PENERBIT
USM

IDENTIFICATION OF FACTORS LEADING TO EXCESSIVE WAITING TIME AT THE PHARMACY UNIT OF HEALTH CLINICS IN TEMERLOH DISTRICT, PAHANG, MALAYSIA

FONG REN YI[*]**, AZURAINE AHMAD, NURUL SHAZWANI SAID, TENGKU NUR'AINI TENGKU MANSHOR, SOO LING LING, NORMUNIRAH JAMIL AND BIZURA AZIRA MOHD ROBY**

Pharmacy Unit, Temerloh District Health Office, Pahang, Malaysia

ABSTRACT

Excessive patient waiting time at dispensing pharmacies is attributed to workflow inefficiencies that are difficult to isolate. The objectives of this study are to quantify current operational process and delay times and also to identify bottlenecks that lead to excessive waiting time at the pharmacy unit of primary health clinics in Temerloh district. A multicentre observational cohort study was conducted at a Pharmacy Unit of Bandar Mentakab Health Clinic (KKBM), Temerloh Health Clinic (KKT) and Tanjung Lalang Health Clinic (KKTL). Stopwatch technique was applied for all four operational procedures (greeting, data entry, filling and dispensing) based on workflow analysis. Data collection forms were used to identify factors and their impact on process time. Major components causing long waiting times were found in delay segments. Significant time delay occurred before greeting at KKT; before data entry at KKBM, KKT and KKTL; and before dispensing at KKTL. Among factors found affecting process segment in data entry include presence of intervention and psychotropic substances in the prescription. Filling process was found to be delayed by the presence of more than three items, cold items, intervention and psychotropic substances in the prescription. In addition, dispensing process was found to be delayed by errors in data entry and filling. This study identified several common bottlenecks and isolated issues specific to each pharmacy unit of three health clinics that lead to excessive operational process and delay times in pharmacy dispensing process. This approach laid a solid base to spearhead future optimisation strategies to improve efficiency and shorten waiting time.

Keywords: Waiting time, Workflow analysis, Health clinic, Outpatient pharmacy, Stopwatch technique

---

[*]Corresponding author: nandafry@gmail.com

INTRODUCTION

Patient waiting time in the health sector has been identified by the World Health Organization (WHO) as one of the key indicators of a good responsive health system (Valentine *et al.* 2003). In several countries including the United Kingdom and the United States, the government health care sector sets series of standards to provide timely care and to reduce harm as a result of delays (Bleustein *et al.* 2014).

A long waiting time has always been significantly associated with patient dissatisfaction as reported by Afolabi and Erhun (2003). A huge scale survey of 2.4 million patients across the United States revealed that there is a strong and inverse relationship between patient satisfaction and wait time (Press Ganey 2009). In addition, medical practices that are continually working to minimise wait time can expect to observe a significant improvement in the overall patient satisfaction as well as medical practice outcomes (Thompson and Yarnold 1995).

The Ministry of Health Malaysia has implemented numerous programmes and activities to achieve a standard of health comparable to that of developed nations. Among them are the Key Performance Indicators (KPI) in the health sector introduced in 2009 that aims to improve healthcare services with regards to efficiency, effectiveness and customer satisfaction.

As one of the key departments in a healthcare setting, the pharmacy is no exception to providing efficient service to the customer by reducing waiting time. The Ministry of Health Malaysia defines waiting time as the duration of time taken for medication to be supplied to patient starting from the receiving of prescription at the pharmacy counter until the medication is dispensed to the patient. In order to ensure that customer satisfaction is given due importance, a KPI was assigned by the Ministry of Health's Pharmacy Practice and Development Division specifically for outpatient pharmacies that sets a target of 95% of prescriptions to be dispensed within 30 min. Over the past nine years since its inception, the Ministry has strived to overcome weaknesses in the system and continually improve to meet the KPI target. However, despite constant efforts, many healthcare facilities still encounter problems with achieving the target, leading to a shortfall in quality and patient dissatisfaction.

After an update in March 2019, the Ministry of Health Malaysia decided to remove this indicator from the KPI and was integrated to the Core Customer Charter of Ministry of Health Malaysia (*Piagam Pelanggan Teras Kementerian Kesihatan Malaysia*) 2019, instead. The target remains the same and is still monitored monthly by the Ministry.

KPI reports have shown an alarming trend whereby outpatient pharmacies of three main health clinics in the Temerloh district (Klinik Kesihatan Bandar Mentakab [KKBM], Klinik Kesihatan Temerloh [KKT] and Klinik Kesihatan Tanjung Lalang [KKTL]) have failed to meet the KPI target of 95% prescription dispensed within 30 min between January and September 2017. Several quality improvement projects have been initiated to curb this trend but were mostly unsuccessful as the factors leading to excessive waiting time have not been identified nor addressed appropriately.

