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Abstract

The process of traceability by radio frequency identification system (RFID) is considered one of the biggest contributions of the last years in the health sector. This article aims to study the academic contributions that this technology has brought to the segment in question and the consequent difficulties resulting from the implementation of this technology in the ambit of hospital and outpatient facilities. To carry out this work, we proceeded to survey and literature review in order to select the research related to the topic of RFID in the context of traceability. The data obtained clearly show that the benefits of this tool are numerous, ranging from drug screening to the correct availability of patient data. Although it is imbued with all these advantages, RFID still represents a visible difficulty of insertion in the hospital environment due to economic and security problems in terms of information privacy. However, this new reality is undeniable and its implementation is increasingly present in the medical environment, being a necessity rather than a technological advance.

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1. Introduction

In the middle of the information age, it can be said that the technology involved in this process has made effective contributions to society. It is also worth noting that it is in this direction that the traceability process is moving through Radio Frequency Identification Technology (RFID), which brings a series of advantages that contribute increasingly to the social advance in the instant identification of objects,

properties, animals and people. In this sense, this tool has been configured as an important instrument for control, localization, tracking and identification of various utensils and objects, giving them an identity capable of effectively collaborating in the control and monitoring of services in the field of health. Building intelligent hospitals with streamlined processes and fluid workflows is the goal of all institutions that claim to be modern and advance in line with aspects of modernity. However, for this to happen, it is necessary to use means that provide conditions to explore this objective. Since RFID has been increasingly incorporated into medical institutions, it is of fundamental interest to seek to report and acquire more information on this technology, to provide a greater science of medical advances through it.

According to Fuhner and Guinardi (2006), an alarming statistic in health care organizations in America reveals that 195,000 people died in the US in hospitals from 2000 to 2002, victims of potentially preventable medical errors. The numbers also show that the problem is not that non expert people take care of other people, but work in bad systems that needs to be safer (Fuhrer & Guinard, 2006). The default of a system that provides greater integrity and security to health institutions seems to be primarily responsible for this situation.

With RFID, such problems could be avoided, as this system not only gives greater accuracy about the information reaching health professionals, but also gives greater control over all actions taken by the medical team regarding patient. According to Linda et al., this inhibits errors, because it gives the team access to more concise data, as well as the accountability for actions taken by the team more clearly, inhibiting medical error (Castro et al., 2013).

With regard to health care, society has been demanding greater efficiency and quality of care, which has led to increased complexity, placing hospitals under great pressure to reduce costs and ensure exceptional service to the general public. It is in this context that information and technology communication, especially RFID, are emerging as a tool to assist hospitals in their most efficient goals (Caldas, 2012).

Within the hospital setting, although the technology is being implemented, it is possible to list a number of medical healthcare applications that make the difference, such as human RFID tag implants, which contain all the information about a patient who enters the hospital, as well as monitoring the production of medicines along the production chain and improving the production of quality management of these medicines (Kalagiakos & Ria, 2006).

These are some of the reasons that make health care the next use of RFID, and how the presence of information technology (IT) in hospitals and healthcare systems is increasingly pressing as a competitive differential, as it provides better patient care. Both the healthcare system and the medical team and the patient have to gain from RFID, which is a tool of undeniable strategic, tactical and operational value (Pedroso et al., 2009). Other applications also point to RFID as the replacement of patient surveillance devices, blood center control, newborn security, supply chain management, and greater control of counterfeit and drug theft, among other things. The value of RFID lies in the fact that it is intelligent administration equipment that serves to assist the hospital in its management and operation of its daily processes (Castro et al., 2013; Rizzotto et al., [s.d.]; Wang et al., 2016). This procedure differs from the others by the careful attention to the observation of all hospital activities through an effective and constantly updated computer system.

Building smart hospitals with improved processes and fluid workflow is the goal of all institutions that

claim to be modern and advanced aligned with aspects of modernity. However, for this to happen, it is necessary to use means that provide conditions to explore this objective. It is believed that, since RFID has been increasingly incorporated into medical institutions, it is of fundamental interest to seek, to report and acquire more information on this technology, in order to provide a greater science of medical advances through it. In addition, several circumstances hinder and prevent the true incorporation of this technology in order to provide a greater science of medical advances through RFID. Thus, it is intended throughout this article, to find out what are the contributions that RFID technology and the traceability process have brought to the health area, as well as to evaluate how these tools are contributing to patient care and the evolution of the health system as a whole. It is also worth highlighting the multiple advantages of using these instruments in the health sector, as well as the main factors that hinder their effective implementation.

The health industry is considered one of the largest sectors of the economy and is an important space for innovation and capital accumulation, generating investment, income and employment opportunities, this is, it is an essential locus of economic development. Wamba et al. conducted studies on the quality of care in hospitals, revealing that this sector already faces several challenges, including the increase in operating costs and high numbers of medical errors, as well as a gradual aging population that has been intensifying , in the last decades. Also, according to Infante, the health organization is defined as a productive health care system, where the supply sector is integrated as a subsystem to meet the needs of inputs and equipment (Wamba et al., 2013).

Besides, it is worth mentioning the selection of materials and inventory management that defines the materials used in the hospital and the ways to monitor consumption levels that allow them to be the program for their acquisition and distribution. They are critical processes of the organization, highlighting the interface between clinical professionals and the supply sector as critical to the organization of supply. Already in Farouk's view , the hospital environment is a complex system with the large physical flow (medicines, materials, patients and documents), large flow of information (medical prescription, patient records, medical records) and large financial flow (patient accounts, receiving and paying financial transactions). Traceability can be defined as an identification system that allows us to retrieve the origin and history of the product at all stages of the supply chain, from raw material production to end-consumer use. Several technologies can be introduced to ensure product traceability in conjunction with quality processes such as barcodes, QR codes, Quick Response, and radiofrequency recognition (RFID, Radio Frequency Identification) (Metzner & Cugnasca, 2015).

RFID is essentially an electronic radio frequency technology that enables automatic identification and location of objects, people and animals in a wide variety of jobs. A brief description of the operation of the RFID system involves the detection and identification of a tag using the data it transmits. This requires a tag (also known as a transponder), a reader (also known as an interrogator), and antennas (also known as a coupling device) located at each end of the system. The reader is connected to a central computer or other equipment that has the intelligence needed to further process the tag data and take action. The computer is usually part of a larger computer network and, in some cases, is connected to the internet (Bhuptani & Moradpour, 2005).

There are three types of RFID tags: passive, active and semi-active. A passive RFD tag receives power through the radio frequency signals from the reader. An active one has a battery attached to each label, so

it enables a larger memory and more features. A semi-active tag communicates with the reader as if it were a passive tag, but additional modules can be supported by a small internal battery. From this, software is responsible for converting data into meaningful information. It is a wireless Automatic Identification and Data Capture (AIDC) technology that uses radio signals to remotely identify an object, store or retrieve information about it, stored in the tag that is attached to it, placed on the object. Within logistics, traceability directly affects the quality of patient care.

The error reduction made possible by an intelligent system directly reflects user safety as it is possible to reduce human interference significantly in the checking and information capture processes.

The literature on RFID technology is rich and diverse, and much has been written about its use that is becoming increasingly used worldwide. In this context, the objective of this research is to perform an integrative literature review, and through it systematizes what are the advantages and disadvantages in the use of RFID and what has been produced about it in the hospital environment.

