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Effect of Healthcare Inventory Management Practices on the Performance of Pharmaceutical Companies' in Rwanda; A Case of Selected Retail Pharmacies in Gasabo District

Regis Nsanzimana[1] & Dr. Joseph Akumuntu[2] (PhD)

[1] Master of Procurement and Supply Chain Management, University of Kigali, Rwanda

[2]University of Kigali, Rwanda

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Abstract

This study investigated the effect of healthcare inventory management practices on the performance of pharmaceutical companies in Rwanda with special focus on selected retail pharmacies located in Gasabo District. This research adopted a descriptive design to describe healthcare inventory management practices most used in retail pharmacies setting and a multivariate regression analysis to determine their effect on retail pharmacies performance. This study targeted a population of 195 respondents where all responsible pharmacists were selected to take part in it, unfortunately only 142 respondents took part in it and the data were collected using a questionnaire of both open ended and close ended questions. Then after, data gathered were processed and analyzed based on objectives to test the hypothesis. The study revealed that retail pharmacies in Rwanda employ a variety of approaches in managing inventory where the Economic Order Quantity (EOQ) method was the most widely used at 46.3%, indicating a focus on cost-effective inventory management. The majority of respondents strongly agreed that inventory control techniques were effective in reducing stock outs, maintaining appropriate inventory quantities, minimizing wastage and losses. Inventory shrinkages, such as expiration, damages, theft, and stock outs, significantly impact pharmacy performance, so emphasizing on addressing these issues through good inventory management would improve the performance effectively. The use of various stock management software systems was also examined, with Ishyiga being the most widely adopted system. These findings suggest that effective inventory management is essential for pharmacy performance, with technology adoption playing a pivotal role in enhancing efficiency and accuracy. The study also highlights the importance of addressing inventory shrinkages and utilizing various inventory control techniques. Therefore, inventory management practices play a crucial role in enhancing various aspects of pharmacy operations.

Keywords: *Healthcare Inventory Management Practices, Performance of Pharmaceutical Companies, Retail Pharmacies, Gasabo District, Rwanda.*

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1. Introduction

Poor inventory management has become a major problem since performance is viewed as the main driver of business growth. By taking advantage of the opportunities presented by better inventory management, a business can boost performance on all key financial metrics. Efficient inventory management is one of the essential ingredients for success in healthcare supply chain. The ideal scenario for a pharmaceutical facility would be to have enough inventory to satisfy customer demand while preventing clientele loss due to stock-outs (Fredrick, 2018). Inventory management is required to strike a balance between the benefits and drawbacks of keeping inventory. When businesses mismanage their inventory, stock outs, a drop in productivity and profitability, and unhappy customers are all inescapable consequences (Bekele, 2020).

According to a study on assessment of factors contributing to medicine expiry in Rwanda, a case of Rwanda Medical Supply (RMS), medicines are still expiring. The total value of all expired products during the course of five years (from 2014 to 2018) was RWF 6,046,778,655 for all program categories. The study identified major contributing factors to the expiry of health commodities at RMS as follows: Supply chain management 90%, other factors 73%, Poor storage management 68% and Excessive drug supply 67%. All those factors are forms of poor inventory management (Hakuzimana, Kayumba, Hahirwa & Kabalisa, 2021).

According to the present study, the monetary value of expired goods is extremely high. When you consider Rwanda's economy and health spending, this is a significant challenge. Additionally, there are several resources that are being lost in retail pharmacies due to expiration and dissatisfied clients as a result of excessive stock outs. It is essential to use proper inventory management techniques to increase accuracy, real-time inventory monitoring to make sure there is enough inventory to fulfill requests, lower costs, and enhance customer service. Therefore, this study assessed the effect of healthcare inventory management practices on the performance of selected retail pharmacies in Rwanda, especially in Gasabo District.

1.1 Research objectives

This research had the general objectives and the specific objectives which directed each phase of this research process.

1.1.1 General objective

The general objective of this study was to assess the effect of healthcare inventory management practices on the performance of the pharmaceutical companies in Rwanda

1.1.2 Specific objectives

(i) To determine the influence of inventory control techniques on selected retail pharmacies performance
(ii) To assess the effect of inventory shrinkages on the performance of selected retail pharmacies
(iii) To find out the influence of using technology in inventory management on the performance of selected retail pharmacies

1.4. Research Hypothesis

$H0_1$: Inventory control techniques have no significant influence on the performance of retail pharmacies;
$H0_2$: Inventory shrinkages have no significant influence on the performance of retail pharmacies;

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$H0_3$: Use of technology in inventory management have no significant influence on the performance of retail pharmacies.

2.1 Empirical Review

A study on the analysis of pharmaceutical inventory management based on ABC/VEN analysis in Rwanda, a case of Rwanda Medical Supply (RMS) Ltd, Nyamagabe Branch for products distributed to health facilities in Nyamagabe District catchment area from the financial years 20172018 to 2019-2020, has revealed that on 476 items analyzed using ABC-VEN analysis, 76 products were classifed in group A. These comprised 19.84% of the total cost of all products and had a value of 74.91%. Group B had 116 products, or 30.29% of the entire cost, valued at 20%, while

Group C had 191 products, or 49.87% of the total cost, valued at only 5.09%. In the VEN study, 202 products (44.20%), 231 (50.54%), and 24 (75.26%) were classified as vital, essential, and nonvital, respectively. The findings of this study suggest that inventory management of essential and pricey goods including antibiotics, antihypertensive medications, consumables, and large solutions should be closely maintained to avoid a scarcity of such goods at the level of health facilities. One efficient and affordable way to attain an optimized supply chain is through the ABC-VEN analysis (Mfizi, Niragire, Bizimana & Mukanyangezi, 2023).

According to a study conducted on Safaricom ltd in Kenya on influence of inventory management practices on organizational competitiveness, Inventory shrinkage, according to 42.3% of respondents, has a very significant impact on Safaricom Ltd's ability to compete, while 38.5% of them said it has a significant impact. Meanwhile, 19.2% of respondents said it has a moderate impact. The results imply that inventory shrinkage has a significant role in determining the competitiveness of Safaricom Ltd. Stock shortages lead to most the hardships for most organizations and leads to low competitiveness and overall performance of a firm. When evaluating how different aspects of inventory shrinkage affect Safaricom Ltd's competitiveness, the majority of respondents reaffirmed that stock outs at wholesalers have a significant impact, as evidenced by a mean score of 3.5656; similarly, employee theft has a significant impact on Safaricom Ltd's competitiveness, as evidenced by a mean score of 3.5656; and expired inventory or stock has a significant impact on Safaricom (Kamau & Kagiri, 2015).

A study on inventory management practices and supply chain performance of antiretroviral medicines in public hospitals in Nyamira County, Kenya found out that the use of scheduled inventory control model (80.95%), forecasting demand using prior consumption data (100%), maintaining accurate and up-to-date stock records for each commodity (92.31%), and including crucial logistical data in reports were among the most common inventory management practices in Nyamira County public hospitals. With the exception of order lead time (17.98 days), it was determined that the supply chain performance measures of stock out rate (52.12%), stock wastage rate (43.2%), and reporting rates (70.84%) were lacking. Inadequate staff, poor training, improper storage, and an unstable pharmaceutical supply were the issues that inventory management was found to be most vulnerable too (Johnson, 2019)

Another study on the effect of information Technology on inventory management for the manufacturing companies in Mogadishu has shown that the adoption of IT has strongly affected inventory management of the company through information sharing with suppliers with a mean score of 1.78 and 1.71 accuracy on inventories and coordination of inventory management decisions between departments involved in inventory management. While it is agreed that information technology have reduced cost of ordering stock, improved order

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processing, improved speed of service to customers and enhanced stock availability to customers and that shows the effect of information technology on inventory management (Mohamed. 2018).

