

Automating the Prescription Filling and Workflow Process



A Before and After Analysis of an Automated Counting and Workflow System and its Effect on Productivity, Efficiency and Safety

The Thomsen *Group* Inc.

Executive Summary

This study utilized the standard observation based method of data collection and analysis and applied both video and audio taping to gather the data.

The purpose of this study was to review the efficiency, productivity and safety of an automated pharmacy workflow system in a real world setting of a community pharmacy.

Conducted over a period of 120 days, before and after the system was installed, the study's goal was also to determine the cost effectiveness of such a system when compared to the current manual method of pharmacy workflow and dispensing.

Marc's Pharmacy filled an average of 526 prescriptions per day before the Innovation systems were installed and an average of 542 prescriptions per day after the Innovation systems were installed.

Time and Labor Savings

The prescription filling and prescription location times were significantly reduced after the innovation systems were installed. A reduction in filling time of 1.260 minutes per prescription and a reduction in prescription location time of 0.122 minutes per prescription were realized in the post-installation phase.

The Innovation systems enhanced filling efficiency both in terms of reducing the time required to complete the filling process as well as facilitating the filling process by lower wage pharmacy staff at Marc's. Based upon an average daily prescription volume of 542 per day, realistic economic results are summarized as follows:

	Before		After	
Total Time Required	542 @ 2.62 min/Rx = 1,420 minutes		542 @ 1.36 min/Rx = 737 minutes	
% of Filling by Pharmacists	43% RPh filling 610 minutes/day 10.17 hours/day	\$508.83 per day	7% RPh filling 52 minutes/day 0.86 hours/day	\$42.99 per day
% of Filling by Technicians	57% Tech filling 809 minutes/day 13.49 hours/day	\$161.88 per day	93% Tech filling 685 minutes/day 11.42 hours/day	\$137.08 per day
TOTAL Filling Cost per Day	\$670.71 per day		\$180.07 per day	
SAVINGS PER DAY	(\$490.64 per day)			

Pharmacist and technician wages provided by RPhlink.com

Pharmacists: \$40/hour + 20% for benefits = \$50/hour
Technicians: \$10/hour + 20% for benefits = \$12/hour

Prescription filling capacity, defined as the number of prescriptions that can be completed by each person in the pharmacy, during a normal 8 hour (480 minute) workday, increased by 13.714 prescriptions per person, per day or an increase of 16%.

Tracking Prescriptions

The second major time savings component quantified by the study was reduction in the frequency and time involved in pinpointing prescriptions in the dispensing process. In addition to detracting from the efficiency of the pharmacy staff, this issue also impacts service and the customer experience. The true economic impact of lost prescriptions is difficult to quantify as it can result in an erosion of customer confidence.

	Before		After	
Frequency of Lost Prescriptions	12/day @ 9.61 min/Rx = 115.32 min		2/day @ 6.23 min/Rx = 12.46 min	
Pharmacist involvement in resolving the lost prescription problem (assume 50%)	50% RPh time 57.6 minutes/day 0.961 hours/day	\$48.05 per day	50% RPh time 6.23 minutes/day 0.103 hours/day	\$5.19 per day
Technician involvement in resolving the lost prescription problem (assume 50%)	50% Tech time 57.6 minutes/day 0.961 hours/day	\$11.53 per day	50% Tech filling 6.23 minutes/day 0.103 hours/day	\$1.25 per day
TOTAL Rx Tracking Cost per Day	\$59.58 per day		\$6.44 per day	
SAVINGS PER DAY	(\$53.14 per day)			

Increased Efficiency and Safety

Once the systems were installed the pharmacy then realized that the automated counting system filled an average of 40% of the total daily volume and reduced the number of steps to fill a prescription, from 17 to 13, and tripled the number of times that a single prescription was verified for accuracy.

Pharmacists greatly removed themselves from the filling process, 43% in pre-installation and only 7% in post-installation, and were able to perform a greater number quality control checks during order entry, prescription inspections and verifications and patient assistance or counseling.

The additional quality and patient safety steps identified in the study have a direct impact in reducing the possibility of medication errors. This quality improvement has been validated by Marcs as zero errors reported since the system was installed. These added quality steps, however, do increase the time in the pharmacist's Inspection/Verification process.

