Preprinted Order Sets as a Safety Intervention in Pediatric Sedation

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Objectives Implement preprinted packets for pediatric procedural sedations to increase documentation compliance and decrease medication ordering errors.

Study design Retrospective chart review of pediatric inpatients undergoing procedural sedation before and after implementation of a preprinted packet including an order set, consent form, and sedation monitoring form. Patient charts before and after the intervention were reviewed for completeness of medical documentation, correct medication dosages, and adverse events. χ^2 or Fisher exact test was used to determine preintervention vs postintervention differences.

Results Forty-two charts preintervention and 42 postintervention were reviewed. Documentation compliance increased on consent forms ($P < .001$), procedure notes ($P = .113$), and sedation monitoring forms ($P = .003$), while dating and timing of order forms decreased. Ordering of resuscitation equipment ($P = .12$), documentation of American Society of Anesthesiologists' (ASA) physical status classification ($P < .001$) and allergies ($P < .001$), and postsedation orders ($P < .001$) also increased. Medications ordered using unit/kg increased 43% ($P < .05$). Medication ordering errors for sedation agents decreased 64% ($P < .001$). Ordering of appropriate reversal agents increased 73% ($P = .02$).

Conclusions Implementing preprinted physician orders, consent forms, and prepared packets increased documentation compliance and ordering of reversal agents and resuscitation equipment. Medication dosage ordering errors decreased. *(J Pediatr 2009;154:865-8)*

The Institute of Medicine estimated that at least 400 000 preventable adverse drug events (ADEs) occur in hospitals each year.[1] Medication ordering errors are the most commonly identified preventable ADEs.[2] Medication errors with the potential to cause harm are 3 times more likely to occur in pediatric versus adult inpatient units.[3] Medications prescribed for children often require dosage adjustments according to the patient's age, weight, or body surface area. Even though these calculations are relatively simple, the opportunity for error is still present. Studies have demonstrated a high frequency of mathematical errors by pediatricians and pediatric residents under optimal testing conditions.[4,5] Also, the child's physiological, pharmacodynamic, and pharmacokinetic differences are often not taken into consideration.[6] The majority of medication errors occur at the ordering stage.[3,7]

Numerous publications discuss ways to reduce medication ordering errors in pediatrics.[7-10] Legible, complete orders that include the patient's weight and allergies are a necessity.[7,8,10-12] Furthermore, appropriate documentation is also linked to billing, liability, and quality of care issues.[13] Thus, computerized physician order entry (CPOE) is increasingly becoming standard of care.[7] However, a recent email survey of hospital or health-system pharmacy directors[6] revealed that only 17.4% of the 662 respondents were using CPOE. Therefore, physicians practicing in institutions without CPOE need to utilize other strategies to reduce and ultimately eliminate medication ordering errors.

Our pediatric sedation team was formed in 2004 consisting of 2 pediatric hospitalists, one pediatric intensivist (who trained the hospitalists), and a nurse. Pediatric residents rotating on the inpatient service were involved in the majority of cases. Lengthy orders and multiple forms are required to perform these procedures safely and to have appropriate medico-legal documentation. We noticed an increase in the number of shortcuts being used by physicians at all levels that might lead to possible adverse events, including (1) unapproved abbreviations; (2) deletions in required documentation (patient

ADEs	Adverse drug events	CPOE	Computer physician order entry
ASA Classification	American Society of Anesthesiologists' physical status classification		

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weight and allergies, weight based dosing, required resuscitation equipment); (3) incomplete consent forms; and (4) inadequate documentation of the procedure.

In response, we developed preprinted consent and physician order forms and prepared packets for pediatric sedations at our institution in an effort to improve documentation compliance and to reduce medication ordering errors.

METHODS

This project was approved by the Institutional Review Board at Louisiana State University Health Sciences Center-Shreveport. Prior to July 2004, there was no standard order set for pediatric patients requiring procedural sedation in our institution. A standard order set was created by one of the authors (M.B.) with input from the Pediatric Department Chairman and a Pediatric Intensivist (available by request from M.B.). The list of all required documents for pediatric procedural sedations was then created by the pediatric hospitalist (M.B.) and pediatric ward charge nurse. The pediatric ward clerk assembled the packets from the list of necessary documents.

