Advanced Patient Care System Model for Enhanced Remote & On-Site Healthcare Delivery in Government Hospitals of Sri Lanka: A Systematic Literature Review

D. Z. S. S. Gunarathne, R. K. A. R. Kariapper, M. S. S. Razeeth, M. A. M. Rizan and S. N. Ali

Abstract Patient care involves a range of services provided by healthcare professionals to ensure the well-being of individuals. This includes preventive care, diagnosis, treatment, and management of illnesses, as well as support for physical and mental health. Effective patient care requires a holistic approach, integrating advanced technologies and personalized treatment plans to meet the unique needs of each patient. This study explores the development and implementation of an Advanced Patient Care System Model aimed at enhancing both remote and on-site healthcare delivery in government hospitals across Sri Lanka. The study also synthesizes existing research on healthcare technologies, patient management systems, and telemedicine to identify key components and best practices. Findings highlight the potential for improved patient outcomes, increased efficiency, and reduced healthcare costs through the integration of advanced technologies. The review also addresses challenges such as infrastructure limitations, data security, and the need for healthcare professional training. Recommendations for future research and policy implications are discussed to support the adoption of this model in Sri Lanka's healthcare system.

***Index Terms*— Advanced Patient Care System, Healthcare Management, Real Time Update, User Interface Design, User Experience Processing.**

I. Introduction

In recent years, the healthcare sector has experienced substantial breakthroughs, especially in the incorporation of technology to improve patient care. Sri Lanka, with a comprehensive network of government hospitals, is on the brink of a transformative phase in healthcare delivery [1],[2],[3].

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The healthcare system in Sri Lanka, especially inside government hospitals, encounters various obstacles in providing efficient and effective patient care. These issues are intensified by constrained resources, rising patient volumes, and the necessity for both remote and in-person healthcare services. An enhanced approach for patient care is necessary to solve these difficulties.

Sri Lankan government hospitals frequently contend with overpopulation, protracted waiting periods, and insufficient facilities. These concerns impact both patient happiness and the overall efficacy of healthcare services. The COVID-19 pandemic has underscored the essential requirement for effective remote healthcare solutions. The incorporation of modern technologies can significantly address these difficulties by optimizing processes and enhancing patient outcomes.[4], [5] This systematic literature analysis examines the several technology advancements and approaches that can be utilized to enhance patient care in government hospitals in Sri Lanka. The Advanced Patient Care System Model seeks to integrate remote and on-site healthcare services, guaranteeing timely and efficient care for patients irrespective of their location.

This study aims to provide a comprehensive framework that utilizes both remote and on-site healthcare delivery systems, based on an examination of existing models and their outcomes, with the goal of enhancing patient outcomes and optimizing healthcare procedures[6], [7].

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II. Literature Review

Efficient management of patient information is vital for the delivery of effective healthcare services, particularly within the context of government hospitals in Sri Lanka. The current healthcare landscape reveals significant gaps that hinder the quality of patient care, necessitating the development of an Advanced Patient Care System Model.[7], [8] This model is designed to enhance healthcare delivery, both remotely and on-site, by integrating advanced technologies to create a user-friendly frontend interface. This interface will facilitate seamless access to, updating, and management of patient information. The proposed Advanced Patient Care System represents an innovative approach that aims to merge state-of-the-art technology with user experience design. By doing so, it seeks to create a more interconnected healthcare system that addresses the immediate needs of patients, medical professionals, and other stakeholders, including family members and administrative personnel. Special functions for security-related officers are included as a new feature to ensure that sensitive patient information is adequately protected. This comprehensive framework sets the stage for a detailed examination of how the proposed model can significantly improve both remote and on-site healthcare delivery within Sri Lankan government hospitals[9], [10].

