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REVIEW ARTICLE

Usability of biomedical technologies in the Intensive Care Unit and their influence on nursing care

Usabilidad de las tecnologías biomédicas en la Unidad de Cuidados Intensivos y su influencia en los cuidados de enfermería

Usabilidade das tecnologias biomédicas na Unidade de Terapia Intensiva e sua influência na assistência de enfermagem

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Abstract

The aim was to describe the usability of biomedical equipment in nursing care for critically ill patients in the Intensive Care Unit. This is an integrative literature review, with an exploratory nature and a qualitative approach. Data collection was performed in the Virtual Health Library and the final sample consisted of 8 articles with full texts, published between 2016 and 2021, available in Portuguese and English in the LILACS and BDENF databases. It is concluded that medical care equipment makes it possible to make the practice of care more humanized and integrated. However, for this to occur, interaction and adequate equipment-professional communication are essential for the correct use of technologies and enjoy their potential benefits in nursing care for critically ill patients.

Descriptors: Biomedical Technology; Intensive Care Units; Nursing Care; Patient-Centered Care; Alert Fatigue, Health Personnel.

Resumén

El objetivo fue describir la usabilidad de los equipos biomédicos en la atención de enfermería al paciente crítico en la Unidad de Cuidados Intensivos. Se trata de una revisión de la literatura integradora, con carácter exploratorio y enfoque cualitativo. La recolección de datos se realizó en la Biblioteca Virtual en Salud y la muestra final estuvo conformada por 8 artículos con textos completos, publicados entre 2016 y 2021, disponibles en portugués e inglés en las bases de datos LILACS y BDENF. Se concluye que el equipamiento médico permite humanizar e integrar la práctica asistencial. Sin embargo, para que esto ocurra, la interacción y la adecuada comunicación equipo-profesional son fundamentales para el correcto uso de las tecnologías y gozar de sus potenciales beneficios en la atención de enfermería al paciente crítico.

Descriptores: Tecnología Biomédica; Unidades de Cuidados Intensivos; Atención de Enfermería; Atención Dirigida al Paciente; Fatiga de Alerta del Personal de Salud.

Resumo

Objetivou-se descrever a usabilidade dos equipamentos biomédicos no cuidado de enfermagem ao paciente crítico na Unidade de Terapia Intensiva. Trata-se de uma revisão integrativa da literatura, de cunho exploratório e abordagem qualitativa. A coleta de dados foi realizada na Biblioteca Virtual em Saúde e a amostra final composta por 8 artigos com textos na integra, publicados entre o ano de 2016 e 2021, disponibilizados nos idiomas português e inglês nas bases de dados LILACS e BDENF. Conclui-se que os equipamentos médicos-assistenciais possibilitam tornar a prática do cuidar mais humanizada e integralizada. Contudo, para que isto ocorra, a interação e adequada comunicação equipamento-profissional se faz indispensável ao correto uso das tecnologias e desfrute de seus potenciais benefícios na assistência de enfermagem ao paciente crítico.

Descritores: Tecnologia Biomédica; Unidade de Terapia Intensiva; Cuidado de Enfermagem; Assistência Centrada no Paciente; Fadiga de Alarmes do Pessoal de Saúde.

Introduction

Technologies in health services consist of technological application aimed at solving medical problems, dividing them into hard, light-hard and light. Hard technology, also called biomedical technologies, consists of equipment and furniture, considered concrete materials for the provision of care. On the other hand, the light-hard one includes structured and specific knowledge of operationalization in health, also known as knowledge-technology. And light technology, which is represented by communication, reception, qualified listening, and the creation of a bond, which enables the development of trust and respect, necessary in the care process[1].

The Intensive Care Unit (ICU) represents an indispensable scenario for the care and recovery of the health of critically ill patients and, therefore, constitutes the sector of the hospital environment that has the most advanced technologies in health, favoring continuous monitoring, maintenance of vital signs, precision in measuring the content to be administered, among other applications of medical-assistance technology, which favor the realization of this complex care, requiring specific specialization and qualification from the nursing professional for the development of their care[2].

The mechanization of care can be understood as the automation of care, where the focus of the nursing professional's attention culminates in being primarily directed to the development of techniques and the pathology to be treated, to the detriment of the biopsychosocial and spiritual being who is also ill and, therefore, it needs to be welcomed and cared for in all its dimensions. Even in the Intensive Care Unit, where the complexity of care is combined with so many technologies available for the recovery of critically ill patients, this being remains the focus of care to achieve comprehensive care[2].

