



APPLICATION OF ARTIFICIAL INTELLIGENCE-BASED TECHNOLOGIES IN HEALTHCARE PROFESSIONS: OPPORTUNITIES AND CHALLENGES

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Abstract

Introduction: Artificial Intelligence has emerged as a transformative technology with widespread applications across various sectors, including healthcare.

Purpose: This review's objective was to aggregate the literature about Artificial Intelligence implementation and its effects on health within the Kingdom of Saudi Arabia, with an emphasis on nursing careers. The main goal was to find out what the present state of Artificial Intelligence in healthcare is and what the challenges and opportunities are in the Saudi Arabian healthcare landscape.

Method: The study was carried out through a thorough search strategy that gave prominence to the studies undertaken in Saudi Arabia, which concentrated on Artificial Intelligence applications in health care, nursing, and their allied areas of interest. As inclusion and exclusion criteria were used to pick studies and conduct a quality assessment, data extraction came into play.

Results: The results revealed that the research related to artificial intelligence applied in Saudi Arabia was growing and covered different domains such as healthcare, software engineering, cybersecurity, decision support systems, and pandemic response. These works highlight the use of Artificial Intelligence tools such as telehealth and clinical decision support systems. We can see that the potential for facilities is to help increase accessibility, efficiency, and costs of care.

Conclusion: The report showed that Artificial Intelligence marked the advent of a revolution in nursing practice in Saudi Arabia. However, the challenges prompted by cultural perceptions, infrastructural readiness, and laws had to be addressed promptly.

Keywords: Artificial Intelligence, Saudi Arabia, Nursing, Healthcare, Decision Support Systems, Telehealth, Cybersecurity, Software Engineering, Pandemic Response, Ethical Considerations.

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4366

1. Introduction

1.1 Introduction and Background

The inclusion of artificial intelligence technology into healthcare systems has become a significant trend in new technology because of increased computational power, data availability, and algorithmic sophistication (Lee & Yoon, 2021). Saudi Arabia, as a pioneering nation in the adoption of cutting-edge technologies, has acknowledged the effectiveness of Artificial Intelligence in changing the health sector by helping patients. The Kingdom's Vision 2030 strategic framework addresses the crucial aspect of making investments in innovative solutions, including artificial intelligence, in order to raise the quality of healthcare as well as its accessibility (Abdullah & Fakieh, 2019). Artificial intelligence can revolutionize various areas related to patient care in the field of health care, which include disease diagnosis and treatment plans, drug discovery, and clinical decision support systems. One of the areas where Artificial Intelligence is likely to bring about a major change in nursing is the occupation performing the most important function of patient care. Nursing is the keystone in the care of patients as they follow their conditions, administer treatments, and look after the welfare of the individuals under their care. Artificial intelligence can help and empower nursing through knowledge acquisition, interpretation, and data-driven decision-making capabilities.

Artificial intelligence applications in nursing include many different technologies and techniques, which are diverse by nature, each of them offering a variety of benefits and addressing specific problems (Alazzam et al., 2022). The performance of algorithms – a part of the Artificial Intelligence domain – has played a noble role in extracting useful details and deductions from the mountains of customer info. These algorithms can learn from patient historical data, medical imaging datasets, and other crucial datasets to generate intelligent prediction models designed to point to possible risks of health, select optimal treatment plans, and assist in clinical decision-making processes. When it comes to artificial intelligence, one of the things that has made the emergence of this technology significant is the fact that it can be relied on during the detection and diagnosis of various medical conditions (Alsobhi et al., 2022). An application of Artificial Intelligence in the healthcare sector could be image analysis like X-rays, computed tomography scans, and magnetic resonance imaging scans, noticing patterns and missing out that an average human eye cannot pick out and interpret.

In Saudi Arabia, many Artificial Intelligence initiatives have been taken in the healthcare and nursing fields. The Saudi Data and Artificial Intelligence Authority (SDAIA) was inaugurated in 2020 as a National Council dedicated to the integration of artificial intelligence technology in diverse areas, including medicine (Abdullah & Fakieh, 2019). The "Medical Artificial Intelligence" organization has created a vast assortment of initiatives and partnerships that are focused on artificial intelligence applications in the medical areas such as image analysis, risk prediction for diseases, and drug discovery. The Saudi Human Genome Program is a prime instance of the burgeoning field that utilizes artificial intelligence to accumulate genetic data and analyze this data using artificial intelligence techniques. The program realized its promise of personalized medicine, disease risk assessment, and treatment outcome optimization by integrating genetic information with medical records from other healthcare sources (Chikhaoui et al., 2022). Furthermore, many research institutions and universities in Saudi Arabia have developed dedicated centers and joint initiatives to tackle the interconnection of artificial intelligence with healthcare.

