



# Automation and Digitalisation of Medication Management in Hospitals

Unpacking Hospital Medication  
Management in Private and Public  
Sector in South Africa





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# Executive Summary

## Overview

This report delves into the transformative potential of automation and digitalisation in medication management within South African hospitals, highlighting both private and public sectors. It aims to assess current processes, identify challenges and opportunities, and propose strategic solutions to enhance patient safety and operational efficiency.

Through a meticulous methodology combining desk research, expert interviews, and on-site observations, the report uncovers critical insights into the integration of technology in healthcare. Addressing the disparities and challenges in South Africa's healthcare system through automation is crucial, given the dual nature of the system and the resource constraints faced by public hospitals.



Automation and digitalisation are poised to revolutionise healthcare delivery by streamlining workflows, reducing medication errors, and optimising resource allocation, ultimately improving patient outcomes and healthcare equity.

## Key Findings

The report reveals significant findings that underscore the urgent need for technological advancements in medication management. Workflow inefficiencies, driven by manual processes and staffing constraints, severely impact turnaround times and operational efficiency, particularly in public hospitals.

These inefficiencies manifest in errors such as incorrect dosages and misinterpretation of medication names, necessitating frequent clarifications and interventions. The manual picking of medications further exacerbates bottlenecks and error rates, detracting from direct patient care. Regulatory challenges, while ensuring patient safety, complicate the rapid adoption of automation technologies, necessitating continuous updates to accommodate automated medical devices.

A pivotal discovery is the role of digital health technologies, including electronic prescribing, barcode technology, robotic dispensing systems, automated dispensing units, and smart infusion pumps, in enhancing medication safety and operational efficiency. These technologies significantly reduce medication errors and improve inventory management by minimising stockouts and expired medications.



Automated dispensing systems streamline storage, retrieval, and distribution processes, enhancing accuracy and efficiency. Dispensing cabinets are instrumental in managing ward stock and emergency cupboards, ensuring timely access to medications, and reducing stockout risks. Smart infusion pumps optimise clinical workflows by ensuring controlled delivery of medications, automatically calculating infusion rates based on protocol inputs.

In this rapidly evolving landscape of healthcare, the integration of automation solutions presents both opportunities and challenges, necessitating a strategic approach to stakeholder engagement and collaboration:

- Effective stakeholder engagement emerges as a vital component for facilitating smoother implementation of automation solutions and improving patient care.
- Coordinated efforts across departments are crucial due to the complexity of hospital operations, and involving healthcare professionals and management in decision-making processes is essential for ensuring effective utilisation of new technologies.
- Strong advocacy, effective collaboration, and early system integration are pivotal in accelerating the adoption of automation and overcoming resistance.
- Continuous development of clinical pharmacy skills and computer proficiency among healthcare staff is essential for effectively utilising new technologies and ensuring successful integration.
- Training and upskilling initiatives are critical for enhancing performance and reducing errors, particularly in high-volume settings where resource constraints are prevalent.

## Strategic Proposals

The report proposes strategic initiatives to address identified challenges and leverage opportunities for improvement. Infrastructure development is highlighted as a critical area, necessitating investments in robust digital infrastructure to support automation solutions, including the integration of electronic health records and pharmacy systems. Comprehensive training programs are recommended to enhance clinical pharmacy skills and computer proficiency among healthcare staff, ensuring they are equipped to effectively utilise new technologies. Stakeholder engagement is emphasised, advocating for the involvement of healthcare professionals and management in decision-making processes to ensure effective utilisation of new technologies and improve patient care. Automation is recognised for its potential to significantly enhance efficiency and accuracy in medication management by reducing manual interventions and streamlining workflows. Innovative funding strategies, such as multi-year payment plans and public-private partnerships, are suggested to make automation more financially accessible and sustainable.

By addressing infrastructure limitations, regulatory challenges, and human resource constraints, these strategic proposals offer a pathway to overcoming existing challenges and capitalising on the opportunities for improvement in medication management within South African hospitals. The insights and recommendations presented in this report are designed to inspire action and drive meaningful change, making it a must-read for stakeholders committed to advancing healthcare delivery and achieving equitable patient outcomes.



# Introduction

Medication management in hospitals is a critical component of healthcare delivery, impacting patient safety and operational efficiency. Globally, hospitals are increasingly adopting automation and digitalisation to enhance medication management processes<sup>1</sup>. In South Africa, the healthcare landscape is characterised by a dual public and private system, presenting unique challenges and opportunities for improvement. The integration of automation technologies is essential to address inefficiencies and improve patient outcomes. These technologies are pivotal in overcoming barriers such as manual processes, staffing constraints, and regulatory challenges, thereby enhancing the quality of care and operational efficiency.

This report aims to explore the current state of medication management in hospitals, with a specific focus on South Africa, and to highlight the critical role of automation and digitalisation in transforming healthcare delivery. The objectives of this paper are to assess the challenges and opportunities in medication management, examine the impact of technological innovations, and propose strategic solutions for enhancing patient safety and operational efficiency. The importance of this topic lies in its potential to revolutionise healthcare delivery, reduce medication errors, and optimise resource allocation, ultimately improving patient outcomes and healthcare equity.

The report covers a comprehensive analysis of medication management processes in South African hospitals, examining both private and public sectors. It delves into the integration of automation technologies, regulatory frameworks, and challenges impacting automation readiness. The report also explores the role of digital health initiatives, stakeholder engagement, and training programs in facilitating successful implementation. By setting the stage for a detailed examination of these areas, the report aims to provide actionable insights and strategic proposals for advancing medication management through automation and digitalisation.







# Industry Landscape

The integration of automation in healthcare necessitates a comprehensive understanding of organisational and regulatory barriers to fully exploit digital technologies for improved patient care and operational efficiency.

## Global Standards and Automation Technologies

### Medication Management and Global Standards

The World Health Organization (WHO) has established global standards to guide best practices in hospital care, patient safety, and medication management. These standards include the Global Patient Safety Action Plan (2021-2030), which aims to implement strategic patient safety interventions worldwide, focusing on building high-reliability health systems and protecting patients from harm<sup>2</sup>. The Strategic Framework of the Global Patient Safety Challenge: Medication Without Harm addresses medication safety through technology-based solutions, targeting high-risk situations, polypharmacy, and care transitions<sup>3</sup>. The Global Strategy on Digital Health (2020-2025) seeks to accelerate digital health adoption to meet Sustainable Development Goals, encouraging collaboration, digital strategy implementation, and human-centered health systems<sup>4</sup>.

### Automation Technologies

Key practices involve adopting reliable health systems and integrating technologies like Electronic Health Records (EHRs) and Computerized

Physician Order Entry (CPOE), managing high-risk situations, and empowering patients with information. Implementing these strategies can enhance health outcomes and achieve universal health coverage. Automation technologies such as Automated Dispensing Units (ADUs) and Smart Infusion Pumps enhance efficiency by automating medication management tasks. However, they require regulatory approval from SAPC and oversight by pharmacists to ensure patient care and compliance<sup>5,6</sup>.

## Governance and Challenges in Healthcare Automation

### Regulatory Framework

South Africa's medication management is governed by a robust regulatory framework ensuring patient safety, quality care, and access to essential medicines. Acts (legislation) provide the legal foundation, implemented, and enforced by Regulations, which inform Standards, Guidelines, and Standard Operating Procedures (SOPs). Key regulatory bodies include the National Department of Health (NDoH), South African Health Products Regulatory Authority (SAHPRA), South African Pharmacy Council (SAPC), Affordable Medicine Directorate (AMD), and Pharmaceutical and Therapeutics Committees (PTCs)<sup>7,8,9,10,11</sup>.

The National Health Act of 2003 underpins healthcare governance, focusing on patient rights and universal healthcare access, with the NDoH driving digital transformation in healthcare<sup>7</sup>. SAHPRA, guided by the Medicines and Related Substances Control Act of 1965, ensures the safety and efficacy of medicines, and regulates digital tools<sup>8</sup>.

Meanwhile, SAPC, mandated by the Pharmacy Act of 1974, oversees pharmacists, pharmacy personnel, and pharmacy practices, promoting good pharmacy practice (GPP) and digital and automated pharmacy processes to uphold professional standards and promote safe dispensing practices<sup>9</sup>.



## Primary Safety Governance



National  
Department of  
Health (NDoH)

The **National Health Act of 2003** governs South Africa's healthcare system, focusing on patient rights, provider responsibilities, and government obligations, with a focus on universal healthcare access. To ensure compliance with these standards, the **Office of Health Standards Compliance (OHSC)** oversees both public and private healthcare providers. The **NDoH plays a crucial role in driving digital transformation** in healthcare, including medication management, through policies, regulations, and frameworks.



South African  
Health Products  
Regulatory  
Authority  
(SAHPRA)

The **National Drug Policy, 1996** aimed to increase access to affordable and quality medicines. To achieve this, regulations were implemented to increase transparency in pricing and reduce costs. The **Medicines and Related Substances Control Act, 1965 and the South African Health Products Regulatory Authority (SAHPRA)** ensure the safety, quality, and efficacy of medicines in South Africa. **SAHPRA also regulates digital tools** used in medication management to maintain safety standards.



South African  
Pharmacy Council  
(SAPC)

An independent statutory body mandated by the **Pharmacy Act, 1974**. SAPC is a regulatory body responsible for overseeing pharmacists, pharmacy personnel, and pharmacy premises, including medication management in South Africa. Its primary goal is to ensure public safety and access to quality pharmaceutical services by **ensuring good pharmacy practice**. Additionally, they regulate digital and automated processes in pharmacies, ensuring they meet professional standards and promote safe dispensing practices.



## Ensuring Rational Medicine Use and Access to Essential Medicine



Affordable  
Medicine  
Directorate  
(AMD)

### National level

**AMD** ensures access to and rational use of essential medicines in South Africa. Key functions include developing the **Essential Medicines List (EML) and Standard Treatment Guidelines (STG)**, managing supplier contracts, and procurement. AMD guides the use of automated and digital systems for inventory management, dispensing, and usage of essential medicines. The **procurement department** selects safe and affordable medicines for the private sector. **Private** hospitals use **Clinical Governance** structures to select national formularies



Pharmaceutical  
and Therapeutics  
Committees  
(PTCs)

### Provincial & District level

The **NDoH** through the **National Drug Policy, 1996** promotes rational medicine use. **Pharmaceutical and Therapeutics Committees (PTCs)** established at institutional level, disseminate (provincial) and implement (district) EMLs and STGs. This guidance aids HCPs in making informed decisions regarding medication selection, prescribing, and dispensing. PTCs contribute to the rational use of medicines and the improvement of patient care.



