

Transforming Pharmacy Technician Duties: The Role of Automation and Technology Advancements

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Abstract

Title: Impact of Automation on Pharmacy Technician Responsibilities: A Comprehensive Analysis

Objective: This study examines the impact of automation and technology advancements on the roles and tasks of pharmacy technicians, focusing on changes in responsibilities, job satisfaction, and work efficiency.

Methods: A mixed-methods approach was employed, combining quantitative surveys (n=250) and qualitative interviews (n=20) with pharmacy technicians from various practice settings. Survey data were analyzed using descriptive and inferential statistics, while interview transcripts were subjected to thematic analysis.

Results: Automation significantly reduced manual tasks (e.g., medication dispensing, inventory management) and increased technical support responsibilities and patient interaction. Job satisfaction and perceived efficiency improved notably post-automation ($p < 0.01$). Key qualitative themes included a shift to technical roles, enhanced patient interaction, increased job satisfaction, and challenges in adaptation.

Conclusion: Automation has positively transformed the roles and tasks of pharmacy technicians, enhancing job satisfaction and professional development while enabling a greater focus on patient care. Despite initial challenges, the long-term benefits of automation underscore its importance in modern pharmacy practice.

Keywords: Automation, Pharmacy Technicians, Job Satisfaction, Technological Advancements, Patient Interaction, Professional Development

Introduction

Background: The role of pharmacy technicians has traditionally been centered around supporting pharmacists in dispensing medications, managing inventory, and assisting with administrative tasks. As integral members of the pharmacy team, pharmacy technicians ensure the efficient operation of pharmacy services, contributing to patient safety and effective medication management. However, the advent of automation and technology advancements is significantly transforming these roles. Innovations such as robotic dispensing systems, electronic health records (EHR), and automated medication dispensing cabinets are reshaping the landscape of pharmacy practice.

Problem Statement: The increasing integration of automation and technology in pharmacies poses both opportunities and challenges for pharmacy technicians. While these advancements can enhance efficiency and reduce the risk of human error, they also necessitate changes in the traditional roles and tasks performed by pharmacy technicians. This transformation raises important questions about the evolving responsibilities of pharmacy technicians and the impact of these changes on their job satisfaction and professional development.

Research Question: This study aims to explore the following research question: ****What are the effects of automation and technology advancements on the roles and tasks of pharmacy technicians?***

Objectives

The objectives of this research are threefold:

1. Analyze the Changes in Responsibilities: To examine how automation and technological advancements are altering the traditional duties of pharmacy technicians.

2. **Identify New Tasks:** To identify the new roles and tasks that have emerged as a result of technological integration in pharmacies.
3. **Evaluate Impact on Job Satisfaction and Efficiency:** To assess how these changes are affecting the job satisfaction and work efficiency of pharmacy technicians.

Automation in pharmacy practice is not a new phenomenon. Studies have shown that automation can improve accuracy and efficiency in medication dispensing, reduce medication errors, and free up pharmacy staff to focus on patient-centered activities (Chapuis et al., 2010; Pedersen et al., 2012). However, the rapid pace of technological advancements necessitates ongoing research to understand their full impact on the pharmacy workforce.

Literature Review

Historical Perspective: The role of pharmacy technicians has evolved significantly over the past few decades. Traditionally, pharmacy technicians were primarily involved in tasks such as counting pills, labeling bottles, and managing inventory under the supervision of a licensed pharmacist. Their roles were largely clerical and supportive, aimed at freeing up pharmacists to focus on clinical duties and direct patient care (Desselle, 2010). However, as the complexity and demands of pharmacy services grew, so did the responsibilities of pharmacy technicians. This shift was driven by the need for more efficient pharmacy operations and the growing recognition of the critical support role that pharmacy technicians play in ensuring patient safety and effective medication management (Rahimi and Timpka, 2011).

