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# Associated factors with nursing practices related to peripheral intravenous catheters in pediatrics: a cross-sectional study

*Fatores associados às práticas de enfermagem referentes ao cateter intravenoso periférico em pediatria: estudo transversal*

*Factores asociados a las prácticas de enfermería relacionadas con el catéter intravenoso periférico en pediatría: estudio transversal*

*Taynarianne Ferreira Alves[I]; Thiago Lopes Silva[I]; Jefferson Wildes da Silva Moura[I]; Aline de Souza Bitencourt[I]; Sabrina de Souza[II]; Isadora Silva de Souza[I]; Luciano Marques dos Santos[III]; Patrícia Kuerten Rocha[III]*

*[I]Universidade Federal de Santa Catarina. Florianópolis, SC, Brazil; [II]The University of Queensland. Brisbane, St Lucia QLD, Australia; [III]Universidade Estadual de Feira de Santana. Feira de Santana, BA, Brazil*

**ABSTRACT**
**Objective:** to verify factors influencing nursing team care practices related to peripheral intravenous catheter assessment, infection prevention, and complication assessment during medication administration. **Method:** cross-sectional, analytical study. The sample consisted of 360 observations of intravenous medication administrations through peripheral intravenous catheters in a Pediatric Inpatient Unit. Descriptive analysis was performed, and risk ratios with 95% Confidence Intervals were calculated. A p-value ≤0.05 was considered significant. **Results:** adherence to catheter-related practices varied. However, only hand hygiene showed a statistically significant difference. Professionals with >20 years since graduation (94.2% adherence), additional training (92.1%), and ≥10 years of experience in the unit (93.8%) showed greater adherence to hand hygiene, with statistically relevant results (p <0.05). **Conclusion:** weaknesses related to catheter necessity assessment, proper disinfection performance, and complication assessment were identified.
**Descriptors:** Patient Safety; Pediatric Nursing; Nursing Care; Catheterization, Peripheral.

**RESUMO**
**Objetivo:** verificar fatores que influenciam as práticas assistenciais da equipe de enfermagem relacionadas à avaliação do cateter intravenoso periférico, prevenção de infecções e à avaliação de complicações durante a administração de medicamentos. **Método**: estudo transversal, analítico. Amostra composta por 360 observações de administrações de medicamentos intravenosos em cateter intravenoso periférico em Unidade de Internação Pediátrica. Foi realizada análise descritiva e calculado razão de risco com intervalo de confiança de 95%. Considerou-se significativo o valor de p≤0,05. **Resultados**: a adesão as práticas em relação ao cateter variaram. Porém, apenas a higienização das mãos apresentou diferença estatisticamente significativa. Profissionais com >20 anos de formação (94,2% de adesão), formação adicional (92,1%) e ≥10 anos de atuação na unidade (93,8%) apresentaram maior adesão à higienização das mãos, com resultados estatisticamente relevantes (p <0,05). **Conclusão**: evidenciaram-se fragilidades relacionadas à avaliação da necessidade do cateter, realização correta da desinfecção e avaliação de complicações.
**Descritores:** Segurança do Paciente; Enfermagem Pediátrica; Cuidados de Enfermagem; Cateterismo Periférico.

**RESUMEN**
**Objetivo:** verificar los factores que influyen en las prácticas asistenciales del equipo de enfermería relacionadas con la evaluación del catéter intravenoso periférico, la prevención de infecciones y la evaluación de complicaciones durante la administración de medicamentos. **Método:** estudio transversal, analítico. La muestra estuvo compuesta por 360 observaciones de administraciones de medicamentos intravenosos mediante catéter intravenoso periférico en una Unidad de Internación Pediátrica. Se realizó análisis descriptivo y se calculó la razón de riesgo con Intervalo de Confianza del 95%. Se consideró significativo un valor de p≤0,05. **Resultados:** la adhesión a las prácticas relacionadas con el catéter fue variable. Sin embargo, solo la higiene de manos presentó diferencia estadísticamente significativa. Los profesionales con >20 años de formación (94,2% de adhesión), formación adicional (92,1%) y ≥10 años de actuación en la unidad (93,8%) presentaron mayor adhesión a la higiene de manos, con resultados estadísticamente relevantes (p <0,05). **Conclusión:** se evidenciaron fragilidades relacionadas con la evaluación de la necesidad del catéter, la correcta realización de la desinfección y la evaluación de complicaciones.
**Descriptores:** Seguridad del Paciente; Enfermería Pediátrica; Atención de Enfermería; Cateterismo Periférico.

