

Readiness for Provision of Online Pharmaceutical Services by Retail Pharmacies in Kampala Metropolitan Area, Uganda

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Background: The first online pharmacy (soma.com), started in the United States in 1999, a decade later, e-pharmacy industry has transformed owing to the rise of online shopping, electronic health solutions and direct-to-consumer healthcare. With over 35,000 online pharmacies worldwide, developing countries like Uganda are seeing the emergence of online pharmacy services yet there is limited data on their readiness to provide these services. We evaluated readiness to offer online pharmaceutical services in Kampala Metropolitan Area (KMA).

Methods: A cross-sectional study was conducted in 272 retail pharmacies selected by proportionate stratified random sampling from Kampala, Wakiso, Mukono, and Mpigi districts of KMA. Data to assess human resource and technological readiness was collected quantitatively using a questionnaire while assessment of legal and regulatory readiness was done qualitatively using key informants (regional managers of National Drug Authority). Descriptive statistics was conducted for quantitative data and thematic analysis was done for qualitative data.

Results: Majority, 222 (95%) of the pharmacies engaged in online pharmacy services offering; tele-pharmacy 189 (85%), home drug delivery 141 (64%), e-prescriptions 97 (44%), home delivery with follow-up 94 (42%), prescription reminder services 79 (36%), and online consultations 75 (34%). Only 23 (10.4%) of online pharmacies had good human resource readiness, 124 (55.9%) had good technological infrastructure readiness and only 20 (9%) had good readiness for both Technological infrastructure and Human resources. Findings also showed a lack of specific regulations and legal frameworks for online pharmacies, minimal enforcement on the quality and authenticity of products sold online, and minimal public awareness and education on online pharmacy services.

Conclusion: The majority of the pharmacies in KMA practiced some online pharmacy with over half of the pharmacies having the necessary infrastructure and the majority lacking the human resource requirements for online pharmacy services.

Keywords: retail pharmacy, readiness, technological infrastructure, human resources, online pharmacy

Introduction

Online pharmacies, often known as e-pharmacies, are non-prescription and prescription drug retailers who dispense or sell medications directly to patients via mail while also providing information about their products and services online.¹ This practice is embodied in the concept of e-health, a broad term that refers to the use of information and communications technologies in healthcare. Strategies to address the barriers to accessing pharmacy services have resulted in the creation of several models of online pharmacy.²

Online pharmacies continue to proliferate and it is now estimated that over 35,000 online pharmacies operate worldwide.³ Many of these operate illegally or inappropriately by distributing counterfeit or substandard medications, dispensing medications without a valid prescription, or filling prescriptions from “cyber doctors” who have no legitimate relationship with the patient.⁴

The International Pharmaceutical Federation (FIP) identifies five core quality requirements for online pharmacies; mandatory pharmacist oversight, secure systems for electronic prescriptions, verification of medicine sources, traceability of products, and provision of patient counseling comparable to physical pharmacies.⁵

In the United States, quality assurance for online pharmacies is enforced through the National Association of Boards of Pharmacy (NABP) Digital Pharmacy Accreditation Program that accredits online pharmacies. Accredited pharmacies are publicly listed, enabling consumers to verify legitimacy and avoid illicit sellers known to supply falsified or substandard medicines.⁶

Similarly, the European Medicines Agency (EMA) enforces strict quality and safety requirements for online pharmaceutical transactions through EU Falsified Medicines Directive that requires all legal online pharmacies to display a common EU logo, implement packaging serialization, and utilize authentication systems to prevent falsified medicines from entering the supply chain.⁷ These measures emphasize traceability, quality assurance, secure distribution, and consumer protection as foundational elements of online pharmaceutical practice.

E-pharmacy is rapidly gaining traction in low- and middle-income countries, and this trend is projected to continue, thanks to the COVID-19 pandemic, rising e-commerce ecosystems, and increased interest in health information technology.⁸

Despite this expansion, existing standards have not kept pace with technological innovation, and high-income countries (HICs) have failed to produce effective models for low and middle-income countries (LMICs) to emulate, with the latter still coping with rampant regulatory infractions in brick-and-mortar pharmacies.⁹ While the unregulated e-pharmacy market spaces pose significant risks to public health owing to prescription misuse, sale of substandard and fraudulent medications, the possibility that e-pharmacy offers to increase access and quality should not be overlooked.

