

Low Adherence To Hand Hygiene: Analysis Of The Impact Factors In Critical Sectors Of A Hospital

Marília Duarte Valim (✉ marilia.duarte.valim@gmail.com)

Universidade Federal de Mato Grosso <https://orcid.org/0000-0002-2746-1865>

Thaissa Blanco Bezerra

Universidade Federal de Mato Grosso

Alvaro Francisco Lopes Sousa

Universidade de Sao Paulo Escola de Enfermagem de Ribeirao Preto

Denise de Andrade

Universidade de Sao Paulo Escola de Enfermagem de Ribeirao Preto

Adriano Menis Ferreira

Universidade Federal de Mato Grosso do Sul

Willian Albuquerque de Almeida

Universidade Federal de Mato Grosso do Sul

Marcelo Alessandro Rigotti

Universidade Federal de Mato Grosso do Sul

Juliano Bortolini

Universidade Federal de Mato Grosso

Research article

Keywords: Hand hygiene; Cross Infection; Patient Safety; Safety culture.

Posted Date: August 20th, 2019

DOI: <https://doi.org/10.21203/rs.2.13238/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Abstract

Background: We aimed to monitor hand hygiene (HH) of health professionals in three critical sectors of a university hospital, to verify the physical structure of these units for HH, gloves use and perception of professionals regarding the patient's safety climate **Methods:** An observational, correlational study, conducted in critical sectors of a hospital. The study population consisted of nurses, nursing technicians, physicians, resident physicians and physiotherapists. The data were collected through four questionnaires to evaluate HH, factors related to adherence to it and sociodemographic characteristics. **Results:** A total of 148 professionals and 3.025 opportunities for HH were observed. Adherence to HH was higher among nurses when compared to nursing professionals ($p < 0.05$), and there was a difference between different sectors ($p < 0.05$). Professionals who previously participated in training had greater adherence (47.79% CI95% 45.38-50.20) to HH than professionals who did not participate (44.62% CI95% 41.95-47.29). There was a statistical difference between the perception of the security climate and the type of employment bond of the professional, as well as the sector in which it operates. **Conclusion:** Adherence to HH was affected and / or influenced by the physical structure, use of procedure gloves, work regimen and perceived patient safety climate. **Keywords:** Hand hygiene; Cross Infection; Patient Safety; Safety culture

Background

Increased mortality, prolonged hospitalization, increased economic burdens on health systems, and potential dissemination of multiresistant microorganisms demonstrate that Healthcare-associated infection (HAI) have a major negative impact on patients, professionals, organizations and currently represent a serious global public health problem.¹⁻²

Most HAIs describe directly or indirectly from the hands of health professionals, so that adherence to Hand Hygiene (HH) has been widely disseminated by the World Health Organization (WHO) as an effective method to minimize the cross-transmission of microorganisms and reduce HAI rates.³

The effectiveness of HH requires the correct execution of the technique at specific moments during patient care. It should be noted that these steps are part of a multimodal strategy disseminated by the WHO, consisting of five components: system change, training and education, performance observation and feedback, workplace reminders and hospital safety climate.⁴ The strategy proved to be highly successful in improving HH good practices in a number of countries according to previous studies.⁴⁻⁷

Despite the evidence that better HH practices reduce cross-contamination of microorganisms and consequently HAI rates, the adoption of this practice in clinical settings, when monitored, has achieved below-acceptable levels of adherence in several countries.⁵⁻⁸

Among the factors contributing to the low adhesion to HH is the infrastructure of the health units (9), represented by the insufficient number of washbasins, a deficit in the supply of liquid soap and paper towels, the absence of posters on HH, the availability of alcoholic preparations outside patient care points, among others.

In addition, there are also organizational factors, which are those related to the involvement of management with patient safety issues that influence HH adherence.^{10,11}

Studies have shown that adherence to safety measures is directly related to the perception of the patient's safety climate by workers.^{10,12} Therefore, health institutions with consistently higher safety cultures had greater adherence to HH compared to institutions with a more fragile safety culture. Another element that hinders adherence to HH is the inadequate use of procedure gloves, although they constitute a mandatory precaution in several clinical situations, in order to avoid contamination of the professional and the dissemination of microorganisms.³

Based on this, we aimed to monitor HH of health professionals in three critical sectors of a university hospital, to verify the physical structure of these units for HH, gloves use and perception of professionals regarding the patient's safety climate.

