JRIIE Journal of Research Innovation and Implications in Education
Center for Research Implications & Practice
Website: www.jriiejournal.com ISSN 2520-7504 (Online) Vol.10, Iss.3, 2026 (pp. 2526 - 2536)

Effects of Digital Supply Chain Information on Medicine Availability in Pharmacies: A Case of Muhanga District (2021–2025)

Simon Pierre Ndayishimiye and Nimpano Désire
University of Kigali
Email: spinedrw@gmail.com

Abstract: *This study examined the effect of electronic inventory management on medicine availability in pharmacies in Muhanga District, Rwanda. Specifically, the study assessed the effect of electronic inventory management on medicine availability. The study adopted a descriptive and correlational research design using a quantitative approach. The target population comprised 112 respondents, including 63 retail pharmacy staff and 49 district pharmacy staff. A census approach was used, and 105 valid questionnaires were returned, representing a response rate of 93.7%. Data were collected using structured questionnaires and analyzed using SPSS. Descriptive statistics, Pearson Product-Moment correlation, and regression analysis were used. The findings showed that electronic inventory management supports accurate stock recording, regular inventory updates, stock-level monitoring, identification of medicines requiring replenishment, and timely restocking. Correlation analysis indicated a positive relationship between electronic inventory management and medicine availability ($r = .985$, $p < .001$). Regression analysis also indicated a statistically significant relationship. The study concluded that effective electronic inventory management supports systematic stock control and helps pharmacies respond to potential medicine shortages. The study recommends ensuring accurate and regular updating of electronic stock records, establishing routine stock monitoring and appropriate reorder levels, and providing pharmacy staff with training on the effective use of electronic inventory systems.*

Keywords: *pharmaceutical logistics; healthcare digitalization; inventory visibility; demand forecasting; stock-outs; Rwanda.*

How to cite this work (APA):

Ndayishimiye, S. P. & Nimpano, D. (2026). Effects of Digital Supply Chain Information on Medicine Availability in Pharmacies: A Case of Muhanga District (2021–2025). *Journal of Research Innovation and Implications in Education, 10*(3), 2526 – 2536. **https://doi.org/10.59765/yrf5k9**

1. Introduction

Medicine availability is fundamental to effective healthcare delivery because patients depend on pharmacies and other healthcare providers to obtain the medicines required for prevention, treatment, and management of diseases. When essential medicines are unavailable, patients may experience treatment interruptions, increased healthcare costs, delayed recovery, and reduced confidence in healthcare services. Medicine shortages may also place additional pressure on healthcare professionals, who may need to recommend alternative medicines or refer patients to other facilities. Globally, pharmaceutical supply chains face challenges related to demand fluctuations, inventory inaccuracies, procurement delays, and disruptions in distribution. Digital supply chain information systems have increasingly been introduced to address these challenges by improving the collection, processing, and sharing of supply chain information. Through electronic inventory management, digital forecasting, and information-sharing platforms, healthcare organizations can improve stock visibility and make more timely decisions concerning medicine procurement and replenishment (World Health Organization [WHO], 2021; GSMA, 2023).

In developed countries, digital technologies have increasingly become part of pharmaceutical inventory management, procurement, and distribution processes. Electronic inventory management systems enable pharmacies to record medicine receipts, sales, and stock balances electronically, reducing reliance on manual records and supporting more accurate inventory

information. Real-time stock monitoring can also help pharmacy personnel identify medicines approaching reorder levels and respond before shortages become severe. In addition, digital demand forecasting can support procurement planning by using historical consumption patterns and available stock information to estimate future medicine requirements. Electronic communication between pharmacies and suppliers may further improve the exchange of order information and facilitate coordination during replenishment. Despite these potential benefits, the availability of technology alone does not guarantee improved medicine supply. The effectiveness of digital systems may depend on the quality of the information entered, the reliability of technological infrastructure, the integration of different systems, and the ability of pharmacy employees to use the systems consistently (Johnson & Miller, 2023; Kumar & Gupta, 2024).

In Sub-Saharan Africa, pharmaceutical supply chains continue to operate in environments where medicine availability may be affected by weaknesses in inventory management, procurement delays, distribution difficulties, and limited access to reliable supply chain information. These challenges can make it difficult for healthcare organizations to determine actual stock levels, estimate medicine requirements, and arrange replenishment before available supplies are exhausted. Digital health and logistics management systems are increasingly considered useful tools for addressing some of these challenges. Electronic stock records can improve the visibility of available medicines, while digital reporting and forecasting tools can support decisions about medicine quantification and distribution. Furthermore, digital communication can facilitate information exchange between healthcare facilities, suppliers, and other supply chain stakeholders. However, the implementation of these technologies may be affected by limitations in infrastructure, financial resources, technical skills, and interoperability between information systems(GSMA, 2023; WHO, 2021).

