PRESCRIPTION AUTOMATION: ENHANCING MEDICATION SAFETY AND HEALTHCARE EFFICIENCY

Noura Ibrahim Sharaf
Erada Services, Jeddah Second Health Cluster

Abstract

This research paper presents a comprehensive analysis of the impact of prescription automation on medication safety, workflow efficiency, and healthcare quality. By employing a mixed-methods approach, including quantitative analysis of medication error reports and qualitative insights from healthcare professionals, this study provides a detailed evaluation of the effectiveness of automated prescription systems in mitigating errors and enhancing clinical workflows. Results indicate significant improvements in prescription accuracy, reduced medication errors, and enhanced patient safety following the implementation of automation technologies. Despite challenges such as system downtimes and staff resistance, the findings demonstrate the potential of prescription automation to significantly contribute to safer and more efficient healthcare delivery. This study further emphasizes the importance of user training and continuous system improvements to address implementation challenges effectively and maximize benefits. The findings provide valuable insights for healthcare policymakers and stakeholders, guiding the adoption and optimization of automation technologies in healthcare settings.

IntroductionMedication errors have remained the Achilles heel of the health care service pointing to a challenge faced by practitioners even with the existence of competent health seeking patients who follow the recommended prescription regimens. It has since been established that the use of technology such as automated prescription systems can go a long way in combating these problems. Pharmacy Times, 2023. It has thus been recognized and recommended that there is need for tackling medication risks through automation systems with the aim of improving and increasing precision as well as risk management on medication errors incidents.It also reduces the reliance on human resources in managing medications. The automation of prescriptions and medication orders through the elimination of manual tasks formulations, Ferreira et al., (2015), emphasises the use of technologies where possible for medication management processes. Franklin, et al., (2009), noted the effective application of E-prescribing systems due to their evidence of reducing medication errors and improving the safety and quality of prescribing. This thus clearly articulates the supportive contributions of automation of tasks and E systems on the healthcare policies and practises.Moreover, it can be stated that healthcare automation is not limited to just reducing noise, but it can also be used to increase noise. Odukoya and Chui (2019) demonstrated that e-prescribing enables better communication and coordination of healthcare processes among the providers. This is important especially in hectic health care settings as enhanced efficiency leads to improved patient care and reduced stress on health care providers. Also Bates et al. (1999) stressed the importance of information systems in avoidance of adverse drug events and remarked that automated systems might allow health care providers to make better decisions while prescribing drugs.

Further still, Slight et al., 2019 demonstrated, the improved communication and mechanical processes brought about by EHR and adoption of automation technology, enhanced the quality of outpatient care in the US. This evidence further strengthens the view that as part of other health information technology tools, automation of prescription is bound to revolutionize health care service provision and raise quality standards.

Nonetheless, prescription automation has its limitations. Problems like system failures, employee reluctance and the requirement for intensive training are typical challenges which have to be resolved in order to harness the full capabilities of these systems (Ro et al., 2024; Upadhyay & Hu, 2022). This process is not merely dependent on a sound technology and resources but also on the existence of a conducive environment that is required for users' acceptance and trust of new systems. Tarrahi et al. (2023) have been able to show that the medication safety climate which includes the attitudes and beliefs of a majority of healthcare providers is an important factor in the successful application of such technologies.

The goal of this study is to examine the effects of prescription automation on medication safety, the workflow processes, and the overall healthcare quality. With the help of healthcare professional's primary survey and medication error self-reporting, this research aims to answer an otherwise underexplored area: the impact of prescription automation on healthcare delivery systems, what difficulties are present and how effective these systems are overall. The aim of this study will add useful information on the literature which is continuously being developed in respect to healthcare automation, thus providing a rationale for policy making and best practices in respect to the application of technology in healthcare provision.

1.1 Research Objectives
- Assess the impact of prescription automation on medication error reduction.
- Evaluate healthcare professionals' perceptions of system usability and effectiveness.
- Identify challenges and benefits associated with system implementation.