### Challenges Impacting Automation Readiness

Several challenges hinder automation readiness in South Africa, including (i) data quality and applicability, (ii) data privacy and security, (iii) infrastructure and capacity, (iv) human resource capabilities, (v) regulatory landscape, and (vi) financial constraints<sup>12, 13, 14, 15</sup>. Data quality issues arise as automated models trained on varying contexts might overlook local disease indicators. Data privacy and security concerns stem from proprietary automation software being susceptible to breaches, discouraging adoption. Infrastructure and capacity issues are exacerbated by fragmented health data systems and limited technical expertise, hindering large-scale implementation. Human resource capabilities are affected by a lack of technical expertise and digital literacy among health professionals. The regulatory landscape may be inadequate for automated medical devices, requiring continuous updates.

Financial constraints, especially in rural areas, impact efficient service delivery. Overcoming these hurdles requires strengthening the health information system, improving data privacy regulation, prioritising infrastructure development, investing in local workforce training, and establishing robust regulations for automated healthcare tools.







# South Africa's Healthcare Landscape

South Africa's healthcare landscape is defined by its dual public and private system, presenting significant disparities in service quality and access, driven by demographic shifts, socioeconomic challenges, and a high burden of both communicable and non-communicable diseases, necessitating strategic interventions to enhance healthcare delivery and equity.

## Healthcare System Overview

### Dual Public and Private System

South Africa operates a two-tier healthcare system characterised by profound disparities and challenges. The public sector serves approximately 84% of the population, accounting for 47% of total healthcare spending and is publicly funded<sup>15</sup>. Conversely, the private sector caters to 16% of the population, with 53% of healthcare spending funded through private procurement and medical schemes<sup>15</sup>. This disparity results in varied service quality and access, with public facilities often understaffed and facing resource limitations<sup>21</sup>. The healthcare landscape is marked by demographic shifts, socioeconomic disparities, and a high burden of communicable and non-communicable diseases<sup>17,18</sup>. Rising life expectancy and an increasing proportion of older individuals add pressure on chronic care. Socioeconomic factors like poverty, inequality, and limited access to facilities, healthcare professionals, and supplies exacerbate health disparities, particularly in rural areas<sup>17</sup>. The widening income gap further strains the public healthcare system<sup>17</sup>.

### Challenges and Opportunities

South Africa faces unique challenges, including a severe shortage of healthcare professionals, particularly nurses and pharmacists, which impacts patient care. The country has approximately 30 pharmacists per 100,000 people, which is below the global average of 4819, <sup>20</sup>.

Similarly, the country has fewer than 2.5 nurses per 1,000 people (1 nurse per 1,000 people)<sup>21</sup>. This shortage impacts essential health services, potentially leading to compromised patient outcomes. To mitigate these issues, South Africa must invest in training programmes and embrace innovative healthcare solutions<sup>16</sup>. The healthcare system is significantly strained by a high burden of communicable diseases such as Tuberculosis (TB) and HIV/AIDS. South Africa remains heavily burdened by TB, with over 290,000 new infections reported in 2022<sup>22</sup>.

The global HIV epidemic also persists, with 39.9 million people living with HIV worldwide in 2023, approximately 25.4 million of whom are in the WHO African Region, including 7.8 million in South Africa.<sup>23</sup>. Non-communicable diseases (NCDs) like heart disease, cancer, diabetes, and lung diseases are also increasing, linked to lifestyle factors, and contributing to a growing burden on healthcare systems<sup>18</sup>. Projections indicate a continued increase in these disease trends, necessitating proactive health strategies<sup>17</sup>.



## Medication Management and Workflow

### Current Processes

Medication management within hospital environments is a complex and critical process, directly impacting patient safety, operational efficiency, and overall healthcare outcomes. Current medication management workflows in South African hospitals are predominantly characterised by several manual processes, including procurement, stock management, and medication usage<sup>5</sup>. These manual processes are susceptible to delays, stockouts, overstocking, and errors, primarily due to the reliance on physical movement of stock and the absence of automated alerts<sup>24</sup>. Collaborative efforts among pharmacists, pharmacy assistants, nurses, and unit managers are crucial for maintaining optimal stock levels and ensuring seamless management by accurately identifying demand, ordering from suppliers, and ensuring timely delivery to departments like wards and ER5, <sup>24</sup>. Frequent interruptions and task switching diminish efficiency and heighten error risk. Nurses complete an average of 72 tasks per hour, spending 37% on patient care and 27% on medication tasks, which are often disrupted by communication, increasing the likelihood of errors<sup>24</sup>. Healthcare professionals, including nurses and clinical pharmacists, spend a substantial portion of their time on non-clinical and administrative tasks, detracting from direct patient care. Nurses allocate 15-28% of their time to non-clinical tasks, with 13-21% dedicated to documentation alone<sup>25</sup>. Clinical pharmacists in emergency departments spend about 42% of their time on medication-related tasks, such as reconciliation and history gathering <sup>26</sup>.

### Impact of Automation

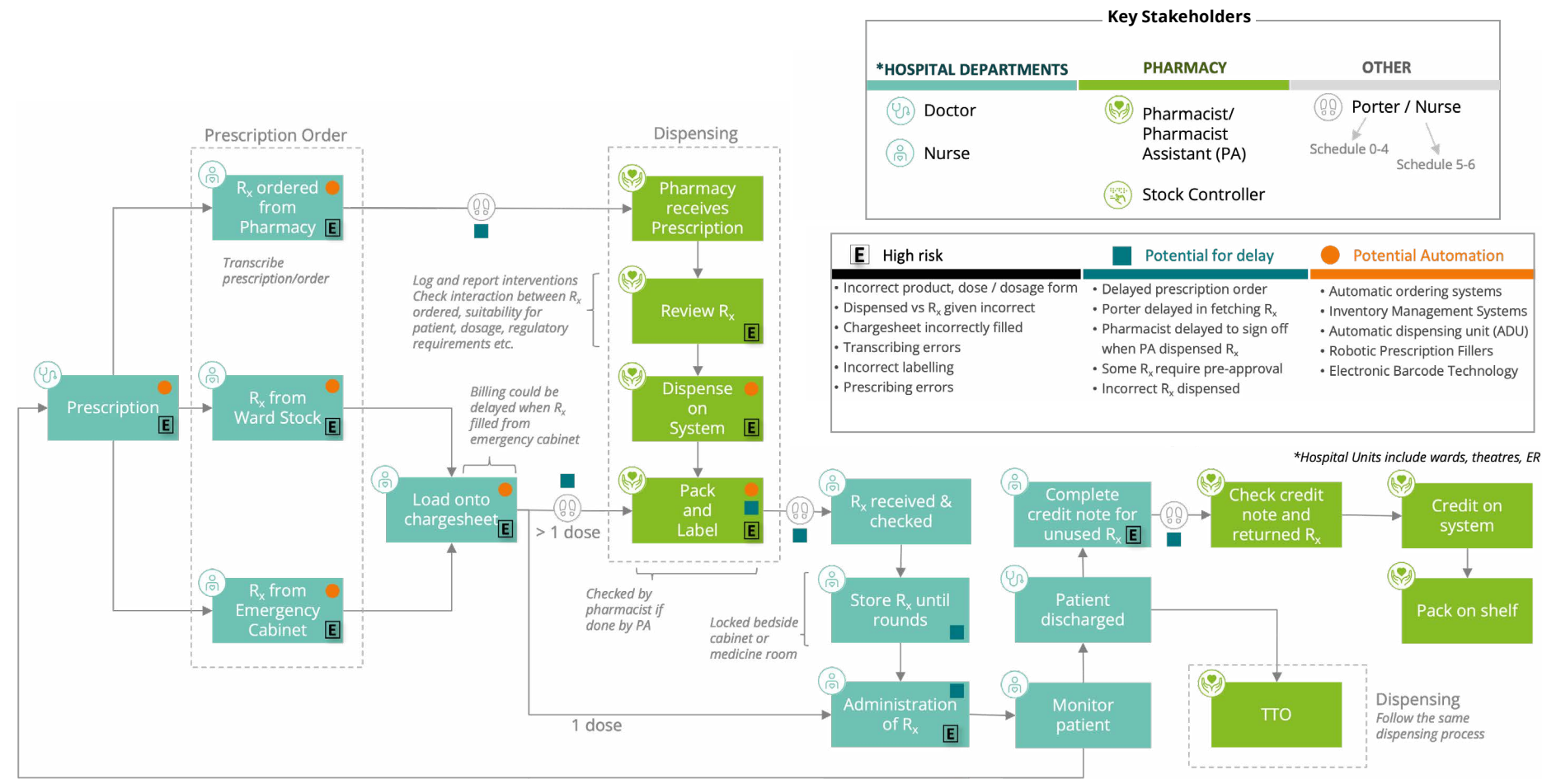
The integration of electronic prescriptions and automated dispensing units (ADUs) is transforming pharmacy practice. Electronic prescriptions must be verified by pharmacists under Regulation 33 of the Medicines and Related Substances Act of 1965 and Electronic Communications and Transactions Act (ECTA) of 2002, requiring an advanced electronic signature (AES) for legal validity<sup>27, 28</sup>. Best practices include direct transmission, robust verification, secure authentication, communication with prescribers, and adherence to guidelines to streamline dispensing and enhance patient care<sup>27, 28</sup>. ADUs, also known as automated dispensing cabinets (ADCs), enhance pharmacy efficiency by automating medication management tasks, but require regulatory approval from SAPC and oversight by pharmacists to ensure patient care and compliance<sup>5</sup>. Pharmacists manage access control, accurate stocking, and security, while maintaining detailed records and adhering to regulations for controlled substances<sup>5</sup>.

Similarly, the guidelines for smart infusion pumps enhance patient outcomes by mandating use, standardising drug libraries, and ensuring compliance, supported by continuous quality improvement through data review<sup>6</sup>. These pumps optimise clinical workflows with safety checks and seamless electronic health record integration, featuring Dose Error Reduction Software (DERS) and integrated drug libraries to improve safety in high-risk environments<sup>6</sup>.



# Medication Use Process in Hospitals

Figure 1: Diagrammatic Workflow Visualisation of Medication Use Process in Hospitals



The hospital medication workflow begins with a prescription order, sourced from the pharmacy, ward stock, or emergency cabinet. The dispensing process involves interpreting prescriptions, verifying details, and ensuring optimal medication use, often requiring prescriber communication. The pharmacy reviews, dispenses, packs, and labels medication, using barcode systems and robots to enhance efficiency and reduce errors. Administration follows, with patient monitoring for reactions.

Upon discharge, unused medication is returned and credited, involving doctors, nurses, pharmacists, and stock controllers, with automation opportunities to enhance efficiency. Patients receive tailored information for safe medication use, with adherence monitored and issues addressed. Rigorous protocols govern medication storage and handling, ensuring proper control of emergency supplies.

While digitalisation can streamline steps, manual processes remain crucial for patient safety, especially in prescription assessment and verification. Digitalisation and automation can streamline some steps, manual processes remain essential for patient safety, particularly in prescription assessment and verification<sup>5, 24</sup>.





# Technology Innovation in Healthcare

The rapid adoption of digital health technologies in South Africa, accelerated by the COVID-19 pandemic, is transforming healthcare delivery by enhancing efficiency, quality, and access, driven by innovative solutions and strategic initiatives that address both immediate challenges and future sustainability.

