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## **Nurses' Knowledge and Practices Regarding Peripheral Intravenous Cannulation and Blood Sampling in Pediatric Health Care Settings**

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### **ABSTRACT**

**Background:** peripheral intravenous cannulation and blood sampling are most frequently procedures for hospitalized children. **Aim of the present study was to:** Investigate nurses' knowledge and practice regarding Peripheral Intravenous Cannulation and Blood Sampling in Pediatric Health Care Settings. Research design: descriptive research design was used. **Setting:** The study was carried out in Pediatric Intensive Care, Neonatal Intensive Care units, Pediatric inpatient and Pediatric emergency department affiliated to Suez Canal University Hospitals and Ismailia General Hospital of Ismailia city affiliated to the ministry of health. The subjects of the study were all nurses (81) working at the above previously mentioned settings. **Tools of data collection:** two tools were used to collect the data; structured interview questionnaire and observational checklists. **Results:** the results of the study revealed that half of the studied nurses had satisfactory knowledge regarding peripheral intravenous cannulation and blood sampling while the majority of them had unsatisfactory practice. There was no statistically significant relation between total nurses' level of knowledge regarding peripheral intravenous cannulation and blood sampling and their practice. **Conclusion:** the study concluded that nurses were lacking knowledge as well as practice toward peripheral intravenous cannulation and blood sampling in pediatric health care settings. **Recommendation:** the study recommended that continuing training, educational programs and workshops concern the care of children with peripheral intravenous cannulation and blood sampling to nursing staff working in pediatric health care setting.

**Key Words:** Peripheral intravenous cannulation - Blood sampling – Nursing knowledge – Practice – Pediatric health.

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## INTRODUCTION

Children undergo numerous diagnostic and therapeutic procedures. The peripheral intravenous cannula placement is one of the most commonly performed procedures in pediatric patients and they can be one of the most challenging procedures, particularly in neonates and infants. Also, multiple attempts at peripheral intravenous cannulation (PIVC) cause increased pain and delayed delivery of therapy (*Yamazaki et al., 2011*). Regardless of the procedure to be performed, the children like adults, need thorough preparation before the procedure and support during and after the procedure to promote the best outcome (*Ricci and Kyle, 2009*).

Peripheral cannulation provides access for the purpose of intravenous hydration, feeding and blood products. Also, administration of medication via peripheral intravenous cannulation is common with children, especially when a rapid response to the drug is desired or when absorption via other routes is difficult or impossible. Moreover, children under the age of 5 to 6 are at risk for aspiration when receiving tablets or capsules because they have difficulty swallowing them (*Phillips et al., 2011*).

Although such peripheral intravenous catheters provide necessary vascular access, their use puts children at risk for local and systemic infectious complications, including local site infection, catheter related bloodstream infection (CRBSI) and septic thrombophlebitis. Healthcare institutions purchase millions of intravascular catheters each year. The incidence of peripheral catheter complications varies considerably by type of catheter, frequency of catheter manipulation and child-related factors (e.g., underlying disease and acuity of illness). Serious infectious complications produce considerable annual morbidity because of the frequency with which such catheters are used (*Elshamy and Mesbah, 2011*).

Conducting a diagnostic test or collecting a specimen is often the first crucial step in determining diagnosis and subsequent mode of treatment for children with suspected infections or to aid in the diagnosis of specific conditions and therefore the mode of treatment (*Korenstein et al., 2012*). However, removal of large quantities of blood at once or even small quantities on a regular basis can lead to anemia. Removing more than 10% of an infant's blood volume at one time can lead to shock and cardiac arrest.

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Most facilities have limits on the amount of blood that can be removed per draw. Many facilities do not allow more than 3% of a child's blood volume to be collected at one time and no more than 10% in 1 month (*Phillips and Gorski, 2014*).

Thus, nursing staff play a key role within the diagnostic testing process also; they often identify the need for diagnostic and microbiological investigations, initiate the collection of specimens and assume responsibility for timely and safe transportation to the laboratory. Also, the nursing staff should follow aseptic technique when performing a venipuncture as the skin is breached and a foreign device is introduced into a sterile circulatory system. The two major sources of microbial contamination are cross-infection from practitioner to child and skin flora of the child (*Dougherty and Lister, 2015*).

