

EFFICACY OF SODIUM HYPOCHLORITE AND 70% ALCOHOL IN SURFACE DISINFECTION: INTEGRATION REVIEW

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ABSTRACT

Objective: To identify the effectiveness of sodium hypochlorite and 70% alcohol in surface disinfection. **Method:** Integrative review in databases: National Library of Medicine of the United States (PUBMED); Scientific Electronic Library Online (SCIELO); Latin American and Caribbean Health Science Literature Database (LILACS) and Web of Science. The search was performed in documents published between 2008 and 2017. The following controlled and combined descriptors were used in Portuguese, English and Spanish: Efficacy, Ethanol, Sodium Hypochlorite, Disinfection and Health Services. Six articles were selected to compose the sample. Of these, 66.6% presented a strong level of evidence. **Results:** The results indicate a higher efficacy of sodium hypochlorite in relation to alcohol at 70%, in the disinfection of surfaces, mainly due to its microbicidal action and spore performance. Nursing stood out in contributing to a greater development in research, being an important protagonist in the evolution of care and in promoting the safety of patients and health workers. **Conclusion:** Although the included studies were carried out in hospital units, the importance of preventing the spread of microorganisms in primary health care environments is highlighted, since the phenomenon of infection is independent of the place where care is provided.

Keywords: Efficacy. Ethanol. Sodium Hypochlorite. Disinfection. Health Services.

INTRODUCTION

Health care-related infections (HCRIs) are considered a global public health problem, since they can cause suffering to the patient and his/her family, by increasing morbidity and mortality rates, length of hospitalization, treatment costs and, mainly representing a risk to the safety of the patient and the health team⁽¹⁾.

An important source of nosocomial pathogens is the endogenous flora of the patient, but it is estimated that 20% to 40% of infections are attributed to cross-contamination through the hands of health professionals, as a result of direct contact with the patient or indirectly when touching on contaminated surfaces⁽²⁾. This fact shows the importance of the health care team's adherence to hand hygiene, and it is necessary to promote updates of health professionals about their influence in the prevention and acquisition of HCRIs⁽³⁾.

In health care establishments, surfaces are

considered important sources of dissemination of microorganisms, such as furniture, floors, walls, partitions, doors and door handles, ceilings, windows, health equipment, benches, sinks, stretchers, IV support, scales, computers, sanitary facilities, fans, extractors, lamps, drinking fountains, telephone sets^(4,5).

Studies on surface contamination have been developed in hospital settings, since hospital care is more complex and it is natural that this space is the focus of these investigations⁽⁶⁾.

Currently, the risk of acquiring infection in primary health care services has been of concern since several procedures with a certain degree of invasiveness have been developed, such as colposcopic exams, intrauterine device insertion (IUD), cauterization of the cervix, capillary glycemia, inhalations, dressings, administration of injectables and immunization, for which some associated adverse event can be anticipated⁽⁷⁾.

In this regard, a study carried out on 12

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mattresses of the gynecological tables of the nursing rooms in Family Health units of a municipality south of Minas Gerais, identified *Pseudomonas aeruginosa* (*P. aeruginosa*) and *Escherichia coli* (*E. coli*) in five and in four health units, respectively. Of the 12 units surveyed, two had higher levels of *Staphylococcus aureus* (*S. aureus*) contamination, and their presence was observed in all gynecological tables⁽⁸⁾.

Microorganisms persist in surfaces of health care establishments for different periods of time and this occurs due to temperature, humidity, topography, porosity, suspension medium, contact duration, surface material, type of microorganism, biofilms, disinfectant residue, microbial load, among others^(2,9).

Faced with this, contamination of surfaces can be established outside the hospital environment and is often neglected by health facilities. Therefore, cleaning and disinfection of surfaces is a relevant issue today in any space or level of care, because when effective, they are able to prevent and reduce infection rates in health services, especially in environments under the responsibility of the professional nurse, who is responsible for the supervision and management of these services.

Although there are national and international laws and protocols related to the prevention and control of infections in healthcare facilities, with emphasis on hospital environments, there is no standardization on the use and effectiveness of the different disinfectants chosen, thus justifying the development of this job. This study aimed to perform an integrative review on the efficacy of sodium hypochlorite and 70% alcohol in surface disinfection.

