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Development and implementation of an education and credentialing programme to provide safe paediatric procedural sedation in emergency departments

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Abstract

Objective: In the conduct of paediatric procedural sedation (PPS) within the ED the combination of powerful drugs, variable competency levels and high staff turnover carry the potential for sedation-associated adverse events. Yet, currently, there is no set programme for education and accreditation of ED staff in PPS. We set out to develop such a programme.

Methods: We outline the development process of a comprehensive multidisciplinary PPS programme and present its key educational elements (sedation manual, lecture, treatment order form and checklist, parent information handout) and credentialing through multiple-choice questions and competency assessments. We describe issues associated with the implementation of the programme at a metropolitan mixed ED and the ED of a major tertiary paediatric centre.

Results: Since its inception a total of 294 emergency staff have either completed or have partially completed the programme. Staff feedback showed that the majority of staff scored the elements of the programme as very good to excellent, and felt that their sedation skills had improved and their practice was safer. The development and implementation of the PPS programme raised many issues and posed a number of challenges. We describe the strategies we used to overcome such challenges and barriers.

Conclusion: We present the development and implementation of a comprehensive PPS programme for emergency staff. As a result of the multicentre development process involving a community and a tertiary paediatric ED the programme will likely have broad applicability in different types of ED caring for children.

Key words: *credentialing*, *education programme*, *paediatric*, *sedation*.

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Introduction

Children presenting to hospital ED often require painful or invasive procedures as part of their management. Paediatric procedural sedation (PPS) for these procedures has become commonplace in EDs in Australasia.[1]

At the same time EDs operate around the clock with unpredictable activity levels and varying levels of seniority and competency within medical and nursing staff. In this environment the use of powerful sedative and analgesic agents has the potential to lead to adverse events.

In 2002 two separate sentinel incidents involving PPS occurred on consecutive days within the ED of the authors. They involved powerful intravenous sedative agents administered by inadequately trained junior staff without adequate preparation or supervision in contravention of existing institutional guidelines. Although neither incident led to an adverse event they highlighted to senior ED staff that previously developed and published guidelines for PPS in both ED[2,3] were not being followed and that large numbers of new staff in the ED had not been appropriately informed of the existence of departmental guidelines. Shift work and high staff turnover, particularly of junior medical staff, creates considerable challenges in the implementation of safety procedures and the dissemination of and compliance with clinical guidelines. There was no process within either ED for informing new staff of such guidelines nor for assessing staff's understanding, adherence and proficiency in aspects of safe PPS practices.

Although there are a number of guidelines for procedural sedation[4–12] neither the Australasian College of Emergency Medicine nor the Royal Australasian College of Physicians offer a set programme for education and accreditation in PPS available for implementation in ED. We decided to develop such a programme as a multicentre effort between a community hospital ED and a tertiary children's hospital ED. We set out to improve PPS guidelines by developing a sedation checklist and a tiered educational and credentialing process for ED medical and nursing staff.

Background

Procedural sedation is defined as a technique of administering sedative or dissociation agents with or without analgesics to induce a state that allows the patient to tolerate unpleasant procedures while maintaining cardiorespiratory function.[6] Procedural sedation and analgesia is intended to result in a depressed level of consciousness but one that allows the patient to maintain airway control independently and continuously.

Underlining the prevalence of this practice in Australasian EDs the responses of 45 EDs to a survey questionnaire were examined by Everitt *et al.* in 1998.[1] Within the survey 39 of 40 (98%) of paediatric or mixed paediatric/adult ED reported using sedation in children. Significantly, only 58% of mixed ED reported the use of formal guidelines for PPS and only 52% of all departments reported the existence of discharge criteria. The authors commented on the wide variation of practice and recommended the development of departmental guidelines, including discharge instructions in order to improve sedation practices for children in EDs.

The results of this survey were disappointing as the Australasian College for Emergency Medicine had published a policy document in relation to intravenous sedation in 1998 which clearly recommends the use of discharge criteria as well as other recommendations centred around personnel, monitoring and equipment guidelines.[13]

