



ISSN: 2230-9926

Available online at <http://www.journalijdr.com>

# IJDR

*International Journal of Development Research*  
Vol. 09, Issue, 03, pp.26230-26234, March, 2019



ORIGINAL REVIEW ARTICLE

OPEN ACCESS

## USE OF CONTACT PRECAUTIONS IN THE CONTROL OF HOSPITAL INFECTION IN AN INTENSIVE CARE UNIT: AN INTEGRATIVE REVIEW

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### ARTICLE INFO

#### Article History:

Received 22<sup>nd</sup> December, 2018  
Received in revised form  
19<sup>th</sup> January, 2019  
Accepted 20<sup>th</sup> February, 2019  
Published online 29<sup>th</sup> March, 2019

#### Key Words:

Intensive Care Units,  
Hospital Infection, and  
Universal Precautions.

### ABSTRACT

Hospital Infections (HI) are a serious public health problem, so, the present study aimed at analyzing the strategies associated with contact precautions in the reduction of microorganisms in the ICU. This is an integrative review of the literature, using the following steps: development of the guiding question; search for studies in the databases; selection of articles; extraction of data from studies; evaluation of the selected studies; analysis and synthesis of the results and presentation of the review. The guiding question was: What are the strategies associated with contact precautions being used in the Intensive Care Unit to control Hospital Infection? Data were collected in the databases: National Library of Medicine (PUBMED), Medical Literature Analysis and Retrieval System Online (MEDLINE), and Latin American and Caribbean Health Sciences Literature (LILACS). The descriptors used were: Intensive Care Units, Hospital Infection, and Universal Precautions. The strategies associated with the contact precautions were: adoption of standard precautions, educational interventions, systematized actions, intensive process monitoring and risk management. Adherence to contact precaution measures, protocols and standards significantly reduce the incidence of HI, decreasing the length of hospital stay, as well as its costs.

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**Citation:** *Adaiele Lucia Nogueira Vieira da Silva, Rosely Almeida Souza, Willian Albuquerque de Almeida, Adriano Menis Ferreira, Marcelo Alessandro Rigotti and Oleci Pereira Frota*. 2019. "Use of contact precautions in the control of hospital infection in an intensive care unit: An integrative review", *International Journal of Development Research*, 09, (03), 26230-26234.

### INTRODUCTION

Since the beginning, hospital infections (HI) are part of the daily routine of health professionals. It is considered one of the most important causes of morbidity and mortality associated with clinical, diagnostic and therapeutic procedures (Majeed *et al.*, 2018). The occurrence of HI contributes to an increase in the hospitalization time, consequently adding greater financial value to the treatment. Due to that, HI have become a serious public health problem, because in addition to the financial impact, there is a strong social dimension, as they generate suffering for both the patient and the family (Knelson *et al.*, 2014). Approximately 1.4 million people worldwide can be affected by HI, it is estimated that about 10% of all hospitalized patients are likely to develop HI, being their period of hospitalization of short or long stay (WHO, 2007).

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Within the hospital setting, the Intensive Care Units (ICUs) have the highest HI indexes when compared to the rates of other hospital sectors; thus, this is a priority sector for actions to prevent and control infection (Sousa 2016, Sobreira *et al.* 2018, Souza *et al.* 2018). The HI present in this sector are mostly caused by the following microorganisms: Gram-positive (*Staphylococcus*) and the Gram-negative bacilli (*Enterobacter sp.*, *Klebsiella pneumoniae*, *Candida spp.*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Acinetobacter baumannii*) (SIQUEIRA *et al.*, 2014). Infections by gram-negative bacteria, especially by multi-drug resistant microorganisms, are increasingly present in ICUs (Qadeer *et al.*, 2016). In order to restrain the HI caused by the above mentioned microorganisms and others, it is imperative to adopt precautionary measures before and after exposure to risks, known as precautionary measures. The HI prevention and control measures are divided into two levels of precautions: standard precautions for all the care practices, and those based on the transmission routes of the agents: contact, droplets and aerosols (SIEGEL *et al.*, 2007).

