and side effects and complications of analgesia and to evaluate and manage new patient referrals (14).

##### *Contactability*

There must be clear guidelines regarding whom nursing and medical staff contact and how. An effective solution is to have 'one number at all times' contact, either via a mobile phone or pager that is carried by pain service personnel. This facilitates prompt notification of and response to pain problems and adequate handover between staff. Nursing staff should be encouraged to communicate their concerns as hierarchical structures often impede the flow of important information (15).

##### *Regular patient review*

Twice daily ward rounds facilitate timely discharge planning and review of interventions instituted earlier to improve or wean analgesia, early detection of complications, and treatment of side effects.

It is the responsibility of the pain service to ensure that analgesia has been prescribed in appropriate doses and by an appropriate route. If side effects of analgesia occur, they should be treated or alternative effective analgesia prescribed.

Direct prompt communication with the primary team responsible for a patient's care is necessary if a serious adverse event related to analgesia occurs or if unexpected increasing analgesic requirements necessitate exclusion of complications such as compartment syndrome (16).

##### *Continuity of care*

Ideally, pain service staff should do blocks of service to facilitate pain assessment of patients from day to day, to establish rapport with children and their families, and to

assess the results of their interventions on previous rounds to improve analgesia or treat side effects. This is particularly important in the treatment of children and adolescents with complex pain problems who receive treatment over prolonged periods. Continuity is also less likely to result in frequent changes in management owing to variability in physician practice.

### **Charting, prescription and documentation**

#### *Pain and sedation scores*

The regular assessment of pain at rest and with movement, together with its documentation as the fifth vital sign on the patient observation chart, increases the likelihood that children and adolescents receive effective and appropriate analgesia. Sedation scores should also be monitored as increasing sedation usually precedes respiratory depression when receiving opioid analgesia (17).

#### *Prescription charts*

Printed dosage guidelines, standardization of the delivery systems, and the preparation of analgesic solutions minimize the potential for errors in prescription. Naloxone should also be prescribed on opioid charts in the event that urgent administration is required. Reportable limits in vital signs (sedation and pain scores, respiratory and heart rate, and blood pressure) should be recorded. Violation of these limits should trigger immediate notification of the pain service and the primary team and a Medical Emergency Team (MET) call if necessary.

Liaison with chart committees and pharmacy representatives ensure pain service charts comply with hospital standards. Regular (annual) review of charts should occur.

Safe prescribing includes ensuring that children do not have multiple orders for analgesia prescribed on separate prescription charts that could lead to side effects, overdose, or drug interactions. Computerized prescribing may further reduce the risk.

Certain situations lend themselves to algorithms promoting safe, timely, and effective intervention that improve analgesia and management of side effects, for example, postoperative nausea and vomiting (Figures 1a,b).

#### *Treatment plan*

A clear treatment plan should be written for each patient after pain service review to facilitate communication between the acute pain service, nursing, allied health, and medical teams. Facilities with limited staffing or equipment for monitoring and drug delivery may do best by limiting themselves to a few standardized treatment protocols (10).

#### *Discharge advice and follow-up*

Written and verbal discharge advice should be given to parents regarding how to recognize if their child is in pain, what analgesia should be administered after hospital discharge, when to give it, where to obtain further prescriptions if required, and what to do if pain relief is inadequate.

Specific discharge advice regarding potential complications following major regional techniques and their symptoms should be given to parents, and their family doctor also notified. The family doctor should also be advised of the postoperative analgesic plan following major procedures where children are likely to require analgesia for some time, facilitating its prescription.

Phone follow-up with the child and family after major procedures where dose titration is required after hospital discharge (e.g., after scoliosis surgery) is good practice.

### **Administrative aspects relating to clinical service delivery**

#### *Choosing pain assessment scales*

Age- and cognition-appropriate pain assessment tools must be used. While a multitude of pain assessment tools exist (18), it is important to standardize the tools used within any institution to facilitate proficiency in their use and communication about pain among staff. Numeric, visual analog scales, or faces scales are good choices for self-report tools in older children, whereas the FLACC, modified FLACC, and NIPS are appropriate as observational tools for younger or noncommunicative children. Some assessment tools have been found to be reliable in multiple geographic locations (19,20) while others have been more variable in their application to patients of different cultural backgrounds (19,21).

#### *Choosing analgesic techniques and drugs*

Nursing staff competency, the nurse-to-patient ratio and the availability of delivery equipment and monitoring will determine which analgesic techniques can be safely administered in any given hospital environment. Private or semi-private rooms may require a centralized monitoring system unless the nurse-to-patient ratio is very high, a luxury not available in many areas of the world where open wards are necessary for safe observation (15).

