

**"تقييم أثر استخدام النظم الذكية في تطوير الأداء بالقطاع الصحي
بالمملكة العربية السعودية "**

" دراسة تطبيقية على مستشفيات منطقة جدة "

**"Evaluating the Impact of Using Smart Systems in "
Developing Performance in the Health Sector in
Saudi Arabia"**

" An Applied Study on Hospitals in the Jeddah Region"

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1/1: Introduction:

Healthcare sectors worldwide are undergoing profound transformations driven by rapid technological advancements, making the utilization of smart systems an imperative for enhancing efficiency and improving the quality of healthcare services. According to the World Health Organization, global healthcare expenditure is projected to reach \$12 trillion by 2025, accompanied by a significant surge in demand for healthcare services due to population growth and the rising prevalence of chronic diseases Khang, (2024)

In the Kingdom of Saudi Arabia, this transformation is integral to Vision 2030, which aims to elevate the quality of life and foster sustainability within the healthcare sector. The Kingdom is committed to advancing its healthcare landscape through the integration of cutting-edge technologies, including smart systems such as artificial intelligence, big data, and the Internet of Things, thus creating a unique opportunity to optimize performance and reduce costs. As per the Saudi Ministry of Health's 2024 report, the adoption of electronic systems in healthcare facilities has increased by 55% over the past seven years, reflecting a national strategic shift towards digital transformation Uraif,. (2024)

Furthermore, the quality of healthcare services is directly impacted by the implementation of these smart systems, which contribute to accelerating diagnostic and treatment processes, enhancing the accuracy of medical data, and improving resource management. For instance, studies indicate that the application of artificial intelligence in disease diagnosis can increase result accuracy by up to 92%, thereby saving time and effort for medical personnel and bolstering the healthcare system's ability to respond swiftly to escalating needs. (Rani,. et al, 2023).

Moreover, smart systems enhance patient experience by delivering more interactive and personalized healthcare services. Through big data analytics, healthcare systems can provide customized recommendations to patients, promoting treatment adherence and reducing hospital readmission rates. This

approach not only improves healthcare delivery but also fosters transparency and efficiency in healthcare service management (Singh, and Chatterjee, 2021)

However, the Kingdom faces several challenges in implementing these systems, including the necessity for training medical staff in the use of modern technology and ensuring data security against cyber threats. Therefore, a comprehensive evaluation of the impact of smart systems on healthcare sector performance is crucial, aiding in the identification of benefits and challenges, and providing evidence-based recommendations to enhance the overall healthcare experience in the Kingdom (Al-Saggaf, et al, 2024).

Consequently, this study aims to assess the impact of smart systems on the development of performance in the healthcare sector of Saudi Arabia, with a focus on an applied study in hospitals within the Jeddah region. Diverse research methodologies, including questionnaires and interviews with medical and administrative staff, will be employed to analyze the extent to which these systems influence healthcare service quality and performance efficiency. Data on healthcare operations before and after the implementation of smart systems will be collected and analyzed to determine realized benefits and potential challenges faced by hospitals.

Additionally, the practical significance of this study stems from its direct impact on improving hospital performance, thereby contributing to the delivery of superior healthcare services to citizens. By evaluating the impact of smart systems, strategies can be developed to ensure the highest levels of efficiency and quality in healthcare provision. The findings of this study will also aid in guiding future healthcare policies and reinforcing Saudi Vision 2030, contributing to the establishment of a sustainable healthcare system that meets the community's needs.

2/1: Study Problem:

According to global statistics, the global artificial intelligence market size was USD 327.5 billion in 2021 and is projected to reach USD 1,594.7 billion by 2028. Investment in artificial intelligence reached USD 77.5 billion in 2022, with key application areas including healthcare, financial services, manufacturing, and retail. The most commonly used artificial intelligence technologies are machine learning, natural language processing, and computer vision. Regarding Internet of Things (IoT) systems, statistics indicate that the number of connected devices reached 12.3 billion in 2021 and is expected to reach 27.1 billion by 2025. Key application areas include smart cities, smart homes, manufacturing, and healthcare, with the most commonly used IoT technologies being Wi-Fi, Bluetooth, and cellular networks. As for big data, the global market size reached USD 229.4 billion in 2021 and is projected to reach USD 1,104 billion by 2028. Key application areas include financial services, healthcare, marketing, and manufacturing, with the most commonly used big data technologies being Hadoop, Spark, and Hive. (Statista, 2023. Grand View Research 2023, International Data Corporation, 2023, McKinsey & Company, 2023)"

According to the report issued by the Ministry of Health (Kingdom of Saudi Arabia) (2021), titled "Digital Health Strategy in the Kingdom of Saudi Arabia," investment in health technology in the Kingdom is projected to reach \$2.5 billion by 2023. Additionally, (40% of hospitals in Saudi Arabia utilize EHRs, over 70% of Saudis use health applications on their smartphones, and the adoption of telemedicine has reached 20% of Saudis using telemedicine services, Ministry of Health, Kingdom of Saudi Arabia, 2023).

