

Original Research

Utilization and Challenges of Computerized Decision Support Systems in Community Pharmacies: A Cross-Sectional Study

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Abstract

Objective: To evaluate the utilization of computerized decision support tools and information resources in community pharmacies across Jordan, focusing on their impact on pharmacy management, patient care, service quality, and barriers to technology adoption. **Methods:** A cross-sectional study was conducted using a validated, self-administered questionnaire distributed to registered pharmacists working in community pharmacies throughout Jordan. A total of 393 collected responses were analyzed using descriptive and inferential statistics to determine the associations related to computerized system adoption and utilization. **Results:** The study revealed that traditional computers (79.6%) and internet access (63.9%) were the most widely used tools in Jordanian community pharmacies, while a small percentage (1.3%) reported having a dedicated website. A significant number of pharmacies used a combination of paper and electronic forms (40.7%) for registration and documentation. Pharmacists highlighted the importance of computerized systems for administrative tasks and financial management (mean score: 4.11, $p < 0.001$). Despite the benefits, barriers such as electricity or internet outages (35.1%) and limited space for computers (34.9%) were identified. The study also found considerable variation in software usage duration, indicating varying levels of experience and familiarity with these systems. **Conclusion:** The study underscores the crucial role of computerized systems in enhancing pharmacy operations and improving patient care in Jordanian community pharmacies. However, the uneven adoption of technology and barriers, such as infrastructure limitations, suggest a need for targeted interventions. Recommendations include comprehensive training programs, policy changes, and enhanced support for technology integration to optimize pharmacy practice and ensure high-quality patient care.

Keywords: community pharmacy, decision-support systems, digital health, healthcare technology, information management, pharmacy management, Jordan.

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INTRODUCTION

Pharmacists play a critical role in healthcare systems worldwide by ensuring the safe dispensing of medications and providing vital patient care services^{1,2}. In recent years, integrating information technology (IT) and digital health solutions into pharmacy practice has become increasingly important to enhance efficiency, accuracy, and patient safety across evolving healthcare landscapes^{3,4}. However, several studies have shown that pharmacies in various locations adopt computerized systems (hardware and software) differently⁵⁻⁷.

Community pharmacies are central places not only for dis-

persing medicines but also for providing other patient care services. Over the years, these institutions have adopted IT-based solutions supporting drug management beyond simple medication dispensing⁸⁻¹⁰. By deploying Health IT, pharmacists are now empowered to stay up to date on drug information and assume a greater role in healthcare provision^{11,12}.

Focusing on quality pharmaceutical services improves patient satisfaction and health outcomes. Community pharmacies are vital players in this regard, especially in the Jordanian health system¹³. Good pharmacy practice initiatives aim to optimize pharmacist roles and promote adherence to high standards of patient care. Pharmacists' performance and pharmacy services are closely related to customer contentment¹⁴.

The integration of technology into pharmacy management systems is not only beneficial for accuracy and efficiency but also positively affects patient outcomes¹⁵. Digital decision support systems are indispensable tools for decision-making and optimizing pharmacy operations^{16,17}. Reliable information sources facilitate proper patient care and medication safety among pharmacists, hence the importance of information resources in pharmacies⁴. These tools empower pharmacists to swiftly access accurate information, reconcile medication orders, cross-reference patient profiles, and monitor inventory levels efficiently^{18,19}.

Research has been conducted on the use of clinical decision support systems (CDSS) and information resources in community pharmacies across different countries, but little has been done in Jordan²⁰. Previous research has examined many areas, including the application of IT in pharmacy activities, the types of technolo-



gies and programs used, and the effects of computer applications on pharmacy operations. Additionally, issues such as challenges with IT utilization and the need for improved use of electronic drug databases have been noted^{21,22}.

However, more work is needed on this topic, specifically in Jordanian settings, to comprehensively explore features, problems, and potential improvements for implementing computerized systems in community pharmacies. This study bridges this gap by evaluating how digital decision support tools, software, and information resources are utilized in Jordanian community pharmacies to improve performance outcomes and service quality. Such a move is crucial for improving healthcare and provides a foundation for future initiatives in the sector.

MATERIAL AND METHODS

Study Design

This study employs a cross-sectional research design using a specifically developed, validated, and self-administered questionnaire to assess the current utilization of computerized decision-support tools among community pharmacies in Jordan. We aimed to evaluate the existing practices related to automated systems in Jordanian community pharmacies, offering a basis for understanding their adoption and usage patterns. Ethical guidelines were followed, and written informed consent was obtained from each participant before study initiation. The informed consent form of approval to participate in the study and to ensure the privacy of the information was included at the beginning of the study questionnaire (S1, Supplementary files).

Data Collection Methods

Sample Selection

The study targeted registered pharmacists working in community pharmacies throughout Jordan (N = 4497, according to the Jordan Pharmacists Association (JPA) in February 2023). The Raosoft online calculator was used to determine the required sample size with a confidence interval of 95%, an alpha level of 5%, a margin of error of 5%, and a sample response distribution of 50%, resulting in a minimum required sample size of 354. The selection approach employed stratified convenience sampling to ensure geographic representation of community pharmacies throughout Jordan while ensuring data collection feasibility. The implementation of a purely random sampling method was impractical due to the lack of a comprehensive, accessible national sampling frame for community pharmacists and to the extensive geographic distribution of pharmacies.

