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ORIGINAL ARTICLE

Physical structure and supplies for hand hygiene in the CCU of a public hospital

Estrutura física e insumos destinados à higienização das mãos no CTI de um hospital público

Estructura física e insumos destinados a la higienización de manos en la UCI de un hospital público

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ABSTRACT

Background and Objectives: healthcare-associated infections (HAIs) are a serious public health problem worldwide. They occur mainly in Critical Care Units (CCUs), where physical structure and supplies do not favor hand hygiene (HH) compliance among health professionals. Thus, the present study aimed to describe and assess the physical structure and supplies for HH practice in a CCU of a public cancer hospital in the North region, Pará, Brazil. **Methods**: this is a descriptive, observational and cross-sectional study with a quantitative approach. Data were collected through a questionnaire based on the Guide to the Implementation of the World Health Organization (WHO) Multimodal Hand Hygiene Improvement Strategy. **Results**: the study identified that there were 17 functioning beds and 6 interdicted, in addition to 11 sinks on site, but only 5 had liquid soap and paper towels, all with water. Ten alcohol dispensers were identified, but only 7 were functioning and replenished. None of the professionals found had a pocket alcoholic bottle. **Conclusion**: the study concluded that the physical structure and supplies found in the investigated CCU are partially adequate for carrying out hand disinfection. However, improvements in these structures must be implemented as well as periodic audits and permanent health education activities, aiming to remind professionals about HH practice correctly.

Keywords: *Cross Infection. Hand Hygiene. Intensive Care Center.*

RESUMO

Justificativas e objetivos: as infecções relacionadas à assistência a saúde (IRAS) são um grave problema de saúde pública mundial. Ocorrem principalmente nos Centros de Terapia Intensiva (CTI), onde a estrutura física e insumos não favorecem a adesão da higienização das mãos (HM) entre os profissionais de saúde. Dessa forma, o presente estudo teve como objetivo descrever e avaliar a estrutura física e de insumos destinados à prática de HM em um CTI de um hospital público oncológico da região Norte, Pará, Brasil. **Métodos**: trata-se de um estudo descritivo,

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observacional e transversal com abordagem quantitativa. Os dados foram coletados através de um questionário baseado no Guia para a Implementação da Estratégia Multimodal da Organização Mundial da Saúde (OMS) para a Melhoria da Higiene das Mãos. **Resultados**: o estudo identificou que existiam 17 leitos funcionantes e 6 interditados, além de 11 pias no local, porém apenas 5 possuíam sabão líquido e papel toalha, todas com água. Foram identificados 10 dispensadores de álcool, porém apenas 7 estavam funcionantes e reabastecidos. Nenhum dos profissionais encontrados possuíam frasco alcoólico de bolso. **Conclusão**: o estudo concluiu que a estrutura física e os insumos encontrados no CTI investigado estão parcialmente adequados para a realização da prática de desinfecção das mãos. Contudo, devem ser implementadas melhorias nessas estruturas, bem como auditorias periódicas e atividades de educação permanente em saúde, visando relembrar os profissionais sobre a prática de HM de forma correta.

***Descritores**: Infecção Hospitalar. Desinfecção das Mãos. Centro de Terapia Intensiva.*

RESUMEN

Justificación y objetivos: las infecciones asociadas a la atención de la salud (IAAS) son un grave problema de salud pública a nivel mundial. Ocurren principalmente en Unidades de Cuidados Intensivos (UCI), donde la estructura física y los suministros no favorecen la adherencia a la higiene de manos (HM) entre los profesionales de la salud. Así, el presente estudio tuvo como objetivo describir y evaluar la estructura física y los insumos para la práctica de la HM en una UCI de un hospital oncológico público de la región Norte de Pará, Brasil. **Métodos:** se trata de un estudio descriptivo, observacional, transversal con enfoque cuantitativo. Los datos fueron recolectados a través de un cuestionario basado en la Guía para la Implementación de la Estrategia Multimodal para la Mejora de la Higiene de Manos de la Organización Mundial de la Salud (OMS). **Resultados**: el estudio identificó que había 17 camas en funcionamiento y 6 intervenidas, además de 11 lavabos en el lugar, pero solo 5 tenían jabón líquido y toallas de papel, todas con agua. Se identificaron 10 dispensadores de alcohol, pero solo 7 funcionaban y se reponían. Ninguno de los profesionales encontrados tenía una botella de alcohol de bolsillo. **Conclusión**: el estudio concluyó que la estructura física y los insumos encontrados en la UCI investigada son parcialmente adecuados para la realización de la práctica de desinfección de manos. Sin embargo, se deben implementar mejoras en estas estructuras, así como auditorías periódicas y actividades de educación continua en salud, con el objetivo de recordar a los profesionales sobre la práctica correcta de HM.

