DOI 10.18471/rbe.v36.45618 Original Article

SAFETY WITH ENGINEERING CONTROL AND TREATMENT TO STANDARD PRECAUTION IN PERIPHERAL VENOUS CATHETERIZATION: OBSERVATIONAL STUDY

SEGURANÇA COM CONTROLE DE ENGENHARIA E ADESÃO À PRECAUÇÃO PADRÃO NO CATETERISMO VENOSO PERIFÉRICO: ESTUDO OBSERVACIONAL

SEGURIDAD CON CONTROL DE INGENIERÍA Y TRATAMIENTO SEGÚN PRECAUCIÓN ESTÁNDAR EN CATETERISMO VENOSO PERIFÉRICO: ESTUDIO OBSERVACIONAL

Guilherme Nascimento de Azevedo[1]
Damiana Aparecida Trindade Monteiro[2]
Letícia Nunes Torres[3]
Lúbia Alves dos Santos[4]
Elucir Gir[5]
Silmara Elaine Malaguti Toffano[6]

How to cite this article: Azevedo GN, Monteiro DAT, Torres LN, Santos LA, Gir E, Toffano SEM. Safety with engineering control and treatment to standard precaution in peripheral venous catheterization: observational study. Rev baiana enferm. 2022;36:e45618.

Objective: to analyze the handling of the safety device with engineering control in peripheral venous catheter and the adherence to Standard Precautions by nursing professionals during peripheral venous puncture in adults. Method: observational, descriptive study, with quantitative approach, performed in a surgical clinical hospitalization unit. Data collected through a semi-structured instrument, containing variables related to the catheter and the observation of the procedure. The data were analyzed using descriptive statistics. Results: the study sample consisted of 28 professionals, and 235 procedures were observed. Hand hygiene with antiseptic was performed in 23% (54); alcohol solution in 10.6% (25). Procedure gloves and goggles were used in 56.6% (133) and 2.1% (5), respectively. The catheter with retractable device was incorrectly activated in 45.1% (106). Conclusion: most professionals used the peripheral venous catheter with inadequate engineering control and the standard precautions were low.

[1] Nurse. Intern in Urgency and Trauma at the Universidade Federal do Triângulo Mineiro. Uberaba, Minas Gerais, Brazil. guilhermenascimentoazevedo@hotmail.com. http://orcid.org/0000-0003-4012-8263.
[2] Nurse. MSc in Nursing. Universidade Federal do Triângulo Mineiro. Uberaba, Minas Gerais, Brazil. http://orcid.org/0000-0002-6740-7687.
[3] Nursing Student. Universidade Federal do Triângulo Mineiro. Uberaba, Minas Gerais, Brazil. http://orcid.org/0000-0001-5654-2341.
[4] Nurse. Intern in Urgency and Trauma at the Universidade Federal do Triângulo Mineiro. Uberaba, Minas Gerais, Brazil. http://orcid.org/0000-0003-0467-876X.
[5] Nurse. PhD in Nursing. Head Professor at the Escola de Enfermagem de Ribeirão Preto da Universidade de São Paulo. Ribeirão Preto, São Paulo, Brazil. http://orcid.org/0000-0002-3757-4900.
[6] Nurse. PhD in Nursing. Adjunct Professor at the Universidade Federal do Triângulo Mineiro. Uberaba, Minas Gerais, Brazil. http://orcid.org/0000-0002-9080-9123.

Descriptors: Peripheral Catheterization. Protective Equipment. Occupational Nursing. Personal Protective Equipment. Observational Study.

Objetivo: analisar o manuseio do dispositivo de segurança com controle de engenharia em cateter venoso periférico e adesão às Precauções Padrão por profissionais de enfermagem durante a punção venosa periférica em adultos. Método: observacional, descritivo, de abordagem quantitativa, realizado em unidade de internação clínica cirúrgica. Dados coletados por meio de instrumento semiestruturado, contendo variáveis referentes ao cateter e a observação do procedimento. Os dados foram analisados mediante estatística descritiva. Resultados: a amostra do estudo foi composta por 28 profissionais, sendo observados 235 procedimentos. A higienização das mãos com antisséptico foi realizada em 23% (54); solução alcoólica em 10,6% (25). Luvas de procedimento e óculos de proteção foram utilizados em 56,6% (133) e 2,1% (5), respectivamente. O cateter com dispositivo retrátil foi acionado incorretamente em 45,1% (106). Conclusão: a maioria dos profissionais utilizou o cateter venoso periférico com controle de engenharia de maneira inadequada e a adesão às precauções padrão foi baixa.