The research population was initially stratified by geographic location, following Jordan's formal administrative division into northern, central, and southern governorates. Geographic stratification was utilized to address potential regional disparities in infrastructure, access to digital tech-

nologies, pharmacy workload, and healthcare resources, all of which may affect the adoption and use of computerized decision support systems.

Pharmacists were subsequently recruited from each geographic stratum utilizing convenience sampling via professional networks, the Jordan Pharmacists Association, and online platforms. This methodology facilitated the proportional representation of pharmacists from various areas while ensuring a sufficient sample size and feasible study conduct.

Survey Instrument

The questionnaire was created in accordance with the study objectives and an extensive examination of the relevant literature^{7,23,24}. The initial draft was evaluated for face and content validity by a panel of five specialists in pharmacy practice, clinical pharmacy, information technology, and health services research. The experts assessed the questionnaire for clarity, relevance, comprehensiveness, and compatibility with the study objectives. Their feedback was used to refine item phrasing, remove ambiguities, and ensure comprehensive coverage of all key domains.

After expert validation, the modified questionnaire was pilot-tested with 30 community pharmacists who met the study's inclusion criteria but were excluded from the final analysis. The pilot study sought to evaluate clarity, readability, completion duration, and administrative practicality. Minor adjustments were implemented in response to pilot feedback to enhance question clarity and coherence. (S2. Supplementary file). The completed questionnaire was distributed in Arabic to meet respondents' linguistic preferences. The internal consistency of the research constructs was evaluated using Cronbach's alpha, which yielded a value of 0.945, indicating excellent reliability.

Survey Process

The questionnaire was distributed to pharmacists via an online survey platform (Google Forms) to facilitate a broad reach. The respondents were contacted through professional networks, including the JPA and various social media platforms, to ensure a diverse representation of pharmacists. Participation in the survey was voluntary, and respondents were informed about the purpose of the study and the confidentiality of their responses. The survey was open between January 2023 and May 2023.

Statistical Analysis

The collected data were exported to Excel, coded, and imported for rigorous statistical analysis using Statistical Package for Social Sciences (SPSS) software, version 26. Descriptive statistics, such as frequencies, percentages, means, and standard deviations, were used to summarize the study participants' characteristics and utilization patterns. Inferential statistics, including chi-squared tests and t-tests, were used to identify associations with computerized system adoption and utilization. Incomplete surveys, non-community pharmacies, or only those holding a diploma in pharmacy (technicians) were excluded. A probability value of p less than 0.05 was considered statistically significant.



Zarqa University
Faculty of Pharmacy



جامعة الزرقاء
كلية الصيدلة

Date: _____

التاريخ: _____

Informed Consent Form for Participation in Research Study

Study Title:

Utilization and Challenges of Computerized Decision Support Systems in Community Pharmacies: A Cross-Sectional Study

Purpose of the Study:

You are invited to participate in a research study conducted by researchers from Zarqa University. The purpose of this study is to evaluate the utilization and challenges of computerized decision support systems in community pharmacies in Jordan.

Procedures:

If you agree to participate in this study, you will be asked to complete an online questionnaire that will take approximately 10 minutes to complete. The survey will ask about your experience with computerized systems, the types of digital tools you use, the perceived benefits and challenges, and your demographic information (e.g., age, gender, education level).

Voluntary Participation:

Your participation in this study is entirely voluntary. You have the right to withdraw at any time without any consequences. There is no compensation for participating in this study.

Risks and Benefits:

There are no foreseeable risks associated with participating in this study. Your responses will contribute to improved patient care and pharmacy management strategies.

P.O. Box 132222 – Jordan 13132 Zarqa – Tel. 962 – 5 – 3656100 – Fax 962 – 5 – 3656120
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جامعة الزرقاء
كلية الصيدلة

Date: _____

التاريخ: _____

Confidentiality:

All information provided will be kept confidential. Your responses will be anonymous, and no identifying information will be collected. The data will be stored securely and used solely for research purposes.

Contact Information:

If you have any questions about the study, please contact the principal investigator at mabuassab@zu.edu.jo.

Consent:

By proceeding to complete the survey, you indicate that you have read and understood the information provided above, that you are 18 years or older, and that you voluntarily agree to participate in this study.

Participant's Statement of Consent:

- I have read and understood the information provided above.
- I am aware that my participation is voluntary and that I can withdraw at any time.
- I consent to participate in this study.

☐ **Yes, I consent to participate in this study.**

☐ **No, I do not wish to participate in this study.**

Survey

Part One: Demographic and General Information

Please mark (✓) in the box that applies to you:

1. **Gender:**

- ☐ Female
☐ Male

2. **Age:**

- ☐ Under 30
☐ 30-40
☐ Over 40

3. **Educational Qualification:**

- ☐ Bachelor's (Pharmacy)
☐ Bachelor's (Doctor of Pharmacy)
☐ Postgraduate Studies

4. **Governorate where the pharmacy is located:**

- ☐ Northern Governorates (Irbid, Jerash, Ajloun, Mafrq)
☐ Central Governorates (Amman, Balqa/Salt, Zarqa, Madaba)
☐ Southern Governorates (Karak, Tafileh, Ma'an, Aqaba)

