



# Digitalisation in Healthcare: A Review of Present Developments in Malaysia

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**Abstract.** The demand for more healthcare services is increasing due to various challenges faced by healthcare systems, including demographics and multi-morbidities. The current solutions to these problems involve leveraging technologies resourcefully, aligning them with integrated work processes, and employing skilled professionals towards digitalisation of healthcare. An extensive review of literature was undertaken to gain a thorough understanding of the present status of digital transformation in Malaysia's healthcare industry, with an emphasis on the potential future advancements in this area. The paper begins by defining digitalisation in healthcare and discussing its significance. It then explores into key concepts such as Electronic Health Records (EHRs), telemedicine, healthcare analytics, and patient engagement through health apps, with a specific focus on their application and challenges in the Malaysian context. The paper identifies several digitalisation gaps in Malaysia, including issues related to infrastructure and connectivity, data security and privacy, digital literacy, and interoperability. It also evaluates government initiatives and policies aimed at promoting healthcare digitalisation in Malaysia.

**Keywords:** Healthcare, Digitalisation, Telemedicine, Data security, Digital literacy

## 1 Introduction

### 1.1 A Subsection Sample

Healthcare systems worldwide are grappling with an increasing demand for services due to demographic shifts and the rise of multi-morbidities. In order to tackle these issues, there is a growing trend towards the digitalisation of healthcare, which involves the strategic use of technology, integration of work processes, and the employment of skilled professionals.

Digitalisation is significantly altering healthcare globally. Tools such as Electronic Health Records (EHRs), telemedicine, and health apps are enhancing patient care and resource management [1, 2]. This shift reflects technology's potential to reshape industries. Artificial Intelligence (AI) and big data analytics are the driving forces behind

this change, leading to the development of innovative digital health tools like telemedicine that improve health outcomes [3-6]. It's impressive how these sophisticated technologies are being utilised to increase the accessibility and efficiency of healthcare. However, data security and privacy are major concerns. As digitalisation in healthcare advances, robust security measures are needed to protect sensitive patient data.

Malaysia has made progress in healthcare digitalisation, but lags in telemedicine compared to countries like the U.S., India, and China [7]. Efforts are underway to improve this. Some interoperability has been achieved, allowing patients access to their records. However, greater integration is needed, including encouraging Health Information Systems (HIS) vendors to open their systems for data analysis [8-10]. There is also a need to accelerate the adoption of digital health cards to enhance healthcare accessibility amongst underserved communities [11, 12].

This paper provides an in-depth review of the current state of digitalisation in the Malaysian healthcare sector and discusses its future prospects. It aims to contribute to the ongoing discourse on healthcare digitalisation by shedding light on the Malaysian experience.

## **2 Digitalisation in Healthcare: Key Concepts**

### **2.1 Electronic Health Records (EHRs)**

Electronic Health Records (EHRs) are the patient paper charts in digital form, which includes patient's medical history, diagnoses, treatment strategies, medications, radiology images, and laboratory test results. This comprehensive digital database captures a patient's health information in a format that can be processed by a computer. These records, which are patient-focused and updated in real-time, provide immediate and secure access to only authorized individuals. The data is useful for medical professionals as it can reflect individual past and present health information [13]. EHRs have emerged as a significant tool in the healthcare sector with the primary objective of enhancing collaboration among healthcare professionals [14].

EHRs aim to improve collaboration among healthcare professionals. They can both aid and limit collaborative practices. EHRs enable health professionals to coordinate patient care anytime, anywhere, but only allow asynchronous patient record use. They provide a comprehensive patient file for joint clinical decision-making, but specialty-specific user-interfaces can limit understanding of the data [14].

EHRs are a "meaningful use" tool that can enhance healthcare quality, efficiency, and reduce health disparities [15]. However, they can also present challenges such as lack of interoperability, functionality [16], and can lead to medical errors [17]. Despite these issues, a review found more benefits than barriers to using EHRs in public health, indicating their usability and acceptance [15].