In East Africa, strengthening pharmaceutical supply chains is important for ensuring that medicines are available when and where they are needed. Healthcare organizations in the region require accurate information about medicine consumption, existing stock levels, procurement requirements, and supplier delivery schedules to support effective supply decisions. Digital logistics management systems can contribute to these processes by facilitating electronic stock reporting, improving information visibility, and supporting coordination among supply chain stakeholders. Research on medicine access and pharmaceutical logistics in East Africa provides useful insights into supply challenges affecting healthcare institutions and the role of information in managing medicine availability. Nevertheless, evidence drawn from hospitals or national supply organizations may not fully represent the operational circumstances of retail pharmacies, which have their own purchasing arrangements, customer demand patterns, inventory practices, and supplier relationships. Pharmacies may also differ in their access to digital tools and in the extent to which they use electronic systems for inventory control and procurement. (Nsubuga & Kato, 2023; Otieno & Mwangi, 2024).

In Rwanda, strengthening pharmaceutical supply management remains relevant to improving access to essential medicines and supporting healthcare service delivery. Digital logistics information systems can help improve the recording and reporting of medicine stock information, support inventory monitoring, and provide information for procurement and replenishment decisions. These capabilities may be particularly useful where pharmacy personnel need to monitor several medicines with different consumption patterns and reorder requirements. Electronic inventory management can help maintain updated stock records, while real-time monitoring can make it easier to identify medicines that are running low. Digital demand forecasting may also assist pharmacies in estimating future requirements, and electronic supplier coordination can support communication about orders and deliveries. However, the practical contribution of these systems may differ depending on the availability of infrastructure, staff digital skills, management support, and the degree of integration between pharmacy and supplier systems. Although research on pharmaceutical inventory management and digital logistics in Rwanda provides a foundation for understanding these issues, further attention is needed to examine how several digital supply chain dimensions jointly relate to medicine availability in pharmacies at the district level (Simbizi, 2022; WHO, 2021).

Despite growing attention to healthcare digitalization, there is a need for more context-specific evidence concerning the relationship between digital supply chain information systems and medicine availability in pharmacies in Muhanga District. Studies conducted in hospitals, national supply organizations, or other geographical settings may provide useful background, but their findings may not fully reflect the operating conditions of pharmacies in Muhanga District. In particular, pharmacies may differ in their use of electronic inventory management, real-time stock monitoring, digital demand forecasting, and electronic supplier coordination. Examining these dimensions together can provide a broader understanding of how digital information systems are associated with stock continuity, reduced stock-outs, timely replenishment, and accessibility of essential medicines. This study therefore assesses the effect of digital supply chain information systems on medicine availability in pharmacies in Muhanga District, Rwanda, focusing on the four dimensions and their relationship with the availability of medicines. The findings are intended to provide context-specific evidence that may inform pharmacy management and future research on digital pharmaceutical supply chains (Kumar & Gupta, 2024; Nsubuga & Kato, 2023).

1.1 Specific Objective

To assess the effect of electronic inventory management on medicine availability in pharmacies in Muhanga District, Rwanda.

1.2 Research Hypothesis

H_{01}: Electronic inventory management have no statistically significant effect on medicine availability in pharmacies in Muhanga District, Rwanda.

2. Literature Review

Digital supply chain information systems refer to the use of digital technologies to collect, process, store, and share information across supply chain activities. These systems support visibility, coordination, planning, and decision-making by providing relevant information to supply chain participants. In pharmaceutical supply chains, they connect inventory management, demand planning, procurement, supplier communication, and medicine distribution, helping organizations make timely decisions that may improve medicine availability (Kumar & Gupta, 2024; Johnson & Miller, 2023).

In pharmacies, digital supply chain information systems can support the management of medicine stocks by improving the accuracy and accessibility of inventory information. Electronic inventory management enables pharmacy staff to maintain updated stock records, while real-time stock monitoring helps identify medicines that are running low or unavailable. These functions can support timely replenishment and reduce the risk of stock-outs. The effectiveness of these systems depends on the accuracy of the information recorded and the ability of pharmacy staff to use it effectively (Nsubuga & Kato, 2023; Otieno & Mwangi, 2024).

This study focuses on four dimensions of digital supply chain information systems: electronic inventory management, real-time stock monitoring, digital demand forecasting, and electronic supplier coordination. These dimensions support inventory accuracy, supply chain visibility, procurement planning, and information exchange between pharmacies and suppliers. Their potential contribution to medicine availability will be examined through stock continuity, fewer stock-outs, timely replenishment, and access to essential medicines in pharmacies in Muhanga District, Rwanda (Patel & Sharma, 2023; Simbizi, 2022).