5. **Ownership of the pharmacy where you work:**

- ☐ Independent
☐ Chain of Pharmacies

6. **Age of the pharmacy since its establishment:**

- ☐ Less than 5 years
☐ 5 to less than 10 years
☐ 10 years or more

7. **Pharmacist Job Title:**

- ☐ Owner Pharmacist
☐ Responsible Pharmacist
☐ Owner and Responsible Pharmacist
☐ Other (please specify): _____

8. **Years of Experience in Community Pharmacies:**

- ☐ Less than 5 years
☐ 5 years to less than 10 years
☐ 10 years or more

9. **Available Equipment in the Pharmacy (you can select more than one option):**

- ☐ One or more computers
☐ Landline phone
☐ Fax machine
☐ Internet connection
☐ Website
☐ Email
☐ Social media page
☐ Electronic system for preparing and printing dispensed medication invoices
☐ One or more programs for processing insurance prescriptions

- ☐ Printer
- ☐ Barcode scanner
- ☐ Photocopier
- ☐ Surveillance cameras
- ☐ Mobile phone
- ☐ None of the above

Part Two: Evaluation of Computerized Systems Used in Community Pharmacies for Decision Support

Please mark (✓) in the box that reflects the frequency of use for each of the following statements according to your practical experience in the pharmacy where you work:

Statement	Always	Often	Sometimes	Rarely	Never
1. We use computer software to manage relationships with insurance companies.					
2. We use computer software to manage employee affairs.					
3. We use computer software for accounting and financial management.					
4. We use computer software to manage purchases and inventory.					
5. We use computer software to manage customer relationships.					
6. We use computer software to store patient files.					
7. Insurance prescriptions are processed electronically.					

Part Three: Purpose of Using Computerized Systems in Community Pharmacies

Please mark (✓) in the box that reflects your level of agreement with each of the following statements:

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. Computerized pharmacy management programs improve financial performance.					
2. Computerized pharmacy management programs improve inventory management.					
3. Computerized pharmacy					

management programs enable us to improve purchasing management					
4. Computerized pharmacy management programs enable us to control financial and accounting matters					
5. Computerized pharmacy management programs enable us to obtain accurate reports that contribute to decision-making and decision-making					
6. Computerized pharmacy management programs enable us to know profits and losses					
7. Computerized pharmacy management programs enable us to manage the relationship with suppliers					
8. Computerized pharmacy management programs enable us to improve the process of exchanging information with various parties related to our work					
9. Computerized pharmacy management programs enable us to provide vital information for decision-making and decision-making					
10. Computerized pharmacy management programs enable us to save time in collecting the information necessary for pharmacy management					
11. Computerized pharmacy management programs enable us to reduce the waiting time for patients and visitors					
12. Computerized pharmacy management programs enable us to improve our service to patients and visitors					
13. Computerized pharmacy management programs enable us to improve the work environment of employees Pharmacy					
14. Computerized pharmacy management programs enable us to reduce the consumption of papers and files					
15. Computerized pharmacy management programs enable us to display various treatment					

alternatives available to patients and visitors					
16. Computerized pharmacy management programs enable us to record data on various medications					
17. Computerized pharmacy management programs enable us to reduce the number of workers in the pharmacy					
18. Computerized pharmacy management programs enable us to improve the process of following up on the implementation of decisions taken					
19. Computerized pharmacy management programs enable us to reduce the effort expended in completing work					
20. Computerized pharmacy management programs enable us to save and document patient and visitor data and information					
21. Computerized pharmacy management programs enable us to reduce the storage space of paper files					
22. Computerized pharmacy management programs enable us to improve our management of damaged/expired materials					
23. Computerized pharmacy management programs enable us to improve pharmacy sales					

Part Four: Software Programs Used in Pharmacy Management

- Do you use any computer software in the pharmacy to manage administrative and financial matters?
 - ☐ Yes (Smart Program)
 - ☐ Yes (Galaxy Program)
 - ☐ Yes (Falcon Program)
 - ☐ Yes (Darwazeh Program)
 - ☐ Yes (Dawatech Program)
 - ☐ Yes (Aumet Program)
 - ☐ Yes (Med Pharma Program)
 - ☐ Yes (Phenix Pharma Program)
 - ☐ Yes (Other programs) _____
 - ☐ No, we do not use any computer software for managing administrative and financial matters.

2. Years of Use of Computerized Programs and Systems in Pharmacy

Management:

- ☐ Less than a year
- ☐ 1 year to less than 5 years
- ☐ 5 years to less than 10 years
- ☐ 10 years or more
- ☐ No computerized programs or systems are used in pharmacy management

Part Five: Evaluation of Information Sources Used in Community Pharmacies

What information sources are used in your pharmacy for obtaining medical, pharmaceutical, and clinical information? (You can select more than one option)

- ☐ Books and scientific journals
- ☐ Drug package inserts
- ☐ Medical publications distributed by pharmaceutical companies
- ☐ Computerized programs and systems
- ☐ Drug formularies
- ☐ Specialized websites
- ☐ Search engines (e.g., Google)
- ☐ Official government websites (FDA, Ministry of Health, Pharmacists Association)
- ☐ Other sources (please specify): _____

Part Six: Challenges to the Use of Computerized Systems in Community Pharmacies

In your opinion, please identify the barriers that limit the use or expansion of computerized systems in the pharmacy where you work (you can select more than one option):