Identification and isolation of inefficiencies within a complex workflow of an outpatient pharmacy is crucial before any quality improvement can be initiated (Jenkins and Eckel 2012). This can be achieved by performing a workflow analysis time study to establish a baseline observation of the patient waiting time in the current volume outpatient pharmacies (Slowiak, Huitema and Dickinson 2008). This observation can be performed more efficiently by breaking down the current operational workflow into separate process

segments for analysis of process and delay times (Lin *et al.* 1999). Unfortunately, there has yet to be any literature in Malaysia that analysed the outpatient pharmacy workflow using workflow analysis.

A root cause analysis performed by the Pharmacy Department of Queen Elizabeth Hospital, Kota Kinabalu found that long patient waiting time was multifactorial. Among the factors identified were inexperienced personnel unfamiliar with dispensing workflow, drug arrangements, insufficient manpower, high burden of prescriptions when multiple clinics were in operation, handling prescription errors, additional steps in dispensing procedures and prescriptions containing controlled substances (Loh *et al.* 2017). However, the measurement methodology of that study was focused on evaluating improvement strategies and was not designed to quantify each factors identified.

Therefore, the objective of this study is to quantify current operational process and delay, and also to identify bottlenecks that lead to excessive waiting time at the pharmacy unit of primary health clinics under Temerloh Health Clinic.

METHODS

This is a multicentre observational cohort study which was conducted in three outpatient pharmacies of primary health clinics under the Temerloh Health Clinic. This included KKBM, KKT and KKTL.

All three study sites follow the same standard operating procedure (SOP) was stated in the Guide to Good Dispensing Practice where the responsibilities of pharmacist and pharmacy assistant are strictly delineated (Ministry of Health Malaysia 2016). According to this SOP, a pharmacy assistant greets the patient, gives a calling number and receives the prescription at the greeting stage. Another pharmacist or pharmacy assistant then screens and keys in the particulars of the prescription into the Pharmacy Information System (PhIS). Next, a pharmacist or pharmacy assistant fills the medication based on the physical prescription and labels printed out from PhIS. Lastly a pharmacist reviews and dispenses the completed medication with counseling if necessary.

The sample size was calculated using the Creative Research Systems survey software. The calculation was based on the average number of prescriptions received daily at each study site. With confidence level of 95% and 5% confidence interval, the recommended total sample size was 265 prescriptions. However, due to the random nature of patient arrival at the pharmacy counter, an additional 10% was added to the estimated total sample size to account for margin of error, thus the total sample size for this study was 293 prescriptions. This sample size was then distributed for each study site based on the ratio of average number of prescriptions received daily at each study site between January and March 2018. Therefore, the sample size distribution for KKBM, KKT and KKTL was 130, 88 and 75 prescriptions, respectively.

Data Collection

The study applied the workflow analysis and stopwatch techniques. Data was collected between July 2018 and January 2019. Each data collection session was conducted starting at 9.00 am each day until the sample size was achieved for each process segment. All pharmacy staff were informed that the data collection will not be used for individual performance evaluations and was only intended for improvement purposes.

