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How to Plan Workflow Changes: A Practical Quality Improvement Tool Used in an Outpatient Hospital Pharmacy

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Abstract

Objective: A quality improvement tool is provided to improve pharmacy workflow with the goal of minimizing errors caused by workflow issues. This study involved workflow evaluation and reorganization, and staff opinions of these proposed changes. *Practice Description:* The study pharmacy was an outpatient pharmacy in the Tucson area. However, the quality improvement tool may be applied in all pharmacy settings, including but not limited to community, hospital, and independent pharmacies. *Practice Innovation:* This tool can help the user to identify potential workflow problem spots, such as high-traffic areas through the creation of current and proposed workflow diagrams. Creating a visual representation can help the user to identify problem spots and to propose changes to optimize workflow. It may also be helpful to assess employees' opinions of these changes. *Conclusion:* The workflow improvement tool can be used to assess where improvements are needed in a pharmacy's floor plan and workflow. Suggestions for improvements in the study pharmacy included increasing the number of verification points and decreasing high traffic areas in the workflow. The employees of the study pharmacy felt that the proposed changes displayed greater continuity, sufficiency, accessibility, and space within the pharmacy.

Keywords

workflow, medication error, floor plan, quality improvement, quality assessment

Introduction

The floor plan is the foundation of any pharmacy because it dictates workflow. An inefficient floor plan can produce high levels of interruption in the natural flow of prescription processing and cause dispensing errors.[1-3] Medication errors can in turn, lead to poor patient outcomes. By prioritizing the planning and design of a pharmacy, pharmacists can help to ensure whether patients are receiving medications safely and effectively.[4] Proper design may even improve staff satisfaction.[5]

One quality improvement tool, the Sentinel System[SM] includes standardized procedures for medication order processing based on an assembly line model.[6] The Sentinel System is a systematic continuous quality improvement program developed by PMC Quality Commitment, Inc. The system uses risk management guidelines as a mechanism to assist community pharmacists in identifying, evaluating, and preventing medication errors. Specifically, the Sentinel System categorizes the overall pharmacy workflow into the following steps: (1) receiving the prescription, (2) data entry, (3) assembly of prescription, (4) professional prescription review, and (5) delivery and counseling. Errors can be made in any of these steps; thus, the working environment is an important factor in preventing a variety of dispensing errors.[7] Modifying the floor plan and workflow can provide a better work environment for employees, and thus, the pharmacy can provide better quality care to patients.[8] The pilot pharmacy had historically encountered a variety of errors that were linked back to the number of interruptions for the pharmacists, the inability for the pharmacist to see their own errors when they were responsible for filling and checking, and the inefficient use of the pharmacy floor plan. The pharmacy had also experienced a growing increase in volume and did not comfortably have enough space to increase the amount of staff or storage. The supervisory pharmacist was a preceptor for the college of pharmacy and requested an assessment of the pharmacy workflow and a plan for improvement.

Objective

This article describes a quality improvement tool that was used to suggest improvements to the floor plan and workflow within

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Table 1. Before and After Pharmacy Personnel Opinions of Current and Proposed Workflow Maps.

Questions	Before			After		
	Median	Minimum	Maximum	Median	Minimum	Maximum
How would you rate the continuity of the workflow? (scale options: *Many distractions/interruptions* = 1, to *No distractions/interruptions* = 5)	2	1	4	4	2	5
How would you rate the accessibility of the pharmacists as a worker within the pharmacy? (How easy is it to get the attention of the pharmacist when help is needed?; scale options: *No accessibility* = 1, *Easy accessibility* = 5)	3	2	5	4	3	5
How would you rate the sufficiency of verification within the current workflow? (scale options: *Very insufficient* = 1, *Sufficient* = 5)	4	2	5	5	3	5
Considering the current workflow, how spacious is the work place? (scale options: *Crammed* = 1, *Spacious* = 5)	3	2	4	4	1	5

a hospital's outpatient pharmacy. The steps taken were as follows: (1) evaluate the pharmacy's current situation with regard to floor plan and workflow; (2) suggest appropriate improvements based on an evaluation of the available literature; and (3) receive feedback from pharmacy personnel concerning the proposed workflow map.

