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The Use of Robotics in Healthcare

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ABSTRACT

The present work aims, along the presented contents, to emphasize the use of robots within health, promoting assistance and assistance to health professionals, and highlighting which processes can be consolidated with the use of technology. The general objective of the research is to highlight the main aspects of the use of robotics in the health area, regarding the specific objectives, they are: to highlight the positive and negative aspects of the use of robotics in health; assess how health professionals use robots in their routines; present the researchers' view on robotic procedures in health. In the methodological field, a literature review was carried out, highlighting some of the main concepts and addressing the vision of renowned authors on the process of inclusion of technology within health organizations. It can be concluded that technology promotes the understanding of relevant points so that treatments, processes and diagnoses are performed more effectively by health professionals.

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Introduction

When the social relevance of robotic applications is addressed today, the use of assistive technology in nursing environments is almost always the first example. Of all conceivable applications, the image of the humanoid robot that unfailingly fetches a glass of water for the elderly seems ubiquitous.

The claim that robots will help care for a growing elderly population is never really questioned. However, despite this vision of the future, there is little evidence that these robots will exist anytime soon. First, in technological terms, autonomous humanoid robots are nowhere near ready for use in care or other real-world settings that involve (physical) contact with people [1].

There is currently little demand for genuine care work done by robots. Neither caregivers nor care recipients expressed an explicit interest in robotics applications. Scenarios that propose this are generally rejected. In addition, there are many questions about ethical and legal issues.

The general objective of the work is to highlight the main aspects of the use of robotics in the health area, as for the specific objectives, they are: to highlight the positive and negative aspects of the use of robotics in health; assess how health professionals use robots in their routines; present the researchers' view on robotic procedures in health.

For a better theoretical foundation, a literature review was carried out, highlighting some of the main concepts and relevant analyzes on the insertion of technology in the health environment. Being used mainly works published over the last 10 years, consolidating the benefits of using robots and technology in the health environment.

Theoretical Framework

Technology in the Area of Health

The use of technological processes and procedures can be considered inevitable for health organizations, with the creation and development of certain technological practices, everything pointed to the use of different areas in all possible fields. With the emergence and development of new diseases, technologies began to be seen as an opportunity to better understand and evaluate the particularities of each case.

The computer came to be considered a fundamental technological tool for health agencies; its use provides greater security to professionals in relation to the development data of their activity. As well as providing certain procedures that can be applied to help in the constitution of accurate reports of the activities carried out and the procedures applied, as a way of observing if they are in accordance with the observed issues [2].

Within the hospital and clinical routine, technologies have become a very important resource, giving professionals an opportunity for greater knowledge or understanding of symptoms, treatments and medications to be implemented in the hospital routine. In the clinics, it appears that digital resources have become one of the most important and necessary, in the search for an effective and efficient diagnosis, giving individuals an opportunity to obtain treatment that is more aligned with their situation and promoting stability in the activities promoted by the patients. Health professionals.

It is worth mentioning that some medical instruments are currently technological, something that promotes a broader observation of the clinical part, as well as promoting a more specialized report on the observed points. As is the case with endoscopy, resonance, x-ray, among other tests that are currently performed by machines in line with the observations of health professionals.

There are many exams that are performed or applied through the use of digital resources, giving health professionals a more detailed understanding and verification of the patient's condition and needs. In the view of some researchers, the interaction between clinical procedures and technologies was essential for stability in the health of individuals, something that has been gaining more and more relevance [2].

Nurses have been working in the field of informatics for nearly four decades, the term "nursing informatics" has been considered a specialization in nursing resources since 1984. Many aspects such as data retrieval, ethics, patient care, decision support systems, human-computer interaction, information systems, informatics, informatics, information science, security, electronic patient record, intelligent systems, e-learning and telenursing were added to the field. The competence of nursing informatics specialists was determined by studying three categories, including informatics skills, informatics knowledge, and informatics skills. It investigates four levels of nursing practice: novice nurse, experienced nurse, informatics specialist and informatics innovator [3].

The following competencies were rejected: diagnostic coding, desktop publishing, managing central facilities to enable data sharing, and writing an original computer program. Some components of accepted competencies are summarized below.

Selected computer skills competencies include computerized surveys and retrieval of patient demographics, use of telecommunication devices, documentation of patient care, use of information technologies to improve nursing care, and use of networks and technology computer safely.

The selected competencies of informatics knowledge are the recognition of the use or importance of nursing data for the improvement of practice, and the recognition of the fact that the computer can only facilitate nursing care and that there are human functions that cannot be performed. by computers, the formulation of decisions in computing, the recognition of the value of the involvement of physicians in the design, selection, implementation and evaluation of health systems, the description of current manual systems, the definition of the impact of the management of computerized information on the role of the nurse and the determination of the limitations and reliability of computerized patient monitoring systems [4].

