Original Article

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☑ Implementation science in nursing, health, and education

Effects of the TIV-Disinfect educational intervention in pediatric units: a quasi-experimental study

Efeito da intervenção educativa TIV-Disinfect em unidades de internação pediátrica: estudo quase-experimental

Efecto de la intervención educativa TIV-Disinfect en unidades de hospitalización pediátrica: estudio cuasi-experimental

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RESUMO

Objetivo: Verificar o efeito da intervenção educativa TIV-Disinfect (Terapia Intravenosa-Desinfetar) no conhecimento de profissionais de enfermagem de Unidades de Internação Pediátrica.

Método: Estudo quase-experimental, com amostra dependente de 65 profissionais de enfermagem de Unidades de Internação Pediátrica. Utilizou-se questionário com questões objetivas quanto a desinfecção de dispositivos venosos, aplicado como pré e pós-teste. Coleta realizada em dois Hospitais Públicos do Sul do Brasil, entre abril e julho de 2022. Para análise de dados, utilizou-se estatística descritiva e teste de McNemar.

Resultados: Verificou-se diferença estatisticamente significativa entre o pré e o pós-teste quanto às variáveis sobre desinfecção passiva, desinfetantes e materiais recomendados, fricção e secagem. Notou-se frequência menor de alternativas incorretas após a intervenção.

Conclusão: A intervenção educativa teve efeito positivo. Observou-se melhores resultados no conhecimento dos profissionais de enfermagem acerca do saber sobre desinfecção de dispositivos venosos, assim como permitiu reforçar conhecimentos já consolidados dos profissionais. Esta intervenção pode ser utilizada como ferramenta para atualização e/ou formação continuada de profissionais de enfermagem, visando a segurança do paciente pediátrico e da prática assistencial.

Descritores: Desinfecção. Enfermagem pediátrica. Infecções relacionadas a cateter. Cateterismo venoso central. Cateterismo periférico. Educação em enfermagem.

ABSTRACT

Objective: To verify the effect of the educational intervention TIV-Disinfect (Intravenous Therapy-Disinfect) on the knowledge of nursing professionals in pediatric inpatient units.

Method: Quasi-experimental study, with a dependent sample of 65 nursing professionals from pediatric inpatient units. A questionnaire with objective questions regarding the disinfection of venous devices was used, and pre- and post-tests were applied. Data collection was conducted in two public hospitals in southern Brazil, between April and July 2022. For data analysis, descriptive statistics and McNemar's test were used.

Results: There was a statistically significant difference between the pre- and post-tests regarding variables of passive disinfection, and recommended antiseptics and materials, rubbing and drying. A lower frequency of incorrect alternatives was noted after the intervention.

Conclusion: The educational intervention had a positive effect. Better results were observed in the knowledge of nursing professionals regarding the disinfection of venous devices, as well as allowing the professionals to reinforce already consolidated knowledge. This intervention can be used as a tool for updating and/or continuing training of nursing professionals, aiming at the safety of pediatric patients and care practices.

Descriptors: Disinfection. Pediatric nursing. Catheter-related infections. Catheterization, central venous. Catheterization, peripheral. Education, nursing.

RESUMEN

Objetivo: Verificar el efecto de la intervención educativa TIV-Disinfect (Terapia Intravenosa-Desinfección) en el conocimiento de los profesionales de enfermería de Unidades de Internación Pediátrica.

Método: Estudio cuasiexperimental, con una muestra dependiente de 65 profesionales de enfermería de Unidades de Internación Pediátrica. Se utilizó un cuestionario con preguntas objetivas sobre la desinfección de dispositivos venosos, aplicado como pre y post test. Recolección realizada en dos Hospitales Públicos del Sur de Brasil, entre abril y julio de 2022. Para el análisis de los datos se utilizó estadística descriptiva y prueba de McNemar.

Resultados: Hubo diferencia estadísticamente significativa entre el pre y postest en cuanto a las variables sobre desinfección pasiva, desinfectantes y materiales recomendados, fricción y secado. Se observó una menor frecuencia de alternativas incorrectas después de la intervención.

Conclusión: La intervención educativa tuvo un efecto positivo. Se observaron mejores resultados en el conocimiento de los profesionales de enfermería sobre la desinfección de dispositivos venosos, además de permitir a los profesionales reforzar conocimientos ya consolidados. Esta intervención puede ser utilizada como herramienta de actualización y/o capacitación continua de los profesionales de enfermería, visando la seguridad de los pacientes pediátricos y de las prácticas de cuidado.

