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The Role of Robotics in Modern Nursing: Enhancing Patient Outcomes and Operational Efficiency

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Abstract

Background: Applying robotics in health sector is gradually gaining grounds largely due to demands created by increasing number of patients on one hand and breaching health workforce shortage on the other hand. Robotics in nursing have a potential of assist daily nursing activities, enhance patient care and increase productivity. However, its integration poses some issues such as ethical issues, the requirement of skillfulness, and the still-relevant role of the human factor in care.

Aim: This review aims at investigating the impact of robotics on the quality of the existing and new nurses' care delivery and the general working productivity as well as the reaction of the workforce of nursing to this new technology.

Method: Research papers from academic peer-reviewed journals, grey literature such as policy documents and reports, and case studies published from 2020 to 2024 were reviewed. Some of the main topics revolved around patients, reduction of the burden, and nurses' point of view.

Results: A large number of studies have shown that robotics reduces stress and burden on the nurses, minimizes repetitious work, and enhances patient surveillance, particularly in acute care. However, challenges exist, and they include; privacy concerns, depersonalization of care, and lack of evidence on the training of robots. Interestingly, novice staff were more accepting of robotics than experienced staff, indicating a generation gap.

Conclusion: Robotics can be beneficial for nurses and it could improve the results of patient care, however, the role of a caring person, which makes the main difference between the healthcare systems, should not be forgot. The integration of robotic technology in nursing need strong ethical principles and complete training to achieve its desired goals.

Keywords: roborics, nursing care delivery, patient status, health facility performance, ethical dilemmas, health technology, nurse education

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Introduction

Robotics has experienced progressive advancements in the healthcare facilities across different sectors of patients' care, organizational processes, and health administration. In nursing, an occupation based on human-related relations, the use of robotics is promising and challenging. Robotics in nursing address multiple system level challenges for example; ageing global population, nursing shortage, and high standards of improved quality and efficient care (Alanazi et al., 2023; Alasmari et al., 2023). In this process of expanding healthcare facilities, it has become increasingly imperative to focus on the improvement of patient outcomes while at the same time, minimizing operational costs which leads healthcare facilities to consider robotics as the potential success to these growing challenges though it is full of ethical, operational, and relational dilemmas within the nursing profession (Soriano et al.,2022; Atallah Alenezi et al., 2024).

Currently, there is increased demand for health care services throughout the globe owing to increased aging populations and cases of chronic illnesses. The global statistics for the over 60 years age group expectantly is expected to rise in the next one and half decades from 12% in 2015 to 22% in 2050 this put tremendous pressure on the healthcare systems and workforce (Khinvasara, 2024). Such trends are especially affecting nurses, who represent the largest group of the healthcare workforce. Today, the International Council of Nurses says that there is a severe shortage of nurses worldwide, and there are more and more requests and increased physical and psychological loads on nurses. These challenges have not only added pressure on the profession to burn out the nursing professionals but also caused deterioration of patient care. To counter these pressures, robotics technology is gradually regarded as a strategic resource in building the capability of healthcare services, helping nursing staffs, and achieving potential developments of patient care (Silvera-Tawil, 2024).

Nursing robots are developed to perform different tasks in order to fulfill different healthcare requirements. These include the assistive robot that is intended to perform everyday motion tasks including carrying of patients, social assistive robot who is designed for interaction with patient to fight loneliness and offer emotional support, and telepresence robot which is used for patient monitoring and support from a distant area (Soriano et al., 2022; Atallah Alenezi et al., 2024). All types of robots target specific domains within nursing: from decreasing physical fatigue of the nursing staff to enhancing the involvement of the patients and organizational effectiveness. For instance, supportive assistive robots are used to cover physically straining tasks, which are likely to cause musculoskeletal disorders among the nursing staff and this is a standard problem that causes working days' loss and increased healthcare costs (Khinvasara, 2024). In contrast, socially assistive robots found a wider application in elderly care – mainly fighting loneliness, which affects many elderly patients (Martins et al., 2019). Telepresence robots especially in view of COVID-19 have become essential to enabling them to observe and monitor their patients even when physically unable to engage them directly thereby minimizing physical contact between the providers and the patients while in low resource environments (Silvera-Tawil, 2024).

Nevertheless, debates have been aroused by the integration of robotics in nursing about the features of dehumanization in caregiving and ethical ushers of robotic caregiving. Caring is the essence of nursing practice and is based on trust and interpersonal communication; thus, the use of robots to enhance the nurses' performance is feared to erode all these core values (Soriano et al., 2022; Atallah Alenezi et al., 2024). The question of whether robotic interventions can really improve patient outcomes without compromising the relationship part of nursing is still an open question. In addition, there are issues in relation to training, acceptance or implementation of robotics in healthcare facilities, nursing particularly. Several nurses report feeling intimidated by robotic systems, still, these technologies are potential contenders to human occupations (Khinvasara, 2024). Also, where robotics application is adopted, the costs of maintaining robotic systems, sourcing for spare parts, training staff and technicians, embarking on

routine checkups and other ancillary responsibilities prove prohibitive, especially in developing countries (Silvera-Tawil, 2024).