2. Methodology

2.1 Study Design

A mixed-methods approach was used to address the study objective regarding the automation of prescription and its influence on medication safety, enhancement of work efficiency, and reduction of the rate of errors. This approach combined quantitative analysis of medication error reports and qualitative professionals' opinions that in the end formed a comprehensive picture concerning the efficiency of the automation system.

2.2 Quantitative Data Collection

Medication Error Reports: Quantitative data was also obtained from monthly medication error reports between August 2023 and August 2024. Such Reports of errors included prescription, dispensing, and preparation errors This data was useful in the first place for trend analysis, at the second place to test the hypothesis concerning the automation effects upon the error rates.

Metrics Analyzed:

Prescribing Errors: Errors that take place when a prescription is being written.

Dispensing Errors: Errors that are done in relation to distribution of wrong medication.

Preparation Errors: Errors that take place during the stage when medication is to be administered but has not yet been given to the patient.

Data Analysis: Changes in the frequency of errors over time were evaluated apply descriptive statistical techniques. The data were analyzed in successive months to check if a stable light pattern emerged which suggested that the system was improving had been established.

2.3 Qualitative Data Collection

Survey of Healthcare Staff : Qualitative information was obtained by a questionnaire given to 27 healthcare providers working at Erada Services center in second health cluster Jeddah. The survey aimed at obtaining their impressions concerning the prescription automation system, its acceptability, its efficacy and the barriers therein. The survey received responses from physicians, pharmacists, nurses, pharmacy intern, medical researchers, health administration officers, laboratory technicians, and orthodontists.

Survey Characteristics:

Overall Sample: 27 health providers

Orientation of Participants: Different categories of healthcare workers such as doctors and nurses, pharmacists and technicians and administrative officers.

Participants of the study

Duration of System usage: The duration in which the participant had used the dispensing system was maintained.

System Usefulness: The users saw the use of required systems as simple and easy to use.

Accuracy of Prescriptions: Due to the deployment of the system, improvement in the precision of prescriptions was witnessed.

Reduction of Authoritative Errors: The extent to which the participants perceived the level of errors being less was captured.

Work Processes and patient safety: The level at which workflows and patient safety issues have improved over time.

2.4 Data Collection Devices

Questionnaires: As for the qualitative survey, structured questions were developed. The question contained both close-ended questions and open-ended perspectives, enabling the users to comment and provide deep information about their encounters with the system deployed. The survey was conducted through the internet in order to cut down on the time of administration of the survey as well as the data collection time.

Medication error reporting system: Information related medication errors was obtained through the monthly medication error reporting systems of the healthcare facility. The procedures of data collection were uniform for all the sources.

2.5 Data Analysis

Quantitative Analysis: The data in the medication error reports were analyzed using graphs to show the progression of the trends over a period of time. This involved calculation of frequencies and percentages of different categories of the errors that were evident before automation and after the automation system was integrated.

Qualitative Analysis: The qualitative data from the survey of the health care practitioners were analyzed thematically. A few themes were formulated, namely usability of the system, effect on workflow, degree of errors, and impact on patient safety. This analysis also served to enrich the quantitative analysis by situating and explaining the statistical results.

2.6 Limitations

Specific limitations have been provided for in this study.

Sample size: The small sample size of respondents n=27, of which healthcare professionals constitutes the greater portion, can impact the findings in the sense that they will not be broadly applicable.

Self-reported Data: The component of the survey in which respondents offered their feedback on the effectiveness of the systems was completely relayed on self-reported information, which may be questionable since it depends on subjective judgment of how effective the system is.

Technical Issues: some respondents claimed to have witnessed some technical hitches and downtimes of the system, this might have affected how the respondents perceive their experience during the surveys.

2.7 Ethical Considerations

The research also satisfied properly all moral principles that relate to researches that involve human beings. Prior to conducting the surveys all of the participants agreed to participate voluntarily and remained anonymous during the course of research. Data obtained was strictly for research purposes and no data containing personal identifiers was ever taken.

