

Original Research Article

PICU admission order set: a quality improvement initiative in a developing country

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ABSTRACT

Background: Multiple studies have shown that standardized admission order sets (AOSs) in general as well as specific clinical diseases improved adherence to evidence-based patient management, minimized variability, improved workflow, and augmented patient safety. These order sets are intended to provide a framework for treating patients and planning a course of care. The objective of this study is to assess the implementation of SAOS in a Pediatric Intensive Care Unit (PICU) of a new public-sector hospital in Pakistan.

Methods: A descriptive, cross-sectional study was conducted on all children (age: 1 month to 15 years) admitted to PICU from October to December 2022. All admission orders were paper-written based on the mnemonic "AD CAVA DIMPLS". All data were collected on Microsoft Excel and descriptive statistics were applied.

Results: A total of 932 admissions were done during the first three months. The most common age and admitting diagnosis were one-year-old and lower respiratory tract diseases respectively. The overall adherence to AOS was 71.68%. Nine components of AOS [AD CAVA DIM] had 90.77% appropriate utilization.

Conclusions: We observed a very high rate of implementation of AOS in our PICU.

Keywords: Admission order set, PICU, Implementation

INTRODUCTION

Quality improvement (QI) is a vital component of the healthcare sector and is recommended by professional healthcare organization bodies like the Institute of Medicine (IOM), Institute of Safe Medicine Practice (ISMP) and World Health Organization (WHO).¹⁻³ QI projects are highly beneficial for clinicians, their patients, and organizations to improve the quality of healthcare. A healthcare QI program is a set of focused activities designed to monitor, analyze, and improve the quality of processes to improve the healthcare outcomes in an organization. The structure represents the first component of the quality of care model and can be defined as the way

we organize care. PICU is a heterogeneous place in many ways with a wide age range, different spectrum of illnesses, various forms of medical care, and the use of multiple forms of technology. These structural variations can affect the quality of care and therefore the increase risk of potential errors in the care of acute critically ill or injured children.⁴⁻⁶ The Computerized Physician Order Entry (CPOE) is an integral part of electronic health records and is a tool for improving the quality and safety of patient care. The CPOE is widely used in hospitals in developed countries.^{7,8} Currently, the admission orders of patients admitted in the pediatric intensive care unit (PICU) are written on blank physician order sheets in most of the institutions across Pakistan. Previous studies

showed the implementation of a structured admission order set (AOS) in clinical practice improves overall standardization, efficiency, and quality of care.^{9,10} The implementation of AOS in both medical and surgical disciplines has positive impacts like uniformity, and familiarity, reducing the chance of missing orders and errors, augmenting patient safety, length of hospital stay, and cost-effectiveness. Several studies on AOS from adult in-patients and few limited reports on AOS from pediatric in-patients are available in the medical literature.¹¹⁻¹⁴ The rationale of this QI project on AOS in PICU is for three reasons. First, it will improve the completeness of physician orders and reduce the number of missing orders. Second, it will improve the efficiency of workflow and save time. Third, it will strengthen teamwork by uniformity.⁹ We hypothesized that there is a wide variation in writing admission orders for new patients in PICUs. The objective of this study is to evaluate the effectiveness of the implementation of AOS in a new medical PICU of a Children's hospital.

METHODS

A descriptive, cross-sectional study was conducted in a closed PICU of a new public-sector Children Hospital Korangi, located in a very low socio-economic area of Karachi and serving in a population of more than 2.5 million. This is one of the Sindh Government's initiatives in the health sector to provide a good standard of medical care to acutely sick children of the province of Sindh Pakistan. Children Hospital Korangi is the first of this initiative, which is an almost 200-bed tertiary-care pediatric hospital with multi-disciplinary and comprehensive care, including outpatient departments as well as large intensive care services for both neonates and

children. This institution is also a training center for both doctors and allied health workers to build capacity for the future. This PICU is a 28-bedded unit, which is spread over four rooms; each room has 7 beds and each bed has a space of 150square feet with double oxygen source suction and invasive hemodynamic intensive care monitors. It is equipped with a central oxygen and medical air supply, a digital mobile X-ray machine, a Point-of-care Ultrasound machine, an EKG machine, a blood gas analyzer, high-flow oxygen nasal machines, mechanical ventilators, high-frequency oscillatory ventilator, and EEG services. This PICU is manned with two full-time PICU consultants, clinical fellows of pediatric critical care medicine, pediatric residents, and nurses with 1:2 patient ratios. We do not have the services of cardiothoracic surgery, neurosurgery, and oncology now. The institutional Ethics committee has approved this study (SICHN/Ex-005/2024). All children (age: 1 month-15 years) admitted to the PICU of SICHN from October 2022 to December 2022 were enrolled, and there were no exclusion criteria. All residents and medical officers, who are the primary users of writing the admission orders in the medical chart, received 1-hour training through a 20-minute didactic PowerPoint presentation and a 40-minute hands-on session with discussions before implementation. A QI project was initiated to write admission orders on each admission in the PICU in a structured and organized way to improve the efficiency of medical care. Our team agreed on using the mnemonic "AD CAVA DIMPLS" for the admission order set (AOS), detailed as shown in Table 1.¹⁵ The estimated sample size was 246 if a 75% change was observed in the implementation of AOS in the medical practice with 95% CI and 5% margin of error by Open-Epi V3 sample size calculator.¹³ If we add 20% dropout, then will be needed 300 cases.

Table 1: Components of AOS - "AD CAVA DIMPLS".