METHODOLOGY

The integrative review of the literature was carried out considering five stages: identification of the theme and selection of the research question; establishment of criteria for inclusion and exclusion of articles (literature search); definition of the information to be extracted from the selected studies; evaluation of selected studies; analysis and synthesis of the results and presentation of the review⁽¹⁰⁾.

For the first stage, the following research question was chosen: what are the scientific evidences of the efficacy of sodium hypochlorite and 70% alcohol in the disinfection of surfaces in health care establishments?

Inclusion criteria were defined as: articles that answered the guiding question from a primary source, with complete texts in Portuguese, English or Spanish, available online in databases searched from 2008 to 2017. Duplicate articles were excluded, theses, dissertations, review articles, manuals and books.

The articles search was carried out from January to June of 2018, in the following databases and databases: National Library of Medicine of the United States (PUBMED); Scientific Electronic Library Online (SCIELO); Latin American and Caribbean Health Science Literature Database (LILACS) and Web of Science.

For the location of the articles, controlled descriptors were used, according to prior consultation with the Health Sciences Descriptors (DECS) and Medical Subject Heading (MeSH): *Desinfecção* (disinfection, *desinfección*); *Álcool* (alcohol, *alcohol*); *Etanol* (ethanol, *etanol*); *superfície* (surface, *superficie*); *hipoclorito de sódio* (sodium hypochlorite, *hipoclorito de sódio*) in Portuguese, English and Spanish in all databases except the PUBMED database, where the search was performed only in English and with the following descriptors: Disinfection, alcohol, ethanol, surface, sodium hypochlorite. The term “and” was used for the combinations between the descriptors.

The studies included in this review were submitted to a level of evidence classification, level 1 - meta-analysis of controlled randomized clinical trials; level 2 - experimental design study; level 3 - design of quasi-experimental study; level 4 - non-experimental, descriptive studies or qualitative methodological approach or case study; level 5 - report of cases or data obtained in a systematic, verifiable quality or program evaluation data; and level 6 - expert opinion, based on clinical or expert committee experiences, including interpretations of information not based on research, on regular or legal opinions⁽¹¹⁾.

For the presentation of the selection of articles and the composition of the corpus of the integrative review, we used the Preferred reporting items for systematic reviews and meta-analyses (PRISMA)⁽¹²⁾.

This study was not submitted to the Research Ethics Committee since the data were collected through primary sources of scientific publications,

publicly accessible and available online.

RESULTS

During the selection of the studies it was verified that the scientific literature on the subject is still scarce, resulting in six articles to compose the sample (Figure 1).

