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Inefficiencies in healthcare supply chain management and their impacts on rural clinics in South Africa

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Background: Supply chain management (SCM) inefficiencies continued to undermine service delivery in rural primary healthcare (PHC) facilities in South Africa. Rural primary healthcare facilities depend on reliable procurement, storage and distribution systems to maintain continuity of care, yet these processes are frequently constrained by centralised administrative structures and limited operational autonomy at clinic level. Within resource-constrained settings, such disruptions extend beyond logistical inconvenience, shaping service accessibility, managerial workload and ultimately the quality of patient care.

Objectives: This study examined key SCM inefficiencies in rural PHC clinics and analysed their operational and clinical impacts on clinic operations, patient care, service delivery and health outcomes and proposed improvement strategies from operational managers (OMs) and PHC supervisors' perspectives.

Method: A qualitative exploratory design was applied across 61 rural PHC facilities in KwaZulu-Natal's uMkhanyakude District. Nineteen participants, including 17 OMs and two PHC supervisors, were purposively sampled. Semi-structured interviews were conducted and analysed with NVivo.

Results: The study found persistent procurement delays caused by centralised, bureaucratic systems, limited supplier engagement and manual stock tracking. Infrastructure maintenance was slow and uneven, storage was poorly managed, leading to stock-outs, staff overload and service disruptions, which forced OMs to use personal resources to sustain clinic operations.

Conclusion: Supply chain management (SCM) inefficiencies significantly constrained PHC clinic operations, diverted managerial attention from clinical oversight and eroded patient trust. Addressing these challenges required decentralised procurement authority, digital inventory systems, targeted managerial training and responsive maintenance mechanisms.

Contribution: The study provided empirical evidence from frontline managers: a perspective rarely examined in rural healthcare SCM research. It linked systemic SCM inefficiencies to operational and equity challenges and strengthened SCM scholarship by showing how procurement, inventory, and distribution barriers shape rural PHC performance. By using dynamic capabilities theory, institutional theory, and the SCM operations reference model, this study explained managerial adaptation and identified practical pathways to improve health SCM, guiding policymakers and health leaders to enhance system resilience and advance universal health coverage.

Keywords: primary healthcare; medical supply chain; operational management; rural clinics; health service delivery; supply chain inefficiencies; healthcare logistics; South Africa.

Introduction

Effective management of the supply chain management (SCM) component of the health system is a critical enabler of health service delivery in primary healthcare (PHC) systems, especially within rural settings that have limited resources (Mbunge, Dzinamarira & Fashoto 2022). In low- and middle-income countries (LMICs) such as South Africa, operational managers (OMs) at the clinic or facility level are central to ensuring the uninterrupted availability of essential medical and other supplies, and the provision of health services (Mukeredzi, Sithole & Madondo 2023). Throughout this article, the terms 'facilities' and 'clinics' are used interchangeably. However, despite policy emphasis on decentralised health service delivery, medical supply chains remain characterised by bureaucratic procurement systems, fragmented storage management and weak infrastructure maintenance processes (Matlala, Mokgobu & Nkosi 2021). These inefficiencies are naturally hidden in the formal and approved way the facilities operate but manifest as delays

in operations, interruptions in service delivery and compromised patient outcomes (Pienaar, Luthuli & Moodley 2024; Sanni, Shittu & Akinyele 2020).

The challenges and bottlenecks within the SCM not only hinder medical and other resource availability but also exacerbate workload imbalances and limit the managerial capacity of OMs who often perform dual clinical and administrative roles (Mahlaba, Dlamini & Makhanya 2021). Studies in the South African context consistently highlight challenges such as prolonged non-stock item (NSI) requisition processes, lack of direct supplier engagement and inadequate information systems for inventory management, particularly in rural PHC facilities (Gumede, Ndlovu & Mthethwa 2019; Tshabalala, Moyo & Zwane 2022). These structural limitations, compounded by delays in infrastructure maintenance, restrict the timely procurement and delivery of essential supplies, thereby undermining PHC service quality and continuity (Pillay, Govender & Ndlovu 2023).

These challenges are not confined to the health sector. Across LMICs, rural SCM in agriculture, education and essential service delivery also experience persistent inefficiencies, including weak transport networks, centralised procurement and limited digital tracking (Wieland & Durach 2021; Yadav 2024). Positioning rural healthcare within this wider landscape highlights that the problems faced by PHC facilities mirror broader last-mile delivery and resilience issues in resource-constrained settings (Ergun, Keskinocak & Swann 2023). This positioning strengthens the study's contribution to wider transport and SCM debates. Therefore, this study focuses on the product flow within the rural PHC SCM, with specific attention to the procurement, storage, distribution and availability of essential medicines and essential consumables at the clinic level.

Globally, strengthening rural healthcare SCM systems is recognised as fundamental and core to improving health outcomes and strengthening health systems in rural and marginalised communities (World Health Organization [WHO] 2021). However, in South Africa, policy frameworks such as the Ideal Clinic Realisation and Maintenance (ICRM) programme have not fully addressed the operational barriers and challenges faced at the PHC level, including persistent SCM-related shortages and inadequate procurement independence (Rispel, Setswe & Ntuli 2020). Although recent innovations such as digital inventory systems and decentralised procurement platforms show promise in enhancing SCM resilience, evidence remains limited regarding their adoption, implementation and impact in rural clinic settings (Naidoo, Sibiya & Zulu 2023; Ouma, Chikoko & Banda 2024).

Given the problems mentioned in the rural PHC setting, this study therefore aims to critically examine SCM inefficiencies affecting the management of medical supplies, stationery and equipment in rural PHC facilities in South Africa. The study further analyses how these inefficiencies influence clinic operations, patient care, service delivery and health outcomes, while identifying contextually relevant strategies for improvement. By focusing on the experiences of OMs, this research contributes empirical evidence to the ongoing discourse on strengthening health systems through operational optimisation, particularly in rural and resource-constrained settings.

Research purpose

The purpose of this study was to examine SCM inefficiencies in rural PHC facilities in South Africa, focusing on how these challenges affect clinic operations, patient care, service delivery and health outcomes from the perspective of OMs and PHC supervisors.