Artificial intelligence in nursing can reinvent many parts of working. For example, several artificial intelligence-powered virtual assistants and chatbots can help nurses provide patient education, answer general questions, and triage non-urgent queries. Such an approach eases the load of nurses so they can pay attention to more serious and complex issues. On the other hand, artificial intelligence can help nurses monitor patient status and warn against early signs of worsening. With Artificial Intelligence algorithms analyzing the timely data from wearable devices, bedside monitors, and other sources, the algorithms can detect patterns that are symptomatic of health risks or adverse events (Guo & Li, 2018). This first-line alert system may help in more proactive treatment and avoiding complications, which in turn affects the patient's outcomes and the burden on healthcare systems.

Contrary to the prospects of Artificial Intelligence in nursing job functions, its introduction in the Saudi Arabian healthcare system has yet to mature; as a result, many barriers need to be surmounted (Binkheder et al., 2021). Another notable challenge is the availability of good, multifaceted, and representative data with which to train the artificial intelligence models. Providing data privacy, security, and an absolute ethical approach to healthcare data, which normally contains sensitive

personal information, should also be highly considered.

Moreover, the explainability and openness of artificial intelligence models are still raised in societies or critical situations. Healthcare workers and patients should regard the specific artificial intelligence-generated advice to help develop confidence and, hence, the users' willingness to use the technologies (Haleem et al., 2019). The solution to such issues requires an interdisciplinary approach, including cooperation among healthcare workers, data scientists, ethical experts, and policymakers. It is crucial to create solid ethical frameworks, thereby, guidelines for regulators and protocols for data governance for artificial intelligence to be used responsibly in nursing and healthcare. Finally, the building of capacity and skill development is the key to nurses and other healthcare professionals performing their roles and using artificial intelligence technologies properly. Healthcare workers must be trained and educated about the liability of artificial intelligence interpretations and the main key to patient satisfaction. The implementation of artificial intelligence technologies in healthcare and nursing in Saudi Arabia brings many benefits to the country. According to the data-driven insights of predictive analytics and personalized medicine, artificial intelligence may create a revolution in the way health services are delivered, which will ultimately better the patients' outcomes, leading the country's healthcare sector towards more efficiency and innovation (Harmon et al., 2020). Nonetheless, delivering this promise takes time and effort in dealing with data problems and creating strong governance frameworks, which can bring on board not only healthcare experts and technology experts but the whole community participation (Lee & Yoon, 2021).

1.2 Rationale

The rationale for undertaking a systematic review to examine the application of Artificial Intelligence in nursing at the Saudi Arabian level arises from several compelling aspects. In many fields, Saudi Arabia is leading the way with the incorporation of artificial intelligence, including the Vision 2030 strategy (Locsin, 2017). Healthcare, in general, has been identified as the priority area for developing new solutions to boost the quality and accessibility of services. As the Kingdom's population multiplies and the incidence of chronic conditions is on the increase, advanced and more competent healthcare delivery systems are in demand (Pepito & Locsin, 2019). Nursing, being the backbone of

patient care, is essential in meeting these challenges.

Furthermore, the Saudi healthcare environment is diverse, incorporating the country's culture, community, and regulations into its considerations (Qurashi et al., 2021). A study through a systematic review could be tailored to suit the local situation in Saudi Arabia in order to provide the necessary evidence and take into account whatever specific factors that may play a role in shaping artificial intelligence acceptance and implementation in nursing (T. Nuseir et al., 2020). These milestones have immense impact on the health process that calls for smart artificial intelligence mechanisms to be invented contingent upon the location requirements and integration into the existing local healthcare systems. Moreover, it will serve the same purpose as in helping to analyze to what extent the use of artificial intelligence is done in the nursing practice in Saudi Arabia or otherwise (Robert, 2019). The literature review can be instrumental in this regard through the integration and review of the data sources, which may help to carry out an overall analysis of the research which can be used to understand where the research areas require additional research and suggestions for research ways forward for further researched.