Motivation for this research arises from a clear understanding of the pivotal role organized patient information plays in delivering high-quality healthcare services. In the context of Sri Lankan Government Hospitals, a significant gap has been identified that calls for innovative solutions to improve the healthcare delivery process. This realization serves as the driving force behind the determination to develop an Advanced Patient Care System Model that addresses the complexities of accessing, updating, and managing medical information effectively, both in-person and remotely. [11]A key objective of this research is to design a system that provides real-time status updates and facilitates communication between patients and their support networks. By focusing on the latest technological innovations, the proposed model not only aims to fulfill the requirements of patients and healthcare providers but also extends its benefits to families and visitors involved in the healthcare process. This dual focus on functionality and security is crucial in an era where patient data protection is paramount[12], [13].

The existing healthcare systems in Sri Lanka face numerous challenges, including inefficient communication, inadequate patient data access, and outdated documentation practices. These issues lead to delays in treatment, hinder effective decision-making by healthcare providers, and can compromise patient safety. For example, the lack of real-time patient status updates means that healthcare providers may not have timely access to crucial information, resulting in potential medical errors or lapses in care. Furthermore, the reliance on paper-based systems complicates the continuity of care, as important patient history may not be readily available when needed.[14] This research aims to identify and address these pressing challenges by developing a comprehensive digital patient management system that allows for seamless viewing, updating, and sharing of patient details among healthcare providers. The study seeks to explore the technological innovations and features necessary to create a patient-centric healthcare system that not only provides real-time updates but also facilitates efficient communication between patients and their support networks. The model will incorporate special functions tailored to unique patient populations, such as prisoners or individuals under police arrest. The focus on remote patient management options further enhances the flexibility and efficiency of healthcare delivery, ensuring that care can be provided regardless of location[15], [16].

The anticipated outcomes of this research include the development of user interfaces that utilize tools such as Figma, WordPress, and Bootstrap for both desktop and mobile devices. These interfaces will be tailored to meet the specific needs of diverse user groups, ensuring that healthcare providers can access vital information quickly and efficiently. Reports on system usage, popularity, and user-recommended technologies will further contribute to understanding how well the system meets user needs and preferences.[17] The significance of this research lies in its potential to transform the healthcare sector by filling critical gaps in patient care, communication, and management. By creating an integrated healthcare system that provides real-time updates on patient status, this project aims to enhance decision-making, minimize medical errors, and improve overall patient satisfaction. The implementation of an efficient, reliable, and user-friendly system, guided by advanced UI and UX design principles, is expected to elevate healthcare delivery standards in Sri Lankan government hospitals.[18], [19] This research sets forth an ambitious vision for an Advanced Patient Care System Model that addresses existing challenges within the healthcare ecosystem. By fostering collaboration between patients, healthcare providers, and technology, the model aims to create a more efficient, responsive, and patient-centered healthcare environment. As healthcare continues to evolve, the integration of innovative solutions such as this model is essential for ensuring that all patients receive timely, accurate, and comprehensive care.[20]

III. Methodology

A. Systematic Literature Review

The mapping study outlined in this research consists of three main phases: Planning, Conducting, and Reporting. In the Planning phase, engagement with electronic databases such as IEEE Explorer, Springer, and ACM Digital Library was initiated. Research questions were formulated, specific search strings were created to retrieve relevant studies, and the mapping procedure was defined. During the Conducting phase, the established search terms were used in the chosen databases to identify and select pertinent studies. A thorough review of the selected studies was performed to finalize the mapping process. Additionally, a snowballing technique was utilized to find more related studies by examining the references of the initially chosen papers. In the Reporting phase, all essential results were documented, focusing on

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prioritizing the retrieved studies and addressing the research questions established earlier.

The summarized and filtered research papers were arranged in a tabular format, including details such as title, abstract, keywords, research objectives, research questions, methodology, summary of results, threats to validity, and future perspectives. These findings were compiled into three documents: a systematic literature review (SLR), a research overview, and a detailed literature review. The SLR document encompassed all research papers gathered from various databases, while the research overview presented details of the filtered papers. The literature review document offered a comprehensive view of the mapping study.