## INTRODUCTION

The peripheral intravenous catheter (PIVC) is widely used in healthcare services to ensure the vascular access required for medication and fluid administration[1], and its insertion is considered a frequent practice. An international study demonstrated that approximately 80% of hospitalized pediatric patients use at least one invasive device, with

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Corresponding author: Thiago Lopes Silva. E-mail: thiagoslopes@outlook.com
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vascular access accounting for more than half of these cases. In this context, the PIVC was the most common type of access, corresponding to 51.1% of the vascular devices used[2].

However, data from systematic reviews indicate that approximately 36% to 38% of PIVCs fail, requiring removal or replacement before completion of the planned treatment[3,4], with infiltration being the most frequent complication[4]. In Pediatrics, the incidence of complications is high, with studies reporting rates of up to 49%[5,6]. These complications may contribute to increased morbidity and mortality, prolonged hospitalization, and increased healthcare costs, in addition to representing a challenge[7] for the clinical practice of the nursing team.

Different factors contribute to the increased risk of complications associated with PIVC use, including patient characteristics, the type of therapy administered, the materials used, and infusion duration[8]. However, the aforementioned complications may also be related to care practices that do not follow evidence-based recommendations, especially during the device maintenance phase. Thus, the nursing team plays an essential role in ensuring PIVC maintenance until completion of the prescribed therapy and its removal at the clinically appropriate time[9].

Care provided for PIVC maintenance often remains below recommended standards[5,10,11]. To ensure the effectiveness and safety of PIVC use, it is essential to guarantee proper device maintenance, as well as continuous monitoring of the insertion site. Constant assessment allows early detection of signs and symptoms of complications during the administration of intravenous (IV) medications and solutions[8,9].

In this sense, the Infusion Therapy: Standards of Practice of the Infusion Nurses Society recommends the use of standardized instruments for the identification and clinical management of complications related to vascular access devices[9]. Among these instruments, the I-DECIDED® stands out as an evidence-based tool with the potential to support the nursing team in PIVC maintenance and to support clinical decision-making regarding the need for its continuation[12,13].

It is important to highlight that nurses' clinical knowledge is not limited to academic education, but is also influenced by professional experience and the ability to critically reflect on daily practice[14]. Furthermore, it is considered that complementary training, longer experience in a specific specialty area, and accumulated professional experience in the unit may favor the adoption of better care practices by the nursing team in caring for PIVCs in hospitalized children, especially due to improved knowledge and increased professional confidence[15].

In addition, no previous studies investigating the effects of these variables on care practices related to PIVCs performed by nursing teams in pediatric units were identified, highlighting the need for investment in research focused on this topic.

Thus, this study aims to verify factors influencing nursing team care practices related to PIVC assessment, infection prevention, and complication assessment during medication administration.

## METHOD

A cross-sectional, analytical study was conducted in the Pediatric Inpatient Unit of a Public Hospital in Southern Brazil. The quality parameters of the *STrengthening the Reporting of OBservational studies in Epidemiology* (STROBE) were followed for reporting the study[16].

The study participants were nursing professionals from the unit, totaling seven nurses, 18 nursing technicians, and four nursing assistants. The sample consisted of the number of IV medication administrations through PIVCs. For sample size calculation, the estimated total number of IV medications administered over a 12-month period (5,824) was used. The statistical software SestatNet®-UFSC was used, with a 95% confidence level, resulting in a sample of 360 observations of IV medication administration.

Members of the nursing team from the Pediatric Inpatient Unit who administered IV medications through PIVCs were included in the study. Professionals who were on vacation or on leave due to health problems during the observation period were not included in the sample. Professionals who did not allow observation of IV medication administration through PIVCs during the study and those who chose to withdraw from observation throughout data collection were excluded.

This study was conducted from March 2023 to January 2024. Data collection was performed through observation of medication administration via PIVC by nursing team professionals. Observations were carried out during professionals' actions throughout the IV medication administration process, from verification of the medical

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prescription to completion of the procedure. The outcome was adherence to best practices in medication administration via PIVC, measured dichotomously (practice performed or not performed/not demonstrated) for each observed item. The data collection instrument was developed according to items from the I-DECIDED® Tool[12,13].