	Before		After	
Time for Rx Inspection & Verification	542/day @ 0.154 min/Rx = 83.47min		542/day @ 0.39 min/Rx = 211.38 min	
Time and Expense of Inspection & Verification	1.39 hours per day	\$69.55 per day	3.52 hours per day	\$176.15 per day
ADDED COST PER DAY	\$106.60 per day			

Packaging and Storing

The study also revealed that the time required for packaging and storage of prescriptions after verification increased after implementation of the Innovation systems by .091 minutes or 5.46 seconds per prescription. Conversely, the average time to locate prescriptions in the will call area decreased after the implementation of the Innovation systems by approximately 0.122 minutes per prescription. The time differential and wage savings attributable to this distinction are negligible and essentially negate one another.

Summary

The efficiency gains identified by this study suggest a potential labor savings of \$437 per day or \$11,362 per month were Marcs to eliminate or re-deploy all excess labor resulting from productivity improvements.

Introduction

The purpose of this study was to determine the effect of an automated workflow system on the productivity, efficiency and profitability of a community pharmacy filling between 200 and 600 prescriptions per day. Marc's Pharmacy, a regional chain pharmacy, was selected for this project and all pharmacy related activities were observed and recorded over a five day period, before and after the installation of an automated workflow system.

Location

Marc's Pharmacy



Hours of Operation:

Monday to Saturday - 8:00 AM to 9:00 PM

Sunday - 9:00 AM to 6:00 PM

Goal and Objectives

This study was based on a scientific approach for analyzing the efficiency and productivity of an automated pharmacy workflow system in the real world setting of a community pharmacy and reviewed the cost effectiveness of such a system when compared to the current manual method of receiving, filling, storing, tracking and dispensing prescriptions.

The specific objectives of this research were to:

1. Determine the efficiency and productivity of the automated pharmacy workflow system in a community pharmacy setting.
2. Determine the cost effectiveness of such a system when compared to the current manual method of pharmacy workflow.

Methodology

To accomplish the above objectives, this study was conducted over a period of 120 days and utilized the standard observation based method of data collection and analysis.

The specific techniques of the observation method in this project applied both video and audio taping and work sampling data analysis.

Work sampling is a data quantification technique, which is based on the laws of probability. A large number of the observations are made over a period of time to provide a pattern of the distribution of time spent in the work activities. The videotapes are then analyzed using the fixed-interval (1 minute) work sampling approach. Work sampling categories (see Appendix A) were developed and defined based on the activities observed in the videos.

Work sampling and time study will also be applied to quantify the movement and operation of the pharmacy staff, the automated systems and the patients from the videotapes collected.

Graduate and undergraduate students from the University of Missouri Kansas City (UMKC) were trained and employed for this data collection and analysis.

Data Collection

For the study site, 60 to 80 hours of operation were recorded over a one week period before and after the automated pharmacy workflow system was installed.

The video and audio taping process for data collection is depicted in [Figure 1](#) and camcorders were strategically located within the pharmacy.

An example of video camcorder view is depicted in [Figure 2](#).

Designed to investigate and determine the effects of an automated pharmacy workflow system before and after the installation, this study utilized the following data collection protocol:

Two separate, five weekday operations as follows:

- Video and audio tape the designated pharmacy for five weekdays (Monday to Friday) **before** the automated pharmacy workflow system is installed.
- Video and audio tape the designated pharmacy for five weekdays (Monday to Friday) **after** the automated pharmacy workflow system is installed.

To secure the appropriateness of using videotaping approach in the pharmacy, permission for videotaping was obtained from corporate management. And, since the visual and audio data that is recorded on the videotapes may contain sensitive or confidential information between the patient and the pharmacy personnel, only the researchers were allowed to review the videotapes.

Upon completion of the data analysis from the tapes, the tapes will be destroyed.

Figure 1 - Array of Equipment

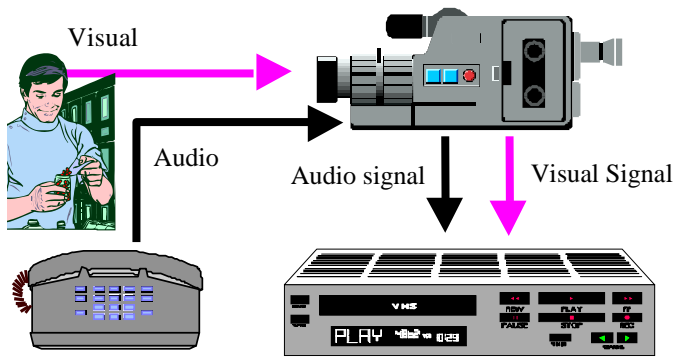


Figure 2 - Example of Video camcorder View



PRE AND POST PRESCRIPTION VOLUME

Pre-Installation Data Gathering Dates:

14 April to 20 April

Daily Rx Volumes:

Wednesday	491 Rx
Thursday	545 Rx
Friday	505 Rx
Monday	578 Rx
Tuesday	509 Rx
Total	2,628 Rx

Average **526 Rx/day**

Post-Installation Data Gathering Dates:

07 July to 12 July 2004

Daily Rx Volumes:

Wednesday	495 Rx
Thursday	457 Rx
Friday	558 Rx
Monday	659 Rx
Tuesday	541 Rx
Total	2,710

Average **542 Rx/day**

PRE INSTALLATION TECHNOLOGY

Pharmacy Management System: Condor

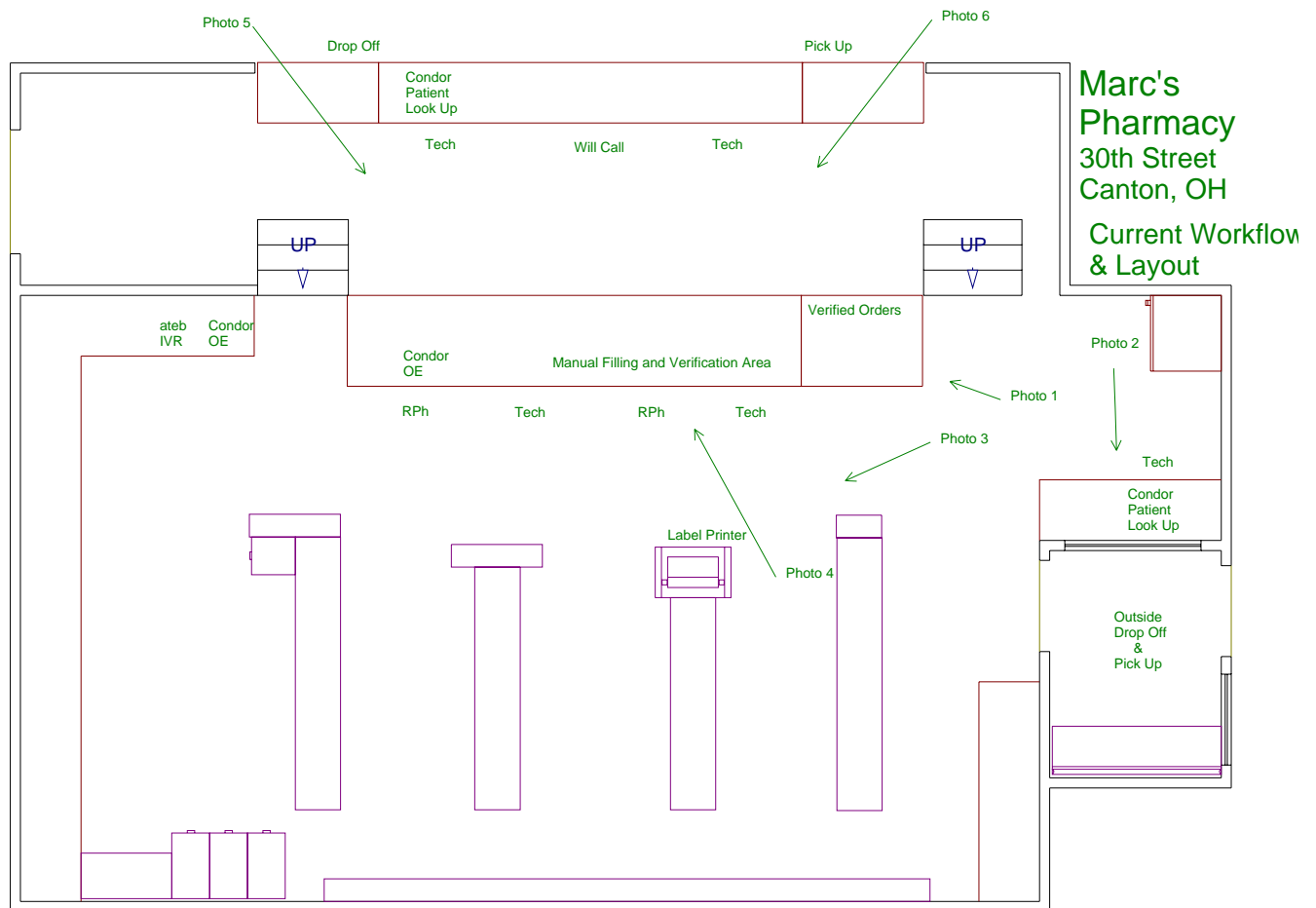
Interactive Voice Response: Ateb

Automated Workflow System: None

Counting Technology: None

Electronic Signature: Ateb

PRE INSTALLATION PHARMACY LAYOUT



POST INSTALLATION TECHNOLOGY

Pharmacy Management System: Condor

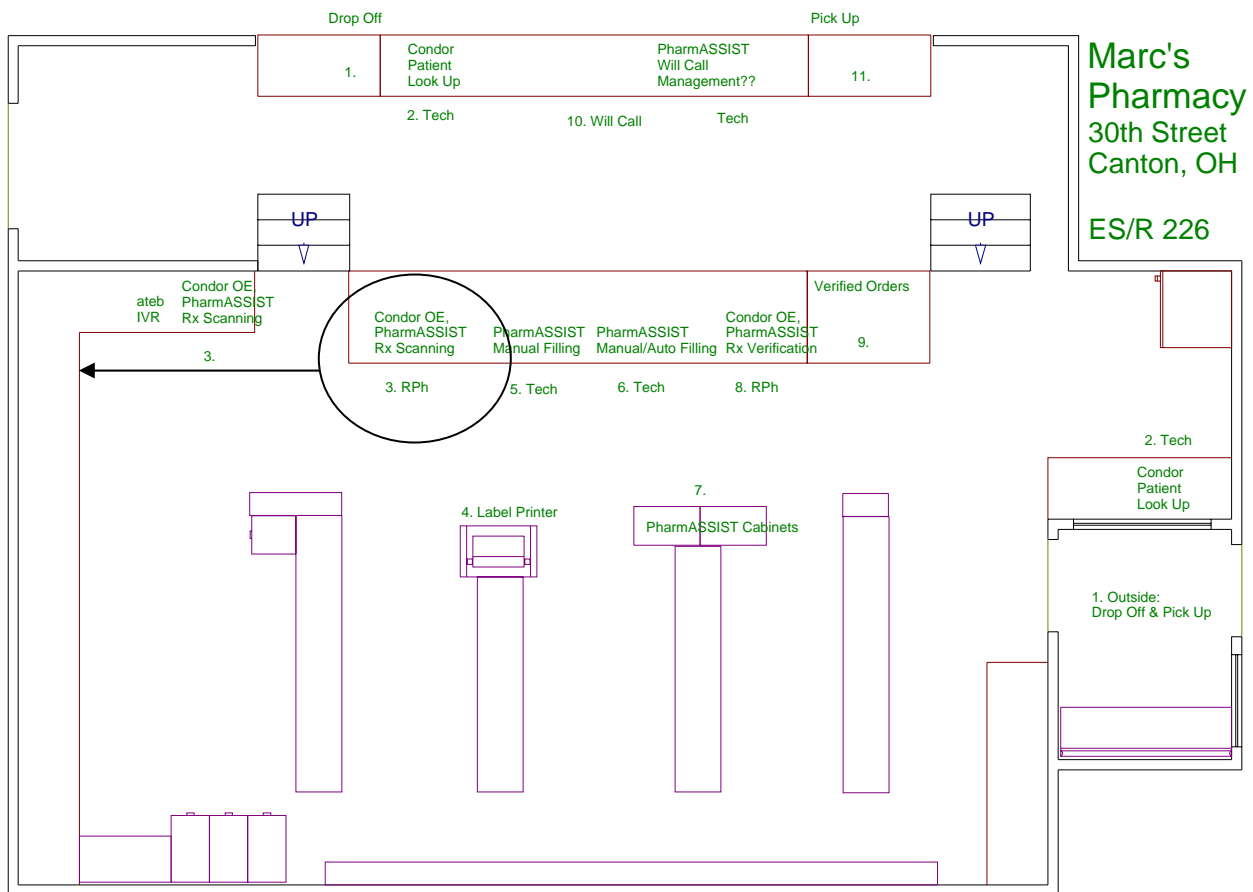
Interactive Voice Response: Ateb

Automated Workflow System: Symphony by Innovation Associates

Counting Technology: SmartCabinet by Innovation Associates

Electronic Signature: Ateb

POST INSTALLATION PHARMACY LAYOUT



Note: Relocated the main the order entry station, including PharmASSIST Rx scanning, to the upper left counter with the second order entry station.

RESULTS

The results of work sampling illustrate the time spent in performing the various pharmacy activities. To adjust the impact of various workload involved in the pre-installation and post-installation phases, the work sampling data were converted to total and average prescription filling time, before and after the automated workflow system was installed. The workload data of the pre-installation and post-installation phases were used in this adjustment.

A total of 31,412 minutes (5 days pre-installation and 5 days post-installation) were observed. 1,445 minutes (4.6%) were not viewable.