There are an increasing number of analgesic agents available and suitable for systemic, regional, and oral administration in children. It is preferable to limit the number prescribed routinely. The likelihood of prescription and administration errors is less when nursing and medical staffs are familiar with drugs, their dose, and route of administration. There is also the potential to

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### Post-operative nausea and vomiting (PONV) attachment

Weight: \_\_\_\_\_ kg

UR NUMBER \_\_\_\_\_  
SURNAME \_\_\_\_\_  
GIVEN NAME(S) \_\_\_\_\_  
DATE OF BIRTH \_\_\_\_\_  
AFFIX PATIENT LABEL HERE ↑

**MEDICAL INSTRUCTIONS:** This order is valid for the treatment of PONV for 5 days. Suggested recommendations for doses and maximums are in brackets [ ].

Please complete intraoperative section and all dosage sections (suggested 3 minimum) and indicate prescribed numerical order. Place [1, 2, 3] in rectangular boxes.

**Please sign overleaf**

**NURSING INSTRUCTIONS:** Please proceed in numerical order. Administer intravenous antiemetics slowly over 10 minutes.

**Intraoperative antiemetic: Please tick box and write time administered (use 24 hour clock).**

<input type="checkbox"/> Metoclopramide loading 0. _____ mg/kg @ _____ hrs	<input type="checkbox"/> Droperidol @ _____ hrs
<input type="checkbox"/> Dexamethasone @ _____ hrs	<input type="checkbox"/> Promethazine @ _____ hrs
<input type="checkbox"/> Granisetron OR <input type="checkbox"/> Ondansetron @ _____ hrs	<input type="checkbox"/> Other _____ @ _____ hrs

**Give Metoclopramide loading dose (if not given in theatre) (0.5mg/kg) \_\_\_\_\_ mg IV x 1 prn [maximum 20mg/dose].**  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_

**OR Give Metoclopramide (maintenance dose) (0.2mg/kg) \_\_\_\_\_ mg IV / PO 6 hourly prn [maximum 20mg/dose].**  
Continue if effective i.e. vomiting recurs more than 5 hours after last Metoclopramide dose.

Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_

**If ineffective** i.e. PONV occurs within 0.5–5 hours of receiving Metoclopramide: **cease** and proceed to next numbered antiemetic.

**Give Granisetron (0.04 mg/kg) \_\_\_\_\_ mg IV**  
daily prn [maximum 1mg/dose].  
Continue if effective i.e. vomiting recurs more than 20 hours after last Granisetron dose.

Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_

**If ineffective** i.e. PONV occurs within 0.5–20 hours of receiving Granisetron: **cease** and proceed to next numbered antiemetic.

**Ondansetron and Granisetron are not to be given together. Use IV Granisetron in preference to IV Ondansetron. Use SL Ondansetron if no IV access.**

**OR Give Ondansetron (0.1mg/kg) \_\_\_\_\_ mg IV / SL**  
(SL = sublingual wafer) 8 hourly prn [maximum 4mg/dose].  
Continue if effective i.e. vomiting recurs more than 7 hours after last Ondansetron dose.

Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_

**If ineffective** i.e. PONV occurs within 0.5–7 hours of receiving Ondansetron: **cease** and proceed to next numbered antiemetic.

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Continued overleaf

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### Post-operative nausea and vomiting (PONV) attachment

**Give Dexamethasone (0.15mg/kg) \_\_\_\_\_ mg IV / PO daily prn [maximum 8mg per dose per day only].**  
This can be repeated once if another antiemetic fails (no more than 2 post-operative doses).  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_

**If ineffective** i.e. PONV occurs within 1–20 hours of receiving Dexamethasone: **cease** and proceed to next numbered antiemetic.

**Give Droperidol (0.01mg/kg) \_\_\_\_\_ mg IV 8 hourly prn [maximum 0.625mg/dose] (NB: 2.5mg ampoules).**  
Continue if effective i.e. vomiting recurs more than 7 hours after last Droperidol dose.  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_

**If ineffective** i.e. PONV occurs within 0.5–7 hours of receiving Droperidol: **cease** and proceed to next numbered antiemetic.

**Give Promethazine (0.5mg/kg) \_\_\_\_\_ mg IV / PO 8 hourly prn [maximum 25mg/dose].**  
Continue if effective i.e. vomiting recurs more than 7 hours after last Promethazine dose.  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_

**If ineffective** i.e. PONV occurs within 0.5–7 hours of receiving Promethazine: **cease** and proceed to next numbered antiemetic.

