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Technology in the future of healthcare in UAE

by

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This dissertation report is submitted in partial fulfillment of the award of Master of Public Policy

Declaration

I, the undersigned, ***Muna Alhammadi***, declare that this Dissertation is my original work, that all material presented to Mohammed Bin Rashid School of Government is my own, and has not been previously submitted to any other university for a higher degree. I also declare that the publications cited in this work have been personally consulted. I understand that if at any time it is shown that I have significantly misrepresented material presented to Mohammed Bin Rashid School of Government, any degree or credits awarded to me on the basis of that material may be revoked.

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Abstract

This research investigates the transformative impact of emerging technologies on healthcare delivery in the United Arab Emirates (UAE), focusing on integration efforts across public and private sectors. The study explores how technologies such as AI, VR/AR, Blockchain, IoT, and robotics are reshaping patient care and operational efficiencies. The primary objective is to assess how these innovations enhance patient outcomes within the UAE's healthcare landscape. Using a qualitative desk research approach with content analysis, the study synthesizes data from diverse sources including reports, studies, and expert opinions.

Key findings highlight the proactive role of the Emirates Health Services (EHS) in pioneering technological adoption to elevate healthcare standards. EHS's strategic use of AI for predictive analytics, VR/AR for medical training and treatment, blockchain for secure health records, IoT for real-time patient monitoring, and robotics for precise surgeries exemplify cutting-edge applications driving systemic improvements. By integrating these technologies, EHS aims to optimize patient care, streamline operations, and ensure healthcare accessibility across the UAE.

The study identifies critical success factors such as strategic planning, collaborative partnerships, pilot projects, and ongoing training initiatives essential for effective technology integration. Insights from empirical studies underscore the benefits of digital transformation, including enhanced patient-provider communication, improved diagnostic accuracy, and operational efficiencies. Challenges such as data privacy, cybersecurity, and infrastructure readiness are also

discussed, emphasizing the need for robust governance frameworks and stakeholder collaboration to mitigate risks.

Ultimately, this research contributes to understanding how advanced technologies can revolutionize healthcare delivery, offering insights to policymakers, healthcare providers, and technology developers aiming to optimize patient outcomes in evolving healthcare environments.

Keywords: *Integrated healthcare technologies, Electronic health records (EHR) in UAE, Patient outcomes in UAE healthcare, Public and private sector healthcare integration*

ملخص البحث

هذا البحث يقوم بدراسة تأثير التقنيات الناشئة على تقديم الرعاية الصحية في دولة الإمارات العربية المتحدة، مع التركيز على جهود الدمج بين القطاعين العام والخاص. تستكشف الدراسة كيفية إعادة تشكيل رعاية المرضى وتعزيز الكفاءات التشغيلية من خلال التقنيات مثل الذكاء الاصطناعي، الواقع الافتراضي/المعزز، إنترنت الأشياء، والروبوتات. الهدف الرئيسي هو تقييم كيفية تحسين نتائج المرضى من خلال هذه الابتكارات في منظومة الرعاية الصحية في الإمارات باستخدام منهجية البحث على نهج تحليل المستندات من بيانات مصادر متنوعة بما في ذلك التقارير والدراسات وآراء الخبراء.

تسلط النتائج الرئيسية الضوء على الدور الفعال لمؤسسة الإمارات للخدمات الصحية (EHS) في اعتماد التكنولوجيا بطريقة رائدة لرفع معايير الرعاية الصحية. يوضح الاستخدام الاستراتيجي للذكاء الاصطناعي للتحليل التنبؤي، والواقع الافتراضي/المعزز للتدريب الطبي والعلاج لسجلات الصحة الآمنة، وإنترنت الأشياء لمراقبة المريض في الوقت الحقيقي، والروبوتات للجراحات الدقيقة، تطبيقات متقدمة تدفع التحسينات النظامية. تهدف مؤسسة الإمارات للخدمات الصحية إلى تحسين رعاية المرضى، وتبسيط العمليات، وضمان إمكانية الوصول إلى الرعاية الصحية في جميع أنحاء الإمارات من خلال دمج هذه التقنيات.

تحدد الدراسة عوامل النجاح الحاسمة مثل التخطيط الاستراتيجي، والشراكات التعاونية، والمشاريع التجريبية، والمبادرات التدريبية المستمرة الأساسية للتكامل الفعال للتكنولوجيا. تسلط الأبحاث التجريبية الضوء على فوائد التحول الرقمي، بما في ذلك تعزيز التواصل بين مقدمي الرعاية والمرضى، وتحسين دقة التشخيص، والكفاءات التشغيلية. يتم مناقشة التحديات مثل خصوصية البيانات، والأمن السيبراني، وجاهزية البنية التحتية، مما يؤكد على الحاجة إلى إطارات حوكمة قوية والتعاون بين الأطراف للتخفيف من المخاطر.

في النهاية، يسهم هذا البحث في فهم كيفية أن تحول التكنولوجيا المتقدمة تقديم الرعاية الصحية، مقدماً رؤى لصانعي السياسات، ومقدمي الرعاية الصحية، ومطوري التكنولوجيا إلى تحسين نتائج المرضى في البيئات الصحية المتطورة.

الكلمات المفتاحية: تقنيات الرعاية الصحية المتكاملة، السجلات الصحية الإلكترونية (EHR) في الإمارات، نتائج المرضى في الرعاية الصحية في الإمارات، دمج الرعاية الصحية في قطاعي العام والخاص

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Abbreviations

UAE.....United Arab Emirates

ICT.....Information and Communication Technology

SDGs.....Sustainable Development Goals

MRIs.....Magnetic Resonance Imaging

PHC.....Primary Healthcare Center

PMR.....Paper Medical Record

EMR.....Electronic Medical Record

HIE.....Health Information Exchange

AI.....Artificial Intelligence

VR.....Virtual Reality

AR.....Augmented Reality

IoT.....Internet of Things

Working Definitions

1. **Healthcare Data Management (HDM):** Healthcare Data Management (HDM) involves overseeing the entire lifecycle of health data. It includes the "creation, storage, organization, processing, archiving, and secure deletion of data." It also involves ensuring data confidentiality and security, limiting access to authorized personnel only, and maintaining integrity (Actian, n.d.).
2. **Data accessibility:** In healthcare, data accessibility means securely and conveniently accessing health information. This ensures that authorized individuals, including patients, healthcare providers, and other relevant parties, can retrieve, share, and utilize the data as needed (Makhene, 2024).
3. **Technology integration:** Technology integration in healthcare refers to the incorporation of various technological tools and systems into existing healthcare practices and workflows. It involves the strategic use of technology to enhance efficiency, improve patient care outcomes, streamline processes, and facilitate better communication and collaboration among healthcare professionals (Bayramzadeh and Aghaei, 2021).

Chapter 1: Technology In The Healthcare Sector

1.1 Background

Technology has entered all aspects of our daily lives in applications and services based on artificial intelligence and other smart technologies. In the health sector, robots are being used to perform complex surgeries like tumor removal to improve patients' healthcare services. Advanced drug dispensing options such as pharmacy Robotics, 3D printing technology in dentistry, and stem cell technologies are other applications that are emerging. The UAE is distinguished as one of the best countries in providing quality healthcare because the Ministry of Health has implemented the best health systems based on the highest international standards, the quality and efficiency of medical staff based on international key performance indicators, and healthcare strategies.

The health sector is one of the fastest growing sectors in the country, based on the positions the sector occupies in a number of international standards. Its superiority in the success of treatments for rare diseases, and the readiness it has achieved in dealing with epidemics and health risks such as the Covid-19 pandemic that occurred recently, are all evidence of how exceptional the UAE health sector is. Moreover, most infectious diseases, such as intestinal sickness, measles, and polio, which were already far-reaching within the Emirates, and other sorts of flu, such as Avian influenza A and H1N1, have been eliminated through continuous vaccination campaigns carried out by the country for any new disease that spreads so that its inhabitants can live in wellbeing, peace, and thriving, and a disease-free society.

The United Arab Emirates has invested in recruiting qualified doctors and modern healthcare infrastructure, including smart hospitals with the latest medical devices and equipment. These advances improve healthcare services, attract medical tourists, and promote innovation in the sector. The UAE government works with all responsible health authorities in the country to ensure the highest quality of health services and the highest effectiveness for patients and medical staff. Accreditation of all hospitals in public and private sectors by clear national and international standards. The National Agenda 2021, superseded by Centennial Vision 2071, is focused on making UAE one of the best countries in the quality of health care to consolidate the preventive aspect and reduce the rate of diseases to achieve a healthy life and develop the health system.

The strategies and laws of the country in the health and technology sectors aim to protect patients' rights, ensure the provision of innovative healthcare services, and provide a comprehensive approach to them. According to Federal Law No. 2 of 2019, concerning the Use of Information and Communication Technology (ICT) in Health Fields, the law "regulates the employment of information and communication technology (ICT) in the health care sector in the UAE. The law aims to guarantee: the optimal use of the technology in the UAE's health sector, the compatibility of the adopted principles, standards, and practices with internationally recognized, and the safety and security of health data and information" (U.ae, 2022).

The results of the research are likely to be in line with the laws and strategies that aim to ensure the optimal use of information and communication technology in the health fields, to ensure the

compatibility of the foundations, standards, and practices adopted with their internationally approved counterparts, to providing the security and safety of data and health information for patients and ensure access to health data and information when they need it. In addition, to achieve the third goal of the sustainable development goals (SDGs), "Good Health and Well-Being", by building up healthy lifestyles and modern health care services for all in the country.

1.2 Problem Statement

Even with this development and the use of technology quickly accessible to patients, doctors need to have gathered treatment decisions. Every doctor needs to know the patient's medical history, all the reports, and results of laboratory tests and medicines given to provide appropriate treatment, as there is no unified technical system in the country involving public and private hospitals that includes patient data and health records.

1.3 Objectives and Research Questions

This research aims to address and bring substantial improvements to an existing challenge within the healthcare sector, specifically in the context of patient data management and accessibility. Currently, there is no unified database between private and public hospitals in the UAE. This fragmentation leads to increased costs and delays in patient treatment, as medical records are not accessible across different healthcare providers. Patients who switch from public to private hospitals, or vice versa, face significant hurdles in continuing their treatment seamlessly.

The literature highlights the critical need for integrated healthcare information systems to improve patient care and operational efficiency. Studies have shown that unified health information systems can improve health outcomes, reduce medical errors, and lower healthcare costs (Häyrinen, Saranto, and Nykänen, 2008; Ammenwerth et al., 2003). Additionally, the World Health Organization (WHO) and other health policy bodies emphasize the importance of health information interoperability to ensure continuity of care and efficient resource use (WHO, 2012).

In line with these findings, this research seeks to support policy decisions that advocate for unified access to patient data, records, and complete medical history across all healthcare institutions. By linking medical record systems into a single standardized system, utilizing the latest technological advancements in healthcare, the study aims to enhance the efficiency and effectiveness of patient care. This aligns with the UAE's Vision 2021, which includes goals for a world-class healthcare system, and the UAE National Health Agenda 2021, which prioritizes the development of an integrated health information system.

The findings from this research are expected to influence the implementation of a cohesive healthcare data management system, ultimately improving patient outcomes and reducing treatment delays. By providing evidence-based recommendations for integrating healthcare information systems, this research will contribute to the body of knowledge and support policy initiatives to improve healthcare delivery in the UAE.

This research is being conducted to achieve the main objectives:

- Integrate technology developed into the healthcare system in the UAE country.
- Figure out technologies or enhance existing systems in patient records.
- Link these technologies and systems and unify the UAE's public and private health authorities.

Main research question

• How can the use of integrated technologies enhance patient outcomes in the UAE private and public healthcare sectors?