Table A lists the daily prescription volumes before and after installing the IA automated counting and workflow systems. The change in dispensing level may have been due to seasonal variation, but additional personnel were not needed to cope with the change.

Table A

Before installing the IA Systems	After installing the IA Systems
Five Day Test Period - April 2004	Five Day Test Period - July 2004
Total Prescription Volume - 2,628	Total Prescription Volume - 2,710
Average Daily Volume - 526 prescriptions	Average Daily Volume - 542 prescriptions

Based on the data, time spent and the number of the prescriptions filled the Table B lists a variety of prescription processing categories and the time that was calculated to process each activity, per prescription filled.

Table B

Activity Categories	Pre-installation (in minutes)		Post-installation (in minutes)	
	Total	Per Rx	Total	Per Rx
Receiving	972	0.373	1,030	0.380
Order Entry	4,686	1.783	4,965	1.832
Staging	1,293	0.492	1,281	0.473
Filling	5,579	2.123	2,412	0.890
Inspection/Verification	405	0.154	1,057	0.390
Packaging/Storing	526	0.200	787	0.291
Prescription Location	858	0.327	556	0.205
Dispensing/Billing	2,349	0.894	2,469	0.911
Total	16,668	6.346	14,557	5.372

Table C illustrates additional prescription filling and staff model findings, the impact of automation on prescription safety, the time to locate prescriptions in will call and lost or misplaced prescriptions and other automation and staffing findings:

Table C

	Pre-installation (times are in minutes)	Post-installation (times are in minutes)	Net Change (times are in minutes)
Prescription Filling and Staff Functions			
Prescription filling staffing model	1 RPh 2 Techs	1.5 Techs	-1 RPh -0.5Tech
Percent of prescription filling by staff member	43% RPh 57% Technician	7% RPh 93% Technician	-36% +36%
Average number of steps to process a prescription	17 steps	13 steps	-4 steps
Total average time to fill a prescription (includes staging and filling)			
	2.62 min/Rx	1.36 min/Rx	-1.26 min/Rx
Average time to fill an "automated" prescription (select vial, label and fill)	NA	23.4 sec/Rx	NA

Prescription Filling Safety			
Average time to scan original Rx	NA	0.07 min/new Rx	NA
Average time spent on inspection/verification	0.154 min/Rx	0.390 min sec/Rx	+0.243 min/Rx
Number of safety/accuracy checkpoints before prescription is released to patient	2 steps	6 steps	+4 steps
Types of checks	Visual	Bar code scan & onscreen drug images	Filling, verification, will call

Locating Prescriptions			
Average time to locate a prescription in will call	0.327 min/Rx	0.205 min/Rx	-0.122 min/Rx
Average number of lost/misplaced prescriptions	12 Rx/day	2 Rx/day	-10 Rx/day
Average time to locate a lost/misplaced prescription	9.61 min/Rx	6.23 min/Rx	-102.8 min/day

Automation and Staffing			
Impact of automation on total daily volume	0% of the TDV	40% of the TDV	+40%
Staffing during peak hours:			
Monday-Tuesday	3 RPh/5 Tech	3 RPh/5 Tech	NA
Wednesday - Friday	2 RPh/3 Techs	2 RPh/3 Techs	NA
Evenings	1 RPh/2 Techs	1 RPh/2 Techs	NA

Pre-installation



Post-installation



CONCLUSION

Prescription Volume

Automation did not affect the changes in prescription volume, but additional personnel were not needed to cope when there was an increase in the daily volume due to seasonal variation.

Marc's Pharmacy filled an average of 526 prescriptions per day before the IA systems were installed and an average of 542 prescriptions per day after the IA systems were installed.

Table D

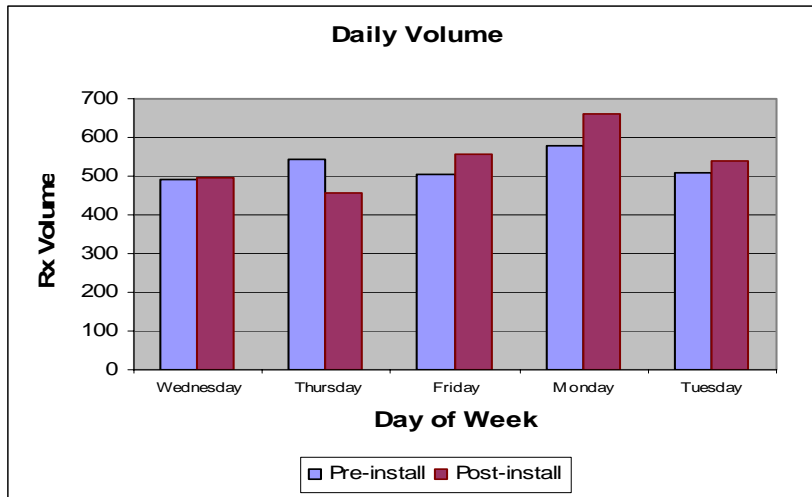


Table E compares prescription activity categories before and after the IA automated counting and workflow systems were installed:

Table E

Prescription Activity Categories	Pre-installation (in minutes)	Post-installation (in minutes)
	Per Rx	Per Rx
Receiving	0.373	0.380
Order Entry	1.783	1.832
Staging	0.492	0.473
Filling	2.123	0.890
Inspection/Verification	0.154	0.390
Packaging/Storing	0.200	0.291
Prescription Location	0.327	0.205
Dispensing/Billing	0.894	0.911
Total	6.346	5.372

While most times remain the same or very close, the prescription filling and prescription location times were significantly reduced after the IA automated counting and workflow systems were installed. A reduction in filling time of 1.233 minutes per prescription (42%) and a reduction in prescription location time of 0.122 minutes per prescription (63%) were realized in the post-installation phase.

Overall, Marc’s Pharmacy realized a reduction of total prescription processing time of 0.974 minutes per prescription after installing the IA automated counting and workflow systems.

Prescription Filling Capacity

Marc’s pharmacy reduced the prescription filling times after the IA systems were installed and, whereas automation did not affect prescription volume, additional personnel were not needed to cope with increases in prescription volume. This would indicate that the IA automated counting systems provided an increase in prescription filling capacity.

Prescription filling capacity is defined as the number of prescriptions that can be completed by each person in the pharmacy, during a normal 8 hour (480 minute) workday.

Prescription filling capacity is illustrated in Table F as follows:

Table F

Prescription Filling Capacity	Pre-installation	Post-installation
Total average time to complete and dispense a prescription - in minutes	6.346	5.372
Prescription Filling Capacity - in prescriptions	75.638 Rx per person, per day	89.352 Rx per person, per day
Additional Prescription Filling Capacity per person - in prescriptions	+13.714 Rx per day	
Additional Prescription Filling Capacity per person - percentage	+16%	

Prescription Inspection and Safety

Each pharmacist noted that the IA workflow system brought a higher level of confidence to the filling process because of the utilization of the original prescription scanning, bar code scanning and onscreen drug images.

While it is noted that the number of steps to complete a single prescription (40% of the total daily volume) was reduced from 17 to 13, the number of times that a single prescription was scanned and reviewed with an onscreen image increased to 3 different times for a total of 6 safety checks. Time to check each prescription increased from 9.24 seconds per prescription to 23.4 seconds per prescription.

Pharmacists spent considerably less time filling prescriptions after the IA systems were installed, but this extra free time allowed them to perform a greater number quality control checks during order entry, prescription inspections and verifications and patient assistance or counseling.

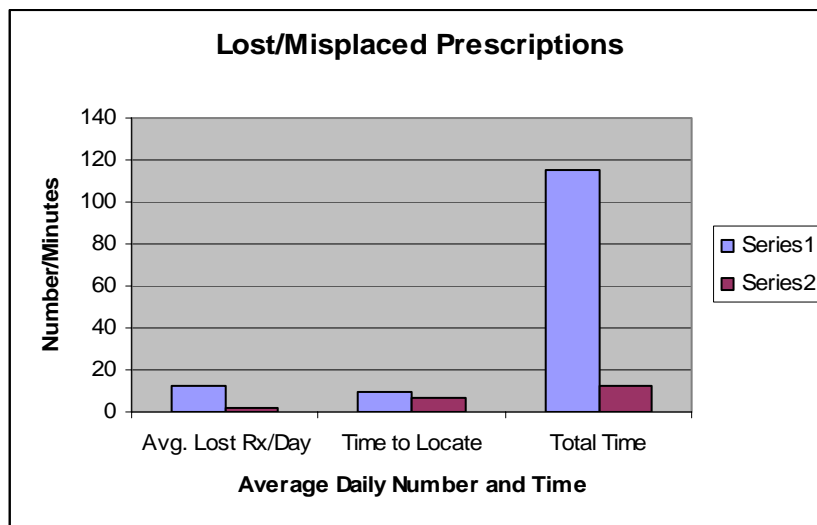
Other studies have also noted that prescription inspection or verification activity generally increases when automated counting or prescription dispensing systems are installed and utilized in community and outpatient pharmacies.