2.2 Research Gap

Although numerous studies have looked at the effect of inventory management on the performance of pharmaceutical companies, there is a dearth of research on the effect of healthcare inventory management on the performance of private health care institutions, particularly retail pharmacies. Despite this, retail pharmacies are now thought to be the place where many patients go when they need medical services.

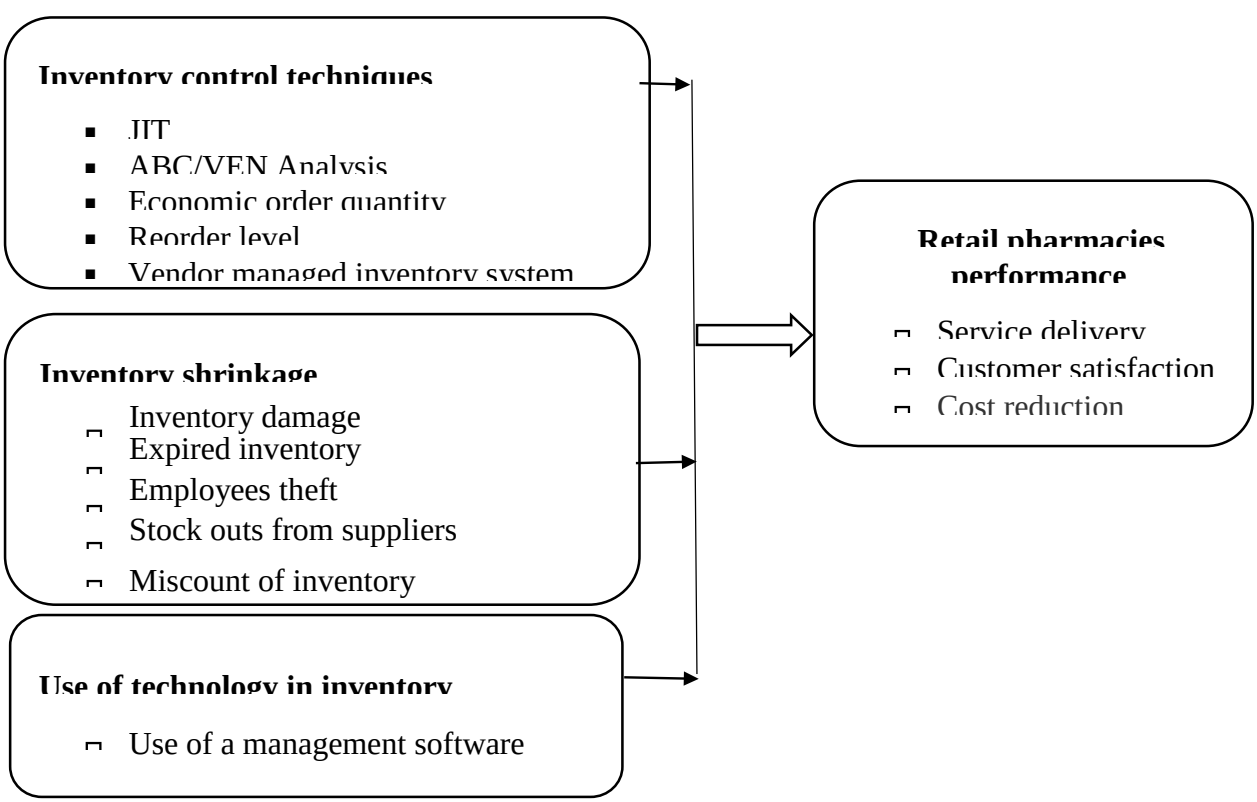
This study is anticipated to offer enough information on healthcare inventory management techniques in the setting of retail pharmacies, which can help in enhancing practices by eliminating healthcare inventory concerns incurred by retail pharmacies, allowing consumers to be easily satisfied.

2.3 Conceptual framework

This demonstrates the connection between the various factors. It serves to demonstrate the relationship between the independent and dependent variables.

When healthcare inventory management practices are implemented and issues are resolved, performance in a pharmaceutical institution is evident, which benefits patients' wellness since they get the right medication at the right time and at the right price.

Figure 1: Dependent and independent variables of the study.



Source: Primary data, 2023

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3. Materials and Methods

The research design employed in this study aimed to investigate healthcare inventory management techniques in retail pharmacies, along with factors affecting pharmacy performance such as technology and inventory shrinkages. A descriptive design was adopted to analyze the current practices in inventory management among selected retail pharmacies in Kigali city, GASABO district. Additionally, multivariate correlation analysis was utilized to explore the cause-effect relationship between inventory management practices and pharmacy performance (Kothari, 2004).

The study population comprised all responsible pharmacists working in retail pharmacies within GASABO district, Rwanda. Community pharmacies in Rwanda are synonymous with retail pharmacies, and pharmacists must obtain a license from the National Pharmacy Council (NPC) to practice professionally. The research focused on pharmacists who voluntarily participated in the study, ensuring adherence to ethical guidelines (O'Leary, 2004).

A census method was employed to collect data from all 195 responsible pharmacists in Gasabo District, as listed by the Rwanda Food and Drug Authority. However, only 142 respondents participated in the study due to various reasons. Data were collected using a questionnaire consisting of both close-ended and open-ended questions, administered digitally through Google Forms. Standardized questions facilitated consistent data collection from respondents (O'Leary, 2004).

Quantitative and qualitative data generated were processed using Statistical Package for Social Sciences (SPSS) for analysis. Descriptive statistics, including frequency distribution, percentages, mean, and standard deviations, were computed to interpret the data. Additionally, multivariate regression analysis was conducted to test the relationship between inventory management practices and pharmacy performance (Kothari, 2004).

Validity and reliability of the study instruments were ensured through peer review, content validation, and pre-testing. Ethical considerations, including obtaining ethical clearance from the University of Kigali Ethical Committee and ensuring respondent privacy and confidentiality, were meticulously addressed throughout the study (Kothari, 2004; O'Leary, 2004). Despite its contributions, the study had limitations, including the sample being limited to GASABO district, potentially impacting the generalizability of results. Additionally, constraints in time and budget hindered physical interactions with respondents, limiting the depth of data collection and explanation (Kothari, 2004)..

4. Presentation of findings

4.1 Inventory control techniques

Monitoring the flow of inventories along the supply chain requires the use of a number of approaches for inventory control which are discussed below.

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Table 1: Approaches Retail pharmacies employ most when deciding which inventory to keep on hand

Percentage uses of Approach that Retail pharmacies employ most when deciding which inventory to keep on hand:

Name of Approach	Percentage (%)
Just in time technique (Ordering inventories when there is customer demand)	25.3 %
Economic order quantity (Ability to order quantities of inventory that meet demand while minimizing the total costs related to ordering)	46.3%
ABC/ VEN analysis (An inventory management technique that determines the value of inventory items based on their importance to the business and how essential is the inventory)	25.4%
Vendor managed inventory (Engaging outsourced suppliers to manage inventory monitoring and replenishment)	3%

Percentage

Source: Primary data, 2023

Table 2 indicates that a diverse set of inventory management approaches is employed by retail pharmacies in Rwanda. Just in Time Technique (Ordering inventories when there is customer demand): This approach was employed by approximately 25.3% of the surveyed retail pharmacies. The "Just in Time" technique involves ordering inventory items precisely when there is a customer demand, minimizing excess inventory storage. This approach suggests that a quarter of the pharmacies prioritize efficient inventory turnover and reducing the costs associated with excess inventory.