Nevertheless, the issue of poor performance efficiency and quality of healthcare services in the Saudi Arabian healthcare sector is a critical concern that necessitates in-depth study. According to the Ministry of Health's 2024

report, hospitals in the Jeddah region suffer from high patient waiting times, with an average waiting time of 2 hours and 45 minutes, negatively impacting patient satisfaction and the quality of care provided.

Furthermore, a study conducted by the General Authority for Statistics indicates that 30% of patients in government hospitals experience a lack of accurate information regarding their health conditions, leading to non-adherence to treatment and repeated hospital visits. Amidst these challenges, it has become essential to explore how smart systems, such as artificial intelligence and big data analytics, can be used to improve performance and deliver faster, more accurate healthcare services.

Additionally, statistics show that 40% of medical staff in Jeddah hospitals do not receive adequate training on the use of these modern systems, exacerbating the gap between available technology and its effective utilization. Consequently, these factors clearly indicate a real problem that warrants an evaluation of the impact of smart systems on developing performance in the healthcare sector, thus reinforcing the importance of this study as a step towards enhancing healthcare service quality and achieving higher efficiency in hospital management, Aldosari, (2017)

Therefore, this study aims to analyze the factors hindering the implementation of smart systems and how they affect performance improvement in hospitals within the Jeddah region, thereby contributing to the overall effectiveness of the healthcare system and better meeting the needs of citizens.

3/1: Importance of the Study:

3/1/1: Scientific Importance:

- 1) **Contribution to Existing Literature:** This study will provide valuable insights into the application of smart systems in healthcare, contributing to the growing body of literature on digital transformation in the medical field.

- 2) **Framework for Future Research:** The findings can serve as a foundation for future research on the impact of technology on healthcare performance, encouraging further investigations in different regions and contexts.
- 3) **Understanding Challenges:** By identifying the challenges faced in implementing smart systems, the study will enhance understanding of barriers to technological adoption in healthcare settings, paving the way for future studies to address these issues.
- 4) **Theoretical Models:** The research may contribute to the development of theoretical models that explain the relationship between smart systems and healthcare performance, offering a basis for academic discourse.

3/1/2: Practical Importance:

- 1) **Improving Healthcare Services:** The study aims to provide practical recommendations for healthcare providers to enhance service delivery, ultimately leading to better patient outcomes and increased satisfaction.
- 2) **Policy Development:** Findings can inform policymakers about the effectiveness of smart systems in healthcare, enabling them to design better policies that promote technological integration in hospitals.
- 3) **Training and Education:** The research will highlight the need for training programs for medical staff on the use of smart systems, which can lead to improved efficiency and better patient care.
- 4) **Resource Allocation:** The results may assist healthcare administrators in making informed decisions regarding resource allocation, ensuring that investments in technology yield maximum benefits.
- 5) **Benchmarking Performance:** The study can provide benchmarks for hospitals in Jeddah and beyond to assess their performance against best practices in the implementation of smart healthcare solutions.

- 6) **Enhancing Operational Efficiency:** By evaluating the impact of smart systems, the study will offer insights into how hospitals can streamline operations, reduce wait times, and improve overall workflow .

This comprehensive view of the significance of the study highlights its potential to influence both academic research and practical applications in the healthcare sector in Saudi Arabia.

4/1: Research Objectives:

The researcher aims to achieve the following main objective:

"To evaluate the impact of using smart systems on developing performance in the healthcare sector in hospitals within the Jeddah region, Saudi Arabia".

In addition to achieving the following sub-objectives:

- 1) To evaluate the impact of using smart systems on performance effectiveness in hospitals within the Jeddah region, Saudi Arabia.
- 2) To evaluate the impact of using smart systems on performance efficiency in hospitals within the Jeddah region, Saudi Arabia.
- 3) To evaluate the impact of using smart systems on performance quality in hospitals within the Jeddah region, Saudi Arabia.
- 4) To evaluate the impact of using smart systems on innovation in performance in hospitals within the Jeddah region, Saudi Arabia.