Prescription Location and Will Call

The next largest amount of pharmacy staff time, after completing the order entry, filling and inspection of the prescription, is the location of lost or misplaced prescriptions. Before the IA automated counting and workflow systems were installed the pharmacy averaged 12 lost or misplaced prescriptions per day with an average locating time of 9.6 minutes per prescription. After the IA systems were installed the pharmacy averaged 2 lost or misplaced prescriptions per day with an average locating time of 6.2 minutes per prescription.

This is a reduction of 102.8 minutes per day to locate lost or misplaced prescriptions.

Table G



Final Notes

There is still a fair amount of time and travel spent by the pharmacist at the verification station when he or she needs to access information that can not pulled-up on his or her monitor. Perhaps the ability to toggle different programs at this station could be implemented.

The same is true at the front counter. Several times throughout the day a technician is requested at the drop off end of the counter and is asked to locate the status of a prescription. He or she then has to travel to the opposite end of the will call area and access that information on the one single will call monitor. Perhaps a second will call monitor could be located near the drop off area.

Finally, there are still a number of completed and verified prescriptions that are not properly scanned into the IA will call system. Perhaps the implementation of a bar code on the outside prescription labels (currently only one bar code on the label inside the bag) so that it can be easily accessed by the staff for scanning.

--END--

Appendix A

Work Sampling Categories

Classification and Descriptions of Work Activities

Prescription processing activities

A. Receiving

1. Patient-in prescription(s)[script(s)][*new/refill*]
 - Greet patient and receive script(s)
 - Ask patient to show his/ her insurance card [*new*]
 - Review script(s) for readability or missing information [*new*]
 - Ask patient to provide complete required information [*new*]
 - Travel to the order entry counter
 - Place new script order(s) into green bin and refill script order(s) into bin for differentiation*
2. Phone-in script(s) from medical doctor (M.D.) office [*new*]
 - Transcribe script order(s)
 - Place order(s) into green bin by patient
 - Travel to place to-be-entered bin(s) on order entry counter
3. Phone-in script(s) from patient [*refill*]
 - Check voice mail messages
 - Record call-in date, patient name, phone number, script number, and pick up date
 - Place order(s) into red bin by patient
 - Travel to place to-be-entered bin(s) on order entry counter

B. Order entry

- Retrieve order from to-be-entered bin [*new*]
- Code script [*new*]
- Establish patient profile [*new*]
- Review patient profile [*refill*]

- Enter physician's order into computer system
- Examine drug regimen of a patient
- Conduct Medication Use Evaluation
- Remove bar code from printer and adhere to original script (with automated workflow system)
- Scan original script (with automated workflow system)

C. Filling

1. Staging

- Print out script label
- Obtain label from printer
- Place order(s) and script label(s) into bin by patient
- Move completed bin to the filling area

2. Manual

- Retrieve script label(s) from to-be-filled bin
- Review script label(s)
- Travel to drug storage shelves
- Obtain drug(s)
- Travel back to filling counter
- Use counting tray or an automated system to count oral solids
- Discard empty drug bottle
- Obtain vial, pour medication into vial, and cap it
- Change oral liquid bottle with secured cap if needed
- Record drug lot number and expiration date on sticker
- Attach the label to filled vial or unit-of-use container
- Place drug bottle(s), filled vial(s), and script label(s) into green/red bin by patient
- Travel to place to-be-checked bin(s) on inspection counter

3. Automated

- Retrieve script label(s) from bin
- Review script label(s)
- Select vial according to size noted on monitor
- Label vial
- Scan bar code on vial
- Dispense script from correct chute on the automated system directly into the labeled vial

- Cap filled vial
- Gather the receipts and filled vial(s) into bin by patient
- Move completed scripts and bin to the inspection area

D. Inspection and verification

1. Manual

- Retrieve drug bottle(s), filled vial(s), order(s), and script label(s) from to-be-checked bin
- Proofread labels one by one, including name, strength, dosage form, and quantity of the drug.
- Inspect and verify medication appearance (size, shape, and color), expiration, *etc*
- Review patient profile as needed
- Attach auxiliary label(s) to vial or container
- Waterproof labels on vial or container
- Correct the problem by repeating appropriate steps if there is a problem
- Sign inspection log after verification
- Attach log sticker on order *[new]* or inspection book *[refill]*
- Place checked script order in script organizer or drop script into file box *[new]*
- Tear off label backing from script label
- Discarding label backing and keep receipt and information forms
- Group filled script(s), receipt and information forms into to-be-packed bin by patient
- Travel to place to-be-packed bin(s) on packaging counter