Current Technologies: Recent years have seen the introduction of various technological advancements in the pharmacy sector. These technologies aim to enhance the accuracy, efficiency, and safety of medication dispensing and management processes. Key technologies include:

1. **Robotic Dispensing Systems:** Automated systems that handle the selection, counting, and packaging of medications, significantly reducing the risk of human error and improving workflow efficiency (Walsh et al., 2011).
2. **Electronic Health Records (EHR):** Digital systems that store and manage patients' health information, enabling seamless access and coordination among healthcare providers. EHRs enhance the accuracy of medication records and streamline communication within the healthcare team (Mooranian, et al., 2013).
3. **Automated Medication Dispensing Cabinets:** Secure storage units that dispense medications to authorized users, ensuring accurate and timely medication administration while maintaining strict inventory control (Sheng et al., 2014).
4. **Barcoding Systems:** Technologies that use barcode scanning to verify medication accuracy at various points in the dispensing and administration process, thereby reducing medication errors (Poon et al., 2010).

Previous Research

Several studies have investigated the impact of automation and technology on pharmacy practice and the roles of pharmacy technicians. Chapuis et al. (2010) highlights that automation in pharmacy can lead to significant improvements in medication dispensing accuracy and efficiency. Similarly, Pedersen et al., (2012) found that the adoption of automated systems in hospital pharmacies contributed to enhanced operational efficiency and reduced medication errors.

A study by Walsh et al. (2011) examined the role of robotic dispensing systems in community pharmacies, revealing that these systems allowed pharmacy technicians to shift their focus from routine tasks to more patient-centered activities. This shift not only improved job satisfaction but also enhanced the overall quality of pharmacy services.

Mooranian, et al. (2013) explored the implementation of EHRs in pharmacies, noting that these systems facilitated better coordination and communication among healthcare providers. The integration of EHRs enabled pharmacy technicians to access and update patient information more efficiently, thus supporting more informed decision-making processes.

Sheng et al. (2014) investigated the impact of automated medication dispensing cabinets in hospital settings. Their findings indicated that these cabinets improved medication management, reduced the time required for medication retrieval, and enhanced inventory control.

Poon et al. (2010) studied the use of barcoding systems in pharmacies, demonstrating that these systems significantly reduced medication administration errors and improved patient safety.

Despite the numerous benefits of automation and technology in pharmacy practice, there are also challenges associated with their implementation. A study by Rahimi and Timpka, (2011) identified several barriers to the adoption of automated systems, including high initial costs, the need for ongoing maintenance, and resistance to change among staff. Additionally, the transition to automated systems requires extensive training for pharmacy technicians to ensure they can effectively operate and troubleshoot these technologies.

Methodology

Study Design: This research employed a mixed-methods design, combining both quantitative and qualitative approaches to gain a comprehensive understanding of the impact of automation and technology advancements on the roles and tasks of pharmacy technicians. The quantitative component involved a structured survey, while the qualitative component included semi-structured interviews. This approach allowed for a detailed analysis of changes in responsibilities and the identification of new tasks, as well as an exploration of the impact on job satisfaction and work efficiency.

Data Collection

Quantitative Component: A structured survey was developed and distributed to a sample of pharmacy technicians working in various settings, in a tertiary hospital. The survey included questions related to:

- Demographic information (e.g., age, years of experience, type of pharmacy).
- Specific tasks and roles performed before and after the implementation of automation technologies.
- Perceived impact of automation on job efficiency and accuracy.
- Job satisfaction levels before and after the introduction of technology.

The survey was distributed electronically via email and through professional pharmacy technician networks. A total of 250 responses were collected, ensuring a diverse representation of pharmacy technicians across different practice settings.

Qualitative Component: Semi-structured interviews were conducted with a subset of survey respondents to gain deeper insights into their experiences and perceptions. Twenty pharmacy technicians were selected based on their willingness to participate and to ensure a diverse sample in terms of experience, pharmacy setting, and geographical location.

The interview guide included questions on:

- Detailed descriptions of changes in specific tasks and roles due to automation.
- New responsibilities that have emerged with the adoption of technological advancements.
- Perceived challenges and opportunities associated with these changes.
- Impact on job satisfaction, professional development, and patient care.

Each interview lasted approximately 45 minutes and was conducted via video conferencing to accommodate participants' schedules. The interviews were recorded and transcribed for analysis.