Uganda has not yet fully operationalized standards for online pharmacies and remains without enacted regulations to enforce quality benchmarks for online pharmaceutical services, despite the existence of draft guidelines by the National Drug Authority (NDA).¹⁰ The guidelines are intended to guide pharmacies that want to establish and maintain an online drug supply presence. However, given the limited literature on the adoption of online health technologies, particularly readiness to provide online pharmacy in Uganda, it would be challenging to evaluate the effectiveness of these regulations.¹¹ Therefore, this study assessed readiness of retail pharmacies in Kampala metropolitan area to provide online pharmaceutical services.

Materials and Methods

Study Design, Settings and Population

We used a cross-sectional study, which used both qualitative and quantitative research methods. Data to assess human resource and technological readiness was collected quantitatively using a questionnaire, while that for assessment of legal and regulatory readiness was collected qualitatively using Key informant interviews. Data was collected from the Kampala Metropolitan Area (KMA), which comprises Kampala City and the neighboring districts of Mpigi, Wakiso, and Mukono.¹² The KMA was selected because it had the most NDA-licensed pharmacies in the country, with more than 41% according to the 2022 published licensed outlets statistics.¹³ The study population consisted of technical staff, managers, or directors of all legally registered and licensed retail pharmacies in KMA. Key informants were the director of the inspectorate directorate of NDA and NDA regional managers within KMA. Pharmacies without technical staff, directors, or managers available at the time of data collection or with only newly employed respondents (for less than a month) were excluded.

Sampling Methods and Sample Size

Proportionate stratified sampling was used to choose a sample of 272 pharmacies using the Krejcie & Morgan sample size determination table.¹⁴ The target population was arranged into strata because of geographical heterogeneity. The names of the pharmacies were entered into a computer based on their location, and a raffle was drawn; only selected pharmacies participated in the study. In cases where the selected pharmacy was closed, the closest pharmacy was chosen.

Stratified random sampling was used because it minimizes bias. We selected 123 retail pharmacies in Kampala, 127 in Wakiso, 18 in Mukono, and 4 in Mpigi to participate in the study.

Purposive sampling was used to determine the participants for the qualitative study where a total of three NDA regional managers in the regions where the pharmacies are located were selected to participate in the study and the director of the Inspectorate Directorate at NDA was also interviewed.

Data Collection

The list of pharmacies and their physical location was obtained from the Directorate of inspectorate of NDA and subjected to random selection using Microsoft Excel version 2021 to generate the list of pharmacies that participated in the study. Structured questionnaires were administered face-to-face to the different study participants in the pharmacies by the researcher after obtaining written informed consent. The survey questionnaire was guided by extracts and modification from the WHO toolkit on e-Health, and the model for evaluating e-health to help answer the objectives.^{8,15–18} Qualitative data was collected using a key informant guide where physical interviews were scheduled with the NDA regional managers and director inspectorate.

Data Quality Control

The research assistants were undergraduate students of Bachelor of Pharmacy who were trained for five days before data collection. A Pre-test of the study questionnaires was conducted at 28 retail pharmacies in Jinja. The hard copies of the questionnaires were sorted, organized, coded and double data entry into Microsoft Excel was done.

Data Analysis

The quantitative was analyzed using STATA version 14 and presented using descriptive statistics. Readiness scores were calculated as the mean availability of tracer items expressed as a percentage and a cut-off threshold of $\geq 70\%$ was used to classify pharmacies as “ready” to offer online pharmaceutical services.¹⁹

Audios recordings from key informant interviews (qualitative data) were transcribed verbatim into Microsoft word and the transcripts were then exported to Atlas Ti version 22 for analysis. A mixed approach of deductive and inductive coding was used. Initially, one of the transcripts was coded, and a codebook was created. This codebook was then used for the remaining transcripts. The codes were further categorized into sub-themes and later into themes. The data was presented using themes and sub-themes with corresponding verbatim quotes.

Results

Out of the 272 pharmacies sampled, 234 participated in the study, representing an 86% response rate. Furthermore, four key informant interviews were conducted with officials from the National Drug Authority (NDA).