B. Research Questions

Research questions form the fundamental core of a mapping study. Table I outlines the specific research questions that this study sought to address. By examining these selected research questions, the mapping study can effectively identify research gaps present in the existing literature.

TABLE I.
RESEARCH QUESTIONS

No	Research Question
RQ1	How can a healthcare information system be enhanced to address issues such as real-time patient status display, identification of patient requirements, accurate ward referrals, and patient communication with home and neighbors?
RQ2	How can a healthcare information system be optimized to accommodate the needs of special patients (e.g., prisoners, patients under police arrest), enable remote patient treatment options, provide efficient management of clinic dates, and facilitate instant access to patient details for visiting doctors?

C. Study Selection

Terms and Search strings

For this study, the primary search is conducted using search strings in scientific databases, as well as manual browsing with relevant keywords. The search strings are organized according to the framework of population, intervention, comparison, and outcome to create effective search strategies. The research topics naturally guide this structure, with each component contributing keywords for the search strings.

Sources

This Systematic Literature Review utilized the following electronic databases to gather the most relevant studies:

1) IEEE Xplore (http://ieeexplore.ieee.org)
2) ACM Digital Library (https://dl.acm.org)
3) Science Direct (https://www.sciencedirect.com)
4) Academia (https://www.academia.edu)
5) Springer Link (https://link.springer.com)
6) Academia (https://www.academia.edu)

TABLE II.
SEARCH TERMS OF THE MAPPING STUDY ON IOT BASED ENVIRONMENTAL INTELLIGENCE THROUGH ADVANCED MACHINE LEARNING

Area	Search Terms
Advanced Patient Care Systems	"Advanced Patient Care System models" "Patient care system innovations" "Next-generation patient care technologies"
Special Patients & Functions	"Healthcare systems for special patient groups" "Adaptive functions in patient care" "Healthcare customization for vulnerable populations"
User Interface Design	"User Interface design in healthcare systems" "Healthcare UI development" "Effective UI for patient management systems"
User Experience	"Patient care system user experience" "UX evaluation in healthcare platforms" "Improving patient interaction through UX"

Inclusion and Exclusion Criteria

The selection process for this study was structured around two inclusion criteria and five exclusion criteria. TABLES III and IV illustrate the inclusion and exclusion criteria applied during the filtering process, respectively.

TABLE III.
INCLUSION CRITERIA OF THE SELECTION PROCESS

No	Inclusion criteria (IC)
IC1	Studies that focus on the development and implementation of advanced patient care systems, emphasizing improvements in both remote and on-site healthcare delivery.
IC2	Research that incorporates user interface (UI) and user experience (UX) design for patient care systems, particularly those addressing the needs of special patient populations such as vulnerable or high-risk groups.

TABLE IV
EXCLUSION CRITERIA OF THE SELECTION PROCESS

No	Exclusion criteria (EC)
EC1	The paper does not provide specific information related to patient care systems or healthcare management.
EC2	The study is only focused on theoretical models without any practical implementation in healthcare environments.
EC3	The paper is not written in English or does not provide an English translation.
EC4	The paper is a previous version of the study already selected
EC5	The paper is a duplicate or earlier version of a study already included in the review.

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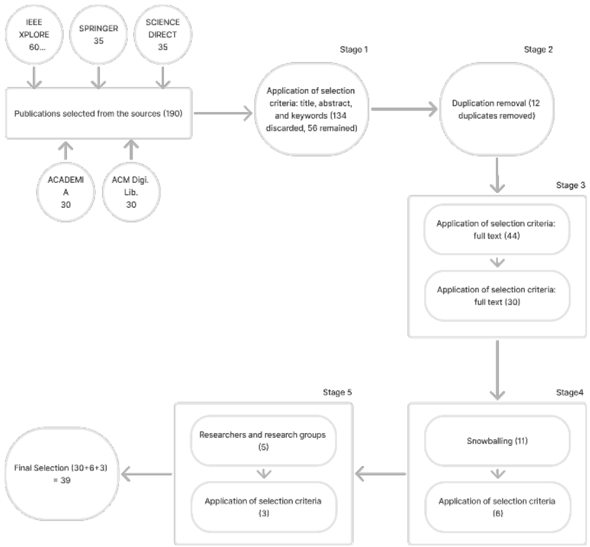

