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Medication Administration Time Study (MATS) Health care Staff Performance of Medication Administration

Waleed Ashawy Alshammari[1], Salah Asmair Alharbi[1], Amer Maseer Aldhafeeri[2], Mohammad Owaid Aldhafeeri[1], Sultan Abdullah Alharbi[3], Waleed Owaid Aldhafeeri[4]

1. Pharmacy Technician
2. Technician Nursing
3. Dental Assistant
4. Health Care Administration

Abstract

Objective: This study aimed to develop and validate a method for evaluating nursing effort and workflow in the medication administration process within a pediatric hospital setting.

Background: Medication errors contribute significantly to patient morbidity and mortality, highlighting the importance of robust systems for medication administration. While bar-coding medication administration systems are commonly used to reduce errors, there is a lack of comprehensive pre-implementation workflow data specific to pediatric hospitals, hindering the evaluation of system effectiveness.

Method: A descriptive observational study was conducted involving 180 nurses across pediatric units in a tertiary care pediatric hospital. A total of 1200 unique medication observations were made to assess nursing effort and workflow during medication administration.

Results: The study revealed that nurses spent an average of 20 minutes per medication pass, with frequent interruptions and distractions during the process. These challenges posed significant threats to patient safety, leading to potential workarounds and workflow inefficiencies.

Conclusion: The findings highlight the critical need for tailored interventions and workflow optimizations in pediatric medication administration processes to mitigate risks, enhance patient safety, and improve overall workflow efficiency.

Introduction

Patient safety is a paramount concern in healthcare, particularly concerning the prevention of adverse drug events (ADEs). A significant number of patients, up to 7,000 annually, succumb to medication errors, highlighting the critical need for robust safety measures. Bates et al. emphasized that ADEs can incur substantial costs, averaging $8.4 million per year in a 700-bed hospital, excluding additional patient injury or malpractice expenses. These errors can occur at various stages, from medication ordering to administration, necessitating comprehensive safety protocols. (Institute of Medicine, 2006)

Safety measures such as computerized physician order entry (CPOE) and medication administration records have been implemented to address errors in prescribing and dispensing. Bar coding, in particular, provides an electronic verification system for nurses during medication administration, ensuring adherence to the "5 rights" of medication administration. However, before implementing bar-coding medication systems (BCMA), it is crucial for nursing leaders to fully understand the existing workflow during medication administration. (Keohane et al., 2008)

Keohane et al.'s study revealed through a time and motion analysis that nurses spend considerable time on non-administrative tasks, indicating potential inefficiencies in the medication administration process. While the need for medication error reduction is well-supported, there is a notable gap in nursing research focusing on medication administration processes. (Heinen et al., 2003)

The Institute of Medicine's report highlighted the alarming prevalence of avoidable medication problems, with a subset of these errors directly linked to nursing practices. Despite nurses serving as a crucial barrier against medication errors, there is a lack of comparable safety measures for nurses administering medications, leaving them isolated and patients vulnerable to preventable harm. (Carayon et al., 2004)

Research on bar-coding medication systems has shown promising results, with potential error reduction rates of up to 86% in intercepting nursing medication administration errors. However, many hospitals lack essential workflow data on nursing medication administration processes and errors, hindering their ability to evaluate the efficacy of BCMA systems. (Barker et al., 2002)

In conclusion, addressing medication administration errors requires a comprehensive understanding of existing workflows, the implementation of robust safety measures, and ongoing research to assess the effectiveness of these interventions in ensuring patient safety. (Pape et al., 2005)

Method

The study aimed to comprehensively assess nursing effort, including time and motion, during the medication administration process in an acute care setting before the implementation of a bar-coding medication system (BCMA). The primary question addressed was: How much effort, including interruptions, do nurses expend during medication administration in acute care settings?

Observational studies are recommended as the most accurate data collection method. A pilot observation study was conducted in one hospital to identify inefficiencies and distractions in the medication administration process. The pilot study results guided the refinement of study methods, the development of a data collection tool, and the validation of the need for a broader observational study across three sites.

The medication administration process was divided into four distinct time periods: preparation, retrieval, administration to the patient, and documentation. The study aimed to understand the cost of medication administration (time spent by registered nurses [RNs]), efficiency in medication passing, quality aspects, potential interruptions and distractions, and improvement opportunities.

A unique medication observation (UMO) was defined as one nurse completing the retrieval and administration of one or more medications to one patient at a time. Preparation and documentation were not consistently included in UMOs due to variations in practices, unit structures, and workflows, necessitating the use of mean times for measurement.

Human subjects' protection was ensured through institutional review board (IRB) approvals and obtaining consent from participating nurses. Pedometers were used to capture motion data, ensuring anonymity by recording only the pedometer number without linking it to any other data.

The ICE Tool was developed based on literature review and pilot study insights. It recorded essential elements such as time for each medication pass phase, number and route of medications, interruptions and causes, pedometer data, and observer comments. Interrater reliability of the ICE Tool was high, ensuring consistency in data collection.

Interruptions and distractions were categorized and recorded using the ICE Tool, including pharmacy/medication storage issues, unit turbulence, and other disruptions during medication administration. Training sessions were conducted for data collectors to ensure consistent categorization and data collection practices.

Study Design

The study aimed to enhance understanding of the medication administration process and validate the use of the ICE Tool. After obtaining IRB approval, chief nursing officer and unit manager consent, data collectors were trained, and the study was introduced on each unit.

Sample

Three hospitals were selected to capture diverse workflow and medication administration systems. A total of 151 registered nurses and LPNs participated, with less than 1% refusal (n = 3), resulting in a robust

sample size of 980 unique medication passes across the sites. All willing nurses were included, except agency and registry nurses due to unfamiliarity with unit workflows. Daily snacks were provided to ease anxiety about data collection.