Methods

The particular pharmacy described in this project is an outpatient hospital pharmacy in Tucson, Arizona, that serves the underserved as well as hospital staff. The pharmacy is staffed by 1 to 2 pharmacists along with 3 to 4 pharmacy technicians during business hours, and an average of 300 prescriptions are processed daily. Upon request from the supervisory pharmacist, this team evaluated the pharmacy's existing floor plan and workflow, suggested improvements based on the available literature and collected and analyzed pharmacy personnel response to the proposed changes. All 13 outpatient pharmacy personnel completed a satisfaction survey regarding current workflow and proposed workflow. This included pharmacists, an intern, and technicians. The employees were given the opportunity to assess the proposed changes via a Likert-type scale. Data were analyzed using the Wilcoxon rank sum test with a Bonferroni correction. The university deemed this project as quality improvement and was exempt from institutional review board approval. A copy of the questionnaire used appears in Table 1.

This was accomplished using the following steps:

Step 1 (Figure 1): Understand the pharmacy's current situation, floor plan, and workflow. The first step in this type of workflow analysis is to create a workflow map of the pharmacy that depicts where each step of prescription processing takes place.

A. Begin by drawing a scaled representation of the pharmacy's physical boundaries.
B. Insert visual representations of structural details concerning the placement of counters, equipment, computers, shelves, printers, safes, and so on.
C. Indicate which components or workstations are portable and may be moved.

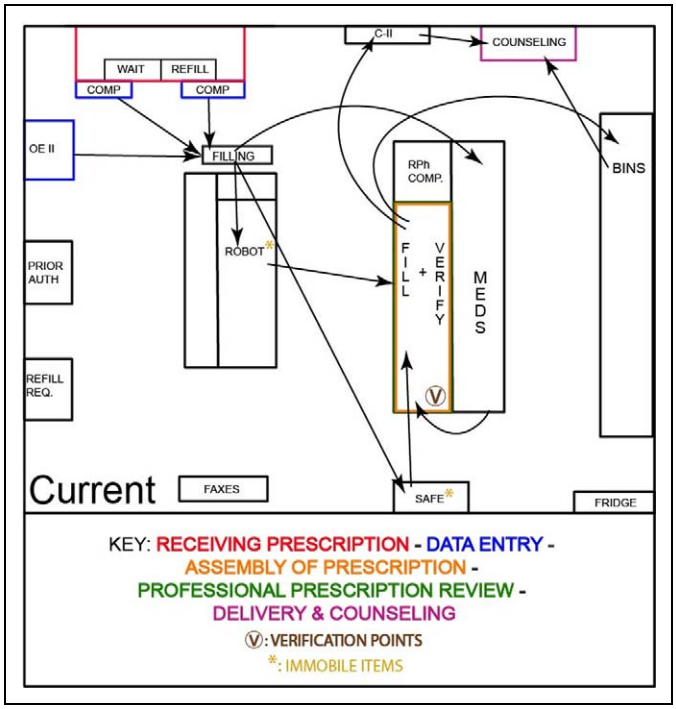

Figure 1. Current workflow map of the study pharmacy with arrows depicting order-entry, filling, verification, storage, pick-up, and counseling of a prescription. BINS, non-C-II prescriptions waiting for pick up; C-II, C-II prescriptions waiting for pickup; COMP, computer; counseling: counseling window for pharmacist; MEDS, medication shelves; OEII, additional order entry; prior auth, prescriptions requiring prior authorization; refill req, prescriptions requiring refill requests; robot, automated dispensing machine; RPh comp, pharmacist's computer; safe, controlled substances safe.

D. Add a step-by-step depiction of the prescription process to the map. The processes to be included are (1) receiving the prescription, (2) data entry; (3) assembly of prescription; (4) professional prescription review; and (5) delivery and counseling. The location at which each process takes place should be noted.
E. Add arrows to depict workflow. For example, the first step of prescription processing is "receiving the prescription" and thus the diagram should start here. An

arrow would be drawn to depict the movement of staff members and the prescription to "order entry" and so on. Arrows should connect the steps in the direction of the flow. If there is more than one possible flow, arrows should indicate this as well.