Background Information of the Respondents and Pharmacies

Out of 234 pharmacies that participated in the study 94.9% offered at least one form of online pharmaceutical service and most pharmacies had less than 7 workers 178 (76%). Majority of the respondents were dispensers 181 (77%) and more than half were male 138 (59%) as indicated in [Table 1](#).

Online Pharmaceutical Services Provided

Out of 222 pharmacies providing online services, the predominant online pharmaceutical service provided was tele-pharmacy 189 (85%), with 108/189 (57%) of them offering the service for less than a year as seen in [Table 2](#)

The results in [Table 3](#) reveals some of the reasons hindering the offering of various online pharmacy-related services, such as: lack of technological infrastructure and human resources emerging as the most common challenges across all online pharmacy services. Electronic prescriptions and Orders through the phone (tele-pharmacy) are hindered by both unfamiliarity (22%) while home delivery services are particularly affected by insufficient staffing (up to 32%) and prescription reminder services are considered not a viable business opportunity by 21% of respondents.

Table 1 Demographics and Background Information of the Respondents and Pharmacies

Variable	Frequency	Percentage
Sex		
Male	138	59%
Female	96	41%
Position at Pharmacy		
Director	21	9%
Manager	32	14%
Employee	181	77%
Number of employees		
1 to 3	80	34%
4 to 6	98	42%
7 to 9	35	15%
Above 10	21	9%
Number of pharmacies that participated in the study n=234 (86%)		
Kampala	97	41%
Mpigi	4	2%
Mukono	18	8%
Wakiso	115	49%
Number of pharmacies providing online pharmaceutical services n=222 (94.9%)		
Kampala	94	97%
Mpigi	3	75%
Mukono	17	94%
Wakiso	108	94%

Table 2 Online Pharmaceutical Services Offered by Retail Pharmacies

Variables	Electronic Prescriptions	Medicine Orders Through the Phone)	Online-Consultation	Home Delivery	Home Delivery with Follow-Up	Prescription Reminder Services
Number of pharmacies that offered the service	97(44%)	189(85%)	75(34%)	141(64%)	94(42%)	79(36%)
Period for the services offered						
Less than a year	48(49%)	108(57%)	44(59%)	90(64%)	62(66%)	51(65%)
2–4 years	45(46%)	68(36%)	27(36%)	44(31%)	27(29%)	26(33%)
5 years and above	4(4%)	13(7%)	4(5%)	7(5%)	5(5%)	2(3%)

Technological Infrastructure Readiness

Table 4 presents the technological infrastructure readiness categorized by district. Overall, out of 222 pharmacies offering online pharmacy services, 124 (55.9%) had at least 70% of the tracer components used to assess infrastructural readiness. Moreover, 180 (81%) pharmacies were equipped with reliable, up-to-date Enterprise Response Planning (ERP) software to support the delivery of online pharmaceutical services, and the majority 160 (72%), of the pharmacies had implemented backup and recovery mechanisms to safeguard against data loss or corruption.

From Table 5, Wakiso had the lowest proportion of facilities with good infrastructural readiness (42.6%), followed by Mukono (64.7%) and Kampala (68.1%), while Mpigi recorded none, with all facilities (100%) meeting the threshold for good readiness.

Table 3 Reason for Not Offering Online Pharmacy Services

Variables	Electronic Prescriptions, n= 125	Medicine Orders Through the Phone, n=33	Online -Consultation n= 147	Home Delivery n= 81	Home Delivery with Follow-Up n= 128	Prescription Reminder Services n= 143
Unfamiliar with the services	28(22%)	11(22%)	20(14%)	17(21%)	10(8%)	5(3%)
Do not have the technological infrastructure	34(27%)	12(24%)	24(16%)	17(21%)	20(16%)	21(15%)
Do not have the human resources required	22(18%)	7(21%)	27(18%)	26(32%)	28(22%)	25(17%)
Do not have the finances to venture into the provision of the services	20(16%)	10(30%)	18(12%)	16(20%)	20(16%)	17(12%)
It's not a viable business opportunity	19(15%)	10(30%)	26(18%)	15(19%)	21(16%)	30(21%)

