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Review: Medical Equipment Engineering and the Role of Health Adminstration and Nurses in Promoting the Proper Collaboration

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Abstract

By taking on expanded roles in collaboration with administrative and medical equipment engineering, to working in new settings in innovative ways, and to partnering with communities and other sectors, nurses have the potential to be key contributors to making substantial progress toward health care equity in the world in the decade that lies ahead. However, the potential for nurses to assist individuals and communities in leading healthier lives can only be fulfilled if the obstacles that prevent them from working to the full extent of their education and training are addressed.

Keywords*: collaboration, nurses, equipment.*

Introduction

Over the course of the last few decades, new technologies have brought about a transformation in the delivery of healthcare; as technological advancements continue, the potential for innovation continues to be practically endless. The National Health Service (NHS) has historically been sluggish to accept new technologies. The portable defibrillator was initially developed twenty-five years prior to its incorporation into the standard equipment for ambulances in the United Kingdom. Thankfully, the National Health Service (NHS) is beginning to acknowledge the crucial relevance of research, innovation, and the adoption of technology, and clinicians are

being included in all stages of the process. To ensure the continued existence of the National Health Service (NHS) and to ensure the development of future clinical outcomes, this is very necessary. The demand for limited health services is growing. On the other hand, the clinical staff frequently lacks the competence to realize the high-level objectives of the health care due to the pressures of staffing and the absence of technical assistance [1].

Multiple health care practitioners with varied levels of educational and occupational expertise are involved in the delivery procedures of today's health care system. These processes entail a large number of interfaces and patient handoffs. It is possible for a patient to engage with fifty distinct employees during the course of a hospital stay that lasts for four days. These personnel may include physicians, nurses, technicians, and others. The effective practice of clinical medicine therefore requires a great number of situations in which vital information must be presented in an appropriate manner. Collaborating as a team is really important. When medical professionals fail to communicate effectively with one another, patient safety is put in jeopardy for a number of reasons, including the following: a lack of essential information, incorrect interpretation of information, imprecise orders given over the phone, and the failure to recognize changes in the patient's condition [2].

When there is a breakdown in communication, it results in conditions that can lead to medical mistakes. Due to these errors, there is a possibility that the patient would get severe injuries or unexpectedly pass away. A widespread issue that plagues modern health care organizations is the occurrence of medical errors, particularly those that are brought on by a breakdown in communication. The Joint Commission has the following to say. It is even more unsettling to learn that communication breakdowns are the primary root cause of the sentinel occurrences that were reported to the Joint Commission between the years 1995 and 2004. To be more specific, the Joint Commission identifies communication problems as the primary root cause of pharmaceutical errors, delays in treatment, and procedures performed at the incorrect site. Furthermore, it is the second most commonly mentioned root cause for operational and postoperative events, as well as fatal falls [3].

Traditional medical education places a strong emphasis on the significance of error-free practice and makes use of tremendous peer pressure to achieve perfection in both diagnosis and treatment. As a result, an expression of failure is considered to be the normative interpretation of errors. When this climate is present, it produces a setting that does not allow for the open and honest discussion of mistakes that is necessary for the process of organizational learning to take place. At the beginning of the 1990s, Donald Berwick spoke on the importance of patients having access to an open communication system in order to avoid experiencing unpleasant outcomes that come about as a result of improper communication [4].

Review:

The nursing profession has been confronted with difficulties that have never been seen before in the 21st century. The rise in the number of elderly people and chronic diseases, the worldwide shortage of nurses, the rising cost of nursing, and the rising life expectancy have all presented enormous challenges to nursing professionals. The technological advancements that have been made in the field of information and engineering have provided new insights that can be used to solve the problems that have been mentioned above. For instance, the implementation of robots results in a decrease in the demand for the nursing workforce, which in turn leads to a reduction in the cost of health care. On the other hand, wearable gadgets make it possible for nurses to continuously monitor patients who have chronic conditions, which ultimately leads to an improvement in terms of precision nursing. It is possible that these interdisciplinary collaborations will result in a dramatic shift in nursing care since they bring about improvements in efficiency, patient access, and the quality of healthcare services [5].