Two studies from the American literature emphasize the relationship between minimization of clinical risk and the usage of and adherence to formal guidelines for PPS.[14–16] Cote *et al.*[15,16] conducted a critical incident analysis of 95 adverse sedation events in paediatrics, although mainly outside the ED setting. The authors were able to identify a number of features that were associated with the poor outcomes, including inadequate resuscitation and failure to use monitoring such as pulse oximetry. Additional issues felt to be contributory to poor outcomes were inadequate presedation medical evaluation, lack of an independent observer throughout the procedure, medication errors and inadequate recovery procedures. The authors recommended the development and implementation of uniform guidelines for monitoring children and the immediate availability of age and size appropriate equipment and medications for resuscitation as well as the availability of health care providers with advanced airway skills. A second study conducted by Hoffman *et al.*[14] at the Children's Hospital of Wisconsin tested a hypothesis that application of risk reduction guidelines for procedural sedation, based on the American Academy of Pediatrics/American Society of Anesthesiologists guidelines[4,5,8,9] would reduce the risk of sedation-related adverse events. The primary finding of this study was that adherence to a structured process for PPS reduced the occurrence of adverse events. Interestingly, the element that proved most important for risk reduction was

the use of a guided presedation risk assessment tool – failure to complete this risk assessment was the single most important predictor of adverse events during sedation. Simply put, use of presedation risk assessment can identify patients who are not suitable for procedural sedation in addition to assisting in the tailoring of a suitable and safe sedation plan for individual patients.

In the Australasian ED setting there have been no published sedation programmes, analysis of clinical risk reduction strategies in procedural sedation nor evaluations of the uptake and implementation of guidelines. A protocol for ketamine sedation of children was published by Priestley *et al.* in 2001[3] which included a discussion of the methodology used to develop and introduce a comprehensive protocol for ketamine sedation in children into an ED.

Development of the sedation programme

We developed an educational and credentialing programme in a joint effort between senior medical and nursing staff at Sunshine Hospital and Royal Children's Hospital, Melbourne, Australia. Sunshine Hospital is a large suburban hospital. Its mixed adult/paediatric ED has an annual paediatric census of 22 000 patients. Royal Children's Hospital is a tertiary children's hospital with an annual ED census of 56 000 patients. Critical decisions during the development process were discussed with all ED consultants and senior nurses at both hospitals. A pain specialist within the Children's Pain Management Service at Royal Children's Hospital contributed a section on non-pharmacological interventions. The project was reviewed by the Human Research and Ethics Committee, Royal Children's Hospital, and was approved as an audit at both hospitals.

Figure 1 summarizes the development process. Given the staffing models and the ED workload, the PPS programme needed to be able to be broken down into modules and be partly achievable during a staff member private study time along with a number of ED based competency activities performed in work time. In this way the concept of a modular, staged credentialing education and credentialing programme was developed including the creation of a sedation manual, two didactic lectures, practical equipment demonstration, and assessment process. Effective implementation of clinical guidelines into usual practice can occur in a variety

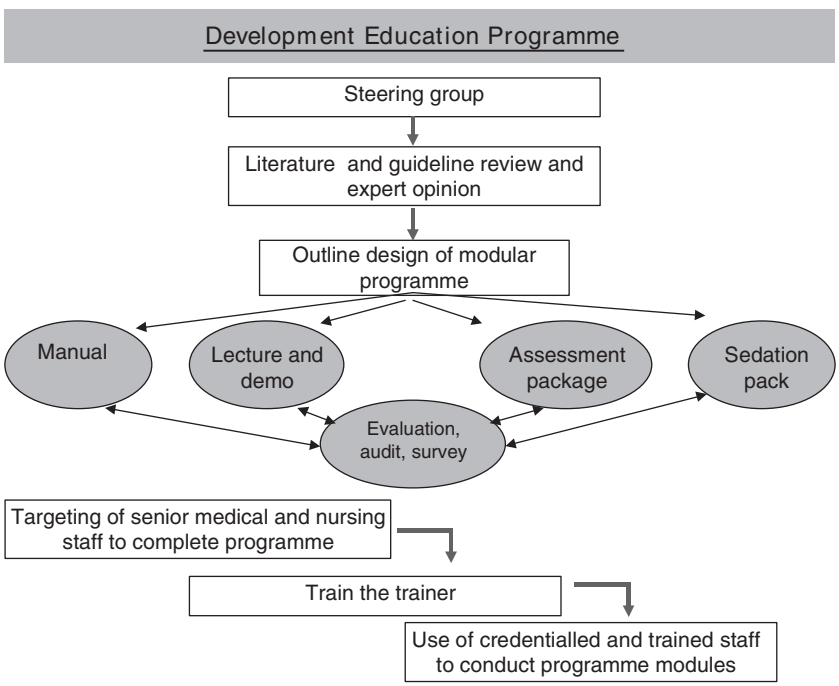

Figure 1. Diagramatic representation of the development of the paediatric sedation programme.

of ways with the success of an implementation process broadly related to the attributes of evidence, identification of barriers and facilitators to changing practice and effectiveness of the dissemination and implementation strategies.[17–19]