Components of AOS - "AD CAVA DIMPLS"	
Admit	Admitting physician and type of unit
Diagnosis	Primary: The chief reason for admission should be listed as the primary diagnosis; Secondary: Associated diagnosis or co-morbid disease
Condition	The patient's condition at the time of admission was stated as a one-word description like either – critical, guarded, unstable, stable
Activity	Level of activity based on diagnosis and condition stated as strict bed rest, bed rest with privilege to the bathroom, out of bed, or ambulate as tolerated
Vital signs (VS)	Usually few VS like heart rate, respiratory rate, and oxygen saturation are monitored continuously on the monitor. Frequency of VS recorded based on unit protocol like q1Hr in PICU and q4Hr in high dependency unit
Allergy	List medications or food allergy (high alert) or not known to drug allergy (NKDA)
Diet	What type of diet patient is allowed: NPO if no feeding, diet order includes type (like breast milk for infants) and route (per oral or nasogastric tube feeding) or regular diet for age (RDA)
Interventions	Intra venous fluid therapy respiratory/ physical therapy, etc.
Medications	Name of medication, dose, frequency, and route of administration
Procedure	Eye care, oral care for intubated patients, positioning, bundle care of PICU (VAP, CLABSI, or CAUTI) wound care, or ostomy care
Labs	Any laboratory test or diagnostic studies needed
Special instructions	Notify if certain parameters are crossed limits or specific instructions for neurosurgical patients

Outcome

The primary outcome of this study is to assess the effectiveness of implementing AOS in a newly open PICU of a public-sector children's hospital.

Data collection and statistical analysis

Demographic data like age, gender, and admitting diagnosis category were recorded from medical records. The rates of compliance of each component of AOS of all PICU admissions were recorded as "1" (Yes) if appropriately filled and "0" (No) if not appropriately filled. Descriptive statistics will be applied to assess the rate of compliance with AOS in all admissions to PICU during the study period.

RESULTS

We identified a cohort of 932 acutely ill children admitted to PICU during the study period. The median age was 15 months (range: 1 month to 15 years) and 59% (n=550) were male. The majority of children were under five years of age in our cohort. The most common reason for admission to PICU was respiratory distress and failure. Acute lower respiratory tract infections were the most common diagnosis followed by shock and acute neurological illnesses (Table 2). The first nine components of AOS (AD CAVA DIM) from "admit to medications" were appropriately filled in 90.77% of cases and a relatively low rate (<50%) of adherence in the last three components (LPS) of AOS, and the overall mean effective implementation of AOS was 71.68% (Table 3).

Table 2: Patients' characteristics (n=932).

Variables	Characteristics
Age (years)	
Median	12 months (1 month to 15 years)
Total no. of patients-under-five years N (%)	606 (65)
Gender (M/ F) N (%)	550 (59)/382 (41)
Admitting diagnosis	N (%)
Respiratory	382 (40.98)
CVS (including septic shock)	212 (22.74)
CNS	196 (21.03)
Tropical infection (severe dengue and malaria)	53 (5.68)
Miscellaneous	89 (9.54)

Table 3: Adherence to components of AOS.

Components	N	%
Admit	853	91.5
Diagnosis	857	92
Condition	844	90.6
Allergy	845	90.7
Vital signs	847	90.9
Activity	844	90.6
Diet	840	90.1
Instructions	843	90.5
Medicines	846	90.8
Proceedings	61	6.5
Labs	446	47.9
Special instruction	74	7.9
Overall	-	71.68

DISCUSSIONS

Our study results found that 72% of appropriate implementation of AOS in the PICU of a newly open public-sector children's hospital. This result almost is parallel to most of the published studies on adherence to AOS.^{9,12,16} For more than two decades, Electronic medical records (EMR) have been an essential component of hospital management in developed countries.

Computerized Physician Order Entry (CPOE) has completely replaced handwritten physician orders on paper and is a component of EMR.^{7,17} Almost published twenty-two observational studies on adherence to AOS have a significant positive impact in a systemic review and meta-analysis.¹⁸ Previously published studies reported a high rate of success in the majority of cases of adherence to AOS of in-pediatric patients. McAlearney et al found 88.1% and 79.4% adherence in acute asthma and appendectomy order sets respectively.¹⁶ Bekmenzian et al

surveyed pediatric residents of an academic hospital on utilization of pediatric admission order set of in-patient and showed convenient, improved patient care and reduced medication errors by 93%, 84% and 75% of respondents respectively.⁹ To the best of my knowledge, this will be the first report on adherence to AOS in pediatric patients from Pakistan and our results are like other reports. We observed about 95% appropriate utilization of the first nine components of AOS [AD CAVA DIM]. These components are related to the general care of all admissions in our PICU. There may be a possibility of a high compliance rate in our cohort. Several clinical reports have described improved compliance and patient care, shorter length of stay and reduced use of specific medications after implementation of disease-specific admission order sets for a variety of illnesses both in pediatric and adult studies.^{11-13,19-23} Few pediatric studies on the implementation of admission order sets on acute respiratory illnesses, diabetic ketoacidosis, and acute pancreatitis found shorter lengths of stay and efficiency in clinical care.^{12,19,23} However, our purpose was only to assess the rate of appropriate implementation of AOS in a PICU of a new public-sector, teaching children hospital in low-and middle-income countries.

We have strengths and limitations in our study. Limitations were a single center, retrospective chart review, and limited sample size. This result cannot be generalized due to these limitations. We are also unable to evaluate the clinical outcome like length of stay, appropriate use of medical care like unnecessary medications and labs as well as satisfaction among healthcare workers. The purpose of this study was implementation of admission order set in a new PICU of a public-sector hospital. The strength of this study is that it is the first study to our knowledge that assesses the rate of implementation of admission order set in a PICU of low-and middle-income countries and can be used as hypothesis-generating.

CONCLUSION

Introduction of admission order set has a high rate of implementation in the PICU of a newly open public-sector children's hospital in Pakistan. The application of this intervention has the potential to improve organizational efficiency and patient outcomes.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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