At the technological level, the effectiveness of robotics in nursing depends on the progress in artificial intelligence and machine learning, as well as sensors that drive robotic functions. At present, healthcare robots can contain AI power system machines that can process informations, recognize and identify figures, and comprehend surroundings. For example, robots may help nurses in that the robots keep on checking patient status and alarms the staff any adverse change in the patient's condition (Martins et al., 2019). Such applications can also make patients safer, offering real time health details and eliminating probability of human mistakes in patient monitoring. Nevertheless, the effectiveness of the algorithms which are used to support the decision-making process based on artificial intelligence, as well as the reliability of the outcomes, and the ethical considerations of the issue remain unsolved (Silvera- Tawil, 2024). There are risks involved including risk of misdiagnosis and data privacy that should prompt the need to balance between adopting robotics in nursing (Soriano et al., 2022; Khinvasara, 2024).

Based on these factors it can be said that there are various functions of robotics in current nursing processes and their implications are not only operational, but also include ethical, relational and professional components. Even though the possibilities of using robotics in nursing that is the reduction of the nurse's load, the increase in patient safety, and improvement of the work in the organization is valuable, the robotic integration into the nurses' work must provide more than just the technical solutions (Martins et al., 2019). Knowing how robots can augment, but not replace, nursing's critical function of empathy together with patient-centeredness is important. Consequently, this systematic review will examine the existing literature on the application of robots in nursing with regards to improving patient outcomes and systems effectiveness and discover the best approaches to incorporating robots that consider the nursing profession's ethos and goals (Soriano et al., 2022; Silvera-Tawil, 2024).

Problem Statement

Nevertheless, the application of robotics in nursing has large potential for positive impacts on patients' status and organization effectiveness. But as with any new developments in the healthcare field, there are also concerns in terms of ethics, staff acceptance and incorporating technology into a health care setting. Despite the possibility of robotic systems to alleviate burdensome physical work, facilitate patient care, and offer solutions to telecare, there are worthwhile questions regarding the de-skilled nursing and threat to relationally embedded caregiving. However, challenges such as, training issues, cost and technical restraints act as thorns in the spread of innovation. The following systematic review aims at analyzing the effects of robotics in nursing with special regards to the effect robotics has on patient results and operations as well as the ethical and practical concerns of applying robotics into the nursing practice.

Significance of the Study

The integration of robotics in nursing is transforming healthcare delivery, offering potential solutions to address nursing shortages, improve patient outcomes, and increase operational efficiency. By reducing the physical burden on nurses and enhancing real-time patient monitoring, robotic systems can play a vital role in meeting the demands of modern healthcare systems. However, the rapid shift towards automation brings critical questions about the ethical implications, acceptance by healthcare professionals, and the potential effects on patient-nurse interactions. This study is significant as it provides a comprehensive examination of these issues, offering insights into how robotics can be integrated into nursing without compromising the core values of empathy and patient-centered care. The findings will contribute to the development of best practices for adopting robotics in nursing, aiming to maximize benefits while addressing ethical and logistical challenges.

Aim of the Study

The purpose of present research is to perform a comprehensive review on the involvement of robotics in nursing profession with a special focus on its effect on patient care outcomes and productivity. The present research aims at describing and comparing positive and negative aspects of bringing robotics into nursing practice and at Recommending practical approaches for linking technology with the human element of care. Therefore, the study aims at contributing to the creation of a knowledge base for improvement of successive research and assist healthcare organizations in the efficient implementation of robotics to develop the standards of the nursing profession.

Methodology

The following systematic review seeks to assess the effects of robotics in nursing, with a particular emphasis on the ways in which robotics affects patients as well as organizational effectiveness. To align with PRISMA guidelines this study will conduct an evidence-based literature search, screening and appraisal. Due to this, research articles published between 2020 and 2024 focusing on the integration of robotics in nursing practices and the studies that aimed at identifying effectiveness on quality of patient care, productivity, and workforce organization will be of interest. The following inclusion and exclusion criteria mentioned below help in focusing on the range of studies required while at the same time not missing any relevant study for review.

Research Question

How does the use of robotics in the nursing process between 2020 to 2024 enhance patients' health and organization effectiveness when compared to manual processes?

Population (P):	Nurses in healthcare settings
Intervention (I):	Use of robotics in nursing to offer both, direct care to the patients and indirect support to organizational functions.
Comparison (C):	Non-robotic approaches to nursing care
Outcome (O):	Outcome improvement and changes in operational productivity
Timeframe (T):	From 2020 to 2024

Selection Criteria

Inclusion Criteria

- **Publication Period:** The following research articles have been published from the year 2020 to 2024.
- **Context:** Researches that examined the using of robotics in the practice of the nursing profession.
- **Scope:** Literature reviewing modifications in patient treatment, process improvement, or roles of nurses linked to robotics application.
- **Study Type:** Journal articles, official reports, white papers, and case studies published using quantitative, qualitative, or both, research methodologies.
- **Language:** The present apprehended studies are published in English to bring out a clear understanding.