Descriptores: Disinfección. Enfermería pediátrica. Infecciones relacionadas con catéteres. Cateterismo venoso central. Cateterismo periférico. Educación en enfermería.

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INTRODUCTION

Infections related to health care, such as Catheter Related Laboratory Bloodstream Infections (CRLBSI)[1], are a global health issue associated with the safety of patients, including pediatric ones. CRLBSI bring direct harm to patients, increasing hospitalization times, morbidity, and mortality, demanding more from professionals and requiring high costs from health institutions[2,3], although many of these events are preventable[4].

A study that analyzed pediatric data from 17,273 children and adolescents from 29 countries, showed that CRLBSI were the most common infections related to health care in children, representing 45% of the 770 infections reported[5].

Regarding CRLBSI prevention and control, there are good practices that can be followed by health workers to provide more safety to patients, including pediatric ones[6]. The main practices in this regard would be disinfecting venous devices in three-way stopcocks, single or multi-way extensions, needleless connectors, self-healing injection ports, and infusion set port access before the administration of medication or manipulating the device on other occasions[6,7].

Disinfection is a process of reducing microorganisms to a degree in which they are unable to cause damage, using chemical products to do so. It can be active or passive. Active disinfection is the act of rubbing products for disinfection directly on the device, while passive disinfection is the use of lids, covered with antiseptics, directly on top of the device, to carry out disinfection. The latter requires no rubbing[7,8]. Thus, it is extremely important for the nursing team to get to know these processes, in order to enable safe care to children undergoing Intravenous (IV) therapy.

In the pediatric setting, the health team is responsible for planning the IV therapy, especially the nurse. This involves the choice of where to insert the venous catheters, the type of device and its characteristics, its maintenance, prevention, monitoring for complications and their impacts, among other types of care[9].

Health education is one of the strategies used to improve the quality of health care. It includes the implementation of basic interventions as one of its strategies to reduce the frequency of complications, such as infections, in the practice of IV therapy [10,11].

A quasi-experimental study elaborated to evaluate the knowledge of the nursing team before and after an educational intervention about care to short-term central venous catheters showed that 73.2% of professionals improved their rate of correct answers in a post-test, indicating an increase in their knowledge regarding the maintenance of the quality of care[11].

A cross-sectional study to verify the association of work shifts and time since the graduation of nursing professionals with the adequate disinfection of the devices attached to peripheral intravenous catheters in pediatric units showed that, the more time passed since the professional graduated, the lower their adherence to the practice of disinfecting the devices attached to the peripheral intravenous catheters in pediatrics[12].

This study is justified by the perception that an educational intervention focused on the exchange of knowledge and on the modification or transformation of clinical practical actions that can contribute to improve patient safety[11]. Furthermore, this educational intervention was developed to allow professionals to collectively discuss the topics and update their knowledge starting with directives, with a critical reflection of their health care practices regarding the handling of venous devices during the IV therapy.

Considering the above, this study aimed to ascertain the effects of the educational intervention TIV-Disinfect (Intravenous Therapy-Disinfect) on the knowledge of nursing professionals in pediatric inpatient units.

METHOD

Type of study

This was a quasi-experimental "before-and-after" study, with a dependent sample. A pre-test and a post-test were used to analyze the effect of an educational intervention on the knowledge of nursing professionals regarding the disinfection of venous devices. The study was elaborated according to the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) declaration, which is a checklist to guide non-randomized studies[13].

Research location

The study was carried out in the pediatric inpatient units of two public hospitals from the south of Brazil, one of which is specialized in pediatric care, with 168 beds, while the other is a teaching general hospital, with 208 beds, whose pediatric hospitalization unit counts on 15 beds.

Eligibility criteria

Inclusion criteria were: being a nursing professional working in a pediatric inpatient unit during the study. Were

excluded those who were on vacation, medical leave, or absent for any other reason during the study.

Population and sample

The population in the children's hospital included 9 nurses, 60 nursing technicians, and 3 nursing auxiliaries. In the teaching hospital, it included 8 nurses and 15, working in the morning, afternoon, and night shifts, to a total of 95 nursing workers.