- ☐ Lack of adequate space for computers and accessories.
- ☐ Limited trust in the output of computerized systems.
- ☐ Internet/power outages.
- ☐ Limited training and qualification of pharmacy staff in using computerized systems.
- ☐ The nature of the work does not require the use of computerized systems.
- ☐ High cost of computerized systems, software, and maintenance.
- ☐ Limited internet coverage.
- ☐ Limited skills required for operating and maintaining computerized systems and their accessories.
- ☐ Loss of stored information.
- ☐ The need for hiring specialized personnel for computerized systems.
- ☐ Damage to computerized system devices.
- ☐ Other barriers not mentioned (please specify): _____

Table 1. Demographic Characteristics of Study Participants (N=393)

Characteristic	Category	N	Percentage (%)
Gender	Female	261	66.4
	Male	132	33.6
Education	BPharm	248	63.1
	PharmD	89	22.6
	Postgraduate	56	14.2
Occupation	Responsible pharmacist	196	49.9
	Pharmacy owner	100	25.4
	Owner and responsible pharmacist	59	15
	Administrative	38	9.7
Governorate	Center	226	57.5
	North	128	32.6
	South	39	9.9
Pharmacy type	Individual pharmacy	296	75.3
	Chain	97	24.7
Age (Mean $\pm$ SD)	37.98 $\pm$ 11.30		
Experience (Mean $\pm$ SD)	12.55 $\pm$ 11.09		
Pharmacy age since the establishment (Mean $\pm$ SD)	16.81 $\pm$ 14.25		

Table 2. Types of Computerized Systems Utilized in Jordanian Community Pharmacies (N=393)

Types of Computerized Systems	N	Percentage (%)
Computers	313	79.6
Internet	251	63.9
Surveillance and security cameras	215	54.7
Mobile phones and tablets	203	51.7
Landlines	184	46.8
Social media pages	176	44.8
Printers	170	43.3
Email clients	163	41.5
Barcode scanners	137	34.9
Copiers	122	31
Medical insurance software/device	109	27.7
Electronic systems for processing medical receipts	101	25.7
Fax machines	95	24.2
Websites	5	1.3
None of the above	17	4.3

Table 3. Pharmacy Management Software Utilization in Jordanian Community Pharmacies (N=393)

Pharmacy Management Software	N	Percentage (%)
Smart	166	42.2
Galaxy	58	14.8
Med Pharma	25	6.4
Falcons	21	5.3
Aumet	20	5.1
Dawatech	20	5.1
Darwazeh	16	4.1
Phenix	6	1.5
Others	5	1.3
No software used	56	14.2

Table 4. Pharmacists' Perceptions of the Importance of Computerized Systems in Pharmacy Practice

Rank	Purposes	Mean $\pm$ SD	t	Agreement (%)	p-value
1	We use computer programs for financial and administrative management purposes	4.12 $\pm$ 1.22	18.286	77.4	<0.001
2	We use software to manage purchases and inventory (warehouse (	4.11 $\pm$ 1.25	17.54	76.1	<0.001
3	We use computer programs to manage the relationship with insurance companies	3.88 $\pm$ 1.44	12.131	72	<0.001
4	Prescriptions for insurance companies are dispensed electronically	3.75 $\pm$ 1.39	10.704	66.2	<0.001
5	We use software to manage personnel affairs	3.70 $\pm$ 1.46	9.47	64.4	<0.001
6	We use software to manage the relationship with customers	3.64 $\pm$ 1.38	9.149	61.3	<0.001
7	We use computer programs to save patient files	3.45 $\pm$ 1.56	5.681	57	<0.001

Quality assessments of the data were conducted prior to the analysis. Responses were evaluated for duplicates, found by matching demographic features and timestamps; duplicates were eliminated, preserving only the most comprehensive response. Questionnaires with significant missing data or incomplete essential portions were omitted from the final analysis. Only thoroughly completed questionnaires from qualified community pharmacists were included. After data cleaning, 393 valid replies were preserved for statistical analysis.

RESULTS

The participants' demographics are presented in Table 1. A total of 393 community pharmacists in Jordan participated in the study. Most of the participants were female (66.4%); the highest percentage held a Bachelor of Pharmacy (BPharm) degree (63.1%), followed by a Doctor of Pharmacy (PharmD) degree (22.6%). Regarding occupation, almost half of the participants were responsible pharmacists (49.9%). A smaller portion of participants had administrative roles (9.7%). In terms of geographic distribution, most participants were from the central governorates (57.5%), followed by the north (32.6%) and south (9.9%) regions of Jordan. Most of the pharmacies represented were individual (75.3%), with 24.7% being part of a pharmacy chain. The average age of the participants was 37.98 years, while their average years of experience in pharmacy practice were 12.55 years. The average age since the pharmacies' establishment was 16.81 years.

Significance of Computerized Systems

The types of computerized systems utilized in Jordanian community pharmacies are presented in Table 2. These systems play a crucial role in pharmacy operations. Traditional computers were the most widely used system, with 79.6% of participants reporting their utilization. Internet access was also prevalent, with 63.9% utilizing it to support their pharmacy activities. A small percentage of pharmacies had websites (1.3%), indicating low online presence. Seventeen participants (4.3%) reported not using any listed systems. When assessing the use of computerized systems for registration and documentation, the results revealed that 40.7% of pharmacists use a combination of paper and electronic forms, 34.4% rely solely on paper forms, and 24.9% exclusively use computerized systems.