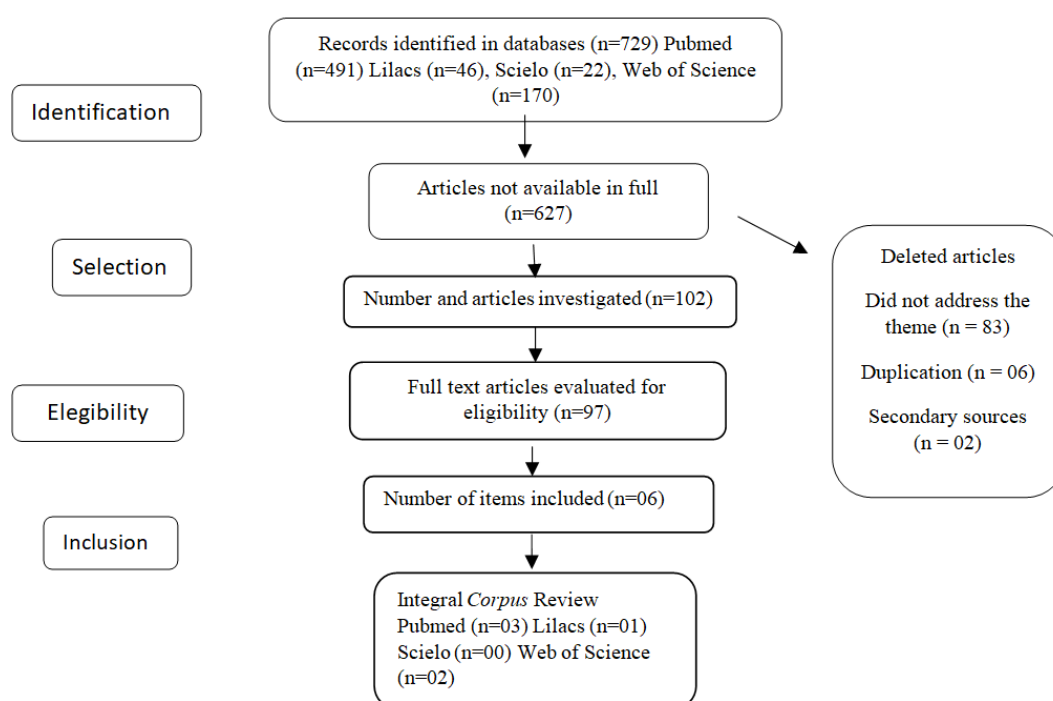


Figure 1 - Flowchart of article selection and composition of the integrative review corpus

The *Revista Latino Americana de Enfermagem* was the journal that presented the largest number of publications, two articles (33.3%). In the periodicals UFPE, American Journal of Infection Control, *Environ Monit Assess* and Open Forum Infectious Diseases, only one article was published (16.7%).

In 2016, the largest number of included studies were identified, two articles (33.3%). In 2013, 2014, 2015 and 2017, one article per year was included (16.7%). Four articles (66.7%) were published in Brazil. The United States and Australia each contributed with one study (33.3%).

In relation to the classification of evidence, two studies of level of evidence 1, two of level 2 and two of which were presented level of

evidence 4 were identified. This assessment, applied to the concepts and tests of levels of evidence, resulted in: a strong level of evidence related studies included in this review⁽¹¹⁾.

DISCUSSION

Of the six articles selected for the study, four of them were carried out in Brazil, being published between 2013 and 2016, highlighting the contribution of the country to the deepening of the knowledge about the subject, as well as its relevance both to the care of the patient and to the patients health professionals⁽¹³⁾.

Nursing was the professional category that most published on the subject, since three articles included (50.0%) were published by

nurses in nursing journal. In care providers, nurses stand out for their important role in the implementation of infection prevention and control measures and patient care safety⁽¹⁴⁾.

As for the included studies, researchers compared a disinfectant spray for surfaces with alcohol at 30% and alcohol at 70%, using as simulated organic load 5% fetal calf serum for all tests to eliminate pathogens such as *Staphylococcus aureus* (S Aureus), *Escherichia coli* (E. coli) and *Enterococcus*. It was found that disinfectant containing 30% alcohol was significantly more effective than 70% alcohol⁽¹⁵⁾. However, results from a study showed that the cyclic activity of alcohol drops markedly when diluted below the 50% concentration, and the optimum bactericidal concentration was 60% to 90% solutions in water⁽¹⁶⁾.

In another study, researchers evaluated the efficiency of surface cleaning and disinfection of an Intensive Care Unit (ICU), using 70% alcohol through the following methods: visual evaluation, bioluminescence adenosine triphosphate and microbiological indicator. The periods before and after the application of 70% alcohol, bed rails, bedside table, infusion pump, nursing desk and medical prescription table were evaluated, totaling 160 samples for each method. After the cleaning and disinfection process, 87.5%, 79.4% and 87.5% of the surfaces were considered clean, using visual monitoring methods, bioluminescence and microbiological adenosine triphosphate, respectively. Visual assessment was the least reliable method⁽¹⁷⁾.

Still in relation to the investigations on the application of 70% alcohol in the disinfection of surfaces, experimental study evaluated the disinfectant efficacy of this product under friction, without prior cleaning, as a concurrent disinfection procedure in health services. The results were compared to disinfection preceded by cleaning. There was no difference in the disinfectant efficacy of alcohol at 70% under friction when applied with or without previous cleaning on contaminated surfaces ($p=0.440$), demonstrating the absence of risk of direct alcohol use at 70% for surface decontamination⁽¹⁹⁾.