Study objectives

The study objectives were:

- To critically investigate key inefficiencies affecting the management of the healthcare SCM in rural PHC facilities.
- To analyse the operational and clinical impacts of these SCM inefficiencies on clinic operations, patient care, service delivery, health outcomes and overall health system functioning.
- To identify and recommend context-specific strategic interventions aimed at improving management of the supply chain and strengthening the rural health system performance.

Research problem

This section outlines the central gaps motivating the study and establishes how systemic inefficiencies translate into managerial adaptation. It also links directly to the propositions that guide subsequent analysis. Despite decades of investment in strengthening South Africa's PHC system, operational bottlenecks in the management of the supply chain (procurement process of medical supplies, equipment and stationery) remain prevalent, particularly in rural facilities or clinics (Matlala et al. 2021; Rispel et al. 2020). These clinics serve as an entry into the health system, the first point of contact for millions of patients, yet are often burdened by unreliable, disjointed and uncoordinated supply chains; fragmented procurement processes and chronic resource shortages (Mukeredzi et al. 2023). Operational managers, who are tasked with overseeing SCM (medical supplies, equipment and other supplies) at the clinic level, report minimal involvement in procurement decision-making and supplier selection, relying instead on bureaucratic hospital-based supply chain processes that are not suited for the dynamic needs of rural clinics (Pienaar et al. 2024). The continued use of manual inventory systems and the lack of direct access to suppliers hinder efficient stock management, leading to stock-outs of essential medical and other supplies and, as a result, delaying effective and needed patient care (Tshabalala et al. 2022).

Moreover, existing health system reforms, including the ICRM programme, have not sufficiently addressed the operational realities of rural clinics (Mhlungu et al. 2024; Pillay et al. 2023). Clinics are expected to meet increasingly complex service delivery demands without corresponding improvements in their supply chain infrastructure or managerial autonomy (Mbunge et al. 2022). These structural inefficiencies worsen staff workload, disrupt service delivery, and negatively impact health outcomes, particularly in maternal and child health, chronic care and emergency services (Gumede et al. 2019; Mahlaba et al. 2021). While prior research has documented supply chain challenges in the broader public health sector, empirical evidence specifically focusing on the operational impacts of SCM inefficiencies at the rural PHC clinic level, through the lens of OMs, remains scarce (Ouma et al. 2024). Hence, its actual evidence-based impact on the provision of services at PHC (the core and provider of primary health care services) is unknown.

Without evidence-based interventions to improve SCM systems and empower OMs, South Africa's rural PHC clinics will continue to face avoidable service disruptions and compromised patient outcomes.

In addition, despite the increasing recognition of healthcare and SCM as vital for ensuring equitable access to essential medical commodities in LMICs, critical gaps remain in our conceptual understanding of how frontline managers respond to systemic procurement and logistics vulnerabilities (Dubey, Gunasekaran & Childe 2022; Yadav 2024). While SCM research often emphasises infrastructure or technical inefficiencies, there is insufficient attention to how such inefficiencies alter the roles and decision-making of OMs during routine service delivery (Setiawati, Simatupang & Okdinawati 2024). Thus, this study seeks to address the gap in understanding how centralised procurement systems, manual inventory processes and fragmented logistics in rural South Africa reshape managerial expectations and resilience at the clinic level.

Furthermore, by focusing on the managerial and institutional dynamics of SCM, rather than only infrastructural deficiencies, this study aims to expand theoretical frameworks and inform policy reforms in decentralising procurement and enhancing system responsiveness. Generating empirical insights from frontline managers is essential for informing policies and operational reforms aimed at optimising healthcare delivery in resource-constrained PHC settings.

Literature review

This section synthesises existing research on healthcare SCM, resilience and institutional theory, highlighting both structural and managerial gaps in LMIC contexts. It provides the conceptual foundation for the propositions introduced earlier.

Supply chain management in resource-constrained primary healthcare settings

Effective SCM is a cornerstone of reliable health service delivery, yet rural PHC clinics in LMICs continue to face significant logistical challenges (Mbunge et al. 2022). In South Africa, medical supply chains are predominantly centralised, with procurement processes managed at the district hospital level and downstream clinics dependent on these institutions for essential medical commodities (Matlala et al. 2021). This centralised approach frequently results in procurement delays, inefficient requisition processing and stock-outs, particularly in rural areas where transport and communication infrastructure are weak (Mukeredzi et al. 2023).

Similar challenges have been observed in other LMIC contexts. In Uganda, rural clinics continue to face persistent medicine shortages because of fragmented procurement processes and weak last-mile distribution, with health workers frequently relying on informal coping strategies to maintain service delivery (Kamba, Tumushabe & Nakabugo 2022). In Nigeria, rigid procurement frameworks and limited transport infrastructure contribute to recurring stock-outs, particularly in maternal and child health services (Ademola & Okafor 2021). Evidence from India also shows that rural PHC centres often lack reliable SCM information systems, resulting in delays of essential medicines and increasing reliance on out-of-pocket expenditure by patients (Patel, Ghosh & Rao 2020). These comparative findings confirm that centralised and bureaucratic systems are not unique to South Africa but represent a wider challenge across LMIC health systems.

According to WHO (2021), failure to decentralise critical aspects of supply chain functions undermines the responsiveness and resilience of PHC systems in LMICs. Additionally, OMs in rural clinics often have minimal control over supplier engagement, stock tracking and procurement planning (Tshabalala et al. 2022). Their roles are generally restricted to order placement via NSI requisition forms, with little involvement in strategic supply chain decision-making (Pienaar et al. 2024). Studies further highlight reliance on manual inventory systems and improvised stock control tools, which are prone to human error and limit real-time visibility of supply availability (Gumede et al. 2019). These structural deficiencies expose rural PHC clinics to chronic medical supply shortages and service delivery interruptions (Sanni et al. 2020).

Operational and clinical implications

Supply chain management inefficiencies have significant knock-on effects on the operational and clinical performance of rural PHC clinics. Delayed or inconsistent medical supplies disrupt the scheduling of patient consultations, procedural interventions and emergency care, leading to longer waiting times and treatment delays (Pillay et al. 2023). Mukeredzi et al. (2023) argue that the cumulative effect of such disruptions erodes patient trust in PHC services, contributing to poor health outcomes, particularly in maternal and child health services. It further leads to a weakened health system, ultimately resulting in the

non-attainment of the sustainable development goals. Furthermore, as OMs are forced to allocate extended hours to manual procurement, emergency ordering and infrastructure problem-solving, their managerial capacity for strategic oversight, planning and clinical supervision is compromised (Mahlaba et al. 2021; Naidoo et al. 2023).

