

Effect of a Four-Pronged Educational Intervention on the Knowledge and Self-Reported Practice of Nurses on Prevention of Medication Errors in Pediatric Care Setting - A Pilot Study

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ABSTRACT

The purpose of this pilot study was to assess the effect of a four-pronged educational intervention on the knowledge and self-reported practice of nurses regarding prevention of medication errors in selected hospitals in Tamil Nadu. The pilot study was focused on a quantitative research approach and quasi-experimental- one group pre-test and post-test study design. A total of 20 nurses participated and attended the four-pronged educational intervention for the nurses regarding prevention of medication errors. The data were collected by using structured questionnaire before and after video teaching intervention program. Content validity and reliability was performed by test-retest analysis. Paired “t” test was used to assess the effectiveness of the training programme on prevention of medication error in children. The tool was feasible, and the main study was carried out without any modification. Reliability of the knowledge was $r=0.81$, the self-reported practice were in three checklists including Preparation of medication ($r=0.86$), administration of medication $r=0.80$ and documentation = $r=0.88$. The posttest mean score of knowledge ($M=11.25$; $SD=3.895$) was higher than the pretest score ($M=8.56$; $SD=5.891$) The posttest self-reported

practice was moderately increased ($M=9.65$; $SD=2.568$) than pretest ($M=8.12$; $SD=4.431$) and showed that there is a positively, significant correlation between knowledge and self-reported practice of the staff nurses towards prevention of medication error in children at $p<0.01$ level of significance. Overall, the pilot study revealed the video teaching intervention would be beneficial to the nurses in prevention of medication error in pediatric settings. It's recommended to proceed with the main study with a large sample at selected hospitals.

Key words: Medication error, pediatric care, drug administration, nurses, knowledge, practice

INTRODUCTION

Worldwide, many children are given medicines for their ailments on an outpatient basis and so medication errors are very common at homes. But in clinical settings, pediatric patient populations continue to be the most vulnerable group to serious and sometimes fatal adverse drug events. Medication Errors (MEs) are the most common medical errors worldwide, especially in children [1]. Monitoring the safety of medicine use in children is of paramount importance. Use of medicines

outside the specifications described in the license (e.g. in terms of formulation, indications, contraindications or age) constitutes off-label and off-license use, and these are a major area of concern [2-3].

MEs were encountered by 74.5% of participants in a review article that included 113 intensive care units (ICUs) from 27 different countries [4] (Valentin, 2009). In India, researchers discovered that errors occur in 68.5% of the medication [5] (Pariharet al, 2008). MEs are widespread in Ethiopia, as they are in many underdeveloped nations; research at the Jimma University Specialized Hospital [6] (Feleke et al, 2010). Children pose special challenges in the drug ordering and delivery process; for example, drug dosages often must be calculated individually, leading to increased opportunities for error with a relatively high risk of 10-fold errors as compared to adults [7]. The availability of most of the drugs in unit dose packaging for adult patients. Very few medications are available in pediatric or neonatal dosage forms or concentrations from pharmaceutical manufacturers. This results in hospital pharmacies repackaging drugs and diluting drugs to accurately measure and make unit dose medications for children [8] (Mehndiratta, 2012).

Interventions on pediatric medication safety can be done based on the "hierarchy of controls" model, which predicts that interventions at higher levels are more likely to bring about change [9-10]. Higher-level interventions aim to reduce risks through elimination, substitution, or engineering controls. Administrative controls such as guidelines, warning signs, and educational approaches are lower on the hierarchy and therefore predicted by this model to be less likely to be successful [7, 10-11].

Nursing practice has changed because of nurses' facilitation of practice reflection, development, and implementation of a combination of interventions, which has also decreased the rates of errors in medication administration [12-13]. The active participation of nurses in continuing

education or training research will enable them to determine strategies that are customized to their local practice context and pediatric care setting.

The investigator's exposure to pediatric units demonstrated that the newly recruited nurses lacked the necessary training and expertise in pediatric medication administration. Furthermore, there was always a possibility of making errors in the dilution and administration of the medication. Therefore, the researcher planned to conduct a pilot study to assess the nurses' competence in giving pediatric medication prior to the main trial. In addition to implement a range of educational interventions to enhance the nurses' understanding of and ability to prevent medication errors.

The purpose of this pilot study was to assess the effect of a four-pronged educational intervention on the knowledge and self-reported practice of nurses regarding prevention of medication errors in selected hospitals in Tamil Nadu.

METHODS

Study design

The pilot study was focused on a quantitative research approach and quasi-experimental- one group pre-test and post-test study design to determine the knowledge and self-reported practice on medication errors in pediatric care setting among nurses working in selected hospitals in Tamil Nadu.

Population and setting

The population for this study included all the nurses working in pediatric wards, pediatric ICU's and neonatal ICU's and pilot study was conducted at 'M' hospital in Tamil Nadu. The nurses both male and female who were willing to participate in the study and who were available during data collection period. The nurses who had completed G.N.M, B.Sc (N), P.B.B.Sc (N) and M.Sc (N) working at selected hospital working at selected hospital, Tamil Nadu. The sampling size for this pilot study was

20 nurses worked in the Pediatric wards, pediatric ICUs and NICUs in the selected hospital in Tamil Nadu.