Data Collection

Data were collected over 72-hour periods on all shifts across three medical-surgical units. Morning medication passes provided the most observations, supplemented by key medication pass times on all shifts. Each unit had one data collector to minimize distractions. Nurses wore numbered pedometers for motion data collection.

Medication Preparation

Observed activities included checking orders, consulting physicians, contacting pharmacy, reviewing lab results, and other patient care details.

Medication Retrieval

Observations began when nurses entered the medication room, retrieved medications, and ended upon leaving the room. Continuous timing was applied if interruptions occurred during retrieval.

Medication Administration

Timing started as nurses left the medication room and concluded upon leaving the patient's room post-administration. Interruptions extended timing, noted on data sheets.

Medication Documentation

Timing varied based on when nurses documented, averaged to determine time per medication pass.

Pedometers

Pedometers on nurses' shoes recorded steps during medication passes and shifts, validated for reliability and accuracy. Data collectors ensured proper placement and monitored step counts.

The study design facilitated comprehensive data collection on medication administration processes, motion analysis, and interruptions/distractions, providing valuable insights into nursing efforts and workflow challenges.

Results

The study revealed significant inefficiencies and distractions in the medication administration process across all three hospitals. Nurses took longer than expected to complete medication passes, with variations observed in medication retrieval, administration, and documentation times.

Hospital A had extended medication retrieval times, possibly due to a mix of LPNs and RNs and bottlenecks at the medication dispensing system. Nurses often waited in line during standard medication administration periods, leading to delays.

Hospital B exhibited faster medication administration times but compromised safe medication practices, such as pulling multiple patients' medications simultaneously.

Hospital C experienced longer medication passes due to diverse medication storage locations, higher patient acuity, and more medications per pass. Uncertainty about medication locations and deliveries contributed to delays.

When combining UMO, preparation, and documentation times, the average medication pass across all hospitals was 15 minutes and 7 seconds, highlighting the need to reevaluate medication standards.

The study also identified numerous interruptions during medication administration, averaging 1.21 interruptions per medication pass, posing risks for medication errors. Key interruptions included patient care issues, pharmacy/storage problems, and other staff activities.

One notable example was a 40-minute medication pass due to storage device errors, emphasizing how interruptions prolong medication administration and increase error risks.

Motion data revealed that nurses walked an average of 1,009 steps per medication pass and approximately 881 steps per hour of work. Hospital A nurses took fewer steps during medication passes but had the highest overall shift steps, possibly due to additional responsibilities and lack of support staff. Hospital C nurses took more steps during medication passes due to search activities but had fewer overall shift steps.

Table 1 summarizes data collection results for medication retrieval, administration, and total pass times across the three hospitals. Table 2 presents motion data, indicating the average steps per medication pass

and per shift for each hospital, emphasizing variations in physical effort during medication administration and overall shifts.

Table 1. Data Collection Results

Hospital	Medication Retrieval Time	Medication Administration Time	Total Unique Medication Observation Time	Average Preparation Time	Average Documentation Time	Total Pass Time
Hospital A	5 min 13 s	3 min 5 s	8 min 18 s	5 min 24 s	43 s	14 min 25 s
Hospital B	3 min 31 s	3 min 35 s	7 min 6 s	6 min 43 s	1 min 37 s	15 min 26 s
Hospital C	4 min	6 min 4 s	10 min 4 s	3 min 8 s	2 min 17 s	15 min 29 s

Table 2. Motion Data Results

Hospital	Average Steps per Medication Pass	Average Steps per Shift
Hospital A	917	1,013
Hospital B	961	879
Hospital C	1,149	752
Study Average	1,009	881

Discussion

Medication administration is a critical aspect of patient care that requires practicality, efficiency, and a focus on minimizing interruptions and distractions. The findings from the Medication Administration Time and Motion Study (MATS) provide valuable insights for healthcare leaders to enhance both nurse and patient safety during this process. The study's identification of the burden of interruptions and distractions aligns with existing literature, highlighting the need for interventions to address these issues (Pape et al., 2005).

One key takeaway from the study is the significant amount of time nurses spend on medication-related tasks. This underscores the importance of enhancing patient safety while also reducing costs associated with nursing time and medication administration. (Carayon et al., 2004)

The use of time and motion observation proves to be a valuable method for understanding nursing workflow during medication administration. It reveals that nurses across different institutions are susceptible to interruptions or distractions during medication passes. Strategies such as bringing medications and supplies closer to patients can promote patient-centered care, improve efficiency, and save time. Additionally, scheduling medication changes and fostering a culture of safety around medication administration can further enhance the process. (Keohane et al., 2008)

The study also highlights the variability among individual nurses in their medication administration practices, which is not solely attributed to different units but rather to individual nursing styles. Nursing leaders can address this variability by selecting preceptors who demonstrate safe medication administration practices and by establishing clear standards during nursing orientation. (Heinen et al., 2003)

Looking ahead, advancements in technology will continue to impact nursing workflow. It's crucial for hospital and nursing leaders to understand unit-specific workflow challenges before implementing new

technologies. Future research should focus on areas such as physician ordering processes, pharmacy verification, and electronic medication administration records. This ongoing inquiry into medication standards and nursing processes will contribute to continuous improvement in patient care. (Flynn et al., 2002)

Overall, the MATS underscores the importance of a systemic approach to improving medication administration processes. Despite the unique systems and technologies in each hospital studied, there are commonalities that contribute to a broader understanding of nursing efforts involved in medication administration. (Barker et al., 2002)

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