1/5: Study Questions:

The research problem centers around evaluating the impact of using smart systems on developing performance in hospitals within the Jeddah region, Saudi Arabia. Based on this, the research problem can be formulated into the following questions:

Main Research Question:

"What is the impact of using smart systems on developing performance in the healthcare sector in hospitals within the Jeddah region, Saudi Arabia"

The following sub-questions branch out from this main research question:

- 1) What is the impact of using smart systems on performance effectiveness in hospitals within the Jeddah region, Saudi Arabia?
- 2) What is the impact of using smart systems on performance efficiency in hospitals within the Jeddah region, Saudi Arabia?
- 3) What is the impact of using smart systems on performance quality in hospitals within the Jeddah region, Saudi Arabia?
- 4) What is the impact of using smart systems on innovation in performance in hospitals within the Jeddah region, Saudi Arabia?

- Main Research Question Two:

"Is there a difference between the responses of the research sample regarding the impact of using smart systems on developing performance in the healthcare sector in hospitals within the Jeddah region, Saudi Arabia, attributable to (Gender - Age - Educational Level - Job Level - Years of Experience)?"

The following sub-questions branch out from this main research question two:

- 1) Is there a difference between the responses of the research sample regarding the use of smart systems in developing performance in the healthcare sector in hospitals within the Jeddah region, Saudi Arabia, attributable to gender?
- 2) Is there a difference between the responses of the research sample regarding the use of smart systems in developing performance in the healthcare sector in hospitals within the Jeddah region, Saudi Arabia, attributable to age?
- 3) Is there a difference between the responses of the research sample regarding the use of smart systems in developing performance in the healthcare sector in hospitals within the Jeddah region, Saudi Arabia, attributable to educational level?
- 4) Is there a difference between the responses of the research sample regarding the use of smart systems in developing performance in the

healthcare sector in hospitals within the Jeddah region, Saudi Arabia, attributable to job level?

- 5) Is there a difference between the responses of the research sample regarding the use of smart systems in developing performance in the healthcare sector in hospitals within the Jeddah region, Saudi Arabia, attributable to years of experience?

1/6: Research Hypotheses:

The researcher can formulate the research hypotheses as follows:

Main Hypothesis One:

- 1) **"There is a statistically significant relationship between the use of smart systems and the development of performance in the healthcare sector in hospitals within the Jeddah region, Saudi Arabia".**

The following sub-hypotheses branch out from this main hypothesis one:

- 2) **H1:** There is a statistically significant relationship between the use of smart systems and performance effectiveness in hospitals within the Jeddah region, Saudi Arabia.
- 3) **H2:** There is a statistically significant relationship between the use of smart systems and performance efficiency in hospitals within the Jeddah region, Saudi Arabia.
- 4) **H3:** There is a statistically significant relationship between the use of smart systems and performance quality in hospitals within the Jeddah region, Saudi Arabia.
- 5) **H4:** There is a statistically significant relationship between the use of smart systems and innovation in performance in hospitals within the Jeddah region, Saudi Arabia.

Main Hypothesis Two:

"There is a statistically significant difference between the responses of the research sample regarding the use of smart systems in developing performance in the healthcare sector in hospitals within the Jeddah region,

Saudi Arabia, attributable to (Gender - Age - Educational Level - Job Level - Years of Experience).

The following sub-hypotheses branch out from this main hypothesis two:

- 1) There is a statistically significant difference between the responses of the research sample regarding the use of smart systems in developing performance in the healthcare sector in hospitals within the Jeddah region, Saudi Arabia, attributable to gender.
- 2) There is a statistically significant difference between the responses of the research sample regarding the use of smart systems in developing performance in the healthcare sector in hospitals within the Jeddah region, Saudi Arabia, attributable to age.
- 3) There is a statistically significant difference between the responses of the research sample regarding the use of smart systems in developing performance in the healthcare sector in hospitals within the Jeddah region, Saudi Arabia, attributable to educational level.
- 4) There is a statistically significant difference between the responses of the research sample regarding the use of smart systems in developing performance in the healthcare sector in hospitals within the Jeddah region, Saudi Arabia, attributable to job level.
- 5) There is a statistically significant difference between the responses of the research sample regarding the use of smart systems in developing performance in the healthcare sector in hospitals within the Jeddah region, Saudi Arabia, attributable to years of experience.

