








Management of mattresses in the prevention of healthcare-associated infection: a cross-sectional study

Gerenciamento de colchões na prevenção de infecção relacionada ao cuidado em saúde: estudo transversal

Manejo del colchón en la prevención de infecciones asociadas al cuidado de la salud: estudio transversal

Alessandra Lyrio Barbosa Giroti¹ , Adriano Menis Ferreira^{2,3} , Elenir Rose Jardim Cury¹ , Marcelo Alessandro Rigotti¹ , Liliane Moretti Carneiro¹ , Maiara Oliveira Diniz¹ 

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¹ Federal University of Mato Grosso do Sul. Campo Grande, Mato Grosso do Sul, Brazil.

² Federal University of Mato Grosso do Sul. Department of Nursing. Três Lagoas, Mato Grosso do Sul, Brazil.

³ Human Exposome and Infectious Diseases Network (HEID), Ribeirão Preto School of Nursing, University of São Paulo. Ribeirão Preto, São Paulo, Brazil.

ABSTRACT

Introduction: Healthcare Associated Infection (HAI) threatens patient safety and can be associated with contamination of surfaces such as mattresses. **Aim:** to identify the criteria for the acquisition and conservation of mattresses in hospitals and Homes for the Aged (HA) as an infection prevention strategy. **Outlining:** Cross-sectional study carried out with 18 institutions. Data were collected through a structured interview with the person responsible for administration, hospitality sector or the Hospital Infection Control Committee, using a validated instrument. Data analysis was performed using descriptive statistics. **Results:** Five HA and 8 Hospitals partook the study. Acquisition by direct purchase prevails (94.4%), with a periodicity of 1 to 5 years (50%). All mattresses purchased are foam ones, due to user comfort (44.4%) and resistance (38.9%). Waterproof cover is used by 83% of the services, made of “napa” (72.2%) and “corvin” (66.7%) for easy sanitizing (77.8%). “During the concurrent cleaning” is the most mentioned time to evaluate the integrity of the mattress (38.8%) and coating (50%). **Implications:** it was observed that there is no systematic management for the acquisition and maintenance of mattresses. This highlights the need to improve the care with patient bed in order to prevent healthcare-associated infections.

DESCRIPTORS

Beds; Cross Infection; Homes for the Aged.

Corresponding author:

Alessandra Lyrio Barbosa Giroti
Address: Cidade Universitária, Av. Costa e Silva - Pioneiros. Campo Grande, Mato Grosso do Sul, Brazil.
ZIP Code: 79070-900 - Campo Grande, MS, Brazil.
Phone: (67) 3345-7000
E-mail: lyrio_barbosa@yahoo.com.br

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INTRODUCTION

The Healthcare-Associated Infection (HAI) is a relevant, complex, and challenging public health problem, expressed by high rates of morbidity and mortality and socioeconomic disorders for the systems, by increasing costs and hospitalization time for treatment. In Brazil, despite the absence of systematic data on the incidence of these infections, a 14% mortality rate is estimated in patients with HAI. Reflection of the inadequate physical structure of health services and lack of knowledge of infection prevention measures associated with lack of professional qualification and shortage of human resources.¹⁻⁵

The occurrence of HAI often results from cross-transmission, commonly by the hands of professionals or by objects close to the patient, among which the mattress stands out due to its direct contact with the patient and its high potential to become a reservoir of relevant pathogens in the health services and a threat to patient safety.^{2,6}

Surface cleaning and disinfection techniques, considered effective strategies in the control and prevention of infections, significantly reduce the contamination of hospital mattresses after cleaning. It is observed in the literature that most of the beds evaluated in research is contaminated with pathogens, especially the bed rails, which reinforces that managers and health professionals must pay attention to the interruption of the dissemination of these microorganisms.⁵⁻⁷

Thus, given the complexity and severity of those infections, there is as explicit need to deepen the management of mattresses aiming to prevent the HAIs, once it is reported that even after terminal cleaning, the surfaces of the bed can remain contaminated when not properly sanitized.⁷

In this manner, considering the pertinence of the topic and the originality of the investigation, as well as the lack of knowledge about the management of mattresses as a measure to prevent infection, this study aimed to identify the criteria for the

acquisition and conservation of hospital bed mattresses and mattresses for Homes for the Aged (HA) as a strategy for preventing and controlling infections related to health care.

METHOD

This is a cross-sectional study carried out in the hospital institutions and HA of the city of Campo Grande, Mato Grosso do Sul. For the selection of the participating services, inpatient beds, and registration in the National Register of Health Establishments (CNES) were considered as inclusion criteria. 31 services were identified, 16 hospitals and 15 Homes for the Aged. Of these, through convenience sampling, 18 services (13 hospitals and 5 long-stay institutions) accepted to partake in the study, due the refuse of the remaining.