Variables

The major dependent variables of this study were knowledge and self-reported practice of the nurses regarding prevention of medication errors. Independent variables were age, gender, educational qualification, years of experience, Duty in charge (At present), number of patients cared for on average per day, average number of working hours per week. Four-pronged educational intervention for the nurses regarding prevention of medication errors was conducted as pre and post evaluation

Data collection tool

The data collection tool was prepared by the researcher based on the available information gathered from the review of literature and objectives of the study. It consisted of three parts:

Part 1: Demographic questionnaire

This tool consisted of baseline characteristics of the nurses working in the pediatric wards included: age, gender, educational qualification, years of experience, Duty in charge (At present), number of patients cared on an average per day, average number of working hours per week.

Part 2: Knowledge questionnaire

The semi structured questionnaire was prepared by the researcher, and it consisted of the items to setting the knowledge of nurses regarding prevention of medication errors in pediatric care setting. It consists of 25 multiple choice questions regarding the methods, types and prevention of medication errors and answers are rated as scores on 0-25 ('Adequate', 'Moderate' and 'inadequate'). Possible ratings were interpreted on the scale ranging included: Adequate ($= \geq 18-25$), Moderately adequate (11-17) and Inadequate ($= \leq 10$). The higher ratings indicate more knowledge regarding Medication errors and its prevention. The

study participants were approached to complete the questionnaire.

Part 3: self-reported practice questionnaire

The self-reported practice questionnaire was prepared as a checklist to assess the self-reported practice of nurses regarding prevention of medication errors. It consists of 30 items of practice regarding medication errors and routine practices in pediatric setting. The answers are rates as scores on 0-25 ('Good practice', 'Average practice' and 'Poor practice'). Possible ratings were interpreted on the check list ranging included: Good practice ($= \geq 18-25$), Average practice (11-17) and Poor practice ($= \leq 10$). The higher ratings indicate the more practice regarding Medication errors and its prevention. The study participants were approached to complete the questionnaire

Content Validity and Reliability of The Tool

The structure tool of knowledge and self-reported questionnaire were prepared and lesson plan on training programme were carefully established and certified by the pediatric Nursing professors, hospital nurse supervisors and statistics. The reliability of the tool was analyzed by inter-rater and test re-test method.

Description of structured training programme

The four-pronged educational intervention on video training programme was developed based on the literature review and expert's opinion. The content of the training programme on "Rights of medication administration" includes introduction, rights of before, during, after administration of medication and factors contributing to medication error. In addition, it added three checks on safe medication, routes of drug administration and types of medication administration with special procedures. The method of video training was given by lecture cum discussion, seminar, and group discussion. The video materials were

prepared and arranged along with the pamphlet and booklet

Pilot study

The pilot study was conducted in Mary Hospital at Samurengapuram in Tamil Nadu from 13.08.2022 to 20.08.2022 with 20 samples by a purposive sampling technique. The participants were recruited by lottery method. The purpose of the study was explained to the respondents, and confidentiality was assured by obtaining their consent. The pretest was conducted by using structured knowledge and a self-reported checklist. The study participants were instructed to fill out the questionnaire before the training. According to the convenience of the participants, they assembled in a group according to the slots provided either in the morning session or afternoon session. A questionnaire was administered to assess the knowledge, and a checklist will be provided to assess the self-reported practice of the nurses. The average time for a pre-test taken is 20 minutes per nurse. Then a four-pronged educational intervention was provided, and the duration was a one hour for each session. The first session was held during the morning shift and the second session in the afternoon. The researcher conducted Intervention 1 by lecturing the nurses using a power point presentation about medication errors; factors contributing to medication errors; types of medication errors; and medication error prevention. And Intervention 2 focused on problem-based learning by providing the nurses with a written case scenario and asking them to provide a written solution. Furthermore, intervention 3 was established by video teaching regarding the rights of pediatric medication administration and routes of medication administration

(Intradermal (ID), Intramuscular (IM), and Intravenous (IV). In addition, in Intervention 4 of a role play on administering oral medication safely, and the volunteer among the nurses acted as a nurse, care giver, and pediatric patient within a team. The post-test was initiated after 7 days of intervention of about 25-30 minutes, to assess the knowledge and the self-reported practice of the nurses regarding prevention of medication errors.

Statistical analysis

Data were analyzed based on objective and hypothesis by using descriptive and inferential statistics. Frequency and percentage distribution were used to describe categorical variables and mean, and standard deviation was used to compare the knowledge, and self-reported practice of staff nurses. Paired “t” test was used to assess the effectiveness of the training programme on prevention of medication error in children. The statistically significant values are considered at the level of $p < 0.05$. All the collected data were analyzed by using the Statistical Package for the Social Sciences software (SPSS) Version 25.