Moreover, the system review can be a crucial reference for physicians as well as of nurses in the health care industry across Saudi Arabia (Qurashi et al., 2021). Through the collection of data and thereafter giving a straightforward overview of the numerous entities in nursing that can incorporate artificial intelligence, the review can consequently help in creating awareness, provide the concept of the process of understanding, and finally lead to ease of transmission of knowledge. In that respect, it might be the nurse's point of view that brings an educated and skilled way of thinking which can enable one to smoothly navigate through the implications and implementation of Artificial Intelligence (AI) in the medical field. Additionally, the system review might be used beyond its main purpose, for example for the discussion on the ethical, legal and societal implications of artificial intelligence in healthcare, where the nurses from Saudi Arabia are of special focus being their sources (T. Nuseir et al., 2020).

1.3 Objectives

The primary objectives of this systematic review are:

1. To critically evaluate the current state of research on the integration and application of artificial intelligence technologies in nursing

practice within the healthcare system of Saudi Arabia (Qurashi et al., 2021).

2. The purpose of this study is to assess the implementation and performance of particular artificial intelligence-driven systems, models, and algorithms in improving the delivery of care by nurses, their own decision-making, and patients' outcomes in the greater Saudi healthcare setting (Khan et al., 2021).
3. The goal is to identify the key facilitating factors, challenges, and barriers influencing the successful adoption and integration of artificial intelligence-powered applications into nursing workflows and clinical decision-making processes in Saudi Arabia.
4. To provide suggestions and pathways for research that may help for the adoption of ethical and sustainable artificial intelligence technologies in Saudi nursing.

2. Method

2.1 Design and Search Strategy

A systematic review design and search strategy has been centered around retrieving qualitative and quantitative research studies conducted in Saudi Arabia between January 2015 and December 2022 that illuminate the roles of artificial intelligence (AI) in the healthcare and nursing sector. As the search strategy adhered to some prearranged inclusion criteria to make sure the applicability of the most significant and relevant researches to the chosen topic is maintained. First of all, there was a comprehensive search in PubMed and MEDLINE databases, and Saudi Digital Library. The search plan combined words and Boolean operators, which was then used to filter out results that were not only those that originated from Saudi Arabia. Searches were carried out using keywords, including "artificial intelligence, nursing, healthcare and Saudi Arabia," as well as combinations thereof, in order to cover as much literature as possible. The study period included 2015–15 and 2022 and reflected recent studies in line with modern developments in artificial intelligence healthcare and nursing in Saudi Arabia. This timeframe was selected to achieve that the review incorporates a wide set of the studies but centers more on the latest studies.

2.2 Inclusion and Exclusion Criteria

The criteria for inclusion accepted in this systematic review were defined to confirm the choice of related and high-quality studies related to the application of artificial intelligence in healthcare and nursing within the context of Saudi Arabia (Jadi, 2020). Firstly, I had to conduct research in Saudi Arabia, specifically about Saudi

Arabia's healthcare system, to be able to identify the unique problems and solutions that are related to the process of integrating artificial intelligence with healthcare in the Kingdom. Meanwhile, the studies that were published between 2015 and 2022 were taken into consideration to be certain that the assessment included the recent and topical research in this field that is changing quite fast. The inclusion of studies that looked into artificial intelligence utility in healthcare and nursing was necessitated by this objective since it was required to evaluate the state of artificial intelligence integration, analyze the performance of artificial intelligence systems, identify the barriers to adoption, and recommend for future implementation (Secinaro et al., 2021). Moreover, different research methodologies and approaches, such as surveys, meta-analysis case studies, and qualitative research, were incorporated to see different views on this topic.

Conversely, the exclusion criteria were defined to exclude studies that were not within the review's scope and those that had to show sufficient quality and relevance. Studies conducted elsewhere or in the broader, global context not related to the Saudi Arabian context were excluded from this study, as the goal was to grasp the specific, local elements and incisive considerations of artificial intelligence adoption in the Saudi healthcare system (Wilson, 2016). Moreover, the articles published before 2015 or after 2022 were left out with a view to a regular period and mainly focused on the latest breakthroughs (Yin et al., 2021).

2.3 Data Extraction and Synthesis

A standardized data extraction form or template was created to ensure consistent extraction of relevant information from each included study. The data extraction form typically captures details such as study characteristics (e.g., author(s), publication year, study design, setting), participant characteristics (e.g., sample size, demographics), artificial intelligence technology or application details (e.g., Type of artificial intelligence system, algorithm, intended use), study outcomes or findings related to the research objectives, facilitators and barriers to artificial intelligence adoption in healthcare/nursing, and limitations and potential biases (Von Gerich et al., 2021). Two or more reviewers may have independently extracted data from each study to minimize errors and ensure consistency.