Methods

Study design

An observational, correlational study was carried out between August and October 2018. The study was conducted in the Intensive Care Units (ICU), Adult and Neonatal and semi-intensive sector of a university hospital with 119 beds in the Center-West region, of Brazil. The hospital where the study was carried out is a reference in medical specialties such as urology, dermatology and cardiopediatry and performs multiprofessional care in several areas, among them, social care, nutrition and psychology.

Population

The study population consisted of all nurses, nursing technicians, physicians, resident physicians and physiotherapists who worked in the morning, afternoon and evening periods. Data were collected in a non-probabilistic convenience approach. To participate in the study it was necessary for the subjects to meet the following criteria: to have more than six months of professional experience in the institution, to be active in this sector at the time of the study, and to accept to participate in the research. Professionals who performed exclusively administrative functions and workers who were in training on biosafety issues were excluded at the time of data collection.

Study protocol

Data were collected through two self-administered questionnaires and two instruments filled out by the researcher. The sociodemographic, professional and participation in training questionnaire included the following variables: gender, age, time of professional experience, place of work, participation in training on hand hygiene and standard precautions offered by the employer, year of training and type training.

The Safety Attitudes Questionnaire (SAQ) Short Form 2006, adapted to validated for the reality of Brazilian hospitals, was used to evaluate the perception of the patient's safety climate. The questionnaire works with a Likert-type ordinal scale (0-5 points): it disagrees totally with total agreement and has 41 items distributed in six domains: teamwork climate, safety climate, work satisfaction, perception of stress, perception

management (labor and hospital sector) and working conditions.¹³ The score ranges from 0 to 100 points and positive values are considered scores ≥ 75 . It should be emphasized that both questionnaires had a filling time of 20 minutes.

In order to evaluate the infrastructure of the sectors, the instrument of verification of the structure of the units for hand hygiene, made available by the WHO (11). This instrument is a checklist, filled by the researcher and has 27 items referring to the physical resources for hand hygiene existing in the units, such as availability of water, number of beds, amount of sinks with water, soap and paper towel, number of dispensers with alcoholic preparations at hand, presence / location of illustrative posters of hand hygiene, training, among others.¹¹

For the monitoring of hand hygiene, the World Health Organization Observation Form was used. This instrument is a checklist type, filled in by the researcher during the direct observation, composed of: identification of the observer's initials, start and end date observations, session duration in minutes and professional category observed. In addition, we observe the opportunities and indications for hand hygiene referring to the five moments in which there are 4 possibilities of filling: 1) friction with alcohol; 2) water and soap; 3) unrealized action and glove use record. It is important to note that the use of gloves is only indicated when hand hygiene is not performed.^{3,11}

The time set for each WHO observation session should be approximately 20 minutes. Several professionals can be observed simultaneously, but in the critical units it is recommended the observation of one professional at a time due to the greater number of procedures performed in these environments and this was the conduct adopted by the researchers.

In the period prior to data collection, training for observers was performed dynamically, with the representation of the scenarios of the five moments for hand hygiene and simulation of the different care procedures. As part of the training, the main researcher, prior to data collection, performed a pilot test to verify the applicability and suitability of the instrument, where it was directed to the sectors in which the study was performed and observed along with another professional, simultaneously the same hand hygiene indications for the work routine and each completed the observation form independently.

Ten professionals and 53 hand hygiene opportunities were observed during the morning and afternoon sessions of the professional practice, with the interobserver agreement test and Kappa index calculation, whose result was 0.90, classified, therefore, as near perfect agreement.¹⁴ It is important to highlight the relevance of this training and agreement among the observers in order to guarantee the reliability of the findings. It should be noted that these data were not included in the results of the present study.

Data analysis

Data were processed and analyzed by software R. The comparison of hand hygiene adherence among the variables occupational categories, five moments, sectors of work, days of the week, work shifts and glove use was used the test z of ratios and calculated the 95% confidence intervals.

The descriptive analyzes of the Safety Attitudes Questionnaire (SAQ) domains were presented in frequency tables and the mean and median scores of each domain were compared between the sectors and the

employment relationship of the professionals through the Kruskal-Wallis and Conover-Iman tests, which allowed us to visualize the significance of the data by means of the calculated medians.

Spearman's correlation between the scores of the questionnaire and the hand hygiene adherence among the sectors was performed. For the interpretation of the positive and negative correlation values, Ajzen and Fishbein (1998)¹⁵ were used, in which values smaller than 0.30 correspond to weak correlations and of little clinical applicability; values between 0.30 and 0.50 are considered moderate correlations and above 0.50, strong correlations. For all statistical tests the significance level was considered 0.05.