Sub questions

- How are patient outcomes affected by the patient database technologies in the health sector globally?
- How do doctors implement advanced patient database technologies in treating patients?
- How do patients perceive the common patient systems?

The possible limitation approach is document analysis, which is different from the exact opinion of people in UAE; this is the reason for the time of the study. This chapter covers the background of the research, the problem statement and objectives, and the research questions.

1.4 Summary of chapters

- **Chapter 1:** It covers the background, problem statement, objectives, and research questions. It also addresses the main research question and sub-questions.
- **Chapter 2:** It consists of the literature review, providing a comprehensive examination of existing scholarly works, theoretical frameworks, and empirical studies relevant to the research topic.
- **Chapter 3:** It comprises the research methodology, including an introduction, data collection, and data analysis. It serves as the methodological framework guiding the research process.
- **Chapter 4:** It covers the analysis and findings of research based on secondary sources. This chapter entails a meticulous examination, interpretation, and synthesis of collected data, contributing to the advancement of knowledge in the field.
- **Chapter 5:** It covers recommendations and concludes the dissertation. This chapter offers practical recommendations, synthesizes key findings, discusses implications, and reflects on the research journey.

Chapter 2: Literature Review

2.1 Introduction

As outlined in Chapter 1, this research paper examines the uses of innovative technologies in healthcare, especially in health records. This is the case and is evident in our treatment experience with the various treatment providers in the United Arab Emirates. The decision to predominantly focus on UAE studies is deliberate and stems from the specific context of this research. This approach is crucial for understanding and addressing UAE healthcare settings' specific challenges and opportunities.

By synthesizing recent scientific research and literature, this review aims to provide a comprehensive analysis tailored to the local context, ensuring relevance and applicability to improving patient outcomes in the country. This literature review collects and analyzes the most recent scientific research and literature related to the research objectives and questionsbased on current knowledge from reviewing and comparing various studies, theories, scholarly articles, and results.

Healthcare data management and technology integration have made significant strides in recent years. Häyrinen, Saranto, and Nykänen (2008) explore electronic health records (EHRs), discussing how they evolved and impact healthcare delivery. They emphasize the importance of standardized systems for seamless data exchange across healthcare settings.

Ammenwerth et al. (2003) evaluate health information systems, focusing on challenges like system integration, data quality, and user acceptance. They argue for robust technological solutions to streamline processes and enhance patient safety.

There's a growing emphasis on improving data accessibility in healthcare. Makhene (2024) defines it as securely accessing health information, ensuring authorized parties can retrieve and use data effectively. This approach enhances care coordination and patient outcomes by enabling timely access to critical information.

Technological integration plays a crucial role in modern healthcare. Bernardo and Maia (2020) explore how technologies such as telehealth and artificial intelligence (AI) are integrated into nursing practice, improving operational efficiency and enabling personalized patient care.

The World Health Organization (2012) emphasizes classifying health workers according to global standards, which helps manage healthcare workforces effectively. Vision 2021 and the National Health Agenda in the UAE prioritize integrating healthcare information systems to create a top-tier healthcare system.

This research presents five main themes derived from relevant studies:

- Wali et al. (2020) compared patient satisfaction reasons when transitioning from traditional paper-based medical records to electronic ones.
- Haleem et al. (2021) explored the benefits of blockchain technology in healthcare applications.

- Mozumder et al. (2023) highlighted challenges and issues related to medical records technology.
- Sharma and Joshi (2020) identified barriers and obstacles hindering the adoption of smart technology systems in healthcare, including the UAE's efforts in electronic medical records and blockchain technology applications.

2.3 Patient Satisfaction with EMR

Technology has revolutionized the management and development of patient medical records. It is one of the reasons why patient satisfaction rates with healthcare technologies have increased in recent years (Wali, et al., 2020), making healthcare delivery more efficient due to factors such as ease of use, accessibility, communication, personalized care, and data security when used effectively, technology can enhance the patient experience and improve outcomes in healthcare because it facilitates time, effort, money, etc. Patient records today are more advanced than in previous eras and keep pace with modern technological developments. The transition from traditional methods of storing medical information such as files, papers, printing, and X-ray CDs to electronic systems is underway. This shift encompasses a variety of materials, including handwritten notes, CT scans, and MRIs, which may be damaged, altered, or lost.

The authors Wali, et al. (2020) pointed out that the EMR technical system provides accurate patient data and facilitates them, as well as healthcare workers and administrators, to communicate as doctors connect with their patients, check, and consult with them to diagnose them in the best condition, and provide appropriate treatment. It reduces financial costs and expenses of healthcare delivery centers, in addition to severe conditions that the patient suffers

from, such as drug interactions. The system also records severe cases, patients' medication allergies, and the date the patient was exposed to the allergy. All of this improves and advances compliance with best practices. Wali et al. (2020) conducted a study to measure patients' satisfaction with electronic medical records regarding heart rate compared with the heart rate of patients who go to primary healthcare centers. The sample was from five selected centers in the western part of the Kingdom of Saudi Arabia and the survey was administered to individuals in primary healthcare (PHC). Results revealed that out of 377 participants, the majority (65.0%) were female. The overall satisfaction rating was 3.708. Notably, Wali et al. (2020), satisfaction with the Electronic Medical Record (EMR) system was significantly higher than with the Paper Medical Record (PMR) system (3.7241 vs. 3.6919, $p < 0.001$). Several factors contributed to this satisfaction with EMR implementation, including increased physician attention during consultations (82.3%), enhanced explanation of tests and medications (85.8%), more time spent with patients during consultations (80.4%), and improved active listening by physicians (77.3%).

According to Patient Satisfaction with the Implementation of Electronic Medical Records in the Western Region, Saudi Arabia, 2018 study, patients felt more confident asking health-related questions during consultations (84.0%). In conclusion, it has appeared from the study that EMR has numerous focal points and characteristics over PMR by implementing an electronic therapeutic records framework made strides generally quiet fulfillment, particularly amid clinical interviews as the specialist was more accessible to examine well-being subjects, had more time to tune in to understanding complaints and examine test comes about and solutions. They are expanding the quality of out-of-clinic administrations, such as booking appointments, medicine

handling, and referral framework, as this application improves patient satisfaction during clinical consultations and with various PHC services.

2.4 Benefits of Electronic Medical Records Using Blockchain

The main and most significant benefit of applying these technologies to electronic patient medical records is a unified system containing all the data for healthcare providers to obtain and exchange between governmental and private healthcare institutions. This would improve healthcare quality in the country's hospitals and centers, reduce medical and medication errors, and provide appropriate treatment.

The benefits of health technologies and how they affect patients and patient satisfaction include adopting cutting-edge technologies like blockchain, which stores patient data and improves the security of electronic patient records and health information, interoperability between health facilities, and counterfeit drugs (Haleem et al., 2021). As a recent innovation, blockchain offers high security through features such as interconnection protection, accountability, and authentication. This transformation aims to ensure the safety and reliability of medical records.

The second study by Haleem et al. (2021) highlights the crucial role of blockchain technology in revolutionizing healthcare. It underscores its benefits, such as enhanced data efficiency and security and its ability to combat deception in clinical trials. It discussed how blockchain offers a unique data storage pattern and ensures the confidentiality of health records, thereby addressing concerns regarding data manipulation and security threats. It emphasizes the importance of

decentralized data protection and outlines various blockchain applications in healthcare, ultimately advocating its adoption to improve healthcare processes globally.

The research by Haleem, et al. (2021) revealed that up to this point, the primary challenges encountered in population health management relate to safeguarding data, facilitating sharing, and ensuring interoperability. Blockchain technology emerges as a dependable solution for addressing these specific challenges. When implemented effectively, this technology improves security, facilitates data exchange, ensures interoperability, maintains data integrity and enables real-time updating and access. Notably, there are substantial concerns regarding data protection, particularly in personalized medicine and wearable devices. Both patients and healthcare professionals necessitate secure and uncomplicated methods for recording, transmitting, and accessing data across networks without compromising safety.

Consequently, the implementation of Blockchain technology effectively resolves these issues. In addition, the study mentioned novel uses of Blockchain technology in healthcare, facilitating seamless data exchange among key network members and providers to develop cost-effective and advanced treatments for various diseases. This is poised to advance and transform the healthcare sector in the coming years. Additionally, Haleem et al. (2021) illuminated the benefits of Blockchain in healthcare logistics, catalyzing digital transformation and innovation, particularly in enhancing quality of life.

Diagrams were utilized to bolster the findings, with Figure 2.1 depicting the integrated workflow process of Blockchain in healthcare finance. Blockchain offers significant opportunities across sectors, from scientific advancements to patient-practitioner relationships.

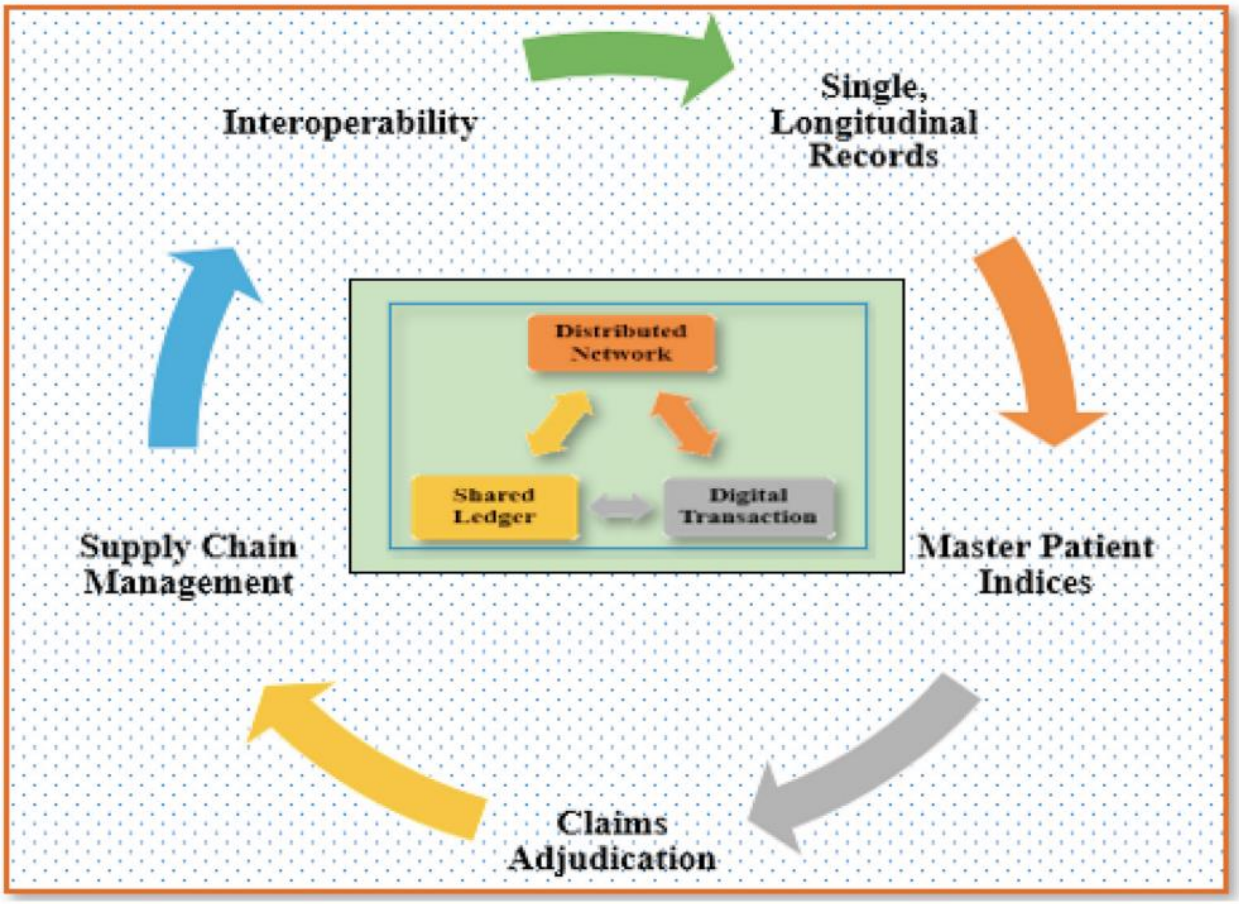

Figure 2.1, Integrated Workflow process of Blockchain in healthcare | Haleem et al. (2021)

Furthermore, table 2.1 outlines critical applications of Blockchain in healthcare, emphasizing its decentralized ledger system's accuracy, simplicity, and efficiency in documenting transactions, thereby streamlining management processes and reducing costs.