Based on the premise that RFID implementation and adoption are barriers and advantages, the study aims to examine through an integrative literature review the factors that inhibit or stimulate the use of RFID in the hospital area.

2. Materials and Methods

In this inquiry the adopted method was the integrative literature review. Initially, we proceeded with a database search that revealed a large number of articles on the research theme. In the case of this research, the keywords RFID and health, and RFID and healthcare in both English and Portuguese languages were used.

The integrative literature review is a method that provides the synthesis of knowledge and the incorporation of the applicability of results of significant studies in practice (Souza et al., 2010). For Mendes et al, the integrative literature review aimed to gather and summarize the scientific knowledge already done on the investigated theme, IE, it enables the search, evaluation and synthesis of available evidence so that it can help in the construction of knowledge on the theme in the area (Mendes et al., 2008).

Regarding the study inclusion criterion, all articles that reported investigations on the subject were included, including descriptive, observational, quantitative and qualitative studies. The criteria used for the selection of the material were: all articles on the subject in question that were directly related to health, that were not exclusively of a technical nature, that were not related to animals, that made available the full texts, which preferably related to hospital health, which were exclusively addressed by authors seeking to reflect on the positive and negative data on the use of RFID. Articles that contained technical reports, that worked with animals, that did not provide the full texts and that only sought to describe systems implementation were excluded.

The survey period was from January 2010 to December 2019. The motivation for the initial period of 2010 was due to the fact that in Brazil the date of the first implementation of RFID technology in a hospital environment was made at Albert Einstein Hospital, located in São Paulo, the capital, which was thought to be a good starting point to exhaust the contributions and shortcomings of such a tool.

Capes, LILACS, MEDLINE, Pubmed and SciELo were used as databases.

The study was divided into three moments. The first one searched and selected articles that contained the intended theme and all articles were selected. In the second moment, the abstracts of articles that apparently in their titles were related to the area of interest were read. In the third, the full reading was done to verify the inclusion or exclusion of articles in the review e, ending with its categorization and analysis.

Initial search in several databases reported about 600 different studies. Based on their titles and abstracts, the number was 120, and after reading the respective texts, 48 articles were selected to compose the work, according to the degree of importance and the diversity of the approach used. It should be noted that the research was conducted in isolated databases and that many titles were repeated. For the approximate number of 600 articles, account was taken of their duplication, since the same article could be in two databases. In addition, the number of articles with the terms RFID and health and RFID healthcare was added.

3. Results

As a result of this study on hospital RFID traceability, a brief summary of the survey's quantitative data was initially obtained. Then, we analyzed the chronological distribution of the articles of great impact to subsequently survey the most relevant authors, articles, scientific journals and institutions. Thus, for the analyzed data, all factors related to the quantity, articles, authors, journals, countries and institutions were taken into account during the analyzed period. In Figure 1 we can see the process of job selection:

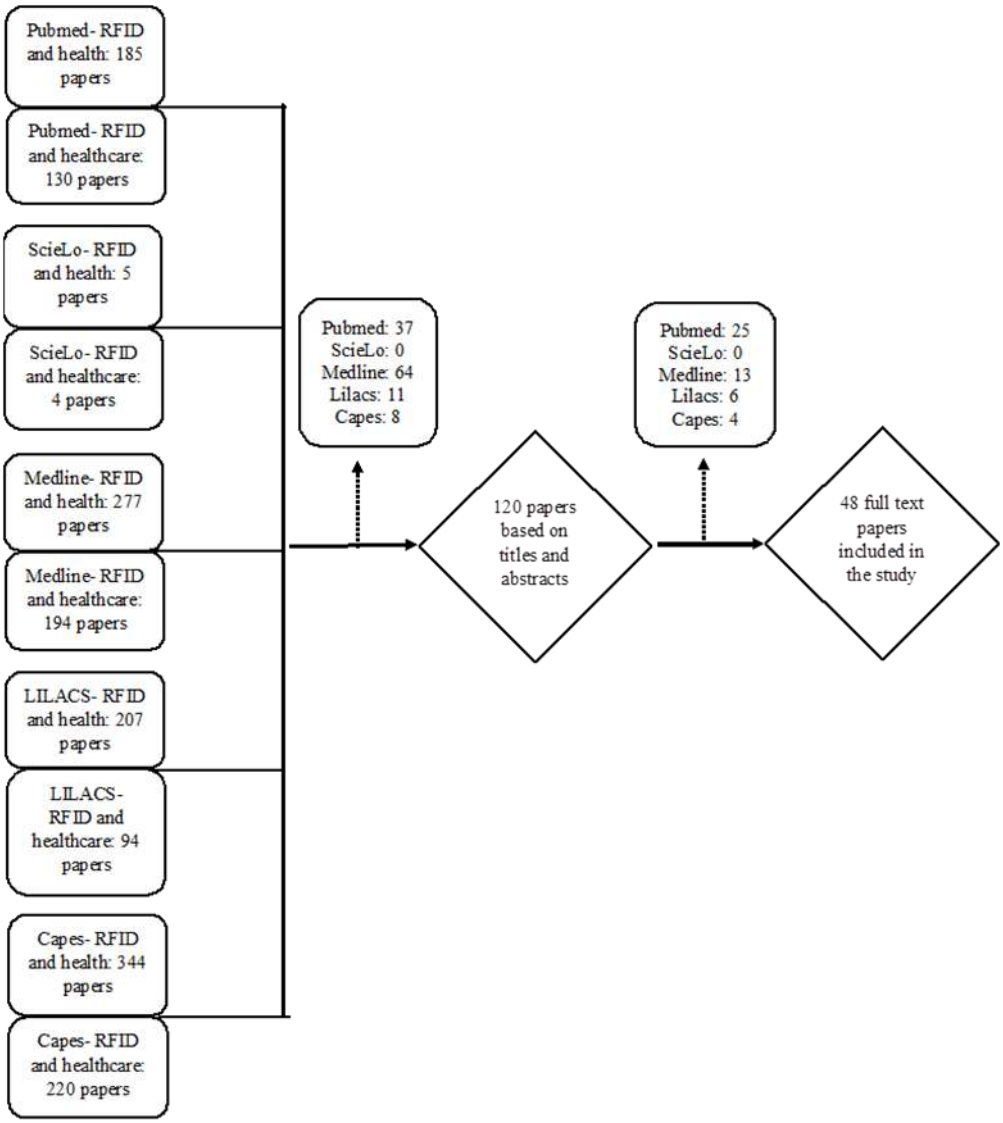

Figure 1. Job Selection Process Board.
Prepared by the authors (2019).

To continue the proposal of the article, about 600 studies have found in different databases, of which 48 were being used for this work. To analyze the source of the studies, the conclusion shows that most of them, 52% (25) came from Pubmed (Table 1). Secondly, 27% (13) articles were been found in Medline and the remaining 21% (10) in the Capes and LILACS Journal portal. No articles related to the topic were been found in the SciELO search (Table 1).

Table 1. Distribution of selected publications based on 2019 query sources

DATABASE AND SOURCE OF CONSULTATION	TEXTS RELATED TO THEMATIC	Selected publications	
		(n)	(%)
MEDLINE	471	13	**27%**
SciELO	9	0	**0**
PUBMED	315	25	**52%**
PERÍODICOS CAPES	564	4	**8%**
LILACS	301	6	**13%**

Source: Prepared by the authors.

