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Medicine Storage Practices at Retail Community Pharmacies in Nyamagana District, Mwanza. A Cross-Sectional Study

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Abstract

Background
Storage practices in community pharmacies are critical to ensuring the safety, efficacy, and quality of pharmaceutical products.

Objectives
This study aimed to assess medicine storage practices in retail community pharmacies in Nyamagana district, Mwanza, Tanzania.

Methods
A descriptive cross-sectional design was conducted to assess 105 community pharmacies in April 2024. A convenience sampling method was employed. Data were collected using self-administered questionnaires. The Clopper-Pearson exact test was used to calculate the 95% Confidence Interval (CI) of proportions.

Results
The findings revealed that only 55.2% (CI=45.2, 64.9) had refrigerators and 35.2% (CI=26.2, 45.2) had electrical power backup. While 88.6% (CI=80.9, 93.9) of pharmacies had sufficient shelves, and 64.8% (CI=54.8, 73.8) stored medicine boxes on the floor. On a positive note, 95.2% (CI=89.2, 98.4) regularly inspected expired medicines, and 84.8% (CI=76.4, 91.0) avoided overstocking. However, only 60.9% (CI=50.9, 70.3) maintained stock records, and 43.8% (CI=34.1, 53.8) used stock tracking software.

Conclusion
This study revealed several gaps in medicine storage practices within community pharmacies, particularly in the arrangement of medicine boxes, the availability of refrigerators, power backup systems, and digital inventory management tools. Policymakers and pharmacy regulators should prioritize these areas to enhance the quality of medicines and patients' safety.

Keywords: Medicine, storage practices, community pharmacies, Tanzania.

1. Introduction

Storage practices in community pharmacies are critical to ensuring the safety, efficacy, and quality of pharmaceutical products [1]. In many low- and middle-income countries (LMICs), including Tanzania, the role of community pharmacies is vital as they often serve as the first point of contact for patients seeking healthcare services [2]. However, inadequate storage practices can lead to significant public health risks, including medication degradation, reduced therapeutic efficacy, and increased potential for adverse drug reactions [3].

To ensure optimal storage conditions, facilities must be robust, secure, and spacious enough to allow safe handling and storage of materials [4]. Adequate lighting is essential for precise and secure operations within storage areas, while facilities must be clean, dry, temperature-controlled, and safeguarded against unauthorized access [5,6]. Whether newly constructed or modified, storage environments must meet stringent standards. All pharmaceuticals should be stored in full compliance with product authorization guidelines and manufacturer instructions, shielding them from contaminants, sunlight, humidity, and adverse temperatures. Special attention to these factors is critical to maintaining proper storage practices [7–10].

In LMICs, the pharmaceutical sector faces numerous challenges, including regulatory inadequacies, limited resources, and a lack of training for pharmacy personnel [11]. These factors can adversely affect medicine storage practices, leading to suboptimal conditions that may compromise the quality of medicines. For instance, improper temperature and humidity levels can cause the degradation of sensitive medications, particularly vaccines and biologics, which require stringent storage conditions [6,12,13]. Moreover, the lack of proper inventory management systems can result in stockouts or the overstocking of medications, further complicating the storage issue [14,15].

In the Nyamagana district of Mwanza, community pharmacies play a vital role in the local healthcare system, providing access to essential medicines for a predominantly low-income population. However, there is limited data on the current medicine storage practices within this district. Finding gaps and creating focused interventions to enhance the quality of medicines requires an understanding of existing practices. This study aims to assess the medicine storage practices at retail community pharmacies in Nyamagana district, Mwanza, to provide a baseline for future improvements and ensure compliance with national and international standards.

Methods

Study Design and setting

This study employed a descriptive cross-sectional design to assess the medicine storage practices at retail community pharmacies in Nyamagana district, one of the seven districts in the Mwanza Region of Tanzania. Mwanza is a northern region in Tanzania, situated along the southern shore of Lake Victoria. The data collection was conducted for four weeks, from 1st April to 28th April 2024.

Study population and sampling

The study population consisted of registered community pharmacies operating within the Nyamagana district. The exclusion criteria for this study included pharmacies that were not operational or closed during the study period, those that did not have licensed pharmaceutical personnel on duty, and any pharmacy that did not consent to participate in the study.

The sample size for the study was calculated using the Taro Yamane formula for estimating sample sizes in a finite population. Given a total population (N) of 143 community pharmacies, a sample size (n) of 105 pharmacies was determined using the desired level of precision (e) of 0.05. A convenience sampling method was employed to select the participating pharmacies.

Data Collection Procedure

Data were collected using self-administered questionnaires designed to assess various aspects of medicine storage practices. The questionnaire was adapted and modified from previous studies [5,10]. It included sections on pharmacy demographics, storage conditions, inventory management, and adherence to recommended storage guidelines. Prior to distribution, the questionnaire was pretested on a small sample of pharmacies to ensure clarity and relevance.