Descritores: Cateterismo Periférico. Equipamentos de Proteção. Enfermagem do Trabalho. Equipamento de Proteção Individual. Estudo Observacional.

Objetivo: analizar el manejo del dispositivo de seguridad con control de ingeniería en catéter venoso periférico y el seguimiento de las precauciones estándar por parte de los profesionales de enfermería durante la punción venosa periférica en adultos. Método: abordaje observacional, descriptivo, cuantitativo, realizado en una unidad de hospitalización clínica quirúrgica. Datos recogidos a través de un instrumento semiestructurado, que contiene variables relacionadas con el catéter y la observación del procedimiento. Los datos fueron analizados mediante estadística descriptiva. Resultados: la muestra del estudio estuvo constituida por 28 profesionales, y se observaron 235 procedimientos. La higiene de manos con antiséptico se realizó en el 23% (54); solución de alcohol en 10,6% (25). Se utilizaron guantes y gafas de procedimiento en el 56,6% (133) y el 2,1% (5), respectivamente. El catéter con dispositivo retráctil se activó incorrectamente en el 45,1% (106). Conclusión: la mayoría de los profesionales utilizaron el catéter venoso periférico con un control de ingeniería inadecuado y las precauciones estándar fueron bajas.

Descriptores: Cateterismo Periférico. Equipo de Protección. Enfermería Ocupacional. Equipo de Protección Personal. Estudio Observacional.

Introduction

The peripheral venous catheter (PVC) is a device routinely used in health institutions for the infusion of medications and intravenous solutions, being an important therapeutic resource. The nursing team is responsible for handling these catheters during their insertion, maintenance and care after infusion therapy[1].

Being a frequent practice, nursing professionals must be trained and have scientific knowledge about catheter choice and management, taking into account the expected duration of treatment, peripheral venous network conditions, cost and benefits[2].

PVC is the most widely used invasive device in the hospital environment. It is estimated that over 300 million PVCs are sold per year in the United States, and that at least 80% of all hospitalized patients receive some type of intravenous therapy during hospitalization[3]. In a study conducted in Spain, it was estimated that, on average, 50% of hospitalized patients received a type of catheter, of which 95% were peripheral[4].

The nursing team within the hospital environment is responsible for most of the invasive procedures, becoming vulnerable to occupational risks, including biological, due to needle recap, improper disposal and transportation and contact with bodily fluids[5-6]. The recap of the needle by professionals is still a reason that causes an accident with sharp-needle devices[7].

To reduce accidents with sharp-needle devices related to the peripheral venous puncture (PVP) procedure, it is recommended to use standard precautions (SP) associated with safety devices with engineering control (SDEC)[8-9]. Data from an American study conducted in 85 hospitals

showed a reduction in accidents by 38% after using the SDEC[10]. Conventional catheters that do not have a safety device continue to cause most needle accidents. According to a study conducted in a hospital in Italy, they were responsible for 82% of all accidents[11].

Despite the protection against needle puncture, there is still the possibility of blood spatter at the time of activation of the device in certain models of PVC[12]. The SDEC is classified into two categories: those that are activated manually and those that allow protection passively at the time of removal of the needle from the cannula[13].

In Brazil, occupational exposure to biological agents, such as microorganisms, toxins, bacteria, fungi, among others, is considered as biological risk[14]. Thus, the SDEC should be integrated into the PVC with technology capable of reducing the risk of accident, whatever the activation mechanism[15].

Due to the scarcity of scientific productions on the subject, the present study aimed to analyze the handling of the safety device with engineering control in peripheral venous catheter and the adoption of Standard Precautions by nursing professionals during peripheral venous puncture in adults.

Method

This is an observational, descriptive and quantitative study, based on the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE). Held in a public teaching hospital of high complexity, located in the countryside of Minas Gerais and receiving users from the *Sistema Único de Saúde* (SUS). Data collection was performed from February 2018 to August 2018 by researchers previously trained and aligned with the method of observation recording.