Results

A total of 148 professionals participated in the study, 66 nursing technicians (46.6%), 29 physicians (19.6%), 24 nurses (16.2%), 17 resident physicians (11.5%), 12 physiotherapists (8.1%). The female population constituted the predominant population with 68.24% of representation. Table 1 shows the characteristics of the sample of the present study regarding the variables of professional experience, work regimen and participation in training.

The mean age of the workers was 38.05 years (SD \pm 8.05), while the mean time of professional experience was 12.35 years (SD \pm 7.62). Regarding the professional activity sector, 60 participants (40.5%) were semi-intensive, 50 (33.8%) belonged to the neonatal ICU and 38 (25.7%) were from the adult ICU.

When asked about the year of the last training, 63 professionals (72.40%) answered that it was in the year 2018, and 9 (10.30%) answered that they had completed training before 2015. The comparison between participation in training and adherence to HH revealed that there was no statistically significant difference between the groups for the increase in adherence to HH, although professionals who reported having participated in these trainings obtained a higher adherence rate (47.79%; 95% CI 45.38 - 50.20) than professionals who did not participate (44.62%, 95% CI 41.95-47.29). Table 2 shows the adhesion to HH.

A total of 148 professionals and 3,025 registered hand hygiene opportunities were observed. Of these, 1,048 were in the adult ICU, 947 in the neonatal intensive care unit and 1,030 in the semi-intensive care unit. The overall rate of adherence to HH among professionals in the three sectors was 46.25%. It was verified that adherence to HH was statistically higher among nurses, when compared to nursing professionals in a significant way ($p < 0.05$).

There was a statistically significant difference between the sectors and the Neonatal Intensive Care Unit (NICU), which obtained a higher adhesion rate to HH ($p < 0.05$) and the semi-intensive one to lower adhesion to HH. Regarding the days of the week, there was no statistically significant difference, except for Saturday, when adherence was significantly lower when compared to the other days of the week ($p < 0.05$). As for work shifts, adherence was higher in the afternoon and evening periods when compared to the morning shift ($p < 0.05$).

In the adult ICU there were two sinks in malfunction, one was in the entrance of the insulation and one in the common area, next to the first bed. In the neonatal ICU only one sink was paperless towel available (Table 3). It is noteworthy that in this sector, all the taps did not require activation by the hands. In the wards of the semi-intensive sector, the sinks had manual taps, of the rotating type, operated by the hands. In the medication

room, there was no liquid soap in the dispenser and the discard containers, which should be triggered by a pedal, were defective, making it difficult to dispose of paper towels and other materials.

Among the sectors of the present study, only the neonatal ICU had, in all incubators, bottles of alcoholic preparations at the point of care, within reach of the hands. In the adult ICU, there were poorly located dispensers such as behind the bed or devices such as infusion pump, mechanical respirator, among others. In the semi-intensive sector, there were 10 units of inoperative alcohol dispensers, five of which were defective and five were not available. In the three sectors investigated, there were no illustrative WHO posters at the assistance points to remind practitioners about adherence to HH, as advocated.

In the present study, there was a high number of glove use related to non-compliance with hand hygiene. Of the 3.025 opportunities observed, 1.399 hand hygiene actions were performed and 1.626 were not performed. Of these actions, in which professionals stopped hand hygiene, 1.258 (77.36%) were related to inadequate use of gloves, which had a negative impact on hand hygiene ($p < 0.01$) (Table 4).

Table 4 shows the frequency of use of gloves over the absence of hand hygiene. The use of gloves was greater at times "before performing aseptic procedures" and "after exposure to body fluids" when compared to moments "before contact with the patient", "after contact with the patient" and after areas near the patient" ($p < 0.05$). Regarding the sectors, glove use was significantly higher in the adult ICU sector when compared to the neonatal ICU and medical clinic ($p < 0.05$).

The perception of the security climate varied according to the professional category, but there was no statistically significant difference. Regarding the total score obtained, no category presented a positive value, except for the domain "Satisfaction at work", which presented a higher score among resident physicians, while the domain "Perception of unit management and hospital" showed the lowest values in all the categories and sectors of the present study.

In order to verify if there was a difference between the perception of the safety climate and the type of employment relationship, the SAQ medians were compared with the type of bond (Table 5).

Contracted employees had higher scores when compared to statutory ones, represented by 60.97 and 55.79, respectively. This difference was considered statistically significant ($p < 0.05$). In addition, a statistically significant difference was observed in the domains of team work climate, stress perception, unit management and hospital management perception ($p < 0.05$).