Themes	Description
Store information of an individual patient	In clinical studies, a wealth of patient information and health data is generated both before and after each phase. This includes blood tests, quality assessments, estimates, and wellness polls. This data can be used to produce results indicating the existence of certain documents or records. Healthcare providers can verify the validity of this data by seamlessly matching it to the original records stored on the Blockchain system. Blockchain employs cryptographic techniques to ensure secure data sharing, making it an ideal framework for healthcare. Patient details such as name, date of birth, diagnosis, treatments, and ambulatory history are recorded in Electronic Health Record (EHR) format by healthcare providers. This information is typically stored in cloud computing systems or existing databases.
Analyse the effects of a particular procedure	Researchers can efficiently analyze specific procedures across a large patient population with verified access to patient data, leading to improved management strategies for these groups. The implementation of Blockchain infrastructure enables pharmaceutical companies to collect real-time data for tailored prescription drugs or services. This simplifies pharmacy operations as all necessary data is readily available. Patients can be effectively instructed on medication usage based on these results, and clinicians can stay updated on patients' status through real-time wearable data, receiving alerts for emergencies.
Validation	Transactions in a Blockchain are validated by algorithms until they are linked to the chain, ensuring authenticity through encryption, digital signatures, and storage. Healthcare companies and technological innovators are exploring opportunities to improve healthcare safety and affordability. Blockchain has the potential to revolutionize the health ecosystem by enabling effective validation of results in healthcare management.
Safety and transparency	Blockchain technology offers enhanced safety and transparency, freeing up physicians to focus on patient care. It supports clinical trials and treatments for rare disorders and facilitates smooth data exchange

	among medical solution providers, leading to precise diagnostics, efficient therapies, and cost-effective healthcare systems. By enabling organizations within the health ecosystem to communicate and share information on a distributed ledger, Blockchain ensures better safety and transparency. Users can exchange and monitor their data securely without compromising integrity or confidentiality.
Health record keeping	Blockchain technology is ideal for medical record-keeping, with applications ranging from sharing healthcare data and managing electronic health records to handling insurance and administrative tasks. Patients can transmit their health information to a Blockchain network via an app, and sensor and device collaboration is facilitated through digital Blockchain contracts. Currently, electronic health records are dispersed across different care institutions, but Blockchain will consolidate this information, granting patients historical access and providing new insights into their health status. The Blockchain paradigm ensures authenticity, legitimacy, and user privacy.
Clinical Trial	Blockchain Technology is utilized in clinical trials to combat issues such as false results and data discrepancies, bolstering trust in the process. Business analysis platforms delve into market dynamics to help the healthcare sector grasp opportunities. Managing medicines on the Blockchain offers a chance to establish and monitor the supply chain from manufacturer to customer, enhancing credibility through Blockchain integration.
Display information	The Blockchain system ensures the transparency of medication origins, guaranteeing high quality from approved manufacturers. It offers robust protection for sensitive data when utilized correctly. Across sectors like finance and retail, Blockchain applications are gaining momentum, providing numerous benefits through transparent information display. However, healthcare's complexity leads to significant debates, especially regarding medicinal products, medications, vaccines, clinical trials, and cloud computing, prompting fundamental advancements in these areas.

Identification of false content	Blockchain enhances clarity and identification of false content, ensuring easy validation of clinical studies for participants and clients. Smart contracts facilitate approval processes and maintain protocol documents and findings openly and publicly verifiable. This technology enables the general public to closely monitor clinical trials, fostering a user-focused approach and providing secure real-time access to health and insurance records for patients.
Reduces needless overhead expenses	Blockchain minimizes unnecessary overhead expenses and facilitates the proper utilization of health records, reducing the reliance on multiple intermediaries for monitoring critical health information sharing. This simplifies the task of healthcare providers in delivering efficient, timely, and adequate services to patients. With blockchain healthcare technologies, service providers can easily access comprehensive medical records for individual patients, resolving various issues in the healthcare system such as interoperability, report completion, data theft, and disaster data failure.
Patient monitoring	Blockchain technology provides medical professionals with trusted access to medical equipment when needed, enabling doctors to devote more time to patient care and respond remotely to health-related incidents. Integration of Blockchain and healthcare enhances monitoring of patient room temperatures, bed usage, and supply availability. A Blockchain healthcare network establishes a secure digital identity for healthcare institutions and providers. Combining Blockchain with IoT technologies improves supply chain responsiveness and traceability, thereby enhancing transparency in healthcare logistics for effective patient monitoring.
Create research initiatives	Blockchains offer a reliable information source and have the potential to revolutionize the manual processing of membership claims and disputes. By facilitating broader exchange of patient data, Blockchains can spark innovative research initiatives. Deeper sharing of patient findings can foster an extraordinary partnership between participants and researchers, leading to breakthroughs in healthcare. Additionally, Blockchain technology can improve patient referrals by incorporating

	therapy schedules into patient care records on the Blockchain after consultation with a doctor.
Improves safety	Blockchain enhances safety in patient healthcare, tackling issues of medication validity, drug traceability, and ensuring safe interoperability. It provides a robust solution to replace existing supply chain management systems, preventing counterfeit drugs from entering the market and ensuring safety across medical centers and organizations. Centralized storage of all data on Blockchain ensures accessibility. Interoperability of Blockchain technology enables doctors to easily access detailed medical records, aiding in diagnosis and facilitating more precise treatment.
Minimise data transformation time and cost	Blockchain networks reduce data transformation time and costs while offering fast and effective verification of medical credentials. They ensure patient anonymity and protection, fostering significant innovations that can revolutionize global healthcare. Implementation of Blockchain enables valuable and privacy-respecting monetized data-sharing networks. Blockchain, as a distributed network computing technology, stores transaction history and documentation with timestamps. Each node in the network processes, verifies, and records each data input.

Table 2.1, Blockchain applications for healthcare | Author created.

Haleem et al.(2021) also addressed the critical issue of data leakage in healthcare and how Blockchain applications can mitigate such risks, ensuring secure access to updated patient records and assessments. Blockchain in healthcare promises groundbreaking solutions to industry challenges, facilitating connectivity among treatment partners and service providers while delivering positive outcomes across various healthcare domains, including patient information, medical research, clinical trials, supply chain management, and product safety.

In the UAE healthcare context, this technology is used in most developed countries, including the United Arab Emirates. Adopting blockchain technology offers significant benefits for patients and

healthcare providers. Blockchain enhances data security, interoperability, and authenticity of medical records, addressing critical challenges in population health management. Recent studies highlight blockchain's transformative potential, emphasizing its role in improving data efficiency, preventing data manipulation, and streamlining healthcare processes. Additionally, blockchain applications enable advanced treatments, logistic improvements, and cost savings. The technology promises groundbreaking solutions by facilitating secure data exchange, reducing management costs, and enhancing patient outcomes in various healthcare domains. Blockchain adoption in the UAE healthcare sector promises to revolutionize patient care and system efficiency. The most relevant benefits to be realized if we have this unified system are ease of access to healthcare services because we live in the Emirates, which has different local emirates and the presence of different touches in each emirate, such as developed cities and remote and developing areas, this will help patients obtain services remotely from their homes through smart applications, and access to the patient's medical record in emergencies or to facilitate diagnosis and dispense treatment. One of the other benefits is constant communication, meaning the patient will feel that he is receiving healthcare and share his symptoms with his doctor immediately (Mohammed bin Rashid Center for Government Innovation, 2023).

2.5 Challenges and Issues of Electronic Medical Records

Of course, electronic medical records (EMRs) have brought about a digital transformation in healthcare delivery through digitizing patient data, ease of access, and enhanced coordination between healthcare providers, doctors, and patients. However, they also immortalize challenges and issues, from interoperability issues that hinder easy data exchange to data security and

privacy issues. Additionally, electronic records can disrupt workflow, increase costs, and exacerbate provider burnout. Ensuring data accuracy, mitigating disparities in access, and effectively managing the vast volume of information are among the multifaceted issues that require attention in the continuous evolution and modernization of electronic medical records.

Despite the benefits of healthcare technologies, healthcare organizations must address and avoid these barriers and ensure secure access to medical records and technology-enabled healthcare services for all patients and doctors.
Despite the advantages of blockchain technology, such as encryption, consensus, immutability, and others (Mozumder et al., 2023), their study, a comprehensive review and comparison of existing literature on healthcare management systems, highlights challenges the technology faces in the healthcare field. It covers its architecture, development frameworks, and diverse applications within healthcare. The study conducted a database search to identify the challenges of current healthcare management systems and analyze applications based on them.

Mozumder et al. (2023) mentioned various challenges facing electronic medical records (EMR), encompassing several key areas. Firstly, there needs to be more reliance on manual record handling, leading to fragmented data sharing among healthcare providers due to disparate systems and the need for interoperability. Additionally, issues with data integrity arise from errors in modification and duplication, hindering the completeness and accuracy of medical records. Data availability remains a concern, with centralized databases limiting access and susceptibility to loss during server failures. Privacy breaches and authentication errors compromise patient

confidentiality and control over health information sharing. Delayed record access poses risks to patient care, while security breaches, including insider attacks and hacking, threaten data security.

Mozumder et al. (2023), Interoperability limitations across healthcare providers impede seamless information exchange, and backup and recovery challenges exacerbate data loss risks. The heterogeneous nature of healthcare data adds complexity to management and storage, and inter-organization access restrictions inhibit efficient data sharing. Centralized frameworks face single-point failure risks, and the absence of a global unique medical record identifier hampers identity management and patient control over their health information. These challenges collectively undermine the effectiveness, integrity, and security of EMR systems, highlighting the need for comprehensive solutions to address these issues in healthcare management.

Implementing a unified system for electronic medical records (EMR) in the UAE presents several challenges unique to the region. Regulatory compliance with healthcare standards in the UAE is crucial, which requires adhering to strict data privacy and security regulations, considering cultural sensitivity regarding patient confidentiality and consent, as well as accommodating the country's linguistic diversity, as more than 200 nationalities live in the country (Ministry of Foreign Affairs, 2023). By providing clear interfaces for electronic medical records in multiple languages. Interoperability with existing healthcare systems is crucial for seamless data exchange, while strong security measures are required to protect against cyber threats and breaches, and the UAE can do this to maintain its position. According to the Digital Enablers Report 2023, it ranked fifth in the Global Cybersecurity Index (TDRA, 2023).

Establishing secure health information exchange (HIE) mechanisms and ensuring reliable infrastructure and connectivity across urban and rural areas presents significant challenges. Comprehensive training programs for healthcare professionals and patient education initiatives are essential to the success and implementation of an electronic medical records system, along with scalability and sustainability measures to support future growth in healthcare services and patient numbers.

2.6 Barriers to Blockchain Technology in healthcare

Blockchain technology holds immense potential to revolutionize the healthcare industry by enhancing data security, interoperability, and transparency. Despite its promising features, the adoption of blockchain in healthcare could be faster due to various barriers. Concerns about regulatory compliance, interoperability challenges, high implementation costs, and a need for standardized frameworks are among the key obstacles hindering its widespread integration. Additionally, the complexity of healthcare data and the need for stakeholder trust further complicate the adoption process.