The instrument consisted of two sections. The first contained professionals' sociodemographic information, and the second was divided according to principles 2, 4, and 5 of the I-DECIDED® Tool. *Principle 2*: DETERMINE whether the patient needs the IV catheter? corresponds to assessment of the need for the IV catheter at each shift and consisted of three variables (assesses PIVC use in the last 24 hours, assesses whether the PIVC will be used in the next 24 hours, and assesses the possibility of PIVC removal if it is no longer necessary)[12,13].

In *principle 4*: COMPLICATIONS at the IV catheter site?, defined as the insertion site of the device that should be assessed for complications at each shift, eight variables were used (assesses the presence of complications, assesses the presence of pain at the PIVC insertion site, assesses the presence of hyperemia, assesses the presence of local edema, assesses the presence of infiltration and extravasation, assesses the presence of rigidity at the site, assesses the presence of a palpable cord, and observes whether there is drainage of purulent secretion)[12,13].

*Principle 5*: INFECTION – Prevention, described as infection prevention practices that should be performed, consisted of eight variables (performs hand hygiene before and after manipulating the PIVC, type of hand hygiene, observes possible disconnections in the PIVC system, performs needleless connector disinfection, friction time in seconds, type of disinfectant, allows drying, and drying time)[12,13].

To measure friction and drying times of the disinfectant during needleless connector disinfection, the researcher used a portable digital clock. It should be noted that, during data collection, at some moments during observation, it was not possible to verify professionals' practices regarding some variables (assessed the PIVC in the last 24 hours; assessed whether the PIVC would be used in the next 24 hours; assessed the possibility of PIVC removal; assessed the presence of complications; and observed possible disconnections in the PIVC system). Therefore, when the professional did not demonstrate having performed the observed practice, it was interpreted as if the action had not been performed.

Exposure variables were organized as time since graduation (≤20 years or >20 years), additional training (has or does not have), length of experience in the unit (<10 years or ≥10 years), number of employment relationships (one or two or more), total weekly workload (≤36 h or >36 h), and work shift (daytime or nighttime). Potential confounders, such as work shift, due to differences in team composition, workload, and unit dynamics; workload and multiple employment relationships, since they may be associated with fatigue and lower attention to unit protocols; and experience time (in the profession or in the unit), because more experienced professionals may present more consolidated practices, were controlled in the statistical analysis.

It should be emphasized that only one researcher performed the observations to reduce the risk of changes in participants' behavior, and there was no interference from the researcher during observation. In addition, professionals were observed on more than one occasion, and the data collection instrument was not presented to participants, aiming to reduce observation bias and minimize the Hawthorne Effect[17].

Initially, a pretest of the instrument was conducted in the Unit with 11 observations (3% of the sample size) to assess its applicability[18]. Based on this, adjustments were made. It should be noted that these observations were not included in the final sample.

Data were organized using the Statistical Package for the Social Sciences® version 22.0. Descriptive analysis of qualitative variables was performed through calculation of absolute and relative frequencies, while measures of central tendency (mean) and dispersion measures (standard deviation) were calculated for quantitative variables. Data normality was verified using the Shapiro-Wilk test ($p > 0.05$).

To assess the association between observed care practices and exposure variables, risk ratio (RR) with a 95% Confidence Interval (95%CI) was calculated to quantify the magnitude of the association between exposures and outcomes. These measures were chosen because of their direct interpretability in comparing risks between groups. Statistical significance was assessed using the chi-square test, adopting a significance level of $p \leq 0.05$.

The study began after approval of the research protocol by the Research Ethics Committee involving Human Beings and signing of the Informed Consent Form by participants.

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## RESULTS

A total of 360 IV medication administration procedures through PIVCs were observed, involving 23 nursing professionals, characterized according to the data presented in Table 1.