Pediatric peripheral venipuncture (PPV) and pediatric peripheral intravenous cannulation (PPIVC) are difficult even for skilled practitioners. Peripheral IV success rates in children have been shown to be around 50% on the first attempt and 90% after 4 attempts, young age is a known predictor for difficult IV access related to differences in physical characteristics of veins, such as size and depth, may impact success rates. However, successful venipuncture and intravenous cannulation are absolutely required for pediatric clinical risk management (*Yamazaki et al., 2011*). Therefore, assessing knowledge of nursing staff and their practice regarding peripheral intravenous cannulation and blood sampling should be regularly repeated and stimulated (*Elshamy and Mesbah, 2011*).

### **Significance of the study**

Preserving venous anatomy from repeated skin punctures is a challenge in pediatric health care setting, repeated needle insertion attempts subject children to pain, stress, increased infection risk, and impact negatively on child (Carr et al., 2015). Despite the known of complications of peripheral intravenous cannulation and blood sampling, there are nurses still not practicing the correct way of applying them (Mohd Ghazali et al., 2013) thus this study will shed light on nursing performance regarding to intravenous cannulation and blood sampling, so the aim of this study is to assess nurses' performance regarding to intravenous cannulation and blood sampling.

### **AIM OF THE STUDY:**

Investigate nurses' knowledge and practice regarding Peripheral Intravenous Cannulation and Blood Sampling in Pediatric Health Care Settings.

### **SUBJECTS AND METHOD :**

**Research design:** A descriptive research design was utilized in the current study.

**Setting:** The present study was conducted at Pediatric intensive care units, Neonatal intensive care units, Pediatric inpatient and Pediatric emergency departments affiliated to Suez Canal University Hospitals and Ismailia General Hospital at Ismailia city.

**Subjects:** The study comprised convenience sampling of all nurses working at health care setting at the previously mentioned settings (81 nurses), regardless of their age, gender, qualification and years of experience. 35 nurses at NICU, 8 nurses at PICU, 23 nurses at pediatric inpatient and 15 nurses at pediatric emergency department. The nurses included in the pilot study were excluded later from the study sample.

### **Tools for data collection:**

**Tool (I): A structured questionnaire sheet:** The questionnaire was prepared by the researcher after reviewing relevant literature; it was designed in simple Arabic language to gather the necessary data. Each nurse was interviewed individually. The questionnaire comprised three parts as the following:

Part I: Characteristics of the studied nurses as nurses' age, degree of qualifications, working department, years of experience and previous attendance of any training courses about peripheral intravenous cannulation and blood sampling. In addition to, the characteristics of children as child's age, gender and diagnosis.

Part II: It was concerned with knowledge about the peripheral intravenous cannula in children, cannula insertion complications, nurses' role as regards care of children with intravenous cannula.

Part III: It included nurses' knowledge about blood sampling in children, its purposes and contraindications. Their knowledge regarding sources of infection transmission, complications and factors that affect blood sample results.

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**Scoring System:**

The total number of questions that assessed nurses' knowledge was 36. Regarding knowledge scores, the correct answer was given one score and incorrect answer or don't know were given zero score. The total knowledge scores were 36 scores, the scores were summed up and converted into percent score (100%).

Nurses' total score of knowledge was considered to be satisfactory (if nurses' total score of knowledge percent  $\geq 75\%$ ) or unsatisfactory (if nurses' total score of knowledge percent  $< 75\%$ ).

**Tool (II): Observational checklists that was adopted from Dougherty and Lister, 2015 and Greenberg, 2016:** It was used to assess nurses' practice during performing peripheral intravenous cannulation and blood sampling.

**Scoring system for nurses care was follows :**

The total number of steps in the observational checklists was 59 steps. Data collected using the observational checklists were based on: "correctly done" and " not done". Regarding practice scores.

- Done correctly and complete was score (1)
- Done incorrect or not done well was score(0)

**The total score of nurses practice was calculated and classified as follow:**

- less than 75 were considered unsatisfactory.
- 75-100 % were considered satisfaction

**Method**

**Administrative design:** An official permission letter was issued from dean of Faculty of Nursing Suez Canal University to the director of each study setting to seek their approval for carrying out the study.

