



## The Case for Automation in Medication Management in South African Hospitals

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# Executive Summary

South Africa's healthcare system stands at a pivotal moment. Confronted with persistent disparities between the public and private sectors, mounting disease burdens, and operational inefficiencies, the system faces mounting pressure to deliver better outcomes with limited resources. While public hospitals serve approximately 84% of the population, they receive less than half of the country's total healthcare funding. In contrast, the private sector, serving just 16% of the population, commands more than half of healthcare spending<sup>1</sup>. This imbalance contributes to stark differences in infrastructure, staffing levels, and quality of care.

Against this backdrop, one critical area ripe for transformation is the medication management cycle — the set of processes that ensures the right person receive the right medication, in the **right** dose, administered through the **right** route at the **right** time. Across prescribing, dispensing, administration, stock management, and billing, inefficiencies are frequent, and errors can have profound consequences for patient safety.

Manual systems continue to dominate in most hospitals, leading to delayed access to medicines, frequent stockouts, high administrative burdens, and preventable clinical errors<sup>2</sup>. Nurses, pharmacists, and managers spend significant portions of their time on medication-related activities — in some cases more than 40% of a pharmacist's time in emergency settings — often interrupted by manual verifications or issues related to stock availability<sup>3</sup>. These interruptions not only slow workflows but also raise the risk of errors that compromise patient safety.

Automation and digitalisation across the medication management value chain have the potential to radically improve efficiency, accuracy, and patient outcomes. Internationally, hospitals that have implemented advanced digital systems for prescribing, dispensing, and monitoring have reported reductions in medication errors, faster turnaround times, and improved inventory management.

This white paper explores the urgent need for improved medication management in South Africa, assesses opportunities for automation across the value chain, identifies implementation barriers, and proposes a framework for successful adoption.

The insights presented are drawn from a comprehensive study that combined desk research, expert interviews, and on-site observations. This integrated methodology enabled a thorough examination of current medication management processes and the identification of practical opportunities for technological enhancement.



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# Introduction: The State of South Africa's Healthcare System

South Africa's healthcare landscape is defined by a dual public-private structure with stark disparities in access, quality, and resource allocation. The public sector, funded primarily through taxation, serves approximately 84% of the population but receives less than half of total healthcare expenditure. In contrast, the private sector, financed through medical schemes and out-of-pocket payments, serves only 16% of the population yet absorbs more than 50% of spending<sup>1</sup>.

This imbalance results in significant quality gaps. Public facilities often contend with budget constraints, infrastructure backlogs, and chronic shortages of healthcare professionals<sup>4</sup>. With just 30 pharmacists per 100,000 people, well below the global average of 48<sup>5</sup>, and fewer than 2.5 nurses per 1,000 people<sup>6</sup>, the system struggles to meet patient needs, especially in rural and underserved regions.

The burden of disease is both high and complex. Communicable diseases remain a priority, with over 290,000 new tuberculosis cases reported in 2022<sup>7</sup> and HIV prevalence remaining significant across the WHO African Region<sup>8</sup>. At the same time, non-communicable diseases such as diabetes, cancer, and cardiovascular conditions are increasing, driven by lifestyle factors, ageing demographics, and rising life expectancy<sup>9</sup>. This "double burden" amplifies demand for medicines and complicates treatment protocols.

Against this backdrop, optimising healthcare delivery is critical. Strategic process improvements, supported by automation and digitalisation, offer opportunities to strengthen patient safety, reduce waste, improve operational efficiency, and enable healthcare workers to devote more time to direct patient care<sup>10</sup>.



**Public sector:**  
Serves ~84% of the population  
but receives <50% of healthcare  
spending.

**Private sector:**  
Serves ~16% of the population  
but absorbs >50% of spending.





# The Case for Automation in Medication Management

Medication management is a cornerstone of hospital healthcare, directly influencing patient safety, clinical outcomes, and operational efficiency. Medication management encompasses the entire process by which medicines are prescribed, procured, dispensed, administered, and monitored. When these processes are manual or fragmented, inefficiencies multiply, leading to delays in procuring and delivering medicines to patients, stockouts caused by inaccurate inventory tracking, errors during prescribing, dispensing or administration, and inefficient use of staff time due to repetitive manual checks<sup>11</sup>.