Table 4 Responses to Tracer Questions Used to Assess Retail Pharmacies' Technological Infrastructure Readiness by District

No.	Tracer Question (Yes Was Given a Score of 1)	Kampala	Mpigi	Mukono	Wakiso	Total n=222
1	A mechanism to secure client data during transmission is present	72	3	11	50	136 (61%)
2	Enterprise resource planning software or applications to aid in the provision of online pharmacy services are present.	74	3	9	72	158 (71%)
3	The software is reliable, up-to-date, and compatible with your business requirements	85	3	16	76	180 (81%)
4	There are secure databases or cloud-based solutions for data storage	76	3	13	54	146 (66%)
5	There is a backup and recovery mechanism to prevent data loss or corruption	79	3	14	64	160 (72%)
6	Operations of the ERP or any devices used in the provision of online pharmacy services require the internet	77	3	14	62	156 (70%)
7	The internet is reliable	74	2	12	56	144 (65%)
8	There is a mechanism in place to ensure external service providers do not have access to or do not share client data	79	3	14	64	160 (72%)
9	There is a system in place to validate and authenticate prescriptions from customers	80	3	12	89	184 (83%)

Table 5 Infrastructural Readiness by District

Overall Infrastructural Readiness	Kampala n=94	Mpigi n=3	Mukono n=17	Wakiso n=108	Total n=222
Poor Infrastructural readiness (Readiness Scores < 70%)	30 (31.9%)	0 (0%)	6 (35.3%)	62 (57.4%)	98 (44.1%)
Good Infrastructural readiness (Readiness scores ≥ 70%)	64 (68.1%)	3 (100%)	11 (64.7%)	46 (42.6%)	124 (55.9%)

Human Resource Readiness

Table 6 illustrates the human resource readiness by district. Majority of the pharmacies 198 (89%) had either a pharmacist or pharmacy technician as staff with more than half of them 120 (54%) participating in the delivery of online pharmaceutical services. Additionally, only 51 (30%) of the pharmacies provided specific training on online pharmacy to their staff. Furthermore, only 77 (35%) of the pharmacies had online prescriptions validated by a pharmacist. However, only 23 (10.4%) demonstrated good human resource readiness (had at least 70% of the tracer components used to assess human resource readiness). Overall, readiness remains low at 10.4% with only Mpigi district having 100% of its facilities meeting the threshold for good human resource readiness for online pharmacy.

Assessment of readiness according to services offered showed that more than half, 110 (58%) had good infrastructural readiness, only 18 (10%) had good human resource readiness, and only 17% were ready with both human resource and infrastructure technology to offer online consultations compared to offering other services, as seen in Table 7.

Table 6 Human Resource Readiness Assessment

No.	Tracer Question (Yes, Was Given a Score of 1)	Kampala	Mpigi	Mukono	Wakiso	Total n=222
1	Have a dedicated staff for the provision of online pharmacy services	52	3	10	42	107(48%)
2	Staff have special certification in online pharmacy	39	3	10	36	88(40%)
3	The pharmacy provides ongoing/special training in online pharmacy for staff	24	2	6	19	51(30%)
4	The pharmacy has either a pharmacist or a pharmacy technician	86	3	13	96	198(89%)
5	The pharmacist or pharmacy technician participates in online pharmacy	46	3	10	61	120(54%)
6	All online prescriptions are validated by a pharmacist	34	3	7	33	77(35%)
7	The pharmacy provides customer support for online pharmacy	78	3	16	82	179(81%)
8	Do you have a dedicated staff/service provider for the provision of IT services	56	3	11	60	130(59%)
Overall Human Resource readiness						
Poor Human Resource Readiness (Readiness Scores < 70%)		86 (91.5%)	0 (0%)	14 (82.4%)	99 (91.7%)	199 (89.6%)
Good Human Resource Readiness (Readiness scores ≥70%)		8 (8.5%)	3 (100%)	3 (17.6%)	9 (8.3%)	23 (10.4%)