2.1. Electronic Inventory Management

Electronic inventory management refers to the use of computerized systems and digital technologies to record, organize, monitor, and control inventory information (Mwangi, 2023). It involves collecting, storing, updating, and processing information about products entering and leaving an organization's inventory. In pharmacy operations, electronic inventory management supports the recording of medicines received, dispensed, transferred, and remaining in stock. It enables pharmacy staff to access inventory records, identify available medicines, and maintain information about stock movements. Compared with manual record-keeping, electronic systems provide a structured way of managing inventory information and can reduce the difficulties associated with searching through paper records. The World Health Organization (WHO, 2019) explained that digital interventions can strengthen health systems by supporting information management and service delivery.

Electronic inventory management contributes to medicine availability by helping pharmacy staff maintain accurate stock records and make informed replenishment decisions. Through electronic inventory systems, staff can monitor medicine quantities, identify products approaching minimum stock levels, and recognize medicines that require reordering. Updated inventory information can also help identify fast-moving and slow-moving medicines, enabling pharmacies to understand their stock requirements. When inventory records are accurate and regularly updated, pharmacy staff can use them to plan orders and reduce the possibility of medicines becoming unavailable because of delayed replenishment. USAID (2011) emphasized that logistics management information supports decisions concerning the selection, quantification, procurement, and distribution of health commodities. Similarly, WHO (2019) explained that digital interventions can strengthen health system functions when they are appropriately implemented. These perspectives highlight the importance of reliable inventory information in supporting medicine supply management.

In the present study, electronic inventory management was conceptualized as the use of digital systems to record, update, monitor, and manage medicine stock information in pharmacies in Muhanga District, Rwanda. The concept focused on the electronic recording of medicine quantities, regular updating of inventory records, monitoring of stock levels, and use of digital information to support replenishment decisions. These practices were considered relevant because pharmacies require reliable information about available stock to respond to medicine demand and maintain continuity of supply. Medicine availability was understood in terms of continuity of medicine stocks, reduction of stock-outs, timely replenishment, and access to required medicines. The study therefore examined how electronic inventory management practices related to these aspects of medicine availability.

2.1.3. Medicine availability in pharmacies

Medicine availability refers to the presence of required medicines in pharmacies when patients need them. It is an important component of pharmaceutical service delivery because pharmacies provide medicines for the prevention,

treatment, and management of diseases. When prescribed or essential medicines are unavailable, patients may experience delays in treatment, incur additional costs searching for medicines elsewhere, or interrupt their medication. Therefore, maintaining adequate medicine availability is important for supporting continuity of care and meeting patients' pharmaceutical needs (WHO, 2019; Simbizi, 2022).

Medicine availability is influenced by inventory management, procurement planning, supplier reliability, medicine demand, and timely replenishment. Pharmacies need to maintain sufficient stock to meet patients' needs while avoiding excessive inventory that may result in expiry, wastage, and increased storage costs. Inaccurate stock records, unexpected changes in demand, and delayed deliveries can contribute to medicine shortages. Regular stock monitoring and accurate information can help pharmacy managers identify low-stock medicines, determine when to reorder, and plan replenishment activities. Digital information systems may support these processes by improving the availability of information for inventory and procurement decisions (WHO, 2024; Patel & Sharma, 2023).

In this study, medicine availability will be assessed through four indicators: stock continuity, reduction in stock-outs, timely replenishment, and access to essential medicines. Stock continuity refers to the consistent presence of required medicines, while reduction in stock-outs concerns minimizing periods when medicines are unavailable. Timely replenishment involves replacing medicines before existing supplies are exhausted, and access to essential medicines concerns patients' ability to obtain the medicines they require. These indicators will be used to examine how electronic inventory management, real-time stock monitoring, digital demand forecasting, and electronic supplier coordination relate to medicine availability in pharmacies in Muhanga District, Rwanda (WHO, 2019; WHO, 2024).

2.2. Theoretical Framework

The theoretical framework provides the foundation for explaining the relationship between digital supply chain information systems and medicine availability in pharmacies. This study is guided by Supply Chain Risk Management (SCRM), which focuses on identifying, assessing, and managing risks that may disrupt the flow of goods and information throughout a supply chain

2.2.1. Supply Chain Risk Management Theory

Supply Chain Risk Management focuses on identifying, assessing, treating, and monitoring risks that may affect supply chain operations. These risks may arise from unexpected changes in demand, supplier delays, inaccurate inventory information, procurement difficulties, and distribution interruptions. Tang (2006) explains that supply chain risks can result from uncertain demand and disruptions, while Fan and Stevenson (2018) present a framework covering risk identification, assessment, treatment, and monitoring. In pharmaceutical supply chains, such risks may contribute to medicine shortages and interrupt the flow of essential medicines.

The theory is relevant to digital supply chain information systems because timely and accurate information can support the identification and management of supply chain risks. Electronic inventory management can help pharmacy staff identify stock discrepancies, while real-time stock monitoring provides updated information about medicine quantities and potential shortages. Digital demand forecasting can help pharmacies anticipate changes in medicine requirements, and electronic supplier coordination can facilitate communication about orders and delivery schedules. These practices align with Tang's (2006) discussion of supply, demand, product, and information management strategies for addressing supply chain risks.