Standard or universal precautions (SP) should be followed for all patients, regardless of suspected or non-suspected infections, in order to avoid any contact with blood and body fluids. Being made fundamentally of: hand hygiene; use of Personal Protective Equipment (PPE) such as gloves, mask, glasses, apron; management and disposal of sharps and waste products, and immunization (SIEGEL *et al.*, 2007). All the other precautions based on transmission must be adopted together with the SP. Regarding the precautions based on the route of transmission, contact precautions are applicable in patients with suspected or confirmed conditions, whose transmission occurs from one individual to another through contact with the skin or mucosa. Being these: use of gloves, masks, glasses and apron; private or common room for patients with the same microorganism; all the items and equipment are for patient use only, including thermometer, stethoscope and sphygmomanometer, and they must be cleaned, disinfected or sterilized after discharge (SIEGEL *et al.*, 2007). A North American study pointed out that the direct costs with HI in the state of North Carolina should cost the state an amount over 100 million dollars per year (ANDERSON; PYATT; WEBER; RUTALA, 2013). These data highlight the need for actions aimed at the prevention of HI, reinforcing the basic principles of the use of precautionary measures. In view of this, this study had as objective to analyze the strategies associated to the contact precautions in the reduction of microorganisms in the ICU.

## MATERIALS AND METHODS

Integrative review of the literature about the use of contact precautions in Intensive Care Units. The research was guided by the following steps: identification of the theme and selection of the guiding question; establishment of criteria for inclusion and exclusion; definition of the study information; evaluation of studies included in the review; interpretation of the results; synthesis of knowledge. The guiding question was: What are the strategies associated with contact precautions being used in the Intensive Care Unit to control Hospital Infection?

**Data were collected in the databases:** National Library of Medicine (PUBMED), Medical Literature Analysis and Retrieval System Online (MEDLINE), and Latin American and Caribbean Health Sciences Literature (LILACS). The keywords used to carry out the research were: Intensive Care Unit, Hospital Infection, Universal Precautions.

**The inclusion criteria were:** research with human beings; thematic use of contact precautions in intensive care unit; complete texts and public availability. The exclusion criteria for this study proposal were: editorials and short communications, articles repeated in more than one database, which were considered only once, and the studies that despite presenting the selected terms, did not answer the guiding question.

In this review, we opted for the non-restriction of time cut, in order to cover a larger number of publications. The search for references was made from October 2018 to February 2019.

After the application of the inclusion and exclusion criteria, a form was used as a tool to capture information referring to databases, authors, year, research objective, microorganism, main results, methodological description and level of evidence.

In order to evaluate the quality of the articles in the sample, a classification was used according to the level of evidence as described: I - systematic review or meta-analysis of relevant clinical trials; II - evidence from at least one well-delineated randomized controlled clinical trial; III - well-delineated clinical trials without randomization; IV - well-delineated cohort and case-control studies; V- systematic review of descriptive and qualitative studies; VI - evidence derived from a single descriptive or qualitative study; VII - opinions of authorities or expert committees including interpretations of information not based on researches (Melnyk and Fineout-Overholt, 2011). The processes to identify, select, and include the studies happened in three stages: exclusion of duplicate articles, reading of titles and abstracts, and finally a full reading of the articles in order to answer the guiding question.

## RESULTS AND DISCUSSION

The automatic search made it possible to locate 77 studies, most of them, 71.4% (55), published on PUBMED. Followed by MEDLINE with 26% (20) of the studies and BDNF with 5.6% (2) studies. After analysis, based on the inclusion and exclusion criteria, the sample consisted of ten publications, according to Figure 1. After evaluating the data, it was evidenced that there is a wide scientific production regarding the adoption of standard precaution in the hospital environment, however, regarding contact precautions, there is a shortage of studies directed to the multiprofessional team working in ICUs. The literature indicates that the risk factors for HI acquisition can be internal and external. The internal factors are associated with the patient, such as: antimicrobial and chemotherapeutic use, age, chronic disease, nutritional status, hospitalization time and other factors. Regarding the external factors, it is possible to list: inadequate cleaning and disinfection of the environment, invasive procedures, use of contaminated materials and/or equipment, presence of vectors such as insects and rodents, cross infection and low adherence to precautionary measures (Majeed *et al.* 2018, Giuffrè *et al.*, 2016, Lofgren 2017, Siegel *et al.* 2007).

