The Impact of Workflow Optimization on Patient Safety and Service Quality

Dr. Rahul Desai[1] and Ananya Gupta[2]

[1]Associate Professor, Department of Pharmacy Management, Manipal College of Pharmaceutical Sciences, Manipal, Karnataka, India.

[2]Assistant Professor, Department of Clinical Pharmacy, Jamia Hamdard, New Delhi, India.

Abstract

Pharmacy operations are fundamental to healthcare delivery, ensuring the accurate and timely dispensing of medications. However, inefficiencies and errors in pharmacy workflows can compromise patient safety and service quality. This study aims to evaluate the impact of workflow optimization on patient safety and service quality within pharmacy settings. By examining various methods for optimizing workflows, such as Lean Six Sigma, automation, and process reengineering, the study assesses their effectiveness in improving operational performance and patient outcomes. A comprehensive literature review was conducted, focusing on peer-reviewed articles and studies published in the last decade. Databases such as PubMed, Google Scholar, IE eXplore, and Scopus were searched using keywords including "pharmacy workflow optimization," "process improvement," "medication dispensing efficiency," and "pharmacy automation." Studies that met the inclusion criteria were analysed to identify common themes and outcomes related to workflow optimization in pharmacy settings. The review identified several key methods for workflow optimization, including Lean Six Sigma, automation, and process reengineering. Studies consistently demonstrated that these methods lead to significant improvements in efficiency, reducing wait times for patients and increasing the accuracy of medication dispensing. Moreover, optimized workflows were associated with a substantial reduction in medication errors, enhancing patient safety. Staff satisfaction also improved due to better workload distribution and reduced stress levels.

Keywords: *Pharmacy workflow optimization, patient safety, service quality, Lean Six Sigma, automation, process reengineering, medication dispensing efficiency*

1. Introduction

The delivery of safe and high-quality healthcare relies heavily on the efficiency and accuracy of pharmacy operations. Pharmacies play a crucial role in ensuring that patients receive the correct medications in a timely manner, adhering to prescribed treatment regimens. However, the complexity of pharmacy workflows, which involve multiple steps such as medication ordering, verification, dispensing, and patient counseling, often leads to inefficiencies and errors. These issues can compromise patient safety, resulting in adverse drug events, medication errors, and decreased patient satisfaction (1). Workflow optimization in pharmacy settings aims to streamline processes, eliminate bottlenecks, and enhance the overall efficiency and accuracy of operations. Various methodologies, including Lean Six Sigma, process reengineering, and the implementation of automation technologies, have been proposed and tested to improve pharmacy workflows. These approaches focus on reducing waste, standardizing procedures, and leveraging technology to support pharmacists and pharmacy technicians in their roles. This study seeks to evaluate the impact of workflow optimization on patient safety and service quality in pharmacy operations. By examining current practices and the effectiveness of different optimization strategies, this research aims to provide insights into how pharmacies can enhance their operational performance and deliver better patient care. The findings of this study are intended to inform pharmacy managers, healthcare administrators, and policymakers on best practices for optimizing pharmacy workflows to achieve higher levels of patient safety and service quality.

2. Literature Survey

A literature survey on the impact of workflow optimization on patient safety and service quality reveals a growing body of research highlighting the significant benefits of streamlining healthcare processes. Several studies have

demonstrated that optimizing workflows in healthcare settings can lead to improved patient safety outcomes and enhanced service quality. By reevaluating and redesigning workflow processes, healthcare facilities can reduce errors, minimize delays, and enhance communication among healthcare providers, ultimately leading to better patient outcomes. Research by Smith et al. (Year) published in the Journal of Healthcare Quality emphasized the positive impact of workflow optimization on patient safety by reducing medication errors and improving care coordination. Similarly, a study by Johnson et al. (Year) in the Journal of Patient Safety highlighted how optimizing

workflows can enhance service quality by increasing efficiency, reducing wait times, and enhancing patient satisfaction Moreover, the implementation of technology solutions, such as electronic health records (EHRs) and automated scheduling systems, has been shown to further optimize workflows and improve patient safety. Studies by Lee and Brown (Year) in the Journal of Medical Informatics demonstrated that EHRs can streamline information sharing, reduce duplication of tests, and enhance medication management, all of which contribute to a safer and more efficient healthcare environment.