## Digital Health Adopting

### Impact of COVID-19 on Digital Health

The COVID-19 pandemic has served as a catalyst for digital health adoption in South Africa, significantly enhancing healthcare delivery through improved efficiency, quality, and access<sup>29</sup>. The pandemic underscored the necessity for robust digital infrastructure and innovative health solutions to manage increased healthcare demands and ensure continuity of care.

As a result, the National Digital Health Strategy has been pivotal in driving advancements in digital governance, integrating information systems, and establishing broadband infrastructure, all aimed at fostering person-centered care. This strategy prioritises the implementation of electronic health records, mHealth interventions, and the development of a skilled digital health workforce, guided by principles of expanded access and innovation<sup>30</sup>.

For instance, the use of electronic health records facilitates seamless information sharing among healthcare providers, while telemedicine

expands access to medical consultations, particularly in remote areas. Mobile health initiatives empower patients with tools and information to manage their health proactively. These efforts are crucial in addressing the challenges posed by the pandemic and ensuring sustainable healthcare delivery in the future.

### Technological Innovations

South Africa has witnessed significant advancements in digital health initiatives, spearheaded by local tech firms developing AI and machine learning solutions for medical risk prediction and personalised diagnostics.

In the realm of healthcare innovation, South Africa is making significant strides with pioneering initiatives that harness technology to enhance efficiency, accuracy, and patient safety. Notably:

- Netcare's e-prescribing system: Optimises prescription processes, minimises errors, and bolsters patient safety through the use of digital tools.

- ATM Pharmacy: Transforms access to chronic medications by employing technology to enhance efficiency, precision, and the overall patient experience
- Health Patient Registration System: Plays a crucial role in preparing citizens for the implementation of National Health Insurance (NHI), striving for a unified and portable patient record system that improves healthcare accessibility and continuity.<sup>30</sup>

Additional initiatives, such as MomConnect, focus on improving maternal health by providing timely information and support to expectant mothers. BroadReach Healthcare's Vantage system optimises HIV treatment by utilising data-driven approaches to enhance patient outcomes. Moreover, Computer-Aided Detection (CAD) employs AI to analyse chest X-rays for TB detection, expanding access to effective screening in resource-limited settings<sup>13, 14, 30</sup>. These technological innovations are reshaping the healthcare landscape in South Africa, offering promising solutions to longstanding challenges, and paving the way for more efficient and equitable healthcare delivery.



## Case Studies



The installation of a smart store system at Guy's & St Thomas' Foundation Trust Hospital aimed to enhance operational efficiency in medication storage and administration while reducing non-moving inventory. The initiative involved configuring smart store cabinets for optimal quantity, size, and location, coordinating with ward staff for deployment and restocking schedules, and training staff to ensure smooth operation. The results were remarkable, showcasing several key achievements<sup>33, 34</sup>:

### Outcomes achieved









Hospital pharmacy	Inventory management
 Average reduction in additional <b>stock holding is 22%</b> across all systems	 Over <b>101,000</b> nursing hours freed up for patient care
 Reduction in medication errors and incident reports	 <b>Non-moving inventory</b> dropped by <b>35%</b>
 <b>Transaction time</b> for drugs reduced to just <b>15 seconds</b> releasing more time for patient care	 <b>Inventory re-order</b> levels reduced by <b>10% in wards</b> and <b>5% in theatres</b>
 <b>Medicine spend dropped</b> by <b>10.64%</b>	 Average <b>picking time</b> reduced from 63 seconds <b>to 17 seconds</b>

Figure 2: Results of smart store system at Guy's & St Thomas' Foundation Trust Hospital

The Themba Lethu Clinic implemented a robotic automated dispensing system integrated with a pharmacy management information system (PMIS) to enhance operational efficiencies and patient care within a high-volume public clinic. Innovations included the integration of PMIS with clinical management systems for electronic data transfers, and a barcoding system for robotic loading and picking of medicines. The change management process involved allocating time for renovations, booking fewer patients during the transition, establishing a temporary manual pharmacy, and implementing training with mentors. The results were impressive, highlighting several key achievements<sup>12</sup>:

### Outcomes achieved

In one year, post implementation:	In the first six months of implementation:
 Patient <b>waiting times</b> in the pharmacy <b>dropped</b> from an average of <b>3.5 hours to 28 minutes</b>	 Only <b>60%</b> of the original staff was required for routine dispensing
 Pharmacy <b>working hours</b> were <b>reduced</b> from an average of <b>11.5 hours to 8.5 hours</b>	 Improved operational efficiencies leading to significant increases in service delivery
 <b>Prescription picking errors</b> were <b>eliminated</b> in the pharmacy thanks to the barcode scanning technology	 Optimised supply chain management

Figure 3: Results of an automated dispensing system integrated with a PMIS at the Themba Lethu Clinic

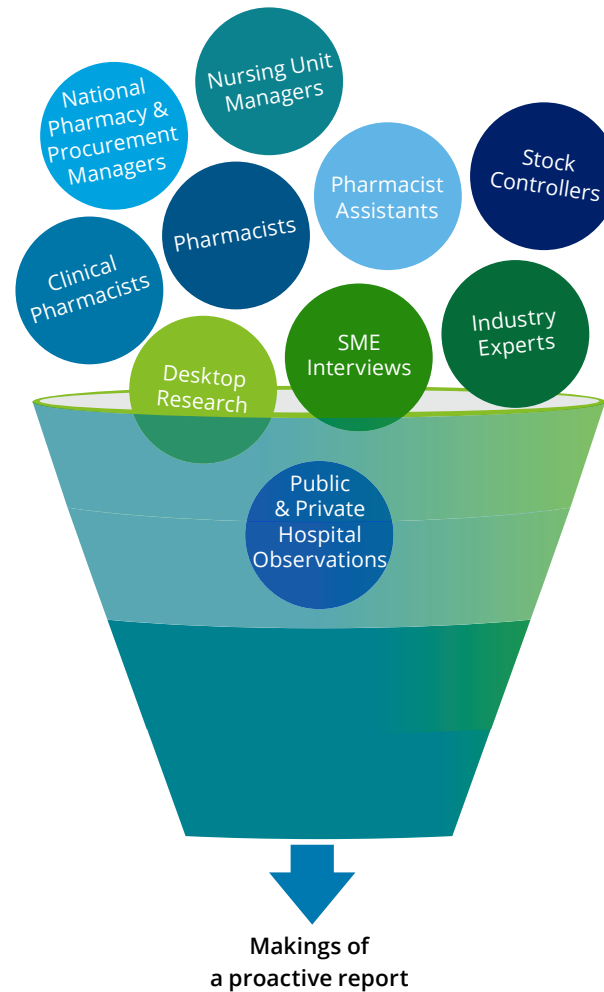


# Methodology

This study employed a comprehensive methodology integrating desk research, expert interviews, and on-site observations to thoroughly examine medication management processes and identify opportunities for technological enhancements. Desk research provided essential background information and context. A total of 34 interviews were conducted, including 28 with key hospital stakeholders such as National Pharmacy and Procurement Managers, Pharmacists, Clinical Pharmacists, Pharmacist Assistants, Stock Controllers, and Nursing Unit Managers, along with six Industry Experts.

To provide a comprehensive perspective, we also engaged with experts from other countries that have implemented automation, which helps contextualise the inclusion of a case study from Saudi Arabia. These semi-structured interviews offered qualitative insights into current workflows, technology utilisation, and challenges, guided by a customised interview framework focusing on workload allocation, human resource ratios, and quality management systems.

Observations were carried out in six hospitals—three large, two medium, and one small—comprising both private and public facilities, documenting real-world practices in prescription handling, stock control methods, and medication distribution routes, while minimising disruption to operations. The data collected was analysed using thematic analysis to uncover patterns and themes, providing valuable insights into efficiency, resource utilisation, and potential areas for improvement in medication management.





# Limitations

The study's limitations, characterised by a small sample size of six hospitals located in urban and semi-urban areas with predominantly low digital maturity levels, underscore the necessity for more extensive research that includes rural hospitals and institutions with diverse levels of digital automation maturity. Such research is essential to comprehensively understand the impact of digitalisation and automation on medication management practices across varied healthcare settings.



# Insights from Industry Experts

Unlocking operational excellence in healthcare requires strategic automation to transform workflows, revolutionise patient safety, and maximise potential through smart investment models and collaborative advocacy, ensuring a shift from routine tasks to high-value, patient-centered activities that drive efficiency and measurable ROI.

## Expert Opinions and Technological Innovations

### Unlocking Operational Excellence and Revolutionising Patient Safety

Industry experts have consistently highlighted the transformative power of automation in healthcare workflows. By enabling professionals to shift focus from routine tasks to high-value, patient-centered activities, automation drives overall operational efficiency.

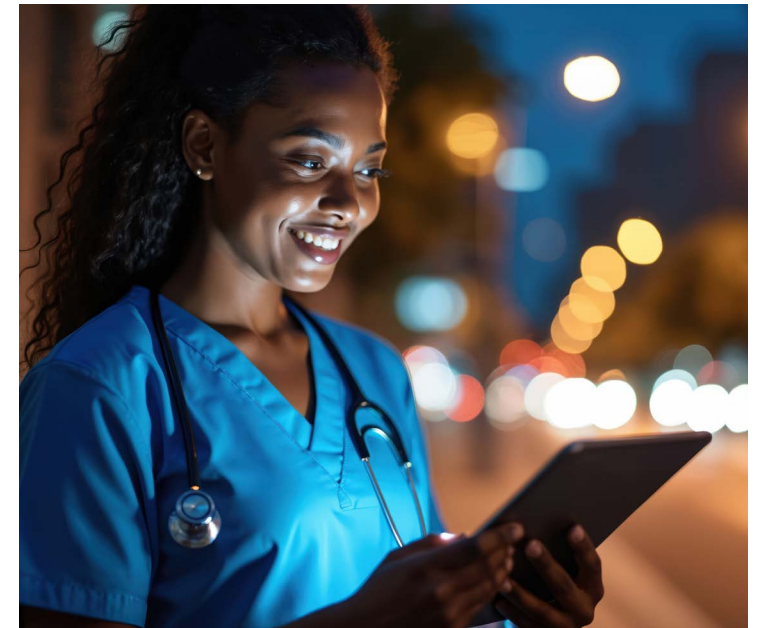
“Automation is not just about replacing manual processes; it’s about enhancing the quality of care,” one expert noted, emphasising the potential for healthcare providers to optimise resource allocation and improve patient outcomes. Advanced automation significantly reduces medication errors, enhances patient safety, and ensures real-time oversight to mitigate potential risks. “Automation provides a level of precision and safety that manual processes cannot achieve,” an expert stated, underscoring the critical role of technology in safeguarding patient health.

### Change Through Advocacy & Collaboration and Maximising Automation Potential

Strong advocacy, effective collaboration, and early system integration are pivotal for accelerating the adoption of automation, overcoming resistance, and ensuring long-term success and transformation.

“Collaboration between is the cornerstone of successful automation implementation,” one expert asserted, emphasising the importance of working together to drive meaningful change in healthcare systems.