Pharmacists rated administrative tasks as highly important, with a mean score of 4.12 and 77.4% of participants in agreement. Financial management came close, with a mean score of 4.11 and an agreement rate of 76.1%. Health-related responsibilities received a mean score of 3.88, with 72.0% of pharmacists in agreement. Inventory management had a mean score of 3.75, and 66.2% of pharmacists agreed on its importance. Lastly, patient care and safety, another critical aspect, received a mean score of 3.70, with 64.4% agreement among participants.

Table 3 provides an overview of the utilization of various computerized pharmacy management software in Jordanian community pharmacies. The data shows the prevalence of different software systems, each offering distinct features and functionalities. The most commonly used pharmacy management software was 'Smart', employed by 42.2% of pharmacies. 'Galaxy' software came second, utilized by 14.8% of pharmacies. Notably, 14.2% of pharmacies reported not using any pharmacy management software and relied on alternative methods or manual processes.

Regarding the duration of pharmacy management software use in Jordanian community pharmacies, which offers insights into pharmacists' experience and familiarity with computerized systems, a significant proportion of pharmacies have used computerized software for less than 5 years (35.6%). Many pharmacies (23.9%) have used software for five to less than 10 years, indicating a longer duration of software use. Furthermore, 14.5% of pharmacies reported using computerized systems for less than one year, indicating a recent adoption of technology in their operations. On the other hand, 11.7% of pharmacies have a history of 10 years or more with computerized software, reflecting their substantial experience and investment in this technology.

Perceptions and Expectations

Table 4 presents pharmacists' perceptions of the importance of computerized systems in various aspects of pharmacy practice. It shows that pharmacists perceive all statements as highly important across various aspects of pharmacy practice, with an overall score of 3.80 ± 1.08 ($p < 0.001$).

Table 5 summarizes pharmacists' perceptions of the utilization and impact of computerized systems. It highlights that pharmacists acknowledge the importance of computerized systems in various aspects of pharmacy practice, mainly financial and administrative management, inventory management, and improving the quality of service provided to patients and auditors ($p < 0.001$). The high agreement percentages reinforce the significance of these aspects in community pharmacies.

Information Sources Utilization

Table 6 shows the sources of medical information used in pharmacy practice. These sources provide insights into where pharmacists obtain medical and financial information. All pharmacists reported using official government websites as a source of medical information (100.0%). 58.5% of pharmacists reported relying on the leaflets accompanying medications to obtain medical information. Approximately half of pharmacists (50.9%) reported using search engines such as Google to access medical information. A small fraction of pharmacists use other medical information sources (0.3%). For the financial information, a substantial portion of pharmacists (47.8%) reported consulting a professional accountant. 37.9% relied on their own efforts to manage financial information, and 26.2% utilized specialized accounting programs to manage financial aspects.

Utilization Barriers

Figure 1 identifies various challenges associated with computerized systems in community pharmacies. The most frequently reported barriers included electricity/internet outages (35.1%), limited space for computers and accessories (34.9%), and insufficient time (32.6%).

DISCUSSION

The healthcare landscape is undergoing rapid transformations, ushering in a paradigm shift in pharmacy staff roles. As technology continues to advance, especially through the utilization of computers,



Table 5. Summary of Perceptions and Importance of Computerized Systems in Community Pharmacies			
Statement	Mean ± SD	Agreement (%)	p-value
Financial and administrative management	4.12 ± 1.22	77.4	<0.001
Purchase and inventory management	4.11 ± 1.25	76.1	<0.001
Managing relationships with insurance companies	3.88 ± 1.44	72	<0.001
Financial performance improvement	4.48 ± 0.77	90.8	<0.001
Inventory management improvement	4.46 ± 0.74	90.1	<0.001
Knowledge of profits and losses	4.41 ± 0.79	89.1	<0.001
Saving time on information collection	4.39 ± 0.83	89.1	<0.001
Improved service to patients and auditors	4.23 ± 0.91	84.5	<0.001
Displaying treatment alternatives in the pharmacy	4.39 ± 0.81	88.8	<0.001
Improving inventory management	4.46 ± 0.74	90.1	<0.001
Saving time in collecting information	4.39 ± 0.83	89.1	<0.001
Obtaining accurate reports for decision-making	4.38 ± 0.82	86	<0.001

pharmacists find themselves at the vanguard of healthcare's digital evolution²⁵. This study explored the utilization of computerized decision support tools and information resources in Jordanian community pharmacies, shedding light on their significance and impact on pharmacy practice, management, and patient care. The findings revealed several key insights with implications for the pharmacy sector and healthcare delivery.

Comparison With Regional and Global Studies

The results of this study align with other regional and global studies, indicating inconsistent adoption of computerized systems in community pharmacy practice. Research from adjacent Middle Eastern nations, including Saudi Arabia and Lebanon, for example, has similarly indicated extensive use of fundamental digital technologies such as computers and internet connectivity, along with limited adoption of sophisticated pharmacy management or clinical decision support systems^{11-12,20}. Community pharmacies in these regions have progressively adopted computerized systems, primarily driven by administrative and financial requirements rather than by clinical decision support capabilities^{11-12,20}.