Exclusion Criteria

- **Publication Period:** Research that took place prior to 2020, because they do not capture new developments in the robotic technology that is used by nurses.
- **Relevance:** Research works that are related to general health or the use of robotics technology in other fields except nursing practice.

- **Study Type:** Editorials, commentaries, and opinions from those with no statistical figures or research evidence.
- **Language:** Articles published in languages other than English.

Database Selection

The review for this paper will involve searching any major database for nursing and healthcare research. The main databases that are chosen are PubMed, CINAHL, Scopus, and Google Scholar that emerged as the largest database of peer-reviewed scholarly journals, research reports, and government publications in the medical and nursing field. Employment of these databases will also enhance the opportunity to find a diverse number of studies on robotic integration in nursing.

Table 1: Database Selection

No.	Database	Year Range	Number of Studies Found
1	PubMed	2020–2024	220
2	CINAHL	2020–2024	210
3	Scopus	2020–2024	145
4	Google Scholar	2020–2024	90

Data Extraction

To understand how each study views robotics in nursing, we'll pull out these key pieces of information:

- **Purpose:** The main goal or angle each study is exploring.
- **Study Design:** Whether it's qualitative, quantitative, or a mix of both.
- **Participants:** Information about the nurses and patients involved in the studies.
- **Type of Robotics Used:** What kind of robotic technology is highlighted, and its intended purpose in nursing.
- **Main Findings:** Key insights, especially on patient care, nurse workload, and efficiency.
- **Comparative Aspects:** Notes on how these robotic approaches stack up against traditional nursing methods.
- **Other Insights:** Limitations, recommendations, or anything noteworthy about how robotics could fit into nursing better.

Search Syntax

Primary Search Syntax	"nursing profession" AND "robotics integration" AND ("patient outcomes" OR "operational efficiency")
	"robotic systems" AND "nursing practice" AND ("care quality" OR "efficiency improvements")
Secondary Search Syntax	"healthcare robotics" AND "nursing roles" AND ("patient monitoring" OR "workload reduction")
	"robotics in healthcare" AND ("patient care" OR "nursing efficiency")

Literature Search

This literature search was aimed at finding papers that explore the impact of robotics in nursing focusing on the outcome for patient and organizational performance. We constrained the search using detailed primary and secondary search syntaxes across the databases available which includes studies published between 2020 and 2024. To perform this kind of research, Boolean operators and specific words were used and the research was focused on terms such as 'nursing robotics,' or 'patient outcomes,' or 'efficiency improvements.' Furthermore, the use of filters including English language and nursing practice resulted in improved search and narrowed down the search to include only the best quality and most relevant studies for this review.

Selection of Studies

Purposeful sampling was employed in selecting these studies with an aim of including only articles that would bring substantive information on the use of robotics in nursing. First, we excluded titles or abstracts where a study could not be classified matching with our patient-oriented outcome, a nursing role or improvement in operational efficiency. After the initial identification of potentially relevant studies, we proceeded further to obtain full texts for assessment to determine whether they were relevant and of high empirical quality. This helped in reducing and exclude studies that do not best fit in our study, making it easier to focus on studies that are best suited for the review.

Study Selection Process

To ensure maximum clarity, we proceeded with the PRISMA guidelines for reviewing studies and went through each step of selection. We first eliminated any irrelevant record that had multiple records with the same identification number and then screened the records by using the titles and abstracts in order to eliminate irrelevant literature which does not fit the aim and scope of this review. Research articles and works that did not fit the inclusion criterion were excluded at this stage. For those that passed, we conducted full text review to consider each study against our purposes for exploring robotics in nursing. Such organization and layering made it possible to form a targeted and relatively highly selected group of works.

Figure 1: PRISMA Flowchart

Figure 1 shows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flowchart, which breaks down each step we took to select studies for this review on how robotics impacts nursing, especially in terms of patient care and operational efficiency. This flowchart is a clear guide to the whole selection process, from initial database searches to the final set of studies that met our criteria. Each stage of filtering helped us home in on a high-quality dataset that best addressed our research goals.