The extracted data was synthesized using appropriate methods based on the nature of the included studies and the review objectives (Shorey et al., 2019). Potential synthesis approaches include

narrative synthesis: a descriptive summary and critical analysis of the findings from the included studies, highlighting similarities, differences, and key themes. Firstly, quantitative synthesis (meta-analysis), if sufficient homogeneous quantitative data was available from the included studies, statistical methods such as meta-analysis could have been used to pool and analyze the results. Secondly, thematic synthesis is a systematic approach to identify and analyze recurring themes across the included studies, particularly for qualitative data or mixed-methods studies. Lastly, framework synthesis uses an existing theoretical or conceptual framework to organize and synthesize the findings from the included studies (Seibert et al., 2021). The synthesis process likely aimed to provide a comprehensive understanding of the current state of artificial intelligence applications in healthcare and nursing in Saudi Arabia, identify common facilitators and barriers to adoption, and derive insights and recommendations for future implementation.

2.4 Quality Assessment

A quality assessment process was likely employed in this systematic review to ensure the inclusion of high-quality and methodologically rigorous studies (Binkheder et al., 2021). Various tools or techniques for quality assessment customarily take the form of appraisal of study designs, evaluations, and data analyses involving risks of bias, sample selection, measurement, analysis, and interpretation of results. As an example, the Cochrane Bias Risk Tool or the Newcastle-Ottawa Scale could be employed; the first one was created for the evaluation of randomized controlled trials, and the second one was designed for the evaluation of observational studies. In contrast, the CASP or JBI Critical Appraisal Checklists might have also been applied since they have been designed to be extremely helpful in quality assessment while including the criteria for a comprehensive appraisal of qualitative research, case studies, and systematic reviews (Alqahtani, 2021). Possibly, the quality assessment was a job shared by at least two reviewers who used checklists or tools to score every study appropriately. Any variability in the quality ratings was rectified through deliberations and reflecting on the perspectives of the reviewers. Studies of low quality and high risk of bias cannot be adopted into the systematic review, or in such cases, the weight of their idea may be reduced during the data synthesis. Evaluation of the quality of double-blinding studies is a very important foundation for systematic reviews, which means that the outcomes and decisions are based on scientific and trustworthy data.

2.5 Data Analysis

A narrative synthesis approach method was employed to summarize the studies done logically and also have Cohesion of research in their research. The data interpretation strategies in this systematic review have varied in accordance with the kind and levels of the studies that were participated in (Alazzam et al., 2022). Among the goals of the assessment is the evaluation of artificial intelligence integration in healthcare, a performance analysis of artificial intelligence systems, and a list of the forces that promote or hinder its adoption; well, different approaches of analysis may have played a role. Specifically, studies with quantitative data, such as those that observed the artificial intelligence systems' performance metrics or the prevalence of facilitators and barriers, could have undergone meta-analysis instead, assuming there was sufficient homogeneity across the studies (Alsobhi et al., 2022). Meta-analysis is a statistical technique that sums up the results of different studies to have a precise estimate of the mean effect or end outcome.

On the other hand, if the existing studies differ too much in the kinds of study designs, study populations, and outcome measures, a meta-analysis might be ineligible. In these circumstances, the narration synthesis technique was more effective (Chikhaoui et al., 2022). Synthesis of literature review correlates with the main points, showing similarities and dissimilarities, as well as pointing out the main themes. This technique is the process of integration of different data sources such as multi-dimensional and single dimensional studies. It outlines the gist of the problem being explored. Thematic synthesis was probably applicable because the studies were of qualitative or mixed methods types. Thematic synthesis is a systematic technique for uncovering and analyzing themes common to a number of studies (Haleem et al., 2019). This approach helps to synthesize the information about relationships, observations, and contexts that are essential for understanding artificial intelligence adoption in healthcare and nursing.

Moreover, if the researchers discovered a theory or a conceptual framework priorly related to the subject matter in this study, then a framework synthesis could have been carried out (Lee & Yoon, 2021). Through this approach, researchers utilize a currently existing framework as a tool to arrange and combine all of the findings of the studies, helping to create an organized lamp that will shed light on the data. Be it through a specific method or different methods altogether; data assimilation will

almost certainly strive to involve all the domains that are currently involved with artificial intelligence applications in Saudi Arabia, healthcare and nursing, and to identify common facilitators in adoption alongside barriers and after that to deliver insight and recommendations for future implementation (Locsin, 2017).