F. Analyze the map to identify high traffic areas. For the purposes of our project, we defined high traffic areas to be where 2 or more arrows converge. Such areas may lead to a lack of continuity of the workflow within the pharmacy.[9] These areas should be considered as focus of change when planning the new workflow.

Step 2 (Figure 1): Suggest appropriate improvements

A. Draft suggested new workflow to improve processes. Start by listing the high traffic areas and which components or workstations can be moved to reduce traffic in those areas. Draft a new workflow map by changing the position or location of tasks or workstations. Repeat step 1 as above when creating new workflow maps to estimate workflow and to identify potential congestion. The ideal workflow map will not have overlapping arrows.

B. Include an area designated for pharmacist–patient counseling and verify that this is included in the floor plan.

C. Ensure that adequate space is designated to allow for different pharmacy personnel to fill and subsequently verify prescriptions. According to Arizona Administrative Code R4-23-609, in the state of Arizona the minimum area of a community pharmacy is 300 square feet with a maximum of 3 pharmacy personnel working simultaneously in that area. An additional 60 square feet of floor is required for each additional staff member.

Step 3 (Figure 2): Receive feedback from pharmacy personnel about the proposed workflow map.

A. Since redesigning workflow should be a team effort, obtain staff feedback to evaluate if the proposed changes are perceived to improve workflow.[10] Specifically, one could list the steps of the prescription processing system, provide the proposed and current maps, and ask staff members to indicate whether there is a perceived improvement in continuity, sufficiency, accessibility, and space for each step. Continuity, sufficiency (whether the work area is enough to accomplish duties), accessibility, and space were selected for evaluation via discussions with the pharmacy personnel where this quality improvement tool was tested. Pharmacy staff members selected these dimensions for evaluation because they felt these components were in need of the most improvement. Each pharmacy will have different needs; therefore, the staff questionnaire may differ from pharmacy to pharmacy. Additional comments and input can be solicited from employees. After the questionnaires are completed, the perceived improvement can be determined. Thus, one can determine whether staff perceives the proposed floor plan to be an improvement. Repeat steps 2 and 3 until there is a consensus that the proposed flow will improve the prescription process.

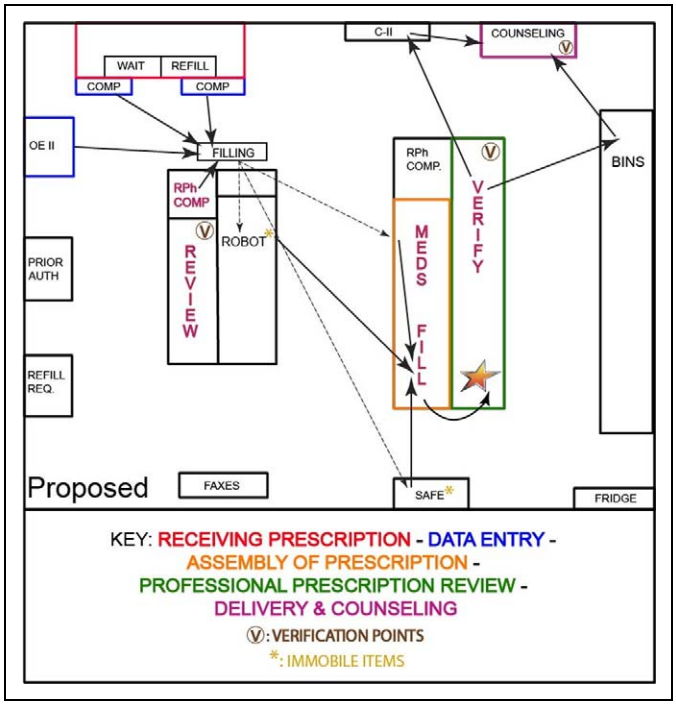

Figure 2. Proposed workflow map of the study pharmacy with suggested changes. BINS, non-C-II prescriptions waiting for pickup; C-II, C-II prescriptions waiting for pickup; COMP, computer; counseling, counseling window for pharmacist; MEDS, medication shelves; OEII, additional order entry; prior auth, prescriptions requiring prior authorization; refill req, prescriptions requiring refill requests; robot, automated dispensing machine; RPh comp, pharmacist's computer; safe, controlled substances safe. Major changes (changes are indicated in pink letters): additional review station; allows pharmacist to be in one centralized location, near pick up/counseling; starred work bench flipped 180° from current.