The inappropriate use of medical care equipment represents an inherent risk factor for the patient's health in the hospital environment, being drastically amplified when inserted in the context of the Intensive Care Unit, where the dependence on biomedical technology for the maintenance of life increases considerably. However, studies show that most of the occurrences of these adverse events could have been avoided through the adoption of safety measures for the hospitalized patient, for the monitoring and prevention of damage to health in care. One of the main strategies to improve the quality of care in the ICU environment is training managed by the permanent education team of health institutions[3,4].

The humanization of care in the Intensive Care Unit consists of developing care in a safe, comprehensive, and individualized way, meeting the subjectivities of each patient, aiming to offer physical, psychological, and spiritual comfort, in search of full recovery of their health. The ICU is characterized as a traumatizing environment, due to the procedures and interventions developed in it to meet the needs of the clinical conditions found in this sector, bringing distress both to the patient and to their families[5].

This study aimed to describe the influence of the usability of biomedical equipment in nursing care for critically ill patients in the Intensive Care Unit. Therefore, this study is considered relevant to elucidate the knowledge of nursing professionals on the subject and to expand their perception of the aspects involving critical patient safety, as well as the importance of maintaining humanization and comprehensiveness. of care, even in the face of so many technologies available to carry out this care, aiming to describe the effects of the usability of biomedical equipment in nursing care for critically ill patients in the Intensive Care Unit.

Thus, it is expected that this study contributes to the understanding of professional nurses on this topic, which constitutes a public health problem denoted through the National Humanization Policy and the National Patient Safety Program, awakening them to the need for expand their perception of the risks of mechanization of care, which may emerge from the various biomedical technologies available for carrying out critical patient care in the Intensive Care Unit, which may compromise the safety of the care provided. In addition, reaffirming the importance of preserving comprehensiveness and humanization in nursing care, developing care that conveys trust, security, welcoming and respect, carrying out an approach focused essentially on the patient and not just on the pathology presented by him.

Methodology

This is an integrative literature review, with an exploratory nature and a qualitative approach, as it consists of the synthesis of previously published studies to promote a deeper understanding and expand knowledge on the topic addressed, responding more subjectively to the question. formulated[6-8].

The literature review was carried out following the six phases of the integrative review and the guiding question formulated using the PICo strategy, which represents an acronym for problem/interest/context, being summarized in the following question according to the components denoted as the usability of technologies Biomedical techniques can influence the safety of critically ill patients and the humanization of nursing care in the Intensive Care Unit?[9,10]

Data collection was performed on the Virtual Health Library (VHL) database platform, using the descriptors Biomedical Technology, Intensive Care Unit and Nursing Care. The texts made available in full, published in the period 2016 to 2021 and in Portuguese, English, and Spanish, were included. The period delimitation criterion was performed to obtain sufficient articles for this research. According to the descriptors used, the combination with the Boolean operator AND was performed for the search strategy. The selection of studies to compose the review took place in March 2021.

The exclusion criteria adopted were the elimination of duplicate articles and the disregard of studies that disagreed with the desired theme. After this process, data collection was completed, obtaining a total of 8 final articles, available in the databases for the discussion of results.

The treatment of the results obtained was carried out through the content analysis of Bardin[11].

Results and Discussion

Benefits of biomedical technologies in critical patient nursing care

Technologies applied to health care have shown relevant indispensability, especially when inserted in the Intensive Care (IT) sector, for the monitoring and implementation of critical patient care. By providing accurate and continuous information about their hemodynamic status, it allows for quick intervention when it disagrees with the parameters consistent with the maintenance of life, guiding the conducts to be developed by the nursing team, based on objective data. It is also indisputable that biomedical technologies enable the planning and organization of care through the information provided, directing nursing care to its fundamental needs[12].

In addition to the benefits related to clinical practice, the data from the analyzed studies also demonstrate that the correct usability of biomedical technologies favors communication and contributes to the humanization of care, by enabling a more qualified time management based on the development of faster actions and accurate. This optimization of time provides opportunities for dialogue between the team, which positively reflects on the quality of care and dedication to subjective aspects of care, through the interpersonal relationship with the patient and support for the family, providing the creation of a bond that will allow them achieving comprehensive care in the process of recovering autonomy and preserving human dignity[12].