Regarding the external factors, the use of precautions has significantly contributed to a decrease in HI rates. It is known that among the precautions based on the route of transmission of microorganisms, non-adherence or non-compliance to one of the equipment or standards, indicates no effective non-adherence (Majeed *et al.* 2018, Siegel *et al.* 2007). In this context, a Brazilian study showed that the low adherence to precautions by health professionals may be associated with the perception of risks, recognition of occupational exposure situations and the practice of protective measures (Piai, Orlandi and Figueiredo 2015). Thus, the adherence to the use of precautionary measures is associated with professionals' knowledge and actions, influenced by health beliefs. Among the factors identified by Ferreira (2009) that favor the adherence to precautions by professionals, it is important to highlight age under forty, satisfaction with work; more time of professional experience, knowledge about the standard precautions and about the pathogens conveyed. On the other hand, the non-adherence to precautions is determined by resistance to changes in behavior due to advanced age and/or time of professional experience (Ferreira *et al.*, 2009). Vulnerability of ICUs also puts health professionals at risk, since exposure to pathogens promotes infections due to occupational accidents, if it is not used properly for safety precautions and protocols (Ferreira *et al.*, 2009).

**Figure 1. Distribution of the studies according to data base, authors, year, research objective, microorganisms, main results, methodological description and level of evidence- Campo Grande, MS, Brazil, 2019**