The “Barriers to blockchain adoption in health-care industry: an Indian perspective” study by Sharma and Joshi, (2020) investigates barriers to adopting blockchain technology in the Indian healthcare industry and examines key issues related to its applications. The research identifies 15 barriers through discussions with experts through a two-phase approach: a literature review and semi-structured interviews with hospital staff and administrators in India. The study involves 15 experts from top-level management, IT, and patients within hospitals, and it employs the total Interpretative Structural Modeling-FUZZY-Cross-impact matrix multiplication applied to this

classification method to understand the interrelationships among the barriers; TISM is used to create a multilevel structure for the barriers, FUZZY MICMAC helped determine driving and dependent barriers and low awareness of legal issues and inadequate support from high-level management were found to be the most significant driving barriers.

Blockchain technology has the potential to revolutionize healthcare by improving data security, privacy, and interoperability through electronic medical records. However, its adoption in India's healthcare sector faces challenges due to a lack of legal framework, insufficient management support, high implementation costs, and a need for more expertise in blockchain technology. Despite these barriers, overcoming them could enable a more efficient and secure healthcare system with better patient outcomes. Integrating blockchain can streamline healthcare supply chains and offer controlled data access through global algorithms, but addressing these challenges is crucial for realizing its full potential (Sharma and Joshi, 2020).

2.7 Examples of UAE applications for blockchain technology in the healthcare sector

The UAE has a leading position and reputation for proactive development, progress, and implementation. The government is harnessing its full technological capabilities in innovative technologies such as Blockchain, which has been adopted in several sectors, including healthcare, as the “UAE Strategy for Digital Transactions 2021” embodied the country’s guarantee of digital transformation (U.ae, 2024). It has honorable examples for health care providers in technological advancement and innovative uses of the latest technologies in health care, as local UAE authorities and institutions use smart applications and platforms for their patients to improve

health systems through transparency, securing medical data, simplifying administrative processes and improving the exchange of medical information between various medical institutions, This facilitates the provision of coordinated and sustainable care for patients. In particular, there are several models and projects of current efforts in the UAE that use blockchain technology in this field; let us highlight some of the capabilities created by the Emirates Health Services Corporation in the field of blockchain technology as it worked on the Digital Trust Platform project: The platform provides a comprehensive environment for managing patient data through secure and seamlessly integrated electronic medical records across various healthcare providers. EHS Intelligence platform: through which the Emirates Health Services Corporation can analyze and manage data, make accurate decisions, and manage workforce productivity. EHS Intelligence Platform (PaCE): The platform represents a proactive step for healthcare management. This platform is based on predicting risks before they occur, taking the necessary measures to prevent them from happening, and accessing medical data immediately in emergencies through the central database of electronic medical records at the Emirates Health Services Corporation and allowing doctors to quickly follow up and retrieve data that helps in making decisions based on it (EHS, 2024).

Moreover, using blockchain to create reliable and secure electronic health records enhances the follow-up of medical conditions and facilitates diagnosis and treatment. It improves the security and integrity of health data through encryption and digital signature technologies, which reduce the risks of unauthorized access and tampering with private data.

This chapter covers patient satisfaction with electronic medical records, the benefits, challenges, and barriers of blockchain and innovative technologies in healthcare and medical records, and the UAE's efforts to integrate the developed technologies in healthcare.

Chapter 3: Methodology

3.1 Introduction

Today, the healthcare system is going through a fast change, but the integration with technology is a factor that could boost the system to a significant disorder. Addressing the research question **"How can the use of integrated technologies enhance patient outcomes in the UAE private and public healthcare sectors?"** examines working to unify a system supported by the latest smart technologies for electronic patient records for healthcare providers in the government and private sectors in the UAE. This qualitative study will focus on the interrelations between the use of integrated technologies and the quality of patients' care. This approach allows the identification of smart technologies used in the healthcare field. In addition, the research adopts a comparative analysis, drawing on a range of studies and reports on the benefits, challenges, and barriers of electronic health records, providing a precise understanding of their use and application. This research aims to understand key issues that are helpful in health policymaking, healthcare delivery, and technological development, particularly in the UAE.

The United Arab Emirates is positioned in the middle of traditional practices and cutting-edge technologies. This is clearly demonstrated by how the country's healthcare system combines the trendiest infrastructure with cultural sensitivity. In recent years, the nation has experienced a vigorous move toward tapping a broad spectrum of the technological field, healthcare included, aiming to better the delivery system and outcome. The private and public health sectors are crucial players in providing the overall healthcare of the UAE population. While the commercial

area can give room to luxury amenities and personalized services, the public is for affordable and accessible healthcare, which benefits the broader sector.

3.2 Data collection

As already mentioned, most of the information for this research is inferred from reports and studies, particularly those conducted by governmental bodies, research institutions, and healthcare organizations, which play a crucial role in understanding how technology is integrated into private and public healthcare. They offer valuable insights into the challenges faced and the benefits gained from such integration, as the research on “patient satisfaction with the implementation of electronic medical records” in the United Arab Emirates focuses on the benefits of electronic medical records, one of the report's pillars. These reports and studies provide nuanced perspectives on the effectiveness of electronic medical records in improving patient care, streamlining healthcare processes, and enhancing overall healthcare delivery. The research also focuses on the many detailed challenges, risks, and barriers patients will likely face using this smart technology. Therefore, the study of (Wali et al., 2020) evaluates several factors: the clinical consultation, the doctor's focus, the manner in which tests and medications are clarified, the duration of interaction with the patient, and the attentive listening by the doctor are all significant, patients feel assured when posing health-related inquiries to their doctor during such consultations that measure patient satisfaction from five different primary healthcare centers (PHCs). The research method included previous studies and research on the subject and secondary data methodology (Haleem et al., 2021), in which they talked about the benefits of

blockchain technology in health records, (Mozumder et al., 2023) they expressed the challenges of EMR and (Sharma and Joshi, 2020) investigated the barriers of blockchain technology.

Moreover, policy documents explain the regulatory mechanisms on which healthcare policies and treatments are based, such as healthcare regulations, strategic plans, and regulations issued by governmental bodies. These documents encompass various aspects, including healthcare regulations, strategic plans, and directives issued by governmental bodies. These policy papers provide detailed discussions on the barriers, incentives, and supportive regulations essential for guiding health technology companies in their endeavors. By outlining the regulatory landscape, policy documents provide clarity on the legal requirements and standards that must be adhered to when developing and implementing healthcare technologies. This clarity helps ensure compliance and fosters an environment conducive to innovation and growth within the healthcare sector. Moreover, policy documents serve as valuable resources for stakeholders, offering insights into healthcare policy initiatives' overarching goals and priorities. They provide a roadmap for aligning technological advancements with broader healthcare objectives, ultimately contributing to the improvement of healthcare delivery and patient outcomes.

3.3 Data analysis

In such research, thematic analysis methods could identify trends, recurrences, and essential data points across multiple secondary data sources. The topics may range from how people embrace change to what barriers there may be, the benefits of technology to the long-term objectives in care and policymaker guidelines.

Thematic analysis involves recognizing patterns or themes in qualitative data. Braun and Clarke (2006) recommend it as the initial qualitative method to master because it equips researchers with fundamental skills applicable to various other analyses (p.78). Taking a cognitive thematic analytical approach of Clarke and Braun's while conducting the research on the consideration of technology integration and patients' health outcomes in the national healthcare organizations of the UAE, we need to follow a systematic method of investigating the secondary data sources, such as levels, studies, and policy documents. The first part involves walking through all the in-depth information to get a well-informed background of the topic. This is followed by systematically organizing the data into chunks and then identifying the key concepts and ideas on technology integration and patient outcomes. While identifying the themes from the analyzed data, revising and polishing the themes is important to make the themes correct and logically connected.

After the themes are identified, they are defined and named descriptively, if possible, and briefly to effectively convey their emotions. For instance, themes would involve barring technology adoption, consumer experience with the integrated environment, organizational problems, and policy implications. Accents are spoken here using iterative analysis and interaction, involving entities of a bulk that are similar, distinct, and subtle within data. Visuals, like thematic charts and matrices, facilitate the thematic model's grouping and summarization, supporting an enhanced understanding of the theme-sub-theme relationships.

Interpretation involves much more than examining them and exercising brainpower, incorporating their relevancies to viewing the research question. Some illustrative instances of the numbers as

evidence were used and to expound on every theme, adding to the strength and assurance of my interpretation. Finding the themes between codes and their result will allow me to catch the important parts of how technological innovations are used by healthcare personnel in the UAE. Yet, compliance with the reflexive attitude is held for the sake of shedding light on the shortcomings of the researcher in relation to personal biases and position.

I used specific search terms and Boolean operators to refine the literature search. This included terms like "patient satisfaction," which covers "patient experience" and "patient feedback" to get insights into healthcare quality. I also focused on "electronic medical records" (EMR) or "electronic health records" (EHR) to ensure I covered digital record-keeping systems in healthcare. Keywords such as "healthcare technology," "digital health," and "health information technology" helped find studies on technological innovations and their applications in healthcare. Geographically, I primarily focused on publications from the "UAE," while also considering insights from other countries like “Saudi Arabia” and other Gulf countries, as well as studies from "developed countries" recognized for their innovative healthcare technologies (see appendix). These criteria and search terms were chosen to gather relevant literature that contributes to understanding and advancing healthcare technology integration specifically within the UAE.

Table 3.1 shows the data, selection inclusion and exclusion criteria:

Inclusion criteria	**Exclusion criteria**
Report time period and its publications: This research includes data from the 2020 Patient	Other Report Indicators: Indicators such as articles used digital technologies but not

Satisfaction with Electronic Medical Records Study. This period was chosen as it was dominated by many reports and sources indicating the application of this technology in Gulf countries such as Saudi Arabia and the United Arab Emirates, which will be discussed in this research. Selected Indicators: Select studies and articles based on relevant of the themes, such as technology, patients, healthcare that are similar to UAE context as the key indicator most relevant to our study. Geographical Focus: The study focuses on countries that are developed in the health field and most use innovative technologies in the healthcare.	similar to the UAE and the articles that commercial in nature not educational and others were excluded from this study.

Table 3.1, Inclusion and Exclusion Criteria | Author created.

Data and information in this study will be analyzed using thematic analysis, which involves looking for articles with themes similar to those of the study. First, document analysis is a structured approach to examining and assessing various types of documents, including printed and digital

materials like computer files and online content. Similar to other qualitative research methods, it involves scrutinizing and interpreting data to uncover meaning, enhance understanding, and build empirical insights (Corbin and Strauss, 2008; also referenced by Rapley, 2007).

These documents typically contain text and images captured without a researcher's direct input. The reason for choosing document analysis and finding it the appropriate type for this research is the timeline, which is the most efficient qualitative document analysis for the topic, which gives complete control over the time to gather and analyze the data. In this stage, we examine relevant documents, such as reports and studies, that are related to our research. By identifying themes, patterns, and concepts from these studies that align with the UAE's context approach, we gain insights to address the research question of this dissertation on the use of integrated technologies to improve patient outcomes across the UAE's private and public healthcare sectors.

During the research process and data analysis, many sources related to the research topic were found and reviewed, and information and studies that were consistent with the selection and use criteria I followed were selected, monitored, and extracted.

Table 3.2 shows the sources searched, including references and their conclusion.