Figure 1: Selection Process Flow

Data Extraction and Synthesis

The study spanned from 2017 to 2023, and initially, 220 publications were collected. These included 60 from IEEE Xplore, 35 from Springer, 35 from ScienceDirect, 30 from Academia, and 30 from ACM Digital Library. A selection process was then applied to discern the most pertinent studies. This process consisted of five distinct stages, depicted in Figure 1. The first stage used the study title, keywords, and abstract as filters to sort the publications. Out of the initial 190, 134 were deemed irrelevant and discarded, leaving 56. This represented a 70.53% reduction. In the second stage, overlapping studies that appeared in multiple databases were identified, and 12 duplicates were removed, which constituted about 21.43% of the filtered set.

The third stage involved a meticulous review of the remaining 44 publications' full texts, assessing their relevance and completeness. This led to 30 publications being excluded based on stringent inclusion and exclusion criteria: & did not meet exclusion criteria (EC4), 4 were non-primary studies like editorials or keynote summaries (EC1), and 7 failed to meet the outlined Inclusion Criteria 1 (IC1) and Inclusion Criteria 3 (IC2). This left 14 studies moving forward. The fourth stage expanded the search beyond the initial databases, examining the references within the 30 surviving publications. This "snowballing" method unearthed 11 more studies, of which 6 met the project's stringent criteria for relevance. The fifth stage sought to identify leading researchers and groups in the field. An in-depth analysis of the contributions from 5 identified groups or individuals led to the inclusion of 4 additional publications, all deemed highly relevant after rigorous evaluation. This brought the total to 39 publications chosen for the final synthesis.

TABLE V.
FEATURE EXTRACTION AND SYSTEM RESULTS ACROSS STUDIES

Paper ID	Title	System Type	Key Features	Results	Limitations
1	Patient-Care Systems	Healthcare Information Systems	Integration of multidisciplinary care, Use of standardized coding, Implementation in various healthcare settings	Improved patient care management, Enhanced data integration and accessibility, Support for clinical decisions	Complexity in system implementation, Dependency on interdisciplinary cooperation, Challenges in data standardization
2	Modeling and Analysis of Care Delivery Services Within Patient Rooms	Healthcare Delivery System Analysis	Use of Markov chains and system-theoretic approach, Detailed modeling of care processes within patient rooms.	Quantitative tool for evaluating patient flow and care delivery, Improvement strategies for care services	Complexity in system representation, Assumptions about service times and resource availability
3	The primary health-care system in China	Primary Health Care System	Comprehensive review of structure, human resources, IT, finance, and quality	Improved access and affordability, increased government subsidies, universal health insurance	Inadequate training of workforce, fragmented IT systems, insufficient quality measurement
4	Interoperable End-to-End Remote Patient Monitoring Platform based on IEEE 11073 PHD and ZigBee Health Care Profile	Remote Patient Monitoring	Implementation of IEEE 11073 standards, use of ZigBee Health Care Profile, focuses on elderly with chronic diseases	Demonstrated interoperability, facilitated remote patient monitoring, enhanced data collection and management	Complexity in system integration, assumptions in protocol efficiency, limitations in device compatibility
5	Clinical Knowledge Management Using Computerized Patient Record Systems	Health Information System	Examined the adoption rates of Computerized Patient Record Systems.	Found significant nonadoption and regional variation in the implementation of CPRs.	The study indicates nonuniform diffusion of technology despite national mandates.
6	Proposal for an eHealth Based Ecosystem Serving National Healthcare	National Healthcare System	Framework for national healthcare system based on interoperable EHRs, patient-centered approach.	Demonstrated methodology for building an eHealth ecosystem, application of the framework in Cyprus as a case study.	Challenges in interoperability, reliance on EU directives, complex implementation across different national systems.
7	A Comprehensive Review on Smart Decision Support Systems for Health Care	Smart Decision Support Systems	Overview of smart DSSs, integration of data mining, model-based systems, knowledge-driven approaches	Enhanced decision-making effectiveness, improved patient care strategies	Complexity in integration, heavy reliance on data accuracy and availability