1/7: Variables and Research Model:

1/7/1: Study Variables

Based on the hypotheses that the research will address, the research variables are as follows:

- **Independent Variable: Smart Systems.**

The researcher will rely on the following dimensions of the independent variable:

- Smart Devices
- Communication Network (Infrastructure)
- Big Data Databases
- Artificial Intelligence

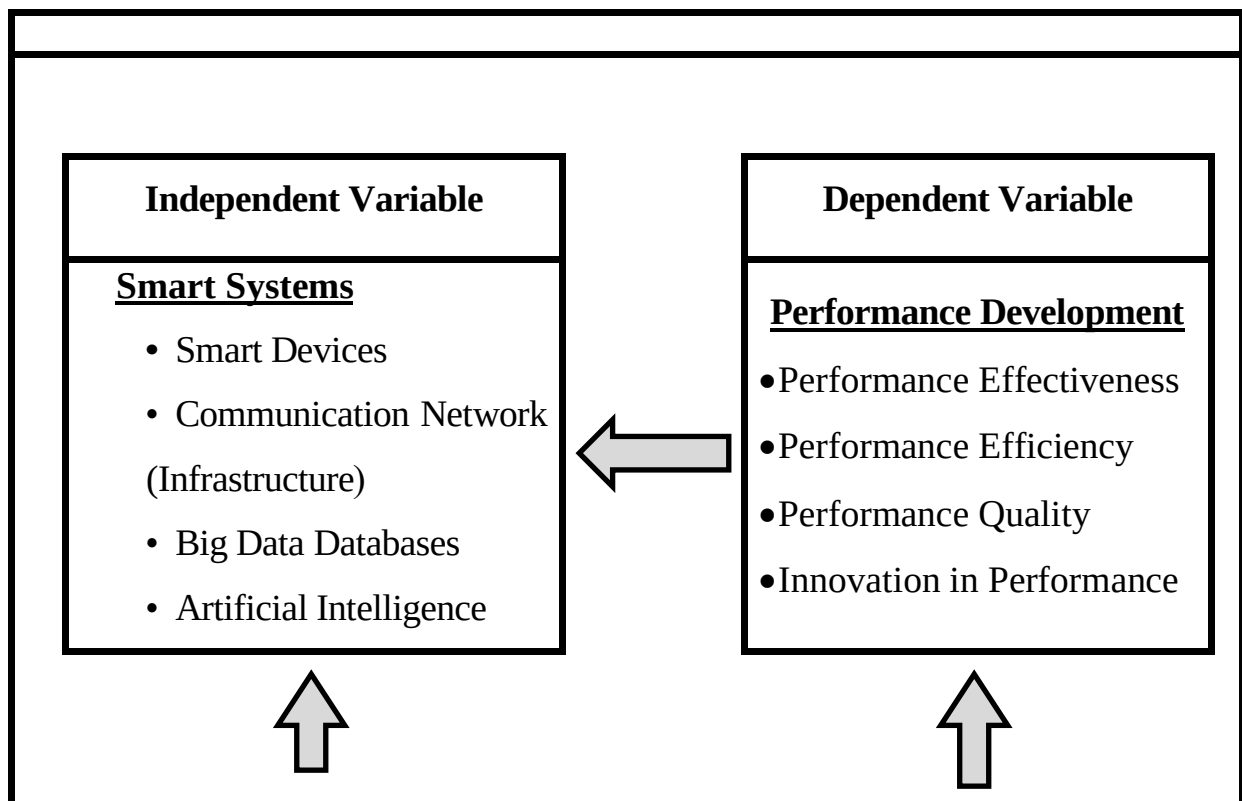
- **Dependent Variable: Performance Development.**

The researcher will rely on the following dimensions of the dependent variable:

- Performance Effectiveness
- Performance Efficiency
- Performance Quality
- Innovation in Performance

1/7/2: Research Model:

The research model can be presented as follows:



Demographic Variables

(Gender - Age - Educational Level - Job Level - Years of Experience)

Source: Prepared by the Researcher.

1/8: Research Terms:

The researcher will address the terms used in this research, as follows:

- **Smart Systems:** Refers to systems that use smart technology and artificial intelligence to learn and make autonomous decisions. These systems can be programmed to perform specific tasks or be capable of learning and adapting to the environment and making independent decisions (Romero,. et al, 2020)
- **Smart Devices:** Means technical devices that are equipped with smart features or capable of communicating with a communication network and exchanging data with other systems. Smart devices include smartphones, tablets, smart home devices, smart cars, and so on (Silverio-Fernández,. et al, 2018)
- **Communication Network:** Refers to the infrastructure and technologies used for seamless communication and data exchange between different devices. These networks can be wired (such as internet networks) or wireless (such as 4G and 5G networks) Jiang, (2022)
- **Big Data Databases:** Means a massive collection of structured data stored in specific data structures that allow efficient data access and analysis. Big data database systems use techniques such as data distribution, data fragmentation, and advanced query analysis (Berisha,. et al, 2022).
- **Artificial Intelligence:** Refers to the ability to develop systems and programs. Artificial intelligence (AI) is a field concerned with developing

systems and programs that have the ability to simulate human intelligence. Artificial intelligence works on designing and developing systems that can extract knowledge from data, make intelligent decisions, solve problems, learn from experience, and perform tasks autonomously Zhang, and Lu, (2021)