3. Results

This section provides a detailed account of the data gathered through the survey, summarized using tables for clarity. Key insights are also discussed to provide context to the results.

3.1 System Usage and Experience

Duration of Prescription System Usage	Respondents (n=27)	Percentage (%)
More than 2 years	15	55.6
1-2 years	8	29.6
6-12 months	3	11.1
Not using	2	7.4

The majority of respondents (55.6%) reported more than two years of experience using the prescription automation system, indicating significant familiarity with the system. A smaller segment (7.4%) was not currently using the system, which could reflect either personal preferences or a lack of access to the technology.

Usability Perception

Usability Rating	Respondents (n=27)	Percentage (%)
Very Easy to Use	11	40.7
Easy to Use	13	48.1
Neutral	3	11.1

Approximately 88.8% of respondents found the system either "very easy" or "easy to use," suggesting that the prescription automation system has a generally user-friendly interface. Only a small portion (11.1%) expressed a neutral opinion, highlighting areas for potential usability enhancement.

3.2 Prescription Accuracy and Error Reduction

Perceived Prescription Accuracy Improvement	Respondents (n=27)	Percentage (%)
Significantly Improved	16	59.3
Somewhat Improved	9	33.3
Neutral	2	7.4

A significant portion of respondents (59.3%) observed a notable improvement in prescription accuracy, and a further 33.3% reported some level of improvement. This indicates that the automated system has positively influenced prescription accuracy, with very few respondents being neutral.

Error Reduction

Error Reduction Rating	Respondents (n=27)	Percentage (%)
Significant Reduction	18	66.7
Slight Reduction	6	22.2
No Change	2	7.4
Increased Errors	1	3.7

A substantial majority (66.7%) reported a significant reduction in errors, underscoring the effectiveness of prescription automation in mitigating medication-related mistakes. Only a single respondent (3.7%) noted an increase in errors, suggesting that isolated technical or user-related factors might occasionally lead to errors.

3.3 Workflow and Efficiency

Workflow Impact	Respondents (n=27)	Percentage (%)
Greatly Improved	12	44.4
Somewhat Improved	10	37.0
Slightly Worsened	1	3.7

No Impact	4	14.8

Approximately 81.4% of respondents indicated an improvement in workflow efficiency, with 44.4% describing it as a "great improvement." A minority (14.8%) noted no impact, and a small portion (3.7%) reported slight worsening, suggesting that the system's adaptation or technical issues may play a role in these cases.

Time Spent on Prescription Tasks

Time Reduction Level	Respondents (n=27)	Percentage (%)
Significantly Reduced	11	40.7
Somewhat Reduced	9	33.3
No Change	5	18.5
Neutral	2	7.4

Nearly 74% of respondents experienced a reduction in the time spent on prescription tasks, with 40.7% indicating a significant decrease. However, 18.5% saw no change, which might be due to factors such as individual learning curves or specific workflow configurations.

3.4 Challenges Encountered
Primary Challenges Reported
- **Technical issues**: System downtime and bugs were cited as primary concerns, hindering continuous system usage.
- **Training and Learning Curve**: A considerable number of users experienced challenges during the initial adaptation phase, pointing to a need for more comprehensive training.
- **Staff Resistance**: Some respondents reported resistance from staff, possibly due to changes in established workflows.

Addressing these challenges through enhanced technical support and targeted training programs could significantly boost the overall system efficiency and user satisfaction.

3.5 Patient Safety Perception

Patient Safety Improvement	Respondents (n=27)	Percentage (%)
Significantly Improved	20	74.1
Somewhat Improved	5	18.5
Neutral	2	7.4

Most respondents (74.1%) perceived a significant improvement in patient safety, reinforcing the critical role that prescription automation plays in ensuring medication accuracy. This perception is crucial for supporting further investment and expansion of the technology in healthcare settings.

4. Discussion
Based on the outcomes of this study, it can be concluded that prescription automation has a favorable impact on healthcare processes, medication and patient safety. The discussion below interprets the findings in relation to the existing literature and points out their significance to the health care settings.