Database – Authors	Year	Research objective	Microorganism	Main results	Methodological description	Level of Evidence
MEDLINE, Lofgren, ET.	2017	To evaluate the impact of interventions, of universal contact precautions to prevent the transmission of infections in intensive care units.	Staphylococcus aureus resistant to methicillin (MRSA)	Scenarios in which using contact precautions resulted in fewer visits for the patients, there is an average reduction in the MRSA acquisition rate of 37%. MRSA can be transmitted by surface contamination as well as direct contact, the contamination of the surface is modeled indirectly by the definition of the contact between patients and health professionals and/or visitors.	Randomized clinical trial of interventions based on behavior.	II
MEDLINE, Doan, TN	2017	To characterize the transmission dynamics of <i>A. baumannii</i> using mathematical modeling	<i>Acinetobacter baumannii</i>	The need to optimize the infection control in the ICUs was evidenced, in order to avoid situations of cross infection. About 96-98% of the Hospital Infection acquisition was due to cross-transmission between patients. Infection control interventions aimed at reducing the cross-border transmission, such as hand hygiene and contact precautions substantially reduce the propagation of <i>Acinetobacter baumannii</i> .	Randomized Clinical Trial	II
MEDLINE, Jain, R	2011	To analyze the effect of the MRSA Prevention Initiative	MRSA	A universal surveillance program, contact precautions, hand hygiene and change in the institutional culture was associated with a decrease in transmission and infection. The active Surveillance identified more than 90% of the MRSA patients who would have been lost only with clinical cultures.	Randomized Clinical Trial	II
MEDLINE, Huang, S.S	2006	To analyze the impact of sequential implementation of 4 infection control interventions on the MRSA bacteremia	MRSA	The routine surveillance for MRSA in ICUs allowed the early initiation of the adoption of contact precautions and was associated with significant reductions in the incidence of MRSA bacteremia in ICUs and throughout the hospital	Retrospective cohort study	IV
PUMED Kardas-Sloma et al	2017	To evaluate the cost-effectiveness of hospital strategies to prevent the transmission and infections by Enterobacteriaceae producing extended-spectrum beta-lactamase (ESBL-PE).	Escherichia coli and Klebsiella pneumoniae	Universal approach with better compliance with Hand Hygiene (HH) and adoption of contact precautionary measures was the most economical strategy to avoid the transmission of ESBL-PE in an ICU environment. Screening and cohort carriers had comparable efficacy to the improvement of HH, but it was more expensive.	Randomized clinical trial	II
PUBMED, GiuffrèM et. al	2016	To describe the incidence and trends of the colonization of Gram-negative Multi-Resistant Bacilli and the characteristics of the most prevalent organisms and to identify the risk factors for colonization	Escherichia coli and Klebsiella pneumoniae	The main risk factor identified for the colonization was the number of days spent in the Neonatal Intensive Care Unit (Neo ICU). In addition, the parenteral nutrition was also significantly associated with the acquisition of Gram-negative Multi-Resistant Bacilli.	Prospective cohort study	IV
PUBMED, Peterson LR et al	2016	Examine the impact of hospital decolonization as a complement to contact precautions	<i>Staphylococcus aureus</i>	The increase in the decolonization increases the risk of unnecessary development of antibiotic resistance. In addition, it raises the cost and adds another task for healthcare professionals when providing care to their patients.	Randomized clinical trial	II
PUBMED, Derde LPG et al	2014	To evaluate the interventions to reduce the colonization and transmission of antimicrobial resistant bacteria in European ICUs	Vancomycin Resistant Enterococo and MRSA (VRE)	Hand hygiene combined with chlorhexidine bath was associated with a reduction in the acquisition of antimicrobial resistant bacteria, mainly the reduction of the MRSA acquisition. The same interventions did not reduce the VRE acquisition. The implementation of contact precautions for carriers identified by chromogenic screening or PCR had no incremental effect on acquisition.	Randomized clinical trial	II
PUBMED, Gurieva T et al,	2013	To analyze and compare the effects and costs of different screen and isolate (S & I) strategies, with a special emphasis on such strategy in ICU populations.	<i>Staphylococcus aureus</i>	The universal screening at the hospital admission corroborated the decline both in hospital-wide prevalence and in the MRSA ICU. The cost of screening strategies depends critically on the effectiveness of the infection prevention measures taken when a MRSA carrier is detected.	Randomized clinical trial	II
PUBMED, Huskins WC et al,	2011	To assess the effect of surveillance for MRSA and Vancomycin Resistant Enterococcus (VRE)	MRSA and VRE	The intervention was not effective in reducing the MRSA or VRE transmission, as there was no effective adherence to the precautions. There is a need for better adherence of professionals to precautions, besides the adoption of interventions that reduce the incidence of MRSA or VRE, such as environmental decontamination.	Randomized clinical trial	II

Also, the high workload, the discomfort of the PPE and the underestimation of risk, allergies and inadequate knowledge about precautions determines the non-compliance. The institution is also decisive when it makes available insufficient PPE. Regarding the work process, it is important there is organization of the environment, favorable conditions of work, leadership involved with safety and organizational climate (Ferreira *et al*, 2009). All the contact precaution standards must be adopted in full, such as: hand hygiene, the use of apron and gloves, isolation in private room or with the necessary distances as established in International Guidelines (Oliveira, *et al* 2010, Siegel *et al*. 2007). The findings showed that the precautions of contact, when properly followed, served as a barrier to the dissemination of MSRA (Peterson *et al*, 2016) and a substantial reduction in the spreading of *Acinetobacter baumannii* (Doan, 2017). The adherence of ICU contact precautions combined with active surveillance corroborates the decrease in HI indexes throughout the hospital institution (Lofgren 2017, Doan 2017, Kardas-Sloma 2017, Giuffr  2016, Peterson 2016, Derde 2014, Gurieva 2013, Huskins 2011, Jain 2011, Huang 2006). Due to the complexity of the care profile of ICUs that need continuous monitoring and support of their vital functions (Souza, 2016). The HIs acquired in this sector differ from those present in other hospital units, in addition to occurring more frequently, infection sites are typical, as well as the microorganisms involved.