Workload imbalances exacerbate the situation, as OMs often juggle patient care responsibilities alongside administrative SCM tasks, a reality that contradicts national policy expectations of dedicated operational leadership (Rispel et al. 2020). Inadequate infrastructure maintenance, compounded by delays in repair services from distant hospital-based maintenance units, further undermines service continuity and operational efficiency in rural clinics (Pienaar et al. 2024). Collectively, these factors represent a systemic failure to align SCM frameworks with the practical demands of rural PHC delivery (Mbunge et al. 2022).

Policy responses and emerging solutions

While national strategies such as the ICRM programme and the district health system reforms aim to improve PHC effectiveness and service delivery in South Africa, these initiatives have not sufficiently addressed the supply chain and procurement challenges faced by rural clinics (Pillay et al. 2023; Rispel et al. 2020). Most interventions and activities in these reforms have been focusing on disease-specific interventions and supervision. They have been focused on strengthening healthcare programmes. Recent literature underscores the potential of digital health innovations to streamline procurement processes and enhance stock visibility (Mbunge et al. 2022). For instance, electronic inventory management systems and district-level e-procurement platforms are recommended to reduce reliance on manual ordering systems and improve real-time stock monitoring (Naidoo et al. 2023). However, their implementation in rural clinics has been hindered by poor network infrastructure, inadequate training and limited managerial autonomy (Ouma et al. 2024).

Comparative experiences in other LMICs reinforce both the potential and the limitations of such reforms. In Kenya, the introduction of electronic logistics management information systems improved stock visibility and accountability, although rural implementation remained constrained by unreliable Information and Communication Technology (ICT) infrastructure (Were, Muga & Musau 2021). Likewise, in Bangladesh, decentralised procurement models at community clinic level enhanced the timeliness of medicine availability and reduced stock-outs, although sustainability depended heavily on continued government oversight and monitoring (Rahman, Akter & Chowdhury 2020). These cases demonstrate that while digitisation and decentralisation can improve responsiveness, their effectiveness relies on strong governance and infrastructure support.

Decentralised procurement models, which permit clinics to engage directly with pre-approved local suppliers for routine consumables, have shown promise in enhancing supply chain responsiveness in other LMIC contexts (WHO 2021). Nonetheless, in South Africa, such models remain largely unexplored in rural PHC settings (Tshabalala et al. 2022). Procurement is still centralised at sub-district or hospital level. Empirical evidence from clinic-level OMs, who manage the frontline consequences of SCM disruptions, remains largely absent from current policy dialogues, presenting a critical gap in health systems research (Mukeredzi et al. 2023).

Theoretical framework

This study is underpinned by three interrelated theoretical perspectives that help explain supply chain challenges and managerial responses in rural South African healthcare settings.

Dynamic capabilities theory

Dynamic capabilities theory argues that organisations deliberately adapt, integrate and reconfigure resources to remain effective in volatile environments (Teece, Pisano & Shuen 1997). Recent reviews highlight the role of dynamic capabilities in strengthening supply chain resilience across different contexts (Boada, Rodriguez & Torres 2024; Dubey, Gupta & Luo 2023). Empirical studies also confirm that dynamic capabilities enhance operational performance, particularly where resilience mediates external disruptions (Al Khatib, Al-Saidi & Hassan 2022; El Baz, Chabchoub & Sheffi 2023). This perspective is useful for explaining how OMs in rural South African clinics improvise with scarce resources and adapt processes to maintain continuity of care despite systemic inefficiencies.

Institutional theory

Institutional theory emphasises the influence of established norms, routines and bureaucratic rules on organisational behaviour, even under operational pressure (Scott 2008). In LMICs' health systems, institutional arrangements frequently perpetuate rigid procurement structures that shape frontline practice (Langabeer 2022). This lens is relevant for explaining why centralised and bureaucratic procurement persists in South Africa's PHC system and how it constrains managerial autonomy at the clinic level.

Supply chain management operations reference model

The supply chain management operations reference (SCOR) model is a widely used process-reference framework for diagnosing SCM performance across six key dimensions: Plan, Source, Make, Deliver, Return and Enable (Özkanlısoy et al. 2023). Applications in hospital settings show its value in mapping inefficiencies and identifying opportunities for digital and managerial innovations (Setiawati et al. 2024). In this study, the SCOR model provided a simple map of SCM activities and was used to organise both the interview focus and the analysis of procurement processes and inventory.

Contextual gaps

Despite the recognition of SCM models and theories, their application in the healthcare contexts of LMICs remains limited. Structural bottlenecks such as central medical stores, fragmented logistics, and weak infrastructure are well-documented (Yadav 2024). However, the managerial adaptations these constraints generate are less theorised. This study contributes to addressing this gap by integrating dynamic capabilities, institutional theory, and the SCOR model to provide a richer explanation of how OMs negotiate systemic inefficiencies in rural South African clinics (Langabeer 2022; Setiawati et al. 2024).

Research methods and design

Study design

Building on the theoretical framework outlined above, the methodology was designed to examine how SCM inefficiencies manifest in rural PHC clinics and how OMs respond to these challenges. The research design, data collection and analytical approach were selected to ensure that both structural constraints and managerial adaptations could be captured in sufficient depth.

The study drew on the SCOR model to frame the analysis of SCM processes. The SCOR model also guided the way SCM processes were examined. It offered a clear structure for looking at how clinics plan, source, deliver and return essential items. This structure was used to organise the themes on procurement, inventory management and distribution, and to link specific barriers to particular points in the supply chain. Insights from dynamic capabilities and institutional theory then helped to interpret how managers responded to these constraints in their daily work.

Dynamic capabilities theory guided attention to how OMs adjusted routines, combined resources and improvised solutions when procurement, particularly the inventory systems (NSI requisitions), failed. Institutional theory, in turn, helped to frame these adaptations within the constraints of formal rules, hierarchies and bureaucratic procedures that shape clinic-level decision-making. Insights from both dynamic capabilities and institutional theory informed the interpretation of managerial practices and systemic influences. The integration of these three theories ensured that the methodology is both empirically grounded and theoretically aligned.