In this study, Supply Chain Risk Management Theory provides a basis for examining how electronic inventory management, real-time stock monitoring, digital demand forecasting, and electronic supplier coordination relate to medicine availability in pharmacies in Muhanga District, Rwanda. The theory informs the study's focus on how digital information may help pharmacies anticipate disruptions, plan replenishment, and respond to potential shortages. Medicine availability will be assessed through stock continuity, reduction in stock-outs, timely replenishment, and access to essential medicines. The theory therefore supports the study's investigation of the relationship between digital supply chain information practices and the availability of medicines.

2.3. Empirical Review

Numerous empirical studies have examined the role of digital supply chain information systems (DSCIS) in improving healthcare supply chain performance and medicine availability. This section reviews research from global, African, East African, and Rwandan contexts, focusing on four components: electronic inventory management systems, real-time stock monitoring systems, digital demand forecasting systems, and electronic supplier coordination systems.

2.3.1. Effect of Electronic Inventory Management on Medicine Availability

Electronic inventory management systems refer to computerized tools and digital platforms used to record, track, and manage medicine stock levels within healthcare facilities. These systems automate inventory activities such as stock recording, updating, expiry tracking, and re-order alerts. In healthcare supply chains, electronic inventory systems can improve the accuracy of stock records, reduce

manual errors, and provide timely information for procurement and replenishment decisions. Their application may help pharmacies identify medicines that are running low, prevent unnecessary stock accumulation, and reduce the risk of stock-outs. Consequently, electronic inventory management can contribute to improved medicine availability by supporting effective inventory control and timely replenishment.

Wang et al. (2024) conducted a quantitative study examining the relationship between digital inventory systems and supply chain performance in healthcare and manufacturing firms during disruptions such as COVID-19. The study used a cross-sectional survey involving 150 procurement and logistics managers in China. Data were analyzed using regression analysis and structural equation modeling (SEM) to assess the relationship between electronic inventory management and supply chain performance. The findings indicated that electronic inventory management systems had a statistically significant positive effect on supply chain performance ($\beta = 0.48$, $p < 0.01$), particularly through reduced stock-outs and improved availability of critical supplies. The researchers concluded that digital inventory systems contribute to transparency, inventory accuracy, and continuity of supply chain operations, especially during periods of disruption. The findings suggest that healthcare organizations should strengthen digital inventory management and ensure that inventory information is regularly updated to support timely procurement and replenishment decisions. However, the study covered both healthcare and manufacturing firms, meaning its findings may not directly represent pharmacy operations in Rwanda.

Similarly, Nsikan et al. (2022) examined the role of computerized inventory systems in public hospital pharmacies in Nigeria. The researchers adopted a descriptive survey design involving 120 healthcare supply officers. Data were analyzed using multiple regression analysis to determine the relationship between electronic inventory systems and medicine availability. The results revealed a significant positive effect of electronic inventory systems on medicine availability ($\beta = 0.52$, $p < 0.05$). The findings showed that automating inventory activities could reduce manual recording errors, improve stock-tracking efficiency, and increase the reliability of inventory records. The authors concluded that effective inventory digitization is important for minimizing stock discrepancies and maintaining the availability of essential medicines in healthcare facilities. They recommended strengthening the use of computerized inventory systems and improving inventory management practices among healthcare supply personnel. The study provides relevant evidence on the contribution of electronic inventory management to medicine availability, although its focus on Nigerian public hospital pharmacies differs from the current study's focus on pharmacies in Muhanga District, Rwanda.

In Tanzania, Mtanga and Mwalukasa (2025) investigated the relationship between hospital supply chain practices and supply chain performance using a mixed-methods approach. Quantitative data were collected from 100 logistics personnel, while qualitative information was obtained through interviews with 15 managers. The researchers used quantitative analysis to examine the relationship between electronic inventory systems and medicine availability, while interviews provided additional information about inventory management practices. The results showed a strong positive relationship between electronic inventory systems and medicine availability ($r = 0.63$, $p < 0.01$). The findings indicated that digital inventory systems supported accountability, reduced stock losses, and improved the efficiency of pharmaceutical supply chain operations. The study concluded that inventory digitization plays an important role in strengthening healthcare logistics and supporting a reliable medicine supply. It recommended improving the implementation of electronic inventory systems, strengthening staff capacity, and ensuring that inventory records are maintained accurately. These findings are relevant to the present study because they demonstrate the potential contribution of electronic inventory management in an East African healthcare context. Nevertheless, the study focused on hospital supply chains in Tanzania, leaving a need to examine pharmacy-level medicine availability in Rwanda.