Economic Order Quantity (Ability to order quantities of inventory that meet demand while minimizing the total costs related to ordering): The majority of retail pharmacies, at 46.3%, utilize the Economic Order Quantity (EOQ) approach. EOQ aims to find the optimal order quantity that balances inventory holding costs and ordering costs. This high percentage indicates that a significant proportion of the pharmacies prioritize cost-effective inventory management while ensuring they meet customer demand efficiently.

ABC/ VEN Analysis (An inventory management technique that determines the value of inventory items based on their importance to the business and how essential is the inventory): Approximately 25.4% of the surveyed pharmacies use ABC/ VEN analysis in their inventory management. ABC analysis categorizes inventory items into different classes based on their value to the business, allowing pharmacies to prioritize their focus on high-value items. This approach suggests that a quarter of the pharmacies place importance on strategically managing inventory based on its significance to their operations.

Vendor Managed Inventory (Engaging outsourced suppliers to manage inventory monitoring and replenishment): A smaller percentage, only 3%, of the retail pharmacies surveyed employ the Vendor Managed Inventory (VMI) approach. VMI involves outsourcing inventory management to suppliers who are responsible for monitoring and replenishing stock. This lower percentage suggests that a relatively small portion of pharmacies have adopted this more collaborative and supplier-driven inventory management strategy.

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The most widely used approach among the surveyed pharmacies is the Economic Order Quantity (EOQ) method, emphasizing cost-effectiveness and efficient inventory ordering. However, a significant portion also utilizes the Just in Time and ABC/ VEN analysis approaches, reflecting a mix of strategies to ensure optimal inventory management. The Vendor Managed Inventory approach, though less common, demonstrates that some pharmacies are open to collaborative inventory management with external suppliers.

Table 5. Effect of inventory control techniques on pharmacies performance

Impact	SD		D		NO		A		SA		Mean	SDv
	F	%	F	%	F	%	F	%	F	%		
To reduce stock outs in the pharmacy	1	0.7	1	0.7	3	2.11	62	43.66	75	52.82	4.47	0.648
To avail appropriate quantity of inventories in the stock to meet patient demand	3	2.11	1	0.7	7	4.93	68	47.89	63	44.37	4.316	0.78
To keep wastage and losses to a minimum	1	0.70	2	1.41	14	9.86	56	39.44	69	48.59	4.338	0.77
To reduce costs associated with inventory (holding, carrying cost, etc)	1	0.7	5	3.52	14	9.86	61	42.96	61	42.96	4.239	0.824
Improved order fulfilment	2	1.41	4	2.82	15	10.56	57	40.14	64	45.07	4.246	0.86
To reduce overstock of essential medicines	2	1.41	3	2.1 1	14	9.86	49	34.51	74	52.11	4.338	0.849
To reduce expiry	1	0.7	1	0.7	7	4.93	46	32.39	87	61.27	4.528	0.69

Key: SD strongly disagree, D disagree, NO no opinion, A agree, SA strongly agree, SDv standard deviation

Source: Primary data, 2023

Table 3 provides information on the perceived impact of inventory control techniques among the surveyed retail pharmacies. The table includes various statements related to the impact of

these techniques, with responses ranging from "Strongly Disagree" to "Strongly Agree," along with mean and standard deviation values.

The majority of respondents (52.82%) "Strongly Agree" that inventory control techniques are effective in reducing stockouts, which indicates a high level of agreement with this statement. Additionally, 43.66% of respondents "Agree." The mean score for this statement is relatively high at 4.47, indicating that inventory control techniques are perceived as effective in mitigating stockouts.

A substantial portion of respondents (47.89%) "Agree" that inventory control techniques help in maintaining the appropriate quantity of inventory to meet patient demand. Furthermore, 44.37% "Strongly Agree." The mean score is 4.316, suggesting that these techniques are seen as valuable in ensuring inventory adequacy.

A majority of respondents (48.59%) "Strongly Agree" that inventory control techniques are effective in minimizing wastage and losses, while 39.44% "Agree." The mean score of 4.338 indicates strong agreement with this statement, highlighting the importance of these techniques in reducing waste.

Reducing costs associated with inventory (holding, carrying cost, etc), respondents are divided on this statement, with 42.96% "Agree" and an equal percentage "Strongly Agree." However, a small proportion (3.52%) "Disagree." The mean score of 4.239 suggests that inventory control techniques are generally perceived as effective in reducing inventory-related costs.

A significant number of respondents (45.07%) "Strongly Agree" that inventory control techniques lead to improved order fulfillment, and 40.14% "Agree." The mean score is 4.246, indicating a high level of agreement regarding the positive impact on order fulfillment.

The majority of respondents (52.11%) "Strongly Agree" that inventory control techniques are effective in reducing overstock of essential medicines, while 34.51% "Agree." The mean score of 4.338 reflects strong agreement with this statement, emphasizing the importance of avoiding overstock.

A substantial majority of respondents (61.27%) "Strongly Agree" that inventory control techniques effectively reduce the expiry of medicines. Additionally, 32.39% "Agree." The mean score of 4.528 indicates a high level of agreement that these techniques help prevent product expiration.

The surveyed retail pharmacies generally perceive inventory control techniques as having a positive impact on various aspects of their operations. These techniques are particularly valued for reducing stockouts, ensuring appropriate inventory quantities, minimizing wastage and losses, and improving order fulfillment. Overall, respondents appear to strongly agree that these techniques are beneficial in enhancing pharmacy performance and efficiency.

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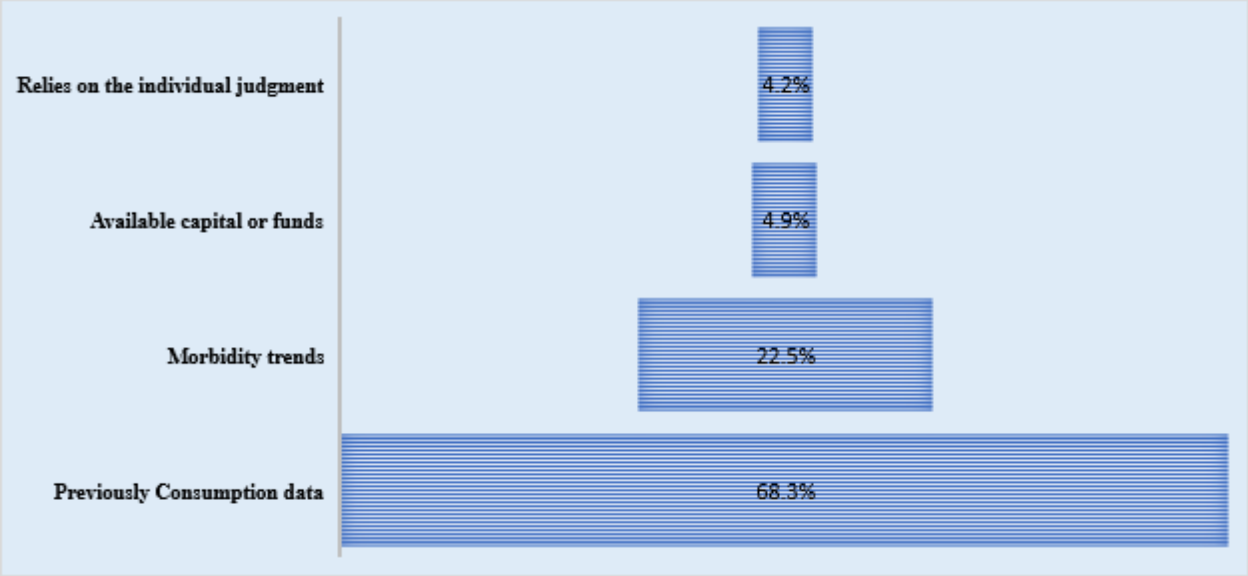
Figure 2. New Stock Forecasting: Exploring Alternative Reference Points



Source: Primary data, 2023

Figure 1 illustrates the different reference points used for forecasting new stock. A relatively small percentage of respondents, approximately 5%, indicated that they rely on available funds or capital This suggests that a limited portion of the decision-makers in retail pharmacies prioritize their stock decisions based on the financial resources they have at their disposal

Similarly, a small percentage of respondents, around 4%, reported that they rely on the individual judgment of knowledgeable staff members for stock forecasting. This indicates that a minority of decision-makers in retail pharmacies significant trust in the expertise and insights of their staff.