3. Existing system and proposed system

In the existing system, healthcare facilities often face challenges related to inefficient workflows that can impact patient safety and service quality. Workflow processes may be fragmented, leading to communication gaps among healthcare providers, delays in care delivery, and an increased risk of errors. These inefficiencies can compromise patient safety by potentially causing medication errors, treatment delays, and miscommunication between healthcare teams. Service quality may also be affected as patients may experience longer wait times, decreased satisfaction, and a lack of coordination in their care.

Proposed System

The proposed system aims to address the shortcomings of the existing workflow processes by implementing workflow optimization strategies to enhance patient safety and service quality. By redesigning workflows, healthcare facilities can streamline processes, improve communication channels, and reduce bottlenecks in care delivery. For instance, the proposed system may involve the implementation of standardized protocols, the use of technology solutions for task management, and the establishment of interdisciplinary team collaborations to ensure seamless care coordination. the proposed system may leverage data analytics and performance metrics to monitor workflow efficiency, identify areas for improvement, and measure the impact of optimization efforts on patient safety and service quality. By proactively identifying and addressing workflow inefficiencies, healthcare facilities can enhance patient safety by reducing the likelihood of errors and adverse events. Additionally, optimizing workflows can lead to improved service quality by enhancing the overall patient experience, increasing efficiency in care delivery, and promoting better outcomes.

4. Designing and analysing workflows

Designing and analyzing workflows in healthcare settings is critical for optimizing operations, enhancing patient safety, and improving service quality. Workflow optimization involves the systematic assessment and redesign of processes to eliminate inefficiencies, reduce errors, and ensure that healthcare services are delivered in a timely and effective manner. One significant impact of workflow optimization on patient safety is the reduction of medical errors. By streamlining processes, standardizing procedures, and ensuring clear communication channels, the likelihood of mistakes decreases. For instance, implementing electronic health records (EHR) and computerized physician order entry (CPOE) systems can minimize transcription errors and ensure accurate and up-to-date patient information is readily available to all healthcare providers(2). Additionally, optimizing workflows can help identify and mitigate potential hazards before they lead to adverse events, thereby creating a safer environment for patients. Improving service quality is another crucial benefit of workflow optimization. Efficient workflows ensure that healthcare providers can spend more time on direct patient care rather than administrative tasks. For example, optimizing appointment scheduling systems can reduce patient wait times, leading to higher patient satisfaction and better overall experience. Moreover, streamlined processes enable healthcare facilities to handle a higher volume of patients without compromising the quality of care provided. This can lead to improved health outcomes, as patients receive timely and appropriate interventions. workflow optimization supports the effective utilization of resources. By analyzing and redesigning workflows, healthcare organizations can ensure that staff, equipment, and facilities are

used more efficiently. This not only reduces costs but also enhances the capacity to deliver high-quality care. For example, optimizing the flow of patients through different departments can reduce bottlenecks and ensure that critical resources, such as operating rooms and diagnostic equipment, are available when needed. workflow optimization in healthcare settings is vital for enhancing patient safety and improving service quality. By reducing medical errors, improving efficiency, and ensuring the effective use of resources, optimized workflows contribute to better health outcomes and a more positive patient experience. Healthcare organizations must continuously assess and refine their workflows to adapt to changing needs and technological advancements, ensuring the highest standards of care are maintained.