#	Themes	References	Conclusion
1	Patient satisfaction with EMR	Wali, Alqahtani, Alharazi, Bukhari, and Quqandi, (2020)	Patients are satisfied with EMR, as it enhances accessibility to healthcare providers, facilitates comprehensive discussions during clinical consultations, and improves the quality of out-of-clinic services such as appointment scheduling and prescription management.
		Jialin, Luo, Zhang, and Huang, (2013)	This study indicates a positive trend in patient satisfaction with EMR/HER. Additional research is necessary to comprehend the various factors that impact patient satisfaction with EMR/EHR systems before definitive satisfaction metrics can be established.
2	Benefits of EMR using Blockchain	Haleem, Javaid, Singh, Suman, and Rab, (2021)	The utilization of Blockchain technology in EMR offers benefits such as resolving data security concerns, enabling seamless data exchange among healthcare stakeholders, fostering cost-effective treatment development, catalysing

			digital transformation, and enhancing overall quality of life in the healthcare sector.
		Aljifri and Moustafa, (2007).	Exploring the benefits of blockchain technology in managing e-health records promises a transformative shift in healthcare, addressing key issues like data security, interoperability, error prevention, and transparency.
3	Healthcare outcomes	Holroyd-Leduc, Lorenzetti, Straus, Sykes, and Quan, (2011)	The study suggests that EMR/EHR systems have a positive impact on healthcare structure and processes, but their influence on health-related outcomes is less clear.
		Red, (2023)	This article examines how healthcare technology is changing the medical field and shows how it can help patients get better health outcomes by being more accessible, accurate, and efficient.
4	Converges between private and public hospitals in patient record	Alrahbi, Khan, Gupta, Modgil, Chiappetta, and Jabbour, (2022)	The adoption of (EMRs) by private and public hospitals aims to enhance healthcare services by promoting data exchange, interoperability, and collaborative workflows among healthcare providers. This digital connectivity is anticipated

			to significantly improve health outcomes and patient care across various sectors.
5	Barriers of Blockchain in Healthcare	Sharma and Joshi, (2020) Barriers to blockchain adoption in health-care industry: an Indian perspective	Blockchain technology improves data security, privacy, and interoperability in electronic medical records. However, its adoption faces hurdles such as a lack of legal framework, insufficient management support, high implementation costs, and a shortage of expertise.
6	UAE Applications for Blockchain Technology in Healthcare	Alhajaj and Moonesar, (2023)	They are investigating why more institutions need to use blockchain technology in healthcare. Quality issues such as regulatory compliance, interoperability challenges, high implementation costs, the complexity of healthcare data, and stakeholders' aspirations for trust make the integration challenging.

		Abed, (2022)	UAE applications in the healthcare domain include programs like the Digital Trust Platform project and initiatives of Emirates Health Services Corporation's blockchain development for managing patient data, EHS analytics, and enhanced decision-making.

Table 3.2, Data Analysis themes | Author created.

3.4 Ethical Considerations

The ethical perspective is related to providing data privacy and confirming that all the data sources are correctly quoted and used in accordance with copyright restrictions. Ensuring data privacy is essential, especially when incorporating sensitive information derived from these sources. The researcher adheres strictly to copyright laws and intellectual property rights, which govern the use and dissemination of published materials. This includes correctly quoting and attributing all secondary data sources and giving due credit to original authors and creators.

3.5 Validity and Reliability

External multi-source data allows for the confirmation and coherence of data gathered from different secondary sources, thus increasing the findings' validity and reliability. This multi-source approach provides a more comprehensive and nuanced understanding of the subject matter, as

it integrates diverse perspectives and information. Researchers can identify patterns and discrepancies by comparing and corroborating data from different sources, strengthening their findings' credibility. This method not only bolsters the overall robustness of the research but also increases confidence in the conclusions drawn, as the convergence of data from multiple, independent sources serves to validate the results. Consequently, using external multi-source data is a fundamental practice in research that significantly enhances the dependability and integrity of the data and its insights.

3.6 Research Accuracy

Reflexivity is a principle of constant critical analysis of the researcher's interpretation and perception of findings to ensure that biases do not hinder them. Thoroughly tracking the review process is a key aspect of research transparency and rigor since it helps clarify and substantiate the rationale for specific study inclusion/exclusion criteria and data extraction methods.

An important aspect of the research includes highlighting the UAE's efforts in technology and digital transformation, with a focus on the use and application of these technologies in the healthcare field. An important aspect of the research includes highlighting the UAE's efforts and role in the technical field and digital transformation, focusing on its application of blockchain technology and its uses of these smart technologies in health care. This highlight aims to reveal the technologies and systems already used in the various emirates of the country for patient records and to consider how to link these technologies into one system that serves the entire country.

In general, this study uses the secondary review of data as a methodological approach to assist in understanding the importance of the integration of technologies in ensuring positive health outcomes for the private and public healthcare sectors in the United Arab Emirates. This research played a vital role in national healthcare policies by analyzing the outcomes from previous reports and documents in the area and suggesting where the gaps were and what needs to be focused on in future policies and research across the UAE and the wider region.

Chapter 4: Analysis and Findings

4.1 Introduction

As we mentioned in previous chapters, the UAE has demonstrated its progress in the field of technology, The UAE ranked highly in global digital life assessments thanks to its remarkable progress in the information and communication technology sector according to the “Digital Lifestyle report in the UAE – 2022”. Additionally, it was placed in the top 5 countries for 59 indicators and in the top 10 for 106 indicators, including healthcare coverage based on the “UAE Digital Transformation Report 2020.” Therefore, this chapter will centralize on the methodology specified in Chapter 3 which will focus on the document analysis.

4.2 Document Analysis

To achieve the main research objectives, which revolve around integrating technology and advanced modern techniques into the healthcare sector in the United Arab Emirates, I highlighted the country's efforts, especially those of the Emirates Health Services Corporation, one of the largest healthcare providers in the UAE in the government sector that serves almost all the country's emirates. Emerging technologies drive progress, offering dynamic solutions that revolutionize how we live, especially how we thrive in healthcare. Innovations like AI, VR/AR, blockchain, IoT, and robotics constantly evolve and have vast potential to reshape healthcare delivery, diagnosis, treatment, and overall wellness. With healthcare as a cornerstone of societal well-being, the challenge lies in providing efficient, accessible, and personalized care to a growing population. In this context, emerging technologies serve as catalysts for transformative change. At Emirates Health Service, embracing these technologies is an option and a responsibility.

Committed to leading this technological revolution, EHS leverages these innovations to redefine healthcare standards, ensuring the health and happiness of those they serve (EHS, emerging technology, 2024). By integrating these advanced technologies, EHS aims to improve patient outcomes, enhance operational efficiency, and provide a higher quality of care. The use of AI in predictive analytics, VR/AR in medical training and patient treatment, blockchain for secure and transparent health records, IoT for real-time patient monitoring, robotics for precision surgeries, and automation of routine tasks exemplify how EHS is at the forefront of modern healthcare advancements. This commitment to innovation ensures that EHS can meet the evolving needs of its patients while maintaining a high standard of care, ultimately contributing to the community's overall well-being.

By analyzing this information and leveraging newly developed technologies in the UAE, we have set these steps to radically transform the UAE's healthcare system and everyone's access to high-quality and efficient care.

Step	Method
Evaluation of the current healthcare system	Starting with a comprehensive assessment of the current healthcare system in the UAE to identify areas for improvement and opportunities to integrate emerging technologies. This assessment should consider factors such as infrastructure, workforce capabilities, patient needs, and the regulatory environment.

Identify key emerging technologies	The emerging technologies at Emirates Health Services (EHS), identify the most relevant and impactful technologies for integration into the healthcare system. This may include artificial intelligence (AI), virtual and augmented reality (VR/AR), blockchain technology, Internet of Things (IoT), robotics, and others.
Strategic Planning and Prioritization	Develop a strategic plan to integrate emerging technologies into the healthcare system, prioritizing technologies based on their ability to address specific healthcare challenges and improve patient outcomes.
Collaboration and Partnerships	Foster collaboration and partnerships with technology developers, healthcare providers, government agencies, and other stakeholders to facilitate the adoption and implementation of emerging technologies. Engage in dialogue and knowledge-sharing initiatives to ensure a comprehensive approach to technology integration and address any barriers or challenges.
Pilot Projects and Proof of Concepts	Implement pilot projects and proof of concepts to test the feasibility and effectiveness of integrating emerging technologies into real-world healthcare settings. This may include deploying technology solutions in selected healthcare facilities, communities,

	and neighborhoods and evaluating their impact on patient outcomes, efficiency, and user experience.
Training and Capacity Building:	Invest in training and capacity-building initiatives to ensure that healthcare professionals have the knowledge and skills needed to effectively use emerging technologies in their practices. Provide ongoing education and support to promote the adoption and acceptance of new technologies among employees and stakeholders.
Continuous evaluation and improvement	Monitor and evaluate the implementation of emerging technologies in the healthcare system continuously and gather feedback from patients, healthcare providers, and other stakeholders. Use feedback to adjust and improve as needed, ensuring technology integration remains compatible with the evolving needs and priorities of the healthcare system. (For example, Customer Pulse is one of the government projects to evaluate customers of government services and work to develop them.)

Table 4.1, Steps for transforming the UAE's healthcare system | Author created.

These procedures will help address the problem of healthcare providers in the government and private sectors using many emerging technologies in the UAE's healthcare field. This will allow for the possibility of working on a unified technical system in the country that satisfies all

stakeholders (patients and their families, doctors, technicians, and administrators for healthcare providers). Further, this unified system would streamline processes, improve data accessibility, and ensure consistency in healthcare services. It would enable seamless sharing of patient information among different healthcare providers, enhancing coordination of care and reducing duplication of tests or procedures. Additionally, the implementation of such advanced technologies fosters innovation in healthcare delivery and promotes the adoption of best practices across the entire healthcare ecosystem in the UAE. By addressing these challenges and leveraging emerging technologies, the healthcare sector in the UAE can advance towards a more efficient, integrated, and patient-centered approach to healthcare delivery.

The primary research question driving this study is **how can the use of integrated technologies enhance patient outcomes in the UAE private and public healthcare sectors?**

To address this question, the paper will concentrate on utilizing the document analysis approach to analyse the data reported by Wali et al. (2020) in their study "Patient satisfaction with the implementation of electronic medical Records in the Western Region, Saudi Arabia, 2018" through which patient satisfaction was measured with the medical consultation before and after the Implementation of EMR and their satisfaction with the services in the PHC which was explained through the figures shown in the study.

Patient Satisfaction with the Medical Consultation before and after the Implementation of EMR

	Agree n (%) Before EMR	Agree n (%) After EMR	*p*-value
Physicians attention	291(77%)	314(82.3%)	< 0.001
Physicians explanation	305(80.7%)	325(85.8%)	< 0.001
Clinical encounter time	279(73.8%)	303(80.4%)	< 0.001
Physicians listening	278(73.5%)	289(77.3%)	< 0.001
Patients ask conveniently	300(79.4%)	316(84%)	< 0.001
Physicians more interested in file than the patients	218(57.5%)	166(44.1%)	< 0.001

Chi-square Test

Figure 4.1, Patient Satisfaction before & after EMR | Haleem et al. (2021)

As illustrated in Figure 4.1, implementing an Electronic Medical Record (EMR) system had a multifaceted and statistically significant impact on the dynamics of the physician-patient consultation process. Notably, there were visible improvements across several key dimensions, including physicians' attention, physicians' explanation, clinical encounter time, physicians listening, patients' asking convenience, and physicians' more interest in the file than the patients. All results and statistics indicate high adoption rates of EMR systems not only streamlined administrative processes but also positively influenced various aspects of physician-patient consultation, leading to improved communication, increased patient engagement, and enhanced overall satisfaction with the healthcare experience. Additionally, it shows from Figure 4.1 that after the implementation of EMR, the doctor's active listening skills improved, and the participants thought it was easier to ask questions about their health and concerns; this may have

been because they had to spend less time filling out forms and writing notes. Electronic medical record systems are dramatically transforming healthcare delivery by enhancing communication, enhancing patient engagement, and facilitating continuity of care. These improvements ultimately translate into better patient outcomes, including improved health status, reduced hospital readmissions, and higher levels of patient satisfaction with the healthcare experience through the use of these technologies in both hospitals and health centers in the government and private sectors in the UAE.