The advantages of applying information technology to all aspects of nursing, including clinical areas, management, education and research, and its influence on health care were reviewed. Today, the topics of clinical nursing information systems, decision support systems and medical diagnostic systems are associated with the collection of patient information. In relation to the technology-rich environment, to the developers of hospital and health information systems, the quality of care is improving.

Robotic Engineering

It is shown how the idea and objective of care robotics can become a catalyst both at the discursive level for innovation policies and at the organizational level for the field of care. The desirability of care robots is fueled by a third strand, the epistemic conditions of robot development. When building robots for applications outside the laboratories, their developers are subject to specific sociotechnical conditions that form a subsequent context for service robots both discursively and overtly [5].

To understand how robotics can matter, one must first understand the challenge of building robots for everyday worlds. For the theoretical, methodological and technical instruments of robotics, everyday worlds – such as care settings – are at the absolute outer limits of workability.

Designers' understanding of the social situation becomes the core of epistemic practices in social robotics. Both the attractions and the problems of robot care therefore reside in the fact that robot care goes beyond the previous limits and possibilities of robotics: if care robotics were understood primarily as a technical enterprise, to what extent? its conditions configured the users addressed and the situation of use would remain invisible [6].

In seeking to describe and explain this epistemic context of robot development for assistive robotics, the main challenge is to show what roboticists actually do – that is, how they try to fix social phenomena like care technically and scientifically. To do so, we will briefly describe typical robot development patterns for service scenarios. These two cases show how the addressed users are configured by development practices and how the social institutionalization of care practices facilitates the development and implementation of robotic scenarios [7].

To understand how the epistemic conditions of health robotics affect the practice of research and development, we conducted ethnographic fieldwork and interviews in five health robotics projects in Europe and the United States [5].

At first glance, assistive robotics projects look very similar: robots are used in care settings and results are measured. The characteristic difference that we will show in two examples is how care is operationalized as a design goal – either as a successful measurable intervention in a field of practice or as a technical challenge.

Robotics is one of the most advanced and emerging technologies in the field of medicine. Embedded electronic sensors with control combination in mechanical systems greatly increase the performance and flexibility of the systems. The robotic technology used for the movement of the arms was inaccurate and unable to send the exact sensory feedback, exact movement and positioning. With advances in hardware, software and control programming systems, extensive automation is being utilized to operate with more degrees of freedom than humans under a wider range of conditions.

Applying Robotics in the Health Routine

Projects with the objective of *applying* service robots aim to implement human-robot interaction in a practical way in a concrete scenario. This typology is often characterized by the participation of non-technical specialists – for example, from gerontology, nursing science or medicine. Assistance robotics of this type is understood as pioneering research that prepares and tests the use of robots in care and tends to generalize from the specific application scenario for which they design [8].

In these development processes, users such as the nursing staff or family members, who are actually secondary and tertiary users, become relevant to engineers. This is because the specific application and testing areas of such projects are located in highly institutionalized environments such as care facilities or wards. The necessary formalization of human-robot interaction, therefore, often occurs according to the organizational and institutional conditions of care practices [9].

The decision to use the paro robot was made based on its availability for use, especially as it was CE certified and therefore met insurance requirements. However, on the way to the field, the researchers faced some rejections regarding the use of the robot in specific care facilities.

Nursing staff members did not want to participate in the study or relatives did not give written consent to allow their senile parents or grandparents to participate in the experiment. Therefore, the research team decided to wait until the Ministry of Health approved the research protocol [1].

The project did not seek to compare different robots or robot characteristics. The motivation was rather to carry out and test the use of a robot in the care of hospitalized patients. The operationalization of the effectiveness measure clarifies the type of reference to the field of application: The members of the nursing team should assess through questionnaires whether the use of robots influenced (positively) the nursing routine. In addition, a scale of medical indication of the well-being of patients with dementia was applied, which was also based on team assessments [8].

Robotic innovations are currently being introduced in several areas that specifically influence the understanding and consideration of patient care. Robotic technology in medicine is the main focus of healthcare services in ICUs, general rooms and operating room, which reduces risks for patients, doctors and is also used in laboratories for sample collection followed by sample transport, if necessary, analysis and preservation for long-term storage [9].

Health services provided by robotics become complex and critical with regard to information sharing, data communication and distribution of sensor data. Internet of Medical Robotics Things (IoMRT) approaches have incorporated robots as a "thing" and build connections with new communications such as Li-Fi technology and web information technology.