The sample was by convenience and the individuals were compared before and after the intervention[14], which was done in a single group of 65 nursing workers from the pediatric units of the hospitals.

Meetings were conducted with the members of the nursing teams in each unit, during their work hours and in different days and shifts, so all professionals could be invited, receiving an explanation of the research and clarifying potential doubts. After their presentation, all nursing workers present in the units during the data collection period were invited to participate in the research. A date and time was scheduled for the intervention, and authorized by the immediate superiors of the workers. Nonetheless, 19 professionals did not want to participate, 8 were on medical leave during collection, and 3 were lost due to the fact they did not finish the research protocol.

Period and strategy of data collection

The study was developed from November 2021 to December 2022. Data collection took place from April to July, 2022.

Data collection comprised three stages: 1) pre-test application; 2) TIV-Disinfect educational intervention; 3) post-test application. Each stage was carried out immediately after the previous one was concluded. All stages of the study lasted for, approximately, 60 minutes.

The TIV-Disinfect educational intervention was conducted in two stages. The first was a theoretical stage, while the second was a practical one. The intervention as a whole lasted for a mean of 35 minutes. The intervention was carried out in private rooms in the institutions where data was collected. The theoretical stage lasted for a mean of 25 minutes. It was carried out through an dialogical expository class, using an audiovisual instrument (a presentation created in the platform Canva®) based on the Infusion Therapy: Standards of Practice, by the Infusion Nurses Society (INS), 2021[7]. When the educational intervention was carried out, nursing workers promoted a group discussion, showing their stance regarding the topic being studied.

The contents of the presentation included: the concept of venous devices; the concepts of microbiota and biofilm; the concept of CRBSI; the occurrence and prevention of CRBSI; the moment where hand hygiene was necessary; the concept of disinfecting venous devices; the concept of passive and active disinfection; materials used for active and passive disinfection; adequate moments to disinfect venous devices; types of antiseptics recommended to disinfect venous devices; time necessary to rub and dry the venous devices for active disinfection; and places where venous devices should be disinfected.

The practical stage lasted for approximately 10 minutes. The disinfection of venous devices in clinical practice, the times when disinfection should be made, and how and where to disinfect were demonstrated using devices attached to dolls, and the participants were given the opportunity to carry out the disinfection by themselves.

The data collection instrument of the pre- and post-tests was elaborated by the researchers, based on the Infusion Therapy: Standards of Practice, by the INS, 2021[7]. It was evaluated by experts on the topic and tested in three clinical practice nurses before being applied to the sample. The pre- and post-test instruments had the same questions for the participants, with no difference.

The data collection instrument had three topics: 1) patient characterization; 2) perceptions and actions of participants regarding the disinfection of venous devices; and 3) knowledge about the disinfection of venous devices. The second topic had questions elaborated using a Likert Scale. The third was composed by multiple choice questions, in which the participant was oriented to select the correct options. After collection was finished, pre- and post-test results were compared.

Data analysis

Descriptive statistics with absolute and relative frequencies were used. The McNemar test was also used to check the level of statistical significance, considering a degree of freedom of 1 and a 0.05 (5%) significance level.

The analyses were carried out in the software Statistical Package for the Social Sciences® (SPSS), version 22.0.

The 15 questions from the third topic of the instrument were developed, and the items were analyzed based on orientations for high-risk tests[15,16].

To ascertain how difficult participants found the questions, items whose level of difficulty was >0.9 were considered very easy, i.e., those which more than 90% of participants got right; when less than 10% marked the right option, the resulting value of <0.1 indicated very difficult questions[15].

In the discrimination of the items, which showed the performance of participants according to their scores and how easy or hard were the questions, values above 0.35 were found to be "good"; values from 0.25 to 0.35 were found to be "satisfactory"; values from 0;15 to 0;25 were found to be "medium"; and values below 0.15 were found to be "bad"[16].

Ethical aspects

All ethical aspects were respected, following Resolution No. 466 from December 12, 2012 by the National Council of Health. This study was approved by the Research Ethics Committee for Research with Human Beings of the Universidade Federal de Santa Catarina, under Certificate for Submission to Ethical Appreciation (CAAE) No. 54382021.0.0000.0121 and opinion No. 5.268.469. It was also approved by the Research Ethics Committee of the Children's Hospital Joana de Gusmão, under CAAE No. 54382021.0.3001.5361 and opinion No. 5.348.004. All participants signed the Informed Consent Form. The study was also registered in the Brazilian Clinical Trial Registry (ReBEC), under No. RBR-108vwpqd.