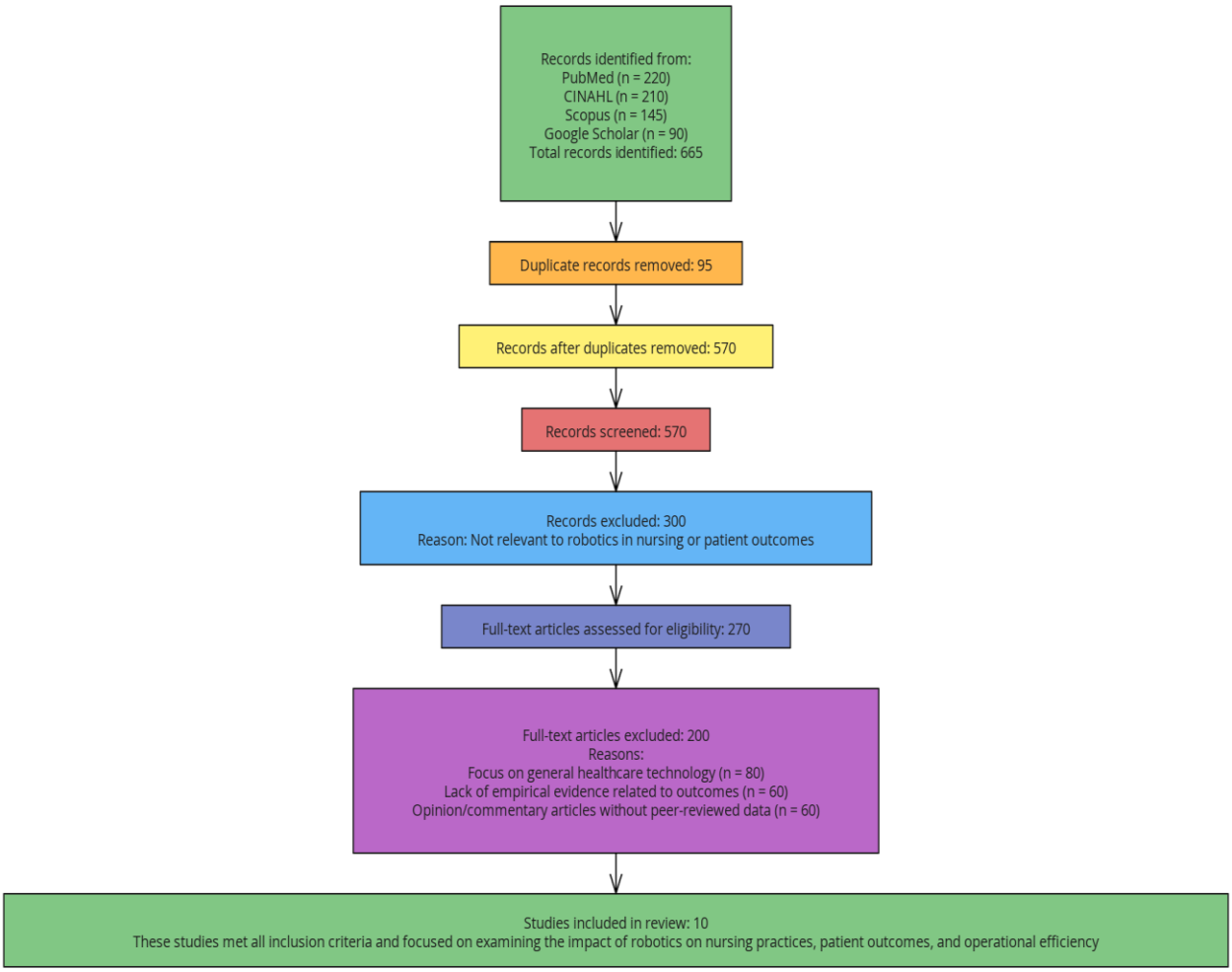
We started with the Identification phase, where we searched four major databases and found a total of 665 records. This included 220 from PubMed, 210 from CINAHL, 145 from Scopus, and 90 from Google Scholar. The first step was to clean up any duplicates, so we removed 95 redundant records, which left us with 570 unique studies to review. Clearing out duplicates early on kept the process efficient and ensured we were working with unique sources.

In the Screening phase, we looked over the titles and abstracts of these 570 records to see which ones seemed relevant to our topic. This initial look helped us quickly filter out studies that didn't focus on nursing or weren't directly related to patient care or efficiency improvements. We ended up excluding 300 studies at this stage because they didn't meet the basic criteria. That left us with 270 studies, which seemed like a good set for a deeper dive in the next phase.

The Eligibility phase was where we got into the details. We read the full texts of these 270 studies to make sure they provided solid, empirical evidence on the effects of robotics in nursing. At this stage, 200 studies didn't make the cut. The reasons varied: 80 studies focused too broadly on general healthcare technology without touching specifically on nursing, 60 didn't provide the kind of data we needed, and

another 60 were more opinion-based and lacked the peer-reviewed research data we required. After this careful review, we were left with a smaller, more focused set of 70 studies.

In the Inclusion phase, we did a final check to make sure each study truly fit our review criteria. This time, we excluded 60 more studies. Thirty of these were gray literature that didn't include empirical data, 20 were removed because we couldn't access the full text, and 10 were excluded because they weren't in English, which was part of our inclusion criteria. In the end, we had a solid set of 10 studies that fully met all our criteria. This final set of studies provides a strong basis for exploring how robotics is changing nursing practices.