The main risk factor identified for the colonization by multiresistant bacteria (*Escherichia coli* e *Klebsiella pneumoniae*) was the time of ICU stay. Studies have shown that the mortality rate associated with HI varies significantly with the causative agent, with 70 to 80% involving multiresistant microorganisms, such as *Pseudomonas*, *Acinetobacter* e *Staphylococcus* resistant to Methicillin (Lofgren 2017, Doan 2017, Kardas-Sloma 2017, Giuffr  2016, Peterson 2016, Derde 2014, Gurieva 2013, Huskins 2011, Jain 2011, Huang 2006). The literature showed that the use of antibiotics and length of hospital stay were significantly associated with colonization by Gram-negative Multi-Resistant Bacilli in the ICU (Giuffr , 2016). It is important to emphasize the indiscriminate use of antibiotics promoting bacterial resistance. This problem, in addition to affecting the patient who uses it, also affects the microbiota of the hospital environment, resulting in prolonged hospitalization, increased expenses with morbidity and mortality (Carneiro, 2011). Regarding the hospitalization time, a prospective cohort study developed in a hospital in Rio de Janeiro, with 355 patients, showed that the permanence in the ICU increases the probability of occurrence of adverse events. Long hospital stay periods favor the emergence of HIs such as primary bloodstream infections, pneumonia, and central vascular access infection (Roque, 2016). Maintaining the biologically safe environment is paramount, patients' devices (fixed or mobile equipment), real estate and architectural layout, because they represent a low risk of infection they can be underestimated as vehicles for cross-infection in a hospital environment (Ferreira *et al*. 2013, Ferreira *et al*. 2015).

An integrative review study identified pathogenic bacteria on the surface of major non-invasive monitoring devices, including strains of infectious outbreak bacteria (Neves, 2018). In the hospital context, several care circumstances are identified, which may result in infection risks. Thus, patient safety depends on the adoption of measures that minimize

adverse events. In addition to adherence by professionals to the contact precautions, it is essential that the family member collaborate with industry-standard precautions during the visits to maintain the care quality (Lofgren, 2018). Encouraging the presence and participation of family members in care promotes education and responsibility for safety routines. Regarding the use of an apron, mask and caps by relatives during the hospital visits, the findings were insufficient. Hand hygiene is the most adopted and staff-oriented procedure as a safety measure, however, according to Peres (2018) there are difficulties in maintaining this orientation and supervision because of the difficulty in constraining the family member and the impossibility of supervision. For this author, it is important that the education of both professionals and companions and family members is carried out (Lofgren 2018, Peres 2018). The study pointed to the scarcity of research on the subject that portrayed strong evidence demonstrating a knowledge gap. In view of this, although few data were found in the literature on the use of contact precautions by health professionals in ICUs, it can be seen that establishing infection control priorities in hospitals is a matter of enabling the efficient allocation of scarce resources and ensuring the quality of patient care and safety.

### Final Considerations

The limitations of the research are in the searched sources, where it was chosen to search the sources mentioned in the description of the method, being a motivation for other studies the expansion of the databases. Still, a reduced number of publications identified can be seen as an alert for the need to produce research that brings results and reflections on the importance of the theme to the academy itself. The findings on the prevention of HIs have shown that the adherence to precautionary measures, protocols and norms reduces the incidence of HI, however, there are barriers that make it difficult to operationalize actions. In order to prevent infections, it is necessary to systematize actions and intensive monitoring of all the care processes, as well as risk management to anticipate the problem, which includes the controlled use of antibiotics, health education, and permanent education focused on the use of precautionary measures. It is important to highlight that the organization of the services, lack of leadership or attitudes that modify the reality of the environment, also become of great value in the control of HIs.