***Palabras clave**: Infección Cruzada. Desinfección de las Manos. Centro de Cuidados Intensivos.*

INTRODUCTION

Healthcare-associated infections (HAIs) are currently considered a global public health problem. They are characterized by the manifestation of infection acquired during or after hospitalization, or even moments after discharge, if the cause is related to hospitalization. HAIs are directly linked to the increase in the mortality rate, increase in hospitalization time and the higher cost of health care. In addition to this, it can be noted that HAIs facilitate the selection and dissemination of multidrug-resistant microorganisms.[1,2]

Thus, it is an important health problem that affects about 1.5 million people annually around the world. In the United States, it is estimated that 5 to 15% of all hospitalized patients develop HAIs.[3] The incidence of these infections reveals the population's health levels and quality of life, and can be used as health indicators for planning public policies. Mortality rates, where it occurs and which group is most affected contribute to analysis of new research and interventions.[3]

Considering the impact of HAIs, it is necessary for hospitals to set up a Hospital Infection Control Commission (CCIH), as guided by Brazilian legislation, based on Ordinance 2616/98, which aims at the implementation and execution of the Hospital Infection Control Program (HICP) to reduce infection rates to a tolerable level, becoming the foundation for excellent care and commitment to patient safety.[4]

In Brazil, even with national control measures, the epidemiological context of HAI is not satisfactory, since the incidence is 22.8%, while European developed countries have rates below 9%, which demonstrates the seriousness of the situation in the country.[5] Another factor is the long hospital stay and increased cost of treatment.[6] It should also be noted that inadequate antimicrobial treatment for HAI favors the spread of multidrug-resistant microorganisms.[7]

In this context, the simple HH practice is a safe and simple way to minimize and prevent high HAI rates. Therefore, it is necessary to know the 5 moments of HH recommended by the WHO: before touching a patient; before clean/aseptic procedure; after body fluid exposure risk; after touching a patient; after touching patient surroundings.[8] Hands are means of transmission of cross-contamination, and although the technique is widely known, its compliance by professionals is low. Therefore, means are needed to increase compliance among professionals, especially in the Intensive Care Unit (CCU), where HAIs most often occur.[9]

In this context, critically ill patients, such as cancer patients hospitalized in CCU, are more susceptible to HAI, given that they are submitted to several invasive proce-

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dures and excessive use of immunosuppressants. This is explained by the fact that patients need chemotherapy treatments, radiotherapy in tissues, antimicrobial drugs and use of invasive devices with a high occurrence of contamination.[10,11]

Furthermore, it was found in a public hospital in the North that the most prevalent devices in cases of HAI, used by cancer patients, were peripheral venous access, central venous catheter, indwelling urinary catheter, surgical wound and drain.[10]

Based on the above, it is noted that these patients need more sensitive care related to hand hygiene (HH). However, HH practice will only be an effective method if there are adequate conditions for its realization, since the physical structure and supplies are essential instruments that increase the compliance rate of CCU professionals.[12]

When it comes to studies focused on HH, there are few that investigate supplies and infrastructure. Thus, the present study aimed to describe and assess the physical structure and supplies intended for HH practice in a CCU of a public oncology hospital in the North region, Pará, Brazil.

METHODS

This is a descriptive, observational and cross-sectional study with a quantitative approach, carried out in a CCU of a public cancer hospital in the North region (PCHNR), Pará, Brazil. The study was conducted in accordance with the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) recommendations.

The population of this study consisted of the CCU's head coordinator and health professionals who worked in the sector, such as doctors, nurses and nursing technicians. The inclusion criteria were: being a health professional, with a higher or medium level; older than 18 years; belonging to the CCU's fixed staff. Exclusion criteria were: under 18 years old; employees who were not part of the CCU's fixed staff; and individuals who refused to participate in the research.

The research was carried out in five stages, as can be seen in the methodological design of this study (Figure 1), and took place from August 2018 to September 2019. The techniques used in data collection were on-site observation, application of a questionnaire and logbook.