Table 7 Online Retail Pharmacy with Good Readiness According to Services Offered

Readiness	Home Delivery with Follow-Up n=94		Home Delivery n=141		Online Consultation n=75		E- Prescriptions n=97		Tele-Medicine n=189		Prescription Reminders n=79	
Human Resource	14	(15%)	19	(13%)	23	(31%)	12	(12%)	18	(10%)	12	(15%)
Technological Infrastructure	66	(70%)	88	(62%)	50	(67%)	63	(65%)	110	(58%)	43	(54%)
Both Human Resource & Technological Infrastructure	12	(13%)	16	(11%)	13	(17%)	10	(10%)	16	(8%)	10	(13%)

Table 8 Online Retail Pharmacy with Good Readiness According to Categories of Drugs Sold

	Prescription-Only Medicines n=170		Over-the-Counter Medicines n=195		Cosmetics n=141		Narcotics and Psychotropic Medicines n=18	
Human Resource	20	(12%)	21	(11%)	18	(13%)	3	(17%)
Technological Infrastructure	104	(61%)	114	(58%)	98	(70%)	10	(56%)
Both Human Resource & Technological Infrastructure	17	(10%)	18	(9%)	16	(11%)	3	(17%)

According to the category of drugs sold, out of 170 (77%) of the pharmacies that offered prescription-only medicines online services, 20 (12%) had good human resource readiness and 104 (61%) had good infrastructural readiness. Only 18 (8%) of the pharmacies provided Narcotics and psychotropic medicines online, and only 3 (17%) of these had both good human resources and technological infrastructural readiness, as seen in [Table 8](#).

Legal and Regulatory Readiness for Online Pharmacy

Seven categorical themes were identified to reflect readiness: legal framework, guidelines for online pharmacy, licensing and regulatory approach, compliance and enforcement, quality, safety and authenticity of products sold online, data privacy and protection, and public awareness and education.

Legal Framework of Online Pharmacy

The participants highlighted that the current legal framework in Uganda does not explicitly address or regulate online pharmacy services. The prevailing laws and regulations are tailored to oversee traditional brick-and-mortar pharmacies, where all pharmaceutical activities and services are conducted at the physical pharmacy premises.

The current legal framework does not necessarily provide any special importance or mention of online pharmacy services, it basically regulates all pharmacies and pharmacy services based on the traditional brick and motor pharmacies and where the physical address and all the pharmacy activities are done at the pharmacy outlet. (KII 1)

In addition, the participants noted that although the legal framework allows for medication orders to be placed over the telephone, it still requires a written prescription or order to be provided within a specific timeframe (either 24 or 48 hours). This written documentation is crucial for compliance with the regulations governing the dispensing of medications based on a valid prescription or order.

... the policy fights for electronic or telephone engagements between the pharmacy and a client or a patient, it allows for phone-based orders but with a provision of having a written order within either 24 or 48 hours. (KII 1)

Draft Guidelines for Online Pharmacy

Recognizing the changing landscape and the need to regulate online pharmacy services, the National Drug Authority (NDA) has drafted guidelines specifically for online pharmacy operations. However, these draft guidelines are currently on hold as the NDA awaits the development of regulations governing the transportation of medicines across borders and within the country. The draft guidelines aim to provide a regulatory framework for online pharmacy services, addressing various aspects such as patient safety, quality assurance, data privacy, and compliance measures. However, the NDA acknowledges that the current legal framework and regulations do not adequately cover the transportation and delivery of medicines, which is a crucial aspect of online pharmacy operations.

... the board has already approved and we have some guidelines in place which we are trying to back up with the law and I think we are ready with guidelines and we should be able to control the online pharmacy. (KII 2)

Licensing and Regulation Approach

The NDA's strategy for regulating online pharmacy services involves granting licenses and authorization to traditional brick-and-mortar pharmacies to expand their operations to include online services. This means that the authority is not considering licensing online-only pharmacies without a physical location. Under this approach, traditional pharmacies must meet all standard requirements for licensing and operation. Once licensed, they can then seek additional authorization from the NDA to offer online pharmacy services. This approach ensures that online pharmacy services are associated with a licensed physical pharmacy outlet with a known address, making monitoring, inspection, and compliance enforcement easier. The NDA sees online pharmacy services as an extension of existing pharmacy operations rather than a separate entity operating solely online.

