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Safe practices for preventing infections related to the administration of injections: knowledge of nursing professionals

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ABSTRACT

Objective: to measure nursing professionals' knowledge of safe practices for preventing infections related to the administration of injectable medications in Brazil. **Methods:** a descriptive, exploratory, quantitative study was conducted between November 2021 and February 2022, using an online survey by applying a validated instrument. **Results:** among the 781 participants, 724 (92.7%) were from the Southeast region of Brazil, 360 (46.1%) worked in hospitals, and 334 (42.8%) were nurses. The overall average percentage of correct answers was 84.48%. The domain "Disposal of sharps" had the lowest score (25.0%). Knowledge with the lowest correct answer rate refers to the possibility of using vials in more than one patient, provided they do not enter the patient's unit (35.3%), and the non-mandatory nature of antisepsis for intradermal and subcutaneous injections (28.8%). **Conclusion:** the knowledge profile of nursing and health professionals reveals strengths and weaknesses in relevant aspects associated with the risk of microorganism transmission during the administration of injectables, underscoring the need for educational interventions to promote safe practices in Brazil.

Descriptors: Nurse Practitioners; Infection Control; Patient Safety; Injections; Health Knowledge, Attitudes, Practice.

INTRODUCTION

Injectable medications are frequently used in healthcare services. The World Health Organization (WHO) estimates that 16 billion injections are administered annually worldwide, often unsafely[1]. Such unsafe practices include the reuse of syringes and/or needles, sharing solution vials among multiple patients, or handling supplies without aseptic technique during the preparation and administration of these medications[2].

In the United States, between 2012 and 2018, more than 66,748 patients were reported as part of 38 different types of adverse events, of which 25 (66.0%) were related to unsafe injection practices[2].

These practices can lead to outbreaks of hepatitis B and C[3,4], both in developed and developing countries, and outbreaks of the Human Immunodeficiency Virus (HIV) in children, probably associated with the reuse of supplies such as syringes and needles, as well as the lack of professional training in rural areas of Pakistan, South Asia, and India[5].

To minimize these risks, in Texas (The United States), the rational use of supplies for injectable administration in health care and administration exclusively by qualified professionals is recommended[6]. Knowledge and adoption of well-established measures, such as hand hygiene (HH), skin preparation, disinfection of vials and connections, avoiding the recapping of needles after use, wearing gloves for vascular access, and the single-use of supplies[7,8], are essential to ensure safe injection practices[4]. However, research indicates that these measures are not always fully adopted[4,7].

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A study[7] conducted in the state of São Paulo, which aimed to present a situational diagnosis of the self-reported behavior of nursing professionals regarding injectable administration practices, revealed knowledge gaps, such as the sharing of multidose vials, reuse of single-use supplies, and non-adherence to glove use. These findings suggest failures in safe injection practices among this group of professionals. Given that nursing staff are the most representative among professionals who provide patient care and are responsible for the preparation and administration of injectables in most health care services, it is important to conduct ongoing studies on the factors that influence the practices of these professionals in relation to the safe administration of injectables, to plan the actions and strategies necessary to increase patient safety.

Thus, the following research question was formulated: What is the Brazilian nursing team's knowledge of safe practices for preparing and administering injections? The development of this research is justified by the importance of assessing the current situation in Brazil, which can highlight specific issues that should be the target of future educational interventions, according to the particularities of each institution, and reinforced in the training process of nurses and nursing technicians.

Given the above, the objective of this study was to measure the knowledge of nursing professionals regarding safe practices for preventing infections related to the administration of injectable medications in Brazil.

METHODS

This was a descriptive and exploratory study, carried out through a national survey conducted in Brazil between November 2021 and February 2022.

The target population consisted of nursing professionals (Registered Nurses, Practical Nurses, or Assistant Nurses) who reported administering injectable medications in their professional practice, without restrictions regarding work experience, setting, or location within the Brazilian territory.