The correlation between SAQ domains in the sectors with HH adherence was verified. In the neonatal ICU there were positive and moderate correlations in the domains of team work ($r = 0.38$, $p < 0.01$), Safety climate ($r = 0.42$, $p < 0.01$), Satisfaction at work ($r = 0.37$, $p < 0.01$) and total score ($r = 0.40$, $p < 0.01$). In the medical clinic, correlations were considered positive and moderate with adherence to HH in the perception of unit management ($r = 0.37$, $p < 0.01$) and hospital management perception domains ($r = 0.40$, $p < 0.01$). These values showed that as domains scores increase the rates of adherence to HH also increase considerably.

Discussion

Our findings revealed a lower adherence rate than that recommended in all professional categories, moments analyzed, days of the week, sectors and work shifts observed in the different scenarios of professional practice. Thus, we verified that adherence to HH is affected, or is influenced by the physical structure, the use of gloves by the procedure, type of labor relationship and perception of the patient's safety.

Different factors may be related to the low adherence to said safety behavior. Among them, health services with inadequate physical structure, including poorly located sinks^{9,16}, dispensers of inoperative and out-of-reach alcoholic solutions³, use of gloves¹⁷⁻¹⁸, lack of training, among others.^{4,11}

It was verified that the participation in training offered by the institution did not influence in the increase of the adherence to HH. It is believed that this fact may have occurred due to the nature of the training offered, in a traditional and little problematizing way. Recent studies have shown that the use of training in this modality, based only on the transmission of knowledge and not protagonism of the participants, had little impact on adherence to Standard Precautions and HH.^{19,20}

Thus, WHO recommends that health institutions invest in multimodal strategies to improve HH with dynamic educational actions, based on permanent health education and multimodal strategy to improve HH in order to foster learning in the work environment through link between theory and practice.¹¹ In addition, dynamic methods that promote the interaction between professionals through wheels and talk, workshops and demonstration of HH practice have been more effective in increasing adherence to HH.^{21,6,7}

The infrastructure for hand hygiene practice in the institution of the present study is deficient. The lack of necessary inputs for HH, such as liquid soap, paper towel or alcohol solution, was visualized. The difficulty of access to sinks and dispensers, as well as installation in ergonomically incorrect points can hinder adherence to HH.⁹

A cross-sectional study conducted in Canada showed that the greater distance between the patient's site and the sink is associated with a decrease in HH adhesion. Each additional meter, which should be covered by the health professional to reach a sink, decreased the probability of hand washing by approximately 10%.⁹ Similarly, a study in the pediatric and neonatal ICU in the United Kingdom found that, as the visibility of the sink increased, the number of HH actions also increased statistically ($p < 0.05$).²²

In our study, although alcoholic preparations were made available in the hospital units in the form of dispensers on the walls, they were not always available at the service centers. According to WHO, the point of care is the place where three elements meet: the patient, the health professional and the assistance or treatment involving the contact with the patient or its surroundings.^{3,11}

In this sense, it is important to consider that studies that implemented the WHO multimodal strategy and achieved satisfactory adherence rates over time invested primarily in infrastructure, which is the first element of this strategy.¹¹ Thus, the support and involvement of the leadership of the institution, as well as a multidimensional approach, are fundamental to reach the significant improvement of HH.¹⁰

The institution of the present study did not have, until the moment of the collection of data, posters about the MH technique at the points of care. WHO posters act as an educational element and have the primary function

of alerting professionals to HH. As an essential element in raising adherence rates, the illustrative posters allied to periodic training on HH have been recommended in the main guidelines on the theme.^{11,23,24}

The use of gloves was observed in parallel with a negative action of HH in the five moments recommended by the WHO. It is important to highlight that the inadequate use of gloves obtained a great impact for adherence to HH and was perceived as one of the factors that can hinder this practice by health professionals, with emphasis on the indications "before performing aseptic procedures" and "after risk of exposure to body fluids."