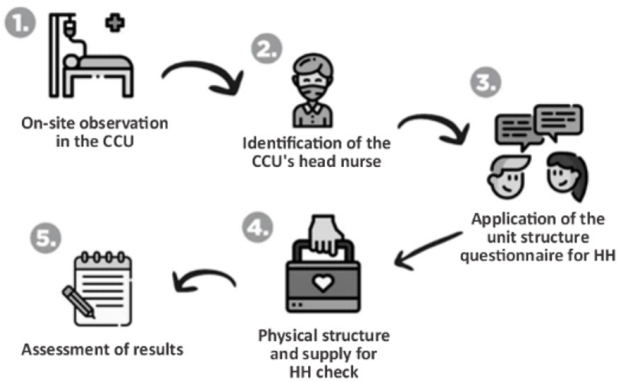

Figure 1. Methodological design of this study.

In the first stage, the technique of on-site observation was programmed, to recognize the physical structure and supplies intended for HH practice in the three Intensive Care Units (ICU), to verify the sector's operating procedures and to identify the existence of educational posters about possible HH practices. Data were recorded in an ambience script, including a sketch of the work area layout.

In the second stage, the CCU's head nurse was identified to answer the research questionnaire.

In the third stage, a questionnaire was applied with the head nurse, aiming at assessing the physical structure and supplies intended for HH at the CCU. The data collection instrument used was the questionnaire on unit structure for HH from the Guide to the Implementation of the World Health Organization (WHO) Multimodal Hand Hygiene Improvement Strategy (2008).[13]

In this phase, the following variables were assessed: number of health professionals per position; water quality; wall-mounted alcoholic preparations; flask-type alcoholic preparations affixed to beds; pocket alcoholic preparations; liquid soap quality; paper towel quality; exhibition of illustrative posters about HH; procedure gloves; and teaching about compliance with HH.

In the fourth stage, the physical structure and supplies intended for HH were checked. The researchers carried out an on-site visit to investigate the following variables: total number of beds; beds with alcoholic preparations within reach; total number of sinks; number of sinks with water, soap and paper towels; total number of dispensers; number of dispensers in perfect working order and replenished; number of CCU professionals found in the three shifts; and number of CCU professionals found in the three shifts with alcoholic preparations in their pockets.

The checking was carried out in the three work shifts, totaling 36 hours of observation, divided into three different and random days, so that there was no interference by the researchers in professionals' work routine.

In the last stage, assessment of results was developed based on descriptive statistics. Data were tabulated and processed for Microsoft® Excel, version 2016, and discussed using updated literature on the subject. The researchers' records, made through observation and the logbook, were important to complement the analysis.

The study is part of a research project entitled "*Caracterização e Controle de Infecções Hospitalares em Centro de Terapia Intensiva (CCU) de um hospital público de ensino da região norte*", approved by the Human Research Ethics Committee of the *Hospital Ophir Loyola* (HOL), under Opinion 1,299,346 and CAAE (*Certificado de Apresentação para Apreciação Ética* - Certificate of Presentation for Ethical Consideration) 48788015.4.0000.5550, fully contemplating all ethical rigor provided for in Resolution 466/2012 of the Brazilian National Health Council. The research received funding from the Amazon Foundation for the Support of Studies and Research (FAPESPA - *Fundação Amazônia de Amparo a Estudos e Pesquisas*) and from the Coordination for the Improvement of Higher Education

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Personnel (CAPES - *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior*).

RESULTS

The study was carried out in a CCU, composed of three functioning ICUs, which provide intensive care to patients. The survey found that 88 health professionals were permanent workers at the CCU, of which 15 (17%) were nurses, 51 (57%) were nursing technicians and 22 (25%) were physicians, including day laborers and on-duty physicians.

In the study, it was possible to access areas intended for patient care in the CCU and perform targeted observation.

The research found that the investigated CCU had three ICUs, one of which was not working, 17 beds were working at the time of the research and six were interdicted by the hospital administration. With regard to the sinks, the CCU had 11 sinks, but only 5 sinks were fully functional, with water, soap and paper towels. Regarding alcoholic preparations, there were 16 wall-mounted dispensers, but only 7 were in perfect working order; there were also 17 flasks placed close to the bed and within reach; and, of the 16 CCU professionals observed, none had a pocket alcoholic preparation bottle.

The research also assessed the existence of illustrative posters about HH in the CCU units (Table 1). There was a shortage of illustrative posters on the indications of the five moments for HH and on HH promotion fixed in the units.

Table 1. Global distribution of types of illustrative posters on hand hygiene, considering the availability in Intensive Care Units. Belém, Pará, Brazil.