The population consisted of 28 nursing team professionals (nurses, technicians and nursing assistants) who worked in the Surgical Clinical Hospitalization Unit. Inclusion criteria were: belonging to the nursing team in the unit under study and performing peripheral venous puncture (PVP) during theobservation period of data collection. Professionals who performed only administrative activities were excluded.

For data collection, two instruments were used: one included the variables related to the professional (category, gender, age and work shift) and the other, to record the observation of PVC (hand hygiene, adhering to standard precautions, type of device, moment for activation of the safety device, contact with blood, transport of the peripheral venous catheter, disposal of the device immediately after the procedure). The instrument was validated according to the form and content by seven nurses, four PhD and three MSc with expertise in the theme.

The researchers observed the professionals during the procedure, daily, in all work shifts. The PVC opportunities observed were followed from the moment of insertion until the disposal of the material, being performed by the researchers in order not to compromise the care routine and without external interference.

The instrument variables were encoded and cataloged in a database, doubly typed and validated in the Microsoft Office® of the Excel® software. Subsequently, the data were exported and analyzed descriptively in IBM SPSS® software version 21.0. The data were analyzed using descriptive statistics (absolute frequencies and percentages).

The guidelines and regulatory norms of research involving human beings, Resolution n. 466/2012, of the National Health Council, in all respects, were considered. The research project was approved by the Research Ethics Committee (REC) of the *Universidade Federal do Triângulo Mineiro* under n. 2.382.208. The professionals were invited to participate in the research during the work shift (morning, afternoon and night), after understanding the Informed Consent Form (ICF) and informed the objectives and purpose of the research. In cases of occupational accident after observation, the professional was scored as to the importance of recording the notification and analysis of the accident.

Results

The study sample consisted of 28 nursing professionals, 24 (85.7%) nursing technicians and assistants and 4 (14.3%) nurses. The highest proportion was female, 21 (75%), aged between 23 and 67 years and with professional experience between 2 and 45 years. Regarding the work shift, the night shift had higher participation, 13 (46.4%) (Table 1).

Table 1 – Profile of nursing professionals from a Brazilian public hospital, according to category, sex, age group and work shift. Uberaba, Minas Gerais, Brazil – 2018. N = 28

Variable	n	%
Professional Category		
Nursing technician and assistant	24	85.7
Nurse	4	14.3
Sex		
Female	21	75.0
Male	7	25.0
Age group		
18 - 25	3	10.7
26 - 35	12	42.9
36 - 45	8	28.6
45 or more	4	14.3
Not observed	1	3.5
Work shift		
Morning	8	28.6
Afternoon	7	25.0
Night	13	46.4

Source: Created by the authors.

A total of 235 PVCs were observed performed by nursing professionals. In the researched institution, the standardized topical antiseptic was available on sinks and benches, with 2% chlorhexidine digluconate, antiseptic solution, and wall-mounted dispensers with alcoholic preparation. Hand hygiene with topical antiseptic was performed in 54 (23.0%) observations and was not performed in 127 (54.0%). Hygiene with alcoholic solution was performed in 25 (10.6%) observations.

Regarding the use of PPE, the disposable mask was used in 3 (1.3%) procedures, goggles in 5 (2.1%), apron in 38 (16.2%), and procedure glove in 133 (56.6%) (Table 2).

Table 2 – Hygiene of hands with antiseptic topical degermante, alcoholic solution and adherence to standard precautions by nursing professionals before peripheral venous puncture. Uberaba, Minas Gerais, Brazil – 2018. N=235 (continued)

Variable	n	%
Hygiene of hands with topic antiseptic		
Yes	54	23.0
No	127	54.00
Not observed	54	23.0
Hygiene of hands with alcoholic solution		
Yes	25	10.6
No	159	67.7
Not observed	51	21.7

Table 2 – Hygiene of hands with antiseptic topical degermante, alcoholic solution and adherence to standard precautions by nursing professionals before peripheral venous puncture. Uberaba, Minas Gerais, Brazil – 2018. N=235 (conclusion)

Variable	n	%
Standard precautions adherence		
Disposable mask	3	1.3
Glasses	5	2.1
Apron	38	16.2
Procedure gloves	133	56.6

Source: Created by the authors.