**Give \_\_\_\_\_ mg/kg \_\_\_\_\_ mg**  
Route: \_\_\_\_\_ / \_\_\_\_\_ hourly prn  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_  
Date: \_\_\_\_\_ Time given: \_\_\_\_\_ Route: \_\_\_\_\_ Initials: \_\_\_\_\_

**If ineffective** i.e. PONV occurs within \_\_\_\_\_ hours of receiving this medication: **cease** and proceed to next numbered antiemetic.

**If PONV persists or occurs after 0.5 hours of administering all numbered antiemetics, contact Children's Pain Management Service (CPMS) Pager 5773 (24 hours).**

**Prescriber's signature** \_\_\_\_\_ Print name \_\_\_\_\_ Date \_\_\_\_\_

(b) For full details of hospital guidelines concerning PONV, see the Children's Pain Management Service Guidelines or on The Royal Children's Hospital intranet.

**Figure 1** (a, b) This chart was designed to overcome barriers to the timely administration of antiemetics such as the availability of an alternative prescribed antiemetic should one be ineffective, vari-

ability in prescribed doses, and the unpredictable availability, willingness, and knowledge of ward residents to prescribe antiemetics when required.

reduce costs by decreasing the workload for the hospital pharmacy and negotiating discounts with pharmaceutical companies. Choice of analgesic modalities can be based on a treatment ladder suitable to the invasiveness of the procedure and the corresponding anticipated pain (22).

*Protocols and guidelines*

Clear dosage, prescription, administration, and monitoring protocols and guidelines must be published for available analgesic therapies. These should include which patient observations should be monitored, how these should be recorded, and their frequency for various modalities.

Guidelines should standardize the dose prescribed, the dilution, volume, and labeling of drugs, and the delivery system. They should include reference to the co-prescription of medications with the potential for interaction, such as benzodiazepines and opioids. Protocols and guidelines should be reviewed annually.

Guidelines can be adapted from other institutions with care to ensure they conform to local requirements. Many larger centers publish their guidelines online.

*Choosing and managing equipment*

Pumps for intravenous continuous or intermittent infusion should be standardized throughout the hospital to reduce the potential for programming error. Some pumps allow programming of named drugs that comply with the local hospital dilution and administration guidelines. The decision regarding which pumps to purchase is best made together with the hospital bioengineering department.

Pumps for epidural or regional local anesthetic infusions should be distinguished from intravenous infusion pumps with distinctly colored tubing to reduce the likelihood of inadvertent connection to an intravenous cannula.

An adequate number of pumps must be purchased. Consideration must be given to repair and maintenance

of pumps that necessitates taking them out of service. It is important to identify whose responsibility it is, and where disused pumps must be returned, to effectively manage the equipment pool. Logistics systems can be employed to keep track of whereabouts and availability of equipment.

Computerized patient order entry (CPOE), programmable PCA pumps, continuous cardiorespiratory pulse oximetry, and endtidal carbon dioxide monitoring are promoted as essential tools for high quality pain management.

## Education

### *Nursing*

It is important to educate nurses to recognize and assess pain and familiarize them with the treatments available with a view to troubleshooting, recognizing side effects and complications, and optimizing analgesia. This can be done using pain resource nurse programs, whereby interested nurses undergo more intense training and become pain resource persons on their ward (23). This type of program inspires confidence in nurses' ability to manage pain issues, reduces the number of calls to an acute pain service, and encourages nurses to improve specific pain management practices on their wards while providing practical experience otherwise unavailable. With appropriate training and protocols nurses can be allowed to adjust settings of advanced analgesic therapies. This may improve the timeliness and responsiveness to patients' individual needs (24). Online annual competency assessments can be utilized to address knowledge gaps.

*Physiotherapists* The timing and administration of analgesia prior to physiotherapy can reduce movement-related pain and facilitate rehabilitation. Communicating analgesia issues to the acute pain service should be encouraged.

*Medical* Teaching medical students about pain in childhood has been shown to be effective (25).

New junior medical staff usually commence work at predictable times of the year. Orientation for these staff should include information on pain assessment and its management within the institution. Orientation provides an opportunity to explain the hospital's commitment to pain management, what the pain service does, and how to contact the service. A pediatric pharmacopoeia that details analgesic drug dosage should be distributed to

junior doctors. Larger pain services may offer elective rotations to junior medical staff.