2. Automated

- Retrieve filled vial(s) from to-be-packed bin
- Scan bar code identification label one by one
- Inspect and verify medication appearance, expiration, *etc*
- Review patient profile as needed
- Attach auxiliary label(s) to vial or container
- Waterproof label on vial
- Correct the problem by repeating appropriate steps if there is a problem
- Group filled script(s) and place into bag
- Attach receipt and information forms and then staple
- Move bag to will call counter

E. Packaging and storing

1. Manual

- Retrieve completed prescription bags from will call counter
 - Store prescription bags in plastic totes by first letter of patient surname
2. Automated
- Retrieve completed prescription bags from will call counter
 - Scan bar code on prescription label and designated storage location
 - Store prescription bags in hanging plastic bags (Monaco) by first letter of patient surname

F. Dispensing and billing

1. Manual

- Page patient *[new]*
- Greet patient and ask patient name *[refill]*
- Travel to obtain prescription from storage bin *[refill]*
- Retrieve filled script(s) from bag
- Check filled items with patients
- Ask the patient if there is any question for counseling
 - If yes, page a Pharmacist to answer patient's question
 - If no or after pharmacist's counseling, ask patient to sign on third-party log
- Wait for patient's signature
- Place medication in bag
- Hand packed medication to patient
- Receive co-pay and see patient off

2. Manual

- Page patient *[new]*
- Greet patient and ask patient name *[refill]*
- Travel to automated system monitor and lookup patient name
- Obtain prescription location
- Obtain prescription from hanging bag system *[refill]*
- Retrieve filled script(s) from bag
- Check filled items with patients
- Ask the patient if there is any question for counseling
 - If yes, page a Pharmacist to answer patient's question
 - If no or after pharmacist's counseling, ask patient to sign on third-party log
- Wait for patient's signature
- Place medication in bag
- Hand packed medication to patient

- Receive co-pay and see patient off

Problem-solving activities

A. Patient- or script-related problem solving

- Deal with the patient who is not qualified for filling script due to his/ her script or insurance problem
- Establish non-formulary drug profile as needed
- Take corrective actions if script label is incorrect
- Refill incorrect order as needed
- Deal with computer problems
- Handle exceptional case

B. Telephone follow-up

1. Script-related

- Call MD office to obtain proper interpretation of order as needed
- Call for physician's refill authorization as needed
- Answer phone call regarding refill authorization from MD office
- Call and inform patient if refill is not authorized
- Recommend different drug use

2. Insurance-related

- Call insurance company to verify patient's insurance status

C. Patient counseling

- Provide basic clinical information
- Review patient profile
- Answer question(s) about script or drug information

Inventory maintenance

A. Inventory ordering

- Record out-of-stock item on order list
- Send inventory order to wholesaler or dealer

B. Inventory stocking

- Refill stock on drug storage shelf
- Return remaining unused drugs back to storage shelves
- Restock returned medications
- Load drugs in dispensing cells

C. Other inventory control activities

- Receive new-coming drug totes from wholesalers or dealers
 - Process returned medications
 - Monitor remaining inventory
 - Remove expired and recalled medications
 - Other

Personal/Idle time

A. Lunch and break

- 30-minute lunch
- 15-minute break

B. Idle time

- Wait to perform a pharmacy task

C. Other non-work-relative activities

- Early departures or late arrivals
- Personal telephone calls
- Chat with consumers, patients, or other pharmacy staff
- Restroom
- Other

Miscellaneous Activities

A. Management

- File medication orders
- Input error inspection
- Run reports
- Other

B. Retail service

- Sell non-script products
- Manage retail inventory
- Counsel over-the-counter product(s)

C. Cash register

- Close cash register
- Complete cash deposit
- Exchange small change

D. Automated counting system maintenance (optional)

- Warm up system
- Test system
- Prepare and perform maintenance
- Load vials to dispensers
- Change printer ribbons and labels

E. Pre-packaging

- Get drugs and prepackage oral solid medications as needed

F. Customer relations

- Conversation with the patient or customer

G. Travel**

- Travel to next workstation when the previous activity is finished and the next activity has not started yet
- For example, the pharmacy staff moves from the filling station to the dispensing windows to answer patient requests.

H. Unobservable

- Any activities beyond observation
- Absent

I. Other work-related activities

- Cleaning of the automated counting systems

- Clean work counter
- Organize work area
- Provide drug information when questioned
- Attend scheduled meetings or educational seminars
- Other

**** Travel within the work area is often difficult to assign to a specific task classification. The researcher will make a judgmental assignment of these observations based on pre and post function of work.**