The absence of complexity of the structure (without recesses and non-cannulated) of products used in semi-critical areas may be a

contributing factor for satisfactory disinfection with 70% alcohol, with or without previous cleaning⁽²⁰⁾.

Another study that tested the efficiency of 70% alcohol in the cleaning and disinfection of telephone sets and electrocardiograms shows that the effectiveness of this product is independent of previous cleaning. There were several applications of the product in a single direction, for an average of three times, without waiting for drying of each movement. The results indicated that the alcoholic solution was effective, eliminating the bacteria⁽²¹⁾.

A study carried out in a general hospital, located in the inner State of São Paulo, aimed to evaluate the action of alcohol at 70% on yeasts present in 74 hospital mattresses, used by patients infected with fungi (Candidemia)⁽²²⁾. As a disinfectant, 70% alcohol was used, without previous cleaning. It was observed that there was a growth of yeasts in 38.2% of the mattresses, 67.9% before and 32.1% after the disinfection, evidencing the complete non-elimination of these agents. In this respect, some studies justify the need for thorough cleaning prior to disinfection due to inorganic and organic materials remaining on the surfaces, and interfering with the effectiveness of disinfection. In addition, if dirty materials dry up, the removal process becomes more difficult and the disinfection process is less effective⁽¹⁶⁾.

Regarding the time and technique in the application of alcohol at 70%, authors state that a surface would be effectively decontaminated with the application of this product directly under friction for at least five times⁽¹⁹⁾. In Brazil, the Ministry of Health recommends its use with ten minutes exposure time, applied and rubbed until drying, and repeated three times⁽⁵⁾.

A study carried out in a medium-sized hospital in the inner state of São Paulo tested two cleaning techniques with 70% alcohol application: the first unidirectional, from the cleanest area to the most contaminated; and the second with circular movements independent of the degree of contamination present in the various areas of the mattress. The results show that the second technique (composed of circular movements) showed a greater reduction in microbial counts when compared to the other technique⁽²³⁾.

Another study compared the efficiency of three surface friction techniques for the reduction of organic matter by applying the unidirectional, bidirectional and centrifugal directions. For each patient unit and friction technique was used a single table and cloth moistened with 70% alcohol. The organic matter was detected by the presence of adenosine triphosphate by bioluminescence, totalizing 78 crops. There was no difference between the techniques in the removal of organic matter, demonstrating that the three techniques of surface friction are equivalent⁽¹⁸⁾.

The authors have recommended new research to improve surface cleaning techniques based on scientific evidence^(18,23).

Regarding sodium hypochlorite, its efficacy depends exclusively on its concentration and on the exposure time of the product, its concentrations varying between 0.01% and 5.25%⁽⁹⁾.

In a randomized clinical trial, it was possible to verify the effectiveness of sodium hypochlorite as a more efficient surface disinfectant compared to alcohol at 70%. Thirty-eight beds were randomly selected and collected in three situations: before and after disinfection with 70% alcohol or 1% hypochlorite. All fungal species were pathogenic and could worsen the patients' clinical condition. The 1% hypochlorite solution proved to be an effective disinfectant against fungi, but this was not observed with 70% alcohol⁽²⁴⁾.

Researchers tested the efficacy of sodium hypochlorite solution against the dry surface biofilms of *Staphylococcus aureus* (S. aureus). Sodium hypochlorite (1000-20000 parts per million) was applied to dry surface biofilm for 10 minutes, resulted in a 7 log reduction in *Staphylococcus aureus* (S. aureus) plate counts and removal of more than 95% of biofilm. However, even after exposure to sodium hypochlorite at 20,000 ppm, live *Staphylococcus aureus* (S. aureus) cells were visible by microscopy and rescreened after prolonged incubation. No resistance mutations occurred, which implies that hypochlorite resistance is an intrinsic property of biofilms of *Staphylococcus aureus* (S. aureus)⁽²⁵⁾.