Patients' Satisfaction with Services in the PHC

	n	%
Improved physician-patients relationship		
Disagree	35	9.2
Neutral	61	16.1
Agree	281	74.5
Total	377	100
Reduced waiting time		
Disagree	101	26.6
Neutral	34	9.0
Agree	242	63.9
Total	377	100
Improved services		
Disagree	32	8.4
Neutral	37	9.81
Agree	308	81.6
Total	377	100
More efficient prescription process		
Disagree	50	13.2
Neutral	23	6.1
Agree	304	80.0
Total	377	100.0
Easier appointment booking		
Disagree	36	9.5
Neutral	37	9.8
Agree	304	80.6
Total	377	100
Improved referral system		
Disagree	46	12.2
Neutral	44	11.6
Agree	287	76.1
Total	377	100

Figure 4.2, Patients' Satisfaction with the services in the PHC | Haleem et al. (2021)

Figure 4.2 shows the additional measured variables in the study, such as patient satisfaction with the EMR and the quality of services provided during the visit, including waiting time, health services improvement, prescription process, appointment system, and referral system. Significant percentages of participants agreed on various improvements. For instance, 74.5% agreed that

the EMR implementation improved the physician-patient relationship, and waiting time was reduced by 63.9%, 81.6% agreed that primary healthcare services improved, and 80% reported more efficient prescription dispensing, 80.6% noted improved appointment booking, 76.1% reported an enhanced referral system.

In addition to this study, we can also answer the question by analyzing the other study by (Jialin, Luo, Zhang, and Huang, 2013) about patient satisfaction with electronic medical/health records, which relied on patient outcomes in emerging technologies in the health sector; this systematic review examined the effects of implementing EMR/EHR systems on patient satisfaction. According to the study, patients were generally satisfied with EMR/EHR, emphasizing the need for more thorough research to quantify and characterize this impact accurately. Concerns regarding validity and reliability were raised by some problems in the reviewed studies, such as low response rates and ambiguous methodology. Many definitions were discussed in the study, and due to differences in assessment instruments and definitions, it is challenging to measure patient satisfaction consistently, which is a complicated concept across studies. Technical difficulties, contextual variables, and unique patient characteristics are all factors that affect satisfaction and should be considered when assessing the implementation of EMR/EHR. Furthermore, by comprehending these elements, EMR/EHR systems can be better designed and implemented to guarantee user satisfaction and positive results.
From what we analyzed, implementing EMR in healthcare services led to widespread improvements in efficiency, quality, and patient satisfaction, benefiting healthcare professionals and patients alike. These results will increase patient outcomes when using smart technologies in

healthcare in the UAE, both in the government and private sectors. There are concerns and problems in electronic health records, such as the validity and reliability of patient data, which is considered completely confidential. Still, there are secure mechanisms and methods for permissions and access.

This study asks, **"How are patient outcomes affected by patient database technologies in the health sector globally?"**

The literature review demonstrates various perspectives and academic works. We can answer this question through a study by Haleem et al. (2021), which talks about blockchain technology, the technology used in the healthcare sector to save patient data. Blockchain technology is a digital ledger that records and stores information. Through it, no one can modify the information stored in the blockchain except after ensuring accountability. It is one of the best and most excellent technologies for protecting confidential data within the smart system, as it securely keeps documents.

Analyzing how blockchain technology affects patient outcomes in healthcare requires understanding how it enables seamless and effective data sharing between healthcare providers and network members, as reported in the "Blockchain Technology Applications in Healthcare: An Overview" study. We benefited greatly from this study; as mentioned above (Figure 4.2), which shows the important applications of Blockchain technology in healthcare and concludes the technology's benefits. Through this, we analyzed how blockchain technology impacts patient outcomes in healthcare, from improving data sharing and treatment decisions to accelerating

innovation and growth in the industry. Figure 4.3 concisely shows how blockchain technology influences patient outcomes in healthcare.

Aspect	Description	Effects on Patient Outcomes
Improved Data Sharing	Blockchain makes it easy for healthcare providers to share patient data securely and effectively, guaranteeing that correct information is available when needed.	This results in better care coordination and prompt interventions.
Economical Sophisticated Treatments	Blockchain helps create affordable therapies and cutting-edge treatments by enabling data sharing and optimizing procedures.	Access to complete and accurate patient data can inform treatment decisions, resulting in more effective interventions.
Accelerated Growth in Healthcare	Adopting blockchain technology in the healthcare sector is anticipated to spur industry expansion.	This expansion may result in advances in medical science, technology, and therapeutic approaches.
Benefits for Healthcare and Logistics	Blockchain technology has revealed opportunities in the	Healthcare organizations use blockchain technology to track

	logistics industry, and this trend is extending to the healthcare sector.	medical devices, manage supply chains, and verify the validity of pharmaceuticals. This can lead to increased efficiency and improved patient safety.
Digital Transformation and Innovation	Blockchain technology's ability to facilitate digital transformation gives healthcare systems the freedom to innovate and streamline operations, eventually improving patient outcomes and care.	This shift toward digitalization makes possible the application of cutting-edge technologies like telemedicine, remote monitoring, and personalized medicine.

Figure 4.3, How blockchain technology affects healthcare patient outcomes | Haleem et al. (2021)

On the other hand, if we approach Mozumder et al. (2023) point of view based on their study is different from the point of view of Haleem et al. (2021), through which they concluded that some possible problems and challenges may occur to patient database technologies, which will negatively affect and impact patient outcomes the health sector:

Despite advancements in electronic medical records (EMRs), data availability problems still need to be solved. Existing systems frequently rely on centralized databases only available within particular healthcare facilities, making data accessibility and retrieval challenging. Data loss may

occur permanently in the case of server failure or latency, endangering patient care continuity and possibly resulting in treatment errors or delays.

Even though encryption technologies offer strong protection for patient data, stakeholders in the healthcare industry continue to have privacy and security concerns. Access control management is essential to prevent unauthorized access to sensitive information, even with encryption. Multiple parties provide healthcare data, which raises the possibility of accidental security and privacy lapses. Patient trust may be eroded, and unfavorable consequences may result if sufficient steps are not taken to assess and foresee these risks and protect patient data from misuse or unauthorized access. These issues highlight the potential negative impacts on patient outcomes using patient database technologies from data availability, privacy, and security concerns. Failure to manage these aspects appropriately may result in compromised data integrity, privacy breaches, disruption of patient care, and ultimately impact patient safety, trust, and well-being.

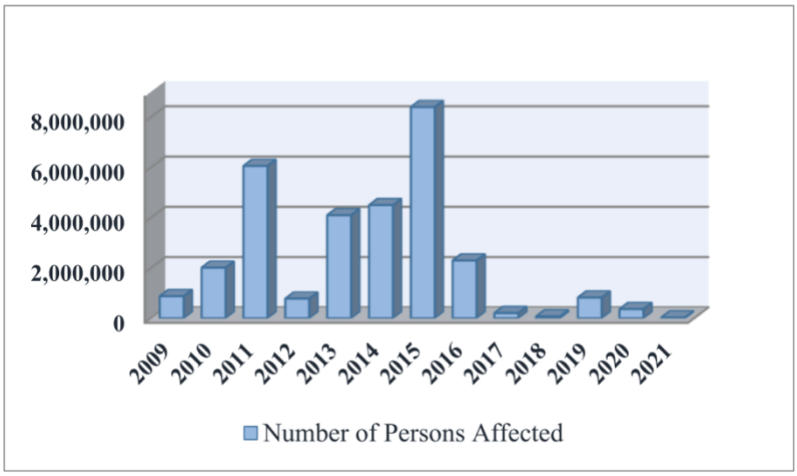

Figure 4.4, Persons affected by cyberattack in HMS| (Mozumder, Armand, Uddin, Athar, Sumon, Hussain & Kim, 2023).

The (Adoption of Blockchain Technology in Healthcare: Challenges, Solutions, and Comparisons) study also provides an example of these problems by describing patients' exposure to electronic attacks.

Many individuals have been affected by cyberattacks, as shown in Figure 4.5; the number of people who have been affected by cyberattacks since 2009 is because they can no longer access their medical information confidentially. The reason behind choosing these years is starting from 2009 when the digitization of medical records appeared as a new development in the world, and the expansion of healthcare systems began. However, Blockchain technology presents a robust solution with built-in security features where the data is encrypted using the sender's private key, and only the proposed recipient can decrypt the data using the sender's private key. This technology addresses the challenge of cyberattacks and significantly enhances the security and privacy of patient data in Healthcare Management Solutions (HMS), thereby improving patient outcomes (Mozumder et al., 2023).

Cyberattacks and providing unauthorized persons access to patient databases pose severe risks to patient outcomes by compromising data integrity, interfering with healthcare services, violating patient privacy rights, putting financial and legal strain on healthcare organizations, and harming patients psychologically. Strong cybersecurity protocols, frequent system audits, and employee training are preventive measures crucial to reducing these risks and protecting patient health data from online threats.

To answer this question: **How do doctors implement advanced patient database technologies in treating patients?** We can answer this from the previous study (Haleem et al., 2021). The study covered many aspects, including the role of doctors when using advanced blockchain technology in the patient database to treat them in several keyways: Comprehensive Health Records: Doctors implement advanced patient database technologies, such as blockchain, in treating patients to enhance the accessibility, security, and integrity of comprehensive health records. These technologies enable the secure storage of a patient's entire medical history, including diagnoses, test results, previous treatments, and sensor readings, in a decentralized manner. Unlike traditional data storage methods that rely on centralized servers, blockchain disperses data across a network of computers. This decentralized approach significantly boosts security, making it much more difficult for unauthorized parties to access or tamper with the data, thereby reducing the risk of data loss or hacking.

By utilizing blockchain, doctors can easily access all necessary information for diagnosing and treating patients, ensuring they have a complete and accurate understanding of their medical history. This comprehensive view is crucial for making informed medical decisions and providing personalized care. The blockchain's immutable nature means that once data is recorded, it cannot be altered, guaranteeing medical records' integrity. Patients and healthcare providers can trust that the information is accurate and complete.

Furthermore, the enhanced security features of blockchain protect patient data from unauthorized access, ensuring confidentiality and privacy. This secure environment fosters trust

between patients and healthcare providers, as patients can be confident that their sensitive health information is protected from breaches and unauthorized use.

Better Diagnosis and Treatment: Doctors can more easily access comprehensive medical records using Blockchain technology's interoperability, which helps with more accurate diagnosis and the creation of precise treatment plans. This accessibility improves the standard of patient care by speeding up obtaining pertinent information. Moreover, the efficiency gained from using blockchain technology means that critical health information is available when and where it is needed, without delays associated with traditional data retrieval methods. This immediate access to detailed patient records can be lifesaving in emergency situations and enhances the overall standard of patient care.

By reducing the time needed to gather information, doctors can focus more on patient interaction and care delivery. Additionally, the integrity and security of the data stored on the blockchain build patient trust, as they can be assured that their sensitive medical information is protected from unauthorized access and tampering. This secure and reliable system improves the quality of care and strengthens the patient-doctor relationship by fostering confidence in the healthcare process.

Patient Monitoring and Remote Response: Blockchain technology revolutionizes patient monitoring and remote response in healthcare by providing a strong framework for ensuring timely access to medical equipment and enabling prompt responses to emergencies, even from a distance. With blockchain-enabled systems, physicians can remotely monitor patient conditions

in real time, allowing for early intervention and more effective management of medical emergencies. This capability is especially crucial in situations where immediate medical attention is required but physical presence is not possible.