The data were collected through structured interviews with the person responsible for mattress management, who was represented by a member of the administration, by a member of the hospitality sector, or by a member of the Hospital Infection Control Committee, according to the organization of each service.

A validated⁵ questionnaire consisting of 19 objective questions was used as instrument for data collection. Of these, three questions refer to the characterization of the institution as to the sort of services provided, legal status, and size; two questions on acquisition and purchase frequency, four questions about composition and integrity of the mattress; six about use of bed cover, its composition and physical integrity; one question on the human resources responsible by the assessment; and three questions related to the sanitization of the mattress and of its cover. Small adaptations in the content of some questions were necessary to better fulfill the objective of this research.

According to the Resolution 466/12, the study was approved by the Research Ethics Committee of the Federal University of Mato Grosso do Sul under the Opinion 4.371.150/2010 (CAAE -

37772920.4.0000.0021) and, subsequently, each partaking institution was contacted for formal authorization of its director and for scheduling the visit. In this previous contact, the research goals and ethical issues were explained, as well as the instrument to be used. At the time of data collection, the objective was explained once more, clarifications were made about the guarantee of anonymity, voluntary participation, and the possibility of minimal risk due to the possibility of discomfort in answering some questions. Then, the Informed Consent Form was read and signed, in two copies, by the participant.

The data, collected from January to February 2021, were organized and tabulated in spreadsheets in Microsoft Office Excel 2016, and the descriptive statistics were supported by the calculation of absolute (n) and relative (%) frequency, with results presented through tables

RESULTS

Eighteen institutions (13 hospitals and 05 HA) participated in the study, of which 44.4% are private, 38.9% philanthropic and 16.7% public. As for size, 16.7% had up to 49 beds, 55.5% from 50 to 99 beds and 27.8% 100 beds or more.

Among the subjects who participated in the interview (n=18), the category nurse stands out (66.7%), directly linked to the Nursing Management or Hospital Infection Control Committee, while the other participants were administrative managers (22, 2%) or the hotel service professionals (11.1%).

Among the ways of acquiring mattresses, the direct purchase process was mentioned in 94.4% of the participating services (n=17), while bidding was referred to as the exclusive method of purchase in only one hospital. Other methods included donation (22.2%) and parliamentary amendment (16.7%), mainly in HA, with each participant being able to mention one or more methods used.

The average period for acquiring new mattresses was between 1 and 5 years, in half of the

consulted services (n=18). The acquisition period of less than 1 year was verified in four institutions (22.2%), while another four mentioned acquiring only as needed. One institution was unable to inform the frequency of acquisition.

With regard to the mattress composition material (n=18), 100% of services use foam mattresses, mainly due to user comfort (44.4%) and material resistance (38.9%). Other reasons for using foam mattresses refer to durability (27.8%), cleaning process (16.7%) and price (22.2%), considering that the respondents could opt for one or more justifications. However, 33.3% of interviewees claimed that there was no standardization of the material to be purchased.

Regarding the way of evaluating the integrity of the mattress, the interviewees of the services (n=18) were able to choose one or more answers, the frequently chosen ones were: during concurrent cleaning, bed making and terminal cleaning, each one of them representing 38.9% of responses. As to this question, five services (27.8%) reported having a specific evaluation routine, while one (5.6%) reported only performing it when the bed cover is damaged and another according to the spontaneous evaluation of the nursing team (5.6%).

The periodicity of this evaluation was referred in 55.6% of the institutions (n=18) as daily, 33.3% weekly and 5.6% monthly. Only one institution stated that it did not carry out a periodic evaluation of the integrity of the mattress and only one HA routinely puts the mattress in the sun for aeration, while 94.4% of the institutions do not carry out any care of this type.

As for the use of waterproof cover on mattresses, 83.3% of institutions (n=18) claim to use it in all and 16.7% only in part of them, and the most used materials were napa (a PVC-based laminated fabric) (72.2%) and courvin (a synthetic leather, vinyl) (66.7%). The justification for choosing such materials is mainly due to the cleaning process (77.8%) and durability (50.0%) as described in Table 1.

Table 1 - Number and percentage of institutions according to the reason for choosing the mattress cover material, Campo Grande - MS, 2021.

| Variables | n | % |
|-----------------------------|----|------|
| Mattress sanitation process | 14 | 77.8 |
| Durability | 9 | 50.0 |
| Material strength | 6 | 33.3 |
| User comfort | 5 | 27.8 |
| Non-optional | 2 | 11.1 |
| Price | 1 | 5.6 |
| Impermeability | 1 | 5.6 |

Note: multiple choice question.