Regarding the availability, disinfectant properties and disadvantages in its use, 70%

alcohol is the most available in the market, mainly because of its low cost when compared to other products, being considered the most accessible by the germicidal action and less toxicity, however can damage plastic and rubber^(5,16,20,22). Its antimicrobial action is related to the denaturation of the proteins and its bactericidal action is due to the mixture of alcohol and water, because the proteins are denatured more quickly in the presence of water. It is also tuberculocidal, fungicidal and virucide, but does not destroy bacterial spores⁽²⁾.

Sodium hypochlorite is used for the disinfection of nonmetallic surfaces in general due to their corrosive action (some products are formulated with corrosive inhibitor), possessing broad spectrum of antimicrobial activity, low cost and fast action, even in the presence of organic matter in small amount. As hypochlorite and other germicides are substantially inactivated in the presence of blood, large spills of the latter require that the surface be cleaned prior to the application of the 1% sodium hypochlorite disinfectant. The exact mechanism by which free chlorine destroys microorganisms has not yet been elucidated. It presents undeniable microbicidal action on agents that cause HCRI, leaves no toxic residue, being superior to other products, including actions that destroy spores^(5,9).

As disadvantages of sodium hypochlorite are its strong odor (some products are formulated with odor inhibitor), inactivation in the presence of large volumes of organic matter, discoloration of tissues and the possibility of causing skin irritations, especially if its use does not is in accordance with the manufacturer's recommendations, safety standards and precautions such as the use of Personal Protective Equipment (PPE) and adequate ventilation of the environment^(2,5,9).

Although it is one of the most used disinfectants in surface disinfection, hypochlorite remains studied and compared with other technologies and products⁽⁹⁾.

As limitations found in this study stand out the non-standardization of the methods of the studies, the techniques of microbiological collection and friction of the disinfectants; variability in sample size; and the distinct methods of cultivation and identification of

microorganisms, which points to the need to increase methodological rigor in the production and evaluation of these researches^(9,20).

It adds to the fact that the use of disinfectants should be compatible with the nature of the surface, the number of microorganisms present, the innate resistance of microorganisms to the products, the amount of organic matter present, the type and concentration of the disinfectant used and the duration and the temperature of the contact with the product, which also hinders the synthesis of scientific evidence⁽⁵⁾.

Another limiting factor found was that studies on the use of 70% alcohol and sodium hypochlorite for cleaning and disinfection do not include the risk of contamination of patients by health professionals, and vice versa, through the dissemination of microorganisms on healthcare facilities, where hand hygiene represents a crucial measure in the prevention and control of HCRI⁽¹⁷⁾.

CONCLUSION

The findings of this study showed a higher efficacy of sodium hypochlorite in relation to alcohol at 70%, in the disinfection of surfaces, mainly due to its microbicidal action and spore performance. With technological development, chemicals such as sodium hypochlorite have been formulated with corrosive and odor inhibitors, which signals a greater safety in the use of this disinfectant.

Despite this, further investigations are needed to construct evidence that indicate sodium

hypochlorite as standard and safe product. The already developed studies are limited by the lack of standardization of disinfectants and protocols of disinfection procedures on surfaces

Nursing stood out in contributing to a greater development in research, being an important protagonist in the evolution of care and in promoting the safety of patients and health workers.

In addition to the results found in this review, it is highlighted the importance of qualification of health professionals, especially nurses, about products and techniques that should be used in the disinfection of surfaces, in any environment of patient care, through the use of assistance protocols for prevention and control of HCRI⁽¹⁷⁾, promoting the systematic updating, based on scientific evidence. And special attention should be given to hand hygiene, as it is an important way of disseminating pathogens.

Although this review aimed to evaluate the efficacy of two products widely used in surface disinfection, whose articles emphasize its application in hospital units, it is important to emphasize the prevention of the dissemination of microorganisms in primary health care settings, since the phenomenon of infection does not depend on where the care is provided.

FINANCING

Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES).