Data were collected using a validated, open-access instrument[9] (Annex A). The instrument was presented to participants through an online form made available via Google Forms® (2025, Google LLC, United States). It comprised an initial section containing sociodemographic data (age, sex, professional category, city/state, type of workplace) and a second section with 27 dichotomous statements (correct/incorrect), covering four domains:

1. Preparation of the environment (2 items);
2. Preparation of injectable medications (13 items);
3. Administration of injectable medications (8 items);
4. Disposal of sharps (4 items).

The instrument enables the measurement of professionals' knowledge, with the ideal outcome being 100% correct answers. Scores below this value indicate the extent to which the professional's knowledge falls short of the expected level[9].

Participant recruitment occurred exclusively through social media, using electronic invitations posted on Facebook® (2021, Meta Platforms Inc, United States), Instagram® (2021, Meta Platforms Inc, United States), WhatsApp® (2021, Meta Platforms Inc, United States), and LinkedIn® (2021, LinkedIn Corporation, United States). The study was also disseminated by the Regional Nursing Council of the State of São Paulo (COREN-SP) through its official websites and email communications to registered professionals. Requests for dissemination were also made to other Regional Nursing Councils, but without success.

The informed consent (IC) was made available at the beginning of the Google Forms® questionnaire. After reading it and agreeing to participate in the survey, the professional gained access to the other screens, which led to the knowledge assessment questionnaire.

The data obtained were initially saved in an Excel® spreadsheet (version 2201, 2022, Microsoft Corporation, United States) and later sent to a statistics professional, with anonymity of responses ensured. Analyses were processed using the Statistical Analysis System (SAS) software (version 9.4, 2013, SAS Institute, United States), with a significance level of 5% adopted.

Descriptive analysis was employed, using simple frequencies and percentages for qualitative variables, and measures of central tendency (mean, standard deviation - SD, median, minimum, and maximum) for quantitative variables. To estimate differences between proportions of correct answers (events/trials), a binomial regression model with an identity link function was applied.

The research project was approved by the Research Ethics Committee of the Federal University of São Carlos, under Certificate of Presentation for Ethical Consideration (Portuguese acronym CAAE – Certificado de Apresentação para Apreciação Ética) No. 48782921.9.0000.5504, in accordance with the guidelines and regulatory standards for research involving human subjects of the National Health Council (Portuguese acronym CNS – Conselho Nacional de Saúde), Resolution No. 466/2012[10].

RESULTS

A total of 781 nursing professionals completed the questionnaire, of whom 724 (92.7%) were from the Southeast region of Brazil. Among them, 334 (42.8%) were nurses and 447 (57.2%) were practical nurses or assistant nurses. Regarding ethnicity, 449 (57.5%) self-identified as White, 226 (28.9%) as Brown, 73 (9.4%) as Black, and 33 (4.2%) did not respond.

The mean age of the participants was 39.53 years (±10.26, with a minimum of 20 and a maximum of 61 years), and the majority were female (690; 88.4%).

Regarding workplace, 360 (46.1%) reported working in hospitals, 321 (41.1%) in non-hospital settings (such as Primary Health Care Outpatient Network), and 100 (12.8%) in other settings (long-term care institutions, pre-hospital services, home care, private practices, teaching contexts, among others).

Table 1 presents the descriptive analysis of correct answer rates by domain and the overall instrument.

Table 1 - Descriptive analysis of overall and domain-specific correct answer rates on safe practices for preventing infections related to the administration of injectables by the nursing team (n = 781), Brazil, 2022

Domain	Mean (%)	Standard deviation (%)	Median (%)	Minimum (%)	Maximum (%)
1. Preparation of the environment	98.1	9.6	100.0	50.0	100.0
2. Preparation of injectable medications	89.2	8.6	92.3	30.8	100.0
3. Administration of injectable medications	74.2	13.0	75.0	37.5	100.0
4. Disposal of sharps	83.0	16.2	75.0	25.0	100.0
Overall instrument	84.5	6.9	85.2	51.9	100.0

Table 2 presents the percentages of correct answers provided by nursing professionals for each item, based on the instrument used to collect data on their knowledge of safe practices for preventing infections related to the administration of injectable medications.