A larger portion of respondents, approximately 23%, rely on morbidity trends as a reference point for stock forecasting. Morbidity trends typically involve analyzing data related to disease prevalence or patient demand patterns to determine stock requirements. This suggests that a significant portion of decision-makers in retail pharmacies consider health trends when forecasting new stock.

The most dominant reference point for stock forecasting, with a substantial majority of approximately 68%, is the previously consumption data. This implies that a significant majority of those involved in stock management in retail pharmacies prioritize to use past consumption patterns to determine their stock needs.

Different reference points used for forecasting while some decision-makers rely on financial factors, particularly available capital or funds and the judgment of knowledgeable staff, a substantial proportion prioritize to base on previously consumption data, and to a lesser extent, morbidity trends with valuable insights into the various approaches taken in stock forecasting within retail pharmacies.

4.3. Inventory shrinkages on the performance of retail pharmacies

The discrepancy between recorded and actual inventory is known as shrinkage. Profit is lost when inventory is lost due to shrinking. Some sources of shrinkage include staff theft, vendor fraud, shoplifting, and expiration were analyzed.

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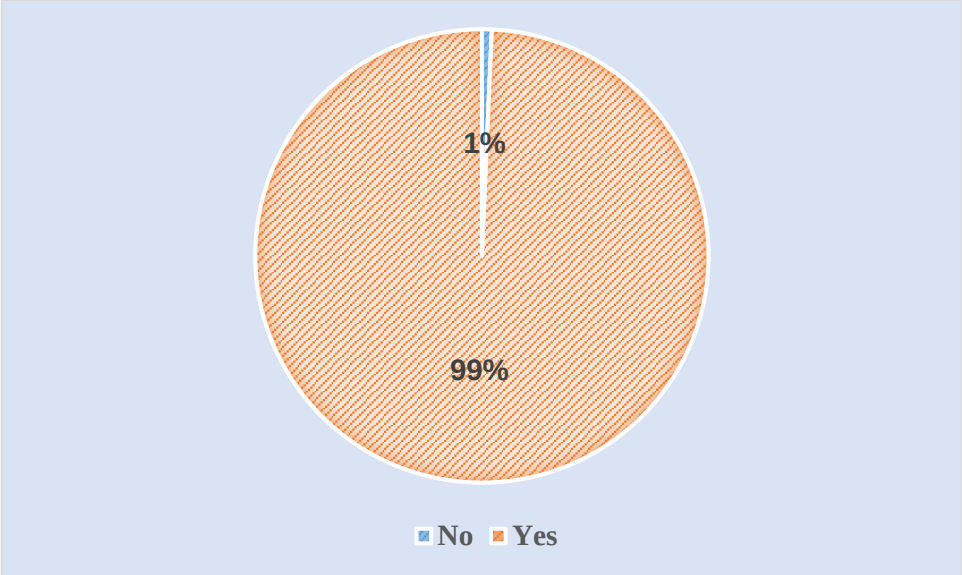
Figure 3. Faced Challenges in Inventory Management: Stock Outs, Overstock, and Wastage



Source: Primary data, 2023

Figure 2 illustrates challenges faced by retail pharmacies in inventory management such as stockouts, overstock and wastage. A very small percentage, only 0.7% of retail pharmacies, indicated that they have not faced challenges in inventory management. This suggests that an extremely limited number of retail pharmacies reported having no difficulties with stockouts, overstock, or wastage in their inventory management practices.

The overwhelming majority, 99.3% of the retail pharmacies, reported that they have indeed faced challenges in inventory management. This high percentage indicates that nearly all retail pharmacies have encountered issues related to stockouts, overstock, or wastage in the course of their inventory management responsibilities.

Table 6. Effect of inventory shrinkages on retail pharmacy performance

Inventory shrinkages	SD		D		NO		A		SA		Mean	SDv
	F	%	F	%	F	%	F	%	F	%		
Medicines expiration	0	0	3	2.11	9	6.34	46	32.39	84	59.15	4.485	0.711
Medicines damages	1	0.7	2	1.41	12	8.45	59	41.55	68	47.89	4.345	0.75
Medicines theft	1	0.7	3	2.11	7	4.93	52	36.62	79	55.63	4.44	0.748
Stock outs of medicines	0	0	1	0.7	8	5.63	42	29.58	91	64.08	4.57	0.634

Source: Primary data, 2023

Table 4 shows the impact of inventory shrinkages on retail pharmacy performance, The majority of respondents, representing 59.15% of the surveyed retail pharmacies, "Strongly Agree" that losses resulting from medicines' expiration significantly affect the performance of their pharmacy. Additionally, 32.39% of respondents "Agree" with this statement. There were no respondents who "Strongly Disagree," and only a small percentage (2.11%)

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"Disagree" or had "No opinion." The relatively high mean score of 4.485 reflects that medicine expiration has a substantial impact on their pharmacy's performance.

Losses resulting from medicines' damages, a significant portion of retail pharmacies surveyed, accounting for 47.89%, "Strongly Agree" that these losses impact their pharmacy's performance, while an additional 41.55% "Agree". Very few respondents (0.7%) "Strongly Disagree," and 1.41% "Disagree." The mean score of 4.345 shows that medicine damage has a substantial impact on their pharmacy's performance.

Majority of retail pharmacies surveyed, totaling 55.63%, "Strongly Agree" that medicine theft affect their pharmacy's performance, while 36.62% "Agree." Minimal respondents (0.7%) "Strongly Disagree," and 2.11% "Disagree." The mean score of 4.44 signifies strong agreement that theft-related losses have a notable impact on pharmacy performance.

