



## AN APPROACH TO IMPROVE OF THE CYTOTOXIC DRUGS COMPOUNDING SERVICE SYSTEM FOR OUT - PATIENT DEPARTMENT IN NAKARA HOSPITAL KHON KAEN PROVINCE

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### Abstract

The objective of this study was to study the current situation and the problems in the Cytotoxic drug compounding service system by collecting the time data in each process in the system in order to specify an approach and a primary improvement of the system for outpatients. This approach was used to analyze the work procedure and the flowchart of the working process in order to compare the queuing delay with the service time. Also, the Fishbone Diagram and the Pareto Chart were used to find causes of the problems. The result found that the processes of the fax receiving and the accuracy checking of the Cytotoxic drugs' prescription by pharmacists were the causes of the queuing delay. Therefore, the researcher introduced the document scanning to the pharmacists to improve the service system of the Cytotoxic admixture for the outpatients. The primary result of the improvement found that the average delay of the system of the Cytotoxic admixture service was decreased from 110.01 minutes to 75.54 minutes. It meant that the queuing time was reduced 31.33 percent from the previous time, and this approach could decrease the number of the complained outpatients from 50 to 11 persons averagely per month or 78 percent from the previous one.

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**Keywords:** The Cytotoxic drug compounding service system, Outpatients, C order viewer scanning

## Introduction

Cancer is a major public health problem. It is the first leading cause of death of the country for more than 10 years, since 1998 to 2013. It is also increasing every year, especially in the year 2013 that there were 104.8 cases passing away from cancer per one hundred thousand population [1]. The pharmaceutical unit at Nakara Hospital is responsible for the Cytotoxic drugs compounding service system in order to treat patients with cancers. The scope of the Cytotoxic drugs compounding service system includes the provision of the Cytotoxic drugs compounding service for inpatients and outpatients. The volume of work of the Cytotoxic drugs compounding service system included 24,073, 26,087 and 27,547 prescriptions and there were 36,560, 38,808 and 41,647 types of drugs in the fiscal year 2012, 2013 and 2014 respectively [2]. The volume of prescriptions of the Cytotoxic drugs compounding is increasing every year. Also, it was found that there were complaints from the patients who were treated at the hospital about the delay of the Cytotoxic drugs compounding service system. The patients did not receive the Cytotoxic drugs compounding service within the day that they received treatment at the hospital, so they had to sleep over to receive chemotherapy the next day. The patients wasted their time and spent more on accommodation and travel expenses. The number of the patients complaining and those who had to postpone the day of receiving chemotherapy were about 50 cases per month, representing 10.30 percent of the total number of the outpatients per month. For these reasons, the researcher studied the approach to improve the system of the Cytotoxic drugs compounding service system for the outpatients in order to reduce the queuing time so that the patients can receive timely treatment according to the treatment plan and do not have to postpone the day of receiving chemotherapy.

## Objectives

1. To study the approach to improve the Cytotoxic drug compounding service system for the outpatients at Nakara Hospital. The sub-objectives are as follows.
2. To study the current situation and the problems in the system of the Cytotoxic drug compounding service system for the outpatients.
3. To identify the approach and improve the Cytotoxic drug compounding service system for the outpatients
4. To compare the results before and after the improvement of the system of the Cytotoxic drug compounding service system for the outpatients.

## Methodology

This study was the study of the current situation and the problems of the Cytotoxic drugs compounding service system for the outpatients at Nakara Hospital and the investigation of the causes of the problems in the Cytotoxic drugs compounding service system for the outpatients. The results of the study were used to determine the approach to improve the Cytotoxic drugs compounding service system for the outpatients and also operated the primary improvement. Then the comparison of the results of before and after the improvement was conducted. The study was conducted according to the following objectives.

1. **Study of the current situation and the problems in the Cytotoxic drug compounding service system for the outpatients:** The work procedure, the flow process chart [3], the process of the Cytotoxic drugs compounding and the service time [4] were analyzed. The time in each process of the Cytotoxic drug compounding service system was collected from December 1, 2014 to January 31, 2015. The study was conducted at five outpatient examination rooms, including the General Medicine Examination Room, the Pediatric Examination Room, the Surgical Examination Room, the Radiation Examination Room and the Ophthalmic Examination Room. Also, the problems of the process were analyzed to find out at what stage of the process made the Cytotoxic drugs compounding service system delay. The Fishbone Diagram and the Pareto Chart were used to consider the causes of the problems.[5]

2. **Identifying the approach and primary improving the Cytotoxic drug compounding service system for the outpatients:** The causes of the problems were analyzed to find out the approach to improve the system of the Cytotoxic drug compounding service system by focusing on the major causes that can be possibly solved. The meeting of pharmacists and pharmaceutical staff was held to propose and conclude the approach for the improvement. After that, the approach for the improvement was put in the flow process chart which the preliminary testing had already been adjusted and done. The time in each process of the Cytotoxic drug compounding service system was collected by timesheet from December 1, 2014 to January 31, 2015, and the study was conducted at five outpatient examination rooms, including the General Medicine Examination Room, the Pediatric Examination Room, the Surgical Examination Room, the Radiation Examination Room and the Ophthalmic Examination Room. The information of the time used in each process was presented by percentage and mean.