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			for		
8	Pros and Cons of Clinical Pathway Software Management: A Qualitative Study	Clinical Pathway Software	Case study on Check-It software, used in pediatric pulmonology, dermatology, and ophthalmology departments	Improved protocol-based working, increased efficiency, better task overview, reduced forgotten tasks	Not flexible enough for certain departments, high learning curve, more work involved
9	Modeling and Analysis of Patient Transitions in Community Hospitals: A Systems Approach	Patient Flow and Transition System	Markov chain-based model for studying patient transitions, focuses on ED, ICU, and ward transitions in community hospitals	Improved quantitative understanding of patient flow and transitions, effective in optimizing hospital bed usage	Computational complexity in larger hospitals, assumes steady state, not real-time transitions
10	Health Care Systems: Efficiency and Institutions	National Health Care Systems	Set of indicators to assess health care system performance, comparative data on health care policies and institutions across OECD countries	Identified that all surveyed countries could improve the efficiency of health care spending. No system is consistently more cost-effective.	Lack of consistent cross-country data, no single system that outperforms others consistently, complexity in measuring efficiency.
11	Public Satisfaction with Health Care Systems in 30 Countries: The Effects of Individual Characteristics and Social Contexts	Health Care System Satisfaction Study	Multilevel analysis of satisfaction with health care systems based on socioeconomic and health system variables.	Higher public spending on health increases satisfaction, but income disparities affect satisfaction in publicly funded systems.	Cross-sectional data, limited control for specific health care quality measures, sampling variations across countries.
12	A Two-Stage Model to Predict Surgical Patients' Lengths of Stay from an Electronic Patient Database	Length of Stay Prediction Model	Two-stage classification model using CART analysis, classification based on electronic patient records (EPR), identifies variability in patients' lengths of stay (LoS)	Explained 53.43% of the variability in patients' LoS, helps improve patient flow management and resource utilization	Variability due to outliers, complexity in model parameterization, some covariates unavailable before surgery
13	International Profiles of Health Care Systems, 2015	Comparative Health Systems	Profiles of health systems in 18 countries, focusing on financing, organization, coverage, care quality, and efficiency.	Highlights major variations in healthcare spending, patient access, quality, and satisfaction across countries	Differences in data reporting between countries, limited focus on long-term impacts of healthcare reforms
14	Density-Based Outlier Detection for Safeguarding Electronic Patient Record Systems	Healthcare Information Security	Uses a density-based local outlier detection model to detect unauthorized access to EPR systems.	Detected 144 anomalous behaviors in over 1 million audit log entries, safeguarding patient data.	Complexity in parameter setting, challenges in generalizing the model to other datasets or systems.
15	Designing Interactive Health Care Systems: Bridging the Gap Between Patients and Health Care Professionals	Interactive Health Care System	Proposes a systematic approach to incorporate patient involvement in health systems, utilizing distributed systems and emergent behavior detection (EBD) tools	Improved patient engagement and communication with healthcare professionals, detected emergent behaviors in system design.	Complexity in modifying existing systems, issues with data synchronization between the database and patient interface.
16	Centralized Medical Practice Management Software System	Medical Practice Management	Centralized platform for patient management, real-time updates for appointments, emergency services integration, ER and ambulance service, online registration.	Streamlined appointment management, improved accessibility to healthcare services.	Requires consistent internet access, initial setup complexity, potential issues with privacy/security of patient data.
17	WordPress: A Content Management System to Democratize Publishing	Content Management System (CMS)	Open-source CMS with PHP and JavaScript foundation, high modularity, REST API support, large community contribution	Powers 29% of websites, extensive plug-in ecosystem, high adoption	Security vulnerabilities due to plugins, complexity for new developers adapting to changes like Gutenberg.
18	Design and Evaluation of Pro object: A Tool for Rapid Prototyping of Interactive Products	Rapid Prototyping Tool	Allows designers to quickly prototype interactive products using visual programming and camera-based object state detection.	Facilitated cooperation between designers and developers, simplified the prototyping process, especially for non-technical users.	Requires camera-based state detection, limited active component integration without external platforms like Arduino.
19	Adaptive Healthcare Framework to Clinical Patient Management In Government Hospitals In Sri Lanka	Health Information System	Scheduling clinic timetables for the patients, providing health tips, exercise tips to the patients, and conducting remote medical camps are based on the history of medical records, drug prescriptions, and background of	The most suitable categories for adaptive healthcare are human, technology, and organization while resistance and risk are failure factor for the adaptive healthcare	Only provide the concept level of adaptive patient care