Effective system integration and customised automation strategies empower healthcare organisations to fully harness technology, optimise processes, and minimise implementation challenges. “The true potential of automation lies in its seamless integration with existing systems,” an expert explained, highlighting the importance of tailoring solutions to meet specific organisational needs.



## Case Studies and Market Perspectives

### Automating for Success and Impact of Automated Dispensing Cabinets (ADCs)

In Saudi Arabia, a private hospital's implementation of an automated medication dispensing system has led to significant improvements in patient satisfaction, primarily due to reduced waiting times and increased pharmacist interaction. "Patients appreciate the opportunity to discuss their medications with pharmacists," an expert noted, highlighting the positive impact on medication adherence and patient outcomes. At King Fahad Medical City, automation has reduced non-value-added tasks for pharmacists, freeing up time for higher-value activities like clinical consultations and medication optimisation.

Notably, the implementation at King Fahad Medical City demonstrated an 83% reduction in medication waste, attributed to improved inventory management, reduced stockouts, and better expiry control. Automated dispensing cabinets (ADCs) have been identified as key tools for enhancing time efficiency and shifting focus from routine tasks to more impactful, patient-centered care. "ADCs allow nurses to focus on direct patient care," an expert explained, noting the varying benefits across different wards.

### Impact on Public vs. Private Healthcare and Tailored Solutions

Government incentives and dedicated budgets for digitalisation significantly drive automation adoption in healthcare. "Public systems often require central government support," an expert noted, contrasting the motivations between public and private providers. While private providers are motivated by efficiency, reduced risk, and cost savings, public systems rely on government support to prioritise automation investments. A one-size-fits-all approach for automation is ineffective. "Understanding each healthcare setting's challenges is crucial," an expert advised, highlighting the importance of tailoring solutions to address specific resource limitations and challenges. By prioritising local needs, policymakers can maximise the impact of automation while ensuring cost-effectiveness.





## Implementation Strategies and Investment Models

### Addressing the Staffing Gap and The Power of Integration

A significant challenge in healthcare is the increasing workload coupled with stagnant staffing levels. “Investing in technology is often influenced by labour costs,” an expert explained, noting the economic justification for automation in countries with lower labour costs like South Africa. The economic justification for automation might be less straightforward compared to countries with higher labour costs. However, even in such contexts, automation can still offer benefits such as increased efficiency, reduced errors, and improved productivity, which can justify the investment despite the lower cost of labour.

By addressing the staffing gap through automation, healthcare organisations can reduce stress and burnout among staff, improving productivity and care quality. Enhancing medication safety and efficiency is crucial, but the true potential of automation lies in seamless integration with other systems. “Integration with EHRs and pharmacy systems can significantly enhance medication safety,” an expert stated, underscoring the importance of system interoperability.

### Smart Investment Models and Understanding Time Utilisation

Strategic investment planning, supported by innovative financial models, ensures that automation delivers measurable ROI, even in resource-constrained environments. “Investment in automation is not just a cost; it’s a strategic move towards long-term sustainability,” an expert remarked, pointing to the financial viability of automation solutions. It’s crucial to understand how the freed-up time from automation will be used. “The real opportunity lies in using that time for something more impactful,” an expert emphasised, suggesting that healthcare providers leverage this time to conduct deeper patient assessments, provide additional clinical services, or improve patient satisfaction.

## Key Focus Areas for Automation and Lessons Learned

### Error Reduction, Inventory Optimisation, and Time Efficiency

Experts have identified error reduction, inventory optimisation, and time efficiency as critical operational and clinical challenges that automation can address. “Automation is a game-changer for inventory management,” one expert asserted, pointing to the potential for reducing stockouts, excess inventory, and expired medications. By optimising inventory management, automation contributes to sustainability and reduces waste. Before-and-after comparisons of workflows are conducted to assess the impact of automation on time efficiency, error reduction, and inventory management. Careful planning is necessary to ensure that the freed-up time is used to enhance patient care or other valuable activities.

### Lessons Learned from Previous Implementations

The importance of tailored solutions is paramount. Healthcare providers have diverse needs, and a “blanket approach” won’t work. Experts propose improving future results by consultatively understanding the unique challenges of each provider to recommend the most suitable solution and leveraging knowledge to ensure successful implementation and measurable results. Increased involvement with robot dispensing technology has shown that automation can lead to improved patient outcomes and overall healthcare efficiency. “Automation doesn’t eliminate jobs; it enhances them,” an expert stated, challenging misconceptions about the impact of technology on employment.





# Hospital Research Findings

The hospital research findings reveal critical insights into medication management processes, highlighting the challenges and opportunities for enhancing patient safety and operational efficiency through automation and digitalisation across diverse healthcare environments.

## Medication Use Process

### Prescribing and Transcribing

Prescribing and transcribing processes are critical components that significantly impact patient safety and operational efficiency. In private hospitals, both large and small, the prescribing and transcribing processes are predominantly manual, leading to frequent issues such as illegible handwriting and incomplete prescriptions. These challenges are reported by 40% of respondents, including pharmacist assistants and nursing unit managers.

For instance, in large private hospitals, approximately 10% of prescriptions require queries due to these issues, consuming about an hour daily in interventions. A pharmacist assistant noted the difficulty in reading doctors' handwriting and the absence of critical information like patient allergies, which necessitates frequent clarifications. In smaller private hospitals, despite lower patient volumes, errors such as incorrect dosage instructions and misinterpretation of medication names are prevalent, requiring pharmacists to contact doctors 5-10 times daily for clarifications.

This highlights the need for precise information and frequent double-checking to ensure patient safety.

“

Firstly, the handwriting of doctors can be difficult to read. Secondly, their scripts might not list the patient's allergies, which is problematic.

– Pharmacist

”

The transcribing process in private hospitals involves nurses recording medication details from ICU charts to prescriptions, starting with the doctor's initial dose entry. This process requires verification and signing by two registered nurses, with daily doctor sign-offs needed for accuracy. However, compliance with these sign-offs varies, prompting efforts to ensure consistency for accountability.

In contrast, public hospitals exhibit a mix of manual and electronic prescribing methods. Medium-sized public hospitals primarily use electronic systems for outpatient prescriptions, while inpatient prescriptions remain handwritten, leading to potential delays and errors. Approximately 70% of staff report issues with handwriting and incomplete scripts, necessitating frequent communication with doctors to rectify errors. The transition to electronic systems especially for out-patients in medium public hospitals, such as web-based patient management systems, aims to streamline processes by integrating patient viewing and reducing reliance on physical folders. However, the lack of integration in patient medication history and record systems complicates the process, requiring manual verification and frequent communication with doctors.

A large public hospital has exclusively used electronic systems for over 15 years, integrating prescriptions with the pharmacy dispensing system. This approach enhances safety but requires the physical hard copy of the prescription before processing, impacting turnaround time. Prescribing errors, particularly concerning medication duration, are prevalent, with approximately 40% of respondents noting these issues.



Doctors occasionally copy-paste the previous month's medication, leading to repeated mistakes. The reliance on electronic systems has eliminated manual transcribing, reduced transcription errors, and improved order accuracy, expediting communication between departments.

Overall, the adoption of electronic prescribing systems offers significant benefits, including enhanced productivity, reduced errors, and streamlined processes. Despite challenges, such as slow systems and inadequate training, the implementation of Computerised Physician Order Entry (CPOE) systems can automate checks for drug interactions and allergies, reducing medication errors, enhancing safety, and streamlining routine orders to improve workflow efficiency.

### Dispensing

The dispensing process in hospitals is a crucial aspect of medication management, involving the meticulous review, preparation, verification, and distribution of prescriptions. This process varies significantly across different hospital types and sizes, presenting unique challenges and opportunities for improvement through automation and digitalisation. In private hospitals, both large and small, the dispensing process begins with the delivery of prescriptions to the pharmacy. Large private hospitals employ runners to log the arrival time of prescriptions, ensuring tracking and accountability. Scripts undergo a high-level scan to prioritise urgent cases and to identify any issues.

Despite these measures, errors are common, with 30% of respondents indicating frequent errors and delays. A clinical pharmacist noted instances where doses are incorrectly calculated, particularly for patients with kidney or liver conditions.

Approximately 5% of scripts require correction after the final check, and pharmacists make 15 to 20 calls daily to resolve script issues. TTOs (To Take Out) are prioritised, with about 30 processed in four hours, primarily between 10:00 and 12:00, creating bottlenecks in inpatient dispensing workflows.







Medium private hospitals employ a three-step approach to ensure accuracy. A pharmacist assistant reviews scripts for obvious issues before manually entering them into the system, prioritising patients using colour-coded charts. The picker retrieves items, matches them with labels, checks expiry dates, and prepares them for the pharmacist's final review. Despite these checks, 40% of respondents report significant error risks and delays. Processing times vary from 15 minutes to 1 hour, depending on complexity and staff availability. Delays can occur if script reprocessing is needed, particularly when clinical interventions are reviewed at the end. Billing delays may arise when a single biller handles multiple tasks, and picking stage delays can happen if only one picker is working during busy retail periods.

Smaller private hospitals (with fewer patients and staff than larger institutions) benefit from a more intimate scale, enabling quicker error resolution and personalised service. Prescriptions are processed in about 30 minutes, with bins turned around within an hour for prompt delivery to wards. Pharmacist assistants select stock, capture batch numbers, and apply warning labels to ensure accuracy. Each ward has a designated bin for prescriptions, transported by porters. Pharmacists manage one bin at a time, prioritising antibiotics, TTOs, paediatric, and ICU scripts. A pharmacist noted the importance of managing prescriptions directly (without involving a pharmacist assistant), checking batch numbers and expiry dates to catch errors early, especially during peak times when staffing is limited.

In small hospitals, TTOs might be issued from a discharge lounge by a registered nurse, facilitating efficient processing and patient discharge, though this is not standard practice. In public hospitals, the dispensing process is similarly structured. Medium public hospitals use a comprehensive multi-step process to ensure accuracy and safety.



Pharmacist assistants review scripts, cross-reference patient histories, and contact doctors if necessary. Less than 10% of scripts require intervention, but interruptions can cause delays. The dispensing process employs a triple-check system, with pharmacist assistants typing prescriptions into the dispensing system, picking medications, and labelling them, overseen by pharmacists.

Manual packing and labelling are error-prone, with 40% of mistakes due to manual entry, with this step taking between 11 to 22 minutes. Observations show potential for mixing scripts and medications at the picking table due to space constraints, indicating a need for better management and automation. Their dispensing system mitigates errors with alerts for medications, while scanners streamline patient profile retrieval, though manual interventions still need improvement.