Table 6. Information Sources in Pharmacy Practice (N=393)		
Source	N	Percentage (%)
Official government websites (e.g., FDA, Ministry of Health, Pharmacists Syndicate)	393	100
Leaflets accompanying the medication	230	58.5
Search engines (e.g., Google)	200	50.9
Scientific books and journals	191	48.6
Medical publications from pharmaceutical companies	183	46.6
Specialized websites	171	43.5
Computer programs and systems	147	37.4
Pharmacopoeia	97	24.7
Others	1	0.3
Professional accountant	188	47.8
Self-effort from the pharmacist	149	37.9
Internet	140	35.6
Specialized employee	110	28
Specialized accounting programs	103	26.2

Worldwide, higher levels of software integration have been observed in community pharmacies in high-income nations, including the United Kingdom and Australia, where electronic prescribing, barcode verification, and integrated decision support systems are more consistently incorporated into daily operations¹⁵. The found mismatch between Jordan and these contexts likely indicates variations in health system maturity, regulatory enforcement, infrastructural investment, and personnel training.

Demographic Characteristics and Utilization Patterns

The study's participants represented diverse community pharmacists in Jordan. The majority were female and held BPharm or PharmD degrees. This observation highlights the significant representation of female pharmacists in the Jordanian community pharmacy workforce²⁶. In terms of technology utilization, the findings were noteworthy. These systems are integral to the efficiency and functionality of these healthcare facilities. Computers and the Internet emerged as the most commonly used tools, aligning with the global trend of technology integration in healthcare²⁷. This high prevalence of usage reflects the importance of these tools in day-to-day pharmacy operations. It underscores the role of computers in managing inventory, dispensing medications, and maintaining patient records, among other essential tasks. Also, the Internet enables access to medical information and facilitates communication with healthcare providers. The high utilization of these tools underscores their importance in facilitating efficient healthcare services, communication, and research²⁸. However, it is noteworthy that only a tiny percentage of pharmacies had websites, indicating a limit-



ed online presence within the Jordanian community pharmacy sector. This finding suggests that community pharmacies may not have fully harnessed the potential of online platforms for patient education, marketing, or e-commerce, leaving room for growth in this area²⁹. Moreover, there is still a notable technology usage gap, with some participants reporting no usage of the identified computerized systems. This subset of pharmacies may face challenges related to digital integration. We suggest further exploration of the potential advantages of adopting such technology to improve their operations, underscoring the need for greater standardization and integration of technology across all community pharmacies. Finally, the findings highlight the importance of recognizing the coexistence of traditional and digital documentation approaches in Jordanian community pharmacies³⁰. This duality may indicate the evolving nature of pharmacy practice, where some pharmacies have embraced digital solutions while others continue to rely on more conventional paper-based methods.

Significance of Computerized Systems

The study highlighted the significant role of computerized systems in pharmacy operations. Pharmacists recognized the importance of these systems in various aspects of practice, with particular emphasis on financial and administrative management, purchase and inventory management, and improving the quality of service provided to patients and auditors. They simplify billing, invoicing, sales tracking, and inventory management. This recognition of the role of computerized systems in enhancing pharmacy management and service quality is a positive sign for the advancement of healthcare in Jordan. This emphasis on administrative tasks underscores the significance of efficient operational management within community pharmacies. The high agreement rate among pharmacists further emphasizes the collective recognition of the importance of these tasks in ensuring the smooth functioning of the pharmacy. Financial management came close, underscoring the vital role of sound financial practices in maintaining the sustainability and growth of community pharmacies. It reflects pharmacists' awareness of the need for effective financial planning and resource allocation. The prevalence of various pharmacy management software systems demonstrates the diversity of software choices available to pharmacists. The duration of software use varied, with some pharmacies having a long history of use, which offers insights into pharmacists' experience and familiarity with computerized systems. This finding aligns with a previous study in southwestern Nigeria, underscoring the critical role of software in managing pharmacy operations³¹. Conversely, many pharmacies had only recently adopted these systems, suggesting a recent wave of adoption and investment in this technology³². Notably, some pharmacies do not use any pharmacy management software, relying on alternative methods or manual processes. This indicates a digital divide within the sector, with some pharmacies embracing technology while others continue to operate using traditional methods³³. This suggests the need for more comprehensive adoption strategies

and education about the benefits of such systems.

Causes of Low or No Software Adoption and Systematic Barriers

The discovery that a particular group of community pharmacies indicated minimal or no utilization of pharmacy management software demands further examination. This observation may be attributed to several factors, including the high cost of acquiring, licensing, and maintaining software systems, especially for independently owned pharmacies. Smaller pharmacies may favour short-term operating expenses over long-term digital expenditures, particularly in the absence of explicit financial incentives or regulatory requirements^{7,23,31,33}.

Moreover, resistance to change and dependence on established paper-based processes may hinder prompt adoption. Pharmacists with extensive experience may recognize minimal additional benefits from adopting digital systems, especially when training options are inadequate or time limitations are significant^{1,21}.

At a systemic level, various obstacles may impede the extensive implementation of computerized decision support systems in Jordanian community pharmacies. This encompasses restricted structured training initiatives in pharmacy informatics, unreliable internet and electrical access, and the lack of obligatory national standards for pharmacy software deployment^{2,21-22}.