3. **Comparing the results before and after the improvement of the Cytotoxic drug compounding service system for the outpatients:** The average time of each process before and after the improvement of the service was compared and presented by percentage.

## Results of the study

### 1. The study of the current situation and the problems in the Cytotoxic drug compounding service system for the outpatients

The study of the process of the Cytotoxic drugs compounding service system for the outpatients was conducted at five outpatient examination rooms, including the General Medicine Examination Room, the Pediatric Examination Room, the Surgical Examination Room, the Radiation Examination Room and the Ophthalmic Examination Room from December 1, 2014 to January 31, 2015: 40 working days. There were 1,109 prescriptions and 1,803 types of drugs. The work procedure and the flow process chart of eight processes of the Cytotoxic drugs compounding service system were studied. The eight processes in the system included the followings. Step 1: the pharmacist received fax of the prescription and checked its accuracy. Step 2: the pharmaceutical officer recorded the prescription and printed the drugs preparation documentation and label. Steps 3: the pharmacist checked the accuracy of the drugs preparation documentation and label and faxed the prescription. Step 4: the officers at the drugs

compounding service prepared the drugs, fluid and equipment. Stage5: the pharmacist checked the accuracy of the drugs, fluid and equipment used for the drug preparation, the documentation of *drug* preparation and *chemotherapy* prescription before submitting them to the Cytotoxic drugs compounding room. Step 6: drugs were waited for the compounding. Step 7: the pharmacist compounded the drugs. Step 8: the pharmacist verified the accuracy and the tidiness of the pharmaceutical dosage.

The average waiting time of patients on the process of the Cytotoxic compounding service system before the improvement was 110.01 minutes. It was found that time lost was mainly occurred in Step 1 which was the process that the pharmacist received the fax and verified the accuracy of the prescription. It was found that the average waiting time in the process of receiving the chemotherapy prescription and checking the accuracy of prescription was 78.78 minutes, representing 71.61 percent of the total waiting time as shown in Table 1.

Therefore, the waiting time in the process of receiving fax and checking the accuracy of the prescription took the longest time to all the processes of the Cytotoxic compounding service system. As a result, the patients complained about the service. Thus, this study aimed to shorten the waiting time for chemotherapy by reducing the amount of time in the process of receiving fax and checking the accuracy of the prescription in order to primarily improve the Cytotoxic drug compounding service system for the outpatients at Nakara Hospital.

According to the analysis of the causes of the problems using the Fishbone Diagram and the Pareto Chart, the 4 factors were analyzed by the Fishbone Diagram.

1. The prescription: A copy of the prescription was unclear and the handwriting was difficult to read. Many prescriptions were sent at the same time.
2. Working process: There were many steps in working and the process of sending the prescription failed.
3. Equipment: A fax machine was out of order.
4. Personnel: Personnel lacked of skills in sending faxing; did not send the prescription immediately and also forgot to send the prescription.

After that, the pharmaceutical unit also studied and recorded the information of these causes to see which cause often occurred in order to explore the approach to improve it. The information was used to construct the Pareto diagram to determine the major causes of the delayed fax receiving and the accuracy checking of the prescription. The major causes of the problem were revealed as follows.

- 1) A copy of the prescription was unclear: 61.9 percent.
- 2) The prescription was not sent right away and also the staff forgot to send it: 17.5 percent.
- 3) The prescription sending was failed: 11.2 percent.
- 4) A fax machine was out of order: 6.2 percent.
- 5) The handwriting was difficult to read: 3.2 percent.

From the analysis the causes of the problem, it was found that about 80 percent of the causes were from the unclear copy of the prescription (61.9 percent) and not sending the prescription right away and forgetting to send the prescription (17.5 percent). The problem of not



sending the prescription right away and forgetting to send the prescription must be resolved by making the understanding with the personnel at the outpatient examination rooms. Therefore, the pharmaceutical unit focused on solving the problem of unclear prescription in order to shorten the time of the process of fax receiving and accuracy checking of the prescription.