This study adopted a qualitative, exploratory research design to investigate SCM inefficiencies in the management of medical supplies and equipment in rural PHC clinics. A qualitative approach was deemed appropriate to capture the in-depth experiences and perspectives of OMs responsible for supply chain oversight at the clinic level (Creswell & Poth 2018). Given the unavailability of clinic-level operational data in South Africa's rural health sector, an exploratory design was particularly suitable for generating empirical insights and uncovering underlying operational barriers (Mukeredzi et al. 2023).

Study setting

The research was conducted in rural PHC clinics located within the uMkhanyakude Health District of KwaZulu-Natal, South Africa. This district, recognised for its geographical isolation and resource constraints, encompasses 56 PHC clinics and five community healthcare centres within five sub-districts that serve dispersed and impoverished rural populations. Clinics are managed by OMs responsible for overseeing medical supplies, equipment and operational services within the constraints of centralised SCM structures.

Study population and sampling

The study population consisted of OMs overseeing the day-to-day operations of PHC clinics, specifically responsible for medical supplies and equipment management and PHC supervisors who are responsible for managing OMs.

Sampling method

Purposive sampling was utilised to identify participants with specific operational responsibilities managing clinics and in SCM (Etikan, Musa & Alkassim 2016). This included managing all SCM activities and value chain at PHC level. Selection criteria included:

- Current designation as an operational manager (OM) within a rural PHC clinic, and all PHC supervisors who are responsible for managing and supervising the OMs.
- Direct responsibility for supply chain requisitions and stock management.
- Minimum of one or more years of experience in the current role.

Sample size

A total of 19 participants (17 OMs and two PHC supervisors) were purposively selected across various clinics within the district, ensuring representation of diverse clinic sizes, locations and operational challenges. Sampling continued until thematic saturation was achieved.

Data collection

Data were collected through semi-structured, in-depth interviews. An interview guide, developed from literature and pilot-tested prior to implementation, focused on exploring:

- Operational processes in medical supplies and equipment management.
- Experiences and challenges related to procurement, storage, ordering and stock control.
- Perceived effects of SCM inefficiencies on clinic operations and patient care.
- Suggested strategies to improve SCM at clinic level.

Interviews were conducted in English, audio-recorded with participant consent, and supplemented with field notes. Each interview lasted approximately 45–60 min and was conducted either on-site or virtually depending on participant preference and logistical feasibility.

Data analysis

Interviews were transcribed verbatim and analysed using thematic analysis, following Braun and Clarke's six-phase framework (Braun & Clarke 2019). Transcripts were iteratively coded using a combination of deductive codes informed by literature and inductive codes emerging from the data. NVivo software (version 12) facilitated data management and coding processes. Themes were derived focusing on:

- Identified SCM inefficiencies.
- Operational impacts on service delivery, health outcomes and clinic functioning.
- Participant-recommended strategies for improvement.

Patterns of improvisation and workarounds were read through a dynamic capabilities' lens, while the persistence of rigid SCM processes, mainly procurement and reporting structures, was interpreted using institutional theory.

The trustworthiness of the findings was ensured through reflexivity, audit trails and member checking with a subset of participants to validate emerging themes (Nowell et al. 2017).

The study adhered to the four criteria of trustworthiness (credibility, dependability, confirmability and transferability) as outlined by Lincoln and Guba (1985). The strategies that were implemented to ensure rigour included prolonged engagement with participants, triangulation of data sources (interviews and field notes), reflexive journaling by the researcher, peer debriefing sessions with supervisory experts, and lastly, thick description to enhance contextual understanding.

Ethical considerations

Ethical clearance was granted by the University of KwaZulu-Natal Humanities and Social Sciences Research Ethics Committee (Ref: HSS/2107/017D) prior to commencement with data collection. Permission to conduct the study was obtained from the KwaZulu-Natal Department of Health. Written informed consent was secured from all participants prior to data collection. Participants' confidentiality and anonymity were rigorously maintained throughout the study.

Results

The analysis of SCM practices across rural PHC clinics revealed multiple systemic inefficiencies as illustrated in Table 1. Many of these inefficiencies fall within the SCOR 'Plan' and 'Source' processes, where clinics struggle to align demand planning with centralised procurement and supplier engagement.

Procurement was described as centralised and poorly coordinated, with OMs left to devise their own procurement plans in isolation from structured district-level support and guidance. This contributed to duplication and delays, wherein orders were not processed for extended periods (even more than 6 months). As one OM explained:

> 'We make our own procurement plans but no one from the district ever sits with us to check if we are doing it correctly or if it fits with other clinics. Everyone is just doing their own thing.' (Participant 4, female, OM)

Bureaucratic dependency on NSI requisitions, which are processed through hospital supply chain systems, was consistently highlighted as a major barrier:

> 'For every single NSI request, we must send it through the hospital SCM. It goes from one desk to another and sometimes just gets stuck there. By the time supplies come, we are already running short.' (Participant 7, female, OM)

A lack of direct supplier engagement further restricted managers' ability to resolve delays:

> 'We never talk to suppliers directly, everything is channelled through the hospital. Even if something is delayed, we cannot phone them or ask questions. It makes us powerless.' (Participant 2, female, OM)

In addition, OMs expressed concerns about storage responsibilities being decentralised without proper pharmacy oversight. On a daily basis, OMs have to delegate this responsibility to any available staff members and request them to help out managing the pharmacy and storerooms:

> 'Our storerooms are run by whoever is available, not trained pharmacy staff. They just help out when they can, but it's not their main job. Sometimes things go missing or expire because no one checks properly.' (Participant 5, female, OM)

Stock tracking was largely manual, with locally improvised forms:

> 'We use forms we designed ourselves. It's not a proper system. If the sister is away, then the records are not updated, and we lose track of what we have.' (Participant 9, female, OM)

Infrastructure challenges exacerbated inefficiencies:

> 'When something like plumbing breaks, we wait for weeks because maintenance must come from the hospital. They don't

TABLE 1: Supply chain management inefficiencies.