Source: Direct research.

In the same way as the mattress integrity assessment occurs, for the bed cover (n=18) the same priority moments for evaluation are also listed, namely: during terminal cleaning (88.9%), bed making (66.7%) and concurrent cleaning (50.0%). The

frequency of this evaluation is daily in 61.1% of the sample, 33.3% weekly and 5.6% monthly.

Figure 1 shows the condition of a mattress in use at one of the studied institutions.

Figure 1 - Conditions of the waterproof coating of a hospital mattress in use, Campo Grande, MS - 2021.

Source: Direct research.

Another point analyzed was the replacement of the bed cover with a view to guaranteeing the quality of the mattress, in which 77.8% of the institutions (n=18) claimed to change it periodically and 11.1% did not. Two institutions (11.1%) mentioned changing the entire mattress when the cover is damaged.

Unlike the sanitizing of the foam of the mattress, absent in almost all institutions studied, bed cover sanitizing was reported in all services in

the sample, with a variation of standardized products for this purpose, as shown in Table 2.

It was possible to verify that the use of 70% rubbing alcohol (66.7%) and water and soap (38.9%) are still the most common methods, although 27.8% of the services (n=18) are already using products based on hydrogen peroxide. This question allowed the interviewee to name more than one product, if used.

Table 2 - Number and percentage of institutions according to the products used to clean mattress covering, Campo Grande/MS - 2021.

| Products | Nº | % |
|-------------------------------|----|------|
| 70% alcohol solution | 12 | 66.7 |
| Water and soap | 7 | 38.9 |
| Hydrogen peroxide | 5 | 27.8 |
| Sodium hypochlorite | 2 | 11.1 |
| Nippo Bac™ Plus | 2 | 11.1 |
| Quaternary Ammonium Compounds | 2 | 11.1 |
| Peroxy™ 4D | 1 | 5.6 |
| Peracetic acid | - | - |
| Other | 2 | 11,1 |

Note: multiple choice question.

Source: Direct research.

Furthermore, it was researched in the institutions (n=18) who are the professionals responsible for evaluating the integrity of the mattress and bed cover, in which several professional

categories were mentioned, with emphasis on nurses (72.2%) and licensed practical nurses (LPN) or certified nursing assistants (CNA) (66.7%), according to data contained in Table 3.

Table 3 - Number and percentage of professionals who assess the integrity of the mattress and coating according to professional category, Campo Grande - MS, 2021.

| Categoria profissional | n | % |
|------------------------|----|------|
| Nurse | 13 | 72.2 |
| LPN/CNA | 12 | 66.7 |
| Sanitation assistant | 5 | 27.8 |
| Caregiver | 2 | 11.1 |
| Manager | 1 | 5.6 |
| Nursing intern | 1 | 5.6 |
| Room maid | 1 | 5.6 |

Note: multiple choice question.

Source: Direct research.

Regarding the sanitizing routine for the mattress and bed cover, practically all participating services (n=18) stated that they had their own routine at the institution (94.4%), while only one of them reported having instituted it due to health surveillance.

DISCUSSION

Identifying the criteria for acquiring and maintaining mattresses in view of the elucidation of the role of the surfaces of health services in the dissemination of HAI, especially those surfaces close to the patient, can collaborate to increase the adherence to prevention and control measures, implementation of protocols and institutional

policies, in addition to the care with areas before underestimated.^{5,8}

Studies that evaluated the contamination of inanimate surfaces, relating them to colonized and infected patients verified similarity among the strains of the identified microorganisms, which corroborates the control of the sources of transmission in the assistance environment.² The bed showed a higher frequency of contamination by vancomycin-resistant *Enterococcus* when compared to other objects.⁸

In this context, regarding the management of mattresses, the present research showed that, among the professionals pointed out by the institutions to participate in the interview, the nurse was the one with the greatest participation, a fact that may be related to the inherent characteristic of the

profession with training based on the safety of the patient, quality of care, prevention, promotion and recovery of the patient, as well as leadership, supervision and planning skills in the organizations.^{5,9}

The direct purchase was the prevailing process for acquiring mattresses, since, of the 18 services, only one did not mention this method, as it carries out acquisitions through a bidding process and replacement with new articles, in general, occurs on average 1 to 5 years, a period considered satisfactory according to the manufacturers' guidelines, given that the late replacement of these articles may favor the use of inappropriate mattresses for the patient, increasing the risk of transmission of microorganisms.^{5,10}

Mattress donation was more frequent in IPLI. These donated mattresses momentarily supply the need, but soon become inappropriate for use. Most donated mattresses do not have a waterproof cover, nor do they meet other criteria established for health services.