Robot deployments in healthcare environments are likely to increase due to increasing technological capabilities, their reduced costs, and increasing pressure to reduce costs. However, robots are potentially highly disruptive innovations and, therefore, it is important to understand the socio-technical challenges that may be encountered as robots are deployed to find mitigation strategies [1].

Sociotechnical approaches to studying technology implementation see social and technical factors shaping each other over time. It is assumed that technologies are shaped by their social environments (e.g., through projects being modified), but also that social environments are shaped by technological resources (e.g., when users' work practices change as a result of change). introduction of technology).

Silva and Caetano (2020) stated that the field of robotics in healthcare environments was still in its infancy and the shift in the role to EHRs currently has a strategic priority over investments in robotics. Specifically, the most innovative developments around humanoids were still a long way off in terms of routine deployment in healthcare and care settings, while service robots were seen as having the greatest near-term promise. However, it was also recognized that there was significant potential and the pace of developments, as well as the increasing convergence of applications, meant that robotics was likely to become a routine aspect of healthcare delivery at some point [10].

Humanoid Robots

Humanoids presented a particularly interesting illustration of the tension between human hopes and expectations of robots and the apprehension of their use in healthcare settings. They also represent an important socio-technical example, as the human and technical dimensions blur together in challenging and highly visible ways [11].

The main goal of some robotics researchers is to build robots that resemble people, both in body and behavior. Until now, however, the most used robots in robotics research have been manipulator robots, mobile robots and robots with legs. On the other hand, in recent years, Japanese industry has made so many strides in building humanoid robots that we have to ask ourselves what role these robots might play in the future of robotics society [12].

The main advantage of using humanoid robots is that this type of robot can work directly in the same environment as humans, without having to make any changes to that environment, unlike what currently happens with manipulator and mobile robots. Furthermore, as most utensils, machines and environments (office, home, subway, cinema, street, etc.) are adapted for human use, they will also be adapted for use by humanoid robots [11].

Another important aspect is that the means of locomotion of humanoid robots can be adapted to their environment. If the environment in which it will be incorporated does not contain obstacles and the ground is smooth, you can use a humanoid robot that moves with wheels, while if it is a real environment (stairs, uneven terrain, etc.) a bipedal humanoid.

Currently, research with humanoid robots is more focused on bipedal locomotion than on cognition, when it is known that both aspects were linked during human evolution, as it was bipedal walking that allowed hominids to release their hands in order to create and manipulate tools and thus develop cognition [13].

In bipedal locomotion of humanoid robots, the zero moment point or Zero Moment Point (ZMP) is the point in relation to which the dynamic reaction force at the foot contact with the ground does not produce any moments, but the total reaction forces. Equal to zero. Therefore, the ZMP is an indicator of the robot's stability: if it is in the shadow of the robot's foot, the movement is stable, otherwise it is unstable.

In addition, active-static locomotion uses all the humanoid's degrees of freedom to perform the movement of walking, therefore, it requires a continuous consumption of the motors of all the joints (including those of the arms), a control and, synchronization in real time. To reduce the complexity of active-static locomotion, the number of active degrees of freedom in the humanoid can be reduced, the energy from the previous step can be used to generate the next one, etc.

Passive-dynamic locomotion, on the other hand, is based on the strategy humans use for walking: letting the legs swing and then adding a small force to compensate for the swing, preventing falling and achieving a smooth walking motion. The disadvantage of this type of locomotion is that its movements are made in a straight line, making it difficult to turn, return, sit, etc.

Conclusion

In today's world, the potential for the application of information and communication technology is increasing to improve the quality of outcomes in nursing domains. Nurses communicate

with patients the most and interact with technology most often. The use of technology should create a positive attitude in nursing productivity. It is essential that nurses are involved in the initial design of systems to improve the quality of health care and change their culture in this regard.

It seems necessary to prepare nurses with knowledge to deal with the selection, development, implementation and evaluation of IT to interpret the data as knowledge and usable information. In the world of nursing, four domains must be trained. Degree and diploma programs can be integrated into courses. Graduate programs can be planned.

Formal and informal continuing education programs for nurses in duty and fellowships for nurses with a doctoral degree can be helpful. Trying to prepare different groups of nurses for the increasing speed of technology in the current century is possible, not only through parallel learning opportunities, but also with the help of assessment tools such as the Self-Assessment of Nursing Informatics Competencies scale that can bring the same range of understanding about the implementation of informatics.

The aspects discussed in this study contribute to new knowledge about robotic surgery and the role of nurses, allowing to identify the challenges that are inserted in the program and in the work of these professionals, allowing to contemplate the new possibilities and perspectives and providing, in this way, more reflection about the scenario presented. In this way, it is concluded that the procedures carried out in communion with technology serve as a basis for health routines to have the expected performance.

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