Our findings showed that gloves were frequently used by professionals before performing aseptic procedures and without prior hand hygiene. At the time "after exposure to body fluids", professionals removed their gloves and did not sanitize their hands immediately after withdrawal, as recommended by WHO. The same situation is reported in other countries according to previous studies.^{17,18}

It should be noted that in addition to the risks of dissemination of IRAS to patients, their environment and care, one of the great risks associated with this low adherence to HH is the contamination of glove boxes, making them an environmental reservoir of pathogens.²⁵

In this research, the sector with the highest adherence to gloves was the adult ICU (91%) and this result may be related to the low adherence to HH found in this sector (44%). These findings are in line with other research that attributed the use of gloves as one of the major risk factors for noncompliance with hand hygiene.^{17,18,26}

Regarding the perception of the patient's safety climate, SAQ scores were low for all domains evaluated, corroborating with studies conducted in other Brazilian states that obtained total scores below 75.²⁷⁻²⁹

It is worth noting the lower scores perceived by professionals in the domain "Perception of unit and hospital management". It is emphasized that this domain is a fundamental factor for patient safety, since it reflects the agreement of the professional regarding the actions and involvement of the management or the administration of the hospital and the units. In this way, creating a favorable working environment that is conducive to open dialogue about errors as well as a collaborative and non-punitive environment are actions of hospital and unit management that can have a positive impact on patient safety.³⁰

The perception of a security climate varied according to different work regimes. Resident physicians and contracted professionals had higher averages when compared to statutory ones ($p < 0.05$).

This finding may be associated with the shorter service time of these professionals in the institution, since the opposite situation was seen in another similar study in which professionals with more time of service in the institution perceived better the individual and collective competences regarding the commitment of the hospital with the security issues.²⁸

In addition, since host servers have little stability due to the adopted (temporary) work regime, they tend to present more positive responses to the security culture because they fear retaliation in the work environment, although the secrecy of the data has been highlighted several times during the study. Similar data were found in the research carried out by Carvalho et al.²⁸, which verified higher scores for contracted employees when compared to statutory ones.

The correlation between SAQ and adherence to HH in the sectors was positive and moderate, which shows that as the safety climate scores increase, adherence to HH also increases statistically significantly. This result reinforces the importance of the organizational security climate for adherence to HH.

This research has limitations to consider. It is understood as one of them, the data collection performed in only one institution, since it reduces the number of observations and representativeness of professionals. In addition, it is necessary to consider the Hawthorne effect, potentially present during observational studies.³¹ To minimize such effect, the approach and signature of the terms of consent to participate in the study were performed 6 months prior to the monitoring. In addition, observations were made daily in 20-minute sessions during the morning, afternoon and evening sessions.

Conclusions

In our study, adherence to HH was low, the institution's infrastructure for hand hygiene showed flaws and professionals wore gloves frequently, without sanitizing hands before and after use. Our findings reveal the need for investment in adequate infrastructure, since greater access to lavatories and availability of alcoholic preparations tend to favor increased adherence to HH.

Regarding the perception of a security climate, the low scores in all domains and sectors evaluated shows the situation of alert to the institution with an urgent need to implement actions that promote the safety climate for the patient and professional. Higher perceptions of the safety climate are associated with the adoption of safe behaviors, improved communication, conducting training with a positive impact, reducing adverse events, among others, contributing to safe practices in patient care.

Abbreviations

Certificate of Presentation for Ethical Appreciation (CAAE)

Hand Hygiene (HH)

Healthcare-associated infection (HAI)

Informed Consent Form (ICF)

Intensive Care Units (ICU)

Neonatal Intensive Care Unit (NICU)

Research Ethics Committee (CEP)

Safety Attitudes Questionnaire (SAQ)

World Health Organization (WHO)

Declarations

Ethics approval and consent to participate

The project was approved by the Research Ethics Committee (CEP) under opinion n° 2,441,333 and received the Certificate of Presentation for Ethical Appreciation (CAAE) n°: 75169317.0.0000.5541, so that all the ethical prerogatives of resolution 466 / 2012 of the Brazilian National Health Council were fulfilled. In this way, participants were invited to sign the Informed Consent Form (ICF).

Consent for publication

Not applicable

Availability of data and material

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

No funding was obtained for this study.

Author's contributions

MDV and TBB conceived and design the study. TBB and MDV acquisition of the data. MDV, TBB, AFLS, D de A, AMF, WA de A, MAR and JB analysed and interpreted the data. MDV and TBB drafted of the manuscript. AFLS, D de A, AMF, WA de A, MAR and JB critical revisioned the manuscript for important intellectual content and statistical expertise. All authors approved the final version of the manuscript to be published.

Acknowledgments

The authors extend their sincere thanks to all participants in the study.