Negative impacts associated with biomedical technologies in the Intensive Care Unit

Although the inclusion of technologies in the care of critically ill patients has shown significant expressiveness, their presence in this sector has been associated with aspects of risk to patient safety. Studies show that, simultaneously with the communication exercised, the alarms of medical-care equipment are related to the high level of noise detected in the ICU, raising levels above those recommended by the Brazilian Association of Technical Standards (ABNT), contributing to the reduction of attention in the team, lack of concentration and stress, making the environment more susceptible to failures, with a latent capacity to compromise the quality and safety of care. A survey carried out with the aim of identifying the factors that generate alarms among electromedical devices showed that the multiparameter monitor was the equipment that most alarmed, with blood pressure as the main triggering factor[13].

The risks of damage arising from the engineering and construction of equipment also showed a significant character in the assessment of the impact caused by technologies on IT, becoming even more evident when the patient depends on them to, in addition to continuous monitoring, perform the maintenance of their functions vital, being considered the main cause of potentially fatal incidents. These dysfunctions are most related to the absence of prior maintenance and obsolescence, given the constant technological advances[14].

As the care process for critically ill patients is mostly mediated by this equipment, due to the specificity of the necessary care, when faulty devices occur in the medication administration process through the infusion pump, the lack of adequate oxygenation as a result of the malfunction of ventilation devices or the absence of triggering the monitor alarm in the face of hemodynamic changes, makes it impossible to quickly intervene in the face of a clinical change, compromising patient safety and possibly causing irreversible damage[15].

Among the impacts caused because of the design of the equipment, studies show that the size of the monitor screens proved to be the main interference agent in their correct handling. Factors associated with the size, shape and spacing of the buttons, in addition to the reversion to standard mode without warning, constituted failures related to the use of the technology. These manufacturing errors are revealed in the construction of equipment out of specifications or when they do not comply with the environment of its application and usage needs, incurring in conceptual errors[16].

It was also found that another risk factor occurred because of potential damage from failure to charge the batteries, which are essential for the use of portable equipment for transporting the patient. This complication was present even when the batteries were fully charged, acting as a generator of insecurity for nurses, stress, and questions about their professional capacity, as well as the imminent compromise of patient safety, having been identified as an agent cause of serious adverse events[17].

Another aspect observed was the dependence developed by professionals on the information provided by this equipment, culminating in the distance between nurse-patient and the mechanization of care, by prioritizing the data provided by the devices to the detriment of the individualized clinic, through the adoption of standardized parameters, as revealed by data from a survey carried out with intensive care nurses in an analysis in the light of social representations[12].

Professional aspects related to risks arising from the poor usability of biomedical Technologies

When analyzed according to professional performance, studies identified the existence of risks to patient safety, related to the inappropriate use of biomedical equipment. Among them, alarm fatigue was the triggering factor for adverse events with the greatest potential for causing harm. A survey carried out in a clinical adult ICU showed that the alarms remained for up to 10 minutes without the intervention of any professional, revealing that more than 66% of the investigated alarms became fatigued. In addition, in more than 15% of the triggers there was an alarm silencing procedure and in only 16.5% there was a professional evaluation and intervention, and only less than 5% of the triggers did not demonstrate any clinical relevance for the benefit of the patient. Therefore, alarm fatigue represents the existence of a

professional desensitization to the relevance of these signs and has been identified as responsible for incidents in the intensive care sector[13,14].

Aiming to assess the lapses and slips made by nurses in the use of the infusion pump, a research based on the application of James Reason's theory of human error observed that failures related to the incorrect handling of this machinery stood out among the reports presented. Mistakes in the insertion of values and schedules, causing discrepancies between medical prescriptions and what was being offered to the patient, as well as forgetting to go back to infusion after the completion of procedures, exposes the patient to serious compromises. It should be noted that, after these complications, the patient was deprived of nutrients and medications, reflecting on his clinical condition and, consequently, on his possibility of recovery. Above all, it is noteworthy that these lapses were associated with overconfidence, forgetfulness, and professional inattention, confirming the theory applied in the research, the influence of human factors on the quality of usability of technologies in critical patient care[17].

The standardization of parameters to be measured by biomedical equipment constitutes the context of inexact applicability of technologies and highlights the underutilization of the beneficial technological potential in nursing care in IT. By adopting the same physiological values for monitoring all patients, the professional reduces the probability of success in their therapeutic care and dissipates the opportunity to meet the patient's subjectivities, which would increase the quality of their care. This conduct also expresses the depersonalization in the care provided to critically ill patients, where it should occur individually, aiming to meet their clinical condition and pathological need, generating concerns about the use of technologies in the ICU and its implications for patient safety[13,17].

