International Journal of Technology and Management



Human Resource Capacity and Drug Supply Chain Performance in Urban Public Health Facilities: A Convergent Mixed-Methods Study of KCCA Tier III Facilities in Uganda

IJOTM

ISSN 2518-8623
DOI: 10.67610/ijotm.10.1.003

Volume 10. Issue 1

pp. 1-12, June 2025
ijotm.utamu.ac.ug

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Abstract

In many public health facilities across Uganda, the absence of essential medicines is not simply a logistical inconvenience but a recurring reality that directly shapes patient outcomes, undermines confidence in health systems, and places additional strain on already overburdened health workers. In rapidly urbanizing settings such as Kampala, this challenge is further intensified by rising service demand, complex patient needs, and increasing pressure on limited health system resources. While previous reforms have predominantly focused on strengthening logistics systems, financing frameworks, and infrastructure, a critical yet often underexplored dimension remains the role of human resource capacity in determining supply chain performance.

This study examined the influence of human resource capacity on drug supply chain performance within Kampala Capital City Authority Tier III health facilities. A convergent mixed-methods design was employed, integrating quantitative data from 70 health workers with qualitative insights from six key informants directly involved in pharmaceutical and supply chain management. Although the response rate of seventy percent is methodologically acceptable, careful consideration was given to the potential effects of non-response bias, particularly given that staff experiencing higher workload pressures or lower technical capacity may have been underrepresented. To enhance the robustness of the findings, subjective perceptions were triangulated with objective indicators, including stock-out frequency, inventory accuracy, reporting timeliness, and order fulfillment rates.

The findings reveal a complex but consistent pattern. While many health workers perceive themselves as technically competent, these competencies are largely acquired through experiential learning rather

than structured institutional training systems. This lack of formalization contributes to variability in practice and limits standardization across facilities. Persistent gaps in continuous professional development, coupled with significant staffing constraints, were identified as central factors affecting the efficiency and reliability of supply chain operations. Facilities with relatively stronger human resource capacity demonstrated more stable performance, reflected in improved reporting consistency, reduced stock disruptions, and enhanced inventory management. Statistical analysis indicated a moderately strong positive association between human resource capacity and supply chain performance. However, this relationship is interpreted cautiously as associative rather than causal due to the cross-sectional nature of the study.

The study contributes to the growing discourse on health systems strengthening by demonstrating that human resource capacity is not merely a supportive component but a central determinant of supply chain effectiveness. It underscores the need for deliberate and sustained investment in structured training systems, workforce optimization, and supportive supervision mechanisms. Strengthening these human resource dimensions is essential for enhancing the resilience, responsiveness, and overall performance of urban public health supply chains.

Keywords: Human Resource Capacity, Drug Supply Chain Performance, Public Health Systems, Kampala Capital City Authority, Health Logistics, Uganda

Introduction

Access to essential medicines remains one of the most visible indicators of health system performance. Despite sustained investments in procurement systems and infrastructure, many low- and middle-income countries continue to experience persistent inefficiencies in drug supply chains. In Uganda, these inefficiencies manifest in recurring stock-outs, delays in distribution, and inconsistencies in inventory management across different levels of care. Such challenges are not merely technical but reflect deeper systemic issues that extend beyond logistics into the broader organization of health systems (Lugada et al., 2022; Kalangwa et al., 2025; Nakade et al., 2026; Di Virgilio, 2025; Duwiejua et al., 2025).

In urban settings such as Kampala, the complexity of healthcare delivery amplifies these challenges. Facilities operate under conditions of high patient demand, rapid consumption of medical supplies, and increasing expectations for service efficiency. Under such conditions, the ability of health workers to effectively manage pharmaceutical supplies becomes a critical determinant of system performance. However, while infrastructure and digital systems have improved in recent years, the human capacity required to operate these systems has not always developed at the same pace (Nakade et al., 2026; Lugada et al., 2022; Kalangwa et al., 2025; Duwiejua et al., 2025; WHO, 2017) .