Types	Availability in Intensive Care Units (n=3)	
	Yes (%)	No (%)
- Simple hand hygiene technique with soap and water, displayed next to each sink	3 (100)	-
- Antiseptic hand rubbing technique with alcoholic preparation, exposed to assistance/ treatment points	3 (100)	-
- Indications of the five moments for HH, exposed to assistance/treatment points	-	3 (100)
- HH promotion posters	-	3 (100)
- Manuals with HH guidelines	3 (100)	-

Regarding supplies intended for HH practice, the study found a variation in their availability shown in the CCU units, as shown in table 2.

Water was always available for the three assessed units. The same was observed in alcoholic preparations posted near the bed, which were in the 3 ICUs. The wall dispensers of alcoholic preparations were present; however, some were not stocked. The research also verified that there was no presence of pocket bottles of alcoholic preparations with the professionals (Table 2).

Regarding the detailed observations of supplies destined for HH, it was identified that all the sinks had water, but only 5 of 11 sinks had liquid soap and paper towels. There were 16 wall-mounted alcoholic prepara-

Table 2. Distribution of supplies and equipment for hand hygiene practice according to availability in Intensive Care Units. Belem, Para, Brazil.

Supplies/equipment	Availability of units (n=3)			
	Always (%)	Sporadically (%)	Rarely (%)	Never (%)
Available water	3 (100)	-	-	-
Wall-mounted alcoholic preparations	-	3 (100)	-	-
Alcoholic preparation of the type affixed to the bed	3 (100)	-	-	-
Professionals with pocket alcohol preparation	-	-	-	3 (100)

Table 3. Distribution of supplies and equipment for hand hygiene practice according to availability in Intensive Care Units. Belem, Para, Brazil.

Supplies	Observations
Water	- Always available in all sinks, running and clean.
Wall-mounted alcoholic preparations	- Available, but only 7 were working and stocked. When they emptied, they were replenished once a week or as needed. The cleaning crew was responsible for restocking.
Alcoholic preparations of the type affixed to the bed	- Always available and within reach of professionals. When emptied, they were replenished once a week or as needed. The cleaning crew was responsible for restocking.
Pocket alcoholic preparations	- No professional was found with the pocket alcohol preparation bottle.
Paper towel	- Always available, white paper, not recycled, in only 5 of the 11 sinks in the three ICUs.
Liquid soap	- Always available, Dermol Bacter plus soap, from the Indeba industry, with proven antiseptic action, for ready use, diluted in the proportion 1 ml of soap to 10 ml of water. Available in 5 out of 11 sinks in ICUs.
Illustrative posters	- All the sinks had posters illustrating the correct technique for simple hand washing with soap and water and/or the antiseptic rubbing technique with alcoholic preparations, the 5 recommended moments for HH and its promotion. However, the posters were not in good view as they were old. Manuals referring to HH guidelines were available in the three ICUs.
Procedure gloves	- Always available and stocked in the three ICUs.
Teaching about HH	- The professionals received training sporadically in the last 2 years. Audits on compliance with HH were carried out at least once a year. Nurses and doctors received specific training on HH in the last 2 years.

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Table 4. Distribution of sink rate per bed and rate of alcohol solution dispensers attached to the bed and within reach. Belém, Pará, Brazil.

Sectors (total n° of beds)	Sinks (*) Rate = sink:bed	Dispensers (*) Taxa = alcohol dispenser within reach:bed
ICU 1	3:10	10:10
ICU 2	0:0	0:0
ICU 3	2:7	7:7

** Corresponds to sinks for simple hand hygiene containing clean water, soap and paper towels.*
***Corresponds to dispensers that are filled and in perfect working order.*

tion dispensers at the time of the survey, however only 7 were working and were replenished once a week or as needed. Moreover, there were several illustrative posters about HH, but they were difficult to see (Table 3).

In the CCU units, the rate of sinks per bed was also verified. In two of the three ICUs assessed, sinks were available at the points of care, with ICU 1 having the highest rate (3:10), and ICU 2 (0:0), the lowest, as the only sink in this unit was not working. Regarding the number of dispensers per bed, it was observed that ICU 1 and ICU 3 had all alcohol preparation dispensers posted close to the assistance points, while ICU 2 did not have this type of preparation due to being banned (Table 4).