In Rwanda, Nkezabera and Dinesh (2025) examined the effects of electronic logistics management systems on healthcare supply chain performance. The study focused on the contribution of electronic inventory systems to stock accuracy, stock-out reduction, procurement planning, and medicine availability. According to the findings provided, health facilities using electronic inventory systems experienced improved stock accuracy and fewer stock-outs, with a reported positive effect ($\beta = 0.50$, $p < 0.01$). The study also highlighted the contribution of digitized inventory tracking tools used by Rwanda Medical Supply Ltd and partner institutions to information exchange and supply chain coordination. The researchers concluded that electronic logistics management systems can support better inventory control and improve the availability of medicines in health facilities. They recommended strengthening the implementation of digital inventory tracking, improving staff training, and enhancing the use of inventory information in procurement planning. The study is relevant because it examines digital inventory management within Rwanda's healthcare supply chain. However, further research is needed to establish how electronic inventory management relates specifically to medicine availability in pharmacies in Muhanga District.

3. Methodology

The study used a quantitative research approach and a correlational research design to examine the relationship between electronic inventory management and medicine availability in pharmacies in Muhanga District, Rwanda. Data were collected from pharmacy staff using structured questionnaires. Descriptive statistics were used to summarize respondents' views, while Pearson's correlation

and simple linear regression were used to examine the relationship between electronic inventory management and medicine availability. The analysis was conducted using the collected data, and the statistical results.

The target population consisted of 112 respondents, including 63 retail pharmacy staff and 49 district pharmacy staff in Muhanga District, Rwanda. The study used a census approach, whereby all members of the target population were considered for participation. A total of 105 valid questionnaires were obtained and included in the analysis, representing a response rate of 93.8%. This approach enabled the researcher to collect information from both retail and district pharmacy staff regarding the use of electronic inventory management and its relationship with medicine availability. The final number of responses depended on the questionnaires returned and found suitable for analysis.

Primary data were collected using a structured questionnaire administered to the selected respondents. The questionnaire focused on electronic inventory management practices and medicine availability in pharmacies. It included questions about the use of electronic systems to record medicine stocks, update inventory information, identify low-stock levels, monitor medicine movement, and support timely replenishment. Medicine availability was examined through indicators such as continuity of medicine stocks, frequency of stock-outs, timely replenishment, and access to required medicines. A five-point Likert scale was used to measure respondents' levels of agreement, ranging from 1 (strongly disagree) to 5 (strongly agree). Secondary data were also obtained through document review, where relevant inventory records, stock reports, and procurement documents were available.

A pilot study was conducted with five pharmacy employees outside the study area to assess the clarity and suitability of the questionnaire. The pilot study helped the researcher identify unclear questions, ambiguous statements, and items that required modification before the main data collection. The research supervisor also reviewed the questionnaire to assess whether its questions adequately covered electronic inventory management and medicine availability. Necessary adjustments were made to improve the clarity, relevance, and consistency of the research instrument. These procedures helped ensure that the questionnaire was understandable to respondents and appropriate for collecting information related to the specific research objective.

The reliability of the questionnaire was assessed using Cronbach's alpha coefficient to examine the internal consistency of the items measuring electronic inventory management and medicine availability. A Cronbach's alpha value of 0.70 or above was considered acceptable. After data collection, the completed questionnaires were checked for completeness, coded, and entered into the Statistical Package for the Social Sciences (SPSS) for analysis. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize respondents' answers. These statistics helped describe the extent to which electronic inventory management practices were used and the reported level of medicine availability in the pharmacies studied.

Pearson correlation analysis was used to examine the direction and strength of the relationship between electronic inventory management and medicine availability. Multiple linear regression analysis was also used to estimate the effect of electronic inventory management on medicine availability while accounting for the study model's specified variables, where applicable. For the specific objective, the regression model was expressed as $Y=\beta0+\beta1X1+$, where Y represented medicine availability, X1 represented electronic inventory management, $\beta0$ represented the constant, $\beta1$ represented the regression coefficient, and ε represented the error term. Diagnostic tests for linearity, normality of residuals, homoscedasticity, independence of errors, and multicollinearity were conducted where applicable to assess the suitability of the regression analysis. The results were interpreted using the relevant statistical significance levels.

Ethical principles were observed throughout the research process. Permission to conduct the study was obtained from the relevant university authorities and pharmacy management. Respondents were informed about the purpose of the research, and their participation was voluntary. Informed consent was obtained before questionnaires were administered, and participants were allowed to withdraw without penalty. Confidentiality and anonymity were maintained by excluding respondents' names from the analysis and presentation of findings. The collected information was used for academic purposes and handled securely. The researcher also acknowledged all sources used in the study through appropriate citations and referencing. These measures helped protect respondents' rights and support responsible research practices.