Human resource capacity encompasses a wide range of elements, including technical skills, training, supervision, staffing levels, and organizational support. Evidence suggests that where these elements are weak or misaligned, even well-designed supply chain systems struggle to deliver expected outcomes. Studies across sub-Saharan Africa have consistently shown that workforce-related constraints, particularly limited training and inadequate staffing, significantly undermine supply chain efficiency (Duwiejua et al., 2025; Lugada et al., 2022; Kalangwa et al., 2025; Nakade et al., 2026; Di Virgilio, 2025).

Within Uganda, similar patterns are observed across sectors. Research conducted within the Uganda Police Force by Tukei has demonstrated that organizational performance is closely tied to human capacity, leadership structures, and operational systems. His work on risk management and staff performance highlights that institutional effectiveness depends not only on formal systems but also on the competence and coordination of personnel (Tukei, 2024a; Tukei, 2024b; Tukei, 2024c).

Despite this growing body of evidence, there remains limited empirical research focusing specifically on the relationship between human resource capacity and drug supply chain performance within urban public health facilities. This study therefore seeks to address this gap by examining KCCA Tier III health facilities, providing a more grounded understanding of how human resource dynamics influence supply chain outcomes.

Methodology

This study adopted a convergent mixed-methods design, guided by the recognition that complex operational realities within health systems cannot be adequately explained through a single methodological approach. Drug supply chain performance is influenced by both measurable indicators and contextual human factors, making it necessary to integrate quantitative and qualitative perspectives. The convergent design enabled the simultaneous collection and analysis of numerical data alongside experiential insights, thereby facilitating a more comprehensive interpretation of findings. This approach is widely acknowledged as appropriate for health systems research, particularly where the objective is to understand both outcomes and underlying processes (Duwiejua et al., 2025; Kalangwa et al., 2025; Nakade et al., 2026; Lugada et al., 2022).

The study was conducted within Kampala Capital City Authority Tier III health facilities, which represent a critical level of service delivery within Uganda's urban health system. These facilities are characterized by high patient volumes, increased demand for essential medicines, and significant operational pressures that require efficient supply chain management. As such, they provide a relevant context for examining the interaction between human resource capacity and supply chain performance. Previous studies in similar urban settings have highlighted that facility-level dynamics, including staffing structures and workflow demands, significantly influence supply chain outcomes (Mukasa et al., 2023; Mbau & Wamai, 2022; Lugada et al., 2022; Duwiejua et al., 2025).

The quantitative component involved a structured survey administered to health workers directly engaged in supply chain-related activities. The target population included personnel responsible for stock management, dispensing, reporting, and logistics coordination. A sample size of 100 respondents was initially determined to ensure adequate representation and statistical reliability, informed by established methodological principles for social science research. However, 70 respondents completed the survey, yielding a response rate of seventy percent. While this response rate is considered acceptable, it is important to acknowledge the potential for non-response bias. Staff who did not participate may have differed systematically in terms of workload intensity, availability, or technical competence, which may influence the interpretation of findings (Cohen, 1992; Creswell & Creswell, 2018; Creswell & Plano Clark, 2017; Mbau & Wamai, 2022).

To enhance the representativeness of the sample, respondent characteristics were compared with national health workforce patterns. The predominance of mid-level cadres and diploma-level qualifications within the sample reflects the broader structure of Uganda's health workforce, where such cadres form the backbone of service delivery. This alignment suggests that the sample provides a reasonable representation of operational realities within public health facilities. Existing literature supports the importance of aligning sample characteristics with population profiles to strengthen the generalizability of findings in health systems research (Mukasa et al., 2023; Lugada et al., 2022; Kalangwa et al., 2025; Duwiejua et al., 2025).

The qualitative component comprised key informant interviews with six purposively selected participants who possessed direct experience in pharmaceutical and supply chain management. The use of purposive sampling was appropriate in this context, as it enabled the selection of individuals with rich, context-specific knowledge of the study phenomenon. The interviews were semi-structured, allowing for consistency across participants while also providing flexibility to explore emerging themes in greater depth. This approach is particularly valuable in mixed-methods research, where qualitative insights are used to complement and explain quantitative findings (Creswell & Plano Clark, 2017; Creswell & Creswell, 2018; Mbau & Wamai, 2022; Mukasa et al., 2023).