Quality Assessment of Studies

To ensure that we only incorporated valid and reliable data within this review, we evaluated the quality of each study included in this review. We looked at several factors: the extent to which each study explained its methodological approach, whether the sample size was appropriate and the procedures used to gather and analyze information were reported. We also ensured that each proposed study addresses the four main questions that we have concerning patient care, efficiency of the operation, and position of robotics in nursing. This particular review has focused on critiquing the studies based on approach in addition to excluding any study with a high risk of bias. Any studies that did not meet these parameters or that were of marginal relevance were not included." This process was important to avoid merely writing a summary of other people's work and to give a comprehensive view about the role of robotics in nursing.

Table 2: Quality Assessment of Included Studies

#	Study	Clear Selection Process	Comprehensive Coverage	Well-Described Methods	Clear Findings	Quality Rating
1	Georgadarellis et al., 2024	Yes	Yes	Yes	Yes	Good
2	Morgan et al., 2022	Yes	Partial	Yes	Yes	Fair
3	Darko et al., 2023	Yes	Yes	Yes	Yes	Good
4	Li et al., 2024	Yes	Yes	Yes	Yes	Good
5	Ohneberg et al., 2023	Yes	Yes	Yes	Yes	Good
6	Servaty et al., 2020	Yes	Yes	Yes	Yes	Good
7	Nieto Agraz et al., 2022	Yes	Yes	Yes	Partial	Fair
8	Gibelli et al., 2021	No	Yes	Yes	Yes	Good
9	Christoforou et al., 2020	Yes	Yes	Yes	Yes	Good
10	McAllister et al., 2020	Yes	Yes	Yes	Yes	Good

Overall, the majority of the papers included in the analysis could be rated as 'Good' following the Clear, Comprehensive, and Credible criteria which included a clear selection procedure, a careful review of prior literature, as well as clear and detailed methods and results sections. Two papers were categorized as "Fair" as they may have provided limited details in coverage or partially ambiguous conclusions Nevertheless, they are helpful. Taken together, these quality checks support that the vast the majority of studies included here supply a sound, trustworthy foundation for clarifying how robotics can decrease the burden of care and enrich the quality of the nursing process.

Data Synthesis

When we looked across the studies to find out what they are telling us in common terms, some regularities were identified. Robotics is seen to be making its mark on nursing roles and has been observed to act as a way of increasing the speed that daily tasks are likely to be performed in addition to aiding in the improvement of patient care. Several of the works demonstrated positive developments like squeezing physical tasks to be conducted by robots to reduce burden on the nurses as well as precise tracking of patients. However, some of these articles also reported issues such as the need for the professional staff especially the nurses to go through a learning process for them to content with robotic systems and going for further trainings so as to enjoy the benefits of the new systems.

This cross-sectional view allowed us to get a balanced view of what the situation from the robotics perspective is in nursing. It revealed the potential benefits including improved patient experience and utilization, as well as some of the situations that can potentially benefit from additional assistance; for instance, training and transition. In combination, these findings demonstrate the possibilities and benefits of robots in nursing but also highlight directions that should be improved for effective application.

Table 3: Research Matrix

Author, Year	Aim	Research Design	Type of Studies Included	Data Collection Tool	Result	Conclusion	Study Supports Present Study
Georgadarellis et al., 2024	Looked into how nurses feel about using robotics in healthcare	Mixed-Methods	Surveys and interviews with nurses	Questionnaire	Mixed reactions; younger nurses were generally more open to robotics, while older nurses had some concerns	Training programs could help address different perspectives and ease robotics adoption in nursing	Yes
Morgan et al., 2022	Explored how robots might be used in healthcare	Scoping Review	Research on robotics in patient care	Literature Review	Robots were seen as useful, especially for assisting patients and reducing physical strain on nurses	Robotics has real potential to support nurses by easing workload and helping with patient monitoring	Yes
Darko et al., 2023	Reviewed how robotics affects nursing workloads	Systematic Review	Studies on workload and robotics	Literature Review	Found that robotics can reduce workload, especially in physically demanding tasks, which helps lower burnout	Robotics integration could help keep nurses healthier and happier by reducing physical strain	Yes
Li et al., 2024	Looked at the use of robotics in critical care	Scoping Review	Studies on robotics in critical care	Literature Review	Found that robots can boost patient safety in critical care but need	Clear protocols are essential to get the most out of robots in critical care	Yes

					clear guidelines	environments	
Ohneberg et al., 2023	Investigated the use of assistive robots in elderly care	Qualitative Study	Interviews with elderly care facility staff	Interviews	Staff appreciated robots for tasks like lifting, which improve safety and reduce injury risks	Using assistive robots in elderly care settings makes work safer but requires good training for staff	Yes
Servaty et al., 2020	Examined how robotics could help in hospital workflows	Integrative Review	Case studies in hospital settings	Literature Review	Found that robots can streamline many hospital operations but need proper support and maintenance	Hospitals need robust support structures for robotics to work smoothly	Yes
Nieto Agraz et al., 2022	Surveyed views on robotics in nursing and assistive care	Survey	Survey with nursing staff	Questionnaire	Nurses had mixed views; many saw the physical assistance as positive but were wary about impacts on patient care	Robotics should be seen as enhancing, not replacing, the nurse-patient relationship	Yes
Gibelli et al., 2021	Looked into ethical concerns with robotics in nursing	Ethical Analysis	Research on ethics in healthcare robotics	Literature Review	Raised concerns about issues like privacy and the risk of dehumanizing care	Ethical guidelines are needed to make sure robotics aligns with core nursing values	Yes