EFICÁCIA DO HIPOCLORITO DE SÓDIO E DO ÁLCOOL 70% NA DESINFECÇÃO DE SUPERFÍCIES: REVISÃO INTEGRATIVA

RESUMO

Objetivo: Identificar a eficácia do hipoclorito de sódio e do álcool a 70% na desinfecção de superfícies. **Método:** Revisão integrativa em bases/bancos de dados: Biblioteca Nacional de Medicina dos Estados Unidos (PUBMED); Scientific Electronic Library Online (SCIELO); Latin American and Caribbean Health Science Literature Database (LILACS) e Web of Science. A busca foi realizada em documentos publicados entre 2008 e 2017. Foram utilizados os seguintes descritores controlados e combinados, em português, inglês e espanhol: Eficácia, Etanol, Hipoclorito de Sódio, Desinfecção e Serviços de Saúde. Foram selecionados para compor a amostra seis artigos. Desses, 66,6% apresentaram forte nível de evidência. **Resultados:** Os resultados apontam maior eficácia do hipoclorito de sódio em relação ao álcool a 70%, na desinfecção de superfícies, principalmente pela sua ação microbicida e atuação nos esporos. A enfermagem se destacou em contribuir para um maior desenvolvimento nas pesquisas, sendo importante protagonista na evolução dos cuidados e na promoção da segurança dos pacientes e de trabalhadores da saúde. **Conclusão:** Embora os estudos incluídos tenham sido realizados em unidades hospitalares, destaca-se a importância da prevenção de disseminação de micro-organismos nos ambientes de cuidados primários de saúde, uma vez que o fenômeno de ocorrência de infecção independe do local onde a assistência é prestada.

Palavras-chave: Eficácia. Etanol. Hipoclorito de Sódio. Desinfecção. Serviços de Saúde.

EFICACIA DEL HIPOCLORITO DE SODIO Y DEL ALCOHOL 70% EN LA DESINFECCIÓN DE SUPERFICIES: REVISIÓN INTEGRADORA

RESUMEN

Objetivo: identificar la eficiencia del hipoclorito de sodio y del alcohol al 70% en la desinfección de superficies. **Método:** revisión integradora en las bases/bancos de datos: Biblioteca Nacional de Medicina de los Estados Unidos (PUBMED); *Scientific Electronic Library Online* (SCIELO); *Latin American and Caribbean Health Science Literature Database* (LILACS) y *Web of Science*. La búsqueda fue realizada entre 2008 y 2017. Fueron utilizados los siguientes descriptores controlados y combinados, en portugués, inglés y español: Eficacia, Etanol, Hipoclorito de Sodio, Desinfección y Servicios de Salud. Fueron seleccionados para componer la muestra seis artículos. De estos, 66,6% presentaron fuerte nivel de evidencia. **Resultados:** los resultados señalan mayor eficiencia del hipoclorito de sodio en relación al alcohol al 70%, en la desinfección de superficies, principalmente por su acción microbicida y actuación en las esporas. La enfermería se destacó por contribuir para un mayor desarrollo en las investigaciones, siendo importante protagonista en la evolución de los cuidados y en la promoción de la seguridad de los pacientes y de trabajadores de salud. **Conclusión:** aunque los estudios incluidos hayan sido realizados en unidades hospitalarias, se destaca la importancia de la prevención de diseminación de microorganismos en los ambientes de cuidados primarios de salud, una vez que el fenómeno de ocurrencia de infección independe del local donde la atención es hecha.

Palabras clave: Eficacia. Etanol. Hipoclorito de Sodio. Desinfección. Servicios de Salud.