Automation offers a transformative opportunity to address these inefficiencies. Digital health tools; including electronic prescribing systems, automated dispensing cabinets, and smart infusion pumps; can streamline processes, improve medication accuracy, optimise inventory control, and enhance clinical workflows<sup>2</sup>. Integrated digital medication management systems link prescribing, pharmacy, and ward-level administration into a seamless, end-to-end process.

They enable automated drug interaction and allergy checks, provide real-time inventory visibility, and use barcode scanning to ensure the correct patient receives the right medicine, dose, and at the right time. These systems also integrate real-time billing, reducing potential revenue loss<sup>12, 13</sup>.

Globally, hospitals adopting integrated medication management solutions are seeing measurable gains in safety, efficiency, and financial performance<sup>2</sup>. For South Africa, automation is not merely a technological upgrade, it is a strategic imperative to modernise healthcare delivery, optimise scarce resources, and accelerate system performance in an increasingly complex care environment.



- **Automated Dispensing Cabinets (ADCs)** automate the stocking and dispensing of medications, reducing nurse workload and minimising medication errors while improving inventory control<sup>14</sup>.
- **Automated Dispensing Systems**, when integrated with hospital IT, streamline the storage, retrieval, and distribution of medications, significantly reducing dispensing errors and medication wastage<sup>15</sup>.
- **Electronic Prescribing and Health Records** automate checks for drug interactions and allergies, improving workflow efficiency and enhancing communication between departments<sup>16</sup>.
- **Smart Infusion Pumps** ensure controlled and accurate medication delivery, reducing infusion errors and improving clinical outcomes, especially in high-risk settings like ICUs<sup>17</sup>.
- **Data analytics** monitor medication usage patterns and trends, enabling hospitals to optimise inventory management and make more informed operational decisions<sup>18</sup>.





# Automation Across the Medication Management Value Chain

A closer examination of medication management in South African hospitals reveals that the level of automation and digitalisation varies significantly throughout the process. Each stage presents distinct challenges, opportunities, and readiness levels for adopting more advanced solutions.

## Prescribing and Transcribing

### Current Challenges and Inefficiencies:

- **Private hospitals:** Handwritten prescriptions are still the norm. This creates transcription errors, with nearly 40% of pharmacist assistants and nursing unit managers citing legibility problems. Missing allergy information is common, increasing patient safety risks. In large facilities, prescription queries affect around 10% of scripts daily, requiring up to an hour of follow-up time. Smaller hospitals face similar challenges, with pharmacist needing to clarify 5-10 prescriptions every day – often due to incorrect dosage.
- **Public hospitals:** While medium and large facilities have adopted electronic prescribing, most inpatient prescriptions continue to be handwritten. Around 70% of staff report problems related to illegible handwriting and incomplete prescriptions, often requiring additional communication with doctors to resolve errors. Even where electronic systems are in place, the continued use of printed prescriptions and limited integration with pharmacy software contribute to slower turnaround times and make it more difficult to verify patients' complete medication histories.

### Technology Utilisation:

- **Private sector:** Most facilities still rely on handwritten orders, with only limited Computerised Physician Order Entry (CPOE) use. This increases workload for transcription and data verification and undermines quality control.
- **Public sector:** CPOE is partially implemented and can generate allergy and drug interaction alerts. However, limited integration with pharmacy and Electronic Medical Records (EMR) systems reduces its potential impact.

### Implications for Stakeholders

- **Clinicians** face constant interruptions to clarify orders
- **Pharmacy staff** spend excessive time on administrative follow-ups rather than clinical tasks.
- **Patients** experience treatment delays and are at greater risk of medication errors.