The most used source was the Journal of Medical Systems and the Journal Sensors, with 15% of the total papers, with the remainder distributed with the other journals (Table 2).

Table 2. Distribution of articles according to bibliographic

Bibliographical Sources	Selected Articles	
	(n)	(%)
Am. J. Infect. Control.	1	**2%**
American Journal Health System Pharm	1	**2%**
American Journal of Pharmaceutical Education	1	**2%**
AMIA Annual Symposium Proceedings Archive	1	**2%**
Ann. Biomed. Eng.	1	**2%**
Aorn Journal	1	**2%**
Asian Pacific J. Cancer Prevention	1	**2%**
Enegep	1	2%
Facilities	1	**2%**
Heath Care Management Science	1	**2%**
IEEExplore	2	**4%**
International J. Health Geographics	1	**2%**
International Journal of Information Management	1	**2%**
International Journal of Health Care Quality	1	**2%**
International Journal of Medical Informatics	1	**2%**
International Journal of Pervasive Computing and Communications	2	**4%**
International Medical Informatics Association	1	**2%**
Journal American Geriatrics Society	1	**2%**
Journal Med. Toxicol.	1	**2%**
Journal of Biomedical informatics	1	**2%**
Journal of Thoracic Disease	1	**2%**
Journal of Medical Systems	6	**13%**

Journal of Research in Medical Sciences	1	**2%**
Journal PLOs One	4	**8%**
Pakistan Journal Medical Sciences	1	**2%**
Perspective in Health Information Management	3	**6%**
Sensors	7	**15%**
Surg. Endosc.	1	**2%**
Technology and Health care	1	**2%**
Telecommun System	1	**2%**
Total	48	**100%**

Source: Prepared by the authors.

The publications chosen were mostly from 2015 and 2018 with 23% (11) and 21% (10) respectively. Following are 2016 with 17% (8) of publications and 2013 with 15% (7) each; 2017, 2014 and 2012 with a total of 6% (3) each and finally 2019, 2011 and 2010 to 2% (1) of the articles selected respectively (Table 3).

Table 3. Publications used by year and author and by magazine

Author	Year	Newspaper
Aboelmaged & Hashem	2018	International Journal of Medical Informatics
Ajami & Carter	2013	Pakistan Journal Medical Sciences
Ajami & Rajabzadeh	2013	Journal of research in medical Science
Alharbe & Atkins	2014	International Journal of Pervasive Computing
Alharbe & Atkins	2016	International Journal of Pervasive Computing and
Álvares Lópes *et al*	2018	Sensors
Asamoa et al	2018	Heath Care Management Science
Asgharzadeh-	2017	Technology and Health care
Barry et al	2018	Journal American Geriatrics Society
Castro, Lefebvre	2013	Journal of Medical Systems
Chai *et al*	2015	Journal Medical Toxicology.
Coustasse et al	2013	Perspective in Health Information Manament
Coustasse *et al*	2015	Perspective in Health Information Management
Coustasse et al	2016	Perspective in Health Information Management
Decker *et al*	2015	American Journal of Pharmaceutical Education
Hamm *et al*	2018	American Journal Health System Pharm
Hazarika *et al*	2019	International Medical Informatics Association
Hu *et al*	2014	Telecommun System
Huang *et al*	2016	Surg. Endosc.
Isella *et al*	2011	PLOs One
Kusuda *et al*	2015	International Journal of Health Care Quality
Lakshmi Dhevi *et al*	2018	Journal Medical System
Lucet *et al*	2012	PLOs One
Marchand-Maillet *et al*	2015	Journal of Medical Systems

Martinez-Pérez *et al*	2012	Sensors
Martinez-Pérez *et al*	2016	Sensors
Martinez-Pérez *et al*	2016	Sensors
Martinez-Pérez *et al*	2018	Sensors
Metzner e Cugnasca	2015	Enegep
Ozella *et al*	2018	PLOs One
Péres, Gonzáles e Dafonte	2017	Sensors
Pineles *et al*	2013	Am. J. Infect. Control.
Radhakrishna *et al*	2015	Journal of Medical Systems
Roper, Sedehi e Ashuri	2015	Facilities
Safdari, Maserat e Maserat	2012	Asian Pacific J. Cancer Prevention
Sejdic *et al*	2013	Ann. Biomed. Eng.
Sipes e Baker	2015	Aorn Journal
Torres *et al*	2017	PLOs One
Trcek	2016	Sensors
Uy, Kury e Fontelo	2015	AMIA Annual Symposium Proceedings Archive
Vakili *et al*	2015	International J. Health Geographics
Vankipuran, Traub e Patel	2018	Journal of Biomedical informatics
Wamba, Anand e Carter	2013	International Journal of Information Management
Wang, Hung e Yen	2016	Journal of Medical Systems
Wang e Zheng	2018	IEEExplore
Yao, Chu and Li	2010	IEEExplore
Yoo, Hwang e Jheon	2016	J. of Thoracic Disease
Zailani *et al*	2014	Journal of Medical Systems

Prepared by the authors.

The most used approach was applied research, with 28% of the total articles, and analytical studies with 19% of the total. Third is the literature review work with 17%. In fourth place we have interview studies and pilot studies with 10% and last fifth we have prototypes for study with 8%. (Table 4).

Table 4. Classification of Articles by Most Used Approach

Approaches	**Number of Newspapers**	**Percentage**
Literature review	8	17%
Case Studies	4	8%
Interview Studies	5	10%
Analytical Studies	9	19%
Prototype for Study	4	8%
Pilot Study	5	10%
Applied Research	13	28%
Total	48	100%

Source: Prepared by the authors.

All of these articles classified this technology as an important tool in the daily practice of the hospital context. In the article by Uy et al, the author notes that the safety standard of medication practices requires the observance of five factors: drug, time, dose, routine and right patient. In this context, the use of tools that automate administration corresponds to a decrease in the number of errors, precisely because it minimizes human factors in the process (Uy et al., 2015). The author also reveals that tools such as bar code, RFID and biometrics suggest effectiveness in the course of processes, but that RFID, in particular, has as a determining factor in its use that it removes the signal line required by scanners from the code bar and the ability to be programmable. All of this leads both patients and medical staff to gain efficiency and safety by having this technology, as medication errors are prevented once the right patient is informed that they are taking the right drug, due to the infrastructure adopted by the hospital. In addition to making it easier for nurses, clinicians and pharmacists to work, RFID also saves time reading handwritten recipes and makes it possible to find errors faster when they occur.

Ajami and Carter, when performing a bibliographic research, bring data about RFID in the emergency rooms of hospital centers. They show through multiple sources of study (libraries, databases, Google searches, and conferences held) how this technology can contribute to overcoming errors in patient care, workflow optimization, and reducing emergency room costs. For these authors, it is evident that RFID leads to excellence and improved quality of care in the health sectors. They also point out some disadvantages that prevent the formalization of this technology in hospitals. These are: insufficient hospital budget, the complexity of technology and systems, still very high costs for hospital procurement, and technological and privacy limitations. Among these disadvantages, which most seem to limit the adoption and expansion of RFID use, is security, as there is a concern with the data that will be captured by the system (Ajami & Carter, 2013).