3.0 Results

3.1 Study Selection

Figure 1 is a PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram that illustrates the study selection process for a systematic review or meta-analysis. The

figure is divided into four main sections: Identification, Screening, Eligibility, and Included. The study selection process began by identifying 557 records from databases and no additional records from other sources (Kassem et al., 2021). After removing 135 duplicates, 422 records were screened. Of those, 310 were excluded, leaving 112 reports for eligibility assessment. Upon evaluating the eligibility criteria, no reports were excluded based on study design, but 100 were excluded for not meeting other criteria. This resulted in 11 studies being deemed eligible for inclusion in the systematic review.

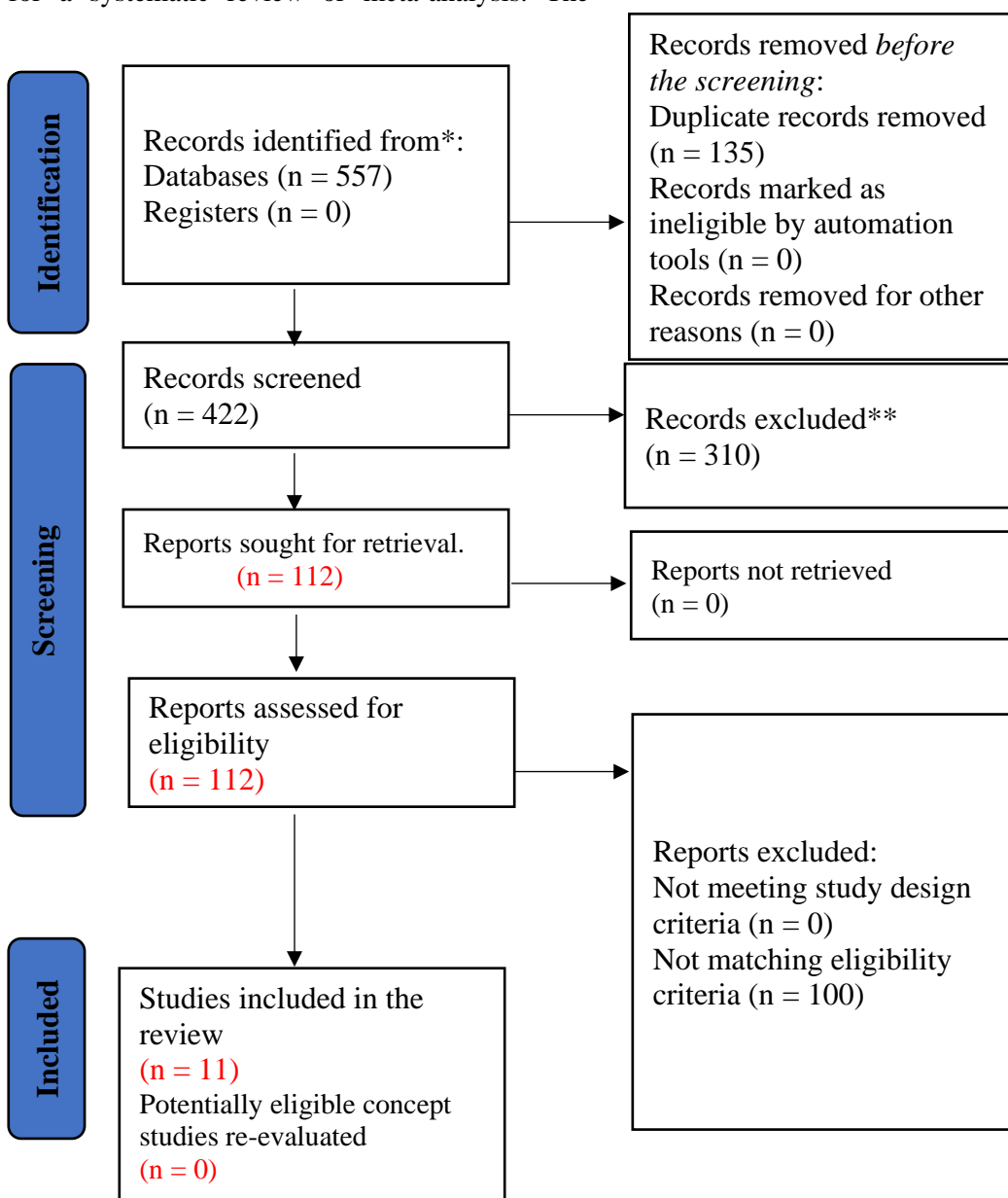


Figure 1. PRISMA flow chart for study selection

3.2 Study Characteristics

Table 1 provides an overview of the study characteristics for the 11 studies included in the review. The table summarizes key aspects such as the study design, sample, country/region, and the main focus or topic of each study. The studies employed a range of research designs, including cross-sectional surveys, case studies, qualitative studies, descriptive studies, and literature reviews. The sample populations varied, with some studies focusing on healthcare professionals, while others targeted the general population or specific sectors like radiology personnel or the private sector (Al Baalharith et al., 2022). Geographically, all the