Large public hospitals enhance medication management through electronic systems like barcode prescriptions. Dedicated teams manage outpatient and inpatient dispensing using a double-check system where pharmacist assistants pick medications and pharmacists ensure accuracy. Outpatients drop off electronic scripts at designated windows, queued by priority, while pharmacists verify and pass them for picking, occasionally facing delays due to stock shortages. Inpatients receive electronically generated prescriptions, typically for a seven-day supply, adjustable for antibiotics, with scripts prioritised and sent via tube or porter, though sorting can be time-consuming and 20% require pharmacist intervention for dosage queries. Limited space can lead to mix-ups, contributing to medication errors. Stat medication is kept in wards, but sometimes nurses collect it from the pharmacy when required. TTO scripts are prioritised due to transport schedules, ensuring that patients receive both their newly prescribed take-home medication and any remaining medication before leaving the hospital.



Despite technological advancements, challenges such as stock-outs and incorrect item collection from the shelf continue to affect workflow and patient care. The dispensing system shows available stock but doesn't flag levels, requiring pharmacy checks of main stores, taking 5-10 minutes. Patients may receive a balance note or be sent back to the doctor for alternative prescriptions, with approval for non-essential items taking anywhere from 5 days to weeks. Non-EML scripts which require special authorization, occur daily for outpatients and more frequently for inpatients (around 10 a day).

Across all hospital types, common discrepancies include incorrect dosages, patient details, and strength selections, often related to locum staff. These issues arise frequently, with significant error risks reported by 40% of respondents. The integration of technology, such as barcode scanners and integrated dispensing systems, helps streamline the process but does not eliminate the need for manual interventions. Both private and public hospitals face challenges in manual processes, underscoring the need for automation to improve efficiency and accuracy in medication management.

Despite efforts to streamline operations, the dispensing phase remains a complex and critical part of healthcare delivery, requiring constant vigilance and adaptation to ensure patient safety and effective medication management. Research shows that automated dispensing systems can enhance safety and efficiency by reducing dispensing errors by up to 76% and cutting medication wastage by 83.9%, while streamlining storage, retrieval, and dispensing through robotics and barcoding integrated with hospital IT systems.

### Administration and Monitoring

The administration and monitoring of medication in hospitals are vital for ensuring patient safety and effective treatment, with distinct approaches observed across private and public healthcare facilities in South Africa. These processes involve rigorous checks and adherence to protocols, particularly in ICU settings, where patient safety and the detection of adverse reactions are paramount.

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Firstly, the nurse must explain the medication they are administering to the patient and its potential side effects.

– Nursing Unit Manager

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In private hospitals, the administration process is characterised by strict verification protocols, including patient identification through wristbands, verbal confirmation, and chart checks. These measures are crucial for reducing errors and ensuring accurate medication delivery.

Approximately 25% of respondents emphasise the importance of consistent patient education, where nurses explain medication and potential side effects. In ICU settings, monitoring devices facilitate the detection of adverse reactions, while general wards rely on direct observation. Nurses use manual flow charts for tracking medication administration, requiring co-signatures for accuracy. Infusion pumps ensure controlled delivery, automatically calculating infusion rates based on protocol inputs.

A Private Hospital Group exemplifies precision in medication rounds, employing strict manual verification processes. Nurses conduct rounds using wristbands, verbal confirmation, and chart checks to minimise errors. Monitoring involves educating patients on potential side effects and instructing them to report adverse reactions. High-risk patients receive closer monitoring, supported by real-time data from ICU equipment. Smart infusion pumps enhance accuracy, and discussions are ongoing about transitioning to a paperless system.

Despite challenges in administering numerous medications quickly, nursing staff maintain high standards through collaborative approaches, ensuring thorough manual checks and balances, which can be further enhanced with the support of technology.



In public hospitals, similar verification processes are employed, with patient identification via blue boards (medication charts), wristbands, and verbal confirmation. Large public hospitals utilise electronic systems for timely administration. The Nurse Unit Manager noted that their ward requires two nurses about 30-40 minutes for rounds. Oral medications are handled by enrolled nurses, while registered nurses manage IV administration. Medicines are stored in a locked trolley, organised by product. The mobile system records nursing notes, enhancing confidentiality. Monitoring includes observing patient reactions and reporting side effects, with physical checks post-administration. Infusion pumps aid in medication administration, especially in advanced care units.

Missed doses are unlikely due to rigorous checks, but incidents are reported to unit managers, reflecting proactive measures to manage potential errors and ensure patient safety.

Across all hospital types, technology integration, such as infusion pumps and electronic systems, aids in streamlining medication administration and monitoring, though manual interventions still pose challenges. Despite efforts to streamline operations, these phases remain complex, requiring constant vigilance to ensure patient safety. Research highlights that smart infusion pumps can reduce infusion errors by up to 80%, significantly improving clinical outcomes.

### Clinical Interventions

Clinical interventions by pharmacists are crucial in enhancing patient care and treatment efficacy across hospital settings. This analysis explores clinical interventions in medication management in South Africa's private and public hospitals, focusing on similarities, differences, and addressing the research objectives.

Both private and public hospitals recognise the importance of clinical interventions in addressing prescription discrepancies and ensuring medication safety. However, communication methods differ significantly. In private hospitals, staff commonly use phone calls or WhatsApp to liaise with doctors for resolving prescription issues, with around 25% of prescriptions requiring clarification. Conversely, in large private hospitals, interns regularly consult pharmacists, and 35% of respondents indicate frequent direct communication with doctors.

In private hospitals, clinical pharmacists significantly improve patient outcomes and hospital efficiency through antimicrobial stewardship and clinical care. Their proactive approach ensures timely treatment adjustments, vital for conditions like sepsis, and safeguards patient safety by identifying dosing errors and developing ICU protocols. A pharmacy manager from a large private hospital emphasised the importance of direct patient engagement, advocating for pharmacists' involvement in ward rounds for medication counselling.

Technology plays a transformative role in private hospitals, automating routine tasks and allowing pharmacists to focus on direct patient care. This enhances collaboration with healthcare teams, particularly in ICU settings. Discussions about further automation, such as transitioning to paperless systems, reflect a commitment to streamlining processes.

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I would prefer pharmacists to be more involved in ward rounds, where they can engage directly with patients and provide counselling on their medication.

– Pharmacy Manager

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Pharmacists in public hospitals address prescription discrepancies and promote patient safety, but public hospitals have ceased clinical ward rounds due to staff shortages. Approximately 10% to 20% of prescriptions require pharmacist intervention to address errors. The absence of clinical ward rounds in both hospital types limits pharmacists' ability to assess prescribed medications and consider patient-specific needs. Despite these challenges, leveraging technology to automate routine tasks remains a shared strategy among healthcare professionals and hospital administrators. This approach optimises operations and enhancing patient care, particularly in ICU settings.



### Issuing Medication from Ward Stock

The process of issuing medication from ward stock is crucial for immediate patient care, necessitating meticulous management and documentation to mitigate potential billing errors and system inefficiencies. In private hospitals, structured processes are established to guarantee accurate and efficient billing of ward stock. This is crucial for ensuring timely patient care, particularly in urgent situations, as unbilled stock prevents the ward from replenishing supplies from the pharmacy, potentially affecting patient care.

Large hospitals utilise a real-time e-billing system with barcode scanning, where nurses often manually document medication usage and record details before charging through the system. Scheduled drugs require additional security measures, stored separately with access limited to registered nurses (RNs), involving dual verification and documentation to ensure compliance and safety. Medium-sized hospitals also employ this real-time e-billing system, where nurses use barcode scanning to directly bill patient accounts. This technology significantly reduces errors and streamlines billing, ensuring medications are accurately recorded against the correct patient.

However, challenges such as system downtime and slow processing speeds persist, with approximately 30% of respondents, including ward stock controllers and pharmacist assistants, identifying these issues. During system disruptions, charge sheets serve as a backup, with nurses manually recording medication usage, which is later billed by the stock controller.

Small private hospitals rely on manual processes, using a “cheat sheet” to record medication usage, which is subsequently entered into the real-time e-billing system. Manual entries are necessary for items without barcodes, with stock controllers resolving discrepancies daily to maintain accurate stock levels. Challenges such as network connectivity problems and the need for manual barcode printing when product barcodes are unavailable or not utilised can cause delays and inefficiencies. Surveillance measures, including monitoring systems, are employed to ensure the efficiency and accuracy of the e-billing system, helping to identify and address these challenges.

In contrast, public hospitals do not bill ward stock directly to patient accounts. Instead, medications are expensed to the relevant ward’s cost centre and recorded on the patient file when administered. This approach poses a potential risk of stock loss if not properly controlled within the wards, leading to discrepancies in stock management and accountability. The absence of direct billing to patient accounts highlights a significant difference in practices between private and public hospitals, necessitating robust internal controls to mitigate risks.

The comparative analysis underscores the varying challenges and opportunities in medication management systems. Private hospitals benefit from technological integration, which enhances efficiency and accuracy, while public hospitals face distinct challenges requiring robust internal controls to ensure accountability. Both sectors recognise the importance of efficient ward stock management in ensuring patient safety and care quality, suggesting opportunities for enhancing systems through improved technology adoption, streamlined processes, and strengthened controls.







### Chronic Medication Management

The Chronic Dispensing Unit (CDU), managed in collaboration with a private courier pharmacy, is integral to chronic medication management in public medium hospitals in South Africa. This system offers significant benefits in terms of convenience and efficiency for patients yet involves several time-consuming tasks that require careful management and coordination.

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The CDU system has significantly improved patient satisfaction by reducing wait times at pharmacies”. “The dual-prescription system ensures continuity of care but adds to the administrative workload.

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– Pharmacist Assistant

Within these hospitals, the CDU plays a pivotal role in streamlining the distribution of chronic medications. The process is labour-intensive, involving meticulous double-checking of prescriptions, placing them in envelopes, and scanning them for pickup. Despite being time-consuming, these steps are essential for ensuring accuracy and compliance with CDU policies. Processing 40 prescriptions in a single day demands substantial time and effort, underscoring the workload involved.

The collaboration between the CDU and the private courier pharmacy enhances accessibility and convenience by facilitating the pre-packing and delivery of medications to patients at their chosen clinics. This system effectively reduces waiting times at pharmacies and alleviates the burden on hospital pharmacies, leading to improved patient satisfaction. Patients benefit from collecting their medications at nearby clinics, significantly enhancing accessibility.

Doctors in public medium hospitals typically provide two prescriptions for chronic medications—one for immediate use and another for processing by the private courier pharmacy. This dual-prescription system ensures continuity of care but adds to the administrative workload. Additionally, certain medications require specialist co-signing monthly, which restricts some patients from using the CDU service.

Patients generally see their doctor every six months for new prescriptions, which helps monitor their condition and adjust treatment plans as necessary. This regular follow-up is crucial for effective chronic disease management but requires careful scheduling and coordination.

Respondents from public medium hospitals have highlighted the importance of efficient medication management. One respondent noted, “The CDU system has significantly improved patient satisfaction by reducing waiting times at pharmacies.” Another stated, “The dual-prescription system ensures continuity of care but adds to the administrative workload.” A third respondent emphasised, “The Courier Pharmacy’s policy on certain medications adds complexity to the medication management process.” This underscores how third-party policies can affect in-house procedures, adding layers of complexity that could be streamlined for greater efficiency.