DISCUSSION

The present study assessed the physical structure and supplies destined to HH practice in an CCU, of a public teaching hospital, in the northern region of Brazil, recognized as a reference in oncology, chronic degenerative diseases and transplants that offers excellent assistance in average and high complexity, teaching, research and extension.

The research was composed of 15 nurses, 22 physicians and 51 nursing technicians who provided care services for 17 functioning beds. This finding shows that the CCU investigated was in compliance with ANVISA's RDC Resolution 07/2010, which provides for the minimum requirements for the ICU operation, in which assistant nurses and day laborers and responsible on-duty physicians are in the proportion of at least 01 (one) for every 10 (ten) beds or fraction in each shift, and nursing technicians are at least 01 (one) for every 02 (two) beds in each shift.[14]

When analyzing the physical structure intended for HH, it was observed that there were 11 sinks with running water and always available, which corroborates a previous study carried out in public hospitals in Kenya, which had a low level of infrastructure for HH, since only 58% of sinks had faucets, 34% of sinks had potable water and in only half of the service areas there were sinks for HH and with little soap available.[15] From this, it is evident that the availability of water in washbasins in the ICU close to the health care/treatment points are fundamental to guarantee an effective HH practice.

According to ANVISA in its RDC 50 of 2002, the proportion between the number of sinks and the number of beds that is foreseen is one sink for every five active ICU beds.[16] The CCU in question has a ratio of 3.2 washbasins for every five active beds, i.e., above the target. However, less than half are in ideal structural and supply conditions for carrying out HH.

Regarding liquid soap and paper towels in the study CCU, it was shown that they were present in only 5 of the 11 sinks. These data differ from a study carried out in a public teaching hospital in southern Brazil, in which, of the assessed nurses, 94.6% stated that they had soap next to the washbasins and 100% stated that they had paper towels next to the washbasins. Despite the disagreement of results, both studies show that the lack of these supplies is related to low HH compliance and, therefore, must be remedied.[17]

Hand washing with soap and water is still recommended as the first option in situations where the hands are visibly dirty, and use of alcohol is indicated in other situations.[14]

Water and soap are important agents of HH, as soap has structures similar to fats, known as amphiphiles, i.e., a hydrophobic part and a hydrophilic part. The hydrophobic part binds strongly to the membrane phospholipids of pathogenic microorganisms, detaching them from the dermis, while the hydrophilic part binds to the water, breaking the lipid layer and destabilizing the microorganisms, whose fragments are eliminated with the water during washing, thus contributing to HAI prevention in the CCU.[18]

With regard to the number of alcoholic preparations in wall-mounted dispensers, 7 of the 10 dispensers analyzed were perfectly working and were replenished weekly or according to need, different from the findings in a study carried out in a university hospital in southern Brazil, in which there were 16 (100%) dispensers that were working and stocked.[19] Furthermore, in our study, dispensers were all close to the beds and within reach, which differs from a study carried out in a teaching hospital in Brasília, in which dispensers were available to professionals, but they were few and far away from the beds.[20] These authors also reveal that the location, visibility and ease of access to HH supplies such as dispensers have a positive influence on results related to HH compliance rate.

The CCU units had a total of 17 (100%) alcoholic preparations, all fixed close to the beds, in bottles in the shape of oil cans, replenished weekly or according to the need and within reach. These data contradict the study carried out in a university hospital in the south of Brazil, in which 6.3% of bottles fixed near the beds were working and replenished and 12.5% of bottles fixed to

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the cart/tray were in perfect working order and filled.[19] This lack of dispensers can hinder HH practice provided to patients and favor the proliferation of HAIs.

A study on use of alcohol in disease control and prevention attested to the effectiveness of alcohol-based products for HH. Research concluded that ethanol and isopropanol solutions dramatically reduced the SARS--CoV-2 virus to a total concentration of 30-40%, being more effective than degerming solutions.[21]

Regarding the use of alcohol preparation pocket bottles, the study identified that none of the 16 CCU professionals found in the direct observation stage had flasks with alcohol. These findings are similar to those of a study carried out in a teaching hospital in Brasília, which also did not identify any health professional with bottles of alcohol in their pockets during their work activities.[20] These findings are different from data from a study carried out in a university hospital in southern Brazil, which showed a small proportion (2.9%) of health professionals with a bottle of alcohol in their pockets.[19]

These cases are alarming, as having pocket bottles for antiseptic hand rubbing is an additional measure to protect professionals and patients, especially in hospitals with inadequate infrastructure.