Table 3 presents the distribution of scores by domain, according to professional category. The response patterns were similar between nurses and practical nurses/assistant nurses across all domains.

The response pattern of the nursing team is also similar across the domains when analyzed by workplace (Table 4).

To estimate the difference between the proportions of correct

Table 2 - Percentages of correct answers by the nursing team, according to the domains of the instrument used to assess knowledge about safe practices for the prevention of infections related to the administration of injectables (n = 781), Brazil, 2022

Continue...

Domain/Items	Answer	Percentage of correct answers n (%)
1. Preparation of the environment		
1.1. Injectable medications must be prepared on a surface specifically designated for this activity to prevent medication contamination.	Correct	772 (98.9)
1.2. Nursing professionals must disinfect the surface before preparing an injectable medication.	Correct	760 (97.3)
2. Preparation of injectable medications		
2.1. Before preparing injectable medications, hands must be sanitized.	Correct	779 (99.7)
2.2. Tearing open syringes and needles wrappers is considered a safe practice.	Incorrect	653 (83.6)
2.3. Disinfecting vials with 70% alcohol before aspirating their contents is unnecessary.	Incorrect	682 (87.3)
2.4. Before aspirating the contents of a vial, it is necessary to disinfect it with 70% alcohol.	Correct	683 (87.5)
2.5. Leaving a needle inserted in the vial does not interfere with contaminating its contents.	Incorrect	720 (92.2)
2.6. Sharing a single saline bag to dilute all medications and salinize venous accesses is a safe practice.	Incorrect	692 (88.6)
2.7. Injectable medications should be administered immediately after preparation.	Correct	776 (99.4)
2.8. Open and unused syringes or needles can be stored for later use.	Incorrect	765 (98.0)
2.9. Using the same syringe to prepare several medications is a safe practice.	Incorrect	772 (98.9)
2.10. Vials and saline bags used in emergencies can be used for other patients during the shift.	Incorrect	768 (98.3)
2.11. Leftover injectable medications can be mixed to complete a new dose.	Incorrect	737 (94.4)
2.12. Vials can be used on multiple patients, as long as they do not enter the immediate patient care area.	Correct	276 (35.3)
2.13. Vials accessed by needles or syringes already used on one patient can be used for other patients.	Incorrect	751 (96.2)
3. Administration of injectable medications		
3.1. Hand hygiene must be performed immediately before administering injectable medications.	Correct	763 (97.7)
3.2. The use of procedure gloves is mandatory when salinizing venous accesses.	Correct	705 (90.3)
3.3. Before administering intravenous medications, the catheter connector must be disinfected, for example: side port, hub, stopcock, multi-way connectors, etc.	Correct	689 (88.2)
3.4. Stopcock caps can be reused as long as they are stored in a safe place.	Incorrect	555 (71.1)
3.5. Syringes for catheter salinization can be shared with different patients.	Incorrect	776 (99.4)
3.6. The use of procedure gloves for administering intradermal, subcutaneous, and intramuscular injections is mandatory.	Incorrect	303 (38.8)
3.7. Skin antisepsis with alcohol-based solutions must be performed before administering intramuscular medications.	Correct	620 (79.4)
3.8. Skin antisepsis with alcohol-based solutions is not mandatory before administering intradermal and subcutaneous medications.	Correct	225 (28.8)

Table 2 - Percentages of correct answers by the nursing team, according to the domains of the instrument used to assess knowledge about safe practices for the prevention of infections related to the administration of injectables (n = 781), Brazil, 2022

Conclusion.