Data Analysis

Quantitative Analysis: The survey data were analyzed using descriptive and inferential statistics. Descriptive statistics, such as means, medians, and standard deviations, were used to summarize the demographic characteristics of the respondents and their responses to survey questions. Inferential statistics, including paired t-tests and ANOVA, were employed to compare job satisfaction levels and efficiency metrics before and after the implementation of automation technologies. Statistical significance was set at $p < 0.05$.

Qualitative Analysis: The interview transcripts were analyzed using thematic analysis to identify common themes and patterns in the participants' responses. Thematic analysis involved the following steps:

1. **Familiarization:** Reading and re-reading the transcripts to become familiar with the data.
2. **Coding:** Generating initial codes from the data to capture significant features.
3. **Theme Development:** Grouping codes into potential themes and reviewing these themes to ensure they accurately reflect the data.

4. **Defining and Naming Themes:** Refining and defining the final themes, ensuring they are clearly described and distinct.
5. **Reporting:** Summarizing the themes and using quotes from the interviews to illustrate key points.

Ethical Considerations

The study was conducted in accordance with ethical guidelines for research involving human participants. Informed consent was obtained from all survey respondents and interview participants. Participants were assured of the confidentiality and anonymity of their responses. The study protocol was reviewed and approved by the ethics committee.

Limitations

While the mixed-methods design provided a comprehensive understanding of the impact of automation on pharmacy technician roles, several limitations should be noted. The sample size for the qualitative component was relatively small, which may limit the generalizability of the findings. Additionally, the self-reported nature of the survey data may be subject to response bias. Future research could address these limitations by including larger and more diverse samples and employing longitudinal designs to assess changes over time.

Findings

The findings from the research study are presented in two sections: quantitative survey results and qualitative interview insights. The results highlight the changes in roles and tasks of pharmacy technicians due to automation and technology advancements, as well as the impact on job satisfaction and work efficiency.

Quantitative Survey Results

A total of 250 pharmacy technicians participated in the survey. The demographic characteristics of the respondents are summarized in Table 1.

Table 1: Demographic Characteristics of Survey Respondents

Characteristic	Number of Respondents (n=250)	Percentage (%)
Age		
- 18-30	80	32.0
- 31-45	100	40.0
- 46-60	55	22.0
- 60+	15	6.0
Years of Experience		
- 0-5	90	36.0
- 6-10	85	34.0
- 11-20	55	22.0
- 20+	20	8.0
Type of Pharmacy		
- Community	140	56.0
- Hospital	80	32.0
- Long-term Care	30	12.0

Changes in Responsibilities

Survey respondents reported significant changes in their responsibilities due to the implementation of automation technologies. The key changes are summarized in Table 2.

Table 2: Changes in Responsibilities Due to Automation

Responsibility	Before Automation (Mean Score)	After Automation (Mean Score)	% Change
Medication Dispensing	4.5	2.1	-53.3
Inventory Management	4.2	3.5	-16.7
Patient Interaction	2.8	3.9	+39.3
Administrative Tasks	4.0	3.0	-25.0
Technical Support for Automation	1.5	3.8	+153.3

Scores were based on a 5-point Likert scale (1 = Never, 5 = Very Frequently).

Impact on Job Satisfaction and Efficiency

The introduction of automation technologies had a significant impact on job satisfaction and work efficiency among pharmacy technicians. Table 3 summarizes the changes in job satisfaction and efficiency metrics.

Table 3: Impact on Job Satisfaction and Efficiency

Metric	Before Automation (Mean Score)	After Automation (Mean Score)	p-value
Job Satisfaction	3.2	4.1	<0.01
Perceived Efficiency	3.5	4.3	<0.01
Error Rate (self-reported)	2.8	1.7	<0.01

Scores were based on a 5-point Likert scale (1 = Very Low, 5 = Very High).

Qualitative Interview Insights: The thematic analysis of the interview transcripts revealed several key themes related to the impact of automation on the roles and tasks of pharmacy technicians.