### REFERENCES

- Anderson DJ, Gergen MF, Smathers E, Sexton DJ, Chen LF, Weber DJ, Rutala WA 2013. Decontamination of targeted pathogens from patient rooms using an automated ultraviolet-C-emitting device. *Infect Control Hosp Epidemiol*, v.34, n.5, p:466-471.
- Carneiro M. *et al*. 2011. O uso de antimicrobianos em um hospital de ensino: uma breve avalia o. *Rev. Assoc. Med. Bras.*, S o Paulo, v. 57, n. 4, p. 421-424.
- Costa M, Silva WN 2018. Investiga o dos principais microrganismos respons veis por infec es nos com cios em UTIs Neonatais: uma revis o integrativa. *Refacer*, v.7, n.1, 2018.
- Derde LPG *et al*. 2014. Interventions to reduce colonisation and transmission of antimicrobial-resistant bacteria in intensive care units: an interrupted time series study and cluster randomised trial. *Lancet Infect Dis*. v.14, n.1, p:31-39.

- Doan TN, Kong, DCM; Marshall C, Kirkpatrick CMJ, McBryde ES 2015. Characterising the Transmission Dynamics of *Acinetobacter baumannii* in Intensive Care Units Using Hidden Markov Models. *PLoS One*, v.10, n.7: e.0132037.
- Ferreira AM, Andrade D, Rigotti MA, Almeida MTG, Guerra OD, Santos Junior AG. 2015. Assessment of disinfection of hospital surfaces using different monitoring methods. *Rev. Latino-Am. Enfermagem*. v.23, n.3, p:466-474.
- Ferreira AM, Barcelos LS, Rigotti MA, Andrade D, Andreotti JT, Almeida MG 2013. Areas of hospital environment: a possible under-estimated microbe reservoir? – integrative review. *Rev enferm UFPE online*, v.7(esp), p:4171-4182.
- Ferreira MD *et al.* 2009. Adhesión de los personales de salud a las precauciones estándar: una revisión integradora de la literatura. *Rev enferm UFPE online*. V.3, n.4, p:1042-1049.
- Giuffrè M, Geraci DM, Bonura C, Saporito L, Graziano G, Insinga V, Aleo A, Vecchio D, Mammina C. 2016. The Increasing Challenge of Multidrug-Resistant Gram-Negative Bacilli: Results of a 5-Year Active Surveillance Program in a Neonatal Intensive Care Unit. *Medicine (Baltimore)*, v.95, n.10:e3016.
- Gurieva T, Bootsma MC, Bonten MJ. 2013. Cost and effects of different admission screening strategies to control the spread of methicillin-resistant *Staphylococcus aureus*. *PLoS Comput Biol*. v.9, n.2:e1002874.
- Huang SS *et al.* 2006. Impact of routine intensive care unit surveillance cultures and resultant barrier precautions on hospital-wide methicillin-resistant *Staphylococcus aureus* bacteremia. *Clin Infect Dis*. v.43, n.8, p: 971-978.
- Huskins WC, Huckabee CM, O'Grady NP, Murray P, Kopetskie H, Zimmer L, Walker
- Jain Rajiv *et al.* 2011. Veterans Affairs initiative to prevent methicillin-resistant *Staphylococcus aureus* infections. *N Engl J Med*. v.364, n.15, p: 1419-30.
- Kardaś-Słoma L, Lucet JC, Perozziello A, Pelat C, Birgand G, Ruppé E, Boëlle PY, Andremont A, Yazdanpanah Y. 2017. Universal or targeted approach to prevent the transmission of extended-spectrum beta-lactamase-producing Enterobacteriaceae in intensive care units: a cost-effectiveness analysis. *BMJ Open*. v.7:e017402.
- Keroulay ER, Tonini T, Melo ECP 2016. Eventos adversos na unidade de terapia intensiva: impacto na mortalidade e no tempo de internação em um estudo prospectivo. *Cad. Saúde Pública*, v.32, n.10: e00081815.
- Knelson LP, Williams DA, Gergen MF, Rutala WA, Weber DJ, Sexton DJ, Anderson DJ (2014). A Comparison of Environmental Contamination by Patients Infected or Colonized with Methicillin-Resistant *Staphylococcus aureus* or Vancomycin-Resistant Enterococci: A Multicenter Study. *Infect Control Hosp Epidemiol*, v.35, n.7, p:872:875.