The core element of the sedation programme is a procedural sedation checklist. A number of studies have addressed the introduction of clinical practice guidelines and checklists and their impact on improving documentation and performance.[20,21] The adoption of checklists has been recommended to reduce violations of standard practice by automating tedious checking, documentation and monitoring tasks in an effort to improve compliance with protocols and critical steps.[22] Appendix I shows the front page of the checklist listing issues relevant for sedation safety before, during and after procedural sedation as well as monitoring and documentation requirements. In addition, the checklist records drugs used, staff involved, depth of sedation score[14] and adverse events. This dataset allows the checklist to be used as a tool to audit sedation safety and improve sedation quality. The back page of the sedation checklist explains in more detail several key areas prompted in the checklist including risk assessment and contraindications, consent, minimum fasting times, minimum staff and equipment requirements, sedation score and discharge criteria. The sedation checklist is printed in the format of a treatment order and becomes part of the medical record.

The sedation handout we created contains a brief explanation of what sedation is, information parents should know before consenting to procedural sedation, how parents can help during the procedure and discharge information. The parent handout was repeatedly simplified and reviewed for readability (at Grade six reading level) and has been placed on the Royal Children's Hospital website (http://www.rch.org.au/parentinformation). In addition, a 'sedation pack' for ED staff was developed containing a sedation checklist, a sedation handout and a sedation specific consent form.

The education and credentialing programme is made up of several discrete parts including prereading of a sedation manual, didactic lectures, a multiple-choice test, practical demonstration of equipment and oral competency testing. The PPS programme does not include airway training. For staff to receive a certificate of completion, nurses and doctors must have completed at least a basic life support (BLS) course and in the case of nurses and doctors practising parenteral sedation, at least an advanced paediatric life support (APLS) course or similar is required.

The sedation manual was developed in a modular form with a general sedation module for all medical and nursing staff and additional modules for more senior nursing and medical staff involved in parenteral sedation.

Two standard PowerPoint sedation lectures were developed- one focused on general sedation principles and nitrous oxide, the other focused on parenteral agents. The 30 minute lectures are used for group teaching and for individual review by candidates online.

The assessment process includes a multiple-choice written assessment, followed by a practical assessment of competency and observation of a sedation. Initially, open-ended essay style questions were developed to assess candidates. This process was abandoned in favour of multiple-choice questions (MCQ) as less time consuming and more standardized for candidates and staff. MCQ can be completed online with automatic evaluation and grading and ED educators are automatically informed by E-mail: upon completion. Individual MCQ tests are randomly selected by computer from a pool of questions. For the practical competency assessment a number of standardized case scenarios were developed with written questions and answer options for use by the nurse educators.

All medical and nursing staff are required to complete the package prior to involvement in PPS. Teaching and assessment materials are identical for doctors and nurses.

Sedation checklist, handout and the educational and credentialing materials underwent numerous revisions based on staff feedback.

Controversies and obstacles

Minimum fasting times for sedation in general and ketamine and nitrous oxide sedation in particular are an area of controversy.[4,5,8,9,14,23–27] Based on a consensus of ED consultants at both institutions fasting times for ketamine follow previously published local guidelines.[2,3] Although recent data on nitrous oxide use for procedural sedation in the ED indicate a lack of association between fasting time and emesis[27] definitive data on the need for fasting in nitrous oxide sedation are not available. A consensus between ED consultants regarding minimum fasting time for nitrous oxide was difficult to achieve as some felt strongly that no fasting time should be mandated and others felt that a minimum fasting time should be imposed (see Appendix I).

The initial design of the programme introduced a sedation specific consent form highlighting the risks and benefits of sedation on a newly designed consent form. Following a discussion with a hospital lawyer, the parent information leaflet was redesigned instead to include consent specific information about sedations. The handout can then be used as an aide-memoire for staff while obtaining informed written consent. Initially, there was also a reluctance by some ED physicians to require written consent for sedation with nitrous oxide, the most frequently used sedative agent in both ED. However, in part based on an audit of sedations indicating the potential to deeply sedate patients with continuous flow nitrous oxide,[27] and in part to provide a consistent approach for junior staff, all ED sedations irrespective of agent used are now commenced after written consent has been obtained. If patients require the emergent use of sedative agents in the ED, such as use of nitrous oxide in a deformed forearm fracture to allow the placement of a plaster slab, no written consent is required similar to all other emergent procedures to save life and limb.

Both departments had a higher staff turnover than expected because of junior medical staff and graduate nursing student rotations and nursing staff leaving and taking up positions. A further challenge was the number of part time and night shift positions among nursing staff and to a lesser degree job share positions among registrars. Overnight and part-time nursing staff were captured by providing education sessions after hours, scheduling sedation teaching to coincide with nursing education days, and training a night duty assistant unit manager to perform staff assessments.