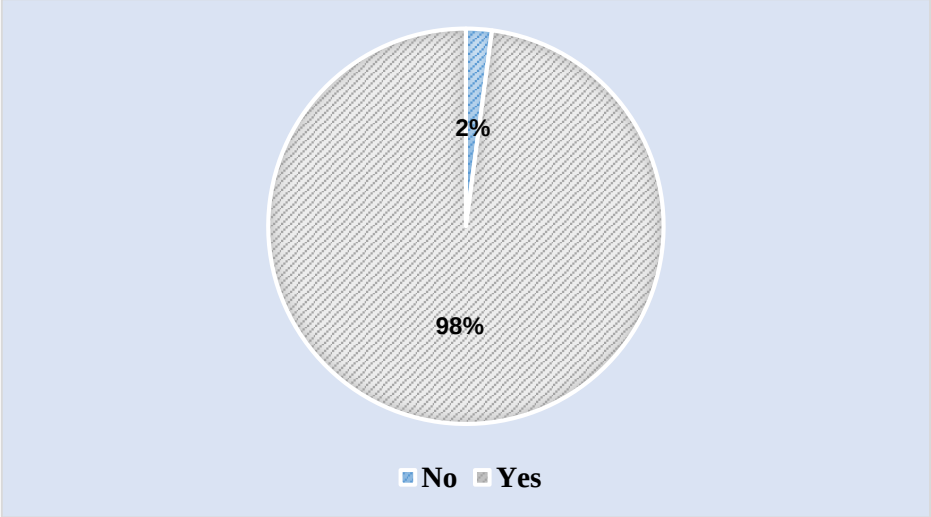
Substantial majority of retail pharmacies surveyed, comprising 64.08%, "Strongly Agree" that medicine stockouts significantly affect their pharmacy's performance. An additional 29.58% "Agree" with this statement, only a small percentage (0.7%) "Disagree" and (5.63%) had "No opinion." The relatively high mean score of 4.57 underscores that medicine stockouts have a substantial impact on pharmacy performance.

The study reveals that inventory shrinkages, encompassing expiration, damages, theft, and stockouts of medicines, are widely perceived by retail pharmacies as having a considerable negative impact on their overall performance. They overwhelmingly agree that addressing these inventory shrinkage issues is crucial for maintaining and improving their pharmacy's performance. The findings insights emphasize the significance of effective inventory management and loss prevention strategies within the retail pharmacy sector.

4.4. Effect of technology on the performance of retail pharmacies

The digital revolution of the pharmacy sector enhances the safety and efficacy of medications by decreasing pharmaceutical errors, automating patient prescriptions, and monitoring a patient's general health and well-being. In this section, the use of technology in inventory management is discussed.

Figure 4. Pharmacy employed technology to assist in stock management



Source: Primary data, 2023

Figure 3 shows the use of technology by pharmacies for inventory management. A small percentage, specifically 2.11% of retail pharmacy surveyed, indicated that they have not

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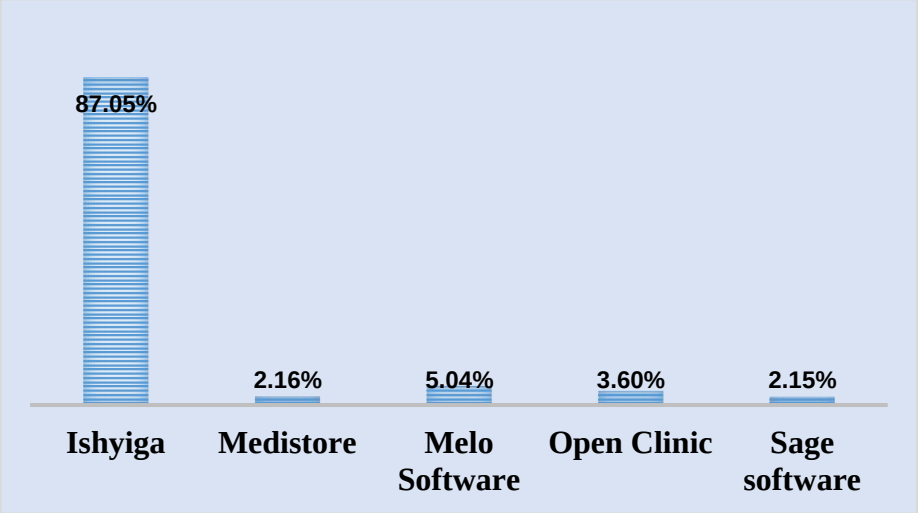
employed technology to assist in stock management. This suggests that a very limited number of pharmacies in the surveyed have not yet adopted technological solutions to aid in their inventory management processes.

The overwhelming majority of retail pharmacies surveyed, representing 97.89%, said that they have indeed employed technology to assist in stock management. This high percentage indicates that nearly all of the surveyed pharmacies have embraced technology as a tool to enhance their inventory management practices.

The study findings reveal that a substantial majority of the surveyed pharmacies have embraced technology to assist in stock management, with nearly all of them employing technological solutions for this purpose. The findings underscore the importance of technology adoption in modern pharmacy operations to improve efficiency, accuracy, and overall inventory management effectiveness.

Figure 5. Types of stock management system (Software)



Source: Primary data, 2023

Figure 4 shows the prevalence of different stock management software systems used by the surveyed retail pharmacies. The overwhelming majority of surveyed pharmacies, comprising 87.05%, reported using the Ishyiga stock management system. This indicates that Ishyiga is the most widely adopted software among the surveyed pharmacies for managing their stock.

A relatively small percentage of retail pharmacies, specifically 2.16%, utilize the Medistore stock management system. While this percentage is significantly lower than Ishyiga, it still represents a notable minority of pharmacies that have chosen Medistore as their stock management software.

Approximately 5.04% of the retail pharmacies surveyed use Melo Software for their stock management needs. Whist not as prevalent as Ishyiga, Melo Software is chosen by a moderate percentage of pharmacies, indicating its presence in the market.

Open Clinic is the stock management software system used by 3.60% of the surveyed pharmacies. It represents a relatively small but still noticeable portion of the pharmacies in the sample. Sage software is used by a minority of pharmacies, specifically 2.15%. While this percentage is smaller compared to some other systems, it signifies that Sage has found adoption among a subset of pharmacies for stock management.

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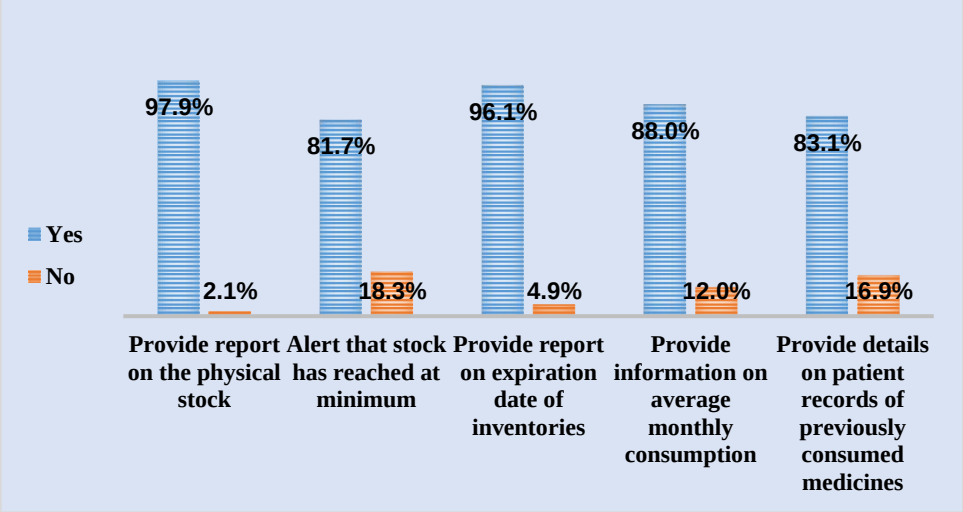
The study findings that among stock management software systems used by the surveyed retail pharmacies. Ishyiga emerges as the dominant choice, being used by the vast majority of respondents. Other systems, including Medistore, Melo Software, Open Clinic, and Sage Software, also have a presence, albeit with smaller percentages. The findings provide insights into the software preferences of pharmacies for managing their stock, with Ishyiga being the most prevalent solution.

Figure 6. Types of information provided by stock management systems



Source: Primary data, 2023

Figure 5 presents the types of information that stock management systems provide. The vast majority of surveyed pharmacies, approximately 97.9%, reported that their stock management systems provide them with reports on the physical stock of their inventory. The high percentage indicates that nearly all of the pharmacies benefit from information regarding their current stock levels, which is crucial for effective inventory management.