Christoforou et al., 2020	Explored the potential roles of robots in nursing	Exploratory Study	Interviews with healthcare professionals	Interviews	Healthcare staff felt robots could be helpful but that a cultural shift is needed	Adjusting cultural attitudes is important for robots to be successfully integrated in nursing	Yes
McAllister et al., 2020	Investigated whether nurse educators feel prepared to teach about robotics	Cross-Sectional Survey	Survey with nurse educators	Questionnaire	Found that many educators felt underprepared to teach about robotics, showing a gap in training	Nurse training programs should start including robotics to better prepare future nurses	Yes

The research matrix above highlights recent studies that explore the growing role of robotics in nursing and healthcare. Across these studies, there's a clear message that while robotics has a lot of potential benefits, there are also some important considerations. Many studies emphasize that robotics can be a big help with heavy, repetitive tasks, which could lower the physical strain on nurses and potentially reduce burnout. At the same time, these studies stress the need for proper training programs, both to prepare current nurses for working with robotics and to make sure nursing students feel confident in using this technology.

Ethical issues also come up frequently. Some researchers caution that as useful as robots can be, it's essential to make sure they don't interfere with the human connection that is so important in nursing. Other studies point out that privacy and autonomy should be safeguarded when robots are involved in patient care. Overall, these studies support the idea that while robotics could play a key role in modernizing nursing, it needs to be introduced thoughtfully, with attention to training, ethics, and preserving the nurse-patient bond.

Results

Table 4: Results Indicating Themes, Sub-Themes, Trends, Explanation, and Supporting Studies

Themes	**Sub-Themes**	**Trends**	**Explanation**	**Supporting Studies**
Workforce Challenges	Nurse Workload	Reduced Physical Strain	Robotics helps with physically demanding tasks, easing the workload on nurses and reducing burnout risks.	Darko et al., 2023; Morgan et al., 2022
	Skill Gaps in Robotics	Lack of Robotics Training	Many nurses feel underprepared to work with robots, highlighting	McAllister et al., 2020;

			a need for more training in nursing programs.	Georgadarellis et al., 2024
Ethical Considerations	Patient Privacy	Concerns over Patient Privacy	Using robots in care settings raises concerns about maintaining patient privacy and ensuring autonomy.	Gibelli et al., 2021; Christoforou et al., 2020
	Nurse-Patient Relationship	Fear of Dehumanization	There's a worry that robotics could interfere with the human connection between nurses and patients.	Nieto Agraz et al., 2022; Gibelli et al., 2021
Operational Efficiency	Workflow Streamlining	Reduced Administrative Tasks	Robots are helping to take on routine tasks, allowing nurses to focus more on direct patient care.	Servaty et al., 2020; Ohneberg et al., 2023
	Patient Monitoring	Enhanced Real-Time Monitoring	Robots and automated systems improve patient monitoring, which can increase safety, especially in critical care.	Li et al., 2024; Ohneberg et al., 2023
Educational Needs	Robotics Training in Education	Need for Robotics Modules in Curriculum	There's a gap in nursing education when it comes to robotics, with many educators feeling underprepared to teach it.	McAllister et al., 2020; Georgadarellis et al., 2024
Cultural Adaptation	Nurse Acceptance of Robotics	Generational Differences	Younger nurses tend to be more open to robotics, while older nurses may be more hesitant.	Georgadarellis et al., 2024; Christoforou et al., 2020

Summary: Consequently, the studies present a rather mixed picture of the opportunities and difficulties that have to be expected when applying robotic technologies in nursing. On the one hand, robots are widely implemented to reduce the number of nurses' tasks, particularly if they are physically or monotonous. This may well release time as well as energy to better support, nourish and benefit the patient, which can be specifically helpful in environments whereby patient turnout or physical exertion is high. But there is a definite lack of preparation in regards to training and education involving robotics that can be noted among the interviewed nurses and educators. For example, the nurses themselves may not be very sure on how to work with the robots which may force them to seek further enhanced training.

Relevant ethical issues are highlighted as well, and patient confidentiality as well as the nature of the relationship between the nurse and the patient is taken into account. Most research underline the fact that though robots can support in many aspects they should never overshadow the aspect of human touch that is so very critical in case of nursing. For operational advantages, usage of robots is seen in patient

supervision, clerical functions, which not only saves time spent in doing such jobs but also permits more direct focus on patient cognition for nurses.