**Table 1**: Characterization of participants (n=23). Florianópolis, SC, Brazil, 2023

| Variables | | n | f (%) |
|---|---|---|---|
| **Sex** | Female | 21 | 91.3 |
| | Male | 2 | 8.7 |
| **Age** | 30 to 40 years | 7 | 30.4 |
| | 41 to 50 years | 9 | 39.1 |
| | 51 to 60 years | 4 | 17.4 |
| | >60 years | 3 | 13.1 |
| **Category** | Nurse | 2 | 8.7 |
| | Nursing technician | 17 | 73.9 |
| | Nursing assistant | 4 | 17.4 |
| **Work shift** | Daytime | 16 | 69.6 |
| | Nighttime | 7 | 30.4 |
| **Time since graduation** | ≤10 years | 2 | 8.7 |
| | 11 to 20 years | 10 | 43.5 |
| | 21 to 30 years | 6 | 26.1 |
| | 31 to 40 years | 4 | 17.4 |
| | >40 years | 1 | 4.3 |
| **Additional training** | None | 5 | 21.7 |
| | Complete higher education | 5 | 21.7 |
| | Specialization | 13 | 56.5 |
| **Time in the unit** | 1 to 5 years | 11 | 47.8 |
| | 6 to 10 years | 2 | 8.7 |
| | 11 to 20 years | 4 | 17.4 |
| | 21 to 30 years | 2 | 8.7 |
| | >30 years | 4 | 17.4 |
| **Number of employment relationships** | One | 5 | 78.3 |
| | Two or more | 18 | 21.7 |
| **Total weekly workload** | 30 hours per week | 9 | 39.1 |
| | 36 hours per week | 7 | 30.4 |
| | 40 hours per week | 2 | 8.7 |
| | ≥60 hours per week | 5 | 21.7 |

It should be noted that all nurses agreed to participate; however, only two (28.6%) administered medications through PIVCs during the study, and one nursing technician (5.6%) did not agree to participate. On average, each professional was observed 17 times. Median age was 45 years (Interquartile Range (IQR) 40–51); median time in the unit was seven years (IQR=4–23); median weekly workload was 36 hours (IQR 30–40); and mean time since graduation was 22.13 ($\pm$10.51). The variables age (p=0.014), time in the unit (p=0.003), and weekly workload (p=<0.001) showed non-normal distribution, while time since graduation (p=0.053) showed normal distribution.

Table 2 presents the results related to PIVC assessment, infection prevention practices, and complication assessment.

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**Table 2:** Peripheral intravenous catheter assessment, infection prevention practices, and complication assessment (n=360). Florianópolis, SC, Brazil, 2023

| Variables | n | f (%) |
|---|---|---|
| **Assessed the PIVC in the last 24 hours** | | |
| Yes | 49 | 13.6 |
| No/Did not show | 311 | 86.4 |
| **Assessed whether the PIVC will be used in the next 24 hours** | | |
| Yes | 67 | 18.6 |
| No | 293 | 81.4 |
| **Assessed the possibility of PIVC removal** | | |
| Yes | 23 | 6.4 |
| No/Did not show | 337 | 93.6 |
| **Performed hand hygiene before manipulating the PIVC** | | |
| Yes | 324 | 90 |
| No | 36 | 10 |
| **Hand hygiene technique** | | |
| Water and soap | 225 | 69.4 |
| Alcohol-based rubbing alcohol | 94 | 29 |
| Water and chlorhexidine degerming agent | 5 | 1.5 |
| **Performed hand hygiene after manipulating the PIVC** | | |
| Yes | 320 | 88.9 |
| No | 40 | 11.1 |
| **Hand hygiene technique** | | |
| Water and soap | 200 | 62.5 |
| Alcohol-based rubbing alcohol | 114 | 35.6 |
| Water and chlorhexidine degerming agent | 6 | 1.9 |
| **Assessed the presence of complications** | | |
| Yes | 128 | 35.6 |
| No/Did not show | 232 | 64.4 |
| **Which complication(s) was(were) assessed** | | |
| Hyperemia at the PIVC insertion site | 42 | 32.8 |
| Pain at the PIVC insertion site | 125 | 97.3 |
| Drainage of purulent secretion | 8 | 6.3 |
| Infiltration and extravasation | 44 | 34.4 |
| Stiffness at the site | 97 | 75.8 |
| Palpable cord | 9 | 7 |
| Local edema | 97 | 75.8 |
| **Observed possible disconnections in the PIVC system** | | |
| Yes | 8 | 2.2 |
| No/Did not show | 352 | 97.8 |
| **Performed disinfection before medication administration** | | |
| Yes | 331 | 91.9 |
| No | 29 | 8.1 |
| **Friction time** | | |
| <5 seconds | 93 | 27.7 |
| ≥5 seconds | 238 | 72.3 |
| **Allowed drying after disinfection** | | |
| Yes | 4 | 1.2 |
| No | 327 | 98.8 |