A significant majority, comprising 81.7% of the surveyed pharmacies, receive alerts from their stock management systems when their stock reaches the minimum level which helps pharmacies avoid stockouts and is considered important for maintaining adequate inventory levels.

Substantial majority, specifically 96.1%, receive reports from their stock management systems regarding the expiration dates of their inventory. This information is critical for preventing the sale of expired medicines, ensuring product quality, and minimizing wastage.

Approximately 88.0% of the surveyed pharmacies receive information on the average monthly consumption of their inventory from their stock management systems which helps pharmacies make informed decisions about restocking and ensures that they maintain an appropriate quantity of inventory to meet patient demand.

A significant percentage, 83.1%, of pharmacies have access to patient records of previously consumed medicines through their stock management systems which aids in patient care by allowing pharmacists to track and provide accurate information on previously dispensed medications.

The study findings highlight that stock management systems are instrumental in providing critical information to pharmacies. The majority of surveyed pharmacies benefit from these systems by receiving reports on physical stock, alerts for minimum stock levels, expiration

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date information, average monthly consumption data, and patient records of previously consumed medicines contribute to efficient inventory management, improved patient care, and overall pharmacy performance.

Table 7. Effect of technology on pharmacy performance

Effect	SD		D		NO		A		SA		Mean	SDv
	F	%	F	%	F	%	F	%	F	%		
Improved the management of expiry, overstock	2	1.41	2	1.41	8	5.63	52	36.62	78	54.93	4.42	0.78
Improved record keeping of essential data	2	1.41	3	2.11	11	7.75	60	42.25	66	46.48	4.3	0.816
Improved the linkage between the physical stock to stock in the system	3	2.11	3	2.11	26	18.31	62	43.66	48	33.8	4.04	0.893
Speed up workflow	3	2.11	1	0.7	7	4.93	61	42.96	70	49.3	4.366	0.79

Source: Primary data, 2023

Table 5 presents the effect of technology on the retail pharmacies performance. A significant majority of retail pharmacies surveyed, representing 54.93%, "Strongly Agree" that technology has significantly improved their ability to manage expiry and overstock issues within their pharmacies. Additionally, 36.62% of respondents "Agree" with this statement. This widespread agreement suggests that technology has played a crucial role in addressing the challenges of managing expiry and overstock effectively. The low percentage of respondents expressing disagreement (1.41% "Strongly Disagree" and 1.41% "Disagree") indicates a strong consensus on the positive impact of technology in this aspect. The mean score of 4.42 underscores the overall agreement among respondents regarding the effectiveness of technology in tackling these inventory management challenges.

The impact of technology on record keeping of essential data, a substantial percentage of respondents, totaling 46.48%, "Strongly Agree" that technology has enhanced this aspect of their pharmacy operations. An additional 42.25% "Agree" with this statement. The limited percentage of retail pharmacies surveyed indicating disagreement (1.41% "Strongly Disagree" and 2.11% "Disagree") suggests a widespread consensus regarding the positive influence of technology on record keeping. This indicates that technology has been instrumental in improving the accuracy and efficiency of data management within pharmacies. The mean score of 4.30 reflects the strong consensus among retailed pharmacies surveyed about the effectiveness of technology in this regard.

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A significant portion of retail pharmacies surveyed "Strongly Agree" (33.8%), while 43.66% "Agree" that technology has improved the linkage between the physical stock to stock on the system. This suggests that technology has been successful in enhancing the integration between physical inventory and digital systems, contributing to smoother inventory management processes. The relatively small percentage expressing disagreement (2.11% "Strongly Disagree" and 2.11% "Disagree") implies that technology has generally been effective in strengthening this linkage. The mean score of 4.04 underscores the substantial agreement among retail pharmacies surveyed regarding the improvement in the connection between physical stock and the system through technology.

Retail pharmacies surveyed generally perceive that technology has expedited workflow within their pharmacies. Approximately 49.3% "Strongly Agree," and 42.96% "Agree" with this statement. This indicates that technology has played a vital role in streamlining operational processes and enhancing overall workflow efficiency. The low percentage of retail pharmacies surveyed indicating disagreement (2.11% "Strongly Disagree" and 0.7% "Disagree") suggests widespread agreement on the positive impact of technology in this regard. The mean score of 4.366 reflects the strong consensus among retail pharmacies surveyed that technology has significantly contributed to speeding up workflow within their pharmacies.

The study findings demonstrate that technology is widely perceived as having a positive and transformative impact on the performance of the surveyed pharmacies. Retail pharmacies surveyed agree that technology has improved various aspects of pharmacy operations, including the management of expiry and overstock, record keeping of essential data, linkage between physical stock and the system, and workflow efficiency. The study findings underscore the crucial role that technology plays in optimizing pharmacy processes and enhancing overall performance.

4.5. Effect of inventory management on the performance of retail pharmacies

Table 8. Effect of inventory management on the performance of retail pharmacies

Inventory management practices	SD		D		NO		A		SA		Mean	SDv
	F	%	F	%	F	%	F	%	F	%		
Improve service delivery	0	0	0	0	6	4.23	55	38.73	81	57.04	4.528	0.57
Enhance customer satisfaction	0	0	1	0.7	10	7.04	61	42.96	70	49.3	4.408	0.65
Increased customer retention	0	0	8	5.63	10	7.04	60	42.25	64	45.07	4.26	0.82
Decreased lost sales	1	0.7	4	2.82	8	5.63	56	39.44	73	51.41	4.38	0.77
Reduce stock out of essential medicines	0	0	1	0.7	8	5.63	68	47.89	65	45.77	4.38	0.628
Reduce overstock which incur unnecessary costs	0	0	1	0.7	8	5.63	65	45.77	68	47.89	4.408	0.631
Reduce expiry which is a big loss of investment	1	0.7	1	0.7	8	5.63	53	37.32	79	55.63	4.464	0.701
Streamline inventory management and order fulfillment	1	0.7	4	2.82	24	16.9	57	40.14	56	39.44	4.14	0.85
Improved labor productivity	1	0.7	2	1.41	9	6.34	49	34.51	81	57.04	4.45	0.74

Source: Primary data, 2023

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Table 8 provides insights into how inventory management practices impact the performance of the surveyed retail pharmacies. The study findings reveal that none of the retail pharmacies surveyed "Strongly Disagree" or "Disagree" with the statement that inventory management practices improve service delivery. A substantial majority of retail pharmacies surveyed, 57.04%, "Strongly Agree" that these practices have a significant positive impact on service delivery, and an additional 38.73% "Agree." This high level of agreement suggests that inventory management practices play a crucial role in enhancing service delivery in retail pharmacies. The mean score of 4.528 indicates a strong consensus among retail pharmacies surveyed, with the standard deviation of 0.57 suggesting a relatively low level of agreement variability.

None of the retail pharmacies surveyed "Strongly Disagree" with the idea that inventory management practices enhance customer satisfaction, and only 0.7% "Disagree." A significant portion of retail pharmacies surveyed, 49.3%, "Strongly Agree" that these practices positively impact customer satisfaction, and 42.96% "Agree." The mean score of 4.408 reflects a strong consensus among retail pharmacies surveyed that inventory management practices contribute to higher levels of customer satisfaction. The standard deviation of 0.65 indicates a moderate level of agreement variability.