- **Performance Development:** Refers to the efforts made to improve the performance of organizations and individuals. This includes implementing new strategies and techniques to achieve better goals and improve efficiency, effectiveness, and quality. Performance development can include improving internal processes, developing products and services, improving team performance, and enhancing organizational excellence (Budworth, and Chummar, 2022)
- **Performance Effectiveness:** Means the ability of an organization or individual to achieve the desired results or goals in an effective and impactful manner (Limna,. et al, 2022).
- **Performance Efficiency:** Means the ability to use available resources efficiently to achieve the desired results. It is related to achieving maximum productivity, reducing waste, and improving resource utilization Cai, (2023)
- **Performance Quality:** Means the ability of an organization or individual to provide services or products with a high level of quality and meet the needs and expectations of customers or beneficiaries (Rizqulloh,. et al, 2024)
- **Innovation in Performance:** Refers to the ability of an organization or individual to develop and adopt new ideas and methods to achieve superior performance and innovative results. It focuses on innovation and renewal to achieve competitive advantage and improve processes, products, and services (O'Dwyer, (2021).

1/9: Previous Studies:

Study by Elhoseny, et al., (2017) titled "Intelligent systems based on cloud computing for healthcare services: a survey"

This study aimed to provide a comprehensive survey of intelligent systems based on cloud computing for healthcare services, with the goal of understanding and determining how these systems impact performance improvement in this vital sector. The study addressed the pivotal role of cloud computing in healthcare services, as it enables the retrieval of patient data and the diagnosis of diseases with high efficiency and low cost. The study also reviewed the use of artificial intelligence techniques such as the Genetic Algorithm (GA) and Particle Swarm Optimization (PSO) in the cloud computing environment, with the aim of improving task scheduling, reducing execution time, and maximizing resource utilization. The study relied on the descriptive analytical method through reviewing and analyzing published scientific literature. Data were collected by reviewing and analyzing previous studies. The study reached clear results highlighting the close relationship between the variables and their impact on performance. The results showed that the use of intelligent algorithms in task scheduling led to a reduction in waiting time and an improvement in workflow in healthcare services, which positively reflected on the speed of providing services to patients. The application of artificial intelligence techniques contributed to reducing the execution time of requests from stakeholders, which led to an improved patient experience and reduced pressure on healthcare sector workers. The use of cloud computing and intelligent technologies contributed to maximizing the utilization of available resources, which led to cost reduction and improved operational efficiency of healthcare institutions. Based on these results, the study recommended the adoption of cloud-based intelligent systems in the healthcare sector, with a focus on developing an advanced technological infrastructure and providing the necessary training for workers in this sector.

Study by Tian, et al., (2019) titled "Smart healthcare: making medical care more intelligent"

This study aimed to provide a comprehensive overview of the smart healthcare concept, focusing on how to make medical care more intelligent through the adoption of modern information technologies. The study addressed how the development of information technology has led to the emergence of the smart healthcare concept, which uses the new generation of information technologies, such as the Internet of Things (IoT), big data, cloud computing, and artificial intelligence, 1 to comprehensively transform the traditional medical system, making 2 healthcare more efficient, more convenient, and more personalized. The study relied on the descriptive analytical method through reviewing and analyzing published scientific literature. Data were collected by reviewing and analyzing previous studies, and analyzed using the qualitative content analysis method, focusing on the key technologies supporting smart healthcare, the current status of their applications in important areas, existing problems, proposed solutions, and future prospects. The study found that the Internet of Things (IoT) contributed to enabling continuous remote monitoring of patients, and providing real-time vital data, leading to improved management of chronic diseases and reduced need for hospital visits. Big data contributed to analyzing massive medical data to extract useful patterns, and improve diagnosis and disease prediction, leading to improved care accuracy and treatment personalization. Cloud computing contributed to providing a flexible and scalable infrastructure for storing and processing medical data, leading to improved access to information and reduced costs. Artificial intelligence contributed to developing intelligent diagnostic systems, improving medication management, and providing virtual assistants for patients, leading to improved care efficiency and service personalization. The application of these technologies led to reduced waiting times, improved workflow, and reduced medical errors, leading to improved operational efficiency of healthcare

institutions. Based on these results, the study recommended the need to accelerate the adoption of smart healthcare, focusing on solving existing problems such as privacy and security issues, providing the necessary training for healthcare practitioners, and developing standards and ethics for the use of these technologies