Workflow Analysis

The workflow analysis of this study was adapted from a study by Lin *et al.* (1999) and, Clark and Klein (2010) whereby the existing system was divided into individual detailed steps and analysed. The current operational workflow of the outpatient pharmacy starts when the prescription is received from the patient and ends when the patient is called to the counter for dispensing. This workflow was divided into four processing segments for detailed analysis according to the Desk File (*Fail Meja*) of Pharmacists and Pharmacy Assistants of Temerloh District 2017. This workflow was adapted from the Dispensing Flow Chart obtained from the Guide to Good Dispensing Practice (Ministry of Health Malaysia 2016) as shown in Figure 1.
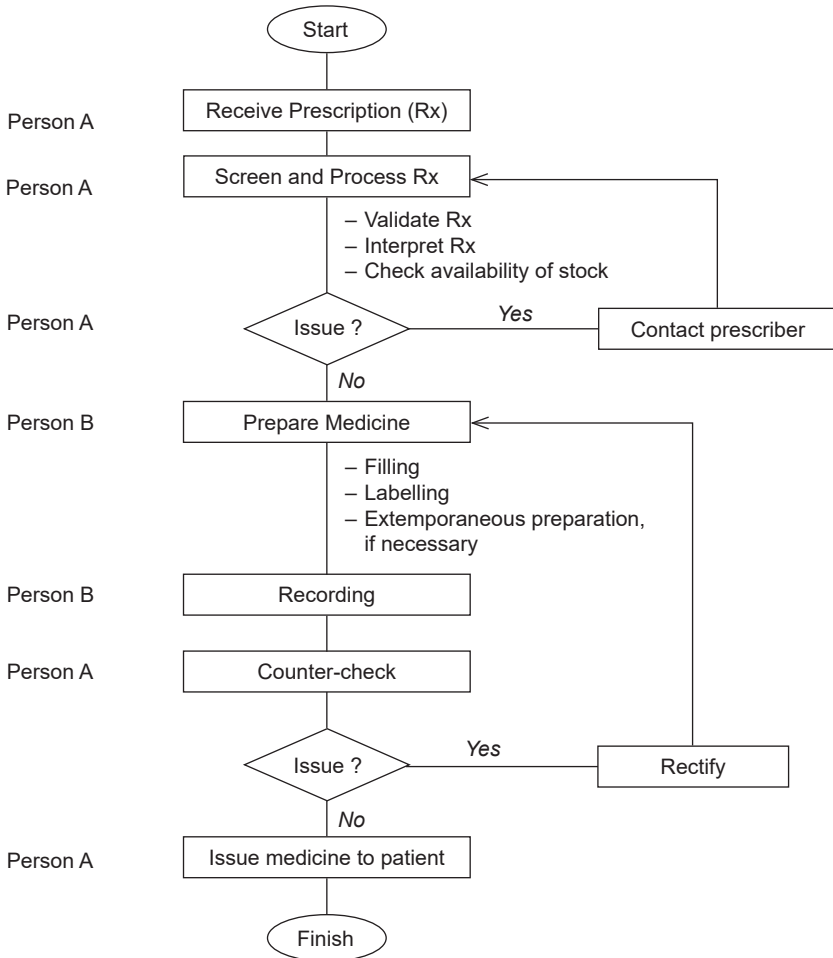

Figure 1: Dispensing process flow chart.

Taken from the 'Guide to Good Dispensing Practice' (Ministry of Health Malaysia 2016).

The processing segments were based on prescription filling functions, locations and workers. Each segment was then divided into standard industrial engineering categories of either process or delay. The process component is defined has a staff member actively working on the prescription, whereas a delay component has the prescription left unattended and is waiting for a staff member to work on it. The ending point of a process or delay component becomes the starting point of the subsequent process or delay component. The definition of the starting and ending point of each dispensing element are as shown in Figure 2.

Processing segment	Process/Delay	Starting point (SP)/Ending point (EP)
Greeting patient and receiving prescription	Wait for greeting	SP: Patient stops at counter to get number EP: Pharmacy staff greets and gives number
	Receiving Rx from patient	SP: Pharmacy staff greets and gives number EP: Received Rx is place in "To be input" box
Screening and entering data into PhIS	Waiting for data entry	SP: Received Rx is place in "To be input" box EP: Rx is retrieved from "To be input" box
	Data entry	SP: Rx is retrieved from "To be input" box EP: Rx is placed in "To be filled" box
Filling the prescription	Waiting for filling	SP: Rx is placed in "To be filled" box EP: Rx is retrieved from "To be filled" box
	Filling	SP: Rx is retrieved from "To be filled" box EP: Filled Rx is placed on counter
Checking and dispensing the prescription	Waiting for checking	SP: Filled Rx is placed on counter EP: Filled Rx is retrieved from counter
	Checking/ Dispensing	SP: Filled Rx is retrieved from counter EP: Patient called to counter

Figure 2: Definition of the starting and ending points of the processing and delay time segments.

Stopwatch Technique

Stopwatch techniques were used to quantify the duration of each step of patient waiting time. Time was measured and recorded to the hundredths of a minute (two decimal points). In each session, only one specified segment was observed (e.g. filling), therefore an investigator measures the 'wait for filling time' (delay) and 'filling time' (process) repeatedly until the sample size is achieved. This is then repeated for other segments in subsequent sessions.

Data was collected by applying a continuous timing technique where the stopwatch is kept running and all times were recorded as it occurs without resetting it, noting the elapsed time. All sampling times over the study period which fulfilled the selection criteria was collected.

In order not to affect the normal working conditions of each study site, one assigned investigator from an external facility was tasked to collect the data at the study site on the day of the week corresponding to the median prescription received. The study day of each study site was chosen based on the average number of prescriptions received each day of the week between January and March 2018. Therefore, the chosen day for KKBM, KKT and KKTL was Tuesday, Monday and Wednesday, respectively.

Data Collection Form

A simple data collection form was developed based on factors identified in the root cause analysis conducted by Queen Elizabeth Hospital (Loh *et al.* 2017). This form was attached to every prescription during the study period to help the investigator in collecting data, specifically for each processing segment with additional tick boxes for each potential factor. This is to quantify the extent of each contributing factor on the waiting time.