This analysis underscores the need for automation and digitalisation to streamline workflows, reduce errors, and enhance safety in chronic medication management.





## Medication Credit Management

Medication credit management is essential for accurate billing and efficient inventory control in hospital pharmacy operations. This process involves prompt review and processing of credits upon patient discharge to facilitate quick restocking and prevent over-ordering. Effective management requires meticulous coordination among pharmacy staff, nursing units, and automated systems to minimise errors and streamline operations.

In private hospitals, medication credit management is integral to maintaining operational efficiency. Large hospitals face significant challenges due to the high volume of credits, with approximately 10% to 12% of daily dispensed medications resulting in credits, primarily due to duplicate orders and over-dispensing. A pharmacy manager noted, “Efficient management is crucial to avoid excess medication.”

Large hospitals mitigate these issues by providing a day's supply of IVs and dispensing tablets in quantities sufficient for two to three days. During the day of observation, it was noted that a large hospital processed a single batch of credits, with 39 credits across three wards: the surgical ward handled 59 credits, the ICU managed up to 86 credits, and the paediatric ward processed 149 credits. However, inefficiencies in electronic billing were evident, as 50% of the credits were not processed on the e-Billing system, contributing to delays.

Staff responsible for credits also unpack boxes from 08:00 to 10:00, potentially contributing to delays in processing credits efficiently. In another large hospital, medication credits management starts with nurses completing credit notes for unused medication at patient discharge, returning them to the stock room for system crediting.

Observations reveal a backlog in shelving credited items, risking breakage and misuse. On average, 135-line items are processed daily as credit notes, indicating a substantial workload.

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Efficient management is crucial to avoid excess medication.

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– Pharmacist Manager

In small hospitals, nursing staff often place multiple orders for the same items, leading to unnecessary processing of medication credits. Pharmacist assistants spend approximately 90 minutes daily processing credits, along with handling emergency cupboard replenishment, and checking stock levels for items without barcodes.

The introduction of the POC system has streamlined the credit process, allowing nurses to process credits directly within the system, with only verification required in the pharmacy. Despite these improvements, challenges remain, such as patients being discharged on the system, which prevents credit processing about 30% of the time.

Medium private hospitals face similar challenges, with a dedicated pharmacist assistant managing the manual credit process, which takes about 4 hours daily. Credits often arrive late from wards, sometimes up to two weeks after being dispensed to the patient, impacting inventory accuracy. Stock controllers must de-identify patient labels,

manually remove items from accounts, document on credit sheets, and return them to the pharmacy, with up to 28 patient credits for a fully occupied ward, each requiring processing of 6 to 10 items. Automation potential exists to streamline the credit management process, reducing manual interventions and improving accuracy. A pharmacist assistant expressed, “Automation could significantly reduce the workload and errors associated with manual credit processing.”

Public hospitals also face challenges in medication credit management. In medium hospitals, credits are collected in a large black bin on Mondays and Fridays and processed by pharmacy stock pharmacist assistants. Each ward typically has credits from about five patients, with the process taking around two hours per week. In a large Public Academic hospital, managing unused medication often leads to discrepancies in system records, as unused medication becomes ward stock instead of being credited. Nurses may record administering stock that hasn't been officially issued, potentially using medicine credits. While the dual-verification process by nurses aims to enhance patient safety, relying on such practices when labels from previous patients are present is not considered standard good practice.

Overall, medication credit management across hospital settings presents several challenges, including inefficiencies in electronic billing, delays in credit processing, and discrepancies in inventory records. Automation and improved systems are essential to support efficient credit management and reduce the workload and errors associated with manual processes.

## Challenges in Medication Management

### Workflow Inefficiencies

Workflow inefficiencies in hospitals, primarily due to manual processes and staffing constraints, significantly impact turnaround times and operational efficiency. In private hospitals, both large and small facilities experience workflow inefficiencies. Approximately 35% of respondents, including pharmacy managers and pharmacist assistants, identified manual processes and staffing constraints as major contributors to delays. In large hospitals, turnaround times (from medication order to receiving medication order) typically range from two to three hours but can exceed three hours due to factors such as missing prescriptions (10%), unavailability of medication (5%), and deliveries to the wrong ward (5%). Automation and digitalisation are proposed as solutions to reduce these delays, freeing up time for critical tasks and enhancing workflow efficiency.

During an interview with a subject matter expert who has implemented robot dispensing technology, it was reported that this technology has streamlined workflow in a private hospital. By integrating script processing and item retrieval, the technology has made script processing 15% to 25% faster.

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The main challenge tends to be the picking process due to the volume of prescriptions handled.

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– Pharmacist

Established procedures exist for processing scripts, but departure times from the pharmacy are not logged in all pharmacies, limiting the ability to track turnaround times. Interruptions during script review are frequent, affecting efficiency. For example, in a large private hospital, a batch of 10 scripts took over three hours to process due to interruptions and layout constraints. Limited space for packing scripts raises a high risk for picking errors, necessitating increased staffing levels to handle hospital script processing more efficiently.

Small hospitals face similar inefficiencies, particularly during high occupancy or staff leave, causing medication processing delays. The stock system's inability to handle negative stock results in charging delays until stock is received. Pharmacist assistants spend considerable time manually entering stock into books and typing out labels, creating cumbersome procedures. Turnaround times vary significantly based on patient volume, with quick processing during low volume periods and delays during busy times.

Medium and large hospitals within a Private Hospital Group face workflow inefficiency due to system downtimes, manual processes, layout constraints, and dispensing interruptions. Approximately 50% of respondents identified these inefficiencies as major challenges. Scheduled system backups and manual ordering processes create bottlenecks, extending prescription processing times during peak periods. Interruptions during dispensing further slowdown the process, impacting turnaround times. Effective time management is crucial, as work pace is influenced by prescription volume and staff availability, with inefficiencies increasing as the day progresses.





In public hospitals, particularly medium and academic large facilities, workflow inefficiencies are prevalent. Approximately 65% of staff in medium hospitals reported inefficiencies, underscoring the urgent need to revisit and optimise workflows. Morning waiting times for out-patients average 15 to 20 minutes due to fewer patients, while afternoon waiting times can extend up to an hour, particularly around 10 AM and 2 PM, due to increased patient numbers. Delays occur as porters juggle multiple duties, leading to waiting time of 45 minutes to an hour after completing blueboard (medication charts). Discharges spike on Fridays and before holidays, worsening afternoon delays. TTOs (To Take Out medications) are returned to wards with porters, reducing pharmacy traffic, but patient counselling remains crucial.

Staff allocation is balanced through a roster system, though the pharmacy is short-staffed, with efforts to fill posts. The picking process is time-consuming due to high prescription volumes, with each staff member handling 12 to 14 items per script, including complex medications like insulin, adding to the workload and potential for errors. Manual picking leads to variability in speed and accuracy, affecting efficiency and patient satisfaction. Interruptions during picking and labelling worsen inefficiencies, with scripts potentially mixed up.

A Public Academic large hospital faces significant challenges due to stock-outs and prescribing errors, which have a profound impact on turnaround times. A pharmacist emphasised, "Out of stocks where items need to be collected from the stores (including paperwork and waiting for stock) and prescribing errors are major challenges which impact workflow." This issue is prevalent, with approximately 60% of respondents reporting similar experiences. The average turnaround time for scripts can range from 15 minutes to two hours, depending on the day's business.

Observations indicate that scripts arriving around 08:30 in the pharmacy only leave the pharmacy around 11:00. High TTO script volumes on Mondays and Fridays impact the processing of other scripts, necessitating strategic planning to maintain operational efficiency. Staffing shortages, particularly of pharmacist assistants, further strain resources in public hospitals. A pharmacist pointed out, "We are short of pharmacist assistants. Yesterday we had 7 pharmacists dispensing and only 3 pharmacist assistants." This shortage forces pharmacists to manage both compiling and dispensing tasks, increasing their workload and stress.

Telephonic queries also contribute to workflow inefficiencies, as people frequently phone in to speak with pharmacists, consuming valuable time, and resources. This additional demand further strains the already limited staff, impacting on their ability to manage prescriptions efficiently.

Across all hospital types, staffing levels are insufficient to meet demand, particularly during peak times or when staff are on leave. This shortage impacts the ability to manage prescriptions efficiently and increases the workload and stress on existing staff. The integration of automated systems and digital solutions is recommended to alleviate these challenges, enhance workflow efficiency, and improve patient satisfaction. Implementing electronic prescribing and enhancing systems with prompts for previously dispensed medication could reduce duplication and improve control. Implementing electronic prescribing would enhance tracking of turnaround times and system reliability.





### Stock Management

Stock management in hospitals faces challenges such as inaccurate inventory data and inefficient replenishment processes, leading to frequent shortages and urgent buy-out orders. In private hospitals, large facilities experience stock shortages often due to supplier issues and delivery delays. Although the ERP software system is reliable, human errors lead to discrepancies, and inefficiencies in ordering fast-moving items daily require time-consuming processes. In small hospitals, stock-outs occur every two weeks, necessitating urgent buy-out orders to manage shortages. Manual entry exacerbates inefficiencies, especially over weekends. Private hospitals rely on manual recording of external orders, with 2-3 orders placed daily due to limited shelf space. Replenishment involves physical shelf inspections, recorded manually in a book, and placed via their ordering system, with separate purchase orders for each supplier.

Public hospitals, particularly medium facilities, face challenges like stock-outs and pack size discrepancies, with inventory checks conducted regularly. In large hospitals, stock management is challenged by manual procedures and frequent stock-outs, with a 20% stock-out rate from direct suppliers, exacerbated by the manual nature of the process. Medium hospitals follow a multi-step ordering process, with auto orders generated through the pharmaceutical management system and sent to the depot weekly, split into different categories. The ordering process in a public academic large hospital is predominantly manual, relying on manual stock cards to track stock movements as a backup system, leading to inefficiencies. Delivery delays are notable, with non-EDL items taking up to six weeks.

The integration of robot dispensing technology in a private hospital improved stock management by facilitating dispensing, stock retrieval and improving the ordering process. The system provided valuable information on stock movement, allowing for better planning and less frequent ordering. Additionally, the system streamlined investigations into stock shortages or losses, offering a camera-recorded movement for monitoring purposes.

Replenishment of ward stock in private hospitals involve manual inspections and recording, slowing down operations. The stock replenishment system for wards lacks alerts for generating automatic orders when stock is low, and replenishing stock in the pharmacy can take 15-20 minutes for a ward, but up to 1.5 hours for theatre, with stock potentially sitting in the pharmacy awaiting verification. Both large and small hospitals have implemented weekly schedules for specific wards to streamline ordering of scheduled drugs, reducing workload, with issuing taking up to two hours and involving transferring stock on their ERP system, printing barcode labels, packing, and completing drug books.

In public hospitals, the ward replenishment process shares similarities, with manual steps contributing to delays. Orders are printed as picking lists, and pharmacist assistants manually check for discrepancies before packing. This manual oversight adds layers of complexity and slows down operations. In medium public hospitals, the process takes approximately 4.5 hours, with varying order volumes across multiple wards.