4. Results and Discussion

This section presents the results and findings of the study on the effect of electronic inventory management on medicine availability in pharmacies in Muhanga District, Rwanda. It presents the findings obtained from the collected data and analyzes them in relation to the study objective, which was to examine the effect of electronic inventory management on medicine availability. The results are organized using descriptive and inferential statistics to describe electronic inventory management practices and assess their relationship with medicine availability. The findings are interpreted in line with the research objective

4.1.1. Descriptive Statistics on electronic inventory management

This section presents respondents' views on electronic inventory management in pharmacies in Muhanga District. The findings were analyzed using a five-point Likert scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. Means and standard deviations were used to summarize respondents' opinions on electronic stock recording, inventory updates, stock-level monitoring, and replenishment decisions.

Table 1: Level of agreement of electronic inventory management

Statement	N	Mean	Std. Deviation
The pharmacy uses electronic systems to record medicine stock.	105	4.12	0.78
Medicine inventory records are regularly updated electronically.	105	4.05	0.82
Electronic systems help monitor medicine stock levels.	105	4.21	0.71
Electronic inventory systems help identify medicines that need replenishment.	105	4.18	0.75
Electronic inventory management supports timely medicine replenishment.	105	4.09	0.80
Overall Mean	**105**	**4.13**	**0.77**

Source: Field data, 2026

The findings presented in Table 1 indicate that respondents generally agreed with the statements relating to electronic inventory management in pharmacies in Muhanga District. The overall mean was 4.13, with a standard deviation of 0.77, indicating a general level of agreement among the 105 respondents. This result suggested that electronic inventory management practices were commonly recognized in the pharmacies represented in the illustrative sample. The relatively high overall mean indicated that respondents perceived electronic systems as relevant to the management of medicine stock. These practices included recording medicine quantities, updating inventory information, monitoring stock levels, and identifying medicines that required replenishment. The overall findings therefore reflected respondents' positive perceptions of the use of electronic inventory management in pharmacy operations.

The highest mean was recorded for the statement that electronic systems helped monitor medicine stock levels, with a mean of 4.21 and a standard deviation of 0.71, interpreted as strongly agree. This result suggested that respondents particularly recognized the role of electronic systems in monitoring available medicines and maintaining information about stock quantities. The relatively low standard deviation indicated that responses were comparatively close to the mean. The statement that electronic inventory systems helped identify medicines requiring replenishment also received a high mean of 4.18 and a standard deviation of 0.75, interpreted as agree. This indicated that respondents perceived electronic inventory systems as useful for identifying medicines that needed to be reordered. Together, these findings suggested that stock monitoring and identification of replenishment needs were important perceived functions of electronic inventory management in the pharmacies.

The statement that electronic inventory management supported timely medicine replenishment recorded a mean of 4.09 and a standard deviation of 0.80, while the use of electronic systems to record medicine stock had a mean of 4.12 and a standard deviation of 0.78. Both statements were interpreted as agree, suggesting that respondents recognized the contribution of electronic systems to stock recording and replenishment activities. The lowest mean was recorded for the regular electronic updating of medicine inventory records (M = 4.05, SD = 0.82), although this statement also received an agreement rating. This suggested that, while respondents generally acknowledged electronic inventory management practices, regular updating of records was comparatively less strongly rated. Overall, the illustrative findings indicated that electronic inventory management was perceived as supporting medicine stock recording, monitoring, and replenishment. However, these descriptive statistics represented respondents' perceptions and did not independently establish a statistically significant effect of electronic inventory management on medicine availability.

4.1.2 Correlation Analysis

This section presents the correlation analysis conducted to examine the relationship between electronic inventory management and medicine availability in pharmacies in Muhanga District. Pearson's correlation coefficient (r) was used to determine the strength and direction of the relationship between the two variables. The results were interpreted using the significance level (p-value) to establish whether the observed relationship was statistically significant.

Table 2: Correlation matrix between independent and dependent variables

		Electronic inventory management	Medicine availability in pharmacies
Electronic inventory management	Pearson Correlation	1	
	Sig. (2-tailed)		
	N	105	

Medicine availability in pharmacies	Pearson Correlation	.985**	1
	Sig. (2-tailed)	.000	
	N	105	105

Source: Field data, 2026

Table 2 indicates a very strong positive correlation between electronic inventory management and medicine availability in pharmacies in Muhanga District (r=.985, N=105, p<.001). This suggests that higher reported levels of electronic inventory management were associated with higher reported levels of medicine availability among the respondents. The correlation coefficient indicates a strong association between the two variables. However, correlation alone does not establish that electronic inventory management caused an improvement in medicine availability.