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			the patient's health		
20	Smart Healthcare Ecosystem for Elderly Patient Care	smart healthcare ecosystem	IoT based patient monitoring system for remote monitoring the patients	data is collected via medical IoT sensors connected to the patient, sensor's data is stored in cloud infrastructure, and is analyzed by an expert from a remote telemedicine center	The proposed system may not adequately address the needs of the elderly and critically ill patients, especially those in remote locations.
21	Proposed Remote Healthcare System for Rural Development	Remote Patient Monitoring (RPM) system	healthcare organizations to monitor and manage patients remotely; provisions of the right information, in the right place	The proposed wireless RPM system can provide enhanced mobility and comfort for patients during hospitalization.	Current wired sensing devices and network systems restrict patient mobility
22	Remote Attention System for Inpatient Care	ICU management	Emergency response, remote monitoring and real time consultation for management of patients admitted in wards and ICUs of hospitals.	The study proposes a remote attention system that enables virtual presence of remote specialists to collaborate with local doctors for emergency response, remote monitoring, and real-time consultation for managing patients in hospital wards and ICUs.	scarcity of experts who can engage full time

CPRs = Computerized Patient Records, EHRs = Electronic Health Records, EU = European Union, DSS = Decision Support Systems, ED = Emergency Department, ICU = Intensive Care Unit, OECD = Organization for Economic Co-operation and Development, CART = Classification and Regression Trees, LoS = Length of Stay, EPR = Electronic Patient Records, PHD = Personal Health Devices, IEEE = Institute of Electrical and Electronics Engineers, CMS = Content Management System, REST = Representational State Transfer, ER = Emergency Room, EBD = Emergent Behavior Detection.

IV. Results and Discussion

The findings of the systematic literature review illustrate the significant evolution of patient care systems, driven by technological advancements and the growing need for efficient healthcare management. Historically, patient care systems have transformed from paper-based methods to complex digital solutions, enhancing data management, clinical decision-making, and patient outcomes.[21], [22], [23] The early systems, such as the Problem-Oriented Medical Information System (PROMIS), laid the groundwork for modern electronic health records (EHR) and decision support systems (DSS). These technological advancements have enabled healthcare providers to collect, store, and analyze patient data with greater precision, improving the overall quality of care. The shift from paper-based systems to fully digital platforms has had a profound impact on patient outcomes. For instance, the introduction of EHRs has allowed for more comprehensive data storage, which supports evidence-based medicine and facilitates better clinical decisions. Decision support systems (DSS) have further contributed to individualized care by offering valuable guidelines and protocols, reducing errors in treatment plans and improving patient safety. This shift to digital records has not only enhanced the quality of patient care but also enabled more efficient communication and coordination among healthcare professionals, particularly in complex care environments. The literature emphasizes the growing importance of remote patient monitoring platforms, especially for managing chronic diseases. These platforms use wearable devices and other technologies to monitor patients' vital signs, enabling continuous observation and early detection of health deteriorations. The real-time data transmission from these devices to healthcare professionals ensures timely interventions, potentially reducing hospitalizations and improving patient outcomes. Despite these benefits, the review also highlights challenges related to the widespread implementation of these technologies, particularly concerning data security, cost, and interoperability[24], [25].