Theme	Description
Centralised, uncoordinated procurement	Procurement plan devised independently by OMs without systematic district-level coordination
Bureaucratic NSI ordering process	Procurement relies on NSI requisitions routed through hospital SCM, causing delays
No direct supplier engagement	OMs not involved in supplier selection or payment processes, limiting ability to address supplier-related delays
Storage responsibility decentralised	Storage areas managed independently per section without formal pharmacy training, risking mismanagement
Inadequate stock tracking tools	Reliance on internally designed, manual forms for ordering surgical and stationery supplies
Poor infrastructure maintenance	Infrastructure repairs delayed because of distance from hospital and lack of maintenance transport
Emergency ordering bypass	Frequent informal or emergency ordering practices because of rigid scheduled ordering system

NSI, non-stock item; OMs, operational managers; SCM, supply chain management.

have transport and we are far. Meanwhile, we struggle.' (Participant 8, female, OM)

Finally, rigid ordering schedules forced reliance on emergency or informal processes:

'Most of the time we end up sending someone to buy small items ourselves because the official system is too slow. It is embarrassing but we cannot stop services.' (Participant 3, female, OM)

Viewed through the lens of dynamic capabilities theory, these informal practices demonstrate how OMs reconfigure scarce resources and adjust processes to maintain service continuity, even when formal SCM systems are slow or unresponsive.

Collectively, these findings highlight systemic weaknesses in procurement coordination, supplier interaction, storage and infrastructure maintenance, which undermine SCM efficiencies at clinic level. These results illustrate how entrenched SCM processes and reporting routines, as described by institutional theory, limit the autonomy of OMs and make it difficult to change everyday practices, even when the inefficiencies are widely recognised.

Table 2 presents the negative effects of SCM challenges or inefficiencies. The reported inefficiencies translated into multiple adverse effects on clinic operations, patient services and health outcomes (Table 2).

Operational delays were particularly evident in the repair of essential infrastructure. For example, one manager explained:

'When the printer broke down, we couldn't send our reports for more than a month. It looks like we are not doing our job, but actually the repair request was stuck at the hospital.' (Participant 1, female, OM)

Stock-outs, although not always severe, were recurring, and these affect the provision of healthcare:

'We run out of surgical gloves and small items often. It's not life-threatening but it disrupts our daily work and delays patients.' (Participant 6, female, OM)

These SCM gaps compounded staff workload, with OMs performing additional manual procurement responsibilities (procurement forms), which still have to be sent to sub-districts for processing:

'I spend hours after my shift writing procurement forms or chasing emergency orders. Instead of resting or focusing on patients, I am busy with paperwork.' (Participant 4, female, OM)

Patient service disruptions were also reported:

'If you don't have what is needed, the patient must come back another day or be referred to the hospital. They lose confidence in us.' (Participant 7, female, OM)

Such disruptions indirectly compromised the quality of care:

'I feel guilty because while I am chasing stock, I am not in the consulting room where I should be supervising and helping.' (Participant 2, female, OM)

Finally, systemic strain was identified, particularly in relation to dependence on hospital-based SCM structures:

'The whole PHC system suffers because everything depends on the hospital. If there is a problem there, all clinics are affected.' (Participant 8, female, OM)

These findings illustrate how SCM inefficiencies reverberate beyond logistics, contributing to operational instability, increased workloads, patient dissatisfaction and reduced service efficiency.

Table 3 presents the suggested feasible interventions proposed by OMs to address and improve the identified supply chain inefficiencies. Central to these was the call for streamlined procurement processes, particularly integration of clinics into district-level e-procurement platforms with one participant saying:

'If we had access to the district e-procurement system, we could send requests directly and track them ourselves. That would save a lot of time.' (Participant 5, female, OM)

Training of OMs in SCM, particularly Department of Health (DOH) procurement was also emphasised as a significant solution to resolving SCM inefficiencies:

'We were never trained for procurement, yet we are expected to manage it. If we had proper training, we could do it better.' (Participant 9, female, OM)

Digitisation of inventory management was highlighted as a priority. This strategy will work especially under the current conditions, wherein all of the clinics do not have dedicated transport to take these manual forms to the sub-district for processing:

'Manual forms don't work. If there was a computer system where we log stock in and out, then we would know exactly what is available.' (Participant 3, female, OM)

Dedicated maintenance units or service contracts for remote clinics were recommended:

TABLE 2: Effects of inefficiencies on primary healthcare and health system.

Effect category	Expression at clinic level
Operational delays	Delayed repairs of critical infrastructure (e.g. printers, copiers) hindering administrative and reporting functions
Stock-outs	Regular out-of-stock items (though not severe), affecting surgical procedures and patient consultations
Staff overload	OMs spend extended hours after official shifts managing manual procurement and emergency stock interventions
Patient service disruptions	Emergency supply needs handled informally, causing potential service disruptions during routine operations
Health outcomes	Indirect compromise in care quality because of OMs' diverted focus from clinical oversight to manual stock management
Systemic strain	Dependency on hospital SCM causes bottlenecks, reducing the efficiency of PHC services

OMs, operational managers; PHC, primary healthcare; SCM, supply chain management.

TABLE 3: Suggestions for improvement.

Suggested intervention	Recommended action
Streamlined procurement process	Integrate clinics into district-level e-procurement platforms for transparent, faster requisitions
Customised DOH SCM training for OMs	Provide targeted training in procurement, supplier management and inventory control to OMs and delegated staff
Digitisation of inventory management	Introduce electronic stock management systems to replace manual forms and improve tracking and accountability
Dedicated maintenance response unit	Establish mobile maintenance teams or service contracts for rapid infrastructure repair in remote clinics
Emergency procurement fund	Allocate small, clinic-level petty cash for urgent, low-cost procurements to reduce personal expenditure by OMs
Decentralised supplier engagement	Empower clinics to directly engage local suppliers for specific low-risk, high-need consumables and equipment

DOH, Department of Health; OMs, operational managers; SCM, supply chain management.

> 'We need a mobile maintenance team that can come quickly when something breaks. Right now, we wait too long.' (Participant 7, female, OM)

The introduction of petty cash funds for urgent needs was suggested as a practical measure:

> 'Sometimes we need small things urgently, like ink cartridges. If we had a small budget for emergencies, we wouldn't have to use our own money.' (Participant 1, female, OM)

Finally, decentralised supplier engagement was viewed as essential for efficiency:

> 'If we were allowed to deal with certain local suppliers directly, especially for basic items, we could avoid unnecessary delays.' (Participant 6, female, OM)

Together, these suggestions provide a realistic and practical set of interventions from frontline managers, aimed at addressing inefficiencies, enhancing autonomy and strengthening PHC service delivery in rural contexts.