***Ethical considerations:***

Official permission was obtained from the directors of the above mentioned settings. Oral approval was obtained from the studied nurses prior to participation in the study

after simple explanation of the aim and expected outcomes of the study. Also, each nurse was familiar with the importance of her participation and they had the right to withdraw from the study at any time. Ensuring the confidentiality of the information collected and anonymity is guaranteed.

**1- Pilot study:** A pilot study was conducted over a period of one month, from the beginning of January 2017 up to the end of February 2017. It was conducted on 10% (9 nurses) of the total sample to evaluate the research plan, clarity and applicability of the study tools. The structured interview questionnaire was revised by a jury of expertise. The necessary modifications were done as suggested by the jury in form of omission, addition and modifying some questions. Then the final form of questionnaire was used for data gathering.

**2- Field work:** The purpose of the study was explained by the researcher to each study subjects. The actual field work was carried out from the beginning of January (2017) to the end of June (2017). The researcher was available 2 days/week (Saturday and Thursday) in the previous mentioned settings by rotation from 9.00 AM to 2.00 PM.

On interviewing the nurses the researcher started by introducing herself to the nurses, give them a brief idea about the study and its expected outcomes. A structured interview questionnaire was distributed in order to collect the required data and each nurse was individually interviewed for 20-30 minutes according to the physical and mental readiness of the studied nurses and the mitigating circumstances in each study setting, the researcher was available for more clarification whenever needed.

The researcher checked the observational checklist while observing the actual nursing practice during peripheral intravenous cannulation and blood sampling that mostly performed by the nurses at 9.00 AM and 12.00 PM.

A Likert Type -Rating Scale was distributed in order to assess the nurses' attitude and each nurse was individually interviewed and the researcher was available for more clarification

**Statistical design:** The collected data were organized, revised, stored, tabulated and analyzed. Statistical analysis was done by computer using Statistical Package of Social Science (SPSS) program version 20. Proper statistical tests were used to determine whether there was a significant statistical difference between variables of the study.

**RESULTS:**

As revealed from **table (1)**: the mean age of the studied nurses is  $24.44 \pm 4.30$  years, 42% of them were working at NICU. Concerning their previous years of experience, about half of them (49.4%) had less than 3 years of experience.

**Table (2)**: clarifies that, less than half of the children (45%) were less than 1 year, (60%) of them were females and more than half (54%) were diagnosed with respiratory problems.

**Table (3)**: clarifies that, about half of the studied nurses (50.6%) had satisfactory knowledge regarding PIVC and blood sampling.

**Table (4)**: shows that there is a statistically significant relation between total nurses' level of knowledge regarding PIVC and blood sampling in relation to their age and working department. Otherwise there is no statistically significant relation between total nurses' level of practice regarding PIVC and blood sampling in relation to their personal characteristics.

**Table (5)**: reveals that, there was no statistically significant correlation between total nurses' level of knowledge and their total level of practice regarding PIVC and blood sampling.

**Figure (1)**: illustrates that, slightly less than two thirds of the studied nurses (61.70%) had technical nursing institute diploma.

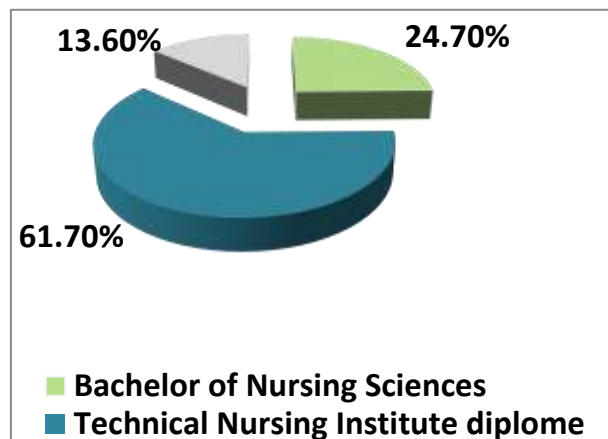
**Figure (2)**: illustrates that more than half of the studied nurses (52%) reported attending previous training courses.