The authors are betting on the quality of health care through this technology, as some of Singapore's largest hospitals, such as Alexandra Hospital and National University Hospital, implemented RFID technology to track equipment during the Severe Acute Respiratory Syndrome epidemic (SARS), a respiratory disease of Asian origin, which hit the city. Other countries like China, Philippines, South Korea, Japan, among others, are massively implementing this technology. In one of the largest surveys ever conducted on the benefit of RFID in the United States, it was found that 70% cited patient safety as the key deciding factor in the implementation (Ajami & Carter, 2013). In a similar study, Isella et al., used RFID to study and measure nosocomial context between different people and functions within the hospital as a way to verify the precise parameterization of the spread of infections in contact between patients and health professionals. This allowed the development of preventive measures for nosocomial respiratory infections, as well as outlining strategies to control the target of the disease and the affected community, inhibiting its spread (Isella et al., 2011).

Authors such as Asamoah et al. assert that RFID provides a decrease in waiting times and hospital queues, improving health resource utilization (Asamoah et al., 2018). Some also point to such technology as an important tool for capturing real-time data and information, which impacts possible interventions and changes (Vankipuram et al., 2018). And in evaluating clinical geriatric health is an important instrument, as it lends itself to determining the health conditions of the most varied forms of older people (Barry et al., 2018).

Radhajrisha et al. understood that RFID can help contain health care-associated infection, which is projected on the world stage as a serious problem to be contained, with an index of 10-20 patients subject to nosocomial infection in the United States. According to the author, the installation of an RFID system in the intensive care center provided a significant increase in hand sanitation and, consequently, an increase in the hygiene of doctors and medical staff, as well as leaving its registered whenever someone was exempt of this practice (Radhakrishna et al., 2015). However, some authors in similar studies found significant differences in the number of hand hygiene by employees in everyday situations, and RFID is not as effective as in the previous study. This was partly justified due to the workload of the period the professionals were facing, also due to the location of the sanitizing dispenser or due to signal inability when the sensor is between the sanitizing water and the badge, which makes proper communication difficult (Decker et al., 2016; Pineles et al., 2013). However, Martinez Peres, Gonzales and Dafonte in a similar situation state that problems with reading through liquids, glass and plastics can be solved 100% thanks to the flag-mode RFID passive tag location strategy that prevents interference with certain materials. Providing a significant increase in the quality of care received by patients during treatment (Martínez Pérez et al., 2016b).

One of the main goals of hospitals is to increase the quality of patient care, as each task is vital for patient protection. In this particular article, the authors are concerned with the drugs that are used for treatment and which result in high levels of poisoning that can result in the patient's death (Pérez et al., 2017). To avoid this type of occurrence, Peres, Gonzáles and Dafonte use an RFID system for intravenous mix administration and propose a scheme that allows for patient/intravenous mixing and tracking. According to the authors, the evaluation of this work was very positive, since the system has been working well for years and is continuously involving more patients and treatments considered high risk and high value. With RFID, it is possible to evaluate the patient's pharmacotherapeutic profile, as well as the weight, height and evolution of the pathology, ensuring that another patient will not take the preparation that would surely cause his death. In addition, compared to other technologies, RFID makes a decisive contribution to these tasks, improving safety and efficiency in its ability to unambiguously identify patients, intravenous mixtures and their components (name, lot number, expiration date) (Pérez et al., 2017). In this case, a medical alert allows the recording of data to be known on time and in real time, for the patient to whom a specific batch of medicine was administered. This whole process undoubtedly contributes to a greater efficiency of the procedure. In this case, a medical alert allows the recording of data to know on time and in real-time for the patient to whom a specific batch of medicine was administered. This whole process undoubtedly contributes to greater efficiency of the procedure (Pérez et al., 2017).

With RFID, it is possible to update in real time whether the equipment is available or not, where it is, and if there is a problem that should be passed on to the maintenance department. In addition, workflow becomes easier and permanently dynamic. With the RFID system, knowledge and experience can be gained, which demonstrates that the emergence of intelligence processes associated with air pump storage, use, and maintenance activities improves the administration of mobile equipment, while at the same time focus on patient care. The author also points out as a barrier to the use of RFID the necessary costs, as well as the bureaucracy that constitutes a limiting scenario so that it can expand fully (Castro et al., 2013). Hamm, states that an emergency medication tracking and administration system enables a 74% decrease in task performance compared to traditional systems (Hamm et al., [s.d.]).

Another important use of RFID is the administration of surgical instruments that can be forgotten inside the patients' bodies, causing extensive harm, or getting lost in the hospital, causing difficulty in finding the instrumentation at the right time. Compared to other existing methods such as barcoding, attaching RFID tags to surgical instruments has several benefits. Barcoding has limitations, such as the fact that bloodstains require frequent and new prints because it makes labels unable to be read. In addition, because of its nature, barcoding allows only one instrument to be read at a time, unlike the RFID system, where there may be multiple readings of the surgical instrument at a time, effectively supporting the central supply department of sterilisables. RFID also decreases the number of surgical items retained in various hospital wards, ensuring the traceability of any instruments purchased and available. This technology still manages the system where infection was possible, reducing this occurrence, since in equipment that requires more accurate sterilization, RFID is not only able to locate but also gather information for individual administration procedures (Kusuda et al., 2016).

In a study of the positive and negative effects of the implementation and use of RFID in medical transfusion systems, it highlights that among the benefits is the fact that the patient is given an identification in the form of a bracelet, which allows its tracking and any information throughout the transfusion process. With RFID, it is still possible, through mobile equipment, to verify the patient's identification and the entire treatment procedure to be applied to him. In this way, medical teams can scan the patient and blood bag during the process, sending data to the system and thus informing that the process is complete (Coustasse et al., 2015).

Benefits related to using RFID include not only improving the supply chain, but also saving lives and improving patient conditions. Barriers to the implementation of this technology include risks involving the privacy and security of patient information. It is noteworthy that the use of low quality labels may increase the probability that patient information will be accessed by unauthorized persons. Besides, of course, the cost, which represents a major obstacle to the implementation of this tracking technology. In this regard, it can be stated that among the technical issues we have: the fact that RFID interferes with the hospital environment and medical devices; not always reliable, depending on factors such as object label, place of labeling, angle of rotation and actual distance. Another technical issue concerns the lack of commonly acceptable standards that allow for industry standardization and ultimately prohibit the use of large-scale RFID, including standard data structure, air interface and local interface. Economic issues include the cost factor that includes an initial investment in hardware and software, training, as well as the constant high capital investment in infrastructure, maintenance, and upgrades that are required throughout the operation (Coustasse et al., 2015).

There is a constant concern about the confidentiality of data transmitted via the RFID method, because when labeling a person with the RFID tag, virtually a range of personal information is available such as patient name, gender, home address and medical history. This information is highly mobile and sensitive and should be ensured that this information is strictly personal or confidential, so it is believed that some information should be restricted to RFID technology. However, restricting information would be a barrier to the full development of the system. In turn, it is fully believed that they should be stored on secure servers and that people with high ethical commitment should be assigned to the control of information.