Discussion

This section interprets the findings in light of the propositions and literature review, demonstrating how South Africa's rural healthcare SCM reflects broader challenges and managerial adaptations in LMICs.

This study provides critical insights into the rural healthcare SCM inefficiencies undermining PHC service delivery, clinic operations and patient care in rural South Africa, highlighting structural, operational and infrastructural barriers. These findings offer a realistic view of SCM in rural PHC settings, as they reflect the everyday constraints, adaptive practices and systemic challenges described directly by frontline managers. They also align with and extend existing literature, underscoring the intersection between SCM dysfunctions and compromised clinical care (Matlala et al. 2021; Mbunge et al. 2022).

Supply chain management inefficiencies

One of the most prevalent challenges identified was the persistence of bureaucratic, centralised procurement systems that restrict clinic autonomy. Recent studies have shown that local procurement changes can help alleviate these limitations by making government agencies more responsive and reducing bureaucratic red tape. For example, the Global Health Supply Chain Program – Procurement and Supply Management (GHSC-PSM 2023) found that subnational procurement best practices facilitate faster access to essential supplies through simplified contracting and primary supplier arrangements. Direct health facility financing greatly improved the timeliness of sourcing medicines and consumables, according to research from Tanzania (Ruhago et al. 2023), proving the value of giving facilities greater financial and operational autonomy. The procurement process remains heavily centralised at sub-district and hospital levels, resulting in delays and inefficiencies. These delays are further shaped by the complex legislative framework governing government-funded procurement, such as the *Public Finance Management Act* and *Preferential Procurement Policy Framework Act* (which often impose multiple compliance requirements that limit flexibility and reduce the feasibility of timely clinic-level decision-making).

Clinics lack direct engagement with suppliers, limiting their ability to respond flexibly to urgent needs. Studies in the South African context indicate that stock visibility system (SVS) and the national surveillance centre (NSC) have improved transparency and supplier accountability, yet their effectiveness is contingent upon empowering frontline staff to act on the data generated (Falco, Meyer & Putter 2023; Global Health Supply Chain – Technical Assistance [GHSC-TA] 2019). These findings highlight that without complementary decentralisation of authority, visibility tools alone cannot resolve procurement bottlenecks. These systemic weaknesses are consistent with reports from other LMIC contexts, where rigid bureaucratic ordering systems constrain service responsiveness (Pienaar et al. 2024; Rispel et al. 2020).

The persistence of procurement delays and weak inventory systems in South African rural clinics is consistent with evidence from other LMIC contexts. In Ghana, for instance, inefficiencies in procurement procedures and limited facility-level autonomy have been shown to compromise the availability of essential medicines in remote districts (Boateng, Darko & Mensah 2021). Similarly, in Nepal, rural PHC centres have struggled with chronic interruptions in supply as a result of fragmented procurement and infrastructural barriers, particularly during health emergencies (Bhandari, Paudel & Adhikari 2020). These comparative insights highlight that systemic weaknesses are not isolated to South Africa but reflect broader structural constraints facing LMIC health systems.

Recent scholarship highlights that digital transformation, including the use of big data analytics, can provide predictive insights that improve forecasting accuracy and optimise procurement cycles in health supply chains (Al Nuaimi & Awofeso 2025; Talwar, Kaur & Gupta 2021). For rural PHC facilities, such innovations could help anticipate demand spikes and prevent recurring stock-outs, although their success remains dependent on infrastructural readiness and managerial capacity (Tortorella, Fogliatto & MacCarthy 2023). This suggests that SCM systemic inefficiencies should not only be addressed through decentralisation but also through gradual adoption of analytical and digital tools that strengthen resilience against volatility.

Inadequate stock tracking and reliance on manual inventory controls further compound procurement inefficiencies. Similar challenges have been reported across LMICs, where manual inventory systems are strongly associated with errors, delays and weak accountability. In South Africa, Mbonane, Sibanda and Matlala (2023) found that while healthcare professionals recognised the value of SVS for stock monitoring, adoption was hindered by inadequate training and lack of managerial support. Comparative assessments of digital health logistics management systems, demonstrated by studies in Ethiopia's Amhara Region, revealed significant differences between physical and electronic inventory records, with inventory accuracy rates around 70% and variations in data completeness and timeliness. These findings highlight the inadequate efficacy of digital tools in the absence of strong infrastructure, ongoing training and data verification protocols (Mekonen, Cho & Fenta 2025).

The absence of standardised digital systems exposes facilities to stock mismanagement, human error and reduced accountability. National assessments validate this disparity, indicating that despite the implementation of SVS in over 3,000 PHC clinics and 300 hospitals, significant differences in digital adoption and connectivity persist (Falco et al. 2023). These findings indicate that digitisation is not merely a technology issue but also an equity issue, as rural institutions frequently lack the infrastructure to effectively benefit from these systems.

Prior literature recognises digitisation as key to improving inventory accuracy and visibility across health systems (Mbunge et al. 2022; WHO 2021). However, the technological divide in rural PHC settings persists, leaving frontline managers to improvise with fragmented paper-based systems.

Maintenance delays also contribute significantly to operational disruptions, as repairs are often dependent on hospital-based teams that frequently lack the resources to reach remote clinics. The continuity of service in rural clinics is directly dependent on the quality of infrastructure. West et al. (2021) indicated that inadequate maintenance and limited space in Mpumalanga rural clinics affected nurses' capacity to deliver consistent care. In-depth evaluations of the ICRM programme initially established to enhance PHC quality indicate ongoing implementation problems, particularly in rural and detached clinics. Onoya et al. (2025) stated in their fast evaluation that several facilities continue to fall short of the ICRM requirements as a result of infrastructure deficiencies, restricted management capabilities and supply chain disruptions. These infrastructural deficiencies mirror broader findings that weak maintenance systems undermine PHC resilience and sustainability in rural regions (Pillay et al. 2023).

Operational and health system impacts

The findings also illustrated how SCM inefficiencies cascade into operational strain, staff burnout and patient service disruptions. Operational managers are forced to divert their time away from strategic functions to perform routine procurement and stock management. This diversion of managerial capacity aligns with broader evidence on workforce strain in South Africa. From a dynamic capabilities perspective, these managers constantly stretch their roles and redesign small processes to ensure service continuity. However, institutional theory reminds us that these efforts take place within rigid SCM systems (particularly procurement) and reporting systems that restrict genuine system improvement, leaving OMs to absorb the strain rather than changing the underlying rules.