Data Storage and Archival of Study Data

All data collected from this study was kept on a password-protected database and was linked only with a study identification number for this research. No identifier data of patient or staff member was recorded during this study, all data was quantitative (number of patients and number of staff members) which was collected using the data collection form. All data was entered into a computer that was password protected.

After completing the study, data in the computer was copied to compact discs (CDs) and the data in the computer erased. CDs and any hardcopy data was stored in a locked office of the investigators and will be maintained for a minimum of three years after the completion of the study. The CDs and data will be destroyed after that period of storage.

Process Selection Criteria

Inclusion Criteria

(i) New, refill and walk-in prescriptions from study site.

(ii) Prescriptions received through Integrated Drug Dispensing System (SPUB).

This referral system follows standard dispensing process as shown in Figure 3.

(iii) Prescriptions with errors requiring intervention with prescriber.

When an error is found in the prescription at any segment, the pharmacist is required to contact the prescriber to rectify the error before proceeding to the next segment.

(iv) Prescriptions containing psychotropic substances.

The supply of psychotropic substances is governed under Poisons (psychotropic substances) Regulations 1989 which mandates additional storage and recording requirements.

(v) Prescriptions containing extemporaneous preparations.

There are several pharmaceutical formulations, for example, isoniazid syrup 10mg/mL and folic acid suspension 1mg/mL that are not available commercially and require compounding in accordance to extemporaneous formulation of Ministry of Health 2015.

Value Added Service	Description	Procedure
Integrated Drug Dispensing System *SPUB*	A uniform referral system designed to supply medicines through a designated SPUB prescription where patients can get their follow-up supply of medicines from a directory-listed health facility under the Malaysia Ministry of Health.	1. Patient collects first month medicine supply at pharmacy and registers for this service. 2. Referring pharmacy notifies referred pharmacy within seven days of registration. 3. Referred pharmacy obtains necessary follow-up medicine supply for patient. 4. Patient arrives with SPUB prescription and it follows standard dispensing process flow.
Appointment Card System *Sistem Kad Temujanji*	A system designed for patients to arrange an appointment date for collection of their follow-up medicine supply with the pharmacy days prior to arrival to reduce waiting time at pharmacy.	1. Patient collects first month medicine supply at pharmacy and registers for this service. 2. Patient arranges an appointment date with pharmacy and is given an appointment card. 3. Follow-up medicine supply is prepared and stored before appointment date. 4. Patient arrives on appointment date and presents appointment card to pharmacy. 5. Pharmacy dispenses prepared medicine supply to patient.
Drop and Collect Later *Letak dan Ambil Kemudian*	A system designed to allow patients to drop their prescriptions for filling and return for collection of their medicine supply at a designated collection time later reduce congestion at pharmacy during peak times.	1. Patient is greeted and prescription is received at pharmacy. 2. Patient arranges a collection time with pharmacy. 3. Medicine supply is prepared and stored before collection time. 4. Patient arrives at pharmacy at collection time. 5. Pharmacy dispenses prepared medicine supply to patient.
Express 3-in-1 *Ekspres 3 dalam 1*	A system that merges three dispensing processes (greeting, screening, filling) into one, to reduce the waiting time for patients with prescriptions with three items or less.	1. Patient is greeted and prescription is screened and filled at pharmacy express counter. 2. Prepared medicine supply is counter-checked and dispensed to patient.
Value Added System Mobile Application (VAS Mobile App) *Aplikasi Mudah alih VAS*	A system that uses an Android application for patients to arrange an appointment date for collection of their follow-up medicine supply with the pharmacy before they arrive to reduce waiting time at pharmacy.	1. Patient collects first month medicine supply at pharmacy and registers for this service. 2. Patient arranges an appointment date with pharmacy via the VAS mobile App and is given an identification code. 3. Follow-up medicine supply is prepared and stored before appointment date. 4. Patient arrives on appointment date and presents identification code to pharmacy. 5. Pharmacy dispenses prepared medicine supply to patient.

Figure 3: Description of value added services.

Taken from Desk File (*Fail Meja*) of pharmacists and pharmacy assistants of Temerloh district 2017.

Exclusion Criteria

(i)   Prescriptions registered for value-added services that do not follow standard dispensing process.

For example, Appointment Card System, Drop and Collect Later, Express 3-in-1 and VAS Mobile App offered by each study site as shown in Figure 3.

Data Analysis and Interpretation

All descriptive data obtained in the study was analysed using Microsoft Excel 2010 only. Standard descriptive statistics (percentages and frequencies) was used to summarise the processing and delay times of each processing segment in each study site individually. Further analysis was conducted by deducting the mean waiting time of prescriptions from each category to the overall mean waiting time to interpret the increase in waiting time caused.