As you can see, there are some obstacles that stand between RFID and its full implementation, so we must

make it clear that the adoption of this system should overcome these barriers that are irrelevant when compared to its benefits. Research into the use of RFID to predict patient turnover in a university outpatient surgical center found that the technology was able to match the length of stay of patients in the outpatient surgical unit by seventy-five percent operation. This made it possible to control patient flow by improving the utilization of resources that have been converted into financial benefits for the hospital. In addition, this form of tracking also allows for faster procedures between patients, avoiding overcrowding and traffic, which not only improves processes, but also results in patient satisfaction that does not have to wait for unnecessary delays. According to the author, one of the factors that contribute to making RFID less usable is the cost of its implementation, which should be evaluated by hospital administrators, since this technological tool improves and facilitates institutional procedures (Marchand-Maillet et al., 2015).

In seeking to understand the determinant factors for the use of RFID in healthcare in Malaysia, Zailani et al undertook an investigation with hospital managers and members directly linked to this area and the support team, through determinant tests in the area adoption of this technology. The results showed that perceived ease of use (the degree to which a person realizes that the use of this technology will be effortless), perceived utility (which refers to one's perception of how the new technology will help them performing their tasks) and the social influence of the implementer has a positive effect on the intention to adopt RFID in Malaysian hospitals (Zailani et al., 2014). Other authors are betting on the robustness of the system and the ability to monitor in real time and the immediate and retrospective collection of available data, which makes RFID a unique device (Huang et al., 2016).

Variables such as security and privacy concerns have had negative effects on the possibility of using this technology, directly affecting managers' intention to adopt it (Zailani et al., 2014). According to Zailani et al, if managers are able to reinforce the perceived ease of use and usefulness of new health care technologies, RFID could be more easily implemented by the team. The author also notes that information security and privacy issues should be targeted by government policies that should dictate how these rights should be protected. These policies should demonstrate how the data will be obtained by the system and clarify who will handle it, and show how the security of this personal data will be protected by those responsible for obtaining it. Only by informing the purpose of data collection and the importance of this procedure for care in hospital institutions, it will be possible to spread the adoption of this technology more widely.

There are many uses in which RFID can be used as we are seeing. For Ozella et al, quantifying and monitoring the contact rate between people with infectious diseases such as pertussis and healthy people is one of the uses that is becoming essential since through this technology it is possible to study and combat the spread of diseases (Ozella et al., 2018).

In the view of some, RFID today is an essential resource for supporting a broad spectrum of patient care activities. When approaching this technology to monitor infusion pumps, it became clear that the efficiency and productivity gain is so wide that it is difficult to measure. In fact, in addition to the gains in control and savings that come from avoiding losses and thefts, the speedy monitoring process and the availability of so-called essential hospital medical instruments outweighs the investments required to implement this traceability technology (Castro et al., 2013). It is noteworthy that, within the hospital system, the beneficiaries are:

- Clinic doctors who can be found almost immediately, as well as the possibility of monitoring and

optimizing your hospital round;

- Patients in which RFID can be attached to wrist straps, allowing patients to be monitored in real time, as well as preventing access to prohibited areas for them;
- Medical staff, patients and visitors. The source of contact with an infected patient can be determined, as well as the people who contacted him or her in the event of an outbreak.

Ajami and Rajabzadeh, say that RFID technology is used for three purposes (Ajami & Rajabzadeh, 2013):
1) Tracking, because it allows the identification of a product quickly for patients and medical staff, reducing the time required for localization, making this process less problematic;
2) Inventory management, an important aspect of the organization, as it enables administrators to monitor inventory by making the right equipment available at the right time and when needed;
3) Validation, as it ensures that an action taken or a desired item is available, i.e. the ability to validate procedures through RFID technology can reduce medical errors, check productivity and help build the documentation needed for administrative purposes audit.

It should be emphasized that the most important function of validation is to verify that the treated patient is, in fact, who he / she really should be, with the proper treatment. The authors also concluded that with regard to the healthcare industry, there are numerous advantages to using RFID, such as reducing process costs, time, human resources, preventing theft, increasing job accuracy, the reduction of human errors, improving safety and patient satisfaction. For them, there is no doubt that in the coming years, RFID will be a highly required health equipment. If integrated with the hospital information system, electronic health recordings, and clinical decision support system, this tracking technology will make processes easier by reducing the number of doctors, misdiagnosis, and wrong drug introductions (Ajami & Rajabzadeh, 2013).

The use of RFID technology stands out for facilitating the tracking of the movement of cargo units, regardless of the type of packaging or form of distribution. According to Capozoli, in 2011 alone, 850,000 units of counterfeit drugs were seized by the National Surveillance Agency (ANVISA) in Brazil (Capozoli, 2013). This number represented a twelvefold increase over the previous three years. Martinez-Peres et al., by integrating multi-sensor RFID in an intelligent environment to monitor patients and the elderly, found that despite increasing costs, it significantly helps improve quality of life (Martínez-Pérez et al., 2012). Alharbe and Atkins state that monitoring and tracking objects and people transmitting in real time to the internet network is one of the institution's goals, which is only possible through the integration of RFID with ZigBee technology, which ensures benefits such as patient safety and identification of important medical equipment and devices, all simultaneously (Alharbe & Atkins, 2014).

Another use of RFID is in the incorporation and integration with medicine pills for various diseases. This type of use, in addition to greater adherence to treatment, enables the doctor to monitor treatment more precisely, especially those diseases considered chronic and in the end the RFID device is eliminated along with the stool without major complications (Chai et al., 2015). RFID is more accessible than some technologies such as infrared, and is easier to acquire and manipulate. For this RFID allows an effective supply of information flow, although it is no more reliable than infrared (Vakili et al., 2015).

Wang, Hung and Yen bet that the use of new information technologies in clinical diagnostics and training has significantly improved the effectiveness of rehabilitation. For them a patient care and monitoring system such as RFID can be attractive as it supports the hospital and the patient in rehabilitation. In addition,

each patient can be individually controlled and tracked, which reduces staff workload and gives full knowledge of the patient's treatment (C.-S. Wang et al., 2016).

In the health field in general, RFID has helped to reduce drug costs in pharmacies, increasing effectiveness in administration, supply chain security and patient dispensing (Coustasse et al., 2016). For the author, the implementation of RFID alone is not enough, it needs to be integrated with other information technologies. Sejdic et al (Sejdić et al., 2013) argues that the next step in dealing with RFID is to consider the idea of internet of things (IoT), enabling a much broader and more effective scenario for the patient. The engineering of the future will involve IoT and RFID and will enable greater acuity in patient care and hospital problem solving for accuracy and efficiency.

In line with these studies Trcek (Trček, 2016) states that numerous areas of our lives are becoming dependent on IoT structures, which include NFCs, RFIDs, RFIDs with sensors, and single sensors. For this author, the issue under discussion is about privacy, although he believes that it is an illusion according to history. In cancer treatment, RFID enables better care by ensuring that hospitals and clinics have greater availability of chemotherapy drugs, less treatment replication, and equipment loss, which saves inventory costs. In addition, it manages people, identifying in an excellent way, producing a new level of service (Safdari et al., 2012; Sipes & Baker, 2015). Sipes e Becker stated in a study about the perioperative scenario implications that RFID facilitates workflow, reduces costs and improves process management and efficiency. The monitoring of labels inserted on the garments enables the regulation of access to hospital wards, the cleaning of clothes and the authorization of people to access the most diverse sectors (Sipes & Baker, 2015).