**Figure (3)**: clarifies that, the majority of the studied nurses (92.6%) had an unsatisfactory practice regarding PIVC and blood sampling.

**Table (1):** Percentage distribution of the studied nurses according to their sociodemographic characteristics (n= 81).

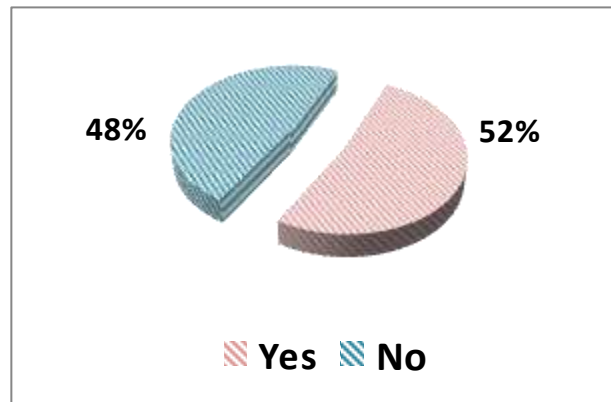
Nurses' characteristics	No	%
<b>Age (in years):</b>		
18:<24	44	<b>54.3</b>
24:<30	27	33.3
30:<36	10	12.3
$\bar{X} \pm SD = 24.44 \pm 4.30$		
<b>Working department:</b>		
NICU	34	<b>42</b>
ICU	15	18.5
Outpatient	20	24.7
Emergency	12	14.8
<b>Previous nursing experience (in years):</b>		
<3	40	<b>49.4</b>
3:<6	18	22.2
6:<9	7	8.6
≥9	16	19.7

**Figure (1):** Distribution of the studied nurses according to their qualification (n= 81).





**Figure (2):** Distribution of the studied nurses according to their previous training courses regarding peripheral intravenous cannulation and blood sampling (n= 81)



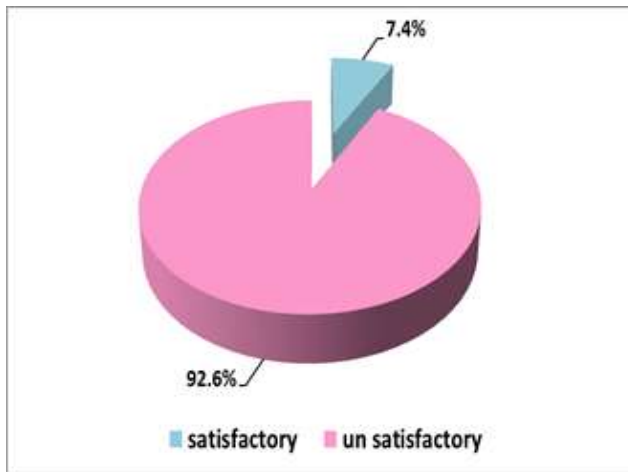
**Table (2):** Distribution of the children according to their characteristics (n= 110).

Children' characteristics	No	%
<b>Age (in years):</b>		
<1	49	<b>45</b>
1<3	28	25
3<6	22	20
≥6	11	10
$\bar{X} \pm SD = 26.90 \pm 20.04$ (month)		
<b>Gender</b>		
Male	44	40
Female	66	<b>60</b>
<b>Diagnosis</b>		
Respiratory problems	60	<b>54</b>
Gastrointestinal problems	22	20
Jaundice	23	21
Cardiac problems	5	5

**Table (3):** Distribution of the studied nurses according to their total level of knowledge regarding peripheral intravenous cannulation and blood sampling (n=81).

Peripheral intravenous cannulation and blood sampling	Nurses total knowledge regarding PIVC and blood sampling	
	No	%
Satisfactory	41	50.6
Unsatisfactory	40	49.4

**Figure (3):** Distribution of the studied nurses according to their total practices regarding peripheral intravenous cannulation and blood sampling (n= 81).



**Table (4):** Relations between the studied nurses' knowledge and practices regarding peripheral intravenous cannulation and blood sampling and their personal characteristics (n= 81).