Deficiencies in technical-scientific qualification has jointly been shown to inhibit the benefits made possible by the application of biomedical technologies in critical patient care. Studies confirm that when nurses master knowledge and establish an understanding of the technological language of the equipment made available for the implementation of their care, this technology is shown to be beneficial and essential in the process of rescuing autonomy and preserving human dignity. But when the nurse is unprepared to deal with this equipment, the technological devices may incorporate the representation of incapacity, fear, stress, and professional suffering, reflecting on the development of their care and resulting in implications for the protection and safety of the patient, through actions capable of producing unwanted effects and providing for the occurrence of adverse events, even compromising ethical and legal aspects of care[18].

Strategies to prevent adverse events resulting from the use of biomedical technologies in IT

The studies analyzed show the urgency of implementing actions aimed at supplying the weaknesses that lead to the occurrence of adverse events in IT, because of the usability of technologies in this sector. The management of biomedical equipment has proven to be an efficient instrument in preventing damage and making the most of the technological potential, as it allows for planning and anticipating failures, promoting error-free assistance. Also in this analysis, another study suggests that the participation of nurses specialized in IT in the assessment and acquisition of these technologies could be efficient in reducing failures in care practice related to engineering and equipment designers. The partnership between the nursing team and technical support would also be able to promote positive effects, from the quick intervention in the event of equipment failure or defect[15,16,19].

Contributing to the management of technologies, the use of checklists and reports in the verification and registration applied to the control of medical-assistance equipment, also demonstrated express effectiveness in promoting patient safety. With periodic reviews and preventive maintenance, as well as the previous checking of the conditions of the devices for use, it was identified that the quality of care was positively impacted by the proper functioning of technological devices, reducing the occurrence of incidents, including during the need to transport the patient due to the advance preparation of the equipment, not incurring in violations in the planning regarding the autonomy of the batteries. These data corroborate the premise that technologies come to contribute to nursing care and provide qualified care, when correctly managed[14,19].

Based on the understanding that human beings are admittedly fallible, an integrative literature review suggests the creation of systems capable of anticipating these errors to identify them before they cause harm to the patient, as well as to analyze the circumstances that provided the risk of its conception. Identifying and anticipating error latency conditions, whether related to human or material resources, exemplify evident characteristics of quality in management. Another study indicates that to prevent violations, it is necessary to create defensive barriers that will intercept the error, before they cause damage, providing for the maintenance of patient safety. This aspect is observed through the metaphor of Swiss cheese, which analogously explains how the presence of holes in protective barriers can trigger incidents when they are found.[14,16,17].

By pointing out the inappropriate use of equipment as the main cause of the occurrence of adverse events in IT, the studies analyzed point to deficiencies in the training, training, and experience of professionals to deal with biomedical technologies in critical patient care, as responsible for 54 % of errors. Since there is a need, by assuming this responsibility, to ensure harm-free care in accordance with the legislation that governs this profession, the lack of scientific knowledge and preparation in intensive care influences the ability to deliberate correctly in the face of the challenges inherent in this sector. hospital. Therefore, the implementation of permanent education programs, aimed at professional training, promotes the development of skills. It is also possible to count on the creation of protocols and routines in the standardization of procedures

and work direction to prevent forgetfulness and failures that lead to the occurrence of adverse events[17].

Nursing actions to promote quality in care and patient safety in the ICU

Since the incidence of adverse events in IT proved to be multifactorial, there was a need to develop a broader view of the mechanisms and actions capable of promoting quality in nursing care, ensuring harm-free care for critically ill patients. It is evident through research with nurses, high rates of violations of rules and recommendations aimed at promoting safety in operating procedures. Therefore, it is essential to understand the aspects associated with this conduct of violation[14].

Understanding professional behavior, attitudes that lead to violations of recommended practices and that this is the beginning of a process that tends to culminate in error, a diagnostic assessment of the skills and difficulties presented by the nursing team regarding usability of biomedical technologies. This action allows us to identify and intervene in the weaknesses of professional competence through training and continuing education, before they can incur damage, keeping the environment safe and creating a culture of patient safety[14,19].

The quality of care is perceived by the availability of professional interaction. Therefore, the development of a promising therapeutic relationship favors the process of bonding and humanization in care through the implementation of welcoming actions, which are expressed, among others, in the attention to the patient's emotional demands, in the realization of self-care and respect for the right to privacy, even in the IT environment, enabling nurses to achieve comprehensiveness in their care, ratifying interaction as an essential technology[15,18].