### **Advantages and challenges of EHR Adoption in Malaysia.**

In Malaysia, the Ministry of Health has implemented an EHR system for coordinated care [10]. These systems offer benefits like cost reduction, improved patient care, data confidentiality, and centralised patient data management. The study found that

knowledge quality was a key factor in predicting performance. EHR systems facilitated clinical procedures and workflows, thereby enhancing the quality of the system and the performance of its users [10].

Despite these advantages, there are challenges in implementing EHR systems in Malaysia. These include prolonged training procedures for learning HIS handling, workflow disruptions with changing and complicated processes, network connectivity issue, low interest among physicians and nurses in using HIS due to poor IT skills, inadequate infrastructure, lack of management commitment, standards, interoperability, support, experience and poor EHR systems [18].

## 2.2 Telemedicine and Remote Monitoring

The fast adoption of digital technology in healthcare has brought about a new way of practicing medicine and caring for patients. The last five years have seen a swift transformation in telemedicine, supported by the advancements in wireless broadband technology and the enhanced features of smartphones. Telemedicine and remote monitoring tools have become important in this change, allowing healthcare to be provided without geographic limitations. Telemedicine, which refers to the use of telecommunications technology for medical consultations and healthcare delivery, has undergone significant evolution. It has emerged as a crucial method for extending healthcare services to remote or underserved areas.

Remote patient monitoring (RPM) is experiencing substantial growth within healthcare, aimed at providing additional support to healthcare professionals across various hospital departments, such as general medical and surgical wards. This is made possible through the integration of innovative Internet of Things (IoT) techniques in through applications in telehealth [20], sensors integrated into wearable devices [21-23], and sensors placed on the patient's body [24]. This approach enables healthcare professionals to monitor vital signs and physiological parameters, including motion detection, which can then aid the healthcare professionals in making clinical assessments and devising treatment strategies for conditions such as psychological or movement disorders [25]. The advantages are numerous, including enhanced accessibility to specialised care, reduced healthcare cost, and improved patient prognosis. Another significant advantage of remote monitoring systems is their ability to minimise face-to-face interactions. This feature has proven to be crucial in providing a safety shield for healthcare workers in the midst of the COVID-19 crisis. During the COVID-19 crisis, Malaysia implemented a system for remote monitoring and management of confirmed COVID-19 cases. This was primarily through My Sejahtera apps by Ministry of Health, Malaysia. The system was designed to monitor individuals with asymptomatic Category 1 or mildly symptomatic Category 2 COVID-19 cases within primary care settings. This approach helped the state health departments in managing the surge of COVID-19 cases, who either need hospital admission or being placed in low-risk quarantine and COVID-19 treatment centres [26].

The propensity to utilise telemedicine services for mental health care has seen a significant rise, particularly among younger individuals, those with a higher level of education, and those already dealing with mental health issues. Despite this, there are still

hurdles to overcome. Privacy concerns, the absence of face-to-face direct contact with healthcare professionals, and challenges in terms of technical have been cited as deterrents to the use of tele-medicine. These findings underscore the potential of telemedicine in the realm of mental health care in Malaysia and highlight the ongoing need to address and eliminate these barriers [27]. According to World Health Organization, not all patients may have the necessary digital literacy or access to use telemedicine services effectively. Factors such as disability, language, location, or internet connection can impact access to remote services [28].

### 2.3 Healthcare Analytics and Big Data

#### **Role of data analytics in healthcare.**

Big data and big data analytics are two other terms that are used interchangeably with data analytics. This term is broadly used in the concepts of statistical analyses, machine learning, data mining and artificial intelligence. In the healthcare industry, data analytics or big data refers to the science of integrating various types of data from diverse sources, making interpretation and predictions from the data captured. These interpretation and predictions would enable innovation and strategic decision-making in healthcare [29].