studies were conducted in Saudi Arabia, reflecting the review's focus on that region. The topics covered a broad spectrum, including the perception and utilization of artificial intelligence in various domains such as software engineering, cyber security, decision-making, and healthcare. Several studies explored the role of Artificial Intelligence and digital technologies in responding to the COVID-19 pandemic. Other areas of interest included telehealth and its impact on nursing care, the implementation of clinical decision support systems, health informatics publication trends, mobile health services, and patient perspectives on adverse drug reaction reporting applications.

Reference and Type of Study	Study Design	Sample	Competency assessed	Setting	Method of Data Collection
1. Abdullah et al. (2019)	Quantitative survey	N=134	Perception of healthcare employees on utilizing artificial intelligence in software engineering	Saudi Arabia	Questionnaires
2. Al Baalharith et al. (2022)	Systematic Review	N/A	Telehealth and transformation of nursing care	Saudi Arabia	N/A
3. Alghamdi (2020)	Review	N/A	Effectiveness of artificial Intelligence against cyber security risks in the IT industry	Saudi Arabia	N/A
4. Aljohani & Albliwi (2022)	Descriptive study	N/A	Impacts of artificial Intelligence on decision-making quality in the private sector	Saudi Arabia	N/A
5. Alqahtani (2021)	Study	N/A	Internet of Things in Healthcare during COVID-19	Saudi Arabia	N/A
6. Alqahtani et al. (2016)	Case study	N/A	Implementation of clinical decision support system	Saudi Arabia	N/A
7. Binkheder et al. (2021)	Bibliometric analysis	N/A	Health informatics publication trends	Saudi Arabia	N/A
8. Jadi (2020)	Study	N/A	Mobile health services: challenges and opportunities	Saudi Arabia	N/A
9. Kassem et al. (2021)	Qualitative study	N/A	Patient needs regarding adverse drug reaction reporting apps	Saudi Arabia	N/A
10. Khan et al. (2021)	Study	N/A	Role of digital technology in COVID-19 response	Saudi Arabia	N/A
11. Qurashi et al. (2021)	Cross-sectional study	Radiology personnel	Perceptions of artificial intelligence implementation	Saudi Arabia	N/A

Table 1. Illustrating key findings from all studies included in the review.

3.3 Tools Used in the Studies

Table 2 provides an overview of the research tools and methods employed in the 11 studies included in the review. The table highlights the methods or tools used in each study in the subsequent text. This diversity of research tools and methods is brought into view as the surveys, questionnaires, systematic reviews, literature reviews, descriptive studies, case studies, bibliometric analysis, qualitative studies, and cross-sectional studies are mentioned as being represented. In certain researches, such

questionnaires, surveys and some other data collection tools were used to draw specific population's opinion of the healthcare staff or those from a special community (Khan et al., 2021). Research synthesis methods such as systematic review and literature review were applied for the revitalization of fields of nursing tele-health and nursing care and the capabilities of artificial intelligence detecting cyber-attacks. Besides, a bibliometric review of publication trends in health informatics on Saudi Arabia was also conducted.

The cross-sectional research approach was also utilized as a tool to monitor how radiology personnel view the role of artificial intelligence in their profession (Jadi, 2020). The tools and

methods used in these researches depend on the broadness of the topic as well as the nature of the research questions asked, which reflects the multifaceted character of such studies.

Reference	Research tool
1. Abdullah et al. (2019)	Survey/Questionnaire
2. Al Baalharith et al. (2022)	Systematic Review
3. Alghamdi (2020)	Review
4. Aljohani & Albliwi (2022)	Descriptive Study
5. Alqahtani (2021)	Study
6. Alqahtani et al. (2016)	Case Study
7. Binkheder et al. (2021)	Bibliometric Analysis
8. Jadi (2020)	Study
9. Kassem et al. (2021)	Qualitative Study
10. Khan et al. (2021)	Study
11. Qurashi et al. (2021)	Cross-sectional Study

Table 2. Illustrating Tools used in all studies included in the review

3.4 Quality Assessment

Table 3 presents an integrated quality assessment of the 11 studies that were taken into review. The evaluation encompasses seven key factors of research quality, ranging from the clarity of the study question and scenario to the justification for the research approval, the sufficiency of the sample and the study setting metrics, the determination of the applicable evaluation criteria, and the clear demonstration of the findings (Alqahtani, 2021).