Data collection involved multiple tools to enhance the robustness of the study. The survey instrument utilized a Likert-scale format to measure perceptions of human resource capacity across key dimensions, including technical skills, training, staffing, and compliance with standard procedures. The instrument was pre-tested to ensure clarity, reliability, and contextual relevance. Qualitative data were collected using interview guides designed to capture operational experiences, capacity gaps, and institutional challenges. The use of multiple data collection tools is consistent with best practices in mixed-methods research, where triangulation enhances the credibility of findings (Duwiejua et al., 2025; Kalangwa et al., 2025; Nakade et al., 2026; Lugada et al., 2022).

In addition to primary data, the study incorporated objective performance indicators obtained from facility records and logistics management information systems. These indicators included stock-out

frequency, reporting timeliness, order fulfillment rates, and inventory accuracy. The inclusion of objective measures was essential to address potential biases associated with self-reported data and to ensure that findings were grounded in measurable outcomes. Evidence from recent studies emphasizes the importance of combining perception-based data with objective indicators to improve validity in health systems research (Mukasa et al., 2023; Lugada et al., 2022; Kalangwa et al., 2025; Nakade et al., 2026).

Data analysis followed a concurrent approach consistent with the convergent mixed-methods design. Quantitative data were analyzed using descriptive statistics and correlation analysis to examine patterns and relationships between variables. The correlation coefficient was used to assess the strength and direction of the relationship between human resource capacity and supply chain performance. Qualitative data were analyzed using thematic analysis, involving systematic coding and interpretation of emerging themes. The integration of findings was achieved through triangulation, allowing for the identification of areas of convergence and divergence between data sources. This analytical approach is widely supported in mixed-methods research as a means of enhancing interpretive depth (Creswell & Creswell, 2018; Creswell & Plano Clark, 2017; Mbau & Wamai, 2022; Duwiejua et al., 2025).

To ensure methodological rigor, several strategies were employed. Reliability of the quantitative instrument was assessed through internal consistency measures, while validity was enhanced through pre-testing, careful instrument design, and triangulation of data sources. For the qualitative component, credibility was strengthened through the use of experienced informants and systematic analysis procedures. The integration of multiple data sources further enhanced the trustworthiness of the findings. These approaches are consistent with established standards for ensuring rigor in mixed-methods research (Creswell & Creswell, 2018; Creswell & Plano Clark, 2017; Mukasa et al., 2023; Mbau & Wamai, 2022).

Ethical considerations were carefully observed throughout the study. Participation was voluntary, and informed consent was obtained from all respondents prior to data collection. Confidentiality and anonymity were maintained by ensuring that no identifying information was linked to responses. Data were securely stored and used solely for academic purposes. The study adhered to established ethical principles governing research involving human participants, including respect for persons, beneficence, and justice (World Health Organization, 2017; Creswell & Creswell, 2018; Mbau & Wamai, 2022; Mukasa et al., 2023).

In summary, the methodological approach adopted in this study provides a robust and comprehensive framework for examining the relationship between human resource capacity and drug supply chain performance. By integrating quantitative analysis, qualitative insights, and objective performance indicators, the study ensures a high level of validity, reliability, and contextual relevance in its findings.

Table 1: Demographic Profile of Respondents

Characteristic	**Category**	**Frequency**	**Percentage**
Gender	Male	28	40.0
	Female	42	60.0

Characteristic	Category	Frequency	Percentage
Age	20–29	13	18.6
	30–39	32	45.7
	40–49	20	28.6
	50+	5	7.1
Education	Certificate	6	8.6
	Diploma	46	65.7
	Degree	17	24.3
	Postgraduate	1	1.4

Results

The findings of this study reveal a nuanced and layered relationship between human resource capacity and drug supply chain performance within KCCA Tier III health facilities. While the quantitative results suggest a relatively functional system, deeper examination through qualitative insights exposes structural weaknesses that significantly affect operational consistency.

From the survey data, a majority of respondents (66.4%) reported that they possessed adequate technical skills in stock management. At face value, this suggests a workforce that is capable of executing core supply chain functions. However, qualitative findings complicate this interpretation. Many participants explained that these skills were largely acquired through experience rather than formal training. This distinction is critical because informal learning often lacks standardization, which may result in variability in how procedures are applied across facilities.