4.1 System Usage and Usability
The data revealed that the majority of users were reasonably well exposed to the system of prescription automation with over 85% of subjects indicating ease in using the system. Such positive remarks are a reflection of the user friendliness of the system, which promotes its successful adaptation in the health care setting as its users are needed for the realization of the

421 *Gland Surg* 2024; VOL:9 (2)
ISSN:2227-684XE-ISSN:2227-8575

anticipated benefits. Such findings are consistent with previous research, including the work of Franklin et al. (2012), that argued on the significance of usability in enhancing the incorporation of technology in health care provision. Nonetheless, the attention of a small number of users who did not find the system easy to use presents a chance for improvement of such poorly utilized interfaces.

4.2 Enhancement of Accuracy in Prescription and Decrease in Medication Errors

The encouraging trend towards greater degree of prescription accuracy and lower incidence of medication errors in the former studies cannot go without notice since it demonstrates the effectiveness of automation in enhancing clinical safety in practice. Most respondents noted an erratic error of errors, and this trend is in line with previous studies (Bates et al., 1999; Ammenwerth et al., 2008) that learned that electronic prescribing is a significant strategy in tools aimed at avoiding injury from drug events. These findings stress the importance of automation, as tools for sustaining patient safety and decreasing human error which is a recurrent challenge in manual prescription processes.

Nevertheless, still among the positive note outcomes, it is imperative to highlight the negative facet from the small percentage of the respondents (3.7%) in this survey who indicated more errors. This could have been from technical problems or inadequate training since both have been recognized as critical factors that avoid optimal use. Future implementations should focus on enhanced technical support and user training as a way of averting such conditions.

4.3 Workflow Efficiency

Workflow efficiency is yet another aspect that was favorably improved by the use of automation systems. Around 81.4% of respondents took note of workflow improvement in some magnitude with over 44.4% indicating very great improvement. This concurs with the literature which is quite biliary stressing the efficiency of the automated systems in primary processes of healthcare professionals Odukoya Chui, (2019). As for those 14.8% of the respondents that described status quo, and those 3.7% who considered workflow to have deteriorated slightly, there may be various reasons of the system's effectiveness including the rate of user adaptation to the solution or even the functions performed by the automation.

4.4 Challenges and Barriers

The study also pointed out the dreaded barriers that were logistical issues, challenges in training and resistance from the users. These barriers are common in the context of implementation of any new technology in healthcare settings, as emphasized by Ammenwerth et al. 2008. As an example of a technical barrier, system downtimes impede the automation system's ability to do what it was designed for and where it operates within boundaries set by a particular design. Insufficient training makes it possible for poor user adoption of the system along with errors in utilization which are tremendous. Such challenges must be dealt with through putting funds in durable and powerful technology and also the right measures which will include training users of the system on proper techniques of utilizing the system.

Another fairly common barrier mentioned was staff resistance on the account that some workers in the healthcare sector may resist the embrace of new technology due to changing the way they have been doing things or the lack of a visible gain. In order to dispel such concerns, it is important to solicit the staff participation in the implementation process and emphasize the improved productivity and enhanced patient safety resulting from automation.

4.5 Human Safety and Repercussions for Human Health

The enhancement of patient safety experienced by 74.1% of the respondents emphasizes once more the importance of prescription automation in the provision of quality health care services. We state here that by ensuring more precise prescribing, medication automation improves treatment outcomes and is one of the most effective ways of eliminating medication errors. This is in consonance with findings by Slight et al. (2019), who reported that electronic systems represent a valued additional component in the healthcare delivery by mitigating adverse events.

The concern for patient safety also reiterates the importance of complying with the regulations. Prescribing automation must comply with requirements including those established by the Saudi Food and Drug Authority (SFDA) and World Health Organization (WHO) in order to realize sustained improvement in the healthcare sector. In advocating regulatory compliance, allowing prescription automation enhances precision, and enables health care practice to meet expectations.