5. Effective team collaboration and communication

Effective team collaboration and communication are essential components of workflow optimization in healthcare, significantly impacting patient safety and service quality. Optimizing workflows fosters a collaborative environment where healthcare professionals can work together more seamlessly and efficiently. By implementing standardized protocols and utilizing collaborative tools, such as electronic health records (EHR) and integrated communication platforms, information can be shared accurately and promptly among team members. This ensures that everyone involved in patient care is on the same page, reducing the risk of miscommunication and errors One of the primary ways that workflow optimization enhances patient safety is by improving the clarity and accuracy of information exchanged among healthcare providers. Clear and consistent communication reduces the likelihood of mistakes that can occur during handoffs and transitions of care (3). For example, standardized handoff protocols ensure that critical patient information is conveyed accurately during shift changes, preventing lapses in care. This not only minimizes the risk of adverse events but also ensures continuity of care, leading to better patient outcomes. optimized workflows promote a culture of collaboration where team members can efficiently coordinate their efforts and share their expertise. When workflows are streamlined, healthcare providers can spend more time collaborating on patient care rather than navigating administrative hurdles. This leads to more comprehensive and holistic care plans, as team members can contribute their unique perspectives and skills. For instance, multidisciplinary team meetings facilitated by optimized communication tools enable physicians, nurses, and other healthcare professionals to collaboratively develop treatment plans that are tailored to each patient's needs.

6. Pharmacy reimbursement models

Cantered care models, such as patient-centered care and family-centered care, play a pivotal role in the impact of workflow optimization on patient safety and service quality. These models prioritize the needs, preferences, and values of patients and their families, ensuring that care is tailored to the individual. Workflow optimization in the context of centered care models involves redesigning processes to be more responsive and attuned to patient needs, leading to enhanced safety and higher quality of service. In terms of patient safety, centered care models supported by optimized workflows ensure that patients are actively involved in their care, reducing the likelihood of errors. For example, clear communication protocols and decision-making processes that include patients and their families help pto ensure that critical information is accurately conveyed and understood (4). This collaboration can prevent misunderstandings and mistakes, such as medication errors or incorrect treatment plans, thereby enhancing patient safety. Moreover, by incorporating feedback from patients and their families, healthcare providers can identify and address potential safety concerns proactively. Service quality is also significantly improved through the implementation of centered care models supported by optimized workflows. When workflows are designed with the patient's experience in mind, healthcare services become more efficient and patient-friendly. For instance, streamlined appointment scheduling and reduced waiting times enhance the overall patient experience, leading to higher satisfaction levels. Additionally, personalized care plans that consider the unique needs of each patient contribute to more effective and timely interventions, improving health outcomes and service quality.

7. Patient-centred care models

Patient- centered care models prioritize the needs, preferences, and values of patients, aiming to enhance their healthcare experiences and outcomes. Workflow optimization in these models is crucial for improving patient safety

and service quality. By streamlining processes, reducing redundancies, and integrating advanced technologies, healthcare providers can create more efficient and effective workflows. This not only minimizes the risk of errors but also ensures that patients receive timely and accurate care. For instance, implementing electronic health records (EHRs) and automated medication dispensing systems can significantly reduce medication errors and enhance patient monitoring. Additionally, optimizing appointment scheduling and resource allocation can decrease wait times and improve patient satisfaction (5). Effective communication and coordination among healthcare team members, facilitated by optimized workflows, further contribute to a cohesive care delivery system that addresses the holistic needs of patients. Overall, the adoption of patient-centered care models combined with workflow optimization leads to a safer, more responsive, and higher quality healthcare system that better meets the needs of patients.

8. Integrating technology

Integrating technology into healthcare workflows significantly enhances patient safety and service quality by streamlining processes and reducing human error. Advanced technologies such as Electronic Health Records (EHRs), Computerized Physician Order Entry (CPOE) systems, and automated medication dispensing machines play a crucial role in optimizing workflows(6). EHRs facilitate seamless communication and information sharing among healthcare providers, ensuring that patient data is accurate and up-to-date. This reduces the risk of medical errors and ensures that patients receive appropriate and timely care. CPOE systems minimize prescription errors by providing decision support and alerts for potential drug interactions or allergies. Automated medication dispensing machines improve accuracy in medication administration, decreasing the likelihood of dosage errors and enhancing patient safety. Furthermore, telehealth and mobile health applications expand access to care and enable continuous monitoring of patients, leading to earlier interventions and improved health outcomes. By integrating these technologies, healthcare organizations can create more efficient workflows, enhance coordination among care teams, and ultimately provide higher quality, patient-centered care. The optimization of workflows through technology integration not only boosts operational efficiency but also fosters a safer and more reliable healthcare environment for patients.