Currently, what we are doing is that those that are going online must have an original physical license with physical presence from which these people are going to access these medicines that are already regulated and now the medium of communication and transfer of these medicines is what we need to look at in details. (KII 3)

Compliance and Enforcement

One of the participants mentioned that the National Drug Authority (NDA) intended to enforce the same compliance monitoring and mechanisms used for traditional brick-and-mortar pharmacies on online pharmacy services. This would involve inspections, documentation review, staff training, and sanctions. Pharmacies would need to maintain proper documentation, including electronic records, prescriptions, and orders, which would be reviewed during inspections. NDA staff would receive ongoing training to stay updated on online pharmacy practices, enabling them to effectively detect any non-compliance. In cases of non-compliance, pharmacies would be issued warning letters and given timelines to take corrective actions. Failure to comply could lead to sanctions or other enforcement actions.

The same way that we enforce compliance to everyone else is that we look at the services you provide and then look at the standards of compliance and ensure that you comply to that; the recordings, their storage, how to ensure those that are expired are sorted so it is the same thing. (KII 1)

Quality, Safety, and Authenticity of Products

Most participants emphasized that ensuring the quality, safety, and authenticity of medicines sold through online pharmacy services is a top priority for the NDA. The existing regulations and requirements for traditional pharmacies regarding the quality, safety, and authenticity of medicines would also apply to online services. Additionally, the following measures would be implemented:

- **Verification of sources:** Pharmacies must ensure that the medicines they dispense through online services are obtained from legitimate and authorized sources to maintain quality and authenticity.
- **Proper handling and storage:** Guidelines will be established to address the proper handling, storage, and transportation of medicines to maintain their quality and safety during the delivery process.
- **Public awareness:** The NDA plans to inform the public about authorized online pharmacy providers to ensure that customers can verify the authenticity of the service and the medicines they receive.

I wouldn't say we have the infrastructure ready to monitor such activity because we need some software and infrastructure to monitor such activity but what I see is with the development of the guidelines and adaptation to modern technology, there is a feature to regulate. For patients' safety, we currently rely on physical inspection and licensing, as well as taking into account the people who will be providing these services, to ensure these medicines are received and safely used. (KII 3)

Data Privacy and Protection

One of the participants mentioned that the NDA acknowledged the importance of data privacy and protection in the context of online pharmacy services. This would be addressed through existing privacy requirements. The data privacy

and protection requirements that apply to traditional pharmacies, such as maintaining patient confidentiality and secure handling of prescriptions, would also apply to online pharmacy services. System validation would be included in the draft guidelines, which would have provisions for validating the systems and technologies used by online pharmacies to ensure data security and protection. Online pharmacy services would also be required to comply with relevant data protection laws and regulations to safeguard patient information and privacy.

... this is a pharmacy whether it is brick and mortar or online, patient prescriptions are not supposed to be shared by everybody so privacy is emphasized and so it is important to maintain the patient privacy and that is why you want the transporter to be registered, the pharmacy has to be licensed so everything should be in a better place. (KII 2)

Public Awareness and Education

The participants mentioned that once the guidelines for online pharmacy services were finalized and implemented, the NDA planned to develop a comprehensive communication strategy. This strategy aimed to educate stakeholders and the public about the new service model. The potential initiatives included stakeholder engagement, such as conducting meetings and workshops to inform and educate relevant parties like healthcare professionals, patient groups, and industry associations about the regulations and guidelines for online pharmacy services. Additionally, there would be public awareness campaigns utilizing various media platforms, including radio, television, social media, and the NDA's website, to raise public awareness about authorized online pharmacy providers, the advantages and potential risks of online services, and how to verify the authenticity of such services. Consumer education would also be a focus, providing educational materials and resources to help consumers understand their rights, responsibilities, and how to safely and responsibly access online pharmacy services.