In contrast to certain healthcare systems that mandate electronic systems for insurance claims or drug tracking, Jordanian community pharmacies operate with significant independence, resulting in varying degrees of digital integration. Moreover, regulatory frameworks presently prioritize dispensing and licensing requirements over technology advancement, thus hindering the impetus for software use^{11,15}.

Clinical Implications: Medication Safety and Workflow Efficiency

In addition to administrative advantages, the restricted implementation of computerized decision support systems carries significant therapeutic consequences. These systems are recognized for diminishing prescription errors by delivering real-time notifications regarding drug interactions, dose inaccuracies, and contraindications. The lack of these technologies in many community pharmacies may heighten dependence on individual pharmacist attentiveness, thereby raising the likelihood of avoidable drug errors, especially in high-volume environments^{3,9}.

Furthermore, computerized systems can significantly improve workflow efficiency by optimizing inventory management, prescription processing, and documentation. Enhanced efficiency enables pharmacists to dedicate additional time to patient-centred services, including counseling, pharmaceutical treatment management, and health promotion initiatives. Consequently, enhancing software adoption could not only elevate opera-

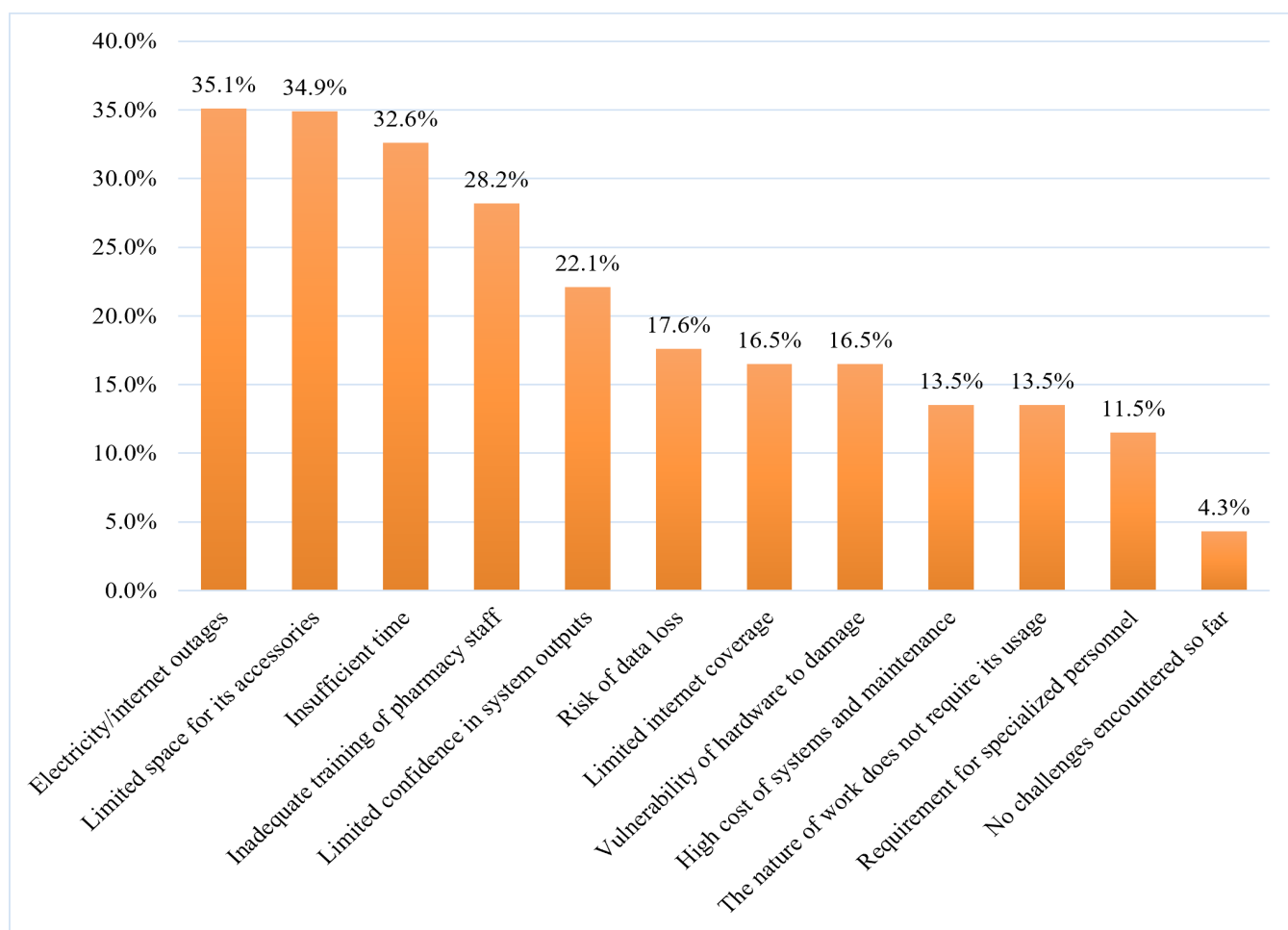


Figure 1.Challenges Associated with Computerized Systems in Community Pharmacies (N=393)

tional performance but also reinforce the clinical function of community pharmacists inside the healthcare framework^{16-17,34}.