There are four types of data analytics namely descriptive, prescriptive, predictive, and discovery analytics. Each of the types of data analytics has its own function. Firstly, descriptive analytics is a branch of data analytics that uses historical big data or records to summarise and interpret these data. The purpose is to gain insights, observe and understand patterns, trends and the correlation within the datasets [30]. Secondly, prescriptive analytics uses simulation or machine learning for the purpose of outlining strategies to treat patients by providing suggestions that improve the decision-making process. Though the prescriptive analytics has a high impact, it must also be recognised that it is the least used due to the need of advanced analytical maturity [31]. Thirdly, predictive analytics is used for forecasting future events via data mining techniques, forecasting and modelling [29]. It predicts the value of a single attribute which is reliant on other attributes through data mining and extraction [32]. Data mining is done to extract some hidden information from large databases [33]. Lastly, discovery analytics uses machine learning to examine clinical data in order to obtain trends and patterns using advanced analytics which will provide some actionable insights. Data analytics in healthcare enable the discovery of new insights in the large data available to automate diagnosing, disease profiling and clinical decision-making in healthcare [29].

The role of data analytics is mainly to manage data sets related to healthcare by promoting preventive care by identifying unknown or unnoticed risk factors which can be utilised to improve overall patient care, manage the health of the population and global health crises through AI models interventions [34]. Big data analytics is utilised to examine patient traits, calculate the cost of treatment, and identify the most affordable treatment options. Besides that, they are also important in the improvement of delivery of care, formulation of health policies and the ability to provide comprehensive measuring and evaluation of complicated healthcare data [35].

The types of data that can be analysed in healthcare include the biomedical data such as imagery and laboratory tests, as well as data obtained from healthcare systems such as doctor's notes, clinical data and laboratory results. These data are unstructured and require digitisation which can be classified into EHR, sensor data, health information exchanges (HIE), registries, portals, databases and public records [35]. The diverse forms of big data are a challenge to develop methods for processing all the dissimilar data. As stated earlier, predictive analytics uses data mining and machine learning to examine current and historical facts to predict the future. For example, the history on duration of hospital stay for patients can provide insights to determine whether readmission is needed for these patients and enables doctors to make important patient care decisions. These data are scanned to identify patterns and is used to improve the program's understanding and thus provide altered program function accordingly [35].

There are four attributes of big data namely volume, velocity, variety and veracity. Volume refers to the large volume of healthcare data collected while velocity refers to the speed of processing the structured as well as unstructured data collected. The attribute, variety refers to the various types of data and sources of data collected from the healthcare setting while veracity assures that the data is consistent and reliable. Development and application of algorithms are used to analyse various data sets to extract information such as knowledge, pattern and information [35]. Data mining is a technique to unveil useful insights and hidden patterns from data by collecting, cleaning, processing, and analysing data sets. Basically, data mining extracts hidden and valuable information from large data to provide a new useful information. Clustering these data into groups with similarities enables to better view and analyse the data [32].

A four-layer architecture consisting of the transformation layer, data-source layer, big data platform layer and analytical layer is used in the big data. There are several models that can be used to process each layer. One of them are the MapReduce model which is used to process data functionality for each layer. Big data analytics processes data at high speed and efficiently update and transform queries. At the same time, it also manages the storage space appropriately. Concept of parallelism is applied to process the data specifically by clustering and scanning of multiple nodes of cluster in the network. Big data can also integrate accessed databases using various applications [35].

### **Potential applications and benefits in the Malaysian context.**

The potential applications of big data analytics are the Hadoop based applications. In the treatment of cancer and genomics, the MapReduce technology simplifies the mapping of three billion DNA base pairs. The mapping allows recommending specific treatment for specific cancer types. This improves the chances of cancer patient's survival due to better treatment options. Hadoop-based components including the Impala, HBase, Hive, Spark and Flume frameworks are used to monitor patient vital signs in the hospital. The unstructured data such as blood pressure levels, respiratory rate and heart beats per minute are generated and analysed. NoSQL database is a Hadoop's ecosystem which is used to collect and manage real-time data for identifying high-risk patients and reducing day-to-day expenditures. Hadoop's system such as Pig, Hive and MapReduce technologies process large datasets from medicines, diseases, symptoms, geographical location and others to extract information. NoSQL aids in the prevention

and detection of fraud by using real-time Hadoop health applications, authentic medical claim bills and other data sources [35].