RFID has become a key technology for logistics and institutional administration, so it has a lot to contribute to industry 4.0 and e-Health in healthcare applications (Álvarez López et al., 2018). RFID deployment has been quite slow due to some shortcomings, including (Aboelmaged & Hashem, 2018):

- Technical complexity: Lack of a global standard, multiple tag frequencies of different architectures and system operations. In addition to compatibility with various vendors and customers, which require multiple specifications (such as long or short frequencies, antenna models and readers among others)
- Organizational resistance: It is generated due to anxiety and resistance among employees, as a new way of doing work emerges.
- Environmental uncertainty: Failure to predict positive or negative trends tend to cause uncertainty, which in the case of RFID concerns the prospects for risks and debates about privacy disputes, and how it may interfere with successful implementation. In addition, lack of government support induces negatively, generating a lack of enthusiasm.

Moving in this direction, Aboelmaged and Hashem, list the facilitators of the adoption of RFID technology, they are (Aboelmaged & Hashem, 2018):

- Technical advantages: reflect the benefits of new technology that outweigh existing ones, or other existing innovations. RFID technology enhances both strategy and operational effectiveness of the healthcare service, providing safety and visibility to processes.
- Organizational capacity: It is a multidimensional concept related to the resources, facilities and attributes of an organization. The implementation of new technologies could be facilitated through the appropriate acquisition of organizational capacity in terms of adaptability to change, secure infrastructure

and resources, making use of beneficial knowledge and experience of the new system. Thus, organizations with inappropriate capabilities are more likely to invest in new innovations, acquire or maintain high employee skills, ensure cost and foresee the benefits associated with innovation.

- Environmental competitiveness: It is an essential skill for assimilating innovation. Health services can therefore be regarded as a dynamic industry that is vulnerable to changes in health management methods as a result of pressures from patients, new rival hospital institutions, government pressures and regulatory authorities along the supply chain, that can influence services for better quality and lower cost.

Wang and Zheng propose a prototype for multi-user breathing monitoring, which according to them is possible and allows non-intrusive monitoring (Y. Wang & Zheng, 2018). Dhevi et al., from this angle, consider RFID a powerful tool that can monitor body glucose levels and heart rate (Lakshmi Dhevi et al., 2018).

According to work done (Ajami & Carter, 2013), RFID not only enables advantages, but also brings with it some barriers that make implementation somewhat difficult. These include insufficient budget availability, complexity of technology and system, very high cost of acquisition, technological limitations by the hospital, and concern for patient privacy. Yao, Chu and Li also point to privacy as one of the central issues that hamper the popularization of RFID broadly within society (Yao et al., 2010). Concern about the reception of information by malicious people has been one of the main reasons for concern among those who bet on the adoption and widespread use of society as a whole (Ajami & Carter, 2013).

The implementation of the traceability process through RFID requires some investment and the issue of privacy is widely discussed in the literature. However, some authors disagree that this technology may be easily accessible to third parties. It is worth noting that bureaucracy is another strong obstacle that hinders the spread of RFID through professional rigidity, institutional inertia, complexity and inflexibility, which are not good conductors for large hospital changes (Castro et al., 2013). In addition, cultural barriers are also imposed on the adoption of new technologies, such as reluctance and discomfort with entirely new computers and devices. This feeling of reluctance and distrust of new technological frameworks is one of the limiting factors for the expansion of its use to become massified and widespread in the hospital spectrum.

Among the negative aspects of RFID is the possible interference with the operation of cardiac pacemakers. Thus, laboratory tests describe that RFID systems can have an effect on those implanted with cardiac management devices, especially those that emit low frequency bands (LH and HL) (Sejdić et al., 2013). The center of the University of Pisttburg has been working on a solution to this problem. While the cost may turn out to be high, it is justified in context precisely when it comes to hazardous treatment and expensive medication. In addition, reducing human errors, improving service efficiency, and waiting time lead services to a higher level of quality. In this case, the application of intravenous RFID mixtures substantially removes the error in the application of expired or exchanged drugs, contributing to the sustainability of the system (Martínez Pérez et al., 2016b).

Yoo, Hwang and Jheon give RFID significant value in patient care and satisfaction. In the adoption of RFID in the Bundang Hospital at Seoul National University, they said such technology reduces the workload on nursing staff, increases accuracy in checking patient documentation and information, prevents medical errors, and promotes the efficiency of resources for emphasizing accountability (Yoo et al., 2016). In addition to the advantages already described, RFID promotes increased motivation to improve the

organization and updating of the institution, favoring increased visibility of institutional excellence, and over time reducing budget redundancies (Roper et al., 2015). Coustasse also mentions cost reduction as one of the main benefits, which results in better financial performance, producing an efficient and productive institution (Coustasse et al., 2013).

For Hu et al , the RFID system can operate throughout the patient's life cycle in medical institutions, improving health care in surgical procedures and operations. Currently, in most hospitals, follow-up is still done on paper. The patient lifecycle that encompasses admission, examination, patient care, recovery, release and payment through RFID is recorded in a system that includes everything from complete patient identification to every step taken in. This cycle should always inform and update the diagnosis and treatment data, as well as the dosage and the recovery process. From the patient's entry into the institution, it will be possible to obtain data on the ability to apply the treatment (Hu et al., 2015).

In this sense, the current situation of RFID in the health sector is in full growth, as the health system urgently needs apparatus that can reduce the errors that happen so regularly. Hu et al (Hu et al., 2015) state that the increase in health care costs is practically the same in all cities of the world, and that governments are looking for ways to reduce these costs and, at the same time, improve health conditions for the patient. For this reason, RFID is configured as an outlet that can, if properly employed, reduce costs while providing support for more accurate and faster patient care. In any case, the growth in the use of this technology in terms of traceability has been booming, allowing health processes and flows to be improved and allocated efficiently within the chain. Compared to other similar technologies such as bar code, RFID stands out due to the following factors: 1) the data are rewritable; 2) the data are easier to transmit; 3) the large capacity of data storage; 4) the possibility of being reusable; 5) the wide read range; 6) security since it does not allow the forgery due to the unique nature.

The construction of intelligent information systems for hospital administration is an ethical issue that discusses not only financial gain, but a whole process based on the structuring and the foundation of health. Alharbe and Atkins discussed issues like these when developing such a controlled environment RFID technology, and came to the conclusion that technology cheapening could be done by integrating with ZigBee technology, which would support a knowledge processing and decision support system (KRDS). This in turn would uniquely support all hospital processes, being a powerful tool for automation, equipment tracking, staff and patients (Alharbe & Atkins, 2016). Among the benefits highlighted by Alharbe and Atkins are real-time data access, which includes information coverage of all tagged objects, which can be retrieved and accessed at any time; improved quality of care due to better management of medical staff and equipment, as well as rapid localization of these and medical equipment, which improves coordination in response to various situations; improves risk management by enabling frequent and rapid device auditing across wards, reducing the potential risk of faulty and poorly maintained equipment; acquire critical data knowledge to continuously monitoring the status and quality of medical and patient equipment, real-time production of historical data that gains informations that enables routine tasks, and consequently reduces costs more efficiently by saving time due

to automatic data management; increased security to prevent loss of mobile and unauthorized access to hospital wards; allows monitoring of all hospital services (Alharbe & Atkins, 2016).