Data Analysis

Data analysis was conducted using statistical software, STATA version 15. Descriptive statistics, including frequencies and percentages, median, and interquartile range (IQR), were used to summarize the data in tables. using tables and figures as frequencies and percentages. The Clopper-Pearson exact test was used to calculate the 95%CI of proportions.

Ethical consideration

Ethical clearance for this study was sought from the joint CUHAS/BMC Research and Ethics review committee with ethical clearance number 2838-2024. Permission to conduct this study in Nyamagana district was given by the Mwanza Regional Administrative Secretary (RAS) and the respective District Medical Officers (DMO). Participants signed an informed consent form before being enrolled in the study. Participation in the study was voluntary.

Results

Sociodemographic Characteristics of the Respondents

Table 1 presents the sociodemographic characteristics of 105 respondents, with 56.2 % being female. The majority were aged 20–29 years (43.8%), with a median (IQR) of 32 (26–38) years. In terms of profession, the majority, i.e., 60.9%, were pharmaceutical technicians. Respondents had a median (IQR) of 5 (3–8) years of experience, with 61.9% having less than 7 years of experience.

Table 1. Sociodemographic Characteristics of the Respondents (N=105)

Variables	Frequency (n)	Percentage (%)
Sex		
Male	46	43.8
Female	59	56.2
Age (Years)		
20-29	46	43.8
30-39	42	40.0
40 and above	17	16.2
Median (IQR)	32 (26 - 38)	

Profession		
Pharmaceutical Assistant	13	12.4
Pharmaceutical Technician	64	60.9
Pharmacist	28	26.7
Experience		
Less than 7	65	61.9
7 and above	40	38.1
Median (IQR)	5 (3 - 8)	

Availability of Different Infrastructure and Storage Facilities in Community Pharmacies

Table 2 outlines the availability of infrastructure and storage facilities in community pharmacies. A high percentage of pharmacies had sufficient reception, 94.3% (CI=88.0, 97.9), dispensing, 87.6% (CI=79.8, 93.2), and storage areas, 90.5% (CI=83.2, 95.3). Dry and ventilated storage was available in 86.7% (CI=78.6, 92.5) of pharmacies, while 55.2% (CI=45.2, 64.9) had a refrigerator, and 74.3% (CI=64.8, 82.3) had air conditioning. Protection from sunlight was available in 64.8% (CI=54.8, 73.8) of pharmacies, but only 35.2% (CI=26.2, 45.2) had electrical power backup. Sufficient pallets were reported by 77.1% (CI=67.9, 84.8), and only 37.1% (CI=27.9, 47.1) had a thermometer for temperature monitoring.

Table 2. Availability of Different Infrastructure and Storage Facilities in Community Pharmacies (N=105)

Variables	Frequency (n)	Percentage (%)	95% CI
Availability of water supply in the dispensing area	72	68.6	58.8 - 77.3
Sufficient reception area	99	94.3	88.0 - 97.9
Sufficient dispensing area	92	87.6	79.8 - 93.2
Sufficient storage area	95	90.5	83.2 - 95.3
Dry and ventilated store	91	86.7	78.6 - 92.5
Availability of a refrigerator	58	55.2	45.2 - 64.9
Availability of AC	78	74.3	64.8 - 82.3
Availability of sunlight protection	68	64.8	54.8 - 73.8
Availability of electrical power backup	37	35.2	26.2 - 45.2
Sufficient pallets	81	77.1	67.9 - 84.8
Thermometer for temperature monitoring	39	37.1	27.9 - 47.1

Arrangements and Records of Medicines in Community Pharmacies

Table 3 describes the arrangements and record-keeping of medicines. Most pharmacies, 88.6% (CI=80.9, 93.9), had sufficient shelves, but only 38.1% (CI=28.8, 48.1) labeled their shelves. Containers were closed in 93.3% (CI=86.8, 97.3) of pharmacies, and 64.8% (CI=54.8, 73.8) reported having medicine boxes on the floor. There was no overstocking in 84.8% (CI=76.4, 91.0) of pharmacies, and 95.2% (CI=89.2, 98.4) regularly inspected expired medicines. Stock records were maintained by 60.9% (CI=50.9, 70.3) of

pharmacies; 43.8% (CI=34.1, 53.8) had stock-tracking software; and 58.1% (CI=48.1, 67.7) arranged medicines according to FEFO.