RESULTS

The study included 65 nursing workers, 92.3% of whom were women. There were 14 nurses, 48 nursing technicians, and 3 nursing auxiliaries (Table 1).

Table 1 – Characterization of the nursing professionals of pediatric inpatient units. Florianópolis, Santa Catarina, Brazil, 2023

Variables	n	%
Sex		
Female	60	92.3
Male	5	7.7
Age (years)		
20-40	33	54.1
41-60	26	42.6
>60	2	3.3
Professional category		
Nursing technician	43	66.2
Nurse	12	18.5
Nurse and nursing technician	8	12.3
Nursing technician and nursing auxiliary	1	1.5
Nurse, nursing technician and nursing auxiliary	1	1.5
Additional education		
None	15	23.1
Technical	12	18.5

Table 1 – Cont.

Variables	n	%
Incomplete higher education	4	6.2
Complete higher education	17	26.2
Specialization	12	18.5
MS	4	6.2
Others	1	1.5
Time since graduation (years)		
<1 year old	1	1.6
2-20	47	73.4
>20	16	25
Role in the sector		
Nurse	14	21.5
Nursing technician	48	73.8
Nursing auxiliary	3	4.6
Time working in the sector (years)		
<1 year old	15	23.4
1-10	28	43.8
>10	21	32.8
Weekly workload (hours)		
20-30	46	71.9
36-40	13	20.3
60	5	7.8
Has another job		
Yes	16	29.1
No	39	70.9

Source: Research data, 2023.

The second portion of the instrument asked participants about their perceptions and actions regarding the disinfection of venous devices, as shown in Table 2.

Initially, they were asked about how they would grade their own knowledge about the disinfection of venous devices. It was found that, after intervention, participants

Table 2 – Perception and actions of participants regarding the disinfection of venous devices by the professionals of pediatric inpatient units. Florianópolis, Santa Catarina, Brazil, 2023

Variables	Before the intervention		After the intervention	
	n	%	n	%
How much do you believe you know about the disinfection of venous devices?				
Some things	19	29.2	5	7.7
I know	31	47.7	31	47.7
I know a lot	15	23.1	23	35.4
No answer	0	-	6	9.2
How important is the disinfection of venous devices?				
Extremely important	64	98.5	64	98.5
No answer	1	1.5	1	1.5
Do you disinfect venous devices?				
Yes	64	98.5	64	98.5
No	0	-	0	-
No answer	1	1.5	1	1.5
If you answered yes in the question above, how would you evaluate the disinfection you perform of the venous devices?				
Adequate	63	96.9	55	84.6
Inadequate	1	1.5	8	12.3
No answer	1	1.5	2	3.1
When do you disinfect the venous devices?*				
Before administering medication	58	89.2	51	78.5
Every time I open or close the system	56	86.2	60	92.3
When the system is replaced	49	75.4	43	66.2
Others	4	6.2	3	4.6
How often do you believe it is necessary to disinfect the venous devices?				
Almost always	5	7.7	0	-
Always	59	90.8	64	98.5
No answer	1	1.5	1	1.5

Source: Research data, 2023.
*More than one alternative could be marked

changed their responses, showing an increase in their knowledge. These changes include a difference in the number of participants who marked the option indicating they knew "some things", which before the intervention was of 29.2%, and decreased to 7.7% afterwards. The response "I know a lot", in turn, increased from 23.1% before to 35.4% after the intervention.

By analyzing the answers of participants regarding the importance of disinfecting venous devices both before and after the intervention, responses did not change, as it was viewed as extremely important (98.5%). Additionally, all participants stated they disinfect the venous devices.

It is also noteworthy that, although some participants stated, before the intervention, that they do disinfect their venous devices adequately, after the intervention they started to consider their practice inadequate.

Participants responded, in the last topic of the data collection instrument, 15 objective questions regarding their knowledge about the disinfection of venous devices, as Table 3 shows.