Emergency cupboard processes in private hospitals face challenges due to their manual nature, requiring manual logging and billing, with pharmacy staff conducting weekly visits and stock checks. Manual billing takes about an hour daily, with monthly checks for expired or missing stock requiring an hour and a half. In public hospitals, the emergency cupboard is predominantly utilised during weekends or evenings when the pharmacy is closed. Medications issued are recorded manually, with replenishment occurring twice weekly.

Academic large hospitals require precise documentation, with manual updates to their integrated software system and Excel lists, and labels are manually captured and printed for items. This manual approach leads to inefficiencies and highlights the need for automation to streamline operations.

Stock-outs are frequent in both private and public hospitals. In private hospitals, stock-outs are managed by contacting sister hospitals, taking 10-15 minutes to arrange, with delivery taking 1 to 1.5 hours. Supplier back orders are the most common cause, and timely communication from suppliers is crucial to arrange alternative sources. In small hospitals, stock-outs occur every two weeks, with urgent buy-out orders placed to manage shortages, and limited stock availability creates bottlenecks, preventing efficient charging, with manual entry adding to inefficiencies, especially over weekends.

Inaccurate inventory data is a significant challenge in both private and public hospitals. Approximately 25% of respondents in private hospitals reported issues with inventory accuracy, with discrepancies often arising from human errors. A stock controller noted, "The ERP system itself is quite reliable.

However, numerous discrepancies arise due to human errors." In public hospitals, manual stock cards and physical checks contribute to inaccuracies, with discrepancies in pack sizes as primary concerns. Regular audits and stock counts are conducted to ensure accuracy, but manual processes slow down operations and increase the risk of errors. In public hospitals, cycle counts are performed monthly, with each bin requiring approximately 40 minutes for counting.

Recent advancements in stock management, such as the introduction of barcodes in private and public hospitals, have improved efficiency and accuracy in stocktaking. These technologies allow for precise verification of items, reducing manual errors. However, further technological improvements are needed, including automated systems for ordering, replenishment, and tracking expiry dates, to minimise errors and enhance operational speed. Private hospitals have implemented weekly schedules to streamline drug ordering, but both private and public hospitals still rely on manual processes for stock write-offs and waste minimisation.

Despite stock write-offs being below 1% in private hospitals, challenges remain, including manual processes, inaccurate inventory data, frequent stock-outs, and delivery delays. While recent improvements have reduced administrative burdens, additional enhancements are necessary to address ongoing challenges and improve stock management efficiency.





## Quality Management

Quality management systems are essential for detecting and managing medication errors across hospital settings, though their effectiveness varies significantly. These systems reveal a complex landscape of challenges and practices aimed at ensuring patient safety and effective service delivery, with quality checks during prescribing and administration being critical components.

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We don't point fingers because when you blame others, they become defensive, and the root of the problem isn't addressed.

– Pharmacist

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In private hospitals, quality management systems are crucial for maintaining high standards of patient care. A pharmacist assistant noted that out of 50 scripts, approximately 4-5 contain errors. Pharmacists double-check scripts before they leave the pharmacy to ensure accuracy in labeling and dispensing. In ICUs, nurses maintain a one-to-one or one-to-two ratio with patients, following specific protocols requiring co-signatures for medication administration to ensure accuracy and accountability. Despite these measures, challenges persist, particularly at the transcribing stages, where nurse errors are common. A Nursing Unit Manager expressed concern about misreading prescriptions, even after verification by two nurses.

Small private hospitals benefit from consistent prescribing practices by a limited number of doctors, resulting in a lower error rate. Pharmacists conduct self-checks, rechecking their scripts after packing. Yet, during peak hours, errors in dosages and dosage forms can occur, underscoring the importance of vigilant oversight. Pharmacist assistants play a crucial role in quality management, ensuring correct labeling and timely processing of prescriptions.

Large private hospitals face challenges such as incorrect dosages, generics challenges, and transcribing errors, with transcribing errors accounting for 7%, not prescribing to antibiotic biogram at 53%, and calculation errors at 40%. Despite pharmacists double-checking scripts, approximately 5% require correction after the final check. Dispensing errors related to misreading prescriptions and missed doses due to delays in medication delivery are prevalent. A quality initiative using blue "sound-alike look-alike" stickers has been implemented to alert staff when handling similar-sounding or looking medications, enhancing accuracy in picking items. Incidents are reported electronically, conducting root cause analyses to prevent recurrence.

Quality management systems are essential for tracking medication errors and turnaround times, ensuring high standards of patient care and operational efficiency in private hospitals. Both medium and large private hospitals have implemented various strategies to manage and reduce errors effectively. However, the effectiveness of these systems can vary, highlighting the need for more active involvement in error trend analysis to improve medication safety. Approximately 45% of respondents, including pharmacists and pharmacy managers, mentioned the effectiveness of quality management systems, indicating a need for continued focus on error reduction.



In public hospitals, quality management systems are integral to maintaining high standards in medication use processes. Systems are in place to track medication errors and turnaround times, providing critical insights for continuous improvement. However, errors persist, particularly during the picking and prescribing processes.

The occurrence of prescribing errors, such as incorrect doses, durations, and occasionally the wrong drugs, is a notable issue. This concern is shared by 75% of respondents who have witnessed similar errors. Public hospitals employ a collaborative approach to quality management, involving various stakeholders to ensure patient safety.

A pharmacist highlighted the importance of collaboration, stating that multiple people must be involved before handing over a script. This approach includes clear labeling and patient counseling to ensure proper usage.

Medication errors in public hospitals present a significant challenge, with incorrect picking accounting for about 20% of errors, incorrect patient charges for about 5%, and prescription errors by doctors for about 10%. A nursing unit manager of a high-care unit addresses medication errors, attributing them to miscommunication between doctors when patients are admitted from different wards. Medication errors are reported monthly to the Clinical Manager and are ranked from near misses to those resulting in death to assess the harm done to patients.

Comparisons between private and public hospitals reveal similarities in the types of medication errors and challenges faced, such as incorrect dosages and misreading prescriptions. However, differences are evident in the approaches to quality management. Private hospitals tend to employ more technology-driven solutions, such as electronic reporting and alert systems, while public hospitals rely on manual tracking and collaborative meetings to address errors.

Across these diverse hospital settings, quality management systems play a pivotal role in safeguarding patient safety and enhancing operational efficiency. While challenges persist, the commitment to continuous improvement and technological integration offers hope for more effective and streamlined healthcare delivery. Research suggests that enhanced quality management systems with automated error reporting and trend analysis could improve medication safety and ensure compliance with national standards.



## Opportunities For Improvement

### Technology Utilisation

The current utilisation of technology in hospital settings is crucial for enhancing operational efficiency and patient care, yet it is accompanied by significant challenges. In private hospitals, electronic billing systems have been implemented to streamline billing and credit processing.

For example, in large private hospitals, approximately 80% of staff have adopted these systems after overcoming initial resistance through targeted training and support. This adoption has facilitated smoother billing processes, although medium private hospitals still struggle with outdated systems and slow Wi-Fi, which significantly hinder productivity and necessitate urgent upgrades. Pharmacy managers and pharmacist assistants have highlighted these inefficiencies, stressing the urgent need for system upgrades to improve workflow.

Public hospitals, particularly medium-sized ones, have benefited from systems like the Electronic Clinical Care Record (ECCR), which improves prescribing accuracy and patient management. However, the lack of integration in patient medication history and record systems means prescriptions often require manual verification, posing risks to patient safety. For instance, healthcare professionals must manually cross-check patient records with previous doctors, leading to inefficiencies and delays. This concern has been echoed by clinical staff who recognise the need for better integration to streamline processes.

Looking forward, both private and public hospitals are exploring further technological advancements to optimise medication management. Large private hospitals are interested in automated systems for drug control in theatres and wards, aiming to enhance medication dispensation and control.



For example, automation in theatre operations is seen as beneficial for managing physician packs during surgical cases, while electronic prescribing is considered a solution to reduce medication errors. Pharmacy managers have expressed the need for extensive training and awareness due to potential drawbacks, as previous experiences with electronic systems have shown resistance from staff, including deliberate sabotage of equipment.

Small private hospitals are keen on implementing electronic medication records and barcode scanning to provide a comprehensive view of the medication process. They believe these tools could address medication errors occurring in wards, although uncertainties remain about the full benefits of automation solutions. Medium private hospitals express interest in technology utilisation, with approximately 55% of respondents, including pharmacists and pharmacy managers, highlighting inefficiencies caused by slow systems and the need for upgrades.

Public hospitals are considering automated systems for picking and ordering, with 80% of respondents in large public academic hospitals, including pharmacy managers and clinical staff, agreeing on their potential to improve efficiency and reduce errors. The integration of barcode prescriptions and smart infusion pumps is also being explored to enhance accuracy and patient safety. Medium public hospitals are actively working towards transitioning to electronic systems to streamline processes, despite challenges such as staff not fully reviewing notes.

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Technology can definitely improve stock control and dispensing processes. We need user-friendly, fast, and effective systems.

– Pharmacist

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To optimise medication management, integrating stock levels, expiry dates, and outstanding orders can prevent overstocking or shortages. Automated ward replenishment could reduce the frequency of daily orders, streamlining operations and enhancing efficiency. For example, implementing alerts for low stock and contraindications could significantly improve stock control and reduce manual workload.

Overall, there is a consensus among stakeholders, including pharmacy managers, pharmacist assistants, and clinical staff, on the necessity of technological advancements to optimise medication management and improve service delivery within hospitals. Successful implementation requires strategic planning and addressing potential barriers, such as financial constraints and staff training needs. By demonstrating the value and benefits of technology to staff, hospitals can facilitate smoother transitions, enhance patient care, and improve operational efficiency.





## Stakeholder Engagement

Stakeholder engagement is a pivotal element in the successful implementation of automation solutions across both private and public hospitals. The involvement of key stakeholders, including healthcare professionals and management, is consistently highlighted as crucial for ensuring smoother implementation of changes and enhancing patient care.

In private hospitals, regardless of size, emphasis is placed on involving doctors, nurses, and pharmacy staff in decision-making processes. A pharmacy manager articulated, "It's about painting the picture, creating the vision, and ensuring everyone is on board and ready to listen." Another pharmacy manager from a large private hospital noted, "Including all these stakeholders ensures a smoother rollout of changes, resulting in happier patients who receive proper care." The complexity of operations in large hospitals requires coordinated efforts across departments, while the smaller scale in small hospitals allows for more direct communication and coordination.

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At a private hospital, the successful adoption of robot dispensing technology was facilitated by engaging staff in the change management process. Staff were consulted on necessary changes, and their input was incorporated into work specifications to ensure smooth transitions. While some initial resistance was encountered, the positive responses from staff encouraged buy-in, demonstrating the importance of effective communication and collaboration in change management.