Study by Owais, (2019) titled "Development of Intelligent Systems to Optimize Training and Real-World Performance Amongst Health Care Professionals"

This study aimed to develop intelligent systems to optimize training and real-world performance among healthcare professionals, focusing on the role of these systems in enhancing the efficiency of medical procedures and reducing errors. The study addressed the importance of training healthcare professionals and providing them with the necessary skills and competencies for their field, and how simulation-based medical education (SBME) represents an attempt to provide training tools. The study relied on the descriptive analytical method through analyzing published scientific literature, in addition to developmental research in the design of intelligent systems. Data were collected by analyzing previous studies related to simulation-based medical education (SBME) and artificial intelligence techniques, and analyzed using the qualitative content analysis method, focusing on developing intelligent systems that provide a detailed analysis of acquired skills and provide insights into future training requirements. The study found that the application of these intelligent systems contributed to improving the real-world performance of healthcare professionals, reducing medical errors, and increasing efficiency in medical procedures. The application of these systems contributed to making training more effective, and customizing training programs to meet the needs of trainees, leading to improved training quality and increased trainee satisfaction. Developing intelligent systems capable of analyzing simulation data in detail, and identifying strengths and weaknesses in trainees, led to improved training

quality and customization of training programs. Based on these results, the study recommended the adoption of intelligent systems in simulation-based medical education (SBME), focusing on developing objective assessment tools, providing detailed data on trainee performance, and customizing training programs to meet the needs of trainees.

Study by Kaur, et al., (2022) titled "Intelligent Systems for Sustainable Development of Healthcare Industry. In Decision Analytics for Sustainable Development in Smart Society 5.0: Issues, Challenges and Opportunities"

This study aimed to explore and analyze the role of intelligent systems in achieving sustainable development of the healthcare sector, focusing on the impact of modern technologies on quality of life and economic performance. The study addressed how healthcare industry standards directly affect economic performance and quality of life in any country, and how modern technological developments and innovative services ensure patient and practitioner satisfaction. It also discussed intelligent systems used in the healthcare sector, which include dimensions such as (robotics and artificial intelligence, augmented reality, blockchain technologies, Internet of Things, and 3D printing). The dependent variable was the sustainable development of the healthcare sector. The study relied on the descriptive analytical method through reviewing and analyzing published scientific literature. Data were collected by reviewing and analyzing previous studies, and analyzed using the qualitative content analysis method, focusing on the objectives, applications, and challenges facing the implementation of these technologies. The study found that robotics and artificial intelligence contributed to improving the accuracy of surgical procedures, reducing medical errors, and accelerating the diagnostic process, leading to improved quality of care and reduced costs. Augmented reality contributed to providing advanced training for healthcare practitioners, and improving physicians' visualization of complex cases, leading to improved quality of medical services. Blockchain technologies contributed to improving

the security and privacy of medical data, and facilitating information exchange between healthcare institutions, leading to improved operational efficiency and reduced fraud. The Internet of Things contributed to enabling remote monitoring of patients, improving medication management, and providing real-time vital data, leading to improved quality of care and reduced need for visits. Based on these results, the study recommended the adoption of intelligent systems in the healthcare sector to achieve sustainable development, focusing on addressing the challenges related to data security, cost, and training healthcare practitioners on the use of these technologies.

Study by Akila, et al, (2023) titled "Intelligent Information Systems in Healthcare Sector: Review Study"

This study aimed to provide a comprehensive analysis of the latest developments and applications of intelligent information systems in the healthcare sector. The study addressed the transformative potential of these systems in enhancing patient care, improving clinical decision-making, and increasing operational efficiency within healthcare institutions. The study also covered key aspects of intelligent information systems, such as electronic health records, machine learning algorithms, natural language processing, and computer vision techniques, and explored their integration with Internet of Things (IoT) platforms and telemedicine. The study addressed the independent variable "intelligent information systems" with its multiple dimensions, including (enhancing patient care, improving clinical decision-making, improving operational efficiency, integrating intelligent information systems with IoT platforms and telemedicine), while the dependent variable was improving performance in the healthcare sector. The study relied on the descriptive analytical method through reviewing and analyzing scientific literature published in academic databases and specialized journals. Data were collected by reviewing and analyzing published scientific literature, and analyzed using the qualitative content analysis method. The study concluded

that there is a positive relationship between the use of intelligent information systems and performance development in the healthcare sector. It also highlighted the significant potential of intelligent information systems in improving healthcare, and emphasized the importance of their integration with IoT and telemedicine technologies. Based on these results, the study recommended the necessity of addressing the challenges associated with the implementation of intelligent information systems, such as privacy and security issues, and the need to focus on future research directions in this field.