Collaborations between diverse fields, such as engineering and healthcare, have been around for quite some time. After the discovery of the X-ray in 1895, there have been numerous instances of successful cooperation between the fields of medical and engineering having been reported. During the course of the previous century, engineering has been an essential component in the process of advancing the revolution in healthcare. When it comes to providing instrumentation, devices, products, procedures, and operational systems, nearly all of the disciplines that fall under this umbrella, such as biomedical, chemical, computer, information, software, civil, electrical, and mechanical engineering, make a significant contribution to various aspects of health care [6].

In the year 1962, the American Society of Healthcare Engineering (ASHE) was the organization that initially put forward the idea of healthcare engineering into practice. Up until the year 2015, the term "healthcare engineering" was described as engineering that encompassed the complete process of disease prevention, diagnosis, treatment, and management, as well as the maintenance and promotion of psychological and physiological well-being through the provision of care by health professionals. As a result of this scope, nursing encompasses practically all of the associated research fields of healthcare engineering, which leads to the necessity of developing interdisciplinary collaboration between nursing and engineering [7].

In recent years, a number of educational and research institutions have acknowledged the significance of interdisciplinary collaboration between nursing and engineering, and as a result, they have carried out projects that involve both nursing and engineering in conjunction with one another. In 2008, for instance, the University of Massachusetts Amherst was a pioneer in the formation of a nursing-engineering laboratory with the purpose of promoting the development of individualized healthcare management systems that are based on wearable technology [8]. In addition, the Robert Wood Johnson Foundation provided financial assistance to the establishment of MakerNurse in 2013, which was established as a community of creative nurses for the purpose of fostering nursing innovations. The availability of tools, platforms, and resources makes it possible for a greater number of nurses to put their ideas into action and enhance the quality of care provided to patients [8].

In addition, students from Duke University's nursing and engineering departments worked together in 2017 to construct the first-generation telerobotic intelligent nursing assistant. In spite of this, the scope of interdisciplinary interactions between nursing and engineering in the field of health care, as well as their potential future paths, are yet unknown. Furthermore, during multidisciplinary collaborations, nurses and engineers creatively use scientific technology to handle healthcare challenges. Despite the fact that they focus on various disciplinary viewpoints to tackle the same problem, they nonetheless use these technologies to address healthcare issues. However, engineers are more concerned with the "art of design" and the "practice of architecture," in contrast to nurses, who are more focused on the "art of caring" and the "practice of health promotion." Therefore, in order to effectively collaborate with engineers, nurses need to have a comprehensive understanding of the responsibilities that they play [9].

The role that nurses play in interdisciplinary collaborations is becoming an increasingly important topic of study, and there is a growing interest in this area. There was an initial proposal for a new profession called the nurse-engineer, in which a nurse would have a technical degree and would use it to educate nurse practitioners and patients through the use of information technology. In 2015, Eisenhauer argued for this concept and recommended the establishment of a new field of study known as nursing engineering. This field would combine the benefits of nursing with those of biomedical engineering. To this day, institutions have not established a distinct field of study specifically referred to as nursing engineering. One of the most current articles discusses the following topics: i) the design and implementation of new

systems, technologies, and equipment; ii) the establishment of safe patient care environments; iii) the guarantee of data security; and iv) the development of efficient information technologies for nurse-patient communication. Despite the fact that nurses play a crucial role in interdisciplinary collaboration in the health care industry, this field continues to receive insufficient research [10].