RESULTS

Characteristics of the participants

A total of 20 nurses participated in the pilot study, most of them were female (80%) and aged 25-30 years (63%).

Reliability of the tool

The reliability results showed the highly reliable values of the structured tool. The Knowledge score was $r=0.81$ and the self-reported practice check list score was $r=0.86$ regarding prevention on medication errors among the nurses in pediatric care setting (Table 2).

Table 1. Reliability of the knowledge and self-practice on prevention of medication error tool

Questionnaire	Number of items	Cronbach alpha	Test-retest (r)	Remarks
Knowledge	25	0.807	0.81	Reliable
Self-reported Practice check list				
Preparation of medication	13	0.821	0.86	Reliable
Administration of medication	14	0.741	0.80	Reliable
Documentation	3	0.719	0.88	Reliable

Effectiveness of the intervention

Table 2 illustrates the posttest mean score of knowledge (M=11.25; SD=3.895) was higher than the pretest score (M=8.56; SD=5.891) and statistically significant at $p < 0.05$ level. Table 3 shows the posttest self-reported practice was moderately

increased (M=9.65; SD=2.568) than pretest (M=8.12; SD=1.431) and showed that there is a positive, significant, and moderate correlation between knowledge and self-reported practice of the staff nurses towards prevention of medication error in children at $p < 0.05$ level of significance.

Table 2: Comparison of pretest and posttest knowledge among Nurses regarding prevention of medication errors in pediatric care setting

Variables	Knowledge		Difference means	“t”	df	Sig (p)
	Mean	SD				
Pretest	5.568	5.891	5.683	12.100	19	0.006*
Post test	11.251	3.895		23.407	19	0.001**

** $p < 0.001$; * $p < 0.05$, statistically significant.

Table 3: Comparison of pretest and posttest Sel-reported practice among Nurses regarding prevention of medication errors in pediatric care setting

Variables	Self-reported practice		Difference means	“t”	df	Sig (p)
	Mean	SD				
Pretest	8.121	1.431	1.534	40.191	19	0.001*
Post test	9.655	2.568		43.432	19	0.001*

* $p < 0.05$, statistically significant.

DISCUSSION

This pilot study was conducted prior to the main study by using 10% of the total sample. There are no practical difficulties experienced in the sample pilot study data collection and tool selection. The tool was feasible, and the main study was carried out without any modification of the pilot study. Verification of prescriptions of the prepared structured questionnaire to identify the knowledge on types and administration of medication and to prevent unintended medication errors affecting children. Previous review study reported, the training education and video teaching were very helpful for the nurses as a firsthand of continuing education programme as verbalized by the nurses [14-15]. This strategy has been proposed to help identify the right treatments to lower known risks that arise during risk-prone processes, and it has been conjectured that this strategy might be effectively used in the healthcare context. Study findings revealed that the posttest knowledge and self-reported score was higher than the pretest score. Similar results were reported in a quasi-experimental study conducted at the Pediatric Department with

samples of nurses obtained [16-17]. Three instruments were used- one contained structured interview questionnaire sheet to identify nurses' knowledge about medication administration safety. Studies showed an observation checklist to observe nurses' preparation for medication administration and detecting medication errors included medication safety audit list for nurses [16, 18-20]. The results of the study showed that errors in the administration of medication occurred between 2% of nurses post intervention instead of 14% pre intervention, also there were significant improvement in nurses' knowledge for medication safety on posttest and follow-up tests (13.64 ± 2.09) and (12.58 ± 1.6) respectively than on pretest (8.02 ± 3.7) [9]. Also, nurse's practices were improved after the implementation of safety strategies related to medication administration [18]. In addition, Ashtiani et al. reported that nurses' pharmacological knowledge was significantly associated with their participation in training classes, and their level of knowledge was considered acceptable [19]. Continuous monitoring of nurses is crucial for enhancing drug safety

by ensuring adherence to the guidelines of medication instruction.

Therefore, this study recommended the development of detailed protocols and guidelines, as well as an appropriate training program, would support nurses in compiling clinical medication errors for children care unit. More research is needed to further develop the awareness on medication errors in children by using large sample size in various settings. This strategy can be a first step in a long-term ongoing process to prevent future medication errors in children's hospitals.

CONCLUSION

The study pilot findings revealed that the four prolonged teaching intervention structured teaching programme on prevention of medication error among nurses working in pediatric hospital was effective. In addition, it was found that age, gender, years of experience and working hours were highly associated with the knowledge and self-reported practice of nurses in prevention of medication errors. To reduce medication errors in pediatric hospitals, it should be considered in clinical practice, regardless of baseline characteristics. The present study's results may differ from those of other studies due to the utilization of various data collection methods and instruments

Therefore, this study recommended, pediatric hospital nurses and administrators should collaborate with hospitals to create efficient protocols for administering medications safely, reporting medication errors, and fostering a medication-safe environment for all pediatric patients admitted to the hospital for the main study.

Declaration by Authors

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