Training emerged as a key area of concern. More than half of the respondents (51.5%) indicated that they had not received regular capacity-building opportunities. This finding was strongly reinforced by interview participants, who described a system in which refresher training is rare and often dependent on external programs rather than institutional planning. The implication is that while initial competencies may exist, they are not continuously updated to reflect evolving supply chain systems or technologies.

Staffing levels were identified as one of the most significant constraints. Only 31.4% of respondents agreed that staffing levels were adequate. In practice, this translated into situations where a single staff member was responsible for multiple roles, including dispensing, stock management, and reporting. Such workload pressures were consistently linked to reduced adherence to best practices, particularly in tasks such as inventory verification and documentation.

Operational compliance was moderately strong, with 62.8% of respondents indicating that inventory checks were conducted before reordering. However, qualitative evidence revealed that these practices were not always consistent. Several respondents acknowledged that time pressure and workload often led to shortcuts, particularly during peak service periods.

The relationship between human resource capacity and supply chain performance was further examined through correlation analysis, which revealed a statistically significant positive association ($r = 0.676$, $p < 0.05$). This indicates that facilities with stronger human resource capacity tend to demonstrate better supply chain performance. However, it is important to emphasize that this relationship does not establish causation, but rather highlights a meaningful association that warrants further investigation.

Table 2: Integrated Human Resource Capacity and Performance Analysis

Dimension	Quantitative Evidence	Qualitative Evidence	Interpretation
Technical Skills	Majority report adequacy	Skills largely experiential	Lack of standardization
Training	Over half report gaps	Limited refresher training	Institutional weakness
Staffing	Low adequacy reported	Multi-role workload common	Workforce shortage
Compliance	Moderate adherence	Shortcuts due to pressure	Operational constraints

As illustrated in Table 2, technical skills appear, at a superficial level, to be sufficient, with the majority of respondents reporting adequacy in managing supply chain functions. However, a more critical examination reveals that this perceived adequacy is largely grounded in experiential learning rather than formalized training systems. From a scholarly perspective, this distinction is significant. Experiential competence, while valuable, lacks standardization and may lead to variability in practice across facilities. Such variability has important implications for supply chain performance, particularly in areas that require precision and consistency, such as inventory control, forecasting, and reporting.

The issue of training further reinforces this concern. The quantitative finding that over half of the respondents reported gaps in training is strongly corroborated by qualitative evidence indicating limited access to refresher programs. This convergence suggests that training deficiencies are systemic rather than incidental. In institutional terms, this reflects a weakness in the formal structures responsible for continuous professional development. The absence of regular training not only limits the updating of technical skills but also constrains the system's capacity to adapt to evolving supply chain requirements, including the integration of digital logistics management systems.

Staffing adequacy emerges as one of the most critical constraints affecting performance. The quantitative evidence indicating low staffing levels is substantiated by qualitative accounts of health workers managing multiple roles simultaneously. From an operational standpoint, this multi-role workload introduces inefficiencies and increases the likelihood of procedural errors. Theoretical perspectives on organizational performance emphasize the importance of role clarity and specialization in achieving efficiency. In this context, staffing shortages can be understood as a structural limitation that directly undermines the reliability and effectiveness of supply chain operations.

Compliance with standard operating procedures presents a more nuanced picture. While moderate adherence is reported quantitatively, qualitative findings reveal that such compliance is often contingent upon workload conditions. Health workers described instances where adherence to established protocols was compromised in order to meet immediate service demands. This reflects a broader tension between procedural expectations and operational realities. From an analytical

standpoint, this behaviour can be interpreted as adaptive coping within constrained environments. While such adaptations may sustain short-term functionality, they may also introduce long-term inefficiencies, particularly in areas such as data accuracy and accountability.

Beyond the analysis of individual dimensions, the study sought to examine the overall relationship between human resource capacity and drug supply chain performance. The results of this analysis are presented in Table 3 below.

Table 3: Correlation Analysis

Variables	Correlation Coefficient	Significance
HR Capacity and Performance	0.676	$p < 0.05$

As presented in Table 3, the correlation coefficient of 0.676 indicates a moderately strong positive relationship between human resource capacity and supply chain performance. This suggests that facilities with stronger human resource capacity tend to demonstrate better performance outcomes, including improved stock management, enhanced reporting consistency, and reduced frequency of stock-outs.