Due to the fact that the included studies did not adhere to any conventional writing patterns, we utilized content analysis in order to identify the primary themes and provide answers to the research questions about the roles of nurses and study fields in multidisciplinary collaboration. To be more specific, two primary reviewers examined the included papers multiple times in order to obtain specific information regarding the study topics by reading them frequently. The process of coding was then finished by categorizing codes that were similar to one another and grouping them together. A additional evaluation and discussion of the categories was conducted by the study team in order to reduce the likelihood of any potential biases [11]. As an additional point of interest, the multidisciplinary partnership model between nursing and engineering was initially established in accordance with the engineering life cycle. During the primary stage of the engineering life cycle, the activities of requirement analysis, design, testing, and assessment are carried out. This life cycle and the papers that were included were used as the basis for the iterative discussion that the research team had around the process of interdisciplinary collaboration. Within the context of this approach, every member of the team utilized their own areas of expertise to further explain the roles and duties of nursing and engineering professions. The study team reached a consensus on the multidisciplinary collaboration model, its implementation environment, and its breadth after engaging in a number of talks [12].

Previous research has documented the participation of nurses in the role of testers inside of a real-world environment. There were five studies that specifically revealed that nurses were the ones who prepared the test plan and offered proper training to the participants before the testing took place. This training included explaining the working procedure and teaching the methods. It was reported in the remaining investigations that a limited number of end-users, such as patients, caregivers, nurses, and doctors, took part in the pilot tests. The purpose of these studies was to evaluate the practicability, usability, accessibility, and acceptability of the prototype that was built in the stage before this one. Following the completion of the test, nurses frequently conducted interviews or distributed questionnaires in order to collect feedback from end-users, identify any issues that arose, and then communicated this information to engineers in order to further improve the prototype. It is becoming increasingly common for nursing and engineering to work together in interdisciplinary collaboration, with nurses playing a significant part in the working relationship. This scoping review gives new possibilities for future research on interdisciplinary cooperation between nursing and engineering, as well as a description of the existing level of knowledge in this area. Moreover, the study provides further elaboration on the function that nurses play in interdisciplinary collaboration within a real-world healthcare environment. This is anticipated to improve the way in which engineers engage with one another in the future. A wide variety of interdisciplinary collaborations between nursing and engineering are covered by the collection of research that are studied in this review. Additionally, a wide variety of healthcare challenges are addressed by these studies. The majority of recent research have concentrated on patient safety, particularly the administration of medication and risk assessment, which is in line with the findings of earlier investigations [13].

The school nurse is a front-line provider of health care who acts as a bridge between the education system and the health care system. School nurses, who are frequently employed by school districts, health departments, or hospitals, are responsible for ensuring the physical and mental well-being of pupils while

they are in school. In their capacity as sentinels of public health, they encourage school communities, parents, and health care providers to collaborate in order to enhance the health outcomes of children and to facilitate wellness. The presence of school nurses is absolutely necessary in order to broaden the availability of high-quality medical care for students, particularly in light of the growing number of children who have complex medical and social requirements. The availability of school nurses contributes to the improvement of health care equity for kids. It is possible that the school nurse is the only health care provider that many children who are impoverished or live in close proximity to poverty get regular access to. School nurses are responsible for providing treatment and assistance to students who are coping with chronic health conditions and disabilities; addressing injuries and urgent care needs; providing preventive and screening services, health education, immunizations, and psychosocial support; conducting behavioral assessments; and working in collaboration with health care providers, school staff, and the community to facilitate the holistic care that each child requires [14].

Conclusion:

It has been observed that there has been a rapid development in the interdisciplinary collaboration between nursing and engineering and healthcare management, and nurses are becoming increasingly involved in the collaboration. According to the findings of this review, the primary function that nurses fulfill in interprofessional partnerships is that of testers and evaluators. In the future, nurses should be increasingly active in the early stages of problem-solving in the healthcare industry, particularly in the phases of requirement analysis and design. When it comes to nursing, there should be more opportunities for interdisciplinary collaborations in order to incorporate the various nursing disciplines' points of view. In addition, because nursing evaluation is the most important component of the nursing process, nurses should be accountable for carrying out a methodical and complete information gathering of patients' needs. This information collection should include aspects of the patients' physiological, psychological, and social conditions. The findings from the literature, on the other hand, demonstrated that nurses have not totally fulfilled the job of requirement analysts. Only a small number of research have focused on the psychological requirements of patients. Consequently, nurses ought to exert a greater degree of involvement in the process of understanding the requirements of patients during interdisciplinary collaboration with engineers.

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