A brief summary of this tool appears as Table 2.

Results

The current workflow map for the pilot pharmacy showed a scattered workflow with many high traffic areas, especially during the "assembly of prescription" step (Figure 1). Pharmacy staff often had to move around the table marked with a gold star to obtain medications. In addition, one pharmacist often manned both the assembly of prescription and "professional prescription review" positions simultaneously. In the study pharmacy, many of the computers, phones, shelving, and refrigerators were portable, whereas the controlled medication safe and automated dispensing machine could not be moved. It was proposed that portable equipment and stations were either rotated or moved to facilitate a workflow with less traffic, collisions, and interruptions.

Table 2. Summary of Quality Improvement Tool.

Step 1: Understand the pharmacy's current situation, floor plan and workflow Create a workflow map of the pharmacy that depicts where each step of prescription processing takes place.	• Draw a scaled representation of the pharmacy's physical boundaries. • Insert visual representations of structural details concerning the placement of counters, equipment, computers, shelves, printers, safes, and so on. Indicate which components or workstations are movable. • Add a step-by-step depiction of the prescription process to the map, including the location where each process takes place including: (1) receiving the prescription; (2) data entry; (3) assembly of prescription; (4) professional prescription review; and (5) delivery and counseling. • Add arrows to depict workflow connecting the steps in the direction of the flow. If there is more than one possible flow, arrows should indicate this as well. • Analyze the map to identify high traffic areas (where 2 or more arrows converge). These areas should be the focus for change when planning the new workflow.
Step 2: Suggest appropriate improvements Draft suggested new workflow to improve processes.	• List the high traffic areas and which components or workstations can be moved to reduce traffic in those areas. • Draft a new workflow map by changing the position or location of tasks or workstations. Repeat step 1 as above when creating new workflow maps to estimate workflow and to identify potential congestion and avoid overlapping arrows. • Ensure that adequate space is designated to allow for different pharmacy personnel to fill and subsequently verify prescriptions.
Step 3: Receive feedback from pharmacy personnel about the proposed workflow map.	• Obtain staff feedback to evaluate whether the proposed changes are perceived to improve workflow.[10] • List the steps of the prescription processing system, provide the proposed and current maps, and ask staff members to indicate if there is a perceived improvement in continuity, sufficiency, accessibility, and space for each step. Each pharmacy will have different needs; therefore, the staff questionnaire may differ from pharmacy to pharmacy. • Repeat steps 2 and 3 until there is a consensus that the proposed flow will improve the prescription process.

Because both the automated dispensing machine and the safe could not be moved, it was proposed that the starred workbench be turned 180° to improve the workflow (Figure 2). The proposed change would allow pharmacists to remain in a centralized location, near the "delivery and counseling" window. This would also encourage pharmacists to separate the performance of the assembly of prescription and the professional prescription review steps. This would be an improvement since it has been noted that it is difficult to detect errors within your own work.[11]

Mapping the current workflow highlighted that there were an insufficient number of verification points in the workflow (Figure 1). This can contribute to errors that could have been caught by having additional verification points.[12] Therefore, 2 more verification points were suggested: (1) a review station before the filling step of the workflow and (2) a show-and-tell procedure to be used during delivery and counseling (Figure 2).

All 13 pharmacy staff employed at the pilot pharmacy completed the evaluation questionnaire (100% response rate). The pharmacy staff (n = 13, 100% response rate) rated the proposed workflow significantly better in the following areas (alpha = .0125, zcrit = 2.576): continuity (zcalc = 2.872), sufficiency (zcalc = 3.078) and accessibility (zcalc = 2.832), and spaciousness (zcalc = 2.745). This information was then provided to the pharmacy management as supporting documentation to make the proposed changes.