Benefits to the healthcare system include clinical operations to effectively determine more clinically relevant and cost-effective ways to diagnose and treat patients. The real-time data analytics allows the remote monitoring of patients without having to consult the doctor in person or visiting the hospital frequently. Secondly, in the research and development areas, big data can help to lower attrition and produce a leaner, faster and more targeted research and development pipelines in drugs and devices. Besides that, statistical tools and algorithms could be used to improve clinical trial design and recruit more suitable patients who match according to individual patients [36]. Analysing clinical trials and patient records to identify any indications and adverse effects before the products reach the market. From the public health sector, disease patterns can be analysed, and disease outbreaks or transmission can be detected for better disease surveillance and response [35]. In the context of pandemic outbreaks, the medical Internet of Things (IOT) devices aid in improving productivity, accuracy and reliability. Similarly, the prediction of hot spot areas for Covid-19 cases was also predicted using real-time data to track the ongoing and newly emerging cases. From the public health perspective, it allows online guidance, vaccinations, and provides evidence-based medicine. It also helps in the prediction of high-risk patients for certain diseases. In complex and critical cases, detection and diagnosis of diseases can be done much earlier where the possibility of providing the most suitable medication based on reducing the adverse effects and also on the patient's genetics make up. The real-time data analytics also benefits in decision-making in clinical laboratories. The emergence of E-health using big data analytics for the purpose of consultation to overcome the shortage of doctors. Medical professionals are able to make better informed decisions due to the transparency obtained in providing better treatments to patients. Data analytics also helps in increasing the lifespan and reliability of the equipment used in healthcare by connecting critical assets for tracking and repair works. In addition, data analytics also helps the administration of the healthcare sector by decreasing the cost of medical assessment, identify the high-risk patients and make conclusions about patient health and treatment [37].

## **2.4 Patient Engagement and Health Apps**

Patient engagement is frequently described as an individual's proactive decision to be actively involved in their healthcare, in a way that is tailored to their specific needs, and in cooperation with a healthcare provider or institution, all with the goal of improving healthcare outcomes and the patient's overall care experience [38]. It is also seen as a collaborative effort involving patients, members of the family, and healthcare professionals at different tiers within the healthcare system, with a common objective aimed at enhancing healthcare quality [39]. Patient engagement in telemedicine is of utmost importance for a variety of reasons. Telehealth makes healthcare more convenient, accessible, and safe. It enables patients to manage their health online, thus increasing accessibility regardless of where the patient may be [40]. Telehealth empowers patients to be more engaged with their care, keep track of their medical records, and promote the decision-making processes for their treatment outcomes and overall wellness.

Through the implementation of telemedicine and enabling patients to consult with physicians beyond just emergencies, it empowers patients to assume control over all facets of their health [41]. Additionally, telehealth removes barriers to care between physicians and patients. It introduces a revolutionized way of how patients obtain medical treatment without the need to leave their homes. and with a virtual presence of a physician. However, it is crucial for both healthcare providers and patients to have a good understanding of the equipment and technology utilized in telehealth [40]. In summary, patient engagement in telemedicine is vital as it enhances accessibility, improves communication, empowers patients, overcomes barriers, and requires technical familiarity.

There are several health apps such as Doc2Us, BookDoc, Doctor2U, TeleMe, DoctorOnCall, MySejahtera etc, that are widely used in Malaysia, each serving a unique purpose. Doc2Us is a mobile application based in Malaysia that enables users to engage with healthcare professionals through text, audio, and image messaging, offering convenient access to healthcare expertise regardless of location and time. BookDoc is accessible in multiple regions including Malaysia, Singapore, Indonesia, Hong Kong, and Thailand. In addition to connecting users with healthcare professionals, it promotes an active lifestyle through BookDoc Activ, allowing users to earn rewards and discounts from various retail partners and service providers for staying physically active. The Doctor2U app permits users to consult with doctors online through live chat or video consultations or request a doctor for a home visit. Users can also arrange for ambulance services or medicine delivery. TeleMe serves as a platform connecting patients with healthcare practitioners, pharmacists, and health labs online, offering services like online consultations, e-prescriptions, medication delivery or collection, health screenings, a reminder system, and a personal health record. DoctorOnCall facilitates user connections with healthcare practitioners via voice or video calls, providing answers and treatment options. On the other hand, MySejahtera is an application developed by the Malaysian government to aid in the management of COVID-19 outbreaks in Malaysia. It provides features such as health self-assessment, hotspot tracker, and vaccination appointment [42, 43].