REFERENCES

1. Brasil. Ministério da Saúde. Fundação Oswaldo Cruz. Agência Nacional de Vigilância Sanitária. Documento de referência para o Programa Nacional de Segurança do Paciente [Internet]. 2014 [citado em 12 ago 2018]. Disponível em: http://bvsms.saude.gov.br/bvs/publicacoes/documento_referencia_programa_nacional_seguranca.pdf.
2. Rutala WA, Weber DJ. Selection of the ideal disinfectant. *Infection control and hospital epidemiology*. [Internet]. 2014 [cited in: 2018 ago 12]; 35(7): 855-865. doi: <https://doi.org/10.1086/676877>.
3. Oliveira AC, Paula AO. Factors related to poor adherence to hand hygiene in healthcare delivery: a reflection. *Rev Cienc Cuid Saude* [Internet]. 2014 [citado em 12 ago 2018]; 13(1): 185-190. doi: <http://dx.doi.org/10.4025/cienccuidsaude.v13i1.13410>.
4. Assad C, Costa G. Manual técnico de limpeza e desinfecção de superfícies hospitalares e manejo de resíduos. [Internet]. 2010 [citado em 01 set 2018]. Disponível em: http://portal.saude.pe.gov.br/sites/portal.saude.pe.gov.br/files/manual_seguranca_do_paciente_limpeza_e_desinfeccao_de_superficies_da_anvisa.pdf.
5. Brasil. Agência Nacional de Vigilância Sanitária. Segurança do paciente em serviços de saúde: limpeza e desinfecção de superfícies. [Internet]. 2012 [citado em 03 set 2018]. Disponível em: <https://www20.anvisa.gov.br/segurancadopaciente/index.php/publicacoes/item/seguranca-do-paciente-em-servicos-de-saude-limpeza-e-desinfeccao-de-superficies>.
6. Marchon SG, Mendes Junior WV. Patient safety in primary health care: a systematic review. *Rev Cad. Saúde Pública* [Internet]. 2014 [cited in: 2018 sept 03]; 30(9): 1-21. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/25317512>.
7. Padoveze MC, Figueiredo RM. The role of primary care in the prevention and control of healthcare associated infections. *Rev. Esc. Enferm. USP* [Internet]. 2014 [cited in: 2018 sept 03]; 48(6): 1137-1144. doi: <http://dx.doi.org/10.1590/S0080-623420140000700023>.
8. Pereira RMS. Índice de contaminação dos colchões das mesas ginecológicas na Estratégia Saúde da Família. 2017. [monografia]. Alfenas (MG). Programa de Residência Multiprofissional em Saúde da Família. Universidade Federal de Alfenas – UNIFAL. 2017.
9. Pereira STP, Oliveira HM, Turrini RNT, Lacerda RA. Disinfection with sodium hypochlorite in hospital environmental surfaces in the reduction of contamination and infection prevention: a systematic review. *Rev. Esc Enferm USP* [Internet]. 2015; [cited in: 2018 sept 03] 49(4): 681-688. doi: <http://dx.doi.org/10.1590/S0080-62342015000400020>.
10. Whittemore R, Knaf K. The integrative review: updated methodology. *J Adv Nurs*. [Internet]. 2005; [cited in: 2018 sept 10] 52(5): 546-53. Available from: http://users.phhp.ufl.edu/rbauer/EBPP/whittemore_knaf_05.pdf.
11. Stetler CBL, Brunell M, Giuliano KK, Morsi D, Prince L, Newell-Stokes V. Evidence-based practice and role of nursing leadership. *Journal of Advanced Nursing* [Internet]. 1998; [cited in: 2018 sept 03] 28(7-8): 45-53. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/9709696>.
12. Moher D, Liberati A, Tetzlaff J, Altman DG, Altman D, Antes G, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *International Journal of Surgery* [Internet]. 2009; [cited in: 2018 sept 03] 6(7):e1000097. doi: <https://doi.org/10.1371/journal.pmed.1000097>.
13. Azevedo PMC, Souza TP, Almeida CPB. Prevenção de infecção hospitalar em unidades de internação pediátrica: uma revisão de literatura. *Rev. Saúde.Com* [Internet]. 2016; [citado em: 14 set 2018] 12(3): 656-665. Disponível em: periodicos2.uesb.br/index.php/rsc/article/download/428/346/.
14. Moura LCD, Carvalho LN, Silva RS, Gouveia BLA. Higiene e desinfecção hospitalar aliadas na segurança do paciente. *Tema em Saúde* [Internet]. 2017 [citado em: 14 set 2018]; 17(1):4-17. Disponível em: <http://temasemsaude.com/wp-content/uploads/2017/05/17101.pdf>.
15. Alhmim H, Koganti S, Cadnum JL, Rai H, Jencson AL, Donskey CJ. Evaluation of a Novel Alcohol-Based surface disinfectant for disinfection of hard and soft surfaces in healthcare facilities. *Open Forum Infectious Disease* [Internet]. 2017; [cited in: 2018 sept 03]; 4(2):ofx054. doi: <https://doi.org/10.1093/ofid/ofx054>.
16. Guideline for disinfection and sterilization in healthcare facilities - 2008. Centers for Disease Control and Prevention. Page last update: September 18; 2016. Available from: <https://www.cdc.gov/infectioncontrol/guidelines/disinfection/updates.htm>.
17. Ferreira AM, Andrade D, Rigotti MA, Almeida MTG, Guerra OG, Santos Junior AG. Assessment of disinfection of hospital surfaces using different monitoring methods. *Rev. Latino-Am. Enfermagem* may-june. [Internet]. 2015; [cited in: 2018 sept 03] 23(3): 466-474. doi: <http://dx.doi.org/10.1590/0104-1169.0094.2577>.
18. Rigotti MA, Ferreira AM, Nogueira MCL, Almeida MTC, Guerra OG, Andrade D. Evaluation of three surface friction techniques for the removal of organic matter. *Texto Contexto Enferm* [Internet]. 2015 [citado em: 14 set 2018]; 24(4): 1061-70. doi: <http://dx.doi.org/10.1590/0104-0707201500003690014>.
19. Graziano MU, Graziano KU, Pinto FMG, Bruna CQM, Souza RQ, Lascala CA. Effectiveness of disinfection with alcohol 70% (w/v) of contaminated surfaces not previously cleaned. *Rev. Latino-Am. Enfermagem*. [Internet]. 2013; [cited in: 2018 sept 14] 21(2): [06 telas]. doi: <http://dx.doi.org/10.1590/S0104-11692013000200020>.
20. Ribeiro MM, Neumann VA, Padoveze MC, Graziano KU. Efficacy and effectiveness of alcohol in the disinfection of semi-critical materials: a systematic review. *Rev. Latino-Am. Enfermagem* [Internet]. 2015 [cited in: 2018 sept 15]; 23(4): 741-52. doi: <http://dx.doi.org/10.1590/0104-1169.0266.2611>.
21. Cordeiro AL, Oliveira MM, Fernandes JD, Barros CS, Castro