Perceptions and Expectations

The study's findings regarding pharmacists' perceptions align with their utilization patterns. High agreement percentages on statements about the significance of these systems across various aspects of pharmacy practice reaffirm their crucial role in daily operations. In areas such as financial and administrative management, purchase and inventory management, interactions with insurance providers, and service quality improvement, pharmacists use tools that enhance efficiency and support informed decision-making and the quality of services provided to patients and auditors. These systems, particularly computerized clinical decision support systems, offer access to critical information, aiding pharmacists in providing optimized patient care³⁴. They improve patient outcomes by ensuring the appropriate and safe use of medications, thereby enhancing the overall effectiveness of the healthcare system. These insights underscore the potential for technology to continue transforming and improving community pharmacy practice in Jordan and beyond. Computerized systems play a pivotal role in enhancing medication safety within community pharmacies³⁵.

They contribute to reducing errors and improving the precision of drug dispensing services. With the aid of barcode scanners and electronic systems for processing medical receipts, pharmacists can minimize errors in prescription filling and maintain precise medication records³⁶. The study's findings, aligned with prior research, demonstrate that pharmacists in Jordan are well aware of the role of computerized systems in enhancing safety and reducing prescription errors.

Information Sources Utilization

Understanding where pharmacists obtain their information is integral to assessing the quality and reliability of the information they utilize. Pharmacists' reliance on official government websites such as those provided by the FDA and the Ministry of Health, medication leaflets, and search engines for medical information aligns with the need for accurate and up-to-date information in pharmacy practice. The widespread use of all these sources reflects their convenience and accessibility^{20,37}. However, the reliance on online search engines also underscores the importance of training pharmacists to critically evaluate the information they find online to ensure its accuracy and relevance. While these sources are convenient and accessible, pharmacists need to be trained to critically evaluate the

information they find online to ensure its accuracy and relevance^{38,39}. Notably, a substantial portion of pharmacists consult professional accountants for financial information, indicating the importance of financial management in pharmacy practice. However, a smaller portion of pharmacists relied on their own efforts to manage financial information using specialized accounting programs, suggesting that some pharmacies may have internal financial management capabilities. This also underscores the need for pharmacists to have a well-rounded skill set that includes financial literacy⁴⁰.

Implications and Recommendations

The findings of this study have several implications for the pharmacy sector in Jordan. Computerized decision support tools and information resources are integral to the efficient delivery of healthcare services and the enhancement of patient care, safety, and operational efficiency in community pharmacies. To maximize their potential, it is imperative to address the technology-usage gap by promoting the adoption of these systems across all pharmacies. Policy changes, awareness campaigns, and comprehensive pharmacists' training are essential to further integrate these tools into practice. Pharmacy associations and regulatory bodies can play a pivotal role in developing guidelines and standards for the adoption of computerized systems in community pharmacies. These software solutions are powerful tools for managing patient data, tracking inventory, and administering medications, reflecting their importance in enhancing pharmacy management. Additionally, educational institutions can incorporate technology training into the pharmacy curriculum to equip future pharmacists with the necessary skills.

This research provides a valuable foundation for further exploration and intervention to enhance computerized system utilization within Jordanian community pharmacies, ultimately elevating healthcare services and patient satisfaction.

Challenges and Limitations

While the study reveals the positive impact of computerized systems on pharmacy practice, it also highlights several challenges and limitations. One notable challenge is the inconsistency in technology adoption across different pharmacies. Not all pharmacies have fully incorporated these technologies into their operations. This discrepancy underscores the need for further integration and standardization of computerized systems in pharmacy to ensure comprehensive, uniform adoption. Addressing these barriers and exploring solutions, such as reliable power backup systems, optimizing space for technology integration, and efficient time-management training for pharmacists, is recommended. Additionally, a small percentage of pharmacists reported not using any computerized systems,

signifying a technology usage gap that warrants attention and action.

This study's limitations include its cross-sectional design and reliance on convenience sampling. While geographic stratification improved regional representation, reliance on convenience sampling within strata may introduce selection bias and limit the generalizability of the results.

Overcoming these technological, educational, and regulatory obstacles is crucial for transforming community pharmacies in Jordan from predominantly dispensing-oriented establishments to digitally integrated healthcare centers that significantly enhance patient safety and treatment quality.

CONCLUSION

This study provides valuable insights into community pharmacies' utilization of computerized decision support tools. It highlights the significance of these tools and the need for further development and standardization. Embracing computerized systems can enhance patient care, safety, and operational efficiency, ultimately advancing healthcare quality in Jordan. The study's findings lay the foundation for further studies and actions to promote technology integration in community pharmacies.

AUTHORS' CONTRIBUTIONS

NA and MA conceptualized the study and participated in its design, validation, data curation, formal analysis, resources, and administration.

AS and HEH participated in the study's design, validation, and investigation.

IA participated in the study's design, validation, formal analysis, and supervision.

HA participated in the investigation and formal analysis, and helped with the study's software and visualization.

FDE participated in data curation, resources, supervision, and administration of the study.

All authors participated in writing the original manuscript draft and reviewing, editing, and approving the final manuscript.

COMPETING INTERESTS

The authors declare that they have no competing interests or conflicts of interest regarding the research, authorship, and/or publication of this article.



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