Domain/Items	Answer	Percentage of correct answers n (%)
4. Disposal of sharps		
4.1. After administering injectable medications, the needle must be manually disconnected from the syringe and disposed of in appropriate containers.	Incorrect	580 (74.3)
4.2. After administering injectable medications, manual recapping of needles is prohibited, but if it is essential, a one-handed recapping technique must be used.	Correct	465 (59.5)
4.3. After use, needles, glass ampoules, needle catheters, and syringes with needles must be immediately discarded in a sharps container.	Correct	773 (99.0)
4.4. For the administration of injectable medications in a household, an appropriate container must be provided for the disposal of sharps.	Correct	775 (99.2)

Table 3 - Descriptive analysis of responses overall and in the domains, according to the instrument used to assess knowledge about safe practices for preventing infections related to the administration of injectables, according to the professional category of the nursing team (n = 781), Brazil, 2022

Domains	Professional category	n	Mean (%)	Standard deviation (%)	Median (%)	Minimum (%)	Maximum (%)
1. Preparation of the environment	Nurse	334	98.2	9.3	100.0	50.0	100.0
	Practical nurse/assistant nurse	447	98.0	9.8	100.0	50.0	100.0
2. Preparation of injectable medications	Nurse	334	90.9	7.1	92.3	53.9	100.0
	Practical nurse/assistant nurse	447	87.9	9.4	92.3	30.8	100.0
3. Administration of injectable medications	Nurse	334	77.8	13.3	75.0	37.5	100.0
	Practical nurse/assistant nurse	447	71.5	12.2	75.0	37.5	100.0
4. Disposal of sharps	Nurse	334	86.6	14.4	100.0	50.0	100.0
	Practical nurse/assistant nurse	447	80.3	16.9	75.0	25.0	100.0
Total	Nurse	334	86.9	6.0	88.9	66.7	100.0
	Practical nurse/assistant nurse	447	82.7	6.9	85.2	51.9	100.0

Note: n = number of participants

Table 4 - Descriptive analysis of nursing team responses (n = 781) regarding knowledge domains on safe practices for preventing infections related to the administration of injectables, according to workplace, Brazil, 2022

Domains	Workplace	n	Mean (%)	Standard deviation (%)	Median (%)	Minimum (%)	Maximum (%)
1. Preparation of the environment	Hospital setting	360	98.9	7.4	100.0	50.0	100.0
	Non-hospital setting	321	97.8	10.2	100.0	50.0	100.0
	Other	100	96.0	13.6	100.0	50.0	100.0
2. Preparation of injectable medications	Hospital setting	360	89.9	8.6	92.3	30.8	100.0
	Non-hospital setting	321	88.9	8.2	92.3	53.9	100.0
	Other	100	87.5	9.8	92.3	53.9	100.0
3. Administration of injectable medications	Hospital setting	360	74.5	12.3	75.0	50.0	100.0
	Non-hospital setting	321	74.3	13.3	75.0	37.5	100.0
	Other	100	72.8	14.7	75.0	37.5	100.0
4. Disposal of sharps	Hospital setting	360	82.2	16.2	75.0	25.0	100.0
	Non-hospital setting	321	84.3	16.0	75.0	50.0	100.0
	Other	100	81.8	16.6	75.0	50.0	100.0
Total	Hospital setting	360	84.9	6.5	85.2	51.9	100.0
	Non-hospital setting	321	84.6	6.7	85.2	63.0	100.0
	Other	100	82.9	8.4	85.2	59.3	96.3