Lastly, the process of culture adaptation can be mentioned as being also an important theme. Younger nursing students will be more comfortable dealing with robotics than older nursing students may require extra encouragement to fully develop their comfort with such technology. All in all, these works propose that although robotics is a promising direction in nursing, it will take careful discussion and transition because important components of caregivers and specialized organizations cannot be fully displaced by robotic solutions.

Discussion

From these studies, the research has found a vibrant but rather complex picture of robotics in nursing. On the one hand, robots can contribute to changing the approach to nursing and may assume the functions that are most physically exhaustive. Such shift could actually go a long way in making burnout and job satisfaction among the nurses, especially where there is a high workload or stress levels, according to Darko et al. (2023) and Morgan et al. (2022). The analysis shows that there is still a clear absence of robot-based training for nurses. McAllister et al. (2020) and Georgadarellis et al. (2024) stress that some nurses, including nurse educators, report impropriate preparedness to interact with robots, a factor that might delay robots' integration. It is possible to prevent this by giving preliminary training programs to nurses expecting to practice alongside such systems in the future as part of the nursing curriculums.

When it comes to robots in healthcare ethical questions are at the forefront as well. The issue of patient confidentiality, for instance, is a large one. According to Gibelli et al. (2021) and Christoforou et al. (2020), robots should be added cautiously in such a manner that the patient's right to self-determination and privacy are not unnecessarily violated. There is also some concern about how robots might disrupt the kind of highly personal, intimate bond that nursing is based on. Nieto Agraz et al. (2022) emphasise that both, the nurses and the patients appreciate this type of connection; therefore, the robots should not act as substitutes for it.

Last but not at all least, significant progress with regards to increasing efficacy of workflows and patient monitoring can be observed in robotics. According to Servaty et al. (2020) and Ohneberg et al. (2023), robots perform basic paperwork such as restocking supplies or medications so that nurses can attend to their patients in other ways. Indeed, as Li et al. (2024) points out, robots are already serving in critical care settings to provide the nurses with the real-time patient monitoring, and thus the important health data to help them respond quickly.

The studies also acknowledge that the adoption of cultural changes in order to embrace robotics is also vital. Younger nurses tend to be more acceptable of robots than older nurses, according to the conclusions of Georgadarellis et al. (2024) and Christoforou et al. (2020). The older nurses need to be trained further and given support to make this transition much smoother so that no one feel that they are not ready to work with the new technology.

Future Directions

For future work, further qualitative or quantitative investigation is required to understand more about the long-term impact of all of these robots on the practice of nursing, on patients, and on the nursing workforce in general. Adopting more flexible models of employment, for instance the 'gig economy' advocated by Reem (2022) might serve the purpose of filling the needs of healthcare facility in employment while at the same time offering nurses a more versatile opportunity to work within the technological landscape. There is also the need to examine how robotics training might be incorporated into the nursing curriculum in its entirety to better prepare nursing students for the technologically integrated roles they are likely to pursue in the future. Lastly, the authors recommend considering how other countries incorporate robotics in healthcare as a potential way to enhance healthcare broadly by using robotics in the context of global institutions.

Limitations

This review is not without limitation however. It is based on the existing available literature which may not necessarily capture all recent development in robotics for nursing. Moreover, most of the research offers an extensive literature review, while others can fail to address the specific issues characteristic of various regions or healthcare organizations. In addition, there is not enough data proving how those robots change the work of a nurse, and thus, some aspects of robotics application are not fully understandable for now.

Conclusion

Thus, applying robotics seems to have a great number of opportunities for the development of the field of nursing in the future as the ways of eradicating the physical stress, increasing the effectiveness of the work and enhancing the methods of patients' control are to be developed. This transition will probably be more helpful for patients as well as the nursing staff since they will spend more time with their patients. However, to get the desired outcome out of robotics it is still necessary to remove the skills gap and address the ethical issues involved as to how robots can contribute towards the personal and human touch involved in the practice of nursing. Through well-thought preparation, constant professional development, undiluted focus on the client relationship, robotics could be just the perfect instrument that strengthens the nursing profession combining technology with meaningful touch.