Theme 1: Shift from Manual to Technical Roles

Many pharmacy technicians reported a significant shift from manual tasks, such as counting pills and labeling, to more technical roles involving the operation and maintenance of automated systems. As one participant noted, "We used to spend most of our time manually preparing medications. Now, with the robotic systems, our focus has shifted to ensuring these machines run smoothly."

Theme 2: Enhanced Focus on Patient Interaction

Automation has allowed pharmacy technicians to allocate more time to patient-centered activities, such as counseling and education. This shift has been positively received, as technicians feel more engaged and valued in their roles. A respondent mentioned, "Automation has freed up time for us to interact more with patients, which has improved the quality of care we provide."

Theme 3: Increased Job Satisfaction and Professional Development

The majority of interviewees reported an increase in job satisfaction due to the reduction in repetitive tasks and the opportunity to develop new skills. The need to troubleshoot and manage automated systems has provided a new dimension to their professional development. One participant stated, "Learning to operate and troubleshoot the new technology has been challenging but also very rewarding. It's a valuable skill set."

Theme 4: Challenges and Adaptation

Despite the benefits, some challenges were noted, including the initial cost of automation systems, the need for ongoing maintenance, and resistance to change among some staff members. However, participants

generally felt that the long-term benefits outweighed these challenges. "It was tough at first, with the training and adjustments, but now we see how much more efficient we are," said one technician.

Conclusion of Findings

The findings indicate that automation and technological advancements have significantly transformed the roles and tasks of pharmacy technicians. While there are challenges associated with these changes, the overall impact on job satisfaction and work efficiency has been positive. The shift from manual to technical roles and the increased focus on patient interaction are notable benefits, contributing to enhanced professional development and improved patient care.

Discussion

Summary of Findings

The results of this study indicate that automation and technological advancements have profoundly reshaped the roles and tasks of pharmacy technicians. The quantitative data reveal a significant reduction in manual tasks such as medication dispensing and inventory management, while highlighting an increase in technical support responsibilities and patient interactions. These changes have been accompanied by notable improvements in job satisfaction and perceived work efficiency. The qualitative insights further enrich our understanding, revealing a positive shift in the nature of work and professional development opportunities, despite initial challenges.

Implications for Pharmacy Practice

- 1. Shift from Manual to Technical Roles:** The reduction in manual tasks and the increase in technical support roles underscore the evolving nature of pharmacy technician responsibilities. Automation has streamlined routine tasks, enabling technicians to focus on higher-value activities that require technical expertise and problem-solving skills. This shift not only enhances operational efficiency but also positions pharmacy technicians as key players in managing and optimizing automated systems. As the healthcare industry continues to embrace technology, the role of pharmacy technicians is likely to become even more integral to the success of pharmacy operations.
- 2. Enhanced Focus on Patient Interaction:** One of the most significant findings of this study is the increased time available for patient-centered activities. Automation has freed up pharmacy technicians from repetitive tasks, allowing them to engage more with patients. This shift can lead to improved patient satisfaction and outcomes, as pharmacy technicians play a crucial role in medication counseling, education, and adherence support. The enhanced focus on patient interaction aligns with the broader trend in healthcare towards patient-centered care and highlights the evolving scope of pharmacy technicians' roles in supporting patient health and safety.
- 3. Improved Job Satisfaction and Professional Development:** The increase in job satisfaction reported by respondents is a testament to the positive impact of automation on the pharmacy workforce. The opportunity to develop new skills and take on more challenging tasks has contributed to greater job fulfillment and professional growth. Pharmacy technicians are now required to be proficient in operating and troubleshooting advanced technology, which not only enhances their skill set but also increases their value within the pharmacy team. This professional development is essential for retaining a motivated and competent workforce in the face of ongoing technological advancements.
- 4. Challenges and Adaptation:** Despite the numerous benefits, the transition to automated systems is not without challenges. The initial cost of implementing automation technologies, the need for ongoing maintenance, and resistance to change among some staff members were identified as significant barriers. However, the long-term benefits of automation, such as increased efficiency and reduced error rates, outweigh these challenges. Pharmacy managers and leaders must invest in comprehensive training programs and change management strategies to ensure a smooth transition and maximize the benefits of automation.