Note: n = number of participants

answers, a binomial regression model with an identity link function was proposed (Table 5). A difference was found in knowledge about safe practices for preventing infections related to the administration of injectables when comparing the overall scores of the professional categories, "Nurse vs. Practical Nurse/Assistant Nurse" ($p < 0.01$), and workplaces, "Hospital vs. Other" ($p = 0.02$). Regarding knowledge in the domains, in relation to domain "1. Preparation of the environment," a difference was found when comparing the workplace "Hospital X Other" ($p = 0.04$). Regarding domain "2. Preparation of injectable medications," differences were observed when considering the professional categories "Nurse X Practical Nurse/Assistant Nurse" ($p < 0.01$), and the workplace "Hospital X Other" ($p = 0.02$). In the domain "3. Administration of injectable medications," a difference in knowledge was observed when comparing the categories "Nurse X Practical Nurse/Assistant Nurse" ($p < 0.01$). Finally, in relation to domain "4. Disposal of sharps materials," a difference in knowledge was also observed when comparing the professional categories "Nurse X Practical Nurse/Assistant Nurse" ($p < 0.01$).

Table 5 - Regression analysis of the nursing team's response pattern (n = 781), comparing professional categories and workplace according to domains of knowledge about safe practices for the prevention of infections related to the administration of injectables, Brazil, 2022

Domain	Comparison	Average difference in percentage points	CI 95%		*p* value
1. Preparation of the environment	Nurse x Practical Nurse/Assistant Nurse	0.220	-1.150	1.580	0,76
	Hospital x Non-hospital setting	1.070	-0.300	2.430	0,12
	Hospital setting x Other	2.890	0.070	5.710	0,04
	Non-hospital setting x Other	1.820	-1.120	4.760	0,23
2. Preparation of injectable medications	Nurse x Practical Nurse/Assistant Nurse	3.060	1.860	4.260	<0,01
	Hospital x Non-hospital setting	0.970	-0.320	2.250	0,14
	Hospital setting x Other	2.330	0.340	4.330	0,02
	Non-hospital setting x Other	1.370	-0.670	3.400	0,19
3. Administration of injectable medications	Nurse x Practical Nurse/Assistant Nurse	6.240	4.080	8.400	<0,01
	Hospital x Non-hospital setting	0.210	-2.110	2.540	0,86
	Hospital setting x Other	1.760	-1.710	5.240	0,32
	Non-hospital setting x Other	1.550	-1.970	5.070	0,39
4. Disposal of sharps	Nurse x Practical Nurse/Assistant Nurse	6.290	3.690	8.880	<0,01
	Hospital x Non-hospital setting	-2.050	-4.850	0.760	0,15
	Hospital setting x Other	0.470	-3.800	4.740	0,83
	Non-hospital setting x Other	2.520	-1.760	6.800	0,25
Total	Nurse x Practical Nurse/Assistant Nurse	4.270	3.300	5.240	<0,01
	Hospital x Non-hospital setting	0.310	-0.740	1.350	0,57
	Hospital setting x Other	1.930	0.340	3.520	0,02
	Non-hospital setting x Other	1.620	0.010	3.240	0,05

DISCUSSION

This study highlights both strengths and weaknesses in nursing professionals' knowledge of safe practices for preventing infections related to injectable medication administration across different domains. This overview can inform reflective actions, reorganization of work processes, and continuing health education initiatives aimed at transforming current practices. It can also support future research, particularly studies that identify successful strategies to address the weaknesses found.

It is essential to emphasize the responsibility of educational institutions in ensuring the quality of nursing training, as well as the responsibility of professionals themselves to remain up to date after completing their initial education. Health care institutions, in turn, must consistently and sustainably implement policies on continuing education, patient safety, and quality of care.

The use of validated instruments to assess professionals' knowledge, as in this study, facilitates the identification of knowledge gaps, supports the design and implementation of targeted interventions, and enables comparisons in future studies.

Overall, the mean percentage of correct answers was above 74%, indicating a substantial understanding of best practices regarding the preparation of the environment, preparation and administration of injectable medications, and disposal of sharps. However, the lowest percentages raise concern, as they indicate that a portion of professionals are engaging in unsafe practices, with legal, ethical, and moral implications[11].