Notably, none of the retail pharmacies surveyed "Strongly Disagree," and only 5.63% "Disagree" that inventory management practices lead to increased customer retention. A significant majority, 45.07%, "Strongly Agree" with this statement, and 42.25% "Agree." The mean score of 4.26 indicates a consensus among retail pharmacies surveyed that inventory management practices are associated with increased customer retention. The standard deviation of 0.82 suggests a moderate level of agreement variability.

A very small percentage, 0.7%, "Strongly Disagree," and 2.82% "Disagree" with the idea that inventory management practices decrease lost sales. A significant majority of retail pharmacies surveyed, 51.41%, "Strongly Agree" that these practices lead to decreased lost sales, and 39.44% "Agree." The mean score of 4.38 reflects a strong consensus among retail pharmacies surveyed that inventory management practices effectively reduce lost sales. The standard deviation of 0.77 suggests a moderate level of agreement variability.

None of the respondents "Strongly Disagree," and only 0.7% "Disagree" that inventory management practices reduce stockouts of essential medicines. A majority of retail pharmacies surveyed, 47.89%, "Strongly Agree" with this statement, and 45.77% "Agree." The mean score of 4.38 indicates a consensus among retail pharmacies surveyed that inventory management practices successfully reduce stockouts of essential medicines. The relatively low standard deviation of 0.628 suggests a relatively low level of agreement variability.

None of the respondents "Strongly Disagree," and only 0.7% "Disagree" that inventory management practices reduce overstock incurring unnecessary costs. A substantial majority, 47.89%, "Strongly Agree" with this statement, and 45.77% "Agree." The mean score of 4.408 reflects a strong consensus among retail pharmacies surveyed that inventory management practices effectively reduce overstock, preventing unnecessary costs. The standard deviation of 0.631 suggests a relatively low level of agreement variability.

A small percentage, 0.7%, "Strongly Disagree," and 0.7% "Disagree" with the idea that inventory management practices reduce expiry, which represents a significant loss of investment. A majority of retail pharmacies surveyed, 55.63%, "Strongly Agree" with this statement, and 37.32% "Agree." The mean score of 4.464 indicates a consensus among retail

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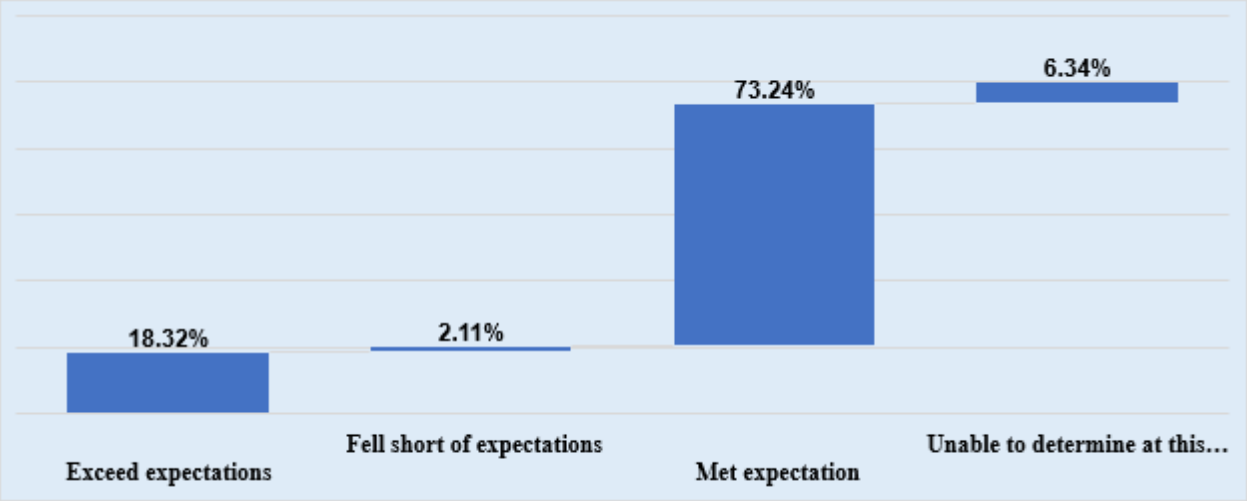
pharmacies surveyed that these practices effectively reduce the financial impact of expiry, which is a substantial loss of investment. The standard deviation of 0.701 suggests a moderate level of agreement variability.

A very small percentage, 0.7%, "Strongly Disagree," and 2.82% "Disagree" that inventory management practices streamline inventory management and order fulfillment. A significant percentage of retail pharmacies surveyed, 40.14%, "Strongly Agree" with this statement, and 16.9% "Agree." The mean score of 4.14 reflects a consensus among retail pharmacies surveyed that inventory management practices are effective in streamlining inventory management and order fulfillment. The standard deviation of 0.85 indicates a moderate level of agreement variability.

A very small percentage, 0.7%, "Strongly Disagree," and 1.41% "Disagree" that inventory management practices improve labor productivity. A majority of retail pharmacies surveyed, 57.04%, "Strongly Agree" with this statement, and 34.51% "Agree." The mean score of 4.45 indicates a consensus among retail pharmacies surveyed that these practices significantly improve labor productivity. The standard deviation of 0.74 suggests a moderate level of agreement variability.

The study finding illustrates that inventory management practices have a largely positive impact on the performance of retail pharmacies according to the surveyed retail pharmacies. These practices are perceived as improving various aspects, including service delivery, customer satisfaction, customer retention, reducing lost sales, preventing stockouts of essential medicines, reducing overstock, minimizing expiry-related losses, streamlining inventory management, and enhancing labor productivity. The mean scores reflect a strong consensus among retail pharmacies surveyed, with varying levels of agreement variability represented by the standard deviations.

Figure 7. Rating the Effectiveness of Inventory Management in Pharmacies



Source: Primary data, 2023

Figure 6 presents a rating of the perceived effectiveness of inventory management in the surveyed retail pharmacies. The majority of retail pharmacies surveyed, comprising 73.24%, indicated that their inventory management practices met their expectations. This suggests that a significant portion of the surveyed pharmacies believed their current inventory management methods were effective in achieving their intended goals and maintaining inventory levels in line with their expectations.

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A notable percentage, 18.32%, stated that their inventory management practices exceeded their expectations. This indicates that a substantial portion of the surveyed pharmacies found their inventory management methods to be even more effective than they initially anticipated. This is a positive sign, as it suggests that these pharmacies have achieved a higher level of inventory management performance than they had hoped for.

A relatively small percentage, 2.11%, expressed that their inventory management practices fell short of their expectations. This suggests that there is room for improvement in the inventory management processes of these pharmacies to align better with their desired outcomes.

A minority of respondents, 6.34%, reported that they were unable to determine the effectiveness of their inventory management practices at the time of the survey. This could indicate uncertainty or a lack of clarity regarding the impact of their inventory management methods on their pharmacy's performance.

The study findings reveal that a majority of surveyed pharmacies believe that their inventory management practices either met or exceeded their expectations. This suggests an overall positive perception of the effectiveness of inventory management in these pharmacies. However, there is a small percentage that felt their practices fell short of expectations, emphasizing the importance of continuous improvement in inventory management processes. Additionally, a minority of respondents were uncertain about the effectiveness of their inventory management practices, highlighting the need for ongoing evaluation and assessment in the field of pharmacy inventory management.

4.5. Regression analysis (Anova Analysis)

Table 9. Anova Table

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19.831	3	6.610	49.832	.000[b]
	Residual	18.306	138	0.133		
	Total	38.138	141			
a. Dependent Variable: Improve service delivery						
b. Predictors: (Constant), Employed technology to assist in stock management, Inventory management technique, Inventory shrinkage						

Source: Primary data, 2023

Table 9 provides essential insights into the statistical significance and effectiveness of the predictors (independent variables) in explaining the variation in the dependent variable, "Improvement of service delivery."