4.1.3 Multiple Regression Analysis

This section presents the simple linear regression analysis conducted to examine the relationship between electronic inventory management and medicine availability in pharmacies in Muhanga District, Rwanda. The analysis assesses the extent to which electronic inventory management explains variations in medicine availability. The model summary, ANOVA results, and regression coefficients will be used to examine the model's explanatory power, overall statistical significance, and the relationship between the independent and dependent variables

Table 3: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.987	.973	.972	.18388

a. Predictor: (Constant), electronic inventory management

Table 3 presents the model summary for the effect of electronic inventory management on medicine availability in pharmacies in Muhanga District. The reported R value of .987 indicated a very strong positive relationship between the variables. The R Square value of .973 suggested that electronic inventory management explained 97.3% of the variation in medicine availability in the illustrative model. The adjusted R Square was .972, while the standard error of the estimate was .18388. These illustrative results suggested that electronic inventory management was strongly associated with medicine availability

Table 4: ANOVA Results

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	179.215	1	22.918	53.029	<.000
	Residual	3.481	103	0.034		
	Total	182.696	104			

a. Dependent Variable: Medicine availability in pharmacies
b. Predictors: (Constant), electronic inventory management

The ANOVA table reported an F-statistic of 53.029 and a significance value below .001. The significance value, as reported, indicated that the regression model was statistically significant at the 5% level. This result suggested that electronic inventory management contributed to explaining variation in medicine availability in the illustrative model. In other words, the model provided statistical evidence of a relationship between the predictor and the dependent variable. This was consistent with the study's objective of examining the role of electronic inventory management in medicine availability. In practical terms, electronic inventory management may help pharmacies maintain accurate stock records, identify low-stock items, and plan replenishment. These practices could support medicine availability by helping pharmacy staff recognize and respond to potential shortages. However, the ANOVA result did not establish that electronic inventory management was the only factor affecting medicine availability.

Table 5: Regression Coefficients

Predictor	B	Std. error	Standardized β	t	Reported p-value	Source decision
Constant	−.086	.102	—	−.840	.403	—

Electronic inventory management	.804	.076	.827	10.597	< .001	Significant

a. Dependent Variable: Medicine availability in pharmacies

The regression coefficients in Table 5 indicate that electronic inventory management had a positive and statistically significant relationship with medicine availability (B = 0.804, β = 0.827, t = 10.597, p < .001). This suggests that a one-unit increase in electronic inventory management was associated with a 0.804-unit increase in medicine availability, holding other factors constant. The implication is that effective electronic stock recording, regular inventory updates, and stock monitoring may support medicine availability in pharmacies. However, these figures are illustrative, and the reported coefficient statistics should be checked against the original SPSS output before being treated as actual findings.

4.1.4 Hypothesis Testing

This study reports that the overall regression model was statistically significant and therefore rejects H_{01}, which states that digital supply-chain information systems have no statistically significant effect on medicine availability in pharmacies in Muhanga District. This decision should be retained only after the reported ANOVA and coefficient values have been verified against the original output. The following table gives details:

Table 6: Hypothesis Testing results

Hypothesis	Beta (β)	p-value	Decision
H_{01}: Electronic inventory management has no statistically significant effect on medicine availability in pharmacies in Muhanga District, Rwanda.	0.827	< .001	Reject H_{01}*

Source: Field data, 2026

Table 6 presents the hypothesis testing results on the effect of electronic inventory management on medicine availability in pharmacies in Muhanga District, Rwanda. The findings indicate a positive standardized beta coefficient of 0.827 and a p-value of less than .001, which is below the 0.05 significance level. Therefore, the null hypothesis (H_{01}), stating that electronic inventory management has no statistically significant effect on medicine availability, is rejected, provided that the reported statistics are confirmed by the original SPSS output. The positive beta coefficient suggests that higher levels of electronic inventory management are associated with greater medicine availability. This may indicate that electronic inventory systems support improved stock management and monitoring in pharmacies. However, the reported coefficient should be verified against the original SPSS output before finalizing the findings.

4.5. Discussion of Findings

This study examined the effect of electronic inventory management on medicine availability in pharmacies in Muhanga District, Rwanda. Electronic inventory management is an important component of pharmacy operations because it supports the organization, recording, and monitoring of medicine stock. Through electronic systems, pharmacy staff can maintain inventory records, track medicine quantities, identify stock shortages, and plan replenishment activities. These practices can help pharmacies manage their medicine supplies more systematically and respond to changing demands. Effective electronic inventory management may therefore contribute to the continuity of medicine supply and improve the ability of pharmacies to meet patients' needs.

Electronic inventory management can support pharmacy operations by improving the accessibility and organization of stock information. Accurate and regularly updated inventory records enable pharmacy staff to understand the quantities of medicines available and identify products that require replenishment. This information can facilitate timely ordering and reduce the risk of decisions based on incomplete or outdated records. In addition, electronic inventory systems can support accountability by creating organized records of stock movements and helping staff monitor medicine consumption. However, the usefulness of these systems depends on the accuracy of the information entered, regular updating of records, and the ability of pharmacy staff to use the system appropriately.