Khan et al. (2024a) and Khan et al. (2024b) note that the cumulative burden of administrative tasks and resource shortages contributes to high levels of burnout and role dissatisfaction among health professionals. Such role misalignment undermines not only managerial effectiveness but also system resilience in the long term. This role misalignment undermines their intended leadership contributions and exacerbates inefficiencies, echoing similar evidence from other sub-Saharan African PHC settings (Mahlaba et al. 2021; Mukeredzi et al. 2023). Beyond workforce strain, inequities are reinforced when rural patients experience avoidable delays or are forced to incur out-of-pocket costs because of service interruptions. Evidence shows that health system resilience is closely linked to equitable distribution of supplies, with fragile systems often amplifying disparities between rural and urban populations (Ergun et al. 2023). This means that supply chain inefficiencies are not only technical failures, but also drivers of inequality that compromise the sustainability of universal health coverage goals (WHO 2021).

Frequent stock-outs and delays in infrastructure repairs contribute to service interruptions, diminished patient trust and increased reliance on informal workarounds. Patient experiences in South Africa validate the correlation between supply reliability and trust in healthcare services. A recent investigation of rural hospitals revealed that the scarcity of medications, inadequate infrastructure and recurrent service interruptions undermined patients' trust in the healthcare system (Chitha et al. 2024). West et al. (2021) also noted that patients perceive frequent shortages as signs of systemic neglect, adversely affecting health-seeking behaviour.

While such adaptive practices help sustain day-to-day service delivery, they reflect deeper systemic dysfunctions and fragile governance structures (Naidoo et al. 2023). In line with other African studies, the personal sacrifices of PHC managers, including financial outlays, highlight the resilience of frontline staff while also revealing unsustainable coping mechanisms that perpetuate inequities in health systems (Matlala et al. 2021).

Strategies for improvement

The proposed solutions emphasise decentralisation, digitisation and training as critical reform areas. Decentralised procurement, including the allocation of petty cash or emergency micro-budgets, would enhance flexibility and responsiveness to urgent supply needs. Results from a study in Tanzania indicate that direct financing of health facilities enhances local responsibility and increases the availability of essential supplies by allowing clinics to purchase what they require promptly and in real time (Ruhago et al. 2023). Similarly, United States Agency for International Development (USAID)'s global supply chain assessments indicate that subnational procurement methods can improve efficiency while maintaining oversight through framework contracts and performance monitoring (GHSC-PSM 2023). Such measures resonate with growing evidence that localised financial autonomy can strengthen accountability and timeliness in PHC service delivery (Ouma et al. 2024).

The study also highlights the urgent need for structured training in SCM and financial oversight for OMs. Limited exposure to management training (particularly customised DOH health SCM) undermines their ability to implement efficient and accountable processes. Empowering frontline managers with skills in procurement governance, budgeting and digital systems is therefore essential to sustainable reform (Mukeredzi et al. 2023). However, training alone is unlikely to address these challenges without clearer administrative structures in rural clinics, as weak organisational arrangements continue to limit the practical application of new skills. In addition to managerial training, strengthening system resilience may require embedding predictive analytics and integrated data systems that enable real-time monitoring and proactive decision-making (Talwar et al. 2021; Yadav 2024). Comparative reviews also suggest that aligning SCM strategies with sustainability principles such as green procurement practices and efficient waste management can reduce costs and environmental impacts while improving the availability of essential supplies (Rezali, Chen & Wong 2021). These broader innovations demonstrate that reforms should combine financial autonomy, digital tools and sustainability-oriented practices to ensure long-term equity and resilience.

Digitisation of procurement and inventory systems emerges as another key strategy. The implementation of such systems has commenced in South Africa. Falco et al. (2023) demonstrate that the NSC has improved the monitoring of pharmaceutical supply at the national level, but Mbonane et al. (2023) demonstrate that the efficacy of SVS is significantly contingent upon sufficient user training and managerial support. The findings indicate that digital tools require accompanying capacity-building programmes and robust infrastructure to be effective at the clinic level.

While challenges such as poor connectivity and lack of hardware were identified, broader health system evidence affirms that even low-cost digital tools can improve efficiency, accuracy and transparency (Mbunge et al. 2022; WHO 2021). Addressing infrastructural deficits, therefore, represents both a technological and equity imperative for rural PHC.

While these theoretical insights extend SCM scholarship, they also carry practical implications. Barriers in procurement, inventory management and distribution undermine both rural healthcare delivery and the resilience of supply chains more broadly. The application of dynamic capabilities theory, institutional theory and the SCOR model illustrates how OMs adapt within these systemic constraints reconfiguring scarce resources (Boada et al. 2024; Dubey et al. 2023), while simultaneously constrained by entrenched bureaucratic rules (Langabeer 2022). The SCOR model, typically applied in manufacturing and logistics, also proves valuable for diagnosing inefficiencies in rural healthcare procurement and delivery (Setiawati et al. 2024). Together, these perspectives provide pathways for translating theoretical insights into targeted operational improvements.

Study implications

The findings carry important implications for policy, practice and scholarship. For policymakers, addressing inefficiencies in rural PHC SCM requires reforms that decentralise procurement, strengthen digital inventory management, and enhance accountability mechanisms. Evidence from other LMICs shows that decentralised procurement improves timeliness, responsiveness and transparency (Ouma et al. 2024; Ruhago et al. 2023). For South Africa, this suggests that devolving certain procurement responsibilities could reduce bottlenecks and allow greater responsiveness to local demand.

For practice, the results highlight the value of investing in digital systems such as the NSC and SVS. Studies show these tools improve transparency and oversight, although their effectiveness depends on adequate infrastructure, managerial training and user engagement (Falco et al. 2023; Mbonane et al. 2023). Building local capacity to manage such systems is therefore essential for sustaining improvements in procurement and distribution.

For scholarship, the study extends SCM research in LMIC health systems by demonstrating the relevance of dynamic capabilities, institutional theory, and the SCOR model in diagnosing last-mile delivery challenges. It shows how OMs navigate resource scarcity, bureaucratic routines and infrastructural gaps, thereby reframing SCM as a field that is

not only technical but also institutional and managerial (Dubey et al. 2023; El Baz et al. 2023; Langabeer 2022).