The F-statistic, a measure of overall model fit, is 49.832 with a very low associated p-value ($p < 0.001$). This implies that the regression model, encompassing predictors like employed technology to assist in stock management, inventory management technique, and inventory shrinkage, is statistically significant in explaining the improvement in service delivery.

The Sum of Squares (SS) helps to quantify the total variation in the dependent variable. The total SS is 38.138, illustrating the overall variability in service delivery improvement. Moreover, the regression model accounts for a considerable portion of this variability, with a

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sum of squares (SS) of 19.831, indicating the influence of the predictors on service delivery improvement.

Examining the Degrees of Freedom (df) is essential in understanding the flexibility within the model. In this case, there are 3 degrees of freedom associated with the predictors, denoting the number of independent variables considered in the model. Additionally, 138 residual (error) degrees of freedom highlight the unexplained variability not captured by the predictors.

The Mean Square, calculated by dividing the Sum of Squares by their respective degrees of freedom, helps in understanding the average variance explained by the predictors while considering the degrees of freedom. For the regression model, the Mean Square is 6.610, portraying the average variance explained by the predictors.

The extremely low p-value ($p < 0.001$) suggests that at least one of the predictors significantly influences the improvement of service delivery hence means that the employed technology to assist in stock management, inventory management technique, and inventory shrinkage collectively have a significant impact on the improvement of service delivery in retail pharmacies.

Table 10. Multivariate regression analysis

Variables	Coefficient	Std. Err.	t	P-value	[95% Conf. Interval]	
Improve service delivery (dependent variable)						
Inventory management technique						
ABC/ VEN analysis (constant)						
Economic order quantity	-0.0704933	0.101007	-0.7	0.486	-0.2702413	0.129255
Just in time technique	-0.0367844	0.116705	-0.32	0.753	-0.2675753	0.194007
Vendor managed inventory	-0.2779277	0.254606	-1.09	0.277	-0.7814264	0.225571
Employed technology to assist in stock management (constant)						
No						
Yes	-0.0535196	0.298551	-0.18	0.858	-0.6439224	0.536883
Inventory shrinkage	0.5683439	0.073257	7.76	0	0.4234735	0.713214
Constant	2.094943	0.397726	5.27	0	1.308416	2.881469
Customer satisfaction (dependent variable)						
Inventory management technique (constant)						
ABC/ VEN analysis						
Economic order quantity	-	0.1163	-	0.966	-	0.2251

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Variables	Coefficient	Std. Err.	t	P-value	[95% Conf. Interval]	
	0.0049395	63	0.04		0.2350553	76
Just in time technique	-0.258942	0.134448	-1.93	0.056	-0.5248225	0.006934
Vendor managed inventory	-0.1667898	0.293314	-0.57	0.571	-0.7468357	0.413256
Employed technology to assist in stock management (constant)						
No						
Yes	-0.7206795	0.34394	-2.1	0.038	-1.400842	-0.04052
Inventory shrinkage	0.5688957	0.084395	6.74	0	0.4020005	0.735791
Constant	2.64855	0.458192	5.78	0	1.742448	3.554653
Cost reduction (dependent variable)						
Inventory management technique (constant)						
ABC/ VEN analysis						
Economic order quantity	0.0740586	0.105649	0.7	0.485	-0.1348678	0.282985
Just in time technique	0.0139739	0.122068	0.11	0.909	-0.227422	0.25537
Vendor managed inventory	-0.3012515	0.266305	-1.13	0.26	-0.8278861	0.225383
Employed technology to assist in stock management (constant)						
No						
Yes	-0.9839127	0.31227	-3.15	0.002	-1.601445	-0.36638
Inventory shrinkage	0.6599702	0.076623	8.61	0	0.5084428	0.811498
Constant	2.397795	0.416001	5.76	0	1.575127	3.220462

Source: Primary data, 2023

Table 10 presents the regression analysis for various inventory management techniques and their relationship with the dependent variables—improving service delivery, customer satisfaction, and cost reduction—within the context of retail pharmacies.

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4.5.1. Improvement of service delivery

The p-values associated with the Economic Order Quantity, Just in Time technique, and Vendor Managed Inventory are 0.486, 0.753, and 0.277, respectively, indicating that these inventory management techniques are not statistically significant in predicting improvements in service delivery. The p-value for Inventory Shrinkage is 0, demonstrating a significant impact on service delivery. Employing technology to assist in stock management does not show statistical significance (p-value = 0.858). The constant term has a p-value of 0, suggesting that it significantly contributes to predicting improvements in service delivery. However, the coefficients for these variables are relatively small, suggesting that the impact may not be substantial.

4.5.2. Customer satisfaction

The coefficients for inventory management techniques, "Economic order quantity" and "Vendor managed inventory," do not exhibit statistically significant effects on customer satisfaction, as their associated p-values are higher than 0.05. However, the "Just in time technique" approaches statistical significance with a p-value of 0.056, suggesting a potential impact on customer satisfaction, though not strong enough to be considered significant at conventional significance levels.

Interestingly, the variable "Employed technology to assist in stock management" exhibits statistical significance in its relationship with customer satisfaction, with a p-value of 0.038. This implies that the use of technology in stock management may have a significant effect on customer satisfaction in the retail pharmacies.

4.5.3. Improvement in cost reduction

Employing technology to assist in stock management is statistically significant with a p-value of 0.002. This suggests that utilizing technology for stock management has a significant impact on cost reduction within retail pharmacies. The p-values associated with other inventory management techniques is above the common significance level of 0.05, indicating a lack of statistical significance in predicting cost reduction and the inventory shrinkage is statistically significant with p-value below 0.01, demonstrating a significant impact on cost reduction.

In summary, within the context of retail pharmacies, the statistically significant predictors for improving service delivery, customer satisfaction, and cost reduction are employing technology to assist in stock management for customer satisfaction and cost reduction. On the other hand, inventory shrinkage is a significant predictor for improving service delivery, customer satisfaction and cost reduction. The inventory management techniques do not show statistical significance in predicting the dependent variables. These findings align with the importance emphasized on embracing technology in inventory management for optimal performance and efficiency in retail pharmacies.

5.1 Conclusion

The study examined demographic profiles, inventory management approaches, and the impact of inventory control techniques and technology on the performance of retail pharmacies in Rwanda. The results found that Economic Order Quantity (EOQ), Just in Time, and ABC/VEN analysis methods were commonly used for inventory management, with Vendor Managed Inventory (VMI) emerging as a collaborative approach. Inventory control techniques were perceived positively for reducing stockouts, minimizing wastage, and improving order fulfillment. Challenges related to inventory shrinkages were prevalent,

emphasizing the need for effective management. Technology adoption, particularly through stock management software like Ishyiga, was widespread, contributing to streamlined processes and improved performance. The study highlights the importance of addressing inventory shrinkages and leveraging technology to optimize inventory management practices and enhance pharmacy operations in Rwanda.

5.2 Recommendations

Based on the study findings, to optimize inventory management in retail pharmacies in Rwanda, it is recommended to invest in continuous training, diversify inventory practices, utilize data-driven forecasting, mitigate shrinkages, integrate technology, analyze data effectively, evaluate performance regularly, collaborate with suppliers, refine regulatory frameworks, stay informed about industry trends, educate patients, and promote sustainability. Implementing these strategies can enhance performance, reduce costs, and improve customer service, aligning with global pharmacy management standards.

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