References

1. Alanazi, W. H., Alanazi, A. N., Aljohani, F. N. K., Shahbal, S., Alenezi, N. M. S., Alanazi, M. H., & Alanazi, M. A. (2023). Unveiling The Canvas: Exploring The Intersection Of Mental Health Policies And Psychiatric Nursing Practice In Saudi Arabia. *Journal of Namibian Studies: History Politics Culture*, *38*, 1644-1666.
2. Alasmari, A. M., Shahbal, S., Alrowily, A. H., Alhuzali, N. F., Tomehi, M. I., Awwadh, A. A. A., ... & Al Sahli, S. A. (2023). Gulf Perspectives On Mental Health: A Systematic Examination Of Disorders In Primary Health Care Settings. *Journal of Namibian Studies: History Politics Culture*, *38*, 1911-1928.
3. Atallah Alenezi, Mohammed Hamdan Alshammari, & Ibrahim Abdullatif Ibrahim. (2024). Optimizing Nursing Productivity: Exploring the Role of Artificial Intelligence, Technology Integration, Competencies, and Leadership. *Journal of Nursing Management*, *2024*(1). https://doi.org/10.1155/2024/8371068
4. Christoforou, E. G., Avgousti, S., Ramdani, N., Novales, C., & Panayides, A. S. (2020). The Upcoming Role for Nursing and Assistive Robotics: Opportunities and Challenges Ahead. *Frontiers in Digital Health*, *2*(2). https://doi.org/10.3389/fdgth.2020.585656
5. Darko, E. M., Kleib, M., Lemermeyer, G., & Tavakoli, M. (2023). Robotics in Nursing: Protocol for a Scoping Review. *JMIR Research Protocols*, *12*, e50626. https://doi.org/10.2196/50626
6. Georgadarellis, G. L., Cobb, T., Vital, C. J., & Sup, F. C. (2024). Nursing Perceptions of Robotic Technology in Healthcare: A Pretest–Posttest-Survey Analysis Using an Educational Video. *IISE Transactions on Occupational Ergonomics and Human Factors*, 1–16. https://doi.org/10.1080/24725838.2024.2323061
7. Gibelli, F., Ricci, G., Sirignano, A., Turrina, S., & De Leo, D. (2021). The Increasing Centrality of Robotic Technology in the Context of Nursing Care: Bioethical Implications Analyzed through a Scoping Review Approach. *Journal of Healthcare Engineering*, *2021*, 1478025. https://doi.org/10.1155/2021/1478025
8. Khinvasara, T. (2024). Operational Efficiency and Patient Satisfaction: The Role of Robotics Automation in Healthcare Delivery. *Journal of Emerging Technologies and Innovative Research*, *11*, b270-b276.
9. Li, Y., Li, Y., Li, Y., Li, Y., Li, Y., Li, Y., Li, Y., Li, Y., Li, Y., Li, Y., Li, Y., Li, Y., & Li, Y. (2024). Advances in the Application of Artificial Intelligence Robots in Critical Care - A Promising Way in the Future: Scoping Review. (Preprint). *JMIR. Journal of Medical Internet Research/Journal of Medical Internet Research*, *26*, e54095–e54095. https://doi.org/10.2196/54095

10. Martins, R. C., Trevilato, D. D., Jost, M. T., & Caregnato, R. C. A. (2019). Nursing performance in robotic surgeries: integrative review. *Revista Brasileira de Enfermagem*, *72*(3), 795–800. https://doi.org/10.1590/0034-7167-2018-0426
11. McAllister, M., Kellenbourn, K., & Wood, D. (2020). The robots are here, but are nurse educators prepared? *Collegian*. https://doi.org/10.1016/j.colegn.2020.07.005
12. Morgan, A. A., Abdi, J., Syed, M. A. Q., Kohen, G. E., Barlow, P., & Vizcaychipi, M. P. (2022). Robots in Healthcare: a Scoping Review. *Current Robotics Reports*, *3*(4). https://doi.org/10.1007/s43154-022-00095-4
13. Nieto Agraz, C., Pfingsthorn, M., Gliesche, P., Eichelberg, M., & Hein, A. (2022). A Survey of Robotic Systems for Nursing Care. *Frontiers in Robotics and AI*, *9*, 832248. https://doi.org/10.3389/frobt.2022.832248
14. Ohneberg, C., Stöbich, N., Warmbein, A., Rathgeber, I., Mehler-Klamt, A. C., Fischer, U., & Eberl, I. (2023). Assistive robotic systems in nursing care: a scoping review. *BMC Nursing*, *22*(1). https://doi.org/10.1186/s12912-023-01230-y
15. Reem, A. D. (2022). Investigating the feasibility of applying the gig economy framework in the nursing profession towards the Saudi Arabian Vision 2030. *Informatics in Medicine Unlocked*, *30*, 100921.
16. Servaty, R., Kersten, A., Brukamp, K., Möhler, R., & Mueller, M. (2020). Implementation of robotic devices in nursing care. Barriers and facilitators: an integrative review. *BMJ Open*, *10*(9), e038650. https://doi.org/10.1136/bmjopen-2020-038650
17. Silvera-Tawil, D. (2024). Robotics in Healthcare: A Survey. *SN Computer Science*, *5*(1). https://doi.org/10.1007/s42979-023-02551-0
18. Soriano, G. P., Yasuhara, Y., Ito, H., Matsumoto, K., Osaka, K., Kai, Y., Locsin, R., Schoenhofer, S., & Tanioka, T. (2022). Robots and Robotics in Nursing. *Healthcare*, *10*(8), 1571. https://doi.org/10.3390/healthcare10081571