Ethical Approval and Publication Policy

This study has obtained approval from the Medical Research & Ethics Committee (MREC) for observational data collection only. All records and data collected are strictly confidential and were used for the purpose of this study only. Consent form requirement was waived by MREC for this study because no personal information and individual-identifiable data was obtained from subjects.

RESULTS

Operational Process and Delay Time Distribution

Based on the study conducted in these three study sites, the most significant component that contributed to the overall waiting times in pharmacy was the delay time rather than the process time as stated in Table 1.

Klinik Kesihatan Bandar Mentakab

Of the mean 29.65 min waiting time, 81.6% was contributed by the delay component while only 18.4% was contributed by the process component. The longest delay time in KKBM occurred prior to screening/data entry which was 64.7% of the total mean waiting times.

Klinik Kesihatan Temerloh

Of the mean 28.43 min waiting time, 74.5% was contributed by the delay component and 25.5% was contributed by the process component. This study site has the longest delay component in the greeting/receiving segment which contributed to 31.5% of the total mean waiting time. The combination of delays from both greeting/receiving and 27.70% from screening/data entry segments totalled to 59.2% of the total mean waiting time.

Table 1: Mean time distribution of both process and delay components for each study site.

Description	KKBM					KKT					KKTL				
	Sample size	Processing		Delay		Sample size	Processing		Delay		Sample size	Processing		Delay	
		Mean (SD)	%	Mean (SD)	%		Mean (SD)	%	Mean (SD)	%		Mean (SD)	%	Mean (SD)	%
Wait for greeting						124			8.97 (7.58)	31.5					
Receive Rx from patient	161	0.88 (1.15)	3.0			124	2.03 (1.38)	7.2			104	1.25 (1.27)	10.7		
Wait for data entry	193			19.18 (8.55)	64.7	105			7.88 (7.60)	27.7	83			2.55 (1.82)	21.7
Enter data	193	2.12 (1.70)	7.1			105	1.53 (1.55)	5.4			83	1.03 (0.43)	8.8		
Wait for filling	143			2.23 (2.42)	7.5	125			1.73 (2.05)	6.1	112			1.73 (2.05)	11.6
Filling	143	1.87 (1.38)	6.3			125	3.00 (2.32)	10.6			112	0.92 (0.82)	7.8		
Wait for dispensing	154			2.77 (1.73)	9.3	135			2.60 (1.97)	9.1	111			4.00 (2.43)	34.1
Dispensing	154	0.60 (0.58)	2.0			135	0.68 (0.68)	2.4			111	0.62 (0.68)	5.3		
Total		**5.47**	**18.4**	**24.18**	**81.6**		**7.25**	**25.5**	**21.18**	**74.5**		**3.82**	**32.5**	**7.92**	**67.5**

Notes: *Data rounded up to tenths of minutes; SD = standard deviation.

Klinik Kesihatan Tanjung Lalang

The delay component accounted for 67.5% while the process component accounted for 32.5% of total mean waiting time of 11.74 min. This study site has the shortest and best process to delay ratio of the three survey sites. The longest delay times were contributed in KKTL occurred before screening/data entry at 21.7% and before dispensing at 34.1% of the total mean waiting times.

Factors Affecting Process Component

Further analysis was performed for each individual processing segment to identify potential contributing factors to excessive process time.

Greeting/Receiving Segment

All categories of prescriptions were shown to be similar on the process component of the Greeting/Receiving segment in all three study sites.

Screening/Data Entry Segment

Intervention was the main contributing factor to excessive process time in all three study sites leading to +3.26 min in KKBM, +3.97 min in KKT and +0.30 min in KKTL. Besides that, excessive process times were observed with new SPUB prescriptions in KKBM (+0.88 min) and KKTL (+0.30 min) as well as prescriptions with psychotropic substances in KKBM (+1.28 min).

Filling Segment

The main factor that contributed to excessive process time in all three study sites was prescriptions with more than three items leading to +0.40 min in KKBM, +1.33 min in KKT and +0.55 min in KKTL. On the other hand, excessive filling times were also observed with SPUB prescriptions in KKBM (+1.36 min) and KKT (+2.00 min), prescriptions with cold items in KKT (+1.35 min) and KKTL (+0.93 min), intervention in KKBM (+0.98 min) and KKT (+0.67 min) as well as prescriptions with psychotropic substances in KKBM (+7.13 min) and KKT (+6.00 min).

Dispensing Segment

Only two factors were observed to contributes to excessive process time which were the occurrence of data entry errors in KKT (+6.97 min) and KKTL (+2.73) as well as filling errors in KKT (+0.80 min).