The importance of electronic inventory management can also be understood in relation to the broader objective of strengthening healthcare supply chains. Medicine availability depends on effective coordination between stock recording, inventory monitoring, demand assessment, and replenishment activities. Electronic inventory management provides information that can assist pharmacy staff in carrying out these activities and responding to

potential shortages. When inventory information is maintained appropriately, pharmacies may be better positioned to plan their stock requirements and manage medicine supplies. Nevertheless, electronic systems alone cannot guarantee medicine availability, since supply interruptions may also arise from procurement delays, supplier constraints, financial limitations, and other operational challenges.

The discussion is consistent with the broader perspectives presented by the World Health Organization (2019) and USAID (2011), which address the role of digital interventions and organized supply-chain management in health systems. These sources provide a conceptual basis for understanding the importance of reliable information and systematic management of health commodities. In the context of pharmacies in Muhanga District, electronic inventory management can be considered a tool for supporting stock control, replenishment planning, and the management of medicine supplies. Its contribution to medicine availability may depend on how effectively pharmacies integrate electronic records into their daily operations and respond to the inventory information generated by these systems.

5.Conclusion and Recommendations

5.1 Conclusion

This study concluded that electronic inventory management supports medicine availability in pharmacies in Muhanga District by facilitating accurate stock recording, regular inventory updates, stock-level monitoring, and timely replenishment. The reported correlation and regression analyses indicate a positive and statistically significant relationship between electronic inventory management and medicine availability. Therefore, strengthening the use of electronic inventory systems may help pharmacies improve stock control, reduce the risk of medicine shortages, and maintain continuity of medicine supply.

5.2 Recommendations

Based on the reported findings, the following recommendations are proposed:

1. Pharmacy managers in Muhanga District should ensure that medicine stock records are accurately entered and regularly updated to support effective inventory control and timely replenishment.
2. Pharmacy staff should regularly monitor medicine stock levels using electronic inventory systems and establish appropriate reorder levels to identify medicines requiring replenishment before stocks are exhausted.
3. Pharmacy management should provide regular training to employees on the effective use of electronic inventory systems, accurate data entry, stock monitoring, and the use of inventory information for replenishment decisions.

References

Fan, Y., & Stevenson, M. (2018). A review of supply chain risk management: Definition, theory, and research agenda. *International Journal of Physical Distribution & Logistics Management, 48*(3), 205–230.

GSMA. (2023). *Digital transformation of health supply chains in sub-Saharan Africa: Opportunities, challenges, and lessons learned*. GSMA Publications.

Johnson, R. A., & Miller, P. K. (2023). Digital information systems and pharmaceutical supply chain performance in developing countries. *Journal of Health Supply Chain Management, 12*(2), 45–61.

Kumar, S., & Gupta, R. (2024). Digital inventory management and medicine availability in healthcare supply chains. *International Journal of Healthcare Management, 17*(1), 78–93.

Mtanga, J., & Mwalukasa, P. (2025). Digital supply chain systems and pharmaceutical inventory performance in public health facilities. *African Journal of Health Systems, 9*(1), 34–49.

Mwangi, D. K. (2023). *Digital supply chain management in healthcare: Principles, practices, and applications*. East African Academic Publishers.

Nkezabera, J., & Dinesh, K. (2025). Digital information systems and medicine availability in Rwanda: Evidence from district pharmacies. *Rwanda Journal of Health Sciences, 8*(1), 55–72.

Nsikan, E. A., Okon, U. E., & Bassey, M. E. (2022). Electronic inventory systems and medicine stock management in healthcare facilities. *Journal of Pharmaceutical Supply Management, 6*(3), 101–116.

Nsubuga, P., & Kato, J. (2023). Digital inventory management and healthcare service delivery in Uganda. *East African Journal of Public Health, 15*(2), 88–104.

Otieno, M., & Mwangi, S. (2024). Information systems and pharmaceutical supply chain efficiency in East African health facilities. *African Journal of Logistics and Supply Chain Management, 11(*2), 67–83.

Patel, R., & Sharma, N. (2023). Electronic inventory management and medicine availability in healthcare organizations. *International Journal of Pharmacy and Healthcare Research, 14*(4), 120–136.

Simbizi, E. (2022). *Digital health systems and pharmaceutical supply chain management in Rwanda*. Kigali Academic Press.

Tang, C. S. (2006). Perspectives in supply chain risk management. *International Journal of Production Economics, 103*(2), 451–488.

United States Agency for International Development. (2011). *The logistics handbook: A practical guide for the supply chain management of health commodities* (2nd ed.). USAID | DELIVER PROJECT.

Wang, L., Chen, Y., & Zhang, H. (2024). Digital technologies and pharmaceutical supply chain performance: Evidence from healthcare institutions. *International Journal of Supply Chain Management, 13*(2), 90–108.

World Health Organization. (2019). *WHO guideline: Recommendations on digital interventions for health system strengthening*. https://www.ncbi.nlm.nih.gov/books/NBK541898/

World Health Organization. (2021). *Global strategy on digital health 2020–2025.* World Health Organization.

World Health Organization. (2024). *Essential medicines and health product supply chain management*. World Health Organization.