Two models of PVC were in use during the data collection period, one with retractable device (active needle protection technique) and the other with needle tip protection (passive needle protection technique). The catheter with retractable device was selected for use in 204 (86.8%) procedures. The safety device was activated after the total removal of the needle from the plastic cannula in 106 (45.1%); there was contact with blood in 30 (12.8%) observations (Table 3).

Table 3 – Device type, active safety device trigger time for peripheral venous puncture and blood contact. Uberaba, Minas Gerais, Brazil – 2018. N=235

Variable	n	%
Type of device		
Retractable device and active needle protection technique	204	86.8
Needle tip protection device and passive protection technique	28	11.9
Not observed	3	1.3
Time for safety device trigger		
Shortly after the visualization of blood reflux	56	23.8
During the withdrawal of the needle and insertion of the plastic cannula (simultaneous)	69	29.4
After full withdrawal of the plastic cannula needle	106	45.1
Not observed	4	1.7
Contact with blood		
Yes	30	12.8
No	202	86.0
Not observed	3	1.3

Source: Created by the authors.

After the PVC procedure, the sharp-needle was transported from the infirmary (bed) to the purge or nursing station to discard the needle in a collecting box for sharp-needle material, since no bedside had it available. The transport of the sharp-needle and other residues was carried out in a plastic tray and by the hands of professionals without packaging in 170 (72.3%) and 31 (13.2%) procedures, respectively, and directly by the hands of professionals in 24 (10.2%) procedures in the packaging itself (Table 4).

Table 4 – Transportation of the peripheral venous catheter and disposal of the device shortly after the procedure. Uberaba, Minas Gerais, Brazil – 2018. N=235 (continued)

Variable	n	%
Transport of the peripheral venous catheter		
Plastic tray	170	72.3
Hands of professionals without packaging	31	13.2

Table 4 – Transportation of the peripheral venous catheter and disposal of the device shortly after the procedure. Uberaba, Minas Gerais, Brazil – 2018. N=235 (conclusion)

Variable	n	%
Transport of the peripheral venous catheter		
Hands of professionals with packaging	24	10.2
Not observed	10	4.3
Disposal of the device shortly after the procedure		
Yes	219	93.2
No	12	5.1
Not observed	4	1.7

Source: Created by the authors.

Discussion

The sample consisted of 28 nursing professionals, with a predominance of female professionals (75%), as shown in other studies on the subject[16]. It is a historical characteristic of nursing, a profession exercised in its beginnings only by women[17].

The adherence of nursing technicians and assistants (85.6%) was higher. This datum corroborates the Brazilian literature because it is the class with the highest number among nursing professionals, and because they provide direct and constant care to patients, performing more procedures[18-19].

SP are indicated and should be applied to any patient, regardless of clinical diagnosis, and disposable mask, glasses, apron and procedure gloves are recommended whenever there is contact with blood and fluids[20]. In the present study, it was shown that in 133 (56.6%) procedures professionals did not use procedure gloves to perform the puncture. A Brazilian study also pointed out that the professionals did not wear procedure gloves in PVC; the professionals justified in this investigation loss of touch at the time of palpation of the vein and puncture[21].

Hand hygiene before the PVC procedure was low (54%). This is a worrisome factor, since non-hygiene is directly related to care-related infections (CRIs)[22]. Low hand hygiene adherence before the invasive procedure, including PVC, has also been pointed out in other studies[23-24]. Even with the recognition of its importance, the non-adherence of health professionals to perform this practice frequently is a problem discussed worldwide[25].

To choose the device model, the professional should consider patient safety, the patient's venous network and the type of indication of PVC, for the appropriate choice of catheter[26]. In this investigation, the most used device model was the active trigger technique, given the greater availability of the model in the hospital under study.

Most professionals used the device incorrectly, triggering the retractable protection mechanism only after total removal of the needle from the vein, which may contribute to the risk of needle puncture and blood splash in mucous membranes, intact and unhealthy skin[27].

A study that compared the efficacy between passive and active safety SDEC showed that the passive trigger model was related to the lowest rates of accidents with sharp-needle materials[28]. On the other hand, in another study, the SDEC increased by 30% in accidents and the cost increased 211.08% in hospital expenses[29].