References

1. Centers for Disease Control and Prevention. Surveillance definitions for specific types of infections. Atlanta (US): CDC, 2014.
2. Storr J, Twyman A, Zingg W, Damani N, Kilpatrick C, Reilly J, et al. Core components for effective infection prevention and control programmes: New WHO evidence-based recommendations. *Antimicrob Resist Infect Control* [Internet]. 2017;6(1). Available from: <http://dx.doi.org/10.1186/s13756-016-0149-9>
3. World Health Organization (WHO). Hand Hygiene Technical Reference Manual. Geneva: 2009.
4. Phan HT, Tran HTT, Tran HTM, Dinh APP, Ngo HT, Theorell-Haglow J, Gordon CJ. An educational intervention to improve hand hygiene compliance in Vietnam. *BMC Infect Dis*. 2018 Mar 7;18(1):116. doi: 10.1186/s12879-018-3029-5.
5. Valim MD, Rocha IL de S, Souza TPM, Cruz YA da, Bezerra TB, Baggio É, et al. Efficacy of the multimodal strategy for Hand Hygiene compliance: an integrative review. *Rev Bras Enferm*. 2019;72(2):552–65.
6. Farhoudi F, Hoshangi Davani M, Sajadi G, Taghizadeh R, Sanaei Dashti A, et al. Impact of WHO Hand Hygiene Improvement Program Implementation: A Quasi-Experimental Trial. *Biomed Res Int* [Internet]. 2016;2016:1–7. Available from: <https://www.hindawi.com/journals/bmri/2016/7026169/>
7. Musu, M, Finco, G, Mura P, Landoni G, Piazza MF, Messina M, et al. Controlling catheter-related bloodstream infections through a multi-centre educational programme for intensive care units. *Journal of Hospital Infection*, 97, n. 3, p. 275-281, 2017.
8. Saharman YR, Fares DA, El-Atmani S, Sedono R, Aditjaningsih D, Karuniawati A, et al. "A multifaceted hand hygiene improvement program on the intensive care units of the National Referral Hospital of Indonesia in Jakarta." *Antimicrobial resistance and infection control* vol. 8 93. 3 Jun. 2019, doi:10.1186/s13756-019-0540-4
9. Deyneko, A. Cordeiro F, Berlin L, Ben-David D, Perna S, Longtin Y. Impact of sink location on hand hygiene compliance after care of patients with *Clostridium difficile* infection: a cross-sectional study. *BMC Infectious Diseases*, v. 16, p. 203, 2016.
10. Daugherty, EL, Paine LA, Maragakis LL, Sexton JB, Rand CS. Safety culture and hand hygiene: linking attitudes to behavior. *Infection Control and Hospital Epidemiology*, v. 33, n. 12, p. 1280-1282, 2012.
11. World Health Organization. Guide to implementation: a guide to implementation of the who multimodal hand hygiene improvement strategy. Geneva: WHO, 2009a
12. Valim MD, Marziale MHP, Hayashida M, Rocha FLR, Santos JLF. Validade e confiabilidade do questionário de adesão às precauções- padrão. *Revista de Saúde Pública, São Paulo*, v. 49, p. 87, 2015.
13. Carvalho REFL.; Cassiani, SHB. Cross-cultural adaptation of the Safety Attitudes Questionnaire - Short Form 2006 for Brazil. *Revista Latino-Americana de Enfermagem, Ribeirão Preto*, v. 20, n. 3, p. 575-582, 2012.
14. Landis JR, Kock GG. The measurement of observer agreement for categorical data. *Biometrics*, v. 33, n. 1, p. 159-174, 1977.
15. Ajzen I, Fishbein M. Understanding attitudes and predicting social behavior. New Jersey: Prentice-Hall, 1998.