### **3 Digitalisation Gaps in Malaysia**

In the healthcare sector in Malaysia, several digitalisation gaps exist, which refer to disparities in the adoption and utilisation of digital technologies and solutions within the healthcare system. These gaps have been identified in various sources and include health information systems, telemedicine and remote healthcare, digital health literacy and data security and privacy.

#### **3.1 Health Information Systems**

Malaysia's objective to progress in the healthcare industry to provide safety, cost-effectiveness, better quality, and access of information technology and management systems. By 2025, the country's digital health strategy focuses on developing a technology for healthcare-related products [44]. The implementation HIS has been slow, leading to several challenges and opportunities. One of the main challenges in executing the

Electronic Medical Records (EMRs) in Malaysia is the lack of standardisation of data across healthcare (Suhaimi, 2023a). Standardising data formats, coding systems, and interoperability frameworks is crucial for seamless data exchange among different HIS and EMR systems. The application of HIS in our country is founded on different systems, including the Malaysian Health Data Dictionary (MyHDD), Malaysian Health Reference Data Model (MyHRDM), and International Classification of Diseases (ICD). However, the lack of standardisation can hinder the seamless exchange of information between different healthcare providers and systems, leading to inefficiencies and potential errors in patient care. Addressing this challenge requires a concerted effort to develop and implement standardised data formats and coding systems across the healthcare sector in Malaysia. This can improve the interoperability of HIS and EMR systems, leading to better coordination of care and improved health outcomes for patient [45]. Therefore, the complexity of integrating various healthcare systems and processes poses a challenge to the effective implementation of HIS in Malaysian public hospitals. This includes integrating EMRs with other systems such as laboratory information systems and radiology information systems [46]. The adoption of HIS in Malaysian healthcare settings faces resistance from healthcare professionals who are accustomed to traditional paper-based systems [47]. Integrating different healthcare systems and processes requires technical expertise and resources, which can pose challenges for healthcare providers in Malaysia. This includes issues related to data standardisation, interoperability, and data exchange protocols [48]. Healthcare professionals in Malaysia may resist the adoption of new systems and processes, including the integration of EMRs with other systems. This resistance can hinder the successful implementation and utilisation of digital health technologies [49].

### **3.2 Telemedicine and Remote Healthcare**

The COVID-19 pandemic has embarked transformation of digitalisation in the Malaysian healthcare systems [50]. Telehealth, drug adherence, remote patient monitoring, and smart access are among the core virtual health scenarios being developed in the country [51]. Medical practitioners in Malaysia have expressed concerns about the current environment lacking adequate infra-structure for telemedicine [52]. This includes issues with internet connectivity, which can affect the quality and reliability of teleconsultations and remote healthcare services. There was survey conducted with 395 doctors in Malaysia revealed that 96% of them raised their concern on patients on their language, disability, digital literacy, location, or internet connection [53]. This gap may affect the relationship between doctor and patients with untreated conditions. Healthcare providers have highlighted concerns about the potential for medicolegal disputes and investigations arising from issues related to telemedicine, such as security and confidentiality. Ensuring the privacy and protection of patient data is vital for the effective operation of telemedicine in Malaysia [53]. The Telemedicine Act 1997, which governs telemedicine practices in Malaysia, has been identified as a possible barrier to the effective implementation of telehealth services. The act was primarily designed for provider-to-provider consultations and may need to be revised to



accommodate the growing demand for patient-to-provider teleconsultations and remote healthcare services [51].