Moreover, healthcare systems empowered by blockchain technology can enhance the monitoring and management of various parameters critical to patient care, such as supply availability, bed usage, and room temperature. By leveraging blockchain's decentralized architecture, healthcare facilities can maintain accurate and transparent records of medical equipment inventory, ensuring that essential supplies are readily available when needed. Additionally, real-time monitoring of bed utilization and room temperature enables healthcare providers to optimize resource allocation and create a more comfortable and conducive environment for patient recovery. Overall, blockchain technology improves the efficiency of patient monitoring and enhances healthcare systems' responsiveness and resilience in addressing medical emergencies and optimizing resource utilization.

Research Initiatives and Patient Referral Control: Blockchain makes it easier to create research initiatives by securely storing patient care records and treatment plans. This technology can also improve patient referral control by monitoring and recording therapy plans, guaranteeing continuity of care, and expediting the referral process between medical professionals (Haleem et al., 2021).

Additionally, as mentioned in the Mozumder et al. (2023), among the proposed solutions to address the challenges facing patient database technologies for treatment by doctors is the need

to integrate the latest patient database technologies in the healthcare sector, with a focus on security protocols and consensus building. The confidentiality and integrity of patient records are ensured through shared consent between healthcare providers such as doctors and patients, as well as authentication using hashed keys. Secure data on the blockchain is further enhanced by encryption techniques, which prevent unwanted access to private medical records. Transparency and trust in healthcare interactions are improved when patients are involved in data management decisions, and adherence to ethical and regulatory guidelines is critical in demonstrating dedication to protecting patients' rights. This helps to improve patient care processes and adapt to changing needs by continuously evaluating and improving clinicians' technology applications.

Implementing advanced patient database technologies, especially Blockchain technology, enables clinicians to have enhanced access to comprehensive patient data in any health facility in the UAE, whether belonging to the government or private sector, and at any time. This improves diagnostic capabilities, increases data security, and streamlines healthcare operations.

We can answer the final question of this research: **How do patients perceive the common patient systems?**

Integrating technical and smart systems has emerged as a critical paradigm in improving patient care and healthcare delivery in the early stages of a quickly changing healthcare landscape. With their transformative power, technological advancements are reshaping patients' engagement with healthcare services. These advancements, from wearable technology and remote monitoring systems to electronic health records and telemedicine platforms, are revolutionizing how patients

interact with healthcare. Patients' opinions of these sophisticated and technologically advanced healthcare systems significantly impact how they experience healthcare as they grow increasingly accustomed to using digital solutions in many areas of their lives. The widespread adoption of these advanced healthcare technologies underscores their potential to revolutionize traditional healthcare practices. Electronic health records, for example, streamline the documentation and management of patient information, enhancing the efficiency and accuracy of clinical decision-making processes. Similarly, remote monitoring systems enable continuous tracking of patients' health parameters, facilitating timely interventions and personalized care plans. The integration of telemedicine platforms further expands access to healthcare services, particularly for individuals in remote or underserved areas, overcoming geographical barriers to care delivery. As patients increasingly embrace these innovative solutions, their expectations for seamless, integrated, and patient-centric healthcare experiences continue to grow. Therefore, healthcare providers must leverage these technological advancements to optimize clinical outcomes and cultivate patient-centered care environments that prioritize accessibility, convenience, and quality.

Look at the themes and research sources monitored in the third chapter from the healthcare outcome's theme. The study by Red (2023) thoroughly examines the transformative role of healthcare technology in contemporary medical practices by exploring its complex effects on patient outcomes. Technological advancements have significantly bolstered healthcare delivery, from the widespread use of telemedicine, which offers remote access to consultations and follow-up care, to the adoption of Electronic Health Records (EHRs) that streamline data management

and improve care continuity. AI algorithms and sophisticated medical imaging technologies allow accurate and timely diagnosis of various medical conditions. Additionally, patients are empowered by wearable technology and remote monitoring tools, which encourage active participation in their health management. AI-driven insights also help to personalize treatment plans. Collaboration between multiple disciplines and a patient-centric mindset is essential to realizing this potential because they can address these issues, enhance patient outcomes, and build a more cohesive, patient-centered healthcare ecosystem.

We can enable patients to perceive, consider, and evaluate technical and smart systems in health care based on diagnosis and treatment and their overall experience through several aspects, such as ease of use and effectiveness, as patients always look for easy-to-use systems through which what is required is obtained very quickly and with simplified processes and steps. Reliability: technical systems that patients can trust and rely on to get accurate information and that have strong security measures to enhance their confidence in the confidentiality of their health data. Customization and excellence are achieved by providing customized methods and features designed according to their needs and preferences. Communication, participation, and integration in care enable patients to communicate and participate with healthcare providers in their care decisions by facilitating the smooth transition and access to medical information, enabling secure communication with service providers, and supporting monitoring and telemedicine. Awareness and education are systems that provide educational resources about the health sector, doctors, diseases, and devices through which patients can make decisions that are in the best interest of their care and safety.

Healthcare providers and organizations looking to optimize the design, implementation, and utilization of technology-enabled solutions to meet patient needs and preferences must thoroughly understand how patients view and interact with these systems. Thus, it is critical to investigate patients' viewpoints regarding technical and intelligent healthcare systems to promote patient-centered care and ongoing advancements in healthcare services.

This thorough understanding of patients' experiences with healthcare technology is crucial for fostering ongoing advancements in healthcare services. By delving into patients' interactions with these systems, providers can identify areas for improvement and innovation. Moreover, incorporating patient feedback into the design and implementation of technology solutions ensures that these tools are user-friendly, accessible, and effective in addressing patients' healthcare needs. Ultimately, by prioritizing and integrating patient perspectives into developing and utilizing healthcare technology, providers can enhance patient-centered care delivery and drive continuous improvement in healthcare services. This thorough understanding of patients' experiences with healthcare technology is crucial for fostering ongoing advancements in healthcare services. By delving into patients' interactions with these systems, providers can identify areas for improvement and innovation. Moreover, incorporating patient feedback into the design and implementation of technology solutions ensures that these tools are user-friendly, accessible, and effective in addressing patients' healthcare needs. Ultimately, by prioritizing and integrating patient perspectives into developing and utilizing healthcare technology, providers can enhance patient-centered care delivery and drive continuous improvement in healthcare services.

Chapter 5: Recommendations

5.1: Summary of the findings

The previous chapter of the study highlights the results obtained by analyzing data from studies conducted on integrating smart technologies in the healthcare sector. This dataset is considered an essential reference due to its comprehensive nature and integration of diverse sources. It is pivotal to highlight the UAE as one of the world's most advanced countries in this field. Specifically, the research focuses on standardizing a technical system in the UAE for EMR "Electronic Medical Records," a repository of patient data and tools that help analyze and support decision-making for doctors and identify trends in care, treatment, and medication. The study revealed the benefits, challenges, and problems of these technologies. The technologies and applications currently applied in the country.

Sub Question 1: How are patient outcomes affected by patient database technologies in the health sector globally?

- A thorough analysis produced several significant findings. Firstly, as pointed out in Haleem's study, one important reason for the positive impact of patient outcomes with their database technologies is the speed of sharing and exchanging information and data between various hospitals and care centers. Doctors follow up on patients' cases and receive appropriate treatment through the system and advanced technology.
- Secondly, the Mozumder et al. (2023) study highlighted patient outcomes from a negative perspective if the system is exposed to a hack, fails, or allows unauthorized persons to

access patient data. This leads to a lack of patient confidence and safety in obtaining care securely by violating their privacy. Still, it proved that the advantages of modern technologies such as technology Blockchain can enhance the security and privacy of patient data with complete confidentiality.

Finally, the analysis revealed the latest innovative technology in the health sector, especially for the patient database: Blockchain technology. Its exceptional features and benefits characterize it, and it can enhance the security and privacy of patient data and information with complete confidentiality.

Sub Question 2: How do doctors implement advanced patient database technologies in treating patients?

- An analysis of the study by Haleem et al. (2021) revealed the pivotal role of doctors in patient data through modern technologies in order to transform patient care; physicians are essential in utilizing cutting-edge blockchain technology inside patient databases.
- The analysis revealed that doctors can easily access vital patient data by safely storing complete medical histories on the blockchain, which enables them to make more precise diagnoses and customized treatment plans.
- The decentralized structure of blockchain guarantees data security and integrity, promoting trust in medical records. This technology's interoperability makes it easier to retrieve relevant data quickly, raising the bar for patient care.

- The analysis highlights that adopting blockchain technology drives industry expansion and advances medical science and technology.
- The analysis revealed that blockchain enhances logistics by tracking medical devices, managing supply chains, and verifying pharmaceutical authenticity, increasing efficiency and patient safety.
- The analysis showed that blockchain facilitates digital transformation, allowing for the application of advanced technologies like telemedicine and personalized medicine, thereby improving patient outcomes and care.

Sub Question 3: How do patients perceive the common patient systems?

- The study serves as the foundation for the analysis, emphasizing the transformative role of healthcare technology and the importance of understanding patients' viewpoints to promote patient-centered care and ongoing advancements in healthcare services.
- Integration of technical and smart systems transforms patients' interactions with healthcare, providing new engagement opportunities throughout their healthcare journey.
- Advanced technologies like wearable devices, remote monitoring systems, EHRs, and telemedicine platforms have the potential to revolutionize healthcare practices and enhance efficiency, accuracy, and accessibility.
- Patients accustomed to digital solutions in daily life expect seamless, integrated, and patient-centric healthcare experiences. They prioritize ease of use, reliability, customization, communication, participation, integration in care, and awareness and education.

- Providers must leverage technological advancements to optimize clinical outcomes and cultivate patient-centered care environments. Understanding patients' experiences with technology is crucial for ongoing advancements. It enables the identification of areas for improvement and innovation and ensures that technology solutions effectively meet patients' needs.

5.2: Proposed Policy Recommendations

As outlined earlier and grounded in the comprehensive findings derived from the research and thorough data analysis in Chapter 4, the study will make recommendations for adoption by the Ministry of Health and Community Prevention. These recommendations are strategically designed to strengthen the healthcare system in the United Arab Emirates by providing high-quality services with the best standards. The discussion will explore the specific details of these recommendations, considering the nuances uncovered during the analysis and aiming to provide actionable insights for the department to implement impactful changes. The proposed recommendations aspire to raise the UAE's position in applying and integrating advanced technologies in the healthcare field by aligning with the identified challenges and leveraging the study's outcomes.

Short-term policy Recommendation 1:

It is crucial for the UAE healthcare system to conduct a comprehensive assessment to identify areas for enhancement and integration of emerging technologies. This evaluation should encompass evaluating infrastructure, workforce capabilities, patient needs, and regulatory

landscapes. Simultaneously, identifying and prioritizing key emerging technologies like AI, VR/AR, blockchain, IoT, and robotics will enable strategic planning at Emirates Health Services (EHS) and other healthcare providers. This strategic plan should outline how these technologies can effectively address specific healthcare challenges and improve patient outcomes. Furthermore, fostering collaboration and partnerships among technology developers, healthcare providers, government agencies, and stakeholders will facilitate adopting and implementing these technologies across the healthcare ecosystem.