### Quality Management:

Systemic weaknesses – particularly in the accuracy and completeness of prescriptions – drive a need for stronger controls. Comprehensive, fully integrated CPOE systems with clinical decision support could reduce manual clarifications, improve prescribing accuracy, and free up staff for patient-facing interventions.



Computerised Physician Order Entry (CPOE) systems standardise the process by allowing clinicians to enter prescriptions directly into a central system. These systems:

- Provide real-time alerts for allergies, interactions, or contraindications.
- Reduce transcription time and errors.
- Enable integration with patient electronic medical records (EMRs).

Globally, CPOE adoption has led to up to a 55% reduction in medication errors. In South Africa, this could free up nursing and pharmacy time for more patient-focused activities.



## Dispensing

### Current Challenges and Inefficiencies:

- **Private hospitals:** Large facilities have structured workflow for logging and prioritising prescriptions, yet 30% of staff report frequent delays and errors. TTO (To Take Out) prescriptions often create a peak-hour bottleneck, especially between 10:00 and 12:00. Physical space constraints in busy pharmacies make it harder to pick and sort medicines accurately, increasing the risk of mix-ups. Smaller facilities can process prescriptions faster (~30 minutes) with pharmacists directly involved but still face space and staffing limitations during peak discharge periods.
- **Public hospitals:** Medium facilities follow a triple-check process, yet manual picking and labelling remain error-prone – 40% of mistakes are linked to manual data entry or space limitations. Large facilities benefit from barcode scanning and electronic outpatient prescription submissions, but delays persist due to stock shortage and manual sorting. Up to 20% of inpatient prescription require dosage clarification from pharmacists.

### Technology Utilisation

- **Private hospitals:** Dispensing is still predominantly manual, even in large facilities. Digital tools, where present, are often limited to final-check barcode scanning or simple prioritisation systems, with minimal integration into prescribing, billing or stock platforms.
- **Public hospitals:** Some large facilities use barcode scanning and electronic prescription systems to verify dispensing accuracy and track inventory real time. However, incomplete integration with pharmacy, prescribing, and stock systems limits full automation, requiring manual workarounds. Medium and smaller facilities remain largely manual, with only basic or inconsistent use of scanning tools.

### Implications for Stakeholders

- **Pharmacy staff** face repetitive administrative tasks and spend less time on clinical verification and patient counselling.
- **Ward staff** experience delays in receiving urgent medications, affecting care timelines.
- **Patients** face delays in the discharge process and are at risk of errors in their take-home medications.

### Quality Management

Multi-step verification is standard, but manual processes introduce delays and errors. Expanding the use of barcode-enabled dispensing, automated storage and retrieval systems, and fully integrated inventory systems could strengthen both safety and efficiency.



- **Automated Dispensing Cabinets (ADCs)** can provide secure, computerised storage that will accurately track and dispense medicines, reducing medication errors and improving patient safety.
- **Integration with stock control systems** to trigger alerts before stockouts occur.
- **Barcode verification** at the point of dispensing to ensure accuracy.
- **Digital tools** can streamline patient record-keeping, coordinate refills, and automate communication with patients (e.g., SMS reminders).
- **Automating credit tracking** and integrating it with ward ordering systems can reduce duplication, improve reconciliation, and lower operational costs.



## Administration and Monitoring

### Current Challenges and Inefficiencies:

- **Private hospitals:** Nurses in private hospitals verify patient identity through wristbands, verbal confirmation, and chart reviews, but rely heavily on manual flow charts for documentation – causing delays in record completion.
- **Public hospitals:** Medication administration in public hospitals also relies on manual verification methods. Documentation is inconsistent often recorded on paper, and adoption of mobile or electronic tools is patchy.

### Technology Utilisation

- Smart infusion pumps are being adopted to automate infusion rate calculations, reducing manual calculation errors.
- Electronic Medication Administration Records (eMARs) in larger hospitals improve accuracy and allow real-time monitoring.