When the right time comes and the guidelines are out, we normally do stakeholder mapping to determine which stakeholders need to be sensitized or educated, and then we develop a communication strategy based on the various stakeholders we need to reach. We organize meetings, but for superior stakeholder engagement, we use radios, TVs and other forms of putting out information, social media platforms and other ways. (KII 1)

Discussion

Technological Infrastructure Readiness

Technological Infrastructural Readiness encompasses the availability and affordability of ICT resources required for the successful implementation of a proposed e-health innovation. These resources include skilled human capital, robust ICT support, high-quality ICT infrastructure, and reliable power supply among others.²⁰ Regarding technological infrastructure readiness, the study revealed that more than half of the pharmacies had good readiness. The findings indicate that several pharmacies lacked adequate technological infrastructure for the delivery of online pharmaceutical services. This finding is consistent with a study in Nigeria, where approximately half of the surveyed healthcare facilities possessed adequate internet and technology infrastructure to support e-health services.²¹ Furthermore, only 58.6% of the pharmacies offering online pharmaceutical services had dedicated staff/service providers for the provision of IT services which can be explained by a study on the preparedness for e-health in developing countries²² which acknowledges a lack of well-trained ICT professionals, and insufficient awareness and experience in the use of ICTs as important challenges in a developing country. The extensive infrastructure requirements essential for achieving information technology (IT) objectives, including the costs of equipment, IT installation, training, support, and maintenance, represent notable obstacles. While there is major progress in technological infrastructure among retail pharmacies in KMA, a considerable proportion of healthcare facilities still require improvements in their technological infrastructure to fully support modern e-health services. This calls for government to provide incentives or support programs for pharmacies to invest in technological upgrades and modernization for example, waiver taxes off equipment, fund the development of an ERP software and which can then be provided to retail pharmacies at subsidized costs.

Human Resource Readiness

The basic goal of human resource development is to improve the knowledge, skills, and capabilities of all individuals. The lack of adequate human resources for online pharmaceutical services was evident, as many pharmacies lacked dedicated staff for online pharmaceutical services. The majority also lacked specialized staff training and less than half had online prescriptions validated by a pharmacist. A recent study in Wakiso district showed that 74.2% of staff at retail pharmacies had not received any form of training in a similarly new concept of antimicrobial stewardship which is in agreement with this study which showed that 77% of the staff lacked special training in provision of pharmacy services online.²³ One of the challenges in implementing health information and communication technology is the need for a skilled workforce that understands healthcare, information, communication technology and designing the necessary software and systems to help in online pharmaceutical.²⁴

The findings of this study also indicate that only 34.7% of the pharmacies had pharmacists validate prescriptions. Based on previous literature in Uganda, it is evident that there is a notable lack of pharmacist presence in private pharmacies, which may contribute to the observed low percentage observed.²³ Furthermore, a study on the compliance of private pharmacies in Uganda with controlled prescription drugs regulations showed that only 32% of pharmacists were present on duty which further explains the low participation of pharmacist in prescription validation.²⁵

The findings of this study regarding the absence of specialized training, dedicated personnel, and pharmacist involvement in online prescription validation are consistent with concerns raised in other research about the need for capacity building, skill development, and regulatory oversight within the domain of online pharmacies.²⁶ The inadequate provision of specialized training for online pharmacy staff presents a significant challenge, as many pharmacies are unable to allocate sufficient resources, both in terms of funding and time, to invest in staff training. These observations are consistent with the concerns highlighted in a systematic review, which underscored the absence of specific training programs for personnel engaged in online pharmacy operations.²⁷ A study in Kenya showed that 80% of primary health care workers were of pre-degree education similar to 77% in this study, underscoring the need to improve their technical capacities through capacity building initiatives.²⁸

These findings highlight the need for further training of retail pharmacy staff to improve their understanding of online pharmacy and some of the dangers it poses in propagating drug abuse and irrational drug use through the dispensing of medicines online without prescriptions. Retail pharmacies can contribute to Uganda's access to medicines if motivated and equipped with adequate knowledge to enhance their practices related to online pharmacy.