**Notes:** PIVC – peripheral intravenous catheter.

Among the 360 observations, the possibility of PIVC removal was assessed in only 23 (6.4%), while in 337 observations (93.6%) it was not assessed or not demonstrated. Hand hygiene and disinfection before manipulating the PIVC showed high performance rates (90% and 91.9%, respectively). It should be emphasized that alcohol-based chlorhexidine was used in 100% of disinfections. In 72.3% of observations, friction was performed for ≥5 seconds; however, in only 1.2% of cases did the professional allow drying, and in all cases drying was allowed for less than 20 seconds.

Tables 3, 4, and 5 present the results of the association analysis between training-related variables and nursing practices related to PIVCs in pediatrics.

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**Table 3:** Association analysis between time since graduation and additional training with infection prevention practices associated with peripheral intravenous catheters in pediatrics (n=360). Florianópolis, SC, Brazil, 2023

| Variables | Time since graduation | | | | Additional training | | | |
|---|---|---|---|---|---|---|---|---|
| | ≤20 years n (%) n=206 | >20 years n (%) n=154 | RR (95%CI) | p-value* | Yes n (%) n= 266 | No n (%) n= 94 | RR (95%CI) | p-value* |
| **Assessed the PIVC** | | | | | | | | |
| Yes | 31 (15) | 18 (11.7) | 1.190 (0.807 – 1.756) | 0.358 | 37 (13.9) | 12 (12.8) | 1.077 (0.637 – 1.821) | 0.781 |
| No/Did not show | 175 (85) | 136 (88.3) | | | 229 (86.1) | 82 (87.2) | | |
| **Assessed whether the PIVC will be used in the next 24 hours** | | | | | | | | |
| Yes | 45 (21.8) | 22 (14.3) | 1.372 (0.952 – 1.977) | 0.068 | 51 (19.2) | 16 (17) | 1.115 (0.698 – 1.780) | 0.645 |
| No/Did not show | 161 (78.2) | 132 (85.7) | | | 215 (80.8) | 78 (83) | | |
| **Performs hand hygiene before manipulating the PIVC** | | | | | | | | |
| Yes | 179 (86.9) | 145 (94.2) | 0.922 (0.863 – 0.985) | **0.023** | 245 (92.1) | 79 (84) | 1.096 (0.996 – 1.205) | **0.025** |
| No | 27 (13.1) | 9 (5.8) | | | 21 (7.9) | 15 (16) | | |
| **Assessed the presence of complications** | | | | | | | | |
| Yes | 77 (37.4) | 51 (33.1) | 1.114 (0.862 – 1.441) | 0.403 | 95 (35.7) | 33 (35.1) | 1.020 (0.708 – 1.468) | 0.916 |
| No/Did not show | 129 (62.6) | 103 (66.9) | | | 171 (64.3) | 61 (64.9) | | |
| **Performed disinfection before manipulating the PIVC** | | | | | | | | |
| Yes | 190 (92.2) | 141 (91.6) | 1.052 (0.690 – 1.606) | 0.816 | 244 (91.7) | 87 (92.6) | 0.918 (0.470 – 1.795) | 0.801 |
| No | 16 (7.8) | 13 (8.4) | | | 22 (8.3) | 7 (7.4) | | |

**Notes:** PIVC – peripheral intravenous catheter; *chi-square; bold - statistically significant; RR – risk ratio.

**Table 4:** Association analysis between time working in the unit and number of employment relationships with infection prevention practices associated with peripheral intravenous catheters in pediatrics (n=360). Florianópolis, SC, Brazil, 2023