### **3.3 Digital Health Literacy (DHL)**

There is a need to ensure that healthcare providers and patients are equipped with the necessary digital health literacy skills to fully benefit from these technologies [54]. Previous studies have proven that there is limited health literacy in Malaysia, which can impact the effective utilization of digital health information and resources [55]. Addressing this challenge requires targeted interventions to improve health literacy levels among the population. Many peoples not technology and electronic gadgets savvy as they are de-pending on others to know about their health issues [56]. Lower-income groups may face additional barriers in accessing and understanding digital health information, highlighting the need for tailored approaches to improve DHL in these populations [55]. The digital divide, including disparities in internet access and digital skills, can pose challenges to the effective implementation of DHL in Malaysia. Ensuring equitable access to digital resources and promoting digital literacy can help bridge this divide and improve DHL among the population [56]. Malaysia is a multicultural and multilingual country, and language and cultural barriers can affect the effective utilization of digital health information and resources. Providing information in multiple languages and considering cultural sensitivities can help improve DHL among diverse populations in the country [56].

### **3.4 Data Security and Privacy**

The digital technologies in healthcare are increasing. Thus, to safeguard the security and privacy of patient data is vital. Malaysia has its digital health strategy which focus on developing the pathway to secure and accountable on the usage of healthcare data [44]. Health-care professionals in Malaysia have expressed difficulties in trusting EMR systems, which can impact their acceptance and usage [57]. Building trust in the security and privacy of digital health systems is crucial for their successful implementation. The Malaysian Personal Data Protection Act (PDPA) has faced challenges in applying AI in healthcare due to the data processing mechanisms of AI. Ensuring that the regulatory framework keeps pace with technological advancements is essential for protecting patient data [58]. For now, there is lacking in providing privacy protection on the health date by public and private healthcare in Malaysia. Addressing this challenge requires clear guidelines on data ownership and privacy rights to protect patient information [59]. The implementation of HIS and EMR systems requires the management and protection of sensitive patient data. Ensuring that appropriate security measures are in place to safeguard patient information is crucial for maintaining data privacy [60].

## **4 Government Initiatives and Policies**

The Malaysian government has been advancing digitalisation in the healthcare sector. Cisco and MyDIGITAL Corporation, a company under Ministry of Economy, hosted

the MyDIGITAL Healthcare Sectoral Workshop in October 2022 to discuss how digital transformation and innovation can transform and modernise Malaysia's healthcare system. Virtual healthcare was the main topic of the workshop, which aimed to enhance the patient's experience by making patient communication, scheduling, consultation, and follow-up appointments more efficient. Virtual healthcare has five potential use cases, namely remote patient monitoring (RPM), patient-centred emergency medical response, virtual palliative care, improved interoperability of electronic medical records (EMR), and virtual clinics based in hospitals [61].

The adoption of technology not only allows for a more efficient system but also makes healthcare much more accessible to those who are less mobile or unable to physically attend a consultation. The Health White Paper by the Ministry of Health (MoH) emphasises the importance of digital health tech for data-driven public health practices [62].

In addition, the Malaysian government has established Digital Nasional Berhad (DNB) to manage the development of MyDIGITAL. DNB's role in Malaysian healthcare digitalisation is to provide faster, more reliable and more secure connectivity for various healthcare applications, such as Telehealth services, remote monitoring, telemedicine, digital health records, and health data analytics. DNB also aims to support the transformation of Malaysia as leader in digital economy and foster a more inclusive society [63].

The National Fourth Industrial Revolution (4IR) Policy that started in 2021 is another initiative that aims to drive digital transformation across various sectors in Malaysia. Based on the report by Economic Planning Unit, Prime Minister's Department, National 4IR Policy is a broad national policy that aims to achieve consistency in advancing the country's socioeconomic development through the responsible use of 4IR technologies. The National 4IR Policy mainly focuses on empowering the people with 4IR knowledge and skill sets, creating a connected nation through digital infrastructure development, adapting regulations to be flexible with technological changes and accelerating 4IR technology innovation and adoption. [64].