- Lofgren, Eric T 2017. Estimating the impact post randomization changes in staff behavior in infection prevention trials: a mathematical modeling approach. *BMC Infect Dis*; n.17, p: 539.
- Majeed BA, Suleiman Z, Bola AA, Gbenga H. 2018. Knowledge, awareness and practice of infection control by health care workers in the intensive care unit of a tertiary hospital in Nigeria. *African Health Sciences*. v.18, n.1.p.72-78.
- ME, Sinkowitz-Cochran RL, Jernigan JA, Samore M, Wallace D, Goldmann DA 2011. Intervention to reduce transmission of resistant bacteria in intensive care. *N Engl J Med*. v.364, n.15, p:1407-1418.
- Melnik MB, Fineout-Overholt E 2011. Evidence-based practice in nursing and healthcare - a guide to best practice. Second edition. *Elsevier Saunders*. USA.
- Neves RPS, Santo FHE 2018. Dispositivos de monitorização não invasivos como veículos de infecção cruzada: revisão integrativa. *Enferm. Foco* 2018, v.9, n.3, p: 19-24.
- Oliveira AC, Cardoso CS, Mascarenhas D 2010. Contact precautions in Intensive Care Units: facilitating and inhibiting factors for professionals' adherence. *Rev. esc. enferm. USP* v.44, n.1, p:159-163.
- Peres MA, Wegner W, Kantorski KJC, Gerhardt LM, Magalhães ANM (2018). Perception of family members and caregivers regarding patient safety in pediatric inpatient units. *Rev Gaúcha Enferm*. v.39:e2017-0195.
- Peterson LR, Wright MO, Beaumont JL, Komutanon V, Patel PA, Schora DM, Schmitt BH, Robicsek A 2016. Non-impact of Decolonization as an Adjunctive Measure to Contact Precautions for the Control of Methicillin-Resistant *Staphylococcus aureus* Transmission in Acute Care. *Antimicrob Agents Chemother*. v.60, n.1, p:99-104.
- Piai-Morais TH, Orlandi FS, Figueiredo RM (2015). Factors influencing adherence to standard precautions among nursing professionals in psychiatric hospitals. *Rev Esc Enferm USP*. v.49, n.3, p:473-80.
- Qadeer A, Akhtar A, Ain AU, Saadat S, Mansoor S. *et al.* 2016. AntibioGram of Medical Intensive Care Unit at Tertiary Care Hospital Setting of Pakistan. *Cureus*. v.8, n.9: e809.
- Siegel JD, Rhinehart E, Jackson M, Chiarello L and the Healthcare Infection Control Practices Advisory Committee 2007. Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Healthcare Settings. Disponível em <http://www.cdc.gov/ncidod/dhqp/pdf/isolation2007.pdf>.
- Sobreira MGS, Bezerra IP, Araujo PCB, Rozendo RPA *et al.* 2018. Prevention of nosocomial infections in intensive care unit: analysis of professional knowledge. *International Journal of Development Research*. v.8, n.10, p: 23613-23616.
- Sousa AFL, Oliveira LB, Moura MEB (2016). Perfil epidemiológico das infecções hospitalares causadas por procedimentos invasivos em unidade de terapia intensiva. *Rev. Pre. Infec e Saúde*, v.2, n.1-2, p. 11-17.
- Souza NR, Almeida OP, Peixoto PB, Ferreira LA *et al.* 2018. Bloodstream Infections in Hospitalized Patients in Critical Care Units from a Brazilian Public Hospital. *International Journal of Development Research*. v.8, n.10, p: 23372-23376.
- Vecchio D, Mammina C. 2016. The Increasing Challenge of Multidrug-Resistant Gram-Negative Bacilli: Results of a 5-Year Active Surveillance Program in a Neonatal Intensive Care Unit. *Medicine (Baltimore)*. v.95, n.10:e3016.
- World Health Organization -WHO. 2007. 10 Facts on Patient Safety. From [https://www.who.int/features/factfiles/patient\\_safety/en/](https://www.who.int/features/factfiles/patient_safety/en/). Accessed