Long term - policy recommendation 2:

Long-term policy recommendations should include the implementation of pilot projects and proof of concepts in diverse healthcare facilities to assess the feasibility and impact of integrating emerging technologies. These initiatives should be rigorously evaluated based on their effects on patient outcomes, operational efficiency, and overall healthcare quality. Additionally, investing in ongoing training and capacity-building initiatives for healthcare professionals is essential to ensure they possess the requisite skills to utilize these technologies effectively. Continuous evaluation and improvement mechanisms should be established to monitor technology implementation, gathering feedback from patients and healthcare providers to refine integration strategies over time. Finally, robust data security measures and privacy protocols must be implemented across all healthcare facilities to safeguard patient information, adhering to international standards and regulations to mitigate risks associated with data breaches and unauthorized access. These comprehensive short-term and long-term policy recommendations

aim to advance the UAE healthcare system through strategic technological integration, ensuring enhanced patient care and operational excellence in healthcare delivery.

5.3: Stakeholders

Our research identifies the stakeholder groups essential to successfully adopting the suggested policies. These parties are essential to the formulation, execution, and approval of the suggested policies.

Table 5.1: Stakeholders to implement recommendations

Stakeholder	Role
Ministry of Health and prevention	Oversee national health policy, regulation, and coordination of healthcare services.
Emirates Health Services	Provide healthcare services, manage hospitals and clinics, and ensure quality of care.
Department of Health - Abu Dhabi	Regulate and monitor healthcare services in Abu Dhabi, implement health initiatives, and ensure compliance with health standards.
Dubai Health	Oversee health sector regulation in Dubai, implement health policies, and promote public health initiatives.

5.4: The impact of a unified system on healthcare

In the bustling world of healthcare, where every second counts and precision is paramount, the impact of a unified system cannot be overstated. Imagine a scenario where patient records seamlessly glide from one medical professional to another; diagnosis and treatment decisions are

made with a comprehensive understanding of a patient's medical history, and communication between healthcare providers is as smooth as silk. This is the promise of a unified system in healthcare—a promise that holds the potential to revolutionize patient care and outcomes.

At its core, a unified system consolidates fragmented information into a cohesive whole, creating a centralized hub where all relevant data converges. Gone are the days of rifling through stacks of paper records or juggling multiple digital platforms. Instead, healthcare providers have instant access to a treasure trove of patient information at their fingertips, allowing for quicker, more informed decision-making. But the impact of a unified system extends far beyond mere convenience. By breaking down silos and fostering collaboration among healthcare professionals, it paves the way for truly holistic care. Specialists can seamlessly consult with one another, sharing insights and expertise to develop comprehensive treatment plans tailored to each patient's unique needs. This interdisciplinary approach enhances the quality of care and minimizes the likelihood of errors or oversights.

Moreover, a unified system holds immense promise for improving efficiency within the healthcare ecosystem. With streamlined workflows and reduced administrative burden, healthcare providers can devote more time and energy to what truly matters: caring for patients. Appointment scheduling, billing, and insurance claims become smoother processes, freeing up valuable resources that can be reinvested into patient care initiatives.

Beyond the immediate benefits, the impact of a unified system on healthcare is likely to ripple outwards, shaping the industry's future landscape. As data collection and analysis become more

robust, researchers gain unprecedented insights into disease patterns, treatment efficacy, and population health trends. This wealth of information informs clinical practice and drives innovation, paving the way for groundbreaking discoveries and advancements in medical science. In essence, the impact of a unified system on healthcare transcends mere convenience—it represents a paradigm shift towards patient-centric, collaborative, and data-driven care. By harnessing the power of technology to unite disparate elements of the healthcare ecosystem, we have the opportunity to create a future where every patient receives the highest standard of care, regardless of where they are or who they see. And in the future, the possibilities for better health outcomes are truly boundless.

This section explores the multifaceted implications of the proposed policy recommendations on linking and unifying an intelligent patient file system within the UAE health sector by improving efficiency, accuracy, and patient outcomes.

Enhanced data accessibility: Healthcare providers have real-time access to comprehensive patient records via a unified electronic medical record system across their facilities. Availability of critical patient information when needed, regardless of facility or location. This ensures improved continuity of care and reduces duplication of tests and procedures.

Improving patient care and safety: To enhance patient safety and thanks to the unified system, medical professionals can quickly learn complete and accurate patient histories, leading to informed clinical decisions, more accurate treatment plans and reducing the risk of medical errors and adverse events.

Increased efficiency and cost savings: The healthcare system streamlines administrative processes by standardizing electronic medical records, reducing time and resources spent on paperwork and records management. This results in cost savings for healthcare providers and more time for direct patient care.

Enhance data security and privacy: A unified electronic medical records system can include strong security measures to protect patient data from unauthorized access and breaches and consistently apply best practices across all healthcare facilities by standardizing security protocols.

Facilitated research and public health initiatives: Researchers can access large, standardized data sets to identify health trends, evaluate treatments, and improve health care policies while providing a standardized electronic medical record system that is a rich source of data for use for medical research and public health monitoring. This supports the advancement of medical knowledge and public health and healthcare strategies and policies in the country.

Improving patient engagement: A unified electronic medical record system allows patients to access their health records more efficiently, empowering them to take an active role in health care. This transparency can improve patient satisfaction and adherence to treatment plans.

Regulatory compliance and reporting: A unified electronic medical records system can simplify regulatory compliance and reporting to ensure that healthcare providers meet national and international standards, improving the quality of healthcare and increasing confidence in the healthcare system.

5.5: Areas for future research

- Given the rapid evolution of technology and its integration into healthcare systems, future research could focus on conducting longitudinal studies to assess the long-term impact of integrated technologies on patient outcomes in the UAE private and public healthcare sectors. By tracking changes over time, researchers can gain insights into the sustainability and effectiveness of technological interventions in improving healthcare delivery and patient care.
- Another avenue for future research is conducting comparative analyses between the UAE's private and public healthcare sectors to understand how integrated technologies impact patient outcomes differently in these settings. By examining factors such as resource allocation, infrastructure, and patient demographics, researchers can identify best practices and areas for improvement in each sector, ultimately leading to more tailored and effective interventions.
- While existing studies provide valuable insights into the benefits and challenges of integrated technologies from a healthcare provider perspective, future research could delve deeper into understanding patients' experiences and perceptions. Qualitative studies, such as focus group discussions or in-depth interviews, can elucidate patients' attitudes toward technology integration, their preferences for digital health solutions, and any barriers they encounter in accessing and utilizing these technologies.
- As the healthcare landscape continues to evolve, there is a need for ongoing policy analysis and development to support the effective integration of technologies into healthcare

systems. Future research could evaluate existing policies and regulations governing health technology adoption in the UAE, identify gaps or areas for improvement, and propose evidence-based policy recommendations to promote innovation, ensure patient safety, and optimize healthcare delivery.

- With advancements in artificial intelligence, telemedicine, and wearable devices, future research could explore the potential impact of these emerging technologies on patient outcomes in the UAE healthcare context. By staying abreast of technological developments and conducting rigorous evaluations, researchers can anticipate future trends and inform strategic decision-making to maximize the benefits of these innovations for patients and healthcare providers alike.

5.6: Conclusion

In conclusion, this research has delved into the intricate relationship between integrated technologies and patient outcomes in the healthcare sectors of the United Arab Emirates (UAE). The central question driving this investigation—"How can the use of integrated technologies enhance patient outcomes in the UAE private and public healthcare sectors?"—has guided our exploration into the adoption and impact of smart technologies, particularly electronic patient records, within government and private healthcare settings.

The UAE stands at a crossroads of tradition and innovation, and its healthcare system mirrors this dynamic blend by combining state-of-the-art infrastructure with cultural sensitivity. Over recent years, the nation has embarked on a robust journey toward leveraging a wide array of technological advancements, including healthcare, to enhance healthcare delivery and

outcomes. Both private and government healthcare sectors play pivotal roles in catering to the diverse healthcare needs of the UAE populace, with private facilities offering luxury amenities and personalized services while public services ensure affordability and accessibility for a broader demographic.

This research methodology primarily involved gathering data from governmental reports, research institutions, healthcare organizations, and previous research to comprehensively understand technology integration in UAE healthcare. This research uncovered insights into the benefits, challenges, and barriers associated with electronic health records (EHRs) and other smart technologies by analyzing studies, reports, and policy documents.

Subsequently, this research addressed three key sub-questions:

1. How patient outcomes are impacted by patient database technologies globally.

2. How doctors implement advanced patient database technologies in treating patients.

3. How patients perceive common patient systems.

This extensive analysis explored the impact of Electronic Medical Records (EMR/EHR) on healthcare processes. Initial expectations regarding EMR/EHR implementation were generally positive, with perceived benefits including improved productivity and quality of care. However, post-implementation surveys revealed mixed results, with some clinics reporting declines in perceived timesaving and productivity due to increased documentation time. Over time, primary-care clinicians showed evolving perceptions, with growing numbers perceiving improved quality

of care and medication-related errors. Retrospective analyses indicated reduced office visits following EMR implementation.

At the same time, provider satisfaction surveys highlighted benefits such as improved access to records and challenges, including increased administrative tasks and system inefficiencies. Interviews across different settings identified advantages such as enhanced record access and improved communication and barriers such as technical difficulties and lost productivity. Concerns included privacy issues, data entry time, hardware problems, and decreased patient-physician interaction. Despite challenges, there was a consensus that EMR/EHR systems were worth the effort, with the potential to improve care quality, particularly in rural and underserved areas.

The study findings highlighted the significant role of technology, particularly blockchain, in improving patient outcomes by facilitating secure data exchange, enhancing diagnostic precision, and fostering industry expansion. Furthermore, we underscored the importance of healthcare professionals in effectively utilizing these technologies to optimize patient care.

Building upon these findings, this research proposed policy recommendations to strengthen the UAE healthcare system's technological infrastructure. These recommendations encompass short-term initiatives, such as mandatory training programs for healthcare professionals, and long-term strategies, including establishing a dedicated research and development fund to foster innovation and collaboration.

Central to the study discussion is the impact of a unified system on healthcare—an impact that transcends mere convenience to usher in a new era of patient-centric, collaborative, and data-driven care. A unified system consolidates fragmented information, fosters collaboration among healthcare professionals, and enhances efficiency within the healthcare ecosystem. Moreover, it holds the potential to drive future advancements in medical science and improve patient outcomes.

This research identifies several areas for future research, including longitudinal studies to assess the long-term impact of integrated technologies, comparative analyses between private and public healthcare sectors, and investigations into patients' experiences and perceptions of technology integration. We can optimize healthcare delivery and enhance patient outcomes in the UAE and beyond by continuing to explore these avenues.

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APPENDIX

SR#	Author(s)	Date	Title	Relevant to Research
1	Makhene	2024	What is data accessibility in healthcare?	Data accessibility and healthcare quality
2	Janett and Yeracaris	2020	Electronic Medical Records in the American Health System: challenges and lessons learned	EMR implementation challenges and outcomes (America)
3	Alami et al.	2021	A "Not So Quiet" revolution: systemic benefits and challenges of Telehealth in the context of COVID-19 in Quebec (Canada)	Telehealth impact on healthcare (Canada) during COVID-19
4	Dumbach et al.,	2021	The Adoption Of Artificial Intelligence In SMEs-A Cross-National Comparison In German And Chinese Healthcare	AI adoption in the healthcare of Germany and China
5	Alzghaibi and Hutchings	2022	Exploring facilitators of the implementation of electronic health records in Saudi Arabia	EHR adoption and impact in Saudi Arabia
6	Almutairi, Almutairi, and Alazemi	2022	The use of mobile application (Shlonik) to control the spread of the COVID-19 pandemic in Kuwait	Technology adoption during the COVID-19 pandemic in Kuwait
7	Waqas et al.,	2021	Telemedicine in Arab countries: innovation, research trends, and way forward	Telehealth implementation in Arab countries
8	Khan	2020	Mobile Health Technology to Enhance Healthcare Service Delivery in Developing Nations (Saudi Arabia).	Mobile health applications in Developing Nations (Saudi Arabia)