DISCUSSION

Patient waiting time at the Ambulatory Pharmacy has consistently been a factor in determining quality of pharmaceutical care services provided. Therefore, shortening this waiting time has been a well-established and important goal. In order to identify the bottlenecks in each segment that accumulates to excessive waiting time at pharmacy unit of all three study sites, this study has broken down the current operational procedure into four segments.

In our literature review, we notice that several studies focused on the patients' response and satisfaction towards waiting time (Afolabi and Erhun 2003). Only Lin *et al.* (1999) managed to diagnose and isolate the problems in each segment in order to suggest potential strategies for improvement. Upon further inspection, we have found that although every study sites followed the standard dispensing practice from the Guide to Good Dispensing Practice (Ministry of Health Malaysia 2016), there were still many differences in the actual on-site implementation, such as distribution of workforce, available equipment, pharmacy layout and types of prescriptions received in each study site. These differences could greatly contribute to efficiency and the resulting process/delay component of each segment.

Greeting/Receiving Segment

The task of receiving prescription was implemented very differently in all three study sites. In KKBM, the person assigned to screening/greeting was tasked to manage the express counter as well, which is a counter dedicated to processing value-added services, most notable Express 3-in-1 as described in Figure 3. Although priority was given to greeting/receiving, this person had to juggle multiple tasks which, in turn, reduced efficiency. In KKT, there was no dedicated person to greeting/receiving. This caused the only delay component in this segment because staff from another segment only attended to this task periodically, and this led to an inefficient batch processing pattern instead of the continuous flow practiced in the other two study sites. As for KKTL, one person was assigned to manage both the greeting/receiving and data entry segments. This was because of the lack of staff and was an attempt to optimise the workflow by merging both segments in close proximity to each other. Lin *et al.* (1999) suggested that having a dedicated staff assigned to this segment will ensure that all prescriptions follow an uninterrupted flow to subsequent segments efficiently.

Screening/Data Entry Segment

In KKBM and KKT, there were two persons assigned to data entry while in KKTL, only one person was assigned to both screening/greeting and data entry. In theory, assigning of more staff and equipment to this segment would reduce processing time and also its preceding delay time. However, the results show the opposite with KKTL having the shortest data entry process times followed by KKT and KKBM. This observation in both KKBM and KKT was probably due to either the inefficiency of staff assigned to this segment, insufficient process capacity or a combination of both. Inefficiency of staff can be attributed to the fact that both KKBM and KKT are training centres for provisional registered pharmacists (PRP) and are also assigned with newly registered contract-based pharmacists. As suggested by Lin *et al.* (1999), having inexperienced staff with a lack of familiarity in data entry system would propel a longer processing time, therefore we suggest assigning more experienced staff to this segment during peak hours and provide sufficient training to new staff to improve

proficiency in data entry during off-peak hours. Loh *et al.* (2017) found that the maximum capacity of an ambulatory pharmacy can be exceeded if the same amount of staff received more workload. If the excessive process time was due to insufficient processing capacity, we suggest an overflow mechanism whereby available staff operating computers in the dispensing segment could be temporarily assigned to assist this bottleneck when their segment was idle as suggested by Dilrukshi *et al.* (2016).

The variety of categories of prescriptions received in each study site was also shown to affect the process time in this segment. Prescriptions requiring pharmacist intervention was the main contributing factor in all three study sites since it requires pharmacist to contact the prescriber to rectify any issues with the prescription before proceeding to the next segment. Prescriptions containing psychotropic substances and new SPUB prescriptions also contributed to the lengthy process time as they require additional steps in the PhIS data entry procedure.