Differences were also identified by professional category and workplace. Nurses had higher overall scores and higher scores in

the domains of "preparation of injectable medications", "administration of injectable medications", and "disposal of sharps". Regarding the workplace, those working in hospitals had higher overall scores, as well as higher scores in the domains of "preparation of the environment" and "preparation of injectable medications".

These results show that knowledge of safe injection practices varies not only across professional categories but also across care settings. This reinforces the need to strengthen educational initiatives tailored to the contexts in which professionals work and the groups performing these procedures.

In Brazil, other studies have reported similar findings and identified unsafe practices such as sharing multidose vials, reusing single-use supplies[7], poor adherence to flushing and hand hygiene, insufficient cleaning of medication preparation surfaces, failure to check the integrity of packaging, and non-use or misuse of personal protective equipment (PPE)[12].

Adherence to best practices for preparing and administration of injectable medications differs across global contexts. A study conducted in India[13] found that syringes and needles were not reused, supplies were used exclusively with intact packaging, and sharps were correctly handled, reflecting strong adherence to safe injection practices.

By contrast, a study conducted in Egypt[14] demonstrated the opposite: insufficient knowledge of safe injection practices during nursing education, resulting in percutaneous injuries. In Ethiopia, a study involving nursing students also identified insufficient knowledge of infection control best practices, with correct answer rates below 40%[15]. These findings are alarming because they pertain to the training of future nursing professionals, which could potentially compromise patient safety.

Although the mean percentage of correct answers regarding the preparation of injectable medications in this study was high (89.2%), some items had rates as low as 30.8%. This highlights the importance of identifying knowledge gaps to design effective training interventions that address them.

Among the practices compromising the safety of "Preparation of injectable medications" was tearing the packaging of syringes and needles in a way that does not guarantee aseptic handling. Packaging should be opened using an aseptic technique, without compromising the sterility of the contents[16]. In this study, 16.4% of respondents did not recognize this practice as necessary. Failure to comply with this step may directly compromise patient safety by increasing the risk of contamination during medication preparation[17].

The disinfection of ampoules and vials with an alcohol-based solution before opening is also an indispensable step to ensure aseptic technique[16], thereby ensuring patient safety. However, more than 12% of respondents did not recognize this need. This process must also be performed on external devices prior to medication administration, including connectors such as stopcocks, hubs, and side ports[18]. This represents another weakness that must be addressed through continuing education in healthcare services and professional training.

Another topic found in this study with incorrect answers, albeit with low frequency, refers to the sharing of supplies, such as large-volume bags, vials, infusion systems, reuse of needles and syringes, and vials already accessed by needles or with needles kept connected to the diaphragm of multidose vials. These practices are inappropriate, as they contribute to outbreaks of hepatitis[3,4]. These are neglected actions, even in developed countries such as the United States, where the storage of single-dose vials for more than one patient and the lack of barriers to prevent reuse in outpatient clinics have been identified[19].

Other weaknesses identified in various scenarios included the salinization and flushing of intermittently used catheters, the prior disinfection of connectors, and the replacement of multi-way caps with new ones after each use[16,20].

These situations are recognized as critical points in the care routine. Failure to disinfect connectors or inefficient decontamination may be associated with a lack of professional training, poor adherence to aseptic technique, and variations in connector design[18]. Improper connector replacement may be linked to these same factors, noting that these devices are improperly stored in lab coat pockets, bedside tables, IV equipment, among others, for reuse[21].

The supplies needed to perform flushing are not always dispensed in kits by the pharmacy, requiring individual requests for items, which takes up more of the nursing team's time, delays care, and may contribute to the improper decision to reuse supplies instead of requesting new ones[22].