In a study carried out in a neonatal surgical intensive care unit in India, structural and supply improvements were proposed to comply with the multimodal strategy for improving HH, which resulted in a significant increase in overall compliance from 26.6% to 65.3%, reduced microorganism load and increased knowledge about HH. This finding highlights the importance of making resources available to increase the rate of HH compliance.[22]

Regarding procedure gloves, it was observed that they were always available and stored in reserve stock so they never run out, in accordance with what is recommended. Always available gloves are important, but they must be used correctly, at the right time (before and after procedures), and do not replace HH. This is what a study in a hospital in the countryside of the state of São Paulo presented, in which, in 510 opportunities for the use of gloves, more than 54% of opportunities presented irregularities, such as absence of use of gloves and reuse of gloves.[23]

The research also analyzed the display of posters on the following topics: simple hand hygiene techniques with soap and water; antiseptic hand rubbing techniques with alcoholic preparation; indications with the five moments for HH; HH compliance promotion; and manuals with guidelines related to HH. Among these, with the exception of the illustrative posters on the indications of the five moments for HH and on HH promotion fixed in the units, all were present, in the appropriate place, but they did not have a good view.

The aforementioned data correlate with an integrative review on HH compliance, since in their study the low rates of compliance with HH were caused by the presence of posters that did not show well. This study shows that these low rates result not from lack of knowledge of the correct technique, but from the lack of incorporation of this knowledge into professionals' daily routine, through constant exposure of intelligent and motivational information regarding HH.[24]

Moreover, data from our study showed that HH compliance audits were performed sporadically at least once a year. Nurses and doctors received specific training on HH in the last 2 years. These results corroborate the previously mentioned integrative review, in which low compliance with HH was explained by the lack of permanent health education. This review also explains that it is necessary to maintain periodic and dynamic training aimed mainly at raising professional awareness and not just at transmitting knowledge, focusing on norms and attitudes and not just on risks, because, in this way, with a view to what needs to be improved, there will be professional incentive.[22]

In a public hospital in the North region, an increase in the rate of compliance with HH among CCU professionals was revealed due to the performance of in-service education activities and use of educational technologies, through posters near the sinks and beds, booklets for health professionals and conversation circles about HH. Using these educational technologies made it possible to improve the pre-existing knowledge of health professionals and also ensured empowerment in actions and decision-making regarding infection prevention and control. Therefore, the importance of the presence of posters in strategic sectors, such as in washbasins, as found in our study, is evident.[2]

These results show us that hand hygiene should be incorporated into the organizational culture of health institutions, especially within health care, in order to guarantee service quality and patient safety. If this practice is not carried out correctly, professionals in the area run the risk of acquiring or transmitting infections to patients and/or surrounding equipment, characterizing the occurrence of HAIs.[2]

In the present study, the CCU investigated is in an oncology hospital, in which a previous work, carried out in the same hospital, Ophir Loyola, pointed out the CCU environment as conducive to high rates of HAI, given that it has patients with invasive devices, immunosuppression and long hospital stay.[6]

In the present study, the CCU investigated is from an oncology hospital, in which a previous work pointed out the CCU environment as conducive to high rates of HAI, given that it has patients with invasive devices, immunosuppression, and long hospitalization time.[10] It is known that debilitating chronic diseases such as cancer are among the risk factors for the occurrence of HAI due to low patient immunity caused by chemotherapy treatments, the effects of radiotherapy on tissues and excessive exposure to invasive procedures.

The correct HH practice by professionals working in health services is the main measure of HAI control and prevention, since it is a simple and low-cost method, and should be performed through the opportunities described in the five HH moments, regardless of use of gloves.[10]

The study found that the physical structure and

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supplies found in the investigated CCU are partially adequate for carrying out HH practice. However, improvements must be implemented in these structures as well as periodic audits and continuing health education activities, aiming to remind professionals to perform HH correctly, contributing to HAI reduction, reflecting on improving health care quality and patient safety.

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AUTHORS' CONTRIBUTIONS

Ademir Ferreira da Silva Júnior, Karla Valéria Batista Lima and Suellen Patrícia Sales da Costa Loureiro contributed to article planning and design, study design, review, collection, data analysis, writing and final approval of the article; **Josiane Macedo de Oliveira Rupf and Priscila do Nascimento Cordeiro Almeida** contributed to data analysis and study design; **Felipe da Costa Soares, Antônio Marcos Almeida Bezerra, Fernando Cesar de Souza Braga** contributed to the writing and discussion of the article.

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