#### Implications for Stakeholders

- **Nursing staff** face increased documentation burdens, limiting time with patients.
- **Patients** benefit from safer administration protocols but may experience delays if verification steps are slowed by manual processes.

### Quality Management

Safety protocols such as barcode wristband scanning, verbal confirmation, and real-time ICU monitoring reinforce adherence to the **“five rights” of medication administration (right patient, right drug, right dose, right route, right time)**. Expanding eMAR usage and ensuring consistent staff training could close documentation gaps and reduce risks.



## Clinical Interventions

### Current Challenges and Inefficiencies:

- **Private hospitals:** Pharmacists play an active role in antimicrobial stewardship, dose adjustments, and ICU medication protocols. Their interventions usually take place during prescription review and medication reconciliation, with clarification required for approximately 25% of prescriptions. Pharmacists regularly communicate directly with doctors and participate in ward rounds more frequently than in the public sector, although the extent of coverage varies depending on the ward and the size of the facility.
- **Public hospitals:** Pharmacists intervene in 10–20% of prescriptions but have a limited presence on wards due to staffing constraints. Much of their time is dedicated to dispensing and stock management, leaving less opportunity for direct clinical care at the bedside.

### Technology Utilisation

- Automation of routine administrative processes – such as dispensing or stock reconciliation – allows pharmacists to focus more on clinical decisions and multidisciplinary care, particularly in ICUs.



#### Implications for Stakeholders

- **Pharmacists** could significantly increase their clinical impact if freed from routine administrative duties.
- **Patients** benefit from more personalised treatment adjustments, leading to shorter hospital stays and better outcomes.

### Quality Management

The absence of structured ward rounds limits personalised medication management. Greater integration of decision-support technology could enhance pharmacists' clinical roles across both public and private sectors.





## Stock Management

### Current Challenges and Inefficiencies:

- **Private hospitals:** Large facilities experience shortages due to supplier delays and late deliveries, while smaller facilities report stock-outs every two weeks, often requiring urgent “buy-out” orders from alternative suppliers. Replenishment typically involves physical shelf inspections and manual system entry, with 2-3 orders placed daily due to limited storage space.
- **Public hospitals:** Medium and large facilities sometimes rely on manual stock cards and physical counts causing replenishment delays. Non-EDL (Essential Medicines List) orders can take up to six weeks to process due to multi-level approval requirements. Full digital integration with ordering platforms remains rare.