Anesthesiologists administer intraoperative analgesia and prescribe postoperative analgesia. Feedback on the effectiveness of their prescribing practices is best obtained from attending acute pain rounds. Alternatively, the pain service staff should develop a feedback system for problems that arose after discharge of patients to the postanesthesia care unit and ward.

Ideally, senior medical and surgical staff should also receive education regarding pain and its management. In large hospitals, this can be difficult due to busy schedules. New appointees should receive this information as part of an orientation package, familiarizing them with the resources available and the culture of the organization regarding pain management.

*Parents and children* Preoperative education regarding postoperative pain, how it will be managed, what to do if analgesia is inadequate, and what resources are available to manage pain should be communicated to parents and children. This information can be reinforced through the provision of child-friendly and age-appropriate information leaflets explaining analgesic techniques for children and information leaflets for parents that describe potential risks and benefits.

## Quality improvement and research

It is essential to periodically assess the acute pain service to identify its strengths and weaknesses as well as strategies for future development and improvement (26). Key performance indicators should be identified and may include adherence to important components in pain management such as pain assessment, its documentation, complications, and response times. Established guidelines and protocols should be reviewed regularly. Chart reviews and surveys can help identify gaps in services provided. Opinion should be sought from hospital staff, parents, and children. All pain service staff should be included to achieve buy-in for necessary changes (10).

## Frequent flyer concept

Some children and adolescents undergo multiple surgical procedures. Implementing an alert system whereby patients attending frequently have recorded details of previous analgesia problems (27) encourages better pain relief by avoiding:

- Medications that may not work (e.g., codeine)
- Techniques that have not worked (e.g., radiographically demonstrated epidural septum resulting in unilateral analgesia)
- Medications associated with side effects in that patient (e.g., pruritis with morphine but not with fentanyl).

### Research

Appointing a Director of Research will foster coordination to answer the questions upon which the evidence base for pediatric pain management can be built. Important roles include building a team to apply for research grants, attracting quality researchers, collaborating with other researchers, and designing trials with robust methodology.

### Adverse events

An adverse events reporting system should be established. Adverse events, including prolonged inadequate analgesia, side effects, and complications of analgesia, should be discussed in regular morbidity and mortality meetings.

### Complaints

Complaints and comments regarding the pain service should be acknowledged and investigated.

### Resource-limited countries

There are many challenges in countries with limited resources, in particular shortages of staff and medicines and regulatory barriers that preclude opioid administration. Monitoring and drug delivery devices are impractical in many countries due to erratic electrical supply and cost (28). The ideal pain service described above is not feasible. It is however, possible, to improve pain management through effective education. The Effective Pain Management manual is an education program focusing on the recognition, assessment, and treatment of pain designed to be taught in a 1-day workshop in resource-poor countries. It has been taught in Papua New Guinea, Solomon Islands, Mongolia, and Rwanda, and its basic principles can be applied to treating pain in children.

It is intended that local champions emerge from such programs becoming educators and establishing local guidelines based on the availability and affordability of analgesics and the procedures performed

in their country. The manual is available online: <http://www.fpm.anzca.edu.au/fellows/essential-pain-management>.

Working with national and international organizations may also be beneficial. The special interest group for Pain in Childhood of the International Association for the Study of Pain (IASP) is a good resource if advice is needed ([www.childpain.org](http://www.childpain.org)).

### Procedural pain

There are very few established procedural pain services in tertiary pediatric hospitals (29). Around 98% of all patients attending hospital undergo at least one procedure that may lead to pain and distress. The problem is greatest in children needing intensive care (30). Education programs that encourage nonpharmacological and nurse-initiated simple pharmacological management (e.g., topical local anesthetic prior to venipuncture) through workshops and education have been successful in conjunction with initiatives to change the culture of the organization.

### Persistent (chronic) pain and palliative pain

One-third of children and adolescents experience recurrent or chronic pain (31). An interdisciplinary approach ideally incorporating psychology, psychiatry, physical therapy, occupational therapy, social work, nursing, and pain medicine specialist's works best for children experiencing chronic pain or requiring palliative care. Some centers have inpatient programs for those children and adolescents who are most disabled by their symptoms (32,33). The more complex systems required to manage these programs are beyond the scope of this article (34).