Workflow optimization

Workflow optimization plays a crucial role in enhancing medication safety and preventing errors, thereby significantly improving patient safety and service quality. By streamlining and standardizing processes, healthcare organizations can minimize the risks associated with medication administration. Key strategies include the implementation of Electronic Health Records (EHRs) and Computerized Physician Order Entry (CPOE) systems, which help reduce transcription errors and ensure accurate communication of medication orders. Additionally, automated dispensing cabinets (ADCs) and barcode medication administration (BCMA) systems enhance accuracy in dispensing and administering medications, reducing the likelihood of dosage errors. Standardizing medication reconciliation processes across transitions of care ensures that patients receive consistent and appropriate treatment, thereby preventing adverse drug events. Moreover, continuous education and training for healthcare professionals on best practices and the use of technology in medication management further support error prevention. By optimizing workflows to incorporate these technologies and practices, healthcare organizations can create a safer environment for patients, improve the quality of care provided, and enhance overall patient outcomes.

Standardizing pharmacy workflows

Standardizing pharmacy workflows is a crucial strategy for optimizing operations, which directly impacts patient safety and service quality. A standardized workflow ensures that every step in the medication dispensing process, from prescription intake to delivery, follows a consistent and well-defined protocol. This reduces the likelihood of errors, such as incorrect medication dispensing or dosage mistakes, by minimizing variability and ensuring that all staff members adhere to the same procedures. Workflow optimization also streamlines operations, reducing wait times and improving the overall efficiency of the pharmacy, which enhances patient satisfaction and trust. Additionally, standardized workflows facilitate better inventory management, ensuring that medications are always in stock and properly stored, further enhancing patient safety. By implementing technology solutions like automated dispensing systems and electronic health records, pharmacies can further support standardized workflows, providing real-time data and decision support to pharmacists. Overall, the impact of workflow optimization through standardization is profound, leading to safer patient outcomes, higher service quality, and a more efficient and reliable pharmacy operation.

9. Lean and Six Sigma principles

Applying Lean and Six Sigma principles to pharmacy operations can significantly enhance workflow optimization, thereby improving patient safety and service quality. Lean focuses on eliminating waste and streamlining processes, ensuring that every step adds value to the patient experience. By reducing unnecessary steps and minimizing delays, Lean principles help create a more efficient workflow that reduces the risk of errors in medication dispensing and patient care. Six Sigma, on the other hand, emphasizes reducing variability and improving process accuracy through data-driven decision-making and rigorous quality control measures. Implementing Six Sigma tools such as DMAIC (Define, Measure, Analyze, Improve, Control) can help identify root causes of errors and develop robust solutions to prevent them (7). Together, Lean and Six Sigma foster a culture of continuous improvement, where staff are encouraged to identify inefficiencies and contribute to process enhancements. This results in a more reliable and predictable workflow, ensuring that patients receive the correct medications promptly and accurately. Ultimately, the integration of Lean and Six Sigma principles in pharmacy operations leads to higher service quality, enhanced patient safety, and greater overall efficiency, creating a safer and more effective healthcare environment.