### Technology Utilisation

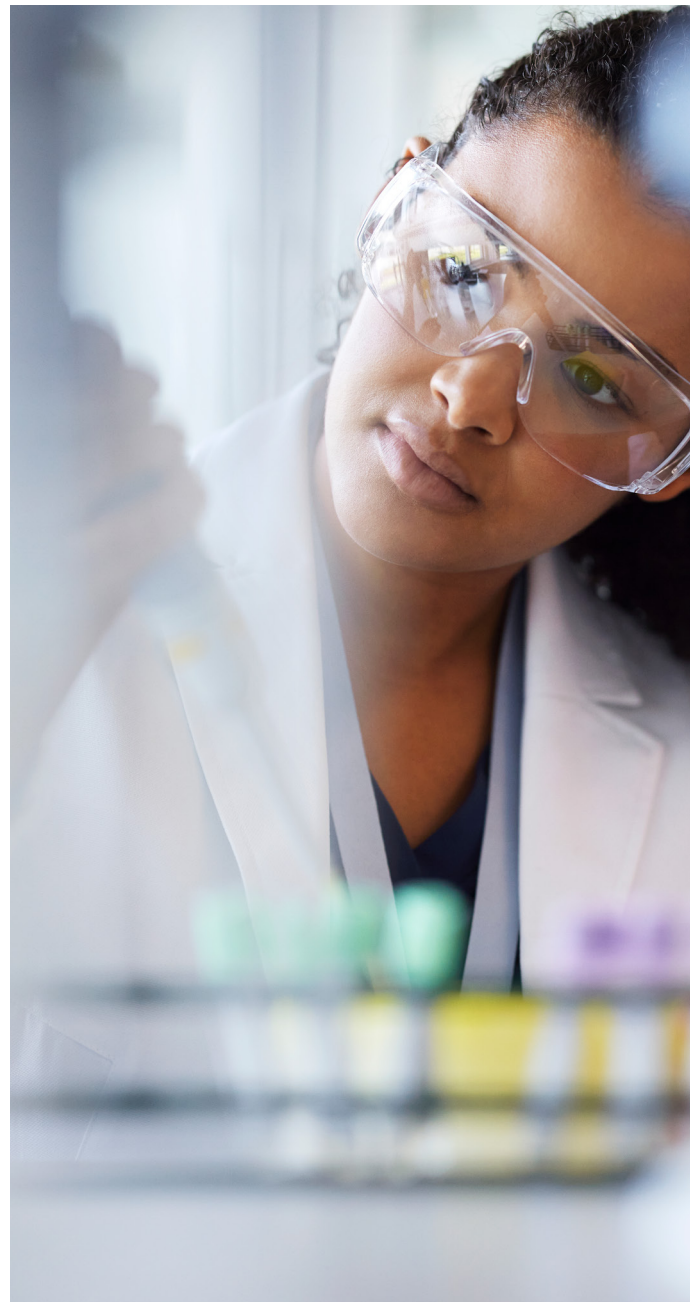
- Barcode scanning has improved accuracy and reduced manual errors in some hospitals.
- In one of the private facilities, the robotic dispensing system manages stock retrieval, ordering, and expiry tracking, with real-time monitoring reducing wastage by up to 84%.
- Many smaller or semi-urban facilities still operate on manual or semi-digital processes, limiting responsiveness.

### Implications for Stakeholders

- **Pharmacists** spend excessive time on manual audits and stock reconciliations instead of clinical duties.
- **Nursing staff** face delays in patient care when urgently needed medicines are unavailable.
- **Hospital Managers** contend with higher operational costs from wastage, urgent procurement, and unplanned deliveries.

### Quality Management

While regular audits are common, manual reconciliation is slow and prone to human error. End-to-end automation for ordering, replenishment, and expiry tracking could ensure more reliable medicine availability and reduce wastage.





# Addressing Barriers to Implementation in South Africa

The implementation of automation in medication management within South African hospitals presents a transformative opportunity for patient safety, operational efficiency, and healthcare quality. However, several interlinked challenges must be addressed to realise its full potential.

## Key Barriers



- **Cost and Funding Constraints:** Deploying automation technologies demands substantial upfront investment in hardware, software, infrastructure, and continuous staff training. Budget limitations—particularly in the public sector—often delay or limit implementation, while competing priorities for scarce resources further hinder adoption.



- **Infrastructure Gaps:** Many healthcare facilities operate with unreliable power supply, inadequate backup systems, and inconsistent network connectivity. These deficiencies undermine the performance of digital systems and limit the scalability of automation projects. In addition, device shortages and insufficient secure data storage capacity compromise both functionality and compliance.



- **Skills Shortages:** Expertise in IT infrastructure, clinical informatics, and digital health operations is limited. A lack of technical and operational capacity impedes both the deployment and long-term sustainability of automation solutions.



- **Regulatory and Compliance Complexity:** Automation systems must meet stringent national standards for data protection, patient confidentiality, and electronic health record management. Navigating this regulatory environment can slow implementation.



- **Human Factors and Change Management:** Resistance to change, cultural barriers, and uncertainty about job impacts can inhibit staff acceptance.

Without strong leadership, transparent communication, and comprehensive training, adoption rates and system utilisation may remain low.

A strategic, coordinated approach is essential to overcome barriers to medication management automation. National health policies should explicitly prioritise automation as a driver of healthcare transformation. Investment in robust IT infrastructure and secure data storage is needed to support digital systems.