Regarding the topics "shared use of vials (35.3%)", "non-mandatory use of gloves for intradermal, subcutaneous, and intramuscular injections (38.8%)", "non-mandatory skin antisepsis with alcohol-based solution for intradermal and subcutaneous medications (28.8%)", and "prohibition of disconnecting the needle from the syringe and recapping needles for disposal (59.5%)", the fact that they present a lower percentage of correct answers by the nursing team reinforces the need to implement continuing education programs in health and programs to improve the quality of care and patient safety.

Structured continuing education programs based on meaningful learning and the possibility of transformation with a focus on the work process, in order to generate not only institutional change but also change in practice, can have a positive impact on patient safety. They involve strategies such as lectures, workshops, discussion groups, and realistic simulations[23], which are highly relevant to the administration of injectable medications, as demonstrated by a study conducted in southern Brazil, in which the construction of scenarios about adverse events that occurred in the hospital not only led to reflection on practice but also to compliance with the recommendations of that institution[24].

Another potentially positive strategy was tested in a tertiary hospital in India, based on the Point of Care Quality Improvement (POCQI) methodology, which showed a significant increase (from 20% to 87%) in adherence to safe injection practices after the implementation of 12 Plan–Do–Study–Act (PDSA) cycles and a 15-item checklist, developed in accordance with recommendations from WHO and the Centers for Disease Control and Prevention[25].

Still in the domain of administering injectables, the use of gloves is another critical point, as shown by a study that observed 396 procedures and found that only 0.3% complied with glove use. Among the main causes of non-compliance were the absence of HH, reuse of gloves two or more times on the same patient or on different patients (18.43%), and use of gloves in procedures without indication for this equipment (8.3%)[22].

Healthcare professionals should critically assess the need to use gloves when administering intramuscular, subcutaneous, or intradermal medications, unless there is a risk of contact with bodily fluids or when treating patients with diseases that are transmitted through contact[26].

The indiscriminate use of this PPE is a practice that can create a false sense of protection for the professional and, consequently, increase the risk of exposure to pathogens, both for the professional and for the patient, as this behavior encourages the professional not to perform HH before and after removing gloves, thus touching surfaces and patients with contaminated gloves, in addition to generating excess waste for the health service[22].

Indiscriminate prior preparation of the skin with alcohol solution also appears among the weaknesses found in this study. There is evidence of its importance only for intravenous access[21], aimed at preventing bloodstream infections[27]. However, preparing the skin with an alcohol solution for intramuscular and subcutaneous medication is mentioned in classic works used in training. The lack of consensus on the relevance of this action in preparing the skin for subcutaneous and intramuscular drug administration can make decision-making difficult for professionals.

The minimum percentage of correct answers (195; 25%) obtained for the domain "Disposal of sharps", which involves the improper handling of sharps, such as disconnecting needles from syringes and recapping needles after use, indicates that the topic still raises questions among the nursing team.

Sharps must be disposed of in specific boxes immediately after use. Catheters and needles with safety devices, even after being locked, must be disposed of in boxes intended for the collection of sharps[8]. Good practice standards for injectables do not ensure the safe administration of these drugs[28]. Efforts are needed to address these gaps and incorporate measures on good practices with injectables, whether in formal learning environments[29] or through open online courses[30].

Despite the contributions of this research to understanding nursing professionals' knowledge of safe practices for preventing infections related to the administration of injectable medications in Brazil, its limitations must be considered. Among them, it is worth noting that the sampling process did not allow for a more equitable geographical distribution of the study's target population, resulting in the majority of participants being from the state of São Paulo. It is essential to note that the same search strategies were employed in all states; however, support was only obtained from the São Paulo section of the Regional Nursing Council.

It is worth noting that, although women and technical and support staff predominated, this does not necessarily represent a limitation of the study, as this profile is inherent to the composition of the workforce in Brazil[31].

Another limitation concerns the method used to recruit participants (social media and emails), as it was not possible to estimate the total number of professionals (target population) who met the inclusion criteria.