Table V.
Patientcare Platforms And Key Features

Patientcare Services	Key features
OpenTable	Calendar Management Real-time Scheduling Booking Management Patient Database Mobile Access
Smartsheet	Mobile Access Calendar Management
Athena One	Calendar Management Real-time Scheduling Booking Management Patient Database

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	Mobile Access
Sign in Scheduling	Calendar Management
	Booking Management
	Customer Database
	Mobile Access

The TABLE V provides some services provided by the online web-based applications. There are several services available in online platforms for patientcare[26], [27].

One key aspect of the technological evolution in patient care systems is the integration of closed-loop medication systems and advanced monitoring tools. These systems have significantly reduced medication errors and improved care quality by ensuring that healthcare providers have immediate access to accurate and up-to-date patient information[28], [29]. Furthermore, decision support systems provide evidence-based protocols that help optimize treatment plans, directly contributing to cost control and quality improvements in healthcare delivery. However, the review also identifies significant challenges in the adoption of modern patient care systems. One of the most prominent issues is the lack of interoperability between different healthcare IT systems. Fragmented systems, especially in countries with decentralized healthcare infrastructure, limit the continuity of care and complicate data sharing between institutions. This fragmentation is particularly problematic in primary healthcare settings, where resources and technological expertise may be limited[30], [31]. As a result, many healthcare providers face difficulties in implementing and maintaining these advanced systems, which can hinder their ability to fully realize the potential benefits of patient care technologies. Security and privacy concerns are another critical challenge identified in the literature. As healthcare systems increasingly rely on digital records and remote monitoring devices, the risk of data breaches and unauthorized access to sensitive patient information becomes a pressing issue. The review highlights the need for robust security measures, such as density-based outlier detection mechanisms, to protect patient records and ensure the integrity of healthcare data. While these technologies offer promising solutions, their implementation remains limited in many healthcare settings, and further research is needed to optimize their effectiveness[32], [33], [34].

Cultural and institutional barriers also play a significant role in limiting the adoption of computerized patient care systems. In some healthcare environments, there is resistance to transitioning from traditional paper-based systems to digital platforms. This resistance is often rooted in concerns about the accuracy and reliability of digital data, as well as a lack of adequate training and support for healthcare professionals. The literature suggests that addressing these cultural barriers is essential for ensuring the successful integration of advanced patient care systems. Incorporating informatics training into healthcare education is one potential solution to this challenge, as it would equip healthcare professionals with the skills necessary to use these technologies effectively[35]. Despite these challenges, the review highlights the positive impact of patient care systems on operational efficiency. Automated patient flow management systems, for example, streamline the registration, room assignment, and discharge processes, reducing bottlenecks and ensuring more efficient resource allocation in hospitals and clinics. Systems like Clinical Pathway Management (CPM) software have been shown to improve task visibility and reduce administrative workloads, although some users report challenges with system flexibility in specialized departments. Overall, the integration of digital systems has led to more streamlined healthcare processes, reducing redundancies and improving the coordination of care delivery[36].