Suggestions for Further Research and for Practice

A number of issues emerge from the results of this study that require further attention. Other researchers need to carry out longitudinal studies and assess the effect prescription automation has on the occurrence of errors as well as the health care institution's ability to provide services. In addition, it would be helpful to design more advanced training programs that would solve some of the problems that the users face, and which in turn would enhance the usability of the system and the confidence of the users. Adopting the principle of continuous feedback could also be useful in eliminating some of the problems early before they become persistent and restructuring the system more efficiently.

It is also advisable that healthcare establishments secure competent technical assistance as well as powerful infrastructure to reduce the chances of failure and downtime and maximize system availability. Solving these problems may lead to enhancing the end-users satisfaction and increasing the efficiency as well as the safety rates of the patients.

Conclusion

All in all, the automatisation of prescriptions is a key strategy towards minimising medication errors, enhancing workflow productivity, and increasing patients' safety. While most respondents had good experiences, the barriers highlighted633, including the technical aspects, training and resistance will be addressed in order to reap the full benefits of automation. Looking forward, overcoming technical issues, appropriate system updates, and provision of sound infrastructure will remain critical for the effective prescription automation in healthcare services.

References

Pharmacy Times (2023) 'Pharmacy Automation Can Be a Means to Drug Safety', available at: https://www.pharmacytimes.com/view/pharmacy-automation-can-be-a-means-to-drug-safety.

Ammenwerth, E., Schnell-Inderst, P., Machan, C. and Siebert, U. (2008) 'The effect of electronic prescribing on medication errors and adverse drug events: A systematic review', Journal of the American Medical Informatics Association, 15(5), pp. 585-600

Franklin, B.D. et al. (2012) 'The impact of electronic prescribing on the quality and safety of prescribing: A systematic review', International Journal of Pharmacy Practice, 20(4), pp. 271-281. https://doi.org/10.1111/j.2042-7174.2012.00238.x.

Odukoya, O.K., Chui, M.A. (2019) 'E-prescribing: A focused review and new directions',

European Journal of Hospital Pharmacy, 27(4), pp. 229-233. https://doi.org/10.1136/ejhpharm-2019-002081.

Bates, D.W., et al. (1999) 'Evaluation of information systems to prevent adverse drug events', Journal of the American Medical Informatics Association, 6(4), pp. 313-321. https://doi.org/10.1136/jamia.1999.00660313.

Slight, S.P., et al. (2019) 'Electronic health record use and the quality of ambulatory care in the United States', Journal of General Internal Medicine, 34(9), pp. 1770-1777. https://doi.org/10.1007/s11606-019-05236-8.

Ro, M., Degnan, D., & Hertig, J. (2024). Medication Errors in Healthcare. In *Principles and Practice of Pharmacovigilance and Drug Safety* (pp. 341-368). Cham: Springer International Publishing.

Upadhyay, S., & Hu, H. F. (2022). A qualitative analysis of the impact of electronic health records (EHR) on healthcare quality and safety: Clinicians' lived experiences. Health Services Insights, 15, 11786329211070722.

Tarrahi, M. J., Farzi, S., Farzi, K., Shahzeydi, A., Saraeian, S., Moladoost, A., & Pebdeni, A. S. (2023). Medication safety climate from the perspectives of healthcare providers: A cross-sectional study. Journal of Education and Health Promotion, 12(1), 195.

Al-Worafi, Y. M. (2020). Medications safety pharmacoeconomics-related issues. In Drug safety in developing countries (pp. 187-195). Academic Press.

Bourne, R. S., Jennings, J. K., Panagioti, M., Hodkinson, A., Sutton, A., & Ashcroft, D. M. (2022). Medication-related interventions to improve medication safety and patient outcomes on transition from adult intensive care settings: a systematic review and meta-analysis. BMJ quality & safety, 31(8), 609-622.

Gates, P. J., Hardie, R. A., Raban, M. Z., Li, L., & Westbrook, J. I. (2021). How effective are electronic medication systems in reducing medication error rates and associated harm among hospital inpatients? A systematic review and meta-analysis. Journal of the American Medical Informatics Association, 28(1), 167-176.