Filling Segment

Filling is another segment that has many differences between all three study sites. This segment was divided into two separate groups in both KKBM and KKT with three persons assigned to filling and two persons assigned to labelling whereas in KKTL, two persons was assigned to this segment as a whole. The difference in staff assignment in KKBM and KKT was designed as an additional counterchecking measure to detect and resolve potential errors prior to dispensing. Even though the staff distribution in both KKBM and KKT was identical, the process time in KKT was longer, which may be attributed to their inefficient workflow due to space restriction as shown in Figure 4.
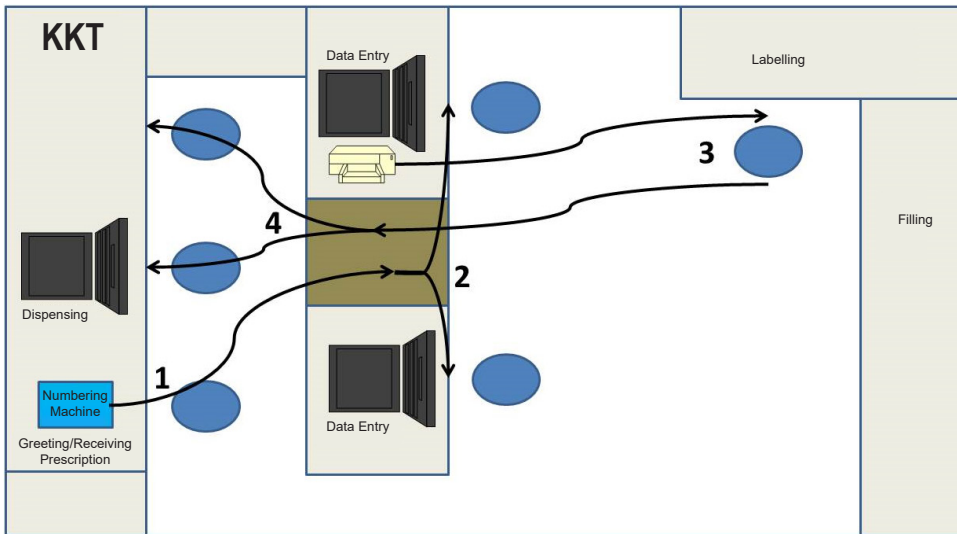

Figure 4: Layout and workflow in ambulatory pharmacy of KKT.

Notes: (i) Greeting/Receiving segment; (ii) Screening/Data entry segment; (iii) Filling segment; (iv) Counter-checking/Dispensing segment

Of all four segments, this segment requires the most room for flexibility to allow staff to easily assemble the contents of a prescription as discussed by Chou *et al.* (2010). Having limited room in the filling and labelling area compared to the other two study sites, staff in KKT have difficulty in manoeuvring a non-ergonomic workspace and was most likely the leading cause of the longer process time. Since relocation or extensive renovation is not an option, we suggest rearranging the overall filling area, focusing on improving the ergonomics, increasing mobility in workspace and prioritising item arrangements-based usage frequency.

Prescription type was shown to also be a major determining factor of process time in this segment. In this study, we have observed that prescriptions requiring pharmacist intervention, complex prescriptions (more than three items), and especially those containing psychotropic substances were shown to contribute to extended process time. Similar to data entry, Loh *et al.* (2017) also observed that psychotropic substances had a great influence in filling process time as they require extensive recording compared to standard medications. Apart from that, prescriptions with cold and SPUB items were also shown to lead to a longer process time. This may be attributed to the non-ergonomic layout of the filling area, particularly the placement of refrigerators in KKT and KKTL, and arrangement of SPUB items in KKBM and KKT.

Counter-Checking/Dispensing Segment

Similar to data entry, there were two persons assigned to dispensing in KKBM and KKT while only one person was assigned in KKTL. The process time was almost equal in all three study sites with a mean time of 0.63 min. The delay preceding dispending segment was also consistent in KKBM and KKT having equal number of staff but was significantly longer in KKTL. The number of staff manning dispensing counters have been identified as a factor affecting process capacity, and this will directly influence process time as studied by Loh *et al.* (2017). Since the infrastructure was sufficient, increasing the number of staff assigned to this segment may improve the process capacity and reduce both process and delay times.

On the other hand, prescriptions that encounter errors in data entry and filling segments prior to dispensing have shown to lead to longer process times in KKT and KKTL. This is because when an error is discovered by the dispenser, the prescription will need to be returned to preceding segments (where the error initially occurred) for rectification. This process depends heavily on the complexity of the error and the familiarity of staff with rectification procedures. In KKBM, the additional counter-checking measures implemented at the filling/labelling segment effectively curtailed this issue. More in-depth studies are required to reveal the importance of additional counterchecking steps throughout the process in reducing the potential errors encountered and to study its impact on waiting time.

Limitations

Unfortunately, this study has several limitations. Firstly, the selection criteria of the study limits observation to be done only on prescriptions that follow the standard four segment procedure of greeting, data entry, filling and dispensing. This omits other prescriptions that were registered for value-added services and those dispensed at the express counter offered exclusively in KKBM, which accounts for over 25% of prescriptions there. Future studies could be designed to focus on these prescription types and identify other factors that may be unique to each service.

Apart from that, despite precautions taken to ensure data was collected in normal dispensing workflow, certain biasness may have been introduced due to the Hawthorne effect whereby subjects may alter their behaviour when being observed (Shaat 2011). Although this effect was inevitable, long term studies could be performed more discretely to minimise its effect and provide a better estimate on the actual working condition.

Lastly, our data merely gives an indication of the overall pattern of waiting time by only collecting on the day of the week corresponding to the median prescription received of each study site. This data might not be generalisable to other days as each study site has varying fluctuations of prescriptions received throughout the week.