Table 3 – Knowledge regarding the disinfection of venous devices before and after the intervention was applied to pediatric inpatient unit professionals. Florianópolis, Santa Catarina, Brazil, 2023

Variables	Before the intervention		After the intervention		*p*-value*
	n	%	n	%	
What are Catheter Related Laboratory Primary Blood Stream Infections?					1.000
Incorrect	5	7.9	6	9.2	
Correct	58	89.2	59	90.8	
What is the disinfection of venous devices?					0.727
Incorrect	7	11.9	5	7.7	
Correct	52	88.1	60	92.3	
When should venous devices be disinfected?					1.000
Incorrect	1	1.6	1	1.5	
Correct	63	98.4	64	98.5	
In what ways can venous devices become contaminated?					0.375
Incorrect	5	7.7	8	12.5	
Correct	60	92.3	56	87.5	
What is active disinfection?					0.092
Incorrect	12	19.4	5	7.8	
Correct	50	80.6	59	92.2	
What is passive disinfection?					**≤0.001***
Incorrect	29	51.8	13	20	
Correct	27	48.2	52	80	
What antiseptics are recommended for the active disinfection of venous devices?					**≤0.001***
Incorrect	44	67.7	14	21.5	
Correct	21	32.3	51	78.5	

Table 3 – Cont.

Variables	Before the intervention		After the intervention		*p*-value*
	n	%	n	%	
What materials are recommended for the active disinfection of venous devices?					**≤0.001***
Incorrect	31	47.7	8	12.3	
Correct	31	47.7	57	87.7	
How long should venous devices be rubbed?					**≤0.001***
Incorrect	50	83.3	7	10.9	
Correct	10	16.7	57	89.1	
If you disinfect using alcohol as your preferred antiseptic, how long should you wait for it to dry?					**0.001***
Incorrect	17	33.3	3	4.6	
Correct	34	66.7	62	95.4	
If you disinfect using chlorhexidine as your preferred antiseptic, how long should you wait for it to dry?					**≤0.001***
Incorrect	23	41.8	4	6.3	
Correct	32	58.2	59	93.7	
If you disinfect using povidone-iodine as your preferred antiseptic, how long should you wait for it to dry?					**0.004***
Incorrect	18	28.6	6	9.5	
Correct	45	71.4	57	90.5	
When you infuse a medication using one-way extensions, two-way extensions, or cockstops, after administration, you should:					**0.001***
Incorrect	21	32.8	5	7.7	
Correct	43	67.2	60	92.3	
When should self-healing injection ports be sterilized?					0.250
Incorrect	3	4.6	0	-	
Correct	62	95.4	65	100	
If you have to administer a medication, when should you clean your hands?					**≤0.001***
Incorrect	34	53.1	18	27.7	
Correct	30	46.9	47	72.3	

Source: Research data, 2023.
*McNemar test for dependent samples; *statistically significant values considering a significance level of 0.05.

In the comparison between the first four questions of the CRBSI instrument, regarding concept, moment, and forms of contamination in the disinfection of venous devices, there were no statistically significant differences regarding responses after the educational intervention. The same was true for the knowledge of participants regarding active disinfection (p=0.092).

On the other hand, there was a statistically significant difference regarding passive disinfection ($p\leq$ 0,001), showing that the knowledge of the participants increased, since the number of incorrect answers fell from 51.8% before the intervention to 20% afterwards, showing that it had a positive effect.

There was a statistically significant difference regarding the questions associated with antiseptics recommended for an active disinfection of the venous devices ($p\leq$0.001). In this question, 5 (8.1%) participants marked the option "Dressings soaked in 0.9% sodium chloride saline" and 22 (35.5%) marked the option "Cotton". After the intervention, there was an expressive change in responses, with 0 participants marking the option "Dressings soaked in 0.9% sodium chloride saline" and only 4 (6.2%) answering "Cotton".

There was also a statistic difference in the questions: materials recommended for the active disinfection of venous devices ($p \leq$0.001); how long venous devices should be rubbed ($p\leq$0.001); how long alcohol ($p\leq$0.001), chlorhexidine ($p\leq$ 0.001), and povidone-iodine (p= 0.004) take to dry out; administration of medications in one-way extensions, two-way extensions, or stopcocks (p= 0.004), and the right moment of cleaning one's hands ($p\leq$0.001).

An analysis of the last topic of the test[15], regarding its level of difficulty, showed that no question was considered to be difficult, that is, no question had less than 10% of right answers. Three of them were considered to be very easy, since more than 90% of participants answered them correctly.