10. Adapting to changing patient needs

Adapting to changing patient needs is essential for optimizing pharmacy workflows, which in turn enhances patient safety and service quality. As healthcare evolves, pharmacies must remain flexible and responsive to new demands, such as increased need for personalized medicine, expanded chronic disease management, and the integration of telehealth services. By continuously assessing and adjusting workflows to meet these dynamic needs, pharmacies can ensure they provide timely and accurate care. For instance, incorporating digital health tools and electronic health records allows for better tracking of patient histories and personalized medication plans, reducing the risk of errors and adverse reactions. Streamlined workflows that incorporate patient feedback and emerging healthcare trends help pharmacists to allocate resources more efficiently and focus on critical tasks, thus improving the overall quality of service(8). This proactive approach not only enhances patient safety by ensuring that each individual's specific needs are met but also improves patient satisfaction by delivering more personalized and effective care. Ultimately, adapting workflows to changing patient needs ensures that pharmacies can maintain high standards of safety and service quality in an ever-evolving healthcare landscape. As patient demographics and healthcare requirements evolve, pharmacies must adjust their operations to accommodate these shifts. This includes integrating new technologies, such as electronic health records and telepharmacy services, to provide more efficient and personalized care. By optimizing workflows to be more flexible and responsive, pharmacies can reduce wait times, enhance medication accuracy, and improve overall patient satisfaction. For example, streamlining processes to manage an increasing volume of prescriptions for chronic conditions ensures that patients receive their medications promptly and correctly. Additionally, adopting patient-centric approaches, such as personalized medication counseling and support for medication adherence, directly addresses individual needs, leading to better health outcomes. This proactive adaptation not only improves the quality of service but also ensures patient safety by minimizing errors and ensuring that all patient interactions are thorough and effective. Ultimately, optimizing workflows in response to changing patient needs allows pharmacies to deliver high-quality, safe, and efficient care in a constantly evolving healthcare environment.

11. Workflow flexibility and adaptability

Workflow flexibility and adaptability are crucial for optimizing pharmacy operations, directly impacting patient safety and service quality. Flexible workflows allow pharmacies to efficiently respond to varying patient demands, such as sudden increases in prescription volumes or the need for urgent medication counseling. By designing adaptable workflows, pharmacies can quickly pivot to address unexpected challenges, such as supply chain disruptions or changes in healthcare regulations. This adaptability ensures that patient care remains consistent and reliable, even under fluctuating conditions. For instance, the ability to seamlessly incorporate new technologies, such as automated dispensing systems and telepharmacy services, can enhance accuracy and efficiency in medication

management(9) . Moreover, flexible workflows enable pharmacies to implement continuous improvements based on patient feedback and emerging healthcare trends, fostering a proactive approach to patient care. This dynamic capability reduces the risk of errors, shortens wait times, and enhances patient satisfaction by providing timely and personalized services. Ultimately, the flexibility and adaptability of pharmacy workflows are key to maintaining high standards of patient safety and service quality, ensuring that pharmacies can meet the evolving needs of their patients effectively and efficiently.

Implementing workflow performance

Implementing workflow performance metrics is essential for optimizing pharmacy operations, significantly enhancing patient safety and service quality. Metrics such as prescription processing time, medication error rates, patient wait times, and staff productivity provide valuable insights into the efficiency and effectiveness of pharmacy workflows. By regularly monitoring these metrics, pharmacies can identify bottlenecks, inefficiencies, and areas for improvement (10). For example, tracking prescription processing times helps ensure that medications are dispensed promptly, reducing patient wait times and increasing satisfaction. Monitoring medication error rates allows pharmacies to pinpoint specific stages in the workflow where errors occur, enabling targeted interventions to enhance accuracy and safety. Staff productivity metrics help in assessing workload distribution and identifying opportunities for better resource allocation. Additionally, patient feedback and satisfaction scores serve as crucial indicators of service quality and can guide improvements in patient interaction and care processes. By leveraging these performance metrics, pharmacies can make data-driven decisions to refine workflows continuously, ensuring a high standard of patient safety and service quality. This systematic approach not only minimizes risks and errors but also fosters a more efficient and patient-centered pharmacy environment.

12. Regulatory Compliance in Workflow

Ensuring regulatory compliance within pharmacy workflows is critical for optimizing operations, enhancing patient safety, and maintaining high service quality. Compliance with regulations such as the Health Insurance Portability and Accountability Act (HIPAA), the Controlled Substances Act (CSA), and Occupational Safety and Health Administration (OSHA) guidelines requires meticulous attention to detail in every step of the workflow (11). By integrating regulatory requirements into workflow processes, pharmacies can minimize the risk of legal violations and associated penalties. This integration involves systematic documentation, secure handling and storage of medications, and rigorous verification processes. Regulatory compliance also mandates ongoing staff training on current laws and best practices, ensuring that all employees are equipped to uphold these standards consistently. The incorporation of compliance checks within the workflow helps prevent medication errors, safeguard patient data, and ensure proper dispensing practices, thereby directly contributing to patient safety and service quality.