Relations between the studied nurses' knowledge and practices	Total nurses' level of knowledge		Total nurses' level of practices	
	X <sup>2</sup>	P-value	X <sup>2</sup>	P-value
Age	8.177	<b>0.042*</b>	3.522	0.318
Qualification	0.599	0.741	0.386	0.825
Working department	8.526	<b>0.036*</b>	2.325	0.508
Previous nursing experience (in years)	5.654	0.227	2.245	0.691
Previous training courses	0.599	0.439	0.570	0.450

P > 0.05.

**Table (5):** Correlation between total nurse's level of knowledge regarding peripheral intravenous cannulation and blood sampling and their total level of practice (n= 81).

Items	Total nurses' level of practice regarding PIVC and blood sampling	
	R	P-value
Total nurses' level of knowledge regarding PIVC and blood sampling	-.003	0.975

P < 0.05.

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**DISCUSSION:**

The procedures of inserting a peripheral intravenous cannula and blood sampling are carried out in most health care settings, but they can be among the most frustrating tasks encountered by nurses. Moreover, it considers one of the recognized challenges of pediatrics due to the veins of children are frequently small, embedded in subcutaneous fat tissue, or simply exhausted from previous blood sampling attempts (*Andrews, 2011*).

The peripheral venous cannulation and venepuncture are sometimes only successful after several failed attempts because nurses experience difficulties in determining the vein. Unsuccessful attempts may lead to frustration, anxiety, and loss of self-confidence and damage the trust relationship between the child and the nurse. Pediatric nurses should therefore use techniques that increase the success rate and need continuous education to improve their knowledge, skills and attitude toward peripheral venous cannulation and blood sampling; to be able to deliver satisfactory nursing care for children *Duygu, (2017)*. Thus, this study aimed to assess nurses' performance regarding to intravenous cannulation and blood sampling in pediatric health care setting.

In the current study, the characteristics of the studied nurses revealed that, their mean age was  $24.44 \pm 4.30$  years **table (1)**. This finding was in an agreement with *Essani and Ali, (2011)* in their study about Knowledge And Practice Gaps Among Pediatric Nurses At A Tertiary Care Hospital Karachi Pakistan who revealed that the majority of nurses' age was between 20-30 years with mean 25.9 years. These findings might be due to that, most of the nurses aged between 18-30 years.

In relation to the studied nurses department **table (1)** clarified that 42% of the studied nurses have worked at NICU. This finding can be interpreted in the light of the fact that the majority of nurses was working in NICU.

Concerning previous experiences of the studied nurses **table (1)**, findings of the study showed that nearly half of the nurses had experience for less than 3 years. This finding was not in an agreement with that of *Perry et al., (2011)* who studied The Efficacy Of A Near-Infrared Light Device In Pediatric Intravenous Cannulation and found that 43% of the studied nurses had 5<10 years of experience.

It was clear from **figure (1)** that almost two thirds of the studied nurses had a diplome of technical nursing institute, while about a third of them had obtained a bachelor of nursing sciences. These findings was contradicting with those of *Arbaee and Mohd Ghazali, (2013)* who found in a similar study about Nurses' Knowledge And Practice Towards Care And Maintenance Of Peripheral Intravenous Cannulation In Pantai Hospital, Batu Pahat, Johor, Malaysia that 79% of nurses had a diplome of nursing.

On the other side, *Sriuapyo et al., (2014)* who studied Effectiveness Of Peripheral Vascular Catheter Care Bundle In The Pediatric Nursing Service, Chiang Mai University Hospital, Thailand found that the majority of the studied nurses had a bachelor of nursing. The study results might be due to the fact that the majority of nurses working in health facilities in Egypt graduates from a diplome of technical nursing institute, while the minorities of them are graduated from faculties of nursing.

In relation to the nurses' attendance of training courses, **figure (2)** showed that more than half of the studied nurses had previously attended training courses. This finding was similar to those of the study conducted by *Sriuapyo et al., (2014)* who found that more than half of the studied nurses had previous training or conference attendance regarding the PVC care bundle.

Concerning nurses' total level of knowledge regarding peripheral intravenous cannulation and blood sampling the findings of the current study illustrated that nearly half of nurses had a satisfactory knowledge regarding both peripheral intravenous cannulation and blood sampling **table (3)**. This finding was in accordance with that of *Ahlin et al., (2017)*, in a study about Assessing Nursing Students' Knowledge And Skills In Performing Venepuncture And Inserting Peripheral Venous Catheters In Sweden. The results indicate that the studied sample had adequate knowledge about the preparation and performance of the procedures.