### Funding an acute pain service

Ideally, every hospital treating children should have a system for providing patients safe and effective analgesia when they are experiencing acute pain, be it after surgery, trauma, injuries sustained in warfare, or other causes. It is difficult and beyond the scope of this article to provide a detailed guide on how to obtain adequate funding for an acute pain service in all countries, hospitals with mixed adult and pediatric caseload, small private hospitals, and large public institutions. The global economic situation has resulted in rationalization of healthcare expenditure, further compounding the funding issue. The stark reality in most countries is that to establish a new service, existing resources must be reallocated or the pain service must fund itself. Attempts

to demonstrate the cost-effectiveness of an acute pain service have not been convincing (35,36).

Achieving organizational change is challenging. Gaining departmental, key stakeholder (e.g., surgeon), and institutional support is vital (37). Pain management should be regarded as a basic standard of care that deserves prioritization. While National Guidelines (38–40) are important, they do not ensure the commitment of all hospitals. In the USA, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) is an independent not-for-profit organization that sets healthcare standards. JCAHO standards require that hospitals assess, treat, and document patients' pain, guarantee the competence of their staff in pain assessment and management, and educate patients and families about effective pain management (41). Adherence to these standards determines, in part, accreditation of healthcare facilities. This has led to a flurry of activity to conform to the JCAHO guidelines. In contrast, pain management was not among a list of 10 new standards recently published by the Australian Commission on Safety and Quality in Health Care that all public hospitals, including small rural health services, are required to implement for ongoing accreditation and funding, with the result that pain management is regarded as 'non-essential'.

Initiatives, such as Hospice Africa Uganda, provide evidence that a few individuals lobbying for influential political support can achieve remarkable change. With endorsement of the Minister of Health, political support was achieved leading to increased availability of opioids, education initiatives, provision of country-wide care teams, and the publication of clinical guidelines (42).

### **Delivery models of care**

Local resource availability, caseload, case mix, and funding influence the most sustainable delivery model of care. Several delivery models of care exist.

#### **Anesthesiologist as sole provider**

Particularly in smaller hospitals, it is common for anesthesiologists to serve as sole providers attending to the postoperative analgesic needs of patients in addition to their operating room duties. Unfortunately, fundamentals of a pain service such as availability, contactability, continuity of care, and consistent quality of care can rarely be achieved except in hospitals with a small caseload where the anesthesiologist often manages his or her own patients' postoperative analgesia (43).

This model is also employed where funding for nursing support is unavailable and where anesthesiologists can generate revenue from pain consultations independent of anesthesia. Flat rate per case reimbursement in acute care hospitals encourages hospitals not to fund 'non-essential' acute pain services. However, regional procedures performed for postoperative analgesia can be additionally billed, as can follow-up consultation. This has resulted in anesthesiologists being responsible for regional analgesia but not enteral and parenteral therapies in some centers.

#### **Anesthesiologist with nursing support**

Recognizing the need for 24-h availability, anesthesiologists added specially trained advanced practice nurses to pediatric pain management teams. The physician will join the nurse for either the morning or afternoon round and is otherwise available to provide anesthesia. Nurses can adjust therapies when a dose range is prescribed, document patient progress, and provide ongoing education to nurses on the ward. This model also facilitates drug prescription where nurses are not licensed to do so, provides opportunity to review complex patients together, and ensures better continuity of care as a limited number of nurses will see patients on a daily basis and the same physician may be assigned to the pain service for several days or a week at a time.

Anesthesiology-based comprehensive pediatric pain services are common in major centers in the US, UK, and Australia. The team may include physicians, specially trained nurses, trainees, and occasionally pharmacists.

#### **Nurses with anesthesiologist support**

As the labor costs for anesthesiologists are high and their availability limited, nursing-based pain service models have arisen (44). Specially trained advanced practice nurses are the primary providers of the service. This model of care may be most suitable for institutions in which the caseload consists mainly of postoperative patients as it has been shown that postoperative pain places a relatively low demand on physicians' activity compared with pain unrelated to surgery such as cancer or sickle cell disease (37).

#### **Nurses, physician assistant, and nonanesthesia trained providers**

Nurses, physician assistants, and nonanesthesia trained providers such as pharmacists or pediatricians may be

the primary members of a pain management team. After participating in relatively brief educational sessions in central locations, they can become champions for improved pain management.

Many remote locations function with few staff. Encouraging a local champion who is responsible for educating all staff members treating children about the recognition, assessment, and treatment of pain as taught in the Effective Pain Management manual will be more pertinent and achievable than attempting to establish an acute pain service.

Establishing a pain service can be rewarding. The benefits and cost-effectiveness, however, have been difficult to demonstrate and attaining funding may be difficult. Nevertheless, institutional support is vital. Adapting the service to local requirements and identifying realistic and achievable objectives increase the likelihood of success.

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