Another area of significant development is the use of wearable devices and mobile health platforms for patient monitoring. [37]These technologies have become particularly valuable in managing chronic diseases and monitoring elderly patients, providing continuous, real-time data that healthcare providers can use to make informed decisions. The literature highlights the potential of wearable devices, such as health watches and smart clothing, to improve patient outcomes by enabling early detection of health issues and timely interventions.[38], [39] However, the widespread adoption of these technologies also raises ethical and legal concerns, particularly regarding the management and privacy of patient data. Looking forward, the future of patient care systems is likely to be shaped by the integration of advanced technologies, such as artificial intelligence (AI), machine learning, and the Internet of Things (IoT). These technologies have the potential to further enhance the capabilities of decision support systems, enabling more accurate predictions of patient outcomes and improving the efficiency of care delivery.[40], [41] However, as these systems become more complex, the challenges related to data security, interoperability, and professional training will need to be addressed to ensure their successful implementation. The review demonstrates that patient care systems have made significant strides in improving healthcare delivery through technological advancements. These systems have enhanced patient outcomes, increased operational efficiency, and provided healthcare professionals with better tools for decision-making. However, challenges related to interoperability, data security, and cultural resistance remain significant obstacles to the full adoption of these technologies. Future research and development should focus on addressing these challenges, ensuring that patient care systems continue to evolve and contribute to the overall improvement of healthcare systems worldwide[42].

The study on Online Health Communities (OHCs) introduces a thread recommendation system using a complex network including diseases and drugs, enhancing user

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engagement by accurately connecting users to relevant discussions. The Consult AI project evaluates a chatbot aiding clinical decisions, noting that on-demand interactions reduce distractions, streamlining consultations and improving physician satisfaction.[36], [37], [38] An Agent-Based Model (ABM) discussed for Emergency Department (ED) scheduling effectively reduces waiting times by optimizing resource allocation. A web-based Electronic Healthcare Record System (EHRS) aims to build trust through enhanced feedback mechanisms and transparent healthcare provider profiles, improving record reliability. Trust and Reputation Systems (TRSs) in healthcare focus on evidence-based trust to enhance service quality and patient-provider relationships. Clinical Decision Support Systems (CDSS) are highlighted for their potential in low-resource settings to support clinical decisions and improve healthcare delivery. [34], [35]The U.S. healthcare system study advocates for integrating patient-centered real-world data to improve care and system efficiency. Innovations in hospital labor planning use a complex system approach to dynamically manage resources, enhancing care quality. A centralized IoT approach in smart healthcare systems emphasizes energy efficiency for patient monitoring. Lastly, the Discrete Event System Specification (DEVS) framework aims to integrate healthcare services for continuous improvement and patient-centered care.[26], [42]

V. Conclusion

This systematic literature review underscores the transformative role of advanced patient care systems in healthcare, particularly in government hospitals within Sri Lanka. The integration of electronic health records (EHR), decision support systems (DSS), and remote monitoring platforms has significantly enhanced patient outcomes, improved operational efficiency, and facilitated more informed decision-making for healthcare providers. The review highlights how technological advancements have streamlined processes, reduced errors, and allowed for more personalized patient care, making these systems indispensable in modern healthcare environments. However, several challenges hinder the full realization of these benefits. Issues related to system interoperability, data security, and resistance to digital platforms are common obstacles that healthcare institutions must overcome. Fragmented IT infrastructure, especially in resource-limited settings, poses a significant barrier to seamless data sharing and continuity of care. Moreover, privacy concerns surrounding sensitive patient data and the reluctance of healthcare professionals to adopt new technologies further complicate the successful implementation of these systems. Moving forward, the successful integration of patient care systems will require addressing these challenges through enhanced security measures, improved interoperability, and targeted training for healthcare professionals. Future innovations, including artificial intelligence (AI) and Internet of Things (IoT) technologies, promise to further improve healthcare delivery, but only if these systems are user-friendly, secure, and adaptable to local healthcare environments. While the evolution of patient care systems presents vast potential for improving healthcare quality, a concerted effort must be made to address the existing gaps. By doing so, healthcare systems can better support clinicians, enhance patient care, and create a more connected and efficient healthcare environment for all stakeholders.

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