Study by Ala, et al., (2024) titled "Enhancing patient information performance in internet of things-based smart healthcare system: Hybrid artificial intelligence and optimization approaches"

This study aimed to develop an innovative model to enhance patient information performance in Internet of Things (IoT)-based smart healthcare systems, using hybrid artificial intelligence and optimization approaches. The study addressed how the use of advanced technology in the healthcare industry can provide advanced methods for managing medical records for patient treatment, and how the integration of core technologies such as artificial intelligence can enhance healthcare services. The study relied on the analytical experimental method through developing a new model and testing it using real data. Data were collected through the use of medical patient data, and analyzed using PSO and PSO-LSTM algorithms, focusing on improving the performance of patient data processing in smart healthcare centers. The study found that the PSO-LSTM algorithm showed more satisfactory performance and higher efficiency in classifying patient medical data compared to the PSO algorithm. The PSO-LSTM algorithm also achieved 92.5% accuracy in predicting patient health risks, demonstrating its ability to provide accurate and reliable predictions. The PSO-LSTM algorithm contributed to providing a more secure and reliable experience for patients, leading to improved overall patient satisfaction. The application of the PSO-LSTM algorithm contributed to

improving the performance of patient data processing in smart healthcare centers, leading to improved quality of care provided. Based on these results, the study recommended the adoption of the PSO-LSTM algorithm in IoT-based smart healthcare systems, focusing on improving data security and providing a better patient experience.

1/9/1: Researcher's Commentary on Previous Studies:

Previous studies have concluded that the use of smart systems in the healthcare sector has a positive impact on performance development and improving the quality of healthcare. Studies have emphasized the importance of adopting modern technologies such as artificial intelligence, the Internet of Things, cloud computing, and big data to improve the efficiency of medical and administrative operations, and to provide smarter and more personalized healthcare services. Studies have also indicated that the use of smart systems contributes to improving diagnostic accuracy, reducing medical errors, accelerating the treatment process, and enhancing the patient experience. However, studies have also highlighted the challenges facing the implementation of these systems, such as privacy and security issues, the need to provide necessary training for healthcare practitioners, and the development of appropriate technological infrastructure. The following is a review of the most important findings of previous studies:

The study by Akila, et al., (2023) found the transformative potential of intelligent information systems in enhancing patient care and improving clinical decision-making. This study agreed with the study by Tian, et al., (2019) in focusing on the importance of adopting modern technologies to make healthcare smarter and more efficient, and differed from the study by Owais, (2019), which focused on developing intelligent systems to improve training and real-world performance among healthcare professionals, as the first two studies addressed a broader scope of smart system applications in the healthcare sector.

In addition, the study by Elhoseny, et al., (2017) found the pivotal role of cloud computing in healthcare services, and how it contributes to improving task scheduling and reducing execution time. This study agreed with the study by Ala, et al., (2024) in focusing on the importance of using hybrid artificial intelligence and optimization techniques to enhance patient information performance, and differed from the study by Kaur, et al., (2022), which addressed the role of smart systems in achieving sustainable development of the healthcare sector, as the first two studies focused on the technical and applied aspects of smart systems, while the third study addressed the strategic and developmental aspects.

The study by Kaur, et al., (2022) also found the importance of adopting smart systems in the healthcare sector to achieve sustainable development. This study agreed with the study by Tian, et al., (2019) in emphasizing the need to accelerate the adoption of smart healthcare, and differed from the study by Owais, (2019), which focused on developing intelligent systems to improve training and real-world performance among healthcare professionals, as the first two studies addressed a broader scope of smart system applications in the healthcare sector, while the third study addressed a specific aspect of smart system applications.

1/10: Research Methodology:

The research methodology includes the following:

- **Research Method:**

To achieve the research objectives and test the validity of the hypotheses, the descriptive analytical method was adopted. This method provides an accurate and detailed description of the social phenomenon under study, in either qualitative or quantitative numerical form. It does not stop at collecting information to describe the phenomenon but also analyzes the phenomenon and reveals the relationships between its various dimensions to interpret it and reach conclusions that contribute to improving and developing reality (Gharaibeh et

al., 2015). In this research, it is used to evaluate the impact of using smart systems on developing performance in hospitals within the Jeddah region, Saudi Arabia.