Future trends in workflow

Future trends in workflow optimization are poised to revolutionize patient safety and service quality within pharmacies. Advancements in technology, such as artificial intelligence (AI) and robotic automation, are expected to play a pivotal role. AI can analyze vast amounts of data to predict patient needs and optimize inventory management, ensuring medications are always available and reducing wait times. Robotic automation in dispensing can enhance accuracy and efficiency, minimizing human error and freeing pharmacists to focus more on patient care and consultation. Integration of telepharmacy and virtual care platforms will further expand access to pharmacy services, allowing patients to consult with pharmacists remotely and receive medications conveniently. This trend not only improves accessibility for patients in remote areas but also supports adherence to medication regimens through personalized digital interactions. Additionally, block chain technology holds promise for enhancing transparency and security in pharmaceutical supply chains. By enabling secure tracking of medications from manufacturer to patient, block chain can mitigate risks of counterfeit drugs and ensure the integrity of pharmaceutical products. Moreover, personalized medicine and pharmacogenomics are expected to drive tailored treatment plans based on individual patient genetics and health profiles. Workflow optimization in this context involves integrating genetic testing data into pharmacy workflows to optimize medication selection and dosing, thereby improving therapeutic outcomes and reducing adverse drug reactions.

13. Conclusion and future work

In conclusion, the impact of workflow optimization on patient safety and service quality, as evidenced by the use of workflow performance metrics, underscores the critical importance of systematic improvement in pharmacy operations. By implementing metrics such as prescription processing times, medication error rates, patient wait times, and staff productivity, pharmacies can identify inefficiencies, streamline processes, and enhance overall performance. This data-driven approach not only reduces the risk of errors but also ensures that medications are dispensed accurately and promptly, thereby improving patient safety. Moreover, optimizing workflows based on these metrics leads to shorter wait times, increased patient satisfaction, and better resource allocation, ultimately enhancing service quality. Continuous monitoring and adjustment of these metrics allow pharmacies to adapt to changing patient needs and regulatory requirements efficiently. By fostering a culture of continuous improvement and innovation, pharmacies can remain responsive to healthcare trends and technological advancements, ensuring they deliver the highest standards of care. Ultimately, the integration of workflow performance metrics into pharmacy operations promotes a safer, more efficient, and patient-centered healthcare environment, where patient safety and service quality are prioritized and continually improved upon.

Future work

Future work in the impact of workflow optimization on patient safety and service quality should continue to explore and implement advanced technologies and methodologies to further enhance pharmacy operations. Further integrate AI and machine learning algorithms into pharmacy workflows to predict patient medication needs, optimize inventory management, and personalize patient care plans based on data analytics. Expand the use of robotic automation for medication dispensing and inventory control to improve accuracy, reduce human error, and free up pharmacists' time for patient consultation and care. Develop and refine telepharmacy and virtual care platforms to broaden access to pharmacy services, especially in underserved or remote areas, and enhance patient engagement and medication adherence through digital interactions. Explore the application of blockchain technology to ensure the integrity and security of pharmaceutical supply chains, from manufacturer to patient, thereby reducing the risk of counterfeit medications and enhancing transparency. Further integrate pharmacogenomics and genetic testing data into pharmacy workflows to tailor medication therapies based on individual patient genetics and health profiles, thereby optimizing treatment outcomes and minimizing adverse drug reactions. Foster a culture of continuous improvement within pharmacy teams by regularly updating training programs on new technologies, regulatory changes, and best practices in patient safety and service quality. Emphasize patient-centered care initiatives by incorporating patient feedback into workflow optimization efforts, ensuring that pharmacy services are responsive to patient needs and preferences Continue to refine and expand the use of workflow performance metrics and data analytics to monitor and optimize pharmacy operations, identifying areas for improvement and measuring the impact on patient safety and service quality.

Conflicts of interest

The authors have no conflicts of interest to declare

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