Comparison with Previous Research

The findings of this study are consistent with previous research that highlights the positive impact of automation on pharmacy practice. Chapis et al. (2010) and Pedersen et al., (2012) both emphasize the

improvements in medication dispensing accuracy and operational efficiency resulting from automation. This study extends these findings by providing detailed insights into the specific changes in pharmacy technician roles and the resulting benefits in job satisfaction and patient interaction.

Walsh et al. (2011) also identified similar shifts in responsibilities, noting that robotic dispensing systems allowed pharmacy technicians to focus on patient-centered activities. This study corroborates their findings and provides additional evidence of the positive impact of automation on professional development and job satisfaction.

Recommendations for Future Research

While this study provides valuable insights into the impact of automation on pharmacy technician roles, further research is needed to explore several areas:

- 1. Longitudinal Studies:** Long-term studies could provide a more comprehensive understanding of the sustained impact of automation on pharmacy practice and the ongoing professional development of pharmacy technicians.
- 2. Broader Sample:** Future research should include a larger and more diverse sample of pharmacy technicians from various geographical regions and practice settings to enhance the generalizability of the findings.
- 3. Patient Outcomes:** Investigating the direct impact of increased patient interaction by pharmacy technicians on patient outcomes would provide valuable evidence of the broader benefits of automation in pharmacy practice.
- 4. Cost-Benefit Analysis:** Detailed cost-benefit analyses of implementing automation technologies in different pharmacy settings could help stakeholders make informed decisions about technology investments.

Conclusion

This study demonstrates that automation and technological advancements have significantly transformed the roles and tasks of pharmacy technicians, leading to improved job satisfaction, increased focus on patient interaction, and enhanced professional development. While challenges remain, the overall impact of automation on the pharmacy workforce is overwhelmingly positive. As technology continues to evolve, pharmacy technicians will play an increasingly crucial role in ensuring the efficiency and effectiveness of pharmacy operations, ultimately contributing to better patient care and outcomes.

References

1. Chapuis, C., Roustit, M., Bal, G., Schwebel, C., Pansu, P., David-Tchouda, S., ... & Bedouch, P. (2010). Automated drug dispensing system reduces medication errors in an intensive care setting. *Critical care medicine*, 38(12), 2275-2281.
2. Desselle, S. P., & Schmitt, M. R. (2010). Pharmacists' perceptions of the value of technician certification through a nationally accredited certification program. *Journal of Pharmacy Technology*, 26(6), 340-351.
3. Mooranian, A., Emmerton, L., & Hattingh, L. (2013). The introduction of the national e-health record into Australian community pharmacy practice: pharmacists' perceptions. *International Journal of Pharmacy Practice*, 21(6), 405-412.
4. Pedersen, C. A., Schneider, P. J., & Scheckelhoff, D. J. (2012). ASHP national survey of pharmacy practice in hospital settings: dispensing and administration—2011. *American Journal of Health-System Pharmacy*, 69(9), 768-785.
5. Poon, E. G., Keohane, C. A., Yoon, C. S., Ditmore, M., Bane, A., Levtzion-Korach, O., ... & Gandhi, T. K. (2010). Effect of bar-code technology on the safety of medication administration. *New England Journal of Medicine*, 362(18), 1698-1707.
6. Rahimi, B., & Timpka, T. (2011). Pharmacists' views on integrated electronic prescribing systems: associations between usefulness, pharmacological safety, and barriers to technology use. *European journal of clinical pharmacology*, 67, 179-184.

7. Sheng, P. O. Y., Li, C. L., Ai, W. J., Gunawan, Y., Jiang, G. W., Chai, T. M., & Boon, L. S. (2014). Evaluating the impact of drug dispensing systems on the safety and efficiency in a Singapore outpatient pharmacy. *INNOVATIONS in pharmacy*, 5(3).
8. Walsh, K. E., Chui, M. A., Kieser, M. A., Williams, S. M., Sutter, S. L., & Sutter, J. G. (2011). Exploring the impact of an automated prescription-filling device on community pharmacy technician workflow. *Journal of the American Pharmacists Association*, 51(5), 613-618.