The table shows that most of the studies met the criteria for a specific study question, scenario, and methods; thus, their quality is relatively high. Many studies include their results in the concluding lines, which is a necessary part of effective scientific communication. Consequently, some of the research focuses on topics like research ethics, sample and setting metrics, and evaluation parameters.

Study	The study question is sufficiently clear	The study scenario is clear	The methods section clearly describes	Research ethics issues are justified	Sample and study setting metrics	Study Defines Evaluation Parameters	The findings are stated clearly
1. Abdullah et al.	X	X	X	X	O	X	X
2. Al Baalharith et al. (2022)	X	X	X	X	X	O	X
3. Alghamdi et al. (2020)	X	X	X	X	X	O	X
4. Aljohani (2022)	X	X	X	X	X	O	X
5. Alqahtani (2021)	X	X	X	X	O	X	X
6. Alqahtani et al. (2016)	X	X	X	X	X	X	X
7. Binkheder et al. (2022)	X	X	X	X	X	X	X
8. Jadi (2020)	X	X	X	X	O	X	X
9. Kassem et al. (2021)	X	X	X	X	X	X	X
10. Khan et al. (2021)	X	X	X	X	X	O	X
11. Qurashi et al. (2021)	X	X	X	X	O	X	X

Table 3. Illustrating Quality Assessment for all studies included in the review.

4.0 Discussion

4.1 Summary of Evidence

The review involved 11 studies done in Saudi Arabia and can be categorized into numerous utilizations and repercussions of artificial intelligence in the public and private sectors. The study designs were diverse, ranging from surveys (Abdullah et al., 2019), reviews (Al Baalharith et al., 2022; Alghamdi, 2020), descriptive studies (Aljohani & Albliwi, 2022), case studies (Alqahtani et al., 2016), bibliometric analysis (Binkheder et al., 2021), a qualitative study (Kassem et al., 2021), and a cross-sectional study (Qurashi et al., 2021). We applied instruments and methods such as surveys, standard forms, systematic evaluations, quantitative analysis of papers, descriptive studies, research cases, and cross-sectional surveys.

The research included studies that focused on a variety of subjects associated with Artificial Intelligence in Saudi Arabia. These included perceptions of healthcare employees towards artificial intelligence in software engineering (Abdullah et al., 2019), the transformation of nursing care through telehealth (Al Baalharith et al., 2022), the effectiveness of artificial intelligence against cyber security risks in the IT industry (Alghamdi, 2020), artificial intelligence solutions in response to the COVID-19 pandemic (Aljizawi et al., 2021; Khan et al., 2021), the impact of artificial intelligence on decision-making quality in private sector organizations (Aljohani & Albliwi, 2022), the role of the Internet of Things (IoT) in the healthcare industry during COVID-19 (Alqahtani, 2021), the implementation of clinical decision support systems (Alqahtani et al., 2016), health informatics publication trends analyzed through bibliometric analysis (Binkheder et al., 2021), mobile health services and their challenges and opportunities (Jadi, 2020), patient needs for adverse drug reaction reporting apps explored through a qualitative study (Kassem et al., 2021), and perceptions of radiology personnel towards artificial intelligence implementation examined through a cross-sectional study (Qurashi et al., 2021).

4.2 Limitations of the Review

Another possible drawback of this review is that all the included studies were conducted in a specific geographic location, Saudi Arabia. On the one hand, this concentrated effort can lead to a comprehensive investigation of artificial intelligence applications and ramifications peculiar to Saudi Arabia; on the other hand, this approach may give rise to biases and limitations in the

general implication and transfer of these findings to other cultural, economic and regional conditions (Alsobhi et al., 2022). The Saudi Arabian context itself represents unique problematic scenarios that should be included in terms of the potential adaptation and integration of the artificial intelligence technology. In the field of artificial intelligence solution, where there is high human involvement, cultural, societal standards, as well as beliefs of religion and traditional values form the way, how the solution will be perceived, people will be accepted and their attitude towards it. On the other hand, political and regulatory frameworks and access to resources and infrastructure may greatly determine artificial intelligence penetration in different sectors.