Item discrimination was analyzed[16] by associating each question with the total score of the participants. Thus, the responses for 10 questions were considered "good"; for 1 they were considered "satisfactory"; for 3 they were considered "medium"; and for one, they were considered "bad".

DISCUSSION

An analysis of the results of this study shows that the TIV-Disinfect intervention increased the knowledge of nursing workers concerning the disinfection of venous devices before the administration of drugs.

It is noteworthy that all participants stated they do sterilize venous devices. These results may have been influenced by the fact the participants knew the objectives of this research beforehand, which may have induced a positive answer to the question, since the data is not in accordance with other investigations, which showed a low adherence of professionals to the correct disinfection of venous devices before administering medication[17, 18].

Regarding the importance of disinfecting venous devices, professionals that participated in this study recognized that it is extremely important. However, a Brazilian study which monitored 385 drug infusions in pediatrics showed that the venous devices were not disinfected in 60.3% of cases[12].

According with the evidence presented here This shows that the participants reflected on their own conducts regarding this procedure.

Reflection and knowledge about disinfection are important, as demonstrated by an international study which was conducted in a Neonate Intensive Care Unit before it adopted and implemented a standard operational protocol for the maintenance of intravenous catheters. The study found that no nursing professional had disinfected the venous devices before drug infusion[19]. It also found that training the team was the best intervention for the adoption of this practice[19]. This setting reiterates the importance of educational interventions and of continued education on the topic.

In this study, nursing workers had a high rate of right answers regarding the concept of CRLBSI, both before (89.2%) and after the intervention (90.8%). The management of venous devices is associated with the risk of complications, such as CRLBSI, and the same is true for a low adherence to CRLBSI prevention practices by health workers[20]. Yet, although professionals have theoretical knowledge about the CRLBSI, they not always adhere to practical orientations for the care and management of venous devices for prevention[20].

Venous device disinfection is one of the challenges to the practice, since the resources available in the services can influence it. Therefore, the failure of professionals to follow practical orientations may be associated to the availability of resources, and not only to literature recommendations[21].

Educational interventions such as this one, as they are implemented in health, seek to improve practical care. However, they need to be in accordance with the reality of each environment. Therefore, the science of implementation, which is the adoption of scientific forms adapted to each context, is an important ally for health promotion[22]. As a result, we recommend continuous adaptations of the

interventions, seek to use theory better in order to conduct the implementation of interventions in health services.

When asked about active disinfection in the pre-test, 12 (19.4%) of participants gave incorrect answers, while only 5 answered incorrectly in the post-test (7.8%). Although the difference is not statistically significant, it can be noted that the knowledge of participants increased regarding active disinfection. Regarding passive disinfection, there were statistically significant results, since before the intervention more than half the participants answered incorrectly, while more than 80% gave correct answers afterwards. These results show how important it is for professionals to increase their knowledge about innovations regarding disinfection, and become cognizant of advances in technologies, since the nursing team is responsible for administering drugs, this would improve the practice of health care in regard to reducing infection[18].

Regarding the attribute "types of antiseptics" for active disinfection, the participants did not know, before the intervention, all types of antiseptics recommended by the National Institute of Health (NIS), which are: 70% isopropyl alcohol and chlorhexidine gluconate in alcohol > 0.5%[7]. After the educational intervention, more participants were able to adequately identify the antiseptics recommended for active antisepsis, going from 21 (32.3%) correct answers to 51 (78.5%).

Regarding the materials recommended for active disinfection, participants marked the options cotton, gauze and surgical tape, dressings soaked in a 0.9% sodium chloride physiological solution, wipes, swabs, or tissues soaked in antiseptics. Only 31 (47.7%) participants marked the last alternative. After the intervention, there was a statistical difference, reaching 57 (87.7%) correct answers. According to an INS guideline[7], wipes, swabs, or tissues soaked in antiseptics should be used for active sterilization, and the use of cotton and gauze are not recommended, as the participants assumed before the intervention.

A randomized clinical trial elaborated to verify which is the most effective method, comparing the use of 70% isopropyl alcohol and chlorhexidine gluconate in alcohol >0.5%, rubbed for 5,10, or 15 seconds in needleless connectors of peripheral intravenous catheters, showed that both antiseptics are efficient to disinfect the needleless connectors. There was no statistical difference in sterilization rates[23]. The same study found no statistical difference between 5,10, or 15 seconds of rubbing, considering that the time interval from 5 to 15 seconds is recommended[23].