In comparison, public hospitals, both medium and academic large, also stress the importance of engaging healthcare professionals and management in decision-making processes. This strategy is deemed vital for facilitating smoother implementation of changes and enhancing patient care. Coordinated efforts across departments are crucial due to the complexity of their operations.

Despite some similarities, there are notable differences in the approach to stakeholder engagement between private and public hospitals. Challenges in engagement often stem from the complexity of hospital operations, requiring coordinated efforts across various departments.

In private hospitals, especially larger ones, decision-making processes typically involve head office and IT executives, underscoring the importance of stakeholder involvement in automation and digitalisation initiatives. Smaller private hospitals, however, benefit from more direct communication and coordination, allowing for quicker adaptation to changes.

In contrast, public hospitals focus on engaging healthcare professionals to ensure the effective utilisation of new technologies and improve patient care. These initiatives are crucial for enhancing efficiency and reducing errors across all hospital environments.

Overall, stakeholder engagement is a key factor in the successful implementation of automation solutions and technological advancements in hospitals. By involving all relevant parties in decision-making processes, hospitals can ensure smoother transitions, improve patient care, and enhance operational efficiency.





## Training and Upskilling

Private hospitals, encompassing large, medium, and small facilities, and public hospitals, particularly medium-sized ones, share a common goal of enhancing clinical pharmacy skills and computer proficiency among their staff. This is deemed essential for effectively utilising new technologies and improving patient care, a sentiment echoed by 15% of respondents from private hospitals, including pharmacy managers and pharmacist assistants. A pharmacy manager from a large private hospital emphasised, "Upskilling will be required to really add value," highlighting the necessity of these programs in addressing the challenges posed by high patient volumes and limited resources.

In private hospitals, the focus varies slightly depending on the size of the institution. Medium-sized hospitals concentrate on induction training for new nurses and implementing stock level controls, while large hospitals aim to leverage technology for ongoing training and reinforcement of stability rules.

Approximately 40% of respondents, including pharmacists and nursing unit managers, identified training, and upskilling as crucial for enhancing performance. A nursing unit manager remarked, "To create a better workflow, it is believed that improving the skills of nurses on the floor and investing in a skills replenishment system to mitigate risk would be beneficial." This underscores the importance of continuous development to improve efficiency and reduce errors.

Public medium hospitals similarly prioritise training programs to enhance clinical pharmacy skills and computer proficiency, recognising their vital role in ensuring staff can effectively utilise new technologies and improve patient care. These initiatives are critical for increasing efficiency and reducing errors across all hospital environments.

Public hospitals focus on induction training for new staff, implement stock level controls, and leverage technology for continuous training and reinforcement of operational guidelines. By advancing the skills of healthcare staff and investing in development systems, these hospitals aim to establish better workflows and mitigate risks.

Overall, training and upskilling are vital components in the successful implementation of automation and digitalisation in medication management. By investing in these initiatives, hospitals can enhance operational efficiency, improve patient care, and better adapt to technological advancements.





# Discussion

The integration of automation and digitalisation in medication management within South African hospitals presents a multifaceted landscape of opportunities and challenges. Insights from industry experts highlight the transformative power of automation in healthcare workflows, emphasising its potential to patient safety and operational efficiency. Automation enables healthcare professionals to shift focus from routine tasks to high-value, patient-centered activities, driving overall operational excellence. As one expert noted, “Automation is not just about replacing manual processes; it’s about enhancing the quality of care.”

In the majority of hospitals where observations were conducted, a low level of digital and automation maturity was evident. Nonetheless, one large hospital distinguished itself by advancing in its digital transformation journey, having successfully implemented electronic solutions for medication prescribing, ordering, and recording the administration of medicines.

Furthermore, despite variations in hospital size and setting, the processes observed were largely analogous, with complexity primarily arising from the scale of operations.

## Barriers to Implementation

The findings from internal stakeholder interviews and hospital research underscore several barriers to implementation, including infrastructure limitations, data quality issues, and human resource constraints.

South Africa’s healthcare system is characterised by disparities between the public and private sectors, with public hospitals often facing resource constraints. The fragmented health data systems and limited technical expertise hinder large-scale automation implementation. The reliance on manual processes for medication management, such as stock management and prescription handling, exacerbates inefficiencies and error risks.



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Automation is not just about replacing manual processes; it’s about enhancing the quality of care.

– Industry Expert

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Research findings reveal that manual processes in prescribing and transcribing lead to frequent issues such as illegible handwriting and incomplete prescriptions, consuming significant time in interventions. The dispensing process is similarly affected by errors and delays due to manual entry and verification steps, while the manual picking of medications further contributes to inefficiencies by requiring significant time and effort from pharmacy staff, often leading to bottlenecks and increased error rates.

The quality and applicability of health data pose significant challenges for automation readiness. Automated models trained on varying contexts might overlook local disease indicators, leading to inefficiencies in medication management. Hospital research indicates that the lack of integration in patient medication history and record systems complicates processes, requiring manual verification and frequent communication with doctors. This impacts the effectiveness of electronic systems in enhancing safety and operational efficiency.

The shortage of healthcare professionals, particularly pharmacists and nurses, impacts patient care and operational efficiency. This shortage leads to increased workload, stress, and burnout among staff, further complicating the adoption of automation solutions.

Training and upskilling initiatives are crucial for enhancing clinical pharmacy skills and computer proficiency, enabling staff to effectively utilise new technologies. Hospital research findings indicate that workflow inefficiencies, primarily due to manual processes and staffing constraints, significantly impact turnaround times and operational efficiency. The administration and monitoring of medication require rigorous checks, with technology integration aiding in streamlining processes.

### Opportunities for Improvement

Despite existing challenges, there are significant opportunities for enhancing medication management through automation and digitalisation, as the current utilisation of technology in hospital settings is crucial for improving operational efficiency and patient care; research highlights the potential for automated systems such as Automated Dispensing Cabinets (ADCs) to reduce nurse workload and medication errors, Automated Dispensing Systems to streamline storage and retrieval processes, and Electronic Prescribing and Records to improve safety and communication, all contributing to enhanced stock control, dispensing processes, and billing accuracy.

Engaging healthcare professionals and management in decision-making processes is vital for facilitating smoother implementation of changes and enhancing patient care. Hospital research suggests that coordinated efforts across departments can improve efficiency and reduce errors. Strong advocacy, effective collaboration, and early system integration are pivotal for accelerating the adoption of automation, overcoming resistance, and ensuring long-term success and transformation.

Investing in training programs to enhance clinical pharmacy skills and computer proficiency is essential for effectively utilising new technologies and improving patient care. Hospital research indicates that continuous development can improve efficiency and reduce errors. By advancing the skills of healthcare staff and investing in development systems, hospitals aim to establish better workflows and mitigate risks.



**Automated Dispensing Cabinets** are pivotal in enhancing time efficiency and shifting focus from routine tasks to more impactful, patient-centered care. These cabinets reduce the workload for nurses by automating the stocking and dispensing of medications, allowing them to focus on direct patient care. The integration of ADCs can significantly reduce medication errors and improve inventory management by minimising stockouts and expired medications.

**Automated Dispensing Systems** can significantly reduce dispensing errors and medication wastage. By integrating robotics with hospital IT systems, automated dispensing systems streamline storage, retrieval, and distribution processes, enhancing accuracy and efficiency.

**Electronic Prescribing and Records** can automate checks for drug interactions and allergies, reducing medication errors and improving workflow efficiency. Electronic health records (EHRs) facilitate seamless data exchange between departments, enhancing communication and patient safety.

**Smart Infusion Pumps** optimise clinical workflows by ensuring controlled delivery of medications, automatically calculating infusion rates based on protocol inputs. Smart infusion pumps reduce infusion errors and improve clinical outcomes, particularly in high-risk environments like ICUs.

**Data Analytics** utilisation to monitor medication usage patterns and identify trends can optimise inventory management and inform decision-making. Data-driven insights enable hospitals to make informed choices about medication selection, stocking levels, and workflow improvements.



## Innovative Funding Strategies

Exploring innovative financial models, such as multi-year payment plans and leasing models, can make automation more financially accessible. Managed services models and fee-per-drug systems can align costs with usage, providing a value-added proposition for automation solutions. Public-private partnerships can drive automation adoption, leveraging strengths from both sectors to improve medication management. Hospital research highlights the importance of strategic investment planning to ensure measurable ROI, even in resource-constrained environments.

Overall, the integration of automation and digitalisation in medication management holds significant potential to transform healthcare delivery in South Africa. By addressing infrastructure limitations, data quality issues, and human resource constraints, hospitals can enhance operational efficiency, accuracy, and patient care. Strategic proposals, such as investing in infrastructure development, prioritising workforce training, and exploring innovative funding strategies, offer a pathway to overcoming these challenges and capitalising on the opportunities for improvement.





# Strategic Proposals

To facilitate the adoption of automation and digitalisation in South African hospitals, several strategic steps are recommended:

## Infrastructure Development



Invest in robust digital infrastructure to support automation solutions. This includes integrating electronic health records (EHRs) and pharmacy systems to enhance medication safety and efficiency.

## Training and Upskilling



Implement comprehensive training programs to enhance clinical pharmacy skills and computer proficiency among healthcare staff. This will ensure effective utilisation of new technologies and improve patient care.

## Change Management



Engage stakeholders in decision-making processes to facilitate smoother implementation of changes. Effective communication and collaboration are crucial for overcoming resistance and ensuring successful integration.

## Efficiency and Accuracy Improvements



Automation can significantly enhance efficiency and accuracy in medication management. By reducing manual interventions, hospitals can streamline workflows, minimise errors, and improve patient care.

## Quantifying Potential Benefits



Automation can lead to a substantial reduction in dispensing errors and medication wastage. These improvements contribute to enhanced operational efficiency and patient safety, offering measurable benefits for hospitals.

## Regulatory Compliance



Ensure compliance with regulatory standards to safeguard patient safety and quality care. Continuous updates to regulations are necessary to accommodate automated medical devices.

## Stakeholder Engagement



Involve healthcare professionals and management in decision-making processes to ensure effective utilisation of new technologies and improve patient care.

## Continuous Evaluation



Implement robust quality management systems to track medication errors and turnaround times, ensuring high standards of patient care and operational efficiency.





## Conclusion

The integration of automation and digitalisation in medication management holds significant potential to transform healthcare delivery in South Africa. By addressing infrastructure limitations, regulatory issues, and human resource constraints, hospitals can enhance operational efficiency, accuracy, and patient care. Strategic proposals, such as investing in infrastructure development, prioritising workforce training, and exploring innovative funding strategies, offer a pathway to overcoming these challenges.

Automation can revolutionise patient safety by reducing medication errors and enhancing real-time oversight. The adoption of tailored solutions, supported by stakeholder engagement and continuous evaluation, is crucial for successful integration. By leveraging automation, hospitals can optimise processes, minimise implementation challenges, and improve patient outcomes. The vision for the future of medication management in South African hospitals focuses on improved patient outcomes and operational efficiencies. Stakeholders are encouraged to consider these proposals and take action towards implementing automation solutions, paving the way for a more efficient and equitable healthcare system.





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