In an American study, among the 110 accidents that occurred with PVC with an active safety device, in 42 of them the device was not activated[30]. Most needle accidents with SDEC can be avoided by training professionals, stimulating the safe disposal of the needle and by the proper use of the device according to the manufacturer's indications[31].

During the observations, there was contact with blood (n=30) mainly involving technicians and assistants, because they performed more PVC than the nurse[32]. Exposure to blood shows a great risk to the health of professionals, evidencing the possibility of contamination for various diseases, such as hepatitis B, HIV, among others[33].

The disposal of the device in specific boxes for needle-sharp was carried out in most observations; however, the transport was often performed inappropriately, by the hands of professionals without packaging, which exposes them to biological risk. In this respect, the disposal and correct use of the device contribute to the decreased number of accidents, as shown in a study conducted in São Luís, Maranhão[34].

The use of SDEC and the adherence to standard precautions may contribute to greater patient comfort and safety to professionals, but does not depend exclusively on the adoption of new devices, but on awareness and preventive attitudes by the nursing team.

This study has some limitations, because it did not allowed evaluating the procedures performed simultaneously and have been performed in a single care unit, which makes generalizations difficult.

Conclusion

Most nursing professionals used the PVC with incorrect engineering control, triggering the retractable protection system after total removal of the needle from the vein. The number of nursing professionals' adherence to SP was low.

The importance of continuing education with these professionals is emphasized, and it is necessary to review the actions to protect workers' health, in order to increase the adherence to SP and the correct use of the safety device with engineering control. The results found in this research are expected to contribute to professionals' adherence to safe practices, promoting strategies to improve the care provided.

Funding Sources

Fundação de Amparo à Pesquisa do Estado de Minas Gerais (FAPEMIG). Process number 00146/2016.

Collaborations:

1 – conception, design, analysis and interpretation of data: Guilherme Nascimento de Azevedo, Letícia Nunes Torres, Lúbia Alves dos Santos and Silmara Elaine Malaguti Toffano;

2 – writing of the article and relevant critical review of the intellectual content: Damiana Aparecida Trindade Monteiro and Elucir Gir;

3 – final approval of the version to be published: Silmara Elaine Malaguti Toffano.

References

1. Phillips LD, Gorski LA. Manual of I.V. Therapeutics: Evidence-Based Practice for Infusion Therapy. 6th ed. Philadelphia (US): Davis Company; 2013.
2. Zerati AE, Wolosker N, Luccia N, Puech-Leão P. Cateteres venosos totalmente implantáveis: histórico, técnica de implante e complicações. J Vasc Bras. 2017;16(2):128-39. DOI: http://dx.doi.org/10.1590/1677-5449.008216
3. Souza-Junior VD, Mendes IAC, Marchi-Alves LM, Jackman D, Wilson-Keates B, Godoy S. Peripheral Venipuncture Education Strategies for Nursing Students: An Integrative Literature Review. J Infus Nurs. 2020;43(1):24-32. DOI:10.1097/nan.0000000000000351
4. López JLG, Vilela AA, Palacio EF, Corral JO, Martí CB, Portal PH. Indwell times, complications and costs of open vs closed safety peripheral intravenous catheters: a randomized study. J Hosp Infect. 2014;86(2):117-26. DOI: https://doi.org/10.1016/j.jhin.2013.10.008
5. Barros DX, Tipple AFV, Lima LKOL, Souza ACS, Neves ZCP, Salgado TA. Análise de 10 anos de acidentes com material biológico entre a equipe de enfermagem. Rev eletrônica enferm. 2016;18:1-10. DOI: https://doi.org/10.5216/ree.v18.35493
6. Silva SMS, Gomes IVMPS, Anjos MS. Acidente perfurocortante: conhecimento e uso de dispositivos de segurança. Rev Saúde. com [Internet]. 2016 [cited 2021 Mar 7];12(2):522-7. Available from: http://periodicos2.uesb.br/index.php/rsc/article/view/406
7. Barbosa ASAA, Diogo GA, Salotti SRA, Silva SMUR. Subnotificação de acidente ocupacional com materiais biológicos entre profissionais de Enfermagem em um hospital público. Rev Bras Med Trab. 2017;15(1):12-7. DOI: http://dx.doi.org/10.5327/Z1679443520177034
8. Ferreira LA, Peixoto CA, Paiva L, Silva QCG, Rezende MP, Barbosa MH. Adesão às precauções padrão em um hospital de ensino. Rev Bras