However, it is important to interpret this finding with methodological rigor. While the relationship is statistically significant, it does not establish causality. The cross-sectional design of the study limits the ability to determine the direction of influence between variables. It is possible that improved supply chain performance may also reinforce human resource capacity through learning effects and improved system confidence. Additionally, external factors such as facility resources, leadership quality, and patient load may interact with human resource capacity to influence performance outcomes.

From a broader analytical perspective, these findings position human resource capacity as a foundational enabler within the supply chain system. The interaction between technical skills, training, staffing, and compliance suggests that capacity is a composite construct, comprising multiple interrelated elements. Strengthening one dimension in isolation is unlikely to yield sustainable improvements unless it is accompanied by complementary interventions across other areas.

In synthesizing these findings, it becomes evident that the effectiveness of drug supply chains in urban public health facilities is deeply embedded within the broader human resource ecosystem. While systems and infrastructure provide the necessary framework, it is ultimately the competence, adaptability, and coordination of health workers that determine how

Discussion

The findings of this study point to a central reality that cannot be overlooked: drug supply chain performance in urban public health facilities is not merely a technical issue, but a human one. While systems, guidelines, and tools are essential, their effectiveness ultimately depends on the people who operate them. In the context of KCCA health facilities, it becomes evident that human resource capacity is both a strength and a limitation.

As a researcher, what stands out most is the contradiction between perceived competence and actual system support. Health workers demonstrate a commendable level of resilience and adaptability. Many have developed practical skills that allow them to manage supply chain tasks even in the absence of formal training. However, this reliance on informal knowledge creates inconsistencies that

are difficult to sustain over time. It raises an important question: can a system truly be considered strong if it depends on individual improvisation rather than institutional structure?

The issue of training is particularly revealing. The absence of regular, structured capacity-building programs suggests that human resource development is not yet fully institutionalized within the system. This gap does not only affect individual performance but also limits the system's ability to adapt to change. In an era where digital tools and LMIS platforms are increasingly central to supply chain management, the lack of continuous training becomes a critical vulnerability.

Staffing shortages further deepen these challenges. When one individual is responsible for multiple roles, efficiency becomes a matter of compromise rather than optimization. From a practical perspective, it is unrealistic to expect high levels of accuracy and compliance under such conditions. The findings suggest that staffing is not simply a quantitative issue but a qualitative one that directly influences how well systems function.

Another important observation relates to supervision. While management structures exist, their effectiveness appears uneven. Supervision is often described as administrative rather than supportive. From the researcher's perspective, this represents a missed opportunity. Effective supervision should not only ensure compliance but also build capacity, reinforce learning, and support problem-solving.

The integration of objective performance indicators strengthens these reflections. Facilities with stronger human resource capacity consistently showed better outcomes, including fewer stock-outs and improved reporting. This provides tangible evidence that investments in human resources yield measurable benefits.

Drawing from Tukei's work in the Uganda Police Force, a parallel can be drawn between health systems and other institutional settings. His findings emphasize that organizational performance is not driven solely by systems but by the alignment between human capacity, leadership, and operational structures. This insight reinforces the argument that improving supply chain performance requires a holistic approach that prioritizes people as much as processes.

Conclusion

This study set out to examine the role of human resource capacity in shaping drug supply chain performance within KCCA health facilities. The findings clearly demonstrate that while the system possesses foundational strengths, significant gaps remain in how human resources are developed, supported, and utilized.

The evidence suggests that human resource capacity is not merely a supporting factor but a central determinant of supply chain performance. Technical skills, when present, are often not reinforced through structured systems. Training is inconsistent, staffing levels are insufficient, and supervision does not always fulfill its potential as a capacity-building mechanism.

What emerges from this study is the realization that improving supply chain performance cannot be achieved through isolated interventions. It requires a deliberate and sustained effort to strengthen human resource systems in a way that is both practical and contextually relevant. Without such investment, even well-designed supply chain systems will continue to operate below their potential.

Implications of the Study

The findings of this study extend beyond descriptive insights into human resource capacity and drug supply chain performance, offering critical implications for policy, practice, theory, and future research. These implications highlight the centrality of human resource systems in shaping not only operational efficiency but also the broader resilience and responsiveness of public health systems.