16. Zellmer C, Blakney R, Van Hoof S, Safdar N. Impact of sink location on hand hygiene compliance for *Clostridium difficile* infection. *American Journal of Infection Control*, v. 43, n. 4, p. 387-389, 2015.
17. Megeus V, Nilsson K, Karlsson J, Eriksson BI, Andersson AE. Hand hygiene and aseptic techniques during routine anesthetic care - observations in the operating room. *Antimicrobial Resistance & Infection Control*, v. 4, n. 1, p. 5, 2015.
18. Kuruno N, Kasahara K, Mikasa, K. Hand hygiene compliance in a universal gloving setting. *American Journal of Infection Control*, v. 45, n. 8, p. 830-834, 2017
19. Ghezjeljeh TN, Abbasnejad Z, Rafii F, Haghani H Effect of a multimodal training program and traditional lecture method on nurses' hand hygiene knowledge, belief, and practice: a brief report. *American Journal of Infection Control*, v. 43, n. 7, p. 762-764, 2015.
20. Wolfensberger A, Anagnostopoulos A, Clack L, Meier MT, Kuster SP, Sax H. Effectiveness of an edutainment video teaching standard precautions - a randomized controlled evaluation study. *Antimicrobial resistance and infection control* v. 8 82. 22 May. 2019, doi:10.1186/s13756-019-0531-5.
21. Santosaningsih D, Erikawati D, Santoso S, Noorhamdani N, Ratridewi I, Candradikusuma D. Intervening with healthcare workers, hand hygiene compliance, knowledge, and perception in a limited-resource hospital in Indonesia: a randomized controlled trial study. *Antimicrobial Resistance & Infection Control*, v. 6, p. 23, 2017.
22. Cloutman-Green E, Kalaycioglu O, Wojani H, Hartley JC, Guillas S, Malone D, et al. The important role of sink location in handwashing compliance and microbial sink contamination. *American Journal of Infection Control*, v. 42, n. 5, p 554 -555, 2014.
23. Centers for Disease Control and Prevention. Guideline for hand hygiene in health-care settings: recommendations of the healthcare infection control practices advisory committee and the HICPAC/SHEA/APIC/ IDSA hand hygiene task force. *Morbidity and Mortality Weekly Report*, v. 51, n. RR-16, p. 1-45, 2002.
24. Association for professionals in infection control and epidemiology. *Guide to hand hygiene programs for infection prevention*. Washington, DC: APIC, 2015.
25. Assadian O, Leaper DJ, Kramer A, Ousey KJ. Can the design of glove dispensing boxes influence glove contamination? *The Journal of Hospital Infection*, v. 94, n. 3, p. 259- 262, 2016.
26. Cusini A, Nydegger D, Kaspar T, Schweiger A, Kuhn R, Marschall J. Improved hand hygiene compliance after eliminating mandatory glove use from contact precautions-Is less more? *American Journal of Infection Control*, v. 43, n. 9, p. 922-927, 2015.
27. Carvalho PA, Göttems LBD, Pires MRGM, Oliveira MLC de. Safety culture in the operating room of a public hospital in the perception of healthcare professionals. *Revista Latino-Americana de Enfermagem, Ribeirão Preto*, v. 23, n. 6, p. 1041-1048, 2015.
28. Carvalho REFL, Arruda LP, Nascimento NKP, Sampaio RL, Cavalcante MLSN, Costa ACP. Assessment of the culture of safety in public hospitals in Brazil. *Revista Latino-Americana de Enfermagem, Ribeirão Preto*, v. 25, p. e2849, 2017.
29. Bezerra TB, Valim MD, Santos EC, Lima JDA, Ribeiro AC. Percepção da equipe de enfermagem sobre o clima segurança organizacional de um hospital público. *Enfermería Global, Espanha*, n. 53, v. 1, p. 103-

30. Ministério da Saúde. Agência Nacional de Vigilância Sanitária. Resolução da Diretoria Colegiada (RDC) n° 36, de 25 de julho de 2013. Institui ações para a segurança do paciente em serviços de saúde e dá outras providências. Diário Oficial da União: seção 1, Brasília, DF, n. 143, p. 1-74, 26 jul. 2013a.
31. Wu KS, Lee SS, Chen JK, Chen YS, Tsai HC, Chen YJ, Huang YH, Lin HS. Identifying heterogeneity in the Hawthorne effect on hand hygiene observation: a cohort study of overtly and covertly observed results. BMC Infect Dis. 2018 Aug 6;18(1):369. doi: 10.1186/s12879-018-3292-5.

Tables

Table 1 - Distribution of the frequency of the 148 professionals according to sociodemographic, professional and training variables. University Hospital, Central West, Brazil (2018)

Variables	f	%
Time of professional experience (in years)		
0 to 5	32	21.62
6 to 10	36	24.32
11 to 15	35	23.65
16 to 20	25	16.90
21 to 30	19	12.84
> 30	1	0.68
Time of professional experience in the sector (in years)		
0 to 1	22	14.86
2 to 4	69	46.62
5 to 7	12	8.11
8 to 10	11	7.43
>10	33	22.30
Did not answer	1	0.68
Work regime		
Contracted (CLT)	99	66.89
Statutory	32	21.62
Resident physicians (without employment relationship)	17	11.48
Participation in training on standard precautions and hand hygiene		
Yes	87	58.80
No	61	41.20
Types of training		
Lecture	82	94.25
Workshop	3	3.44
<i>Web-class</i>	2	2.29

Table 2 - Opportunities, actions and adherence to hand hygiene according to professional category, days of the week and work shift. University Hospital, Central-West, Brazil 2018.