Regarding how long the venous devices should be rubbed with the antiseptic, the intervention showed a positive result, since the result went from 10 (16.7%) correct answers about how long to rub the antiseptic to 57 (89.1%), leaving only 7 (10.9%) wrong responses.

Regarding how long the antiseptics should be left to dry, there were three questions about how long the alcohol, the chlorhexidine, and the povidone-iodine should be left to dry, and all showed statistically significant results. The lack of knowledge of participants of this study in this regard is noteworthy, since, according with the INS[7], the devices should be left to dry for 5 seconds if isopropyl alcohol is used, and 20 seconds if chlorhexidine gluconate in alcohol > 0.5% is used. Waiting for the correct period for the antiseptic to dry is important, as the sterilization process does not take place properly if the right time is not respected[7].

A scoping review to identify methods to sterilize hubs and needleless connectors of intravenous catheters of hospitalized patients and check how effective were the interventions to prevent intravenous-catheter associated BSI, it was found that there are many antiseptic methods, and more studies must be done regarding the amount of antiseptic and the pressure that should be applied[24].

Regarding the protective lid in one-way extensors, two-way extensors, or stopcocks, participants understood that, by when the lid was removed, another sterilized one should be put in its place. All participants also understood, after the intervention, that the self-healing injection port of the saline bag should be sterilized before medications are infused.

A Brazilian research carried out in an Intensive Care Unit to evaluate whether the nursing team had adequate practices in regard to the infusion of drugs, showed that these professionals did not carry out all necessary preventive actions. The study considered that antisepsis was a procedure with low rates of conformity, and inferred that these rates were affected by their lack of information and awareness about the impact of these activities[25].

Regarding the appropriate moments to sterilize one's hands, 34 (53.1%) did not know the correct answer. This result is similar to that of another study, which showed a low adherence of professionals to adequate hand hygiene, especially before and after the administration of drugs[18].

The TIV-Disinfect intervention led to less incorrect answers from the participants, and to an increased perception from them regarding their own actions associated with disinfection. A quasi-experimental study that evaluated the effect of an educational intervention for nurses to increase their knowledge and practical abilities to manage totally implantable venous access devices showed that an educational intervention significantly increased the score of the knowledge and the practical abilities of the nurses, indicating

that continued education is necessary for a better care of the patient[26]. Starting with the results presented in this study, new educational interventions for nursing care may emerge, in order to aid and improve the safety of patients who need health care.

Limitations of this study include: the small number of participants when compared to initial expectations, due to professionals who were not interested in participating, and thus created many obstacles, opposing and denying participation; instruments that were not answered in full, leading to the loss of answers/sample with incomplete questionnaires; the fact that a convenience sample was used; the fact that the post-test was conducted immediately after the educational intervention; and the fact that the interventions were not carried out in the same unit, in a single moment, allowing participants to exchange information with others who would still participate in the research.

Although we understand how important it is to promote education to the professionals, their adherence to actions that could deepen their knowledge about professional practices is still a challenge, and it must be considered how to promote actions that encourage their participation.

We believe that investigations such as this one, that is, which involve education, are indispensable for health care and enable the promotion of safer care to patients. Despite our results, further research, with a greater number of participants, is necessary to contribute for good practices in the prevention of CRLBSI.

CONCLUSION

The educational intervention TIV-Disinfect had a positive effect on the knowledge of nursing workers in pediatric inpatient units. After the educational intervention, improvements were found in the knowledge of professionals regarding: knowledge of how to disinfect venous devices; self-evaluation about their own ability to disinfect venous devices properly or not; adequate moments to disinfect venous devices; passive disinfection; recommended antiseptics and materials for the active disinfection of venous devices; how long to rub the venous devices and to let them dry after disinfection; and the importance of hand sterilization.

It was also found that the educational intervention allowed reiterating knowledge that was already ingrained in nursing workers, such as the concepts of CRLBSI and of disinfecting venous devices, the ways in which these devices can become contaminated, and the process of active disinfection.

As a contribution for nursing research and clinical practice, this study shows that interventions such as this one can be used as a tool to update the knowledge of professionals or carry out continued education, in order to ensure the safety of the pediatric patient. It should also be noted that this study brought forth new knowledge regarding healthcare practices in IV therapy.

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