In addition to the frequency of replacement, the criteria that managers use to choose the material purchased were researched, a fact that must be considered in the purchase process, including factors related to patient comfort and safety in care.

All mattresses analyzed were foam ones. That was mostly because they are considered a user comfort item. However, foam mattresses require replacement strategies if used continuously for long periods, due to the possibility of damaging the matrix of the foam and the patient ending up sinking, being uncomfortably supported by the bed frame.¹¹

A similar result was verified in a research carried out in the north of Paraná, where the foam was chosen not only for its comfort and durability, but also for the possibility of this raw material being recycled and, therefore, causing less impact to the environment.⁵

The evaluation of the integrity of the mattress, carried out more frequently during the concurrent and terminal cleanings, as well as during

bed making by the participants, is fundamental to guarantee safety in the care, once damaged surfaces facilitate contamination and interfere with the cleaning and disinfection process, facilitating the adhesion and survival of pathogens.¹²

This evaluation, described as daily by most of the participating services, coincides with another Brazilian survey that mentions a triad for conservation of the mattress and its cover, which includes periodic evaluation, adequate cleaning and disinfection and use of cover.⁵

On the same premise, a study carried out in hospitals in Canada reflects that of 2,561 mattresses evaluated, 833 were damaged, while other locations identified outbreaks of infections and ended them with the disposal of contaminated mattresses. These situations emphasize the need for a routine inspection and periodic replacement of these items, in addition to the mandatory use of waterproof cover on all of them.^{11,13}

According to Regulatory Standard 32, all mattresses must be coated with a washable and waterproof protective cover, with an intact and smooth surface to promote easy cleaning and disinfection. However, this research identified services with mattresses without adequate coating, although all of them mentioned having an evaluation routine, primarily daily. The materials evidenced for bed cover were, in short, napa and corvin, both in compliance with the standard.

It is relevant that for many hospitals and, mainly, HA, the cost of replacing mattresses is high and, sometimes, indefensible, especially in those with minor damage. Therefore, the importance of planning for scheduled inspection and immediate replacement of protective covers at the slightest sign of wear, in addition, the use of washable protective bed covers also collaborates to prevent infections.^{5,11-12,15}

Another crucial measure in the maintenance and conservation of these articles is the correct, frequent, and routine cleaning.¹⁶ In this research, this

cleaning is absent for the mattress (foam), but it is always performed for the protective cover in the participating services. 70% alcohol was the most mentioned product, followed by soap and water considering accessibility, cost and ease of use, however, some institutions already use hydrogen peroxide-based products for more efficient cleaning.

Two relevant pathogens in the context of HAIs and with an impact on morbidity and mortality, *Acinetobacter baumannii* and *Enterobacter* spp, were found in patients' beds in a research carried out in Brazil. These pathogens would be eliminated with good sanitizing strategies and greater adherence of professionals to hand hygiene.¹⁶⁻¹⁸

It is possible to observe flaws in the cleaning and disinfection processes of surfaces both by the team that perform them incorrectly, and by the standardized products. The low efficiency of the product used, inadequate techniques, contaminated utensils, in addition to the stability of the microbiota to disinfection, were verified as potential obstacles to this process in a recent study in Brazil, which requires managers to be increasingly attentive to their epidemiological scenarios.¹⁹

Alcohol-based products have been used for many years for disinfection in health services. They are ready-to-use, have an acceptable odor and a good antimicrobial spectrum, however, they act slowly against certain viruses and do not eliminate sporulated microorganisms, as well as being flammable and damage some equipment, which suggests the search for alternative products, with new associations.²⁰

Associated with cleaning and conservation measures, services need to establish a mattress inspection routine, to be carried out by a professional with knowledge based on HAI control and with decision-making power, such as nurses, so that this management is carried out successful. Often, and in this research, the professionals who handle the mattresses do not have managerial attributions to

solve the problems arising from the damaged mattress.⁵

This study has as limitations the fact that it was carried out during the Covid-19 pandemic, then many institutions refused to participate, in addition to the use of an instrument with previously established responses, in which the participants' self-response on certain routines suggest a better description of the practice, than the actual performing of it.

In this sense, new research based on direct observation of daily mattress management practices would be of great value and, along with this study, will contribute to clinical practice by encouraging the incorporation of criteria for the acquisition and maintenance of mattresses. Given the relevance of the topic, another contribution comes from the emphasis on assessing internal and external integrity and the timing of replacing the mattress as part of an Infection Prevention audit to ensure compliance with established institutional standards for mattress management and safety of the patient.