Also, this result was supported by a study done by *Ahmed, (2016)* entitled" Nurse's Knowledge And Practice Regarding Peripheral Cannulation Procedure In Almak Nemer Hospital In Shendi- Sudan" who depicted that, more than half of the nurses had a satisfied knowledge regarding insertion of peripheral intravenous cannulation and its indication.

Moreover, this result concur with a study done by *George and Muninarayanappa, (2013)* entitled" Effectiveness Of Structured Teaching Program On Knowledge And

Practices Of Staff Nurses On Prevention Of Intravenous Cannula Complications" who showed that most of the staff nurses had average knowledge and good practices regarding prevention of intravenous cannula complications. This result may be due to unsatisfactory levels of nurses' knowledge regarding PIVC and blood sampling results from borderline scores of knowledge. Thus, when both results were summed together, the results of the study were satisfactory.

Regarding to total nurses' level of practice about peripheral intravenous cannulation and blood sampling **figure (3)** the current study results showed that the great majority of the studied nurses had unsatisfactory practice. This finding was to some extent similar to that of *Chang et al., (2012)* about Adherence To Major Standard Precautions: An Audit Of Venepuncture And Intravenous Cannula Insertion In The Pediatric Unit Of Hospital Sultanah Aminah, Johor Bahru, *Chang et al., (2012)* stated that, measures were generally higher during preparation but low during the actual performance of venepuncture and intravenous cannulation in the pediatric unit in hospital.

One possible explanation of these results that there was a knowledge- practice gap and lack of integration of theoretical knowledge into practice and, also these gaps were related to clinical knowledge that nurses perform in pediatric settings that are very essential for child care. This point of view is supported by *Essani and Ali, (2011)* who mentioned that there was knowledge and practice gap.

Investigating the relationship between total nurses' level of knowledge and their characteristics **table (4)**. The findings of the study revealed that there was a significant relationship between total nurses' level of knowledge and their age and department. These results weren't in agreement with *Ahlin et al., (2017)* who clarified that no differences were found in demographic characteristics in relation to the results of the assessment of nursing knowledge and skills.

It was clear from the **table (4)** that, there was no significant difference between the total level of practice and the studied nurses' characteristics. This finding was in the same line with *Mahmoud and Abd-ElSadik, (2013)* about Effect of Clinical Pathway Regarding Promoting Quality Nursing Care of Children with Meningitis Exposed to Invasive Procedures that regarding to the relationship between nurses' performance and

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their socio-demographic data the study showed that there was no significant differences.

Moreover, this result wasn't in agreement with a study done by *Lund et al., (2012)* about Effectiveness Of IV Cannulation Skills Laboratory Training And Its Transfer Into Clinical Practice: A Randomized, Controlled Trial. They stated that, nurses who have received training courses of intravenous cannulation, scored significantly better in binary checklist ratings.

Investigating correlations between total nurses' level of knowledge and total level of practice **table (5)** revealed that, there was no significant correlation. Similarly *Mahmoud and Abd-El-Sadik, (2013)* stated that there was no significant correlation between total knowledge and performance of nurses regarding caring of children exposed to an invasive procedure

Moreover, this result was in agreement with a study done by *Chanu et al., (2010)* entitled" A Study To Assess The Effectiveness Of Structured Teaching Program Regarding Knowledge On Intravenous Cannulation For Under Five Children Among Staff Nurses" who showed that there was a negative correlation between total nurses' level of knowledge and their total level of practice.

Finally, the study results answered the research questions and intravenous cannulation and blood sampling are essential procedures that require adherence of nurses to a designed protocol and guidelines to be performed effectively and efficiently.

**CONCLUSION:** the study concluded that nurses were lacking knowledge as well as practice toward peripheral intravenous cannulation and blood sampling of pediatric health care settings.

**RECOMMENDATION:** the study recommended that continuing training, educational programs and workshops concern the care of children with peripheral intravenous cannulation and blood sampling to nursing staff working in pediatric health care setting.

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