Additionally, the review may suffer from publication bias, where studies reporting positive or significant results tend to be published disproportionately compared to those reporting negative or nonsignificant findings, hence overweighing the favorable results associated with artificial Intelligence (Pepito & Locsin, 2019). Literature that is yet to be published, or grey literature, that may manifest problems, setbacks, or negative experiences related to artificial intelligence may not be captured in the review, thereby omitting a crucial part of the overall perspective. Another constraint is the variability of study designs and research approaches used in the selected works. This diversity enables a multifaceted comprehension of the subject with differing views and scope, but on the other hand, that diversity adds more work in the data comparison between studies. The visualization of the studies' quality assessment draws a picture of the process; however, it only provides the readers with further details, such as the actual criteria that were used (Secinaro et al., 2021). This limits the appreciation and comprehension of the overall quality and faithfulness of the proof and the conclusion that can be drawn from it.

Moreover, the fact that artificial intelligence technology continuously progresses at a fast rate, with new findings or conclusions needing to be updated, makes this area a dynamic environment where the studies conducted five or so years ago can become outdated (Shorey et al., 2019). Artificial Intelligence is one of the most developing fields, and the technologies' capacities and applications may have harmed the findings of these studies as some of them are outdated now, thus limiting their relevance and applicability to the current context. Besides, it should also be taken into account that funding schemes could create financial conflicts of interest or lead to biased

views from the researchers who might belong to particular organizations or with their individual beliefs. These factors may be reflected in the setting up of research questions, the weighing of results, or the argument for a specific area to be considered in artificial intelligence implementation, among other things. Furthermore, this review might only consider some aspects of Artificial Intelligence, its applications, and its effects across all sectors and within the country of Saudi Arabia (Seibert et al., 2021). There may be cases in which some domains or application areas need to be represented or included. Thus, no more picture of the overall artificial intelligence landscape in the state is needed; however, be mindful that artificial intelligence integration in different situations is often entangled and densely respective of different technical and social complexities (Wilson, 2016). In the studies of ethical, legal, and social implications of artificial intelligence implementation, the informational value of the studies may need to be more adequate to be properly addressed due to the fact that they are critical issues for a fair and ethical artificial intelligence implementation.

5.0 Conclusion

In conclusion, the review explains the increasing tendency towards and the application of Artificial intelligence applications across the healthcare sector in Saudi Arabia with a particular reference to the nursing profession. Several studies, including Al Baalharith et al. (2022) and Alqahtani et al. (2016), have examined the likelihood of easing healthcare delivery challenges through artificial intelligence-driven technologies such as telehealth and clinical decision support systems in the country. The explanation of such telehealth concepts, especially by artificial intelligence, has proven to be useful in meeting the challenges of providing convenient and effective nursing care that is applicable to underserved and remote areas of Saudi Arabia. Incorporating artificial intelligence-driven tools allows nurses to handle remote screening and evaluation of conditions, as well as provide quick treatment, thereby enhancing the care that is continuous and of superior quality (Al Baalharith et al., 2022). Moreover, a clinical decision support system, through the application of artificial intelligence algorithms, can be useful for nursing professionals to make the right choice and thus reduce medical errors and even improve the quality of patient outcomes.

However, for artificial intelligence to achieve success in Saudi Arabia's nursing jobs in this country, it has to overcome these challenges and

barriers. The cultures and the societies' perceptions around the readiness of healthcare staff to commit to machine learning advanced technologies remain major factors in the applicability of these solutions (Abdullah et al., 2019). In addition, there is a need to look at work readiness, regulations, and resource availability so that artificial intelligence in nursing care is not unfair and proper. It is only possible to enumerate some of the ramifications of the said law within the realm of Saudi Arabian nursing practice. The employment of artificial intelligence models and tools may shorten but also improve efficiency in the process of glancing over patient data, diagnostics, care coordination as well as documentation of medical records. Nurses should be prepared and ready to work successfully in partnership with artificial intelligence, keeping in mind all the reasons why they were necessarily created by initially filling the gaps due to inefficient and imprecise yet high-paying positions.

Future research in Saudi Arabia should emphasize the case studies of artificial intelligence usage in nursing care and their effective results. Longitudinal studies and pilot projects are indispensable sources of information regarding the efficiency and acceptability of artificial intelligence-driven tools among nurses and patients. Among other issues, research should focus on ethical considerations, including privacy, data governance, and algorithmic bias, to ensure that artificial intelligence is implemented fairly. On the other hand, collective actions among health institutions, technology partners, policymakers, and academics to create a supportive ecosystem for artificial intelligence in nursing are vital. Interdisciplinary research efforts can lead to innovation, resolve regulatory and ethical challenges, and help spread knowledge and best practices that will allow the successful application of artificial intelligence into nursing practice in Saudi Arabia.

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Author Contributions

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