Junior doctors work shifts, do not attend all education sessions and are present in the ED for relatively short periods of time. Successful strategies used to capture junior doctors included sedation teaching on orientation day, a concerted effort to capture all doctors within the first week of the new rotation and communication of the clear understanding that completion of the sedation programme was a departmental expectation for the ED rotation. Staff were able to use paper or online versions of the educational materials and the credentialing process. In addition, a number of senior trainee physicians were recruited to conduct sedation teaching.

Based on initial staff feedback a number of staff were intimidated by the size of the package and the length of the assessment process. This was addressed by reducing the manual size and shortening and standardizing the assessment process.

The initial development, implementation and evaluation of the programme was time- and resource-intense and could only be undertaken through a grant by the hospital insurer (Victorian Managed Insurance Authority [VMIA]) which funded nurse educators at both sites and a research coordinator. To ensure the long-term viability of the programme once grant funding expires, it was essential to create a PPS programme which requires relatively low senior nursing and medical staff resources. The development of a computer based, online evaluation process with automatic feedback to the nurse educators significantly lessened the workload of the educators.

Implementation of the sedation programme

The programme was first implemented at Sunshine Hospital after a 3 month development phase. The experience of this pilot phase and formal and informal staff feedback were used to refine the programme prior to implementation at the second site (Royal Children's Hospital).

A total of 294 staff at Sunshine Hospital and at Royal Children's Hospital have now completed at least part of the programme. All sedations at both EDs are now completed under the new programme. Since the inception of the programme more than 800 patients have been sedated under the programme.

Anonymous feedback based on a written survey was also obtained from 41 ED staff (17 nurses and 24 junior doctors) who had completed the programme. Staff were asked to provide feedback on individual elements of the PPS programme using a modified five-point Likert scale (excellent, good, average, fair, poor) and provide comments or suggestions for improvements regarding the education and credentialing process and regarding the change in sedation practice. The surveys indicate excellent or good ratings for checklist (93%), lectures (92%), MCQ (79%), module (95%) and demonstration of nitrous machine (85%). Ninety-seven per cent thought teaching was useful and 87% thought sedations were safer after completing the programme.

Of specific interest was the opinion of the consultants, fellows and senior nurses who were present before and after implementation of the programme. All 21 senior staff interviewed rated sedation practice as safer or much safer. All thought the programme was useful or very useful. Fifty-seven per cent thought sedation

practice had changed very much and 42% thought there was some change.

Outlook

We were concerned that the number of procedural sedations might decrease as a result of the small increase in administrative burden the programme imposes. A comparison of the number of sedations in the 6 months prior to implementation and post implementation at Royal Children's Hospital did not indicate a change in the raw number of sedations. It is likely, however, that sedation in some children was deferred because of their higher risk status upon initial risk assessment, and that other children appropriately received sedation by trained staff who now feel more comfortable with the administration of sedation. It is difficult to quantify the number of deferred sedations. Anecdotally, patients who had ED sedations deferred or were referred to anaesthesia services after formal checklist based presedation risk assessment indicated a history of severe sleep apnoea, active asthma exacerbation, medication allergy, prior anaesthetic mishaps and anatomic airway abnormalities. A review of sedations before and after implementation of the sedation programme has been undertaken (see following article in this issue of *Emergency Medicine Australasia*).

Even prior to the official release of the PPS programme, a number of EDs requested sedation programme materials and it is being introduced by four community EDs who provide sedation to children. The materials are made available free of charge. Prior to implementation of the sedation programme EDs interested in the sedation programme will need to come to a local consensus regarding some of the controversial issues outlined above, such as fasting requirements, delineation between anaesthesia and ED services, modification of forms and the use of the sedation checklist as a treatment order form.

Summary

We developed a comprehensive educational, testing and credentialing sedation programme for ED staff as a multicentre effort between a community hospital ED and a tertiary children's hospital ED. We outlined the development and implementation process of the sedation programme and presented the key elements of the programme. The programme is being made available to all EDs who are interested in this risk reduction strategy.

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Competing interests

None declared.