| Variables | Time working in the unit | | | | Number of employment relationships | | | |
|---|---|---|---|---|---|---|---|---|
| | <10 years n (%) n=200 | ≥10 years n (%) n=160 | RR (95%CI) | p-value* | One employment relationship n (%) n=271 | Two employment relationships n (%) n=89 | RR (95%CI) | p-value* |
| **Assessed the PIVC** | | | | | | | | |
| Yes | 33 (16.5) | 16 (10) | 1.418 (0.932 – 2.157) | 0.074 | 38 (14) | 11 (12.4) | 1.117 (0.642 – 1.946) | 0.691 |
| No/Did not show | 167 (83.5) | 144 (90) | | | 233 (86) | 78 (87.6) | | |
| **Assessed whether the PIVC will be used in the next 24 hours** | | | | | | | | |
| Yes | 44 (22) | 23 (14.4) | 1.362 (0.957 – 1.939) | 0.650 | 55 (20.3) | 12 (13.5) | 1.467 (0.788 – 1.024) | 0.152 |
| No/Did not show | 156 (78) | 137 (85.6) | | | 216 (79.7) | 77 (86.5) | | |
| **Performs hand hygiene before manipulating the PIVC** | | | | | | | | |
| Yes | 174 (87) | 150 (93.8) | 0.928 (0.868 – 0.992) | **0.034** | 248 (91.5) | 76 (85.4) | 1.539 (0.956 – 2.480) | 0.095 |
| No | 26 (13) | 10 (6.3) | | | 23 (8.5) | 13 (14.6) | | |
| **Assessed the presence of complications** | | | | | | | | |
| Yes | 74 (37) | 54 (33.8) | 1.083 (0.846 – 1.386) | 0.522 | 92 (33.9) | 36 (40.4) | 0.812 (0.564 – 1.169) | 0.266 |
| No/Did not show | 126 (63) | 106 (66.2) | | | 179 (66.1) | 53 (59.6) | | |
| **Performed disinfection before manipulating the PIVC** | | | | | | | | |
| Yes | 182 (91) | 149 (93.1) | 0.843 (0.521 – 1.363) | 0.462 | 249 (91.9) | 82 (92.1) | 0.974 (0.498 – 1.908) | 0.939 |
| No | 18 (9) | 11 (6.9) | | | 22 (8.1) | 7 (7.9) | | |

**Notes:** PIVC – peripheral intravenous catheter; *chi-square; bold - statistically significant; RR – risk ratio.

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**Table 5:** Association analysis between weekly workload and work shift of nursing professionals with infection prevention practices associated with peripheral intravenous catheters in pediatrics (n=360). Florianópolis, SC, Brazil, 2023

| | Weekly workload | | | | Work shift | | | |
|---|---|---|---|---|---|---|---|---|
| Variables | ≤36 h n (%) n=237 | >36h n (%) n=123 | RR (95%CI) | p-value* | Daytime n (%) n=260 | Nighttime n (%) n=100 | RR (95%CI) | p-value* |
| **Assessed the PIVC** | | | | | | | | |
| Yes | 35 (14.8) | 14 (11.4) | 1.227 (0.768 – 1.958) | 0.374 | 38 (14.6) | 11 (11) | 1.275 (0.736 – 2.208) | 0.370 |
| No/Did not show | 202 (85.2) | 109 (88.6) | | | 222 (85.4) | 89 (89) | | |
| **Assessed whether the PIVC will be used in the next 24 hours** | | | | | | | | |
| Yes | 49 (20.7) | 18 (14.6) | 1.334 (0.741 – 1.038) | 1.620 | 49 (18.8) | 18 (18) | 1.042 (0.674 – 1.611) | 0.853 |
| No/Did not show | 188 (79.3) | 105 (85.4) | | | 211 (81.2) | 82 (82) | | |
| **Performs hand hygiene before manipulating the PIVC** | | | | | | | | |
| Yes | 215 (90.7) | 109 (88.6) | 0.921 (0.702 – 1.209) | 0.529 | 230 (88.5) | 94 (94) | 0.574 (0.271 – 1.216) | 0.117 |
| No | 22 (9.3) | 14 (11.4) | | | 30 (11.5) | 6 (6) | | |
| **Assessed the presence of complications** | | | | | | | | |
| Yes | 80 (33.8) | 48 (39) | 0.862 (0.644 – 1.153) | 0.322 | 95 (36.5) | 33 (33) | 0.958 (0.841 – 1.092) | 0.530 |
| No/Did not show | 157 (66.2) | 75 (61) | | | 165 (63.5) | 67 (67) | | |
| **Performed disinfection before manipulating the PIVC** | | | | | | | | |
| Yes | 217 (91.6) | 114 (92.7) | 0.901 (0.513 – 1.582) | 0.711 | 236 (90.8) | 95 (95) | 0.601 (0.266 – 1.358) | 0.186 |
| No | 20 (8.4) | 9 (7.3) | | | 24 (9.2) | 5 (5) | | |