These welcoming actions are also expressed in the correct and resolute decisions of nurses, which enable the recovery of autonomy and full recovery of the patient's health. When this professional seeks the improvement necessary for the proper use of biomedical technologies and applies it to achieve the desired results in their care, they reveal their ethical-professional values, promoting quality in care and patient safety, placing it as a central focus of your interventions[15,18].

Developing communication skills is also configured as a nursing action capable of promoting patient safety in the ICU, as approximately 70% of the complications identified in the studies were due to communication failures. This process is applied in the transmission of information inherent to care and favors the planning of actions in the implementation of care, ensuring its effective continuity and, therefore, a constituent part of the patient safety protocol[14,18].

Effective communication is also revealed in the therapeutic relationship established with the patient's family support network and social life, promoting information about their clinical status, capable of producing clarification and alleviating anxiety, in addition to reducing insecurity arising from the uncertainties that are characteristic of this hospital sector. In addition, enabling the patient-family interaction in the IT environment eases the pain and suffering caused by social distancing. Asking family members to provide music that is good for the patient, as well as speaking positive and encouraging words, even if the patient is sedated or intubated, also represents a way of using technologies in favor of health, promoting humanization[14,18].

Conclusion

Nursing is a science with transcendent evolution over the years, denoted through solidified knowledge that adapts to constant changes in the health area, contributing to the improvement of care, in a systematic and comprehensive way. When associated with biomedical technologies currently available for the provision of care in the ICU, nursing care works together to promote and recover the patient's health, directing care to their clinical condition, aiming at their full rehabilitation.

It is evident that such technologies corroborate the development of qualified care, enabling the time allocated to activities to be better managed and, thus, actions related to subjective aspects of care can also be developed. In addition, it was found that the insertion of biomedical equipment in this hospital sector, provides the rescue of autonomy and helps to preserve life. It is reiterated that the ICU is the hospital sector with the highest prevalence of hard technologies. However, this does not exclude the need for the intertwining of light and light-hard technologies in the use of equipment, since it is essential to consolidate the insertion of the three levels of technologies so that comprehensive, individual, and humanized care is developed.

The patient is in a situation of vulnerability, in such a way as to depend on the care of the health professional and biomedical equipment partially or totally, so it is important that the creation of a bond and embracement, of the patient and their families, is part of the assistance provided by the nursing team. The humanization of care in IT is expressed through the therapeutic relationship, respect, trust, touch and qualified listening, as well as, through the professional effort to develop a carefree of damage, responsibility in the pursuit of knowledge and competence, so that the patient regains your autonomy and get your recovery as soon as possible.

To this end, there is a need to raise awareness of the nursing team, regarding the recognition of human fallibility and the risks of overconfidence. Considering the relevance of medical-assistance equipment alarms in providing adequate care to the needs of the critical patient, preventing them from becoming fatigued, prevents essential care from not being provided. Adapting the monitoring parameters according to the clinical condition presented by the patient, developing care in an individualized manner, also reflects professional commitment. In addition, giving due attention and care in the insertion of values to be infused, as well as, in the preparation of these medications, makes it possible to anticipate the error, promoting a safe and favorable environment for the patient's recovery.

Therefore, the need for constant improvement of the nursing team through training and continuing education is ratified, so that the patient obtains efficient care and free from damage resulting from preventable adverse events, arising from the inadequate usability of technologies in health care. It is up to the managers of these units to identify the weaknesses in care to offer training and encouragement to the team, so that the professional-technology relationship occurs effectively. It is also necessary to create and implement protocols and checklists to verify and check the proper functioning of medical-assistance equipment, thus preventing the occurrence of failures due to the need for use.

Aiming at a more suitable environment for the recovery of highly complex patients and the professional practice of nursing, it was observed that it is necessary to develop planning and communication actions to contribute to teamwork and continuity in care, preventing the occurrence of errors and adverse events that cause harm to the hospitalized client. Thus, it is necessary to develop communication with the patient's family support network, promoting humanization through integrated care, meeting their needs in all dimensions. It is essential to offer adequate working conditions, providing human and material resources that prevent professional overload, identified as a generator of inattention and recklessness in the act of caring.

Therefore, the importance of complementing this research is highlighted, based on other studies, aiming to broaden the understanding of this topic with a focus on the usability of biomedical technologies in the ICU, given the constant advances and numerous technological options available to assist in the treatment and recovery of patients in this hospital sector and how its inappropriate use can influence the quality of care provided and the safety of critically ill patients.

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