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Appendix I. Paediatric sedation programme: sedation checklist

TREATMENT ORDERS
(SEDATION)
Sunshine Hospital, Melbourne, Australia

AFFIX PATIENT LABEL

(*Refer to appendix on back of form)

DATE___/___/___ TIME_____

PROCEDURE_____SEDATION DRUG USED_____im/in/PO/IV

PRE PROCEDURE **N_2O(%)_____for _____min**

- ❑ Sedation drug – recorded on **Medication Chart**
- ❑ Allergies – recorded on **Medication Chart**
- ❑ Weight kg – recorded on **Medication Chart**
- ❑ Risk assessment checked **(1.)*** List if any _____
- ❑ Exclusion criteria checked **(2.)*** List if any _____
- ❑ Minimum fasting time **(3.)*: Actual fasting time:** solids_____h liquids_____h
- ❑ Equipment checked **(4.)***
- ❑ Adequate staff available **(5.)***
- ❑ Risks discussed, consent signed (No ❑ Yes ❑) and sedation handout to parents

DURING PROCEDURE

- ❑ Baseline vital signs recorded on observation chart PRIOR to commencing sedation
- ❑ Continuous oximetry, plus ECG monitoring and BP every 5 min for ketamine and i.v. midazolam. Vital signs documented every 5 min.
- ❑ All i.v. sedation drugs administration by a credentialed physician
- ❑ Depth of sedation score **(6.)*** _____

POST PROCEDURE

- ❑ Staff present continuously, vital signs recorded every 15 min once roused, quiet area for ketamine
- ❑ Nil orally until fully alert
- ❑ Fulfills discharge criteria **(7.)***
- ❑ Post-sedation handout discussed and provided
- ❑ GP discharge letter (given to parents / to be posted)
- ❑ *Side effect or adverse event* of sedation: (No ❑ Yes ❑)
  What_____

_____

Any other comments

_____

Doctor: _____
Doctor: _____
Nurse:_____
Nurse:_____

CHECK LIST FOR SEDATION (box number corresponds to number on other side ofpage)

1. Risk Assessment

Snoring, stridor, sleep apnoea,
Craniofacial abnormalities, history of airway difficulty
Vomiting, bowel obstruction, GE reflux
Asthma exacerbation, pneumonia
Cardiac disease, hypovolaemia, sepsis
Altered mental status, neurologic/neuromuscular disorder
History of sedation failure
Age < 1 year
Moderate or severe systemic disease which limits activity

Any positive findings on risk assessment or exclusion criteria need to be discussed with the consultant. Sedation in the emergency department might be contraindicated.

2. Exclusion Criteria

Ketamine	Nitrous oxide	Midazolam
< 1 y.o. or >12 y.o. (relative)	<3 y.o. (relative)	<1 y.o. (relative)
Acute resp. tract infection (URTI)	URTI	URTI
Asthma exacerbation	Head injury or LOC	Asthma exacerbation
Prior airway surgery	Chest injury or pneumothorax	Prior adverse reaction
Prior adverse reaction	Bowel obstruction	
Glaucoma	Middle ear disease	
Head injury, CNS lesion, epilepsy		
Altered conscious state		
ADHD, psychosis		

3. Fasting Times

Ketamine) 4 h solids, 2 h liquids
Midazolam i.v./i.m.)

Minimum fasting times for Nitrous Oxide or Midazolam PO (when used as single agents) are controversial, but some ED consultants at SH and RCH will fast for a minimum of 2 h for solids and liquids

4. Equipment Check

Functioning suction device
Bag-mask-valve set up for appropriate size and able to deliver O_2
O_2 available by mask
Pulse oximetry operative, plus ECG monitoring operative for ketamine and i.v. midazolam
Blood pressure monitoring operative for ketamine and i.v. midazolam
Resuscitation trolley with paediatric airway equipment in ED

5. Adequate staff available

For nitrous oxide and midazolam PO, nasal, rectal – 2 staff available *(1 credentialed)*
For ketamine/midazolam i.v./i.m.: 3 staff available plus consultant aware –
2 credentialed for ketamine and midazolam i.v./i.m.

6. Depth of Sedation Score (Wisconsin score)

Inadequate	6	Anxious, agitated or in pain
Minimal-conscious	5	Spontaneously awake without stimulus
Conscious-moderate	4	Drowsy, eyes open or closed but easily arouses to consciousness with verbal stimuli
Moderate–deep	3	Arouses to consciousness with moderate tactile or loud verbal stimuli
Deep	2	Arouses slowly to consciousness, with painful stimulus
	1	Arouses, but not to consciousness, with painful stimulus
Anaesthesia	0	Unresponsive to painful stimulus

7. Discharge Criteria

Resumption of presedation level
Resumption of purposeful neuromuscular activity
Ability to ambulate (if appropriate) or able to sit without support
Ability to verbalise appropriate to age
Final set of vital signs are within normal limits for the child's age
Ability to tolerate oral fluids

©The above Sedation Orders/Check List is a form to be ***filed*** in the patient's history with the Consent Form.