**Notes:** PIVC – peripheral intravenous catheter; *chi-square; bold - statistically significant; RR – risk ratio.

Regarding the association between PIVC assessment variables, infection prevention practices, and complication assessment with time since graduation, additional training, and time working in the unit, only hand hygiene before manipulating the PIVC showed a statistically significant difference. Thus, professionals with >20 years since graduation (n=145; 94.2%; RR=0.922; 95%CI: 0.863–0.985; p=0.023), who had additional training (n=245; 92.1%; RR=1.096; 95%CI: 0.997–1.205; p=0.025), and with ≥10 years of experience in the unit (n=150; 93.8%; RR=0.928; 95%CI: 0.868–0.992; p=0.034) showed greater adherence to hand hygiene. On the other hand, the association between PIVC assessment variables, infection prevention practices, and complication assessment with the number of employment relationships, total weekly workload, and work shift in the unit showed no statistically significant difference.

## DISCUSSION

This study identified weaknesses and potential influences on nursing care practices related to PIVC assessment, adoption of infection prevention measures, and assessment of PIVC complications. Despite the high rates of hand hygiene and disinfection, low rates were identified in essential practices such as PIVC assessment, complication assessment, and antiseptic drying after PIVC disinfection. In addition, factors such as longer time since graduation, having additional training, and longer experience in the unit positively influenced adherence to hand hygiene before manipulating the PIVC, but did not influence other practices.

A cross-sectional study identified inadequate maintenance practices, since only 4.9% of participants demonstrated good practices. Professional experience (Adjusted Odds Ratio 7.269, 95%CI 1.68–31.40), training on PIVC care (Adjusted Odds Ratio 10.12, 95%CI 4.32–19.45), and the presence of guidelines (Adjusted Odds Ratio 3.31, 95%CI = 2.83–12.87) were significantly associated with good practices in PIVC care and maintenance[19].

Aiming to improve PIVC care, international evidence-based manuals and guidelines provide recommendations regarding best practices for PIVCs[9,20]. Among the recommended practices is PIVC assessment to ensure necessity, functionality, and absence of complications. In this study, only 13.6% of professionals assessed the PIVC, and 6.4% assessed the possibility of removal. Assessing the possibility of removal is an essential practice, since studies report high rates of idle PIVCs in pediatrics, ranging from 8.4% to 12.8%[5,11]. Contexts such as patients with difficult venous access or situations in which the patient may require the PIVC in a possible emergency are associated with the high rates of idle PIVCs[21].

Hand hygiene may be considered the most widely recommended infection prevention practice. However, studies show concerningly low adherence rates to hand hygiene[22,23]. A cross-sectional study conducted in three pediatric units showed that 60.5% of professionals did not perform hand hygiene before preparing medication, 92.5% did not perform it before administration, and 78.4% did not perform it after administration[22].

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In this study, professionals with longer time since graduation, additional training, and longer experience in the Unit showed greater adherence to hand hygiene. This result is consistent with a descriptive correlational study conducted in a large public hospital, which identified that participants with longer professional experience demonstrated higher levels of perception regarding the effectiveness of adherence to hand hygiene. These findings may be due to differences in professional education or previous participation in infection control programs and regular training[24].

Assessing the PIVC for complications is essential, considering the high rates of PIVC-related complications in pediatrics[5,11]. A quasi-experimental study showed that 34.1% of pediatric patients presented some complication, with hyperemia, infiltration, and pain being the most prevalent[11]. Furthermore, a cross-sectional study conducted in Latin America with adult and pediatric patients identified a total complication rate of 18.3% (n=1757/9593) across five countries over an 11-month period, while in Brazil 16.7% (n=457/2741) of complications were reported[10].

Catheter-associated bloodstream infection may occur due to different causes, including contamination of the catheter connector or hub resulting from inadequate manipulation before or after handling by the professional[25]. In this context, disinfection of the venous device is considered an essential practice for preventing these infections[9]. There are still few studies regarding PIVC disinfection in the pediatric context; however, a cross-sectional study demonstrated low adherence to PIVC disinfection in pediatrics, where only 39.7% performed disinfection, 13.7% scrubbed for the appropriate time, and 27.5% allowed drying for the recommended time[22]. Furthermore, time since graduation influenced disinfection performance, as professionals with less than 10 years since graduation performed disinfection more frequently compared to those with more than 10 years since graduation (53.2% and 32%, p=<0.001, respectively)[22].