When it comes to RFID technology, you should look to the future that is being outlined, so that if the

healthcare institution wishes to have a reality-transforming potential and operate on innovative foundations in order to increase gain in strategy and innovation, thus improving your business model, the investment can offset the accomplishment. Therefore, enabling an RFID implementation requires a project that is well built, financially supported and managed. Based on the results of their research by Wamba, Anand and Carter they concluded that RFID technology is mainly used for the purpose of institutional administration, and secondly for the purpose of patient administration. These results reveal that the potential for tracking medical products and devices, as well as laboratory specimens and real-time surgical instrumentation is a use that yields many economic benefits to the hospital (Wamba et al., 2013).

Regarding patient acceptability, which for some authors is one of the biggest barriers to RFID adoption, Torres et al. states that this is a matter of experience with the technology, and that its use would promote demystification that could be formed around her. Studies on the use of RFID to prevent falls of debilitated and elderly patients in hospitals show that, in addition to being a crucial tool in preventing patient falls, it also prevents patients with dementia or delirium from circulating without proper assistance. In this study, it was found that the acceptability of the tool increases with the use of the patient, who sees in it an essential addendum in their treatment, and the anxiety that is configured at the beginning, becomes confidence after contact with technology (Torres et al., 2017) .

4. Discussion

With this integrative literature review, we realize that the use of RFID technology brings in its essence a series of factors that make its use complex and surrounded by nuances that invest it with elements that surpass the merely visible. The 48 selected papers addressed the context of the application of the RFID traceability system in hospitals and medical institutions. In view of a greater diversity of opinions, a dialogue was opened between the researcher and the literature from various parts of the world.

Regarding what operates the use of RFID in healthcare organizations, we have as determinants the efficiency gain, i.e., there is a clear reduction in the costs of the operation, savings in the work performed, increased control and administration of the patient and a clear reduction inventory cost (Coustasse et al., 2016; Roper et al., 2015).

In addition, there is still a gain in quality where patient care is improved by eliminating errors that are made against the patient, such as incorrect drug administration and procedures. Coordination between health professionals and staff is improved and patient satisfaction is increased. Infection control is more efficient. The preventive/corrective control and maintenance capacity of the equipment is optimized (Ajami & Carter, 2013).

RFID also provides management gains by covering all benefits related to healthcare professionals, such as regulation of performance and reduction of insurance payments and indemnities, allowing for greater and better auditing when necessary, diagnosing and predicting possible errors (Chai et al., 2015). Other benefits include minimal research time with staff location, increased equipment availability, increased equipment utilization, increased staff productivity, improved preventive maintenance, increased patient turnover, improved ease of access and safety, improved patient billing, improved reimbursement management, reduced emergency equipment purchase and rental, reduced inventory depletion, improved equipment

return, better inventory lead times, reduced inventory shrinkage, fewer defective equipment used, decreased personnel charges, reduced poor service quality, decreased delays (Roper et al., 2015).

In this sense, RFID has several positive aspects in terms of patient care and the use of efficiency. This tool has enabled health care organizations to gain accurate and timely access to information to effectively treat patients (Vakili et al., 2015). In addition, RFID is becoming for some an emerging technology that plays a crucial role in the hospital system as a whole (Alharbe & Atkins, 2014). The ability to attach an electronic identity to a concrete object effectively extends the Internet to the physical world, transforming real objects into an "Internet of Things." Rather than requiring human interaction to register assets, equipment, or even services, applications may "see" items on the network due to their electronic IDs and wireless RF (radio frequency) connections. For businesses, this can mean faster automation, greater control over processes and continuous and accurate inventory. For the health area, it will mean more safety and comfort to the patient, as it will streamline hospital processes. Users of this technology will finally be able to share asset information from the beginning to the end of the supply chain and, just as important, instantly identify the current location of the items. In this way, pharmacists and laboratories will be able to record how long perishable materials have been without proper refrigeration (Trček, 2016).

In turn the physical safety and comfort of patients and system users often raise concerns for hospitals. Even though doctors, nurses and other staff take primary responsibility for physical safety, RFID traceability technology enables an even more efficient and complete care process to be created. This is because this instrument increases user satisfaction and, at the same time, decreases the possibility of errors that can be caused by the “separation” of a patient's information. In addition to the already foreseeable security and accuracy benefits of searching for individual case data in the system, reducing patient / data error rates can help reduce occupational malpractice claims as well as hospital insurance rates, which can generate resources to improve overall care (Coustasse et al., 2013, 2016).

Privacy is the main problem that may eventually complicate the use of RFID. Many believe that by using the tool, both patients and healthcare professionals will lose much of their privacy. And that's making it available will be a precedent for making the information available on the network, enabling it to be seized by anyone who has the technical means to do so. Although it may be pointed by some as a remarkable solution for the most diverse applications, there are those who disagree and point out flaws in its use. Describing the system as needing further research and improvement (Pineles et al., 2013). Still others attribute the lack of integration with other devices as the cause of their deficiencies (Decker et al., 2016).

Other issues that make it difficult to use is related to interoperability as the systems that the hospital has, a health organization often has at its disposal a series of equipment that need to work together and that need such devices to work in harmony. Often as it is an emerging technology, systems either interoperate weakly or do not interoperate, which emerges as one of the intervening factors. Lack of standardization is a strong barrier to RFID acquisition (Coustasse et al., 2016).

Studies such as those by Kamaludin, Mahdin and Abawaly point out that while RFID is more efficient than bar code, the problem of cloning, counterfeiting and security attacks is a problem that must be solved. To address this, they suggest an approach to detecting RFID tag clones in the system that according to research has shown good performance.

The limited budget of hospitals makes it a deterrent to participation by some hospitals that believe the cost

of technology is expensive, making it prohibitive for providers (Ajami & Carter, 2013). The lack of preparedness to deal with RFID-sized technology also makes it inaccessible, so for some it is a highly complex tool to use, which hampers the spread for its use (Ajami & Carter, 2013; Wamba et al., 2013).

Competition with other similar technologies that, although inferior in quality, can rival in value with RFID is another constituent factor. In fact, the expressive use of this technology often demands that it can be valued as a technology that is significantly determinant in the daily performance of hospital operational and technical achievements. On the financial side, we can say that this is the most influential aspect that stands between the widespread use of RFID. Many consider the initial investment in hardware and software to be high and not worth it for the institution despite the advantages it offers, even when they seem to be superior to what other appliances of the same size seem to offer. So, thinking in the short term the investment may not be really attractive anymore in the long run, it has an almost certain higher return, saving large sums of money. Thus, the initial invested capital, although high, becomes smaller over time, which contributes to an almost certain return (Coustasse et al., 2013).

Thus, some hospital institutions are not inclined to adopt RFID because there is not enough capital, staff or return on investment (ROI) defined. However, although not cheap, the value of RFID technology has been declining in recent years, enabling a greater number of supporters of this instrument. There is some skepticism about RFID and this is reflected in the restricted implementation in some hospitals, in part because the initial cost and return is only reached in the long term. Although it is known of all the benefits and advantages over similar tools, and the satisfaction rate achieved because it is used, most managers are still unmotivated about investing in this tool (Roper et al., 2015).