Finally, the equity implications are significant. Supply chain management inefficiencies disproportionately affect rural patients, reinforcing barriers to access and perpetuating health inequities (Chitha et al. 2024). Strengthening the rural PHC healthcare SCM is therefore central to advancing universal health coverage and achieving more equitable health outcomes in South Africa.

Recommendations for policy and practice

In light of these implications, the following recommendations are proposed to guide policy and practice and also strengthen the rural PHC healthcare SCM in South Africa:

- **Decentralise procurement processes:** Shift selected procurement responsibilities from central authorities to district and facility levels to improve timeliness, responsiveness and accountability in medicine and equipment supply.
- **Invest in digital inventory systems:** Scale up the use of platforms such as the NSC and SVS, ensuring that implementation is supported by adequate infrastructure, stable connectivity and reliable data reporting mechanisms.
- **Strengthen managerial capacity:** Provide targeted and customised DOH SCM training for OMs to enhance OMs' competencies in SCM planning, digital system use and resource allocation, thereby reducing reliance on improvised coping strategies.
- **Improve governance and accountability structures:** Establish clear reporting mechanisms and feedback loops across all levels of the SCM to reduce inefficiencies and build transparency in procurement, distribution and stock management.
- **Address rural equity challenges:** Prioritise investment in transport, storage and distribution infrastructure in rural areas to ensure that supply chain reforms also reduce health inequities and support universal health coverage goals.
- **Strengthen community partnerships and collaboration:** Leverage community partnerships by strengthening collaboration with local stakeholders to support resource sharing, enhance accountability and reduce patient-level burdens.

Study contribution

This study contributes to SCM scholarship by extending the application of dynamic capabilities, institutional theory and the SCOR model to rural healthcare contexts. It demonstrates, in line with dynamic capabilities theory, how OMs reconfigure scarce resources to sustain service delivery. Drawing on institutional theory, this study examines how bureaucratic routines and hierarchical controls limit meaningful system change. In contrast, the SCOR model helps identify these issues within specific SCM processes, particularly in procurement and distribution. These insights advance theory by shifting attention from technical processes to the governance and adaptive practices shaping last-mile delivery.

Practically, the study highlights the importance of decentralising procurement, digitising inventory systems, and investing in strengthening managerial capacity through DOH-customised SCM training. Such reforms can strengthen transparency, accountability and responsiveness, thereby improving the resilience of rural PHC SCM.

By linking theoretical frameworks with operational realities, the study offers a balanced contribution to both scholarship and practice, while emphasising equity implications for rural patients who face the greatest barriers to healthcare access.

Limitations

This study was limited to a specific rural setting in one district and comprised a small qualitative sample of 19 participants. Although this is adequate for topic saturation in qualitative studies, this may constrain the generalisability of findings to other districts or clinic types (clinics situated in townships or metropolitan regions). The dependence on interview data introduces the potential for perception bias, and the lack of triangulation with objective supply chain records, such as SVS or NSC reports, limits the validation of the frequency and severity of the alleged inefficiencies. This study exclusively examined the viewpoints of OMs and their line managers (PHC supervisors), excluding patients, suppliers and senior administrators, whose perspectives would have contributed to a more comprehensive understanding of systemic challenges. Consequently, these constraints emphasise the necessity for further research using mixed approaches, larger samples and multi-stakeholder viewpoints to enhance the evidence base.

Another limitation is that, although the study focused solely on healthcare SCM in rural South Africa, many of the barriers identified such as bureaucratic procurement, transport delays and reliance on manual inventory processes are common across other rural supply chains in LMICs. This again limits the generalisability of findings solely to healthcare and suggests that comparative, cross-sectoral research is required. Future studies could therefore investigate how similar SCM inefficiencies affect agriculture, education or the distribution of essential goods in rural areas, thereby building a more comprehensive evidence base for strengthening community-level resilience.

Future research should evaluate decentralised procurement models, implementation outcomes of digital systems and governance reforms across rural and peri-urban settings. Ultimately, resilient healthcare SCM at the clinic level is not merely a technical fix, but a prerequisite for sustaining equitable healthcare access in rural South Africa and beyond.

Conclusion

This study examined the structural, operational and infrastructural barriers affecting rural PHC SCM in South Africa. Centralised procurement, manual inventory systems

and limited managerial autonomy continue to undermine service delivery. These inefficiencies not only disrupt logistics but also reshape the roles of OMs, who are compelled to adopt coping strategies that divert them from clinical leadership.

From a theoretical perspective, the study shows how dynamic capabilities enable OMs to reconfigure scarce resources in volatile contexts (Boada et al. 2024; Teece et al. 1997), while institutional theory explains how entrenched bureaucratic routines perpetuate inefficiencies (Langabeer 2022; Scott 2008). The application of the SCOR model further demonstrates its relevance in diagnosing procurement and distribution inefficiencies in rural healthcare (Setiawati et al. 2024). Collectively, these perspectives extend SCM scholarship in LMIC contexts (Dubey et al. 2023; El Baz et al. 2023).

Practically, the findings emphasise the need for reforms that decentralise procurement, strengthen digital inventory systems and enhance managerial training. Evidence from LMICs confirms that decentralisation and digitisation improve timeliness, accountability and transparency, although their success depends on supportive infrastructure and governance (Falco et al. 2023; Mbonane et al. 2023; Ouma et al. 2024; Ruhago et al. 2023). Addressing rural PHC healthcare SCM inefficiencies is therefore essential not only for operational and clinical efficiency but also for reducing inequities in healthcare access and also for improving patient care (Chitha et al. 2024).

In sum, the study contributes to SCM by shifting attention from logistics processes to the governance and adaptive practices of OMs in rural healthcare. It provides theoretical insights, practical recommendations and equity-focused implications for policy reform. Strengthening rural PHC healthcare SCM is thus both a technical necessity and a strategic imperative for building resilient and equitable health systems in South Africa and beyond.

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The author declares that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

CRediT authorship contribution

Zamanguni F. Kubheka: Conceptualisation, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Visualisation, Writing – original draft, Writing – review & editing. The author confirms that this work is entirely their own, has reviewed the article, approved the final version for submission and publication, and takes full responsibility for the integrity of its findings.

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