In this study, despite the high rates of disinfection (91.9%) and adequate scrubbing (73.3%), drying was allowed in only 1.2% of cases and always below the recommended time. Since alcohol-based chlorhexidine was used in all disinfections in this study, scrubbing for at least five seconds and allowing drying for 20 seconds are recommended[9]. Allowing drying is part of the microorganism elimination process; therefore, not allowing drying increases the risk of infection and creates a false perception that disinfection was adequately performed[26]. Although studies do not always clearly specify the ideal drying time, respecting this step is essential given its importance for disinfection effectiveness[26].

These findings indicate the need for hospitals to improve nursing practices related to PIVC assessment, prevention, and complications, aiming to ensure patient safety. A study that implemented an assessment and decision-making tool regarding PIVCs in a pediatric unit demonstrated a reduction in idle catheters from 37 (12.8%) to 16 (5.4%) (p=0.002), and in complications from 89 (34.1%) to 41 (14.8%) (p=<0.001), as well as increased PIVC assessment from 237 (82%) to 271 (96.6%) (p=<0.001), increased hand hygiene from 183 (63.3%) to 243 (82.1%) (p=<0.001), and increased PIVC disinfection from 155 (53.6%) to 222 (75%) (p=<0.001)[11].

The nursing team should remain updated regarding PIVC management and care through evidence-based training[19]. An educational intervention conducted in pediatric inpatient units of two hospitals in Southern Brazil aimed to verify the nursing team's knowledge regarding venous device disinfection and showed that, after the educational intervention, there was a statistically significant increase in nine of the 15 variables assessed[27]. Furthermore, when questioned about the disinfection they performed, before the intervention 96.9% considered it adequate, whereas after the intervention this proportion decreased to 84.6%. However, knowledge regarding the topic improved, since initially 23.1% reported knowing a lot about disinfection, a proportion that increased to 35.4% after the intervention[27].

**Study limitations**

Although strategies were adopted to minimize the Hawthorne Effect, it is not possible to completely exclude the potential influence of the researcher's presence on professionals' behavior. The results cannot be generalized to other hospital or population realities because this was a study conducted in a pediatric unit of a public hospital in southern Brazil. In addition, the absence of demonstration of a given practice by the professional was interpreted as non-performance, which may have underestimated the actual frequency of the observed nursing actions.

The associations between care practices and some professional characteristics (time since graduation, additional training, time working in the unit, employment relationships, workload, and work shift) allowed relevant analyses, but do not fully explain the various contextual, organizational, and cultural factors that may influence clinical practice. Future studies may address and further explore these aspects and contribute to more effective care improvement strategies.

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## CONCLUSION

The study showed that, despite the high rates of hand hygiene and PIVC disinfection practices during medication administration, important weaknesses still exist regarding assessment of catheter necessity, correct disinfection performance, and complication assessment. It was observed that factors such as longer time since graduation, additional training, and longer experience in the unit positively influenced adherence to hand hygiene, but were not associated with the other practices assessed.

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**Authors contributions**

Conceptualization, T.F.A., T.L.S. and P.K.R.; methodology, T.F.A. and P.K.R.; formal analysis, T.F.A., T.L.S., L.M.S. and P.K.R.; investigation, T.F.A., T.L.S., J.W.S.M., A.S.B., S.S., I.S.S., L.M.S. and P.K.R.; resources, T.F.A. and P.K.R.; data curation, T.F.A., T.L.S., J.W.S.M., A.S.B., S.S., I.S.S., L.M.S. and P.K.R.; manuscript writing, T.F.A., T.L.S., J.W.S.M., A.S.B., S.S., I.S.S., L.M.S. and P.K.R.; review and editing, T.F.A., T.L.S., J.W.S.M., A.S.B., S.S., I.S.S., L.M.S. and P.K.R.; visualization, T.F.A., T.L.S., J.W.S.M., A.S.B., S.S., I.S.S., L.M.S. and P.K.R.; supervision, P.K.R.; project administration, T.F.A. and P.K.R.; financing acquisition, P.K.R. All authors read and agreed with the published version of the manuscript.

**Use of artificial intelligence tools**

Authors declare that no artificial intelligence tools were used in the composition of the manuscript "*Associated factors with nursing practices related to peripheral intravenous catheters in pediatrics: a cross-sectional study*".