1/10/1: Research Population and Sample:

- **Research Population:**

The study population is the group of elements or individuals that are the focus of interest in a particular study. In other words, it is all the elements related to the research problem. The study population consists of employees in hospitals within the Jeddah region, Saudi Arabia, which includes (11) government hospitals, comprising approximately (9500) employees, according to the Saudi Ministry of Health. These employees are distributed across various medical and administrative specialties, including (medical staff, nursing staff, technical and administrative staff). The researcher will select the sample from the employees of the hospitals under study.

- **Research Sample:**

The population size is estimated to be approximately (9500) employees according to the annual statistical book issued by the Saudi Ministry of Health. The research sample size can be determined from a finite population according to the sample size determination formula, ensuring complete representation of this population and that the estimation error does not exceed 5%. The researcher relied on the following formula to determine the sample size.

$$n = (Np(1 - p))/((N - 1)((d \wedge 2) / (z \wedge 2)) + p(1 - p))$$

Population size N = 9500

- Expected proportion (p): The expected proportion of the characteristic we want to measure in the population, assumed to be approximately 0.5 (i.e., 50%). Therefore, $p = 0.5$.
- Margin of error (d): The permissible margin of error is $\pm 3\%$. Therefore, $d = 0.03$.
- The critical value of z at a 95% confidence level is 1.96.

Equation:

$$n = (Np(1 - p))/((N - 1)((d \wedge 2) / (z \wedge 2)) + p(1 - p))$$

We substitute the values into the equation:

$$n = (9500 * 0.5 * 0.4) / ((9500 - 1)((0.03 \wedge 2) / (1.96 \wedge 2)) + 0.5 * 0.4))$$

Thus, the value of n = 350

Based on this, a sample of 350 individuals will be taken to evaluate the impact of using smart systems on developing performance in the healthcare sector in hospitals within the Jeddah region, Saudi Arabia.

1/10/2: Data Types and Study Tools:

The researcher will rely on the following:

- **Data Types:**

Data will be collected from the following sources:

- 1- Primary Data:**

This is the data obtained through the field study related to the research, which will be collected using a questionnaire. This includes surveys and employee questionnaires in hospitals within the Jeddah region. Questionnaires will be designed to evaluate the impact of using smart systems on developing performance in the hospitals under study in the Jeddah region. The questionnaires will be distributed to a random sample of hospital employees, and the data extracted from the questionnaires will be analyzed.

- 2- Secondary Data:**

This is the data obtained through research in books, journals, studies, and conferences related to the study variables, which include:

- **Published Reports and Studies:** Previous reports and studies discussing smart systems and performance development will be reviewed. Academic databases and scientific journals will be searched for relevant research.
- **Statistical Data:** Statistical data available from official sources such as the Ministry of Health or government agencies concerned with healthcare will be used. These sources will provide data on the extent of using smart

systems in the healthcare sector and indicators of performance development in the hospitals under study.

- **Internal Reports:** Some data will be obtained from the internal reports of hospitals within the Jeddah region. These reports include performance evaluations and annual reports, which may contain information about the smart systems used and development indicators, etc.

1/10/3: Data Collection Methods:

Data will be collected using "questionnaire forms," which will be distributed to the research sample in hospitals within the Jeddah region. In addition, personal interviews will be conducted, and official reports issued by the hospitals under study will be reviewed, to collect data on the extent of using smart systems in developing performance.

1/10/4: Data Analysis Methods:

The researcher will analyze the data using the SPSS statistical analysis software, relying on the following methods:

- Multiple regression analysis
- One-sample T-test
- Calculation of means and standard deviations

1/11: Research Limitations:

- **Subjective Limitations of the Research:** The research topic will focus on evaluating the impact of using smart systems on developing performance in hospitals within the Jeddah region, Saudi Arabia.
- **Temporal Limitations of the Research:** During the time period from 2025 to 2026.
- **Spatial Limitations of the Research:** Hospitals within the Jeddah region, Saudi Arabia.
- **Human Limitations of the Research:** Includes employees in hospitals within the Jeddah region, Saudi Arabia.

1/11: Proposed Research Structure (Research Plan):

Chapter One: General Framework of the Research.

Chapter Two: Intellectual Framework of the Research, including:

- Section One: Smart Systems
- Section Two: Performance Development
- Section Three: The Relationship Between the Use of Smart Systems and Performance Development

Chapter Three: Field Study of the Research:

- Section One: Applied Field: Hospitals in the Jeddah Region, Saudi Arabia
- Section Two: Testing Research Hypotheses

Chapter Four: Results and Recommendations.

- References.
- Appendices.
- Research Abstract in Arabic.
- Research Abstract in English

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