CONCLUSION

The study allows the conclusion that there is no methodical management for the acquisition and maintenance of mattresses, expressed by the absence of relevant routines and the difficulty of the participants in answering certain questions, often reflecting that the mattress is not considered a potential reservoir of infections acquired in health services.

There is an immediate need to review protocols and adopt indicators on the management process of these items, in the same way that recent health legislation needs to be more detailed and incisive with guidelines for the acquisition, conservation and replacement of mattresses to collaborate in the reduction of IRAS and ensure quality in care.

It is imperative that regulatory agencies and health services recognize how important a robust

program to inspect mattresses and ensure proper mattress management would be. Furthermore, it is

expected that these results may be useful for the Hospital Infection Control Committee, with a view to planning permanent education programs.

RESUMO

Introdução: A Infecção Relacionada à Assistência à Saúde (IRAS) ameaça a segurança do paciente e pode estar associada à contaminação de superfícies como o colchão. **Objetivo:** Identificar os critérios para aquisição e conservação de colchões hospitalares e de Instituições de Longa Permanência para Idosos (ILPI) como estratégia de prevenção de infecção. **Delineamento:** Estudo transversal realizado com 18 instituições. Os dados foram coletados por entrevista estruturada ao responsável pela administração, hotelaria ou Comissão de Controle de Infecção Hospitalar, por meio de instrumento validado. A análise dos dados ocorreu por estatística descritiva. **Resultados:** Participaram 05 ILPI e 13 hospitais. Prevalece aquisição por compra direta (94,4%), com periodicidade de 1 a 5 anos (50%). Todos os colchões comprados são de espuma, devido ao conforto do usuário (44,4%) e resistência (38,9%). Revestimento impermeável é utilizado por 83% dos serviços, confeccionados de napa (72,2%) e corvin (66,7%) pela fácil higienização (77,8%). Durante a limpeza concorrente é o momento mais referido para avaliar a integridade do colchão (38,8%) e do revestimento (50%). **Implicações:** Observou-se que não há gerenciamento sistemático para aquisição e manutenção dos colchões. Isto evidencia a necessidade de melhorar os cuidados com o leito do paciente para prevenir infecção relacionada ao cuidado em saúde.

DESCRIPTORIOS

Leitos; Infecção Hospitalar; Instituição de Longa Permanência para Idosos.

RESUMEN

Introducción: Las infecciones relacionadas con la atención de la salud (IRAS) amenazan la seguridad del paciente y pueden estar asociadas a la contaminación de superficies como los colchones. **Objetivo:** identificar los criterios para la adquisición y conservación de colchones hospitalarios e Instituciones de Larga Estancia para Ancianos (ILPI) como estrategia de prevención de infecciones. **Delineación:** Estudio transversal realizado con 18 instituciones. Los datos fueron recolectados a través de una entrevista estructurada con el responsable de la administración, los hoteles o el Comité de Control de Infecciones del Hospital, utilizando un instrumento validado. El análisis de los datos se realizó mediante estadística descriptiva. **Resultados:** Participaron 05 ILPI y 13 hospitales. Predomina la adquisición por compra directa (94,4%), con una periodicidad de 1 a 5 años (50%). Todos los colchones adquiridos son de espuma, debido a la comodidad del usuario (44,4%) y la resistencia (38,9%). El impermeabilizante es utilizado por el 83% de los servicios, fabricado en napa (72,2%) y corvin (66,7%) de fácil limpieza (77,8%). Durante la limpieza concorrente es el momento más mencionado para evaluar la integridad del colchón (38,8%) y el revestimiento (50%). **Implicaciones:** Se observó que no existe una gestión sistemática para la adquisición y mantenimiento de los colchones. Esto destaca la necesidad de mejorar la atención al lado de la cama del paciente para prevenir infecciones asociadas a la atención médica.

DESCRIPTORIOS

Lechos; Infección Hospitalaria; Hogares para Ancianos.

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COLLABORATIONS

ALBG e AMF: substantial contributions on study's outlining, collection and analysis of the data, interpretation of the results, and writing of the manuscript. ERJC: substantial contributions in the analysis and interpretation of data and results. MAR, LMC e MOD: substantial contributions in the review of the manuscript and final version to be published. All authors agree and are responsible by the content of this version of the manuscript to be published.

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AVAILABILITY OF DATA

The original data are responsibility of the corresponding author and are available in spreadsheets.

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CONFLICTS OF INTEREST

There are no conflicts of interest to declare.