Continuous training for clinical, pharmaceutical, and IT staff will ensure effective use of these technologies. Establishing interoperability standards will enable seamless integration and data sharing between public and private sectors. Phased implementation, starting with high-impact areas like ICUs, can deliver early improvements in patient safety before expanding more widely. Ongoing monitoring and evaluation should be embedded to track outcomes and guide continuous improvement.



## Anticipated Outcomes of Successful Automation

When these foundational elements are established, South African hospitals can expect:

- **Enhanced Patient Safety:** Significant reductions in medication errors, improving patient outcomes and public trust.
- **Operational Efficiency:** Faster turnaround times reduced administrative bottlenecks, and improved patient throughput.
- **Cost Optimisation:** Lower wastage, better inventory control, and minimised revenue leakage.
- **Workforce Empowerment:** More time for clinical interventions and direct patient care, increasing job satisfaction.
- **Data-Driven Decision-Making:** Real-time analytics to inform clinical decisions, monitor epidemiological trends, and improve supply chain management.



# Building Blocks for Successful Automation in Medication Management

The successful implementation of automation in South African hospitals requires a coordinated approach that combines infrastructure readiness, workforce development, policy alignment, and sustainable funding. When strategically planned and executed, automation can transform medication management, improving efficiency, accuracy, and patient safety.

## Strategic Policy and Governance

National health policies should explicitly support the integration of medication management automation, backed by updated regulatory frameworks to accommodate evolving technologies. Establishing interoperability standards will ensure that systems function seamlessly across both public and private healthcare sectors.

## Infrastructure Development

Robust digital infrastructure is essential, including reliable IT networks, secure data storage, and the integration of electronic health records (EHRs) with pharmacy management systems. Targeted infrastructure upgrades should focus initially on high-impact areas such as intensive care units, where automation can yield the most significant safety and efficiency gains.

## Skills Development and Change Management

Continuous training and professional development are critical for empowering staff to effectively use new systems. Training programs should cover both advanced clinical pharmacy skills and digital literacy. Change management strategies—emphasising clear communication, collaborative decision-making, and stakeholder engagement—are vital to overcoming resistance and ensuring smooth adoption.

## Funding and Investment Models

In resource-constrained environments, innovative funding approaches can accelerate adoption. Options such as leasing, multi-year payment plans, managed service contracts, and public-private partnerships can spread costs and reduce upfront capital requirements. Demonstrating measurable return on investment (ROI) through reduced errors, improved productivity, and cost savings strengthens the case for sustained investment.

## Robust Monitoring and Evaluation

Automation can significantly reduce dispensing errors, minimise medication wastage, and streamline workflows by decreasing manual interventions. A robust monitoring and evaluation framework should be in place to track performance indicators such as error rates, stockouts, turnaround times, and staff productivity. Continuous evaluation ensures that technology delivers tangible improvements in patient care and operational performance.

## Stakeholder Engagement for Long-Term Success

Active involvement of healthcare professionals, pharmacy staff, and hospital leadership throughout the planning, implementation, and optimisation phases is essential. By fostering ownership and aligning technological changes with frontline needs, hospitals can maximise the long-term impact of automation.







# Conclusion and Call to Action

Automation in medication management is a critical necessity for South African hospitals, improving patient safety, treatment outcomes, and cost-efficiency. To realise these benefits, healthcare leaders, policymakers, and private partners must collaborate on infrastructure investment, clear policies, and phased implementation.

Overcoming infrastructure gaps, regulatory hurdles, and workforce limitations will enhance accuracy, efficiency, and care quality. Real-time analytics will further support clinical decisions, epidemiological tracking, and supply chain management, fostering a responsive and equitable healthcare system.

Embracing automation is essential to modernising South Africa's healthcare—optimising processes, reducing errors, and improving outcomes. The call is clear: adopt automation now to drive meaningful, lasting change for all South Africans.

## Full Report

This white paper presents key insights from a comprehensive study on medication management automation in South African hospitals.

Read the full report, Medication Management in Hospital, for an in-depth analysis and detailed findings here. [➤](#)



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