LM. Equipment contamination in an intensive care unit. *Acta Paul Enferm* [Internet]. 2015 [cited in: 2018 sept 15]; 28(2): 160-5. doi: <http://dx.doi.org/10.1590/1982-0194201500027>.

22. Fernando FSL, Ferreira AM, Colombo TE, Rigotti MA, Rubio FG, Almeida MGT. Ethyl alcohol: an analysis of its disinfecting action on yeast found in hospital mattresses. *Rev enferm UFPE* [Internet] 2014[cited in: 2018 sept 17]; 8(5): 1273-83. Available from: <https://periodicos.ufpe.br/revistas/revistaenfermagem/article/view/9809>.

23. Silva NO, Ferraz PC, Silva ALT, Malvezzi CK, Poveda VB. Avaliação da técnica de desinfecção dos colchões de uma unidade de atendimento à saúde. *Rev. Min. Enferm.* [Internet] 2011 [citado em: 17 set 2018]; 15(2): 242-247. Disponível em:

<http://www.reme.org.br/artigo/detalhes/31>.

24. Aquino IS, Porto JCS, Silva JL, Morais KFC, Coelho FA, Lopes TS et al. Evaluation of disinfectants for elimination of fungal contamination of patient beds in a reference hospital in Piauí, Brazil. *Environ Monit Assess* [Internet]. 2016[cited in 2018 sept 22]; 188(11):644. doi: <https://doi.org/10.1007/s10661-016-5654-z>.

25. Almatroudi A, Gosbell IB, Hu H, Jensen SO, Espedido BA, Tahir S et al. *Staphylococcus aureus* dry-surface biofilms are not killed by sodium hypochlorite: implications for infection control. *Journal of Hospital Infection* [Internet]. 2016 [cited in: 2018 sept 30]; 93:263-270. doi: <https://doi.org/10.1016/j.jhin.2016.03.020>.

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