Variables	Op. N= 3.025	Action	Adhesion (%)	95% CI
Professional category				
Nursing technicians	1.453	510	35.09 a	32.82 - 38.12
Nurses	607	363	59.80 b	55.90 - 63.70
Physiotherapy	412	214	51.80 b	47.00 - 56.69
Medical Residents	139	66	47.76 b	39.30 - 56.22
Physiotherapists	414	246	59.42 b	54.69 - 64.15
Sectors				
Adult ICU	1.048	457	43.61 b	40.60 - 46.61
Neonatal ICU	947	596	62.94 c	59.86 - 66.01
Semi-intensive	1.030	346	33.59 a	30.71 - 36.48
Days of the week				
Monday	360	181	50.28 b	45.11 - 55.44
Tuesday	559	295	52.77 b	48.63 - 56.91
Wednesday	619	296	47.82 b	43.88 - 51.75
Thursday	790	359	45.44 b	41.97 - 48.92
Friday	410	169	41.22 b	36.45 - 45.98
Saturday	157	46	29.30 a	22.18 - 36.42
Sunday	130	53	40.77 b	32.32 - 49.22
Work shift				
Morning	1.032	417	40.41 a	37.41 - 43.40
Evening	1.125	472	49.78 b	46.86 - 52.70
Night	868	100	48.62 b	45.29 - 51.94

Notes: op. Number of opportunities

a, b, c - hand hygiene compliance, followed by different lowercase letters, between the lines of the same variable, differ statistically from each other at the 5% level of significance by the z test of proportions ($p < 0.05$).

Table 3 - Structure of the sectors for hand hygiene. University Hospital, Central West, Brazil, 2018

Sectors	Beds	Sinks	Sinks with water, soap and paper towels available	Bottles and alcoholic preparations available at your fingertips	Alcohol dispensers available in the unit
Adult ICU	8	5	2	4	9
Neonatal ICU	10	4	3	10	13
Semi-intensive	30	9	6	19	26

Table 4 - Number of opportunities, unrealized actions, frequencies, proportions and Confidence Interval (CI) of the use of gloves in the five moments and sectors studied. University Hospital, Central West, Brazil (2018)

Moments	Opportunities	Actions not performed	Frequency gloves use	Proportion (%) (CI)
Before contact with the patient	959	518	358	69.11 a (65.13 - 73.09)
Prior to the aseptic procedures	544	370	350	94.59 b (92.29 - 96.90)
After exposure to fluids corporal	523	205	187	91.22 b (87.35 - 95.09)
After contact with the patient	681	317	228	71.92 a (66.98 - 76.87)
After contact with areas close to the patient	318	216	135	62.50 a (56.04 - 68.96)
Sectors				
Adult UCI	1.048	591	536	90.60 b (88.35 - 93.04)
Neonatal UCI	947	351	246	70.09 a (65.30 - 74.88)
Semi-intensive	1.030	684	476	69.59 a (66.14 - 73.04)

a, b: proportions of the use of gloves in relation to unaccomplished hand hygiene actions, followed by different lowercase letters, between the lines of the same variable, differ statistically from one another at the 5% level of significance by the z test of proportions ($p < 0.05$).

Table 5 - Distribution of medians, means and standard deviations (SD) of the domains of the Safety Attitudes Questionnaire (SAQ) and comparison with work regimens (n = 148). University Hospital, Central West, Brazil (2018).

Domains SAQ	Work regime					
	Statutory		Contracted (CLT regime)		Without employment relationship	
	Median	Mean (SD)	Median	Mean (SD)	Median	Mean (SD)
Climate of teamwork	62.50 a	61.84 (15.59)	70.83 b	67.38 (14.12)	70.83 b	70.09 (13.83)
Safety climate	50.00 a	51.00 (14.06)	57.14 a	55.91 (14.61)	60.71 a	59.24 (12.37)
Job satisfaction	67.50 a	67.03 (16.84)	75.00 a	72.02 (17.61)	75.00 a	75.00 (18.87)
Stress perception	68.75 a	66.79 (16.75)	75.00 a	69.94 (17.78)	87.50 b	80.51 (18.47)
Perception of unit management	41.66 a	43.09 (18.28)	45.83 a	48.31 (14.96)	54.16 b	56.37 (13.43)
Perception of hospital management	39.58 a	39.58 (16.53)	50.00 b	48.52 (12.17)	50.00 b	50.98 (16.23)
Work conditions	45.83 a	42.70 (21.97)	50.00 a	51.17 (20.62)	58.33 a	53.43 (20.63)
SAQ total	55.79 a	55.20 (12.94)	60.97 b	61.17 (10.83)	64.63 b	65.53 (9.54)