Enferm. 2017;70(1):96-103. DOI: http://dx.doi.org/10.1590/0034-7167-2016-0138

9. Santos LT, Rocha FLR, Marziale MHP. Agulhas com dispositivos de segurança e a prevenção de acidentes: revisão integrativa. Rev Bras Enferm. 2018;71(6):3084-92. DOI: http://dx.doi.org/10.1590/0034-7167-2017-0719

10. Stringer B, Astrakianakis G, Haines T, Kamsteeg K, Danyluk Q, Tang T, et al. Conventional and sharp safety devices in 6 hospitals in British Columbia, Canada. Am J Infect Control. 2011;39(9):738-45. DOI: http://dx.doi.org/10.1016/j.ajic.2010.12.004

11. Ottino MC, Argentero A, Argentero PA, Garzaro G, Zotti CM. Needlestick prevention devices: data from hospital surveillance in Piedmont, Italy–comprehensive analysis on needlestick injuries between healthcare workers after the introduction of safety devices. BMJ Open. 2019;9:e030576. DOI: 10.1136/bmjopen-2019-030576

12. Roff M, Basu S, Adisesh A. Do active safety-needle devices cause spatter contamination? J Hosp Infect. 2014;(86):221-3. DOI: https://doi.org/10.1016/j.jhin.2014.01.006

13. Mitchell AH, Parker GB, Kanamori H, Rutala WA, Weber DJ. Comparing non-safety with safety device sharps injury incidence data from two different occupational surveillance systems. J Hosp Infect. 2017;(96):195-8. DOI: https://doi.org/10.1016/j.jhin.2017.02.021

14. Silva GF, Rocha DO, Capelete AIGB, Silva CP. Subnotificações de acidentes de trabalho com material biológico de profissionais da enfermagem de um hospital do Paraná. Var Sci - Ci Saúde. 2020;6(2). DOI: https://doi.org/10.48075/vscs.v6i2.26238

15. Reddy VK, Lavoie MC, Verbeek JH, Pahwa M. Devices for preventing percutaneous exposure injuries caused by needles in healthcare personnel. Cochrane Database Syst Rev. 2017;11(11):CD009740. DOI:10.1002/14651858.CD009740.pub3

16. Silveira RCP, Ribeiro IKS, Mininel VA. Calidad de vida, perfil sociodemográfico y laboral del personal de enfermería de un hospital universitário. Enferm actual Costa Rica. 2021:41. DOI: 10.15517/revenf.v0i41.44769

17. Melo EM, Aragão AL, Pessoa CMP, Lima FET, Barbosa IV, Studart RMB, et al. Cuidados dispensados pela equipe de enfermagem durante o procedimento de punção venosa periférica. Rev Enferm UFPE. 2015;9(3). DOI: 10.5205/reuol.7505-65182-1-RV.0903201502

18. Arantes MC, Haddad MCFL, Marcon SS, Rossaneis MA, Pissinati PSC, Oliveira SA. Acidentes de trabalho com material biológico em trabalhadores de serviços de saúde. Cogitare enferm. 2017;(22)1. DOI: http://dx.doi.org/10.5380/ce.v22i1.46508

19. Souza LS. Clima organizacional e ocorrência de acidentes com materiais perfurocortantes num hospital público do Estado de São Paulo [dissertação]. Ribeirão Preto (SP): Universidade de São Paulo, Escola de Enfermagem de Ribeirão Preto; 2016. DOI:10.11606/D.22.2017.tde-28032017-153644

20. Siegel JD, Rhinehart E, Jackson M, Chiarello L. Guidelines for Isolation Precautions: Preventing Transmission of Infectious Agents in Health Care Settings. Am J Infect Control. 2007;35(10 Suppl 2):S65-S164. DOI: https://doi.org/10.1016/j.ajic.2007.10.007