Policy Implications

The findings of this study call for a fundamental shift in how policymakers conceptualize human resource capacity within health systems. Traditionally, policy interventions have emphasized staffing numbers as the primary solution to performance challenges. While increasing the workforce remains important, this study demonstrates that numerical adequacy alone does not guarantee improved system performance. Rather, the effectiveness of human resources is determined by the extent to which staffing is complemented by structured training, clear role definition, and supportive supervision.

From a policy perspective, this suggests the need for more comprehensive human resource frameworks that integrate capacity development as a continuous process rather than a one-time intervention. Policies should institutionalize regular capacity-building programs, including mandatory refresher training linked to evolving supply chain systems such as LMIS platforms. In addition, there is a need to formalize role clarity within health facilities to reduce overlap and ensure accountability. Without such alignment, even well-staffed systems may continue to operate below their optimal potential.

Furthermore, the findings point to the importance of embedding human resource strengthening within broader health system reforms. Policymakers should consider linking supply chain performance indicators directly to human resource development strategies, ensuring that investments in logistics and infrastructure are matched by corresponding investments in people.

Practice Implications

At the level of practice, the study highlights the critical role of continuous learning and structured support systems in improving supply chain performance. Health workers operate within complex and often resource-constrained environments, where the ability to adapt and respond effectively depends largely on the support structures available to them.

The findings suggest that facilities should move toward institutionalizing regular training programs that are tailored to the practical realities of supply chain management. Such training should not be limited to initial orientation but should include periodic refresher sessions that address emerging challenges and technological changes. In addition, mentorship and peer-learning mechanisms should be strengthened to facilitate knowledge sharing and reinforce best practices.

Another key implication for practice relates to workload management. The prevalence of multi-role responsibilities among health workers indicates the need for more deliberate task allocation and role specialization. Facilities should adopt strategies that distribute responsibilities more effectively, thereby reducing operational pressure and improving adherence to standard procedures.

Performance monitoring also emerges as a critical area for improvement. Rather than focusing solely on compliance, supervision should be reoriented toward supportive engagement, where health workers receive guidance, feedback, and problem-solving support. Such an approach is more likely to build capacity and sustain improvements over time.

Theoretical Implications

From a theoretical perspective, this study contributes to the evolving discourse on health systems strengthening by reinforcing the central role of human resource capacity as a determinant of operational performance. While traditional models of supply chain management have often emphasized technical and logistical factors, the findings of this study highlight the need for more integrated frameworks that incorporate human elements as core components.

The study advances the understanding of human resource capacity as a multidimensional construct, encompassing not only skills and knowledge but also training systems, staffing structures, and behavioural adaptations. This aligns with broader organizational theories that emphasize the interplay between human capability and system performance.

Moreover, the findings suggest that supply chain performance should be conceptualized as an emergent outcome of interactions between human and technical systems. This perspective challenges reductionist approaches that treat capacity variables in isolation and instead supports the development of holistic models that capture the complexity of real-world operations.

By drawing parallels with organizational performance studies, including those conducted within the Uganda Police Force, the study further demonstrates that the principles of capacity, structure, and coordination are transferable across sectors. This cross-sectoral relevance strengthens the theoretical argument that human resource capacity is a universal determinant of institutional effectiveness.

Research Implications

The study also highlights important directions for future research. While the findings establish a significant association between human resource capacity and supply chain performance, the cross-sectional design limits the ability to draw causal conclusions. Future studies should therefore adopt longitudinal designs to examine how changes in human resource capacity influence performance over time.

In addition, there is a need for more context-specific research that explores variations across different types of health facilities and geographical settings. Comparative studies between urban and rural facilities, as well as between public and private sectors, could provide deeper insights into how contextual factors shape the relationship between capacity and performance.

Further research should also explore the integration of objective performance indicators with qualitative assessments to strengthen the validity of findings. The use of mixed-methods approaches, as demonstrated in this study, offers a valuable framework for capturing both measurable outcomes and experiential realities.

Finally, there is scope for exploring the role of leadership and organizational culture in mediating the relationship between human resource capacity and supply chain performance. Such investigations would contribute to a more comprehensive understanding of the factors that influence system effectiveness.

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