#### **4.1 Assessment of The Effectiveness of Existing Policies and Initiatives**

MoH has proposed six new initiatives for inclusion in Budget 2023, aimed at improving the healthcare system. These initiatives include strengthening the Healthcare and Wellness programme, improving and repairing health facilities, enhancing the effectiveness of healthcare treatments, replacing outdated and critical medical equipment, digitalising healthcare services, and providing incentives to medical personnel [65]. However, despite these initiatives, there is currently no explicit national policy for quality improvement and patient safety across the health system. Instead, there are several disjointed legal measures and national plans leading to fragmentation. For instance, the 12th Malaysia Plan outlines strategies under Priority Area B (Enhancing Healthcare Service Delivery), but key areas are either lacking in substance or missing altogether from the national strategic plan. This could signal a lack of recognition, support, and commitment on the part of the Government to address these issues. Therefore, there is a need

for a comprehensive and cohesive national policy that addresses all aspects of quality improvement and patient safety in the healthcare system.

#### **4.2 Recommendations for Policy Improvements**

To improve access to healthcare in Malaysia, it is recommended that the government continuously spend a minimum of 6% of the GDP on healthcare as recommended by the World Health Organisation (WHO). Currently, Malaysia is spending around 2.58% of its GDP on healthcare. This is below the WHO's recommended level, which could impact the quality and accessibility of healthcare services in the country [66].

Moreover, it is suggested that wider implementation and streamlining of the application of the case-mix system for public hospitals in highly urbanised areas could help manage future costs [67]. The case-mix system, specifically the Diagnosis-Related Group (DRG)-based payment scheme, has been implemented in Malaysia since 2010. This system measures costs of health service provision and is crucial in planning and hospital budgeting. However, many health professionals were unaware of its importance, and there were issues with inaccurate clinical documentation and coding error in the Malaysian DRG casemix system [68].

Therefore, to fully benefit from the case-mix system, the quality and accuracy of its data must first be established. This could involve training for health professionals on the importance of accurate clinical documentation and coding, as well as regular audits to ensure data accuracy. Additionally, wider implementation of this system could help manage healthcare costs, particularly in highly urbanised areas where healthcare demand is high. In conclusion, increasing healthcare spending to meet WHO's recommended level and improving the implementation of the case-mix system could help improve access to healthcare in Malaysia. However, these recommendations should be considered alongside other factors such as population health needs, healthcare infrastructure, and workforce capacity.

## **5 Future Prospects**

The Malaysian government's initiatives and policies towards digitalisation in the healthcare sector are expected to improve accessibility, efficiency, and quality of healthcare services in Malaysia. The future of country's healthcare system is promising with the government's active promotion of digitalisation in the healthcare sector. The Health White Paper prepared by the Ministry of Health emphasizes the importance of digital health tech for data-driven public health practices [62].

According to a report by PwC Malaysia, the COVID-19 pandemic has high-lighted untapped opportunities that can be harnessed to enhance the delivery of healthcare in a digital economy. The report shares views on the future of Malaysia's virtual healthcare landscape from HealthTech players with operations in Malaysia and insights from their 'Future of Digital Healthcare' survey [68]. The Malaysian government has established Digital Nasional Berhad (DNB) to oversee the unfoldment of Malaysia Digital Economy Blueprint (MyDIGITAL). The National 4IR Policy is another initiative that aims

to drive digital transformation across various sectors in Malaysia, including healthcare [64].

## 6 Conclusion

The digitalisation of the healthcare sector in Malaysia holds great promise. EHRs and telemedicine offer advantages such as improved patient care and accessibility, although challenges persist. Healthcare analytics and big data enhance data-driven decision-making and patient care. Health apps empower individuals to manage their health. Despite these advances, digitalisation gaps exist, and the government is taking proactive steps to address these challenges. The future of Malaysia's healthcare sector is promising, with a focus on digital health technology and data-driven public health practices. As Malaysia continues to embrace digitalization, its healthcare system is poised for transformation and improvement.

Researchers have a pivotal role to play in advancing the digitalization of the healthcare system in Malaysia. To address existing challenges and gaps, re-search efforts should focus on enhancing data security and privacy, improving interoperability and standardisation, bridging the digital health literacy gap, optimising telemedicine infrastructure, and evaluating the effectiveness of healthcare apps. Additionally, researchers can contribute to policy development, prioritize patient-centred research, and engage in international collaborations to bring global best practices to the Malaysian context. Their work can provide valuable, evidence-based insights and recommendations, ultimately guiding the nation toward a more accessible, efficient, and patient-centric digital healthcare ecosystem.

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