Table 3. Arrangements and Records of Medicines in Community Pharmacies (N=105)

Variables	Frequency (n)	Percentage (%)	95% CI
Sufficient shelves for the storage of medicines	93	88.6	80.9 - 93.9
Labeled shelves	40	38.1	28.8 - 48.1
All containers closed	98	93.3	86.8 - 97.3
Availability of some medicine boxes on the floor	68	64.8	54.8 - 73.8
No overstocking	89	84.8	76.4 - 91.0
Inspection of expired medicines performed	100	95.2	89.2 - 98.4
Availability of stock records	64	60.9	50.9 - 70.3
Availability of stock tracking software	46	43.8	34.1 - 53.8
Arrangement of medicine as per FEFO	61	58.1	48.1 - 67.7

Discussion

Medicine storage practices at retail community pharmacies are critical for ensuring the safety, quality, and efficacy of medications. This study aimed to assess medicine storage practices at retail community pharmacies in Nyamagana district, Mwanza. The sociodemographic profile of the respondents revealed that 56.2% were female, consistent with the findings from a previous study conducted at Bahir Dar and Gondar Towns, Ethiopia (56.3%) [10]. The predominance of female respondents may reflect broader trends in healthcare employment, where women often comprise a large portion of pharmacy staff. The majority of respondents (43.8%) were aged 20–29 years, with a median age of 32 years, indicating a relatively young workforce. Additionally, 60.9% of respondents were pharmaceutical technicians, highlighting the critical role of mid-level pharmacy professionals in service delivery. The median years of experience (5 years) and the fact that 61.9% had less than 7 years of experience suggest a workforce with moderate experience levels, which may impact the quality of services provided. While the experience level of community pharmaceutical personnel is crucial for their practice, it is essential to consider that ongoing training and support can significantly enhance their capabilities, regardless of their years in the field [16]. In this study, the availability of infrastructure and storage facilities in community pharmacies was generally high, with 94.3% having sufficient reception areas, 87.6% having dispensing areas, and 90.5% having storage areas. These findings are comparable to those of a study by Limenh et al, which reported similar trends in the availability of basic infrastructure in Ethiopian pharmacies [10]. The presence of these facilities supports the delivery of various health services, enhancing access to care [17]. However, this study identified gaps in specific storage conditions. For instance, only 55.2% of pharmacies had refrigerators, and 74.3% had air conditioners, which is essential for storing temperature-sensitive medicines. However, Limenh et al reported a higher availability of refrigerators (80.0%) but a lower availability of air conditioners (46.6%). Proper refrigeration (2°C–8°C) is essential for preserving the efficacy of thermolabile drugs [18]. Additionally, only 35.2% of pharmacies in this study had electrical power backup, which is a critical requirement for maintaining the integrity of medicines during power outages. The study conducted in Pakistan reported that only 11% of the pharmacies had a backup power

supply [19], which highlighted the lack of power backup systems as a significant challenge in community pharmacies.

The study revealed that most pharmacies (88.6%) had sufficient shelves, but only 38.1% labeled their shelves, which could lead to inefficiencies in medicine retrieval and inventory management. This finding is concerning, as proper labeling is a fundamental aspect of good pharmacy practice. In contrast, a study by Limenh et al reported that more than 84.0% of pharmacies labeled their shelves, indicating better adherence to this practice in their study setting. Furthermore, 64.8% of pharmacies in this study reported having medicine boxes on the floor, which poses a risk of contamination and damage to medicines [1,20]. On a positive note, 95.2% of pharmacies regularly inspected expired medicines, and 84.8% reported no overstocking, which reflects good inventory management practices. However, only 60.9% maintained stock records, and 43.8% used stock tracking software, indicating room for improvement in record-keeping and digitalization. Community pharmacies face challenges in implementing effective record-keeping and digital systems. A survey in Southwestern Nigeria found that only 47% of pharmacies used inventory management software, with erratic power supply [21]. There is significant potential for enhancing record-keeping practices within these pharmacies. Improved inventory management can lead to better medication availability, reduced waste, and more efficient operations [22]. The low usage of stock tracking software points to a gap in adopting technology that could streamline operations and improve accuracy in inventory management [23]. Encouraging the use of such software could lead to better data management and decision-making.

Limitations

The study has several limitations that should be considered. Firstly, the cross-sectional design restricts the ability to establish causal relationships between variables, as data were collected at a single point in time, potentially failing to reflect changes in medicine storage practices over time. Additionally, the reliance on self-administered questionnaires may introduce response bias, as participants might provide socially desirable answers rather than accurate reflections of their practices, affecting the validity of the findings. The focus on a specific district limits the generalizability of the findings to other regions, and a larger, more diverse sample would enhance understanding of medicine storage practices across different contexts.

Conclusion

Most of the pharmacies had sufficient reception, dispensing, and storage areas and sufficient shelves. Additionally, medicine containers in the majority of pharmacies were closed, and their pharmaceutical personnel regularly inspected expired medicines. However, this study revealed several gaps in medicine storage practices within community pharmacies. There are areas where significant improvements are needed, particularly in the arrangement of medicine boxes, the availability of refrigerators, power backup systems, and digital inventory management tools. Policymakers and pharmacy regulators should prioritize these areas to enhance the quality of medicines and patients' safety.

Authors' contributions

JM and SM conceived the study. JM collected the data. JM and SM analysed the data and drafted the manuscript. SM critically reviewed the manuscript. All authors approved the final version of the manuscript.

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Competing interests
The authors declare that there are no conflicts of interest.

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