CONCLUSION

Nursing professionals show high rates of assertive responses regarding knowledge about safe practices for preventing infections related to the administration of injectable medications. However, weaknesses are found in relation to relevant aspects associated with the risk of microorganism transmission in the administration of injectables. In this field of professional practice, this can have serious consequences and requires constructive action.

The need for educational actions in the training and updating of nursing professionals is reiterated, as well as their commitment to continuing education to promote safe practices, especially in drug administration and disposal of sharps.

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CER: formal analysis, writing – original draft and writing – review & editing.
RMF: funding acquisition; supervision; writing – original draft and writing – review & editing.

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Conflict of interest

None.

Appendix A - Instrument for Measuring Nursing Professionals' Knowledge of Infection Prevention in the Administration of Injectable Medications

Instrument for Measuring Nursing Professionals' Knowledge of Infection Prevention in the Administration of Injectable Medications		
Suggestion: enter data related to population categorization, such as age, gender, position, work sector, etc.		
Read carefully and analyze the statements, marking the answer option you consider appropriate with an "X."		
1 – Preparation of the environment		
Statement	Correct	Incorrect
1.1. Injectable medications must be prepared on a surface specifically designated for this activity to prevent contamination of the medication.		
1.2. Nursing professionals must disinfect the surface before preparing an injectable medication.		
2 – Preparation of injectable medications		
Statement	Correct	Incorrect
2.1. Before preparing injectable medications, hands must be sanitized.		
2.2. Tearing open syringe and needle wrappers is considered a safe practice.		
2.3. Disinfecting vials with 70% alcohol before aspirating their contents is unnecessary.		
2.4. Before aspirating the contents of a vial, it is necessary to disinfect it with 70% alcohol.		
2.5. Leaving a needle inserted in the vial does not interfere with the contamination of its contents.		
2.6. Sharing a single saline bag to dilute all medications and salinize venous accesses is a safe practice.		
2.7. Injectable medications should be administered immediately after preparation.		
2.8. Open and unused syringes or needles can be stored for later use.		
2.9. Using the same syringe to prepare several medications is a safe practice.		
2.10. Vials and saline bags used in emergencies can be used for other patients during the shift.		
2.11. Leftover injectable medications can be mixed to complete a new dose.		
2.12. Vials can be used on more than one patient, as long as they do not enter the immediate patient care area.		
2.13. Vials accessed by needles or syringes already used on one patient can be used for other patients.		
3 – Administration of injectable medications		
Statement	Correct	Incorrect
3.1. Hand hygiene must be performed immediately before administering injectable medications.		
3.2. The use of procedure gloves is mandatory when salinizing venous accesses.		
3.3. Before administering intravenous medications, the catheter connector must be disinfected, for example: side port, hub, stopcock, multi-way connectors, etc.		
3.4. Stopcock caps can be reused as long as they are stored in a safe place.		
3.5. Syringes for catheter salinization can be shared with different patients.		
3.6. The use of procedure gloves for administering intradermal, subcutaneous, and intramuscular injections is mandatory.		
3.1. Hand hygiene must be performed immediately before administering injectable medications.		
3.2. The use of procedure gloves is mandatory when salinizing venous accesses.		
4 – Disposal of sharps		
Statement	Correct	Incorrect
4.1. After administering injectable medications, the needle must be manually disconnected from the syringe and disposed of in appropriate containers.		
4.2. After administering injectable medications, manual recapping of needles is prohibited, but if it is essential, a one-handed recapping technique must be used.		
4.3. After use, needles, glass ampoules, needle catheters, and syringes with needles must be immediately discarded in a sharps container.		
4.4. For the administration of injectable medications in a household, an appropriate container must be provided for the disposal of sharps.		

Source: Fittipaldi TRM. Prática Segura na Administração de Medicamentos Injetáveis para Prevenção de Infecção Relacionada à Assistência à Saúde: Elaboração e Validação de Instrumento [dissertation]. São Carlos: Universidade Federal de São Carlos; 2019.