All of the members of the sedation team were involved in the creation and assembly of the new packets therefore an official in-service on their use was not performed. Residents were instructed in their use in real-time as they rotated on the service.

This pilot study was conducted to evaluate the intervention. It included charts reviewed from the 12-month period before the implementation of the prepared documents and packets and the 12-month period after the implementation. Charts were identified using handwritten monthly log sheets of patients on the pediatric inpatient service undergoing procedural sedation. The monthly log sheets were sent to Health Information Management and charts were reviewed as they became available. Allowing for a learning curve, "after" charts were requested from Health Information Management in order according to a random number list.[14] Indications, documentation requirements, medications, and education of the residents and nursing staff for procedural sedation were not changed during this time period. All results were entered into an Access database in real-time as the charts were reviewed.

Charts were reviewed for completeness of medical documentation and correct medication dosages by the pediatric hospitalist who assisted in creating the forms and packets (M.B.). Required medical documentation for procedural sedation was reviewed. The required documents are (1) informed consent form; (2) procedure note; and (3) sedation monitoring form.

The consent form was considered complete only if it was stamped with the patient's addressograph card, the physician filled in the indication for the sedation and the patient's problem, and the appropriate signatures were present (physician, patient or authorized person, and witness). The procedure note written on a progress note sheet in the patient's chart was deemed complete if it included the indication for the sedation, a description of the sedation and complications (if any), the performing physician's signature and an attending physician signature if a resident wrote the note.

Our sedation monitoring form consists of a brief checklist and a short fill-in-the-blank list of questions about the patient's past medical history, past sedation history, and current physical examination that the physician must complete. When the sedation is completed, the inside of this form must be signed by a physician to confirm that the documentation by the sedation monitoring Registered Nurse is complete and accurate.

The physician order form was reviewed for documentation of date, time, American Society of Anesthesiologists' physical status classification (ASA classification), allergies, ordering of resuscitation equipment, and postsedation orders. The preprinted forms include prompting for entering the date, time, ASA classification, allergies, and weight of the patient. The preprinted forms also contains resuscitation equipment and postsedation orders in their entirety. The medication dosages for the sedative and reversal agents on the preprinted physician order form include the standard dose per weight. The physician is expected to check the agents desired and calculate the dose using the patient's weight. These medication dosages were reviewed to ensure that medications were ordered using unit/kg, that appropriate reversal agents were ordered, and that the absolute dosage ordered was within a 10% margin of error using the Lexi-Comp's Pediatric Dosage Handbook, 13th Edition.[15] If any adverse events were noted in the charts, this information was also recorded in our Access database.

We compared the percentage of charts with complete and accurate documentation and medication orders before intervention to that after intervention. Chi-square or Fisher Exact was used to determine preintervention vs postintervention statistical differences.

RESULTS

A total of 84 charts were reviewed (42 preintervention and 42 postintervention). The mean ages of the patients being sedated were 71 months "before" (range: 19 days to 15 years old) and 43 months "after" (range: 60 days to 14 years old). Sedation was required for a variety of diagnostic and therapeutic procedures in both groups. After the implementation of pre-printed physician orders, consent forms and prepared packets, 2% of order forms (1 of 42) and 14% of consent forms (6 of 42) were still handwritten. There was 1 chart "before" and one chart "after" that did not have a patient weight listed. The medications ordered on these 2 charts were included in the incorrect dosage calculations. The Table demonstrates the increase in documentation compliance for the consent form ($P < .001$), procedure note ($P = .113$), sedation monitoring form ($P = .003$), and components of the physician's order form. The only studied item on the physician order form that did not show significant improvement was documentation of date ($P < .001$) and time ($P = .013$). The Figure illustrates significant improvement in medication or-

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