CONCLUSION

This study successfully quantified the current operational dispensing process of pharmacy units in the three main health clinics in Temerloh Health Clinic which laid a solid baseline for comparisons to be made in future studies. We also employed a quality improvement approach and revealed several common bottlenecks as well as variations in each health clinic that lead to excessive waiting time. We discovered that the lengthy waiting time in general was contributed to processing time of certain types of prescriptions received. The factors that lead to excessive waiting time identified in this study could be used to set a focus to spearhead the development of future optimisation strategies to improve efficiency and shorten waiting time. However, variations between study sites indicate a need to pinpoint and quantify more isolated issues, such as poor distribution of workforce and flaws in pharmacy layout in each health clinic, in order to address them individually.

ACKNOWLEDGEMENTS

REFERENCES

AFOLABI, M. O. & ERHUN, W. O. (2003) Patients' response to waiting time in an out-patient pharmacy in Nigeria, *Tropical Journal of Pharmaceutical Research*, 2(2): 207–214. https://doi.org/10.7324/JAPS.2012.21018

BLEUSTEIN, C., ROTHSCHILD, D. B., VALEN, A., VALATIS, E., SCHWEITZER, L. & JONES, R. (2014) Wait times, patient satisfaction scores, and the perception of care, *American Journal of Managed Care*, 20(5): 393–400.

CHOU, Y., CHEN, B., TANG, Y., QIU, Z., WU, M., WANG, S., LIN, H. & CHUANG, W. (2010) Prescription-filling process reengineering of an outpatient pharmacy, *Journal of Medical Systems*, 36: 893–902. https://doi.org/10.1007/s10916-010-9553-5

CLARK, S. & KLEIN, A. (2010) An analysis of current state workflow, workloads, and error rates in UMHS inpatient pharmacies. University of Michigan Health System. Available at: http://umich.edu/~ioe481/ioe481_past_reports/W1003.pdf

DILRUKSHI, P. A. D., NIRMANAMALI, H. D. I. M., LANEL, G. H. J. & SAMARAKOON, M. A. S. C. (2016) A strategy to reduce the waiting time at the outpatient department of the National Hospital in Sri Lanka, *International Journal of Scientific and Research Publications*, 6(2): 281–287. www.ijsrp.org.

JENKINS, A. & ECKEL, S. F. (2012) Analyzing methods for improved management of workflow in an outpatient pharmacy setting, *American Journal of Health-System Pharmacy*, 69(11): 966–971. https://doi.org/10.2146/ajhp110389

LIN, A. C., JANG, R., LOBAS, N., HEATON, P., IVEY, M. & NAM, B. (1999) Identification of factors leading to excessive waiting times in an ambulatory pharmacy, *Hospital Pharmacy*, 34(6): 707–712. https://doi.org/10.1177/001857879903400609

LOH, B. C., WAH, K. F., TEO, C. A., KHAIRUDDIN, N. M., FAIRUZ, F. B. & LIEW, J. E. (2017) Impact of value-added services on patient waiting time at the ambulatory pharmacy Queen Elizabeth Hospital, *Pharmacy Practice*, 15(1): 1–7. https://doi.org/10.18549/PharmPract.2017.01.846

MINISTRY OF HEALTH MALAYSIA (2016) Guide to good dispensing practice, *Pharmaceutical Service Division*, 1st edition. pp. 1–17. https://www.pharmacy.gov.my/v2/sites/default/files/document-upload/gdsp-2016-final.pdf

PRESS GANEY ASSOCIATES, INC. (2009) Medical practice — patient perspectives on American health care, *Pulse Report 2009*. http://pressganey.com (14 March 2018).

SHAAT, M. (2011) Improving pharmacy dispensing performance through time management. Masters diss., Royal College of Surgeons in Ireland, Dublin.

SLOWIAK, J. M., HUITEMA, B. E. & DICKINSON, A. M. (2008) Reducing pharmacy wait time to promote customer service*, Quality Management in Health Care*, 17(2): 112–127. https://doi.org/10.1097/QMH.0000000000000045

THOMPSON, D. A. & YARNOLD, P. R. (1995) Relating patient satisfaction to waiting time perceptions and expectations: The disconfirmation paradigm, *Academic Emergency Medicine*, 2(12): 1057–1062. https://doi.org/10.1111/j.1553-2712.1995.tb03150.x

VALENTINE, N., DE SILVA, A., KAWABATA, K., DARBY, C., MURRAY, C. J. L. & EVANS, D. B. (2003) Health system responsiveness: Concepts, domains and operationalization, IN: D. B. EVANS & C. J. Murray (Eds). Health system performance assessment: Debates, methods and empiricism. Geneva: World Health Organization, pp. 573–680. https://www.researchgate.net/publication/242475744