Legal and Regulatory Readiness

The findings of this study indicate that the regulation and legal framework for e-pharmacies has not kept pace with the rapidly evolving and dynamic markets that operate seamlessly across national boundaries. Currently, there are limited standard regulations for the practice of tele-pharmacy. Even in developed countries, each state has its own rules and restrictions tailored to its specific needs. Many countries cite limitations such as geographic restrictions, facility limitations, staffing and educational requirements for pharmacists, as well as restrictions on permitted providers and interstate accessibility.²⁹ Given the insufficient number of pharmacists in low-income countries, medical regulatory authorities and pharmacist professional regulatory agencies need innovative strategies to reduce pharmacist absenteeism in pharmacies and its impact on compliance with medicines regulations. These strategies could involve enhanced regulatory supervision and support for pharmacies, continuous professional development for dispensing staff, understanding the reasons for pharmacist unavailability in pharmacies, and acknowledging the most compliant pharmacies, among other measures.²⁵

Among the barriers to the widespread adoption of tele-pharmacy are payment issues, licensure challenges, online prescribing concerns, pharmacist specialization issues, and security considerations. These concerns were also expressed by many of the National Drug Authority participants in this study. A study on practices and state regulations regarding tele-pharmacy found that the respondents generally agreed that pharmacists providing tele-pharmacy services should be licensed in the state where they are providing the service.³⁰ This study is in agreement with the majority of NDA respondents, who suggested that only brick-and-mortar pharmacies already licensed in the country would be allowed to

provide online pharmaceutical services. The respondents at NDA also expressed concerns and reservations regarding patient safety during the delivery process of the online pharmaceutical service. This is in line with encryption and security being top priorities for legislators due to the sensitive nature of health records and the need to prevent drug diversion in order to safeguard patients and communities, as raised by.²⁹

The study's findings align with research in low and middle-income countries, that show the need for regulators to focus on online services offered by pharmacies. Regulators must have the technical expertise to oversee online pharmacies and adjust regulatory processes to improve traceability and transparency in medicine sales.⁹ The current telehealth legislation has not kept pace with rapidly advancing telecommunication technology. Legislation is typically based on evidence, and lawmakers are hesitant to support untested new services.²⁹ To address regulatory challenges in retail pharmacies, researchers suggest implementing a clear framework of inspections and regular support visits from the National Drug Authority (NDA). These measures are intended to enable ongoing assessment of the pharmacies' needs, knowledge, and resources, without causing fear or intimidation among the staff.²³ In Uganda, there is a recommendation to strengthen pharmacist professional regulation to improve accountability and reduce violations in medication dispensing. The current lack of coordination among different oversight entities leads to weak regulation. Legislative amendments are necessary to centralize pharmacist professional regulation and pharmacy licensing under one governing body.²⁵ However, the regulation of online in Uganda should be in such a way that it does not undo the gains in technological infrastructure and accessibility to medicines, especially to vulnerable and hard-to-reach populations that online pharmacies have shown.

One of the major limitations was that the study was conducted in an urban setting hence the findings may not be generalizable to other settings in the country. The study assessed only one regulatory organization which is the NDA, leaving out other organizations such as the Ministry of Health, and health professional bodies (PSU, Uganda Allied Health Professional Council, Uganda Nurses and Midwives Council) that have roles to play in effective online pharmacy services regulations thus missing out on some information. Therefore, further research can be done in this area so that their views on online pharmacy are documented. Further research needs to be done on readiness in terms of QMS/QA systems, processes, and procedures in place to ensure that online pharmacies function properly.

Conclusion

More than half of the pharmacies in KMA were technologically prepared for online pharmacy, yet affordability and access to advanced ICT resources remained a challenge. Majority of the pharmacies lacked the necessary human resources for delivery of online pharmaceutical services, with most having limited pharmacist involvement and insufficient training in online services. Therefore, the National Drug Authority should provide regulations and guidelines on telepharmacy to streamline and enhance accountability while ensuring innovation in the sector. The establishment of clear guidelines and supportive supervision mechanisms will be critical for fostering trust, compliance, and sustainable growth in Uganda's e-pharmacy ecosystem.

Data Sharing Statement

Data Sets and materials for information in this manuscript are available upon request from the corresponding author, Allan Emmanuel Wadada, E-mail: wadadaallan@gmail.com.

Ethical Approval and Consent to Participate

Ethical approval was obtained from the Makerere University School of Health Sciences Research and Ethics Committee (MAKSHSREC- 2023-579). Administrative clearance from NDA and the respective pharmacies was also obtained before the data were collected. Individual informed consent was obtained before the interviews were conducted with key respondents, which also included consent to publication of anonymized responses/direct quotes.

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