This is why for some the use of RFID is fully justified in cases where the high cost of services and the high risk to the patient accompany the hospital routine (Martínez Pérez et al., 2018). This is how its use becomes for these authors of essential relevance (Martínez Pérez et al., 2016a). By allowing the institution to make use of this equipment, it is stocking up on successful medical practices that increase productivity and save time for the medical staff (Coustasse et al., 2015). In addition to enabling the construction of a smart hospital (Alharbe & Atkins, 2016). Others see in RFID the future of hospital processes, even intending to expand their use (Huang et al., 2016)). The use of communicable diseases in epidemics has proven to be of fundamental use for health institutions (Ajami & Carter, 2013; Isella et al., 2011; Lucet et al., 2012).

The scenario for using RFID is wide, ranging from the newborn, being identified and ensuring pairing with the mother, to the care of the elderly who want some independence accompanied by safety (Alharbe & Atkins, 2016; Martínez-Pérez et al., 2012; Torres et al., 2017). In hospital wards of the aged and immobilized sick patients, it can act to prevent falls from happening (Torres et al., 2017).

In our present society, the Internet of Things has increasingly occupied space. There are numerous applications regarding health, and RFID comes to occupy a privileged space in this field, where process automation is a global trend (Lakshmi Dhevi et al., 2018).

RFID can modernize the most diverse hospital sectors, leading institutions that use it to a standard of excellence in their service. There are many applications, such as supply management, patient management, medicines, newborns, hand cleaning adherence, surgical instrumentation, blood bags, collective and sectoral equipment, and so on. In all of these, RFID allows customization of both attendance and administration. It can potentially change the way health services have been delivered over the years. As is

known, the lack of control over health is one of the pressing issues, and with RFID this problem is almost instantly resolved from its implementation (Martínez Pérez et al., 2016b; Safdari et al., 2012). And there is almost a consensus that RFID strives to improve service quality and process efficiency (Kusuda et al., 2016; Yoo et al., 2016). Thus, it can be stated that RFID is a very powerful and ubiquitous tool that enables the streamlining of a range of processes and has considerable value in this regard (Hazarika et al., 2019).

Uy, Kury and Fontelo, making an analytical descriptive retrospective of RFID, conclude that there is great optimism about its growth, thus ensuring the satisfaction of security needs and institutional excellence (Uy et al., 2015). And most importantly, RFID adds intelligence and support to decision making (Ajami & Rajabzadeh, 2013; Castro et al., 2013; Marchand-Maillet et al., 2015). In the drug traceability chain it is possible to prescribe, validate, dose and prepare the drug in a competent and skillful manner (Hamm et al., [s.d.]; Pérez et al., 2017). And in the supervision of hygiene procedures, the use of the device increases the number of people who start to perform hand cleaning procedures (Radhakrishna et al., 2015).

These contributions have positively impacted the health system as it provides a reduction of medical failures and errors, especially in drug administration. For Álvarez-Lopes the added value is high and the disadvantages, such as equipment integration, can be easily overcome simply by making efforts to improve the equipment, for which the author suggests a solution (Álvarez López et al., 2018).

RFID technology can be considered expensive for small hospitals, however, for those with a large number of beds, it is advantageous because it allows more safety for the patient, giving greater control that has a positive impact on the number of employees hired, instead, they are used in an efficient and quite satisfactory manner. Return on investment may be in the form of hiring fewer employees (Asgharzadeh-Karamshahloo et al., 2017).

It is also noted that there is a large gap between managers and health staff, who on the one hand do not want adoption due to lack of knowledge and familiarity and on the other hand managers who see a potential tool for administration assistance (Zailani et al. 2015).

Thus, the high misinformation regarding RFID is a problem to be faced for its dissemination.

As long as the institution can overcome the preconceptions that are being conveyed about this technology, in which the restriction on privacy spreads, its intelligent use can become a fundamental piece in its adoption.text text text text text text text text text text text text text text text text text text text text text text text

5. Conclusions

The concept of traceability in health can no longer be considered as a competitive factor, but rather as a necessity to ensure the quality and safety of the drug that reaches the end consumer. For the traceability model to be accepted, it is necessary that the existing steps are respected and that the change is not sudden, making use of appropriate technologies. RFID technology in conjunction with others (RSSF, GPRS and QR) ensures drug tracking to their final destination as well as quality, thereby reducing the number of counterfeit drug cases and contributing to an effective response to treatment. Therefore, it contributes to the reverse logistics procedure of these products, thus ensuring the sustainability of the process. The proposed model makes use of RFID technology along the chain, enabling the inclusion and access to data in real time by any user, bringing the end customer responsible for the two links in the final chain.

The contributions of RFID tracking technology to the healthcare field are unlimited in locating and tracking products, objects and people. More than a locating mechanism, it is a control device that enables its users to better assess the situation of a range of processes and flows. When RFID is used, contributions are diverse, such as locating and verifying adulteration and counterfeiting of drugs, proper administration of blood bags, and drug interaction with patients, obtaining patient information faster, as well as locating and restricting certain hospital departments, including the location of medical staff, improved hospital rounding, smart operating rooms, smart medicine cabinets, the location of equipment, and their best distribution, according to hospital needs. The main advantage is in monitoring the patient through smart wristbands that provide information such as blood type, allergies and other relevant data about him or her.

Regarding the numerous factors that hinder the mass access of this technology, the main one concerns the economic order, security and technicians, as well as the cultural, human and bureaucratic barriers that tend to hinder the implementation of a traceability system. These range from budget limitation aspects, including possible interference with electromagnetic equipment. The issue of patient privacy is another much cited obstacle, as it is believed that patient data can be intercepted by unethical individuals. Regarding the fact that full and ubiquitous screening of medical staff, there may also be a nuisance and a negative reaction because of the feeling of constant vigilance, including the time off from health professionals.

To prevent this happening, nor is there a surveillance similar to George Orwell's 1984 fiction, in which the big brother was the ubiquitous figure of the moment, RFID-free areas can be established. Thus, it is possible to preserve the privacy of those who are not strictly related to the hospital context. Despite having to face this challenge, the fact is that traceability through RFID can be considered the next step in the future medical hospital, which should soon be a reality for many professionals and healthcare institutions. Despite the niches that may still reject it, the health area is optimistic and prone to its use with a view to improving safety both in the case of patients and in the presence of greater control and the verification of errors that will be minimized by this technological apparatus.

In this context, it is intended for academic studies to explore and investigate the structural change that is being implemented, in order to spread the importance of RFID. Exploratory, descriptive, explanatory studies, i.e., all studies that may help to broaden the knowledge of the subject. In Brazil, this tool is even more important since technological development occurs slowly and unevenly. RFID demonstrates through this article that despite all the barriers to its spread, RFID is a technology that makes a difference in the hospital environment. Especially when you think that processes are an inherent and important part of healthcare professionals and their patients. This “academic look” focuses on the implementation of this new technology, in view of all the benefits it is already bringing to providing more effective care, thanks to the agility and faster access to information that can make the difference between life and the death of patients who are treated daily in hundreds of clinical and outpatient hospitals. For this reason, studies related to this new setting for data consultation should be encouraged so that researchers realize the need to draw the attention of hospital managers to a process of irreversible technological advancement that is becoming essential in health.

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