21. Batista OMA, Moreira RF, Sousa AFL, Moura MEB, Andrade D, Madeira MZA. Complicações locais da terapia intravenosa periférica e fatores associados em hospital brasileiro. Rev Cubana Enferm [Internet]. 2018 [cited 14 Jul 2021];34(3). Available from: http://www.revenfermeria.sld.cu/index.php/enf/article/view/1246

22. Oliveira HM, Silva CPR, Lacerda RA. Policies for control and prevention of infections related to healthcare assistance in Brazil: a conceptual analysis. Rev esc enferm USP. 2016;50(3):505-11. DOI: https://doi.org/10.1590/S0080-623420160000400018

23. Oliveira AC, Pinto SA. Participação do paciente na higienização das mãos entre profissionais de saúde. Rev Bras Enferm. 2018;71(2):259-64. DOI: https://doi.org/10.1590/0034-7167-2016-0124

24. Medrado MMPM, Correa I. Processo de observação da lavagem das mãos em relação ao tipo de procedimento realizado. Rev UNINGÁ [Internet]. 2017 [cited 2019 Mar 7];35(1). Available from: http://revista.uninga.br/index.php/uninga/article/view/1079

25. Giordani AT, Sonobe HM, Ezaias GM, Valério MA, Andrade D. Adesão da equipe de enfermagem à higienização das mãos: fatores motivacionais. Rev Rene.

2014;15(4):559-68. DOI: https://doi.org/10.15253/2175-6783.2014000400002

26. Oliveira AM, Danski MTR, Pedrolo E. Punção venosa periférica guiada por ultrassonografia: prevalência de sucesso e fatores associados. Cogitare enferm. 2017;22(3). DOI: http://dx.doi.org/10.5380/ce.v22i3.49599

27. Ansari A, Ramaiah P, Collazo L, Salihu HM, Haiduven D. Comparison of visual versus microscopic methods to detect blood splatter from an intravascular catheter with engineered sharps injury protection. Infect Control Hosp Epidemiol. 2013;34(11)1174-80. DOI: https://doi.org/10.1086/673462

28. Tosini W, Ciotti C, Goyer F, Lolom I, L'Hériteau F, Abiteboul D, et al. Needlestick Injury Rates According to Different Types of Safety-Engineered Devices: Results of a French Multicenter Study. Infect Control Hosp Epidemiol. 2010;31(4):402-7. DOI: https://doi.org/10.1086/651301

29. Mendes RNC, Silva LGC, Haddad MCL, Moreno FN, Gil RB. Custo-efetividade de agulhas e cateteres sobre agulha com dispositivos de proteção ativa no contexto hospitalar. Texto contexto - enferm. 2015;24(3):867-74. DOI: https://doi.org/10.1590/0104-07072015002870014

30. Green-Mckenzie J, McCarthy RB, Shofer FS. Characterisation of occupational blood and body fluid exposures beyond the Needlestick Safety and Prevention. J Infect Prev. 2016;17(5):226-32. DOI: https://doi.org/10.1177/1757177416645339

31. Schuurmans J, Lutgens SP, Groen L, Schneeberger PM. Do safety engineered devices reduce needlestick injuries? J Hosp Infect. 2018;100(1):99-104. DOI: https://doi.org/10.1016/j.jhin.2018.04.026

32. Carvalho DC, Rocha JG, Gimenes MCA, Santos EC, Valim MD. Acidentes de trabalho com material biológico na equipe de enfermagem de um hospital do Centro-Oeste brasileiro. Esc Anna Nery. 2018;22(1):e20170140. DOI: http://dx.doi.org/10.1590/2177-9465-ean-2017-0140

33. Maristela AMM, Jairo AA. Acidentes com material biológico: a realidade de uma instituição hospitalar do interior paulista. Rev Min Enferm [Internet]. 2009 [cited 2021 Mar 7];13(1):115-22. Available from: https://cdn.publisher.gn1.link/reme.org.br/pdf/v13n1a17.pdf

34. Santos SR, Novaes CO. Profile of accidents with sharps among health professionals from a hospital of the public network at São Luís city. R pesq cuid fundam online. 2018;10(4):977-85. DOI: http://dx.doi.org/10.9789/2175-5361.2018.v10i4.977-985

Received: August 5, 2021

Approved: November 7, 2021

Published: November 22, 2021