Discussion

When initially assessing the study pharmacy, crowded spaces and congested workflow were noted; both of which created numerous interruptions during prescription processing. As a result, there was no designated physical space for pharmacist verification checkpoints. This may lead to high dispensing error rates.[13] In several situations, prescription leaflets were misfiled with the incorrect patient tote. In the study pharmacy, the same pharmacist filled and verified prescriptions. This may result in a possible confirmation bias, which can increase the risk of medication errors.[14] This is important because incidents such as misreading the prescriptions and selecting similar drug names are the most commonly made errors in pharmacy.[15]

The pharmacy staff recognized that the clustered floor plan was one of the contributing factors for interruptions in workflow, which ultimately led to errors. This is consistent with previous studies done, which attributed increased errors in a pharmacy to interruptions while dispensing and poor workflow.[1,7,16,17] Moreover, the pharmacist/pharmacists did not have a designated workspace, which may also increase the possibility of an error occurring.[13]

Redesigning the workflow may not only positively impact the prescription dispensing process but may allow the pharmacist more time to counsel patients. A study by Lin et al designed a new pharmacy floor plan that reduced the distance pharmacy personnel had to travel to fill prescriptions.[18] As a result, the pharmacy design in the Lin et al study allowed pharmacists to be more involved in receiving, dispensing and checking prescriptions, and technicians to focus more on data entry and prescription filling. The above changes resulted in more efficient use of both the pharmacists and technician's time. In our pilot study, the proposed changes were well received by the pharmacy staff.

Research suggests that wrong drug and wrong dose are common errors.[2] These errors can be detected during an independent double check or during show and tell patient counseling[19] so it is anticipated that the 2 new suggested verification points (Figure 2) should provide more chances to identify and correct medication errors before they reach the patient.

Research supports that additional verification points can help to decrease errors or that the lack of these verification points leads to errors. For example, in one study, pharmacies with high dispensing error rates were associated with the lack of verification of patient's name and the number of prescriptions being picked up.[13] In addition, the "show and tell" patient-counseling technique (also known as the Indian Health Service Counseling Method) has been shown to decrease medication errors by helping to identify 83% of the medication errors before the patient leaves the pharmacy.[19] Moreover, the act of educating patients and allowing them to play an active role in their therapy may aid in averting errors.[20] Thus, verification points are necessary for optimal patient safety. Sometimes, it is a matter of small, realistic practice changes that could have a dramatic effect on patient health and safety.[21]

The questionnaire results demonstrated that staff viewed the suggested changes favorably and welcomed the idea of workflow changes. Giving the staff a chance to voice their opinions on what they felt were problematic areas and the suggested changes were an important part of transitioning the pharmacy into the new floor plan model.[22]

Update

The pilot pharmacy was able to implement some of the changes recommended in this quality improvement project. Pursuant to this report, the management physically separated the duties of assembly of the prescription and verification, creating a specific area for verification. This occurred concurrently with a change in prescription processing software that supported the author's recommendation for additional verification points. The software requires a verification of order entry before the prescription is assembled. Anecdotal reports from the pharmacy staff indicated an increase in satisfaction, organization, improvement in process. Additionally, there was a perceived decrease in the number of distractions for the pharmacists.

Limitations

Certain limitations must be considered when interpreting this report and when using the proposed tool. First, the physical limitations may reduce the number of options for floor plan optimization. Second, there are labor limitations as well and each pharmacy varies with regard to staffing. The authors recommended adding a verification point in the workflow. However, we did not consider whether the additional labor was financially feasible before making recommendations. The next phase of this project will evaluate the outcomes of the proposed changes. Finally, this was a quality improvement project that used a small sample size for statistical analysis. Statistical analysis was completed only to get a feeling for staff member opinions and buy-in for the proposed changes. Attitudinal instrument development and generalizability was not the project focus.

Conclusion

Following the steps outlined in this manuscript will help the user detect the problem areas of a pharmacy's workflow. Solutions consistent with the quality improvement and medication error reduction literature can then be implemented to improve pharmacy workflow.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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