**2. Identifying the approach and primary improving the Cytotoxic drug compounding service system for the outpatients:** The approach for the improvement was obtained from the meeting of the pharmaceutical unit and other related departments, including the outpatient examination rooms and the outpatient chemotherapy unit. The C order ViewerB scanning technology was used instead of a fax machine. The personnel studied the scanning technology for sending the prescriptions. The project for searching for the appropriate scanning technology was done. The training on the scanning system was also provided. The verification of the prescription sending and the trial of scanning system were also arranged.

The advantages of using the C order ViewerB scanning instead of the fax machine include that a copy of the prescription is clear and those who send the prescription can check the submission of the prescription on their own. Moreover, each prescription which is sent via the C order ViewerB scanning can be monitored. The information of the prescription is recorded and it can be browsed back anytime and the prescription can be reprinted. In addition, it is easy and convenient and the prescription can be sent right away.

Then, the management within the pharmaceutical unit and among the pharmaceutical unit, outpatient examination rooms and the outpatient chemotherapy unit was done. Training and explanation on the instructions of the scanning system on how to reprint the prescription, information transferring and accessing to the information in order to do the report were also managed.

After that, the approach for the improvement was put in the flow process chart which the preliminary testing had already been adjusted and done. The time in each process of the Cytotoxic drug compounding service system was collected from March 1, to April 30, 2015. The study was conducted at five outpatient examination rooms, including the General Medicine Examination Room, the Pediatric Examination Room, the Surgical Examination Room, the Radiation Examination Room and the Ophthalmic Examination Room from March 1, to April 30, 2015 for a period of 39 days. During that time, there were 1,063 prescription and 1,641 types of drugs. It can be seen that the number of steps and the flow process chart were not changed. The only change was the use of the scanner and the C order ViewerB scanning instead of the fax. The first step was changed from receiving the prescription from the fax to receiving the prescription from the scanner. The average waiting time of process of the Cytotoxic drug compounding service after the improvement was 75.54 minutes.

**3. Comparing the results before and after the improvement of the Cytotoxic drug compounding service system for the outpatients:** It was found that after the Cytotoxic drug compounding service system was primarily improved by using C order ViewerB scanning instead of a fax machine to send a prescription, the average time of the Cytotoxic drug compounding service reduced to 75.54 minutes while that of before the improvement was 110.01 minutes. In addition, the duration of the procedure that the pharmacist received and checked the prescription reduced to 41.07 minutes (54.37 percent of the total waiting time) while that of

before the update was 78.78 minutes (71.61 percent of the total waiting time)

Therefore, it was obvious that after the improvement of the Cytotoxic drug compounding service system for the outpatients, the average waiting time reduced from 110.01 minutes to 75.54 minutes, representing 31.33 percent of the reduction by using C order ViewerB scanning instead of a fax machine to send a prescription. The duration of the procedure that the pharmacist received and checked the prescription reduced from 78.78 minutes to 41.07 minutes, considering 54.37 percent of the total waiting time. This allowed the patients to receive chemotherapy faster and the number of complaints from patients reduced from the average of 50 cases per month to 11 cases per month, considering 78 percent decrease from the previous complaints.

## Conclusion and recommendations

### 1. Conclusion of the study

The objective of this study was to study the approach to improve the Cytotoxic drug compounding service system for outpatients at Nakara Hospital. The sub-objectives were to study the current situation and the problems in the Cytotoxic drug compounding service system for the outpatients and to identify the approach and improve the Cytotoxic drug compounding service system for the outpatients, to compare the results before and after the improvement the Cytotoxic drug compounding service system for the outpatients at Nakara Hospital For specify the approaches to solve the problems in order to shorten the waiting time and improve the Cytotoxic drug compounding service system for the outpatients of the pharmaceutical unit at Nakara Hospital.

There were complaints from patients who received the treatment at the hospital about the delay of the Cytotoxic drugs compounding service. The patients did not receive the Cytotoxic drugs compounding service within the day that they received treatment at the hospital, so they had to sleep over in order to receive chemotherapy the next day. The patients wasted their time and spent more on accommodation and travel expenses. The number of patients complaining and those who had to postpone the day of receiving chemotherapy were about 50 cases per month, representing 10.30 percent of the total number of outpatients per month. For these reasons, the researcher studied the approach to improve the Cytotoxic drugs compounding service system for the outpatients to reduce the queuing time so that the patients can receive timely treatment according to the treatment plan and do not have to postpone the day of receiving chemotherapy.

The current situation and the problems of the Cytotoxic drugs compounding service system for the outpatients were studied by analyzing the work procedure and the flow process chart consisting of eight processes. After that, the time in each process of the Cytotoxic drug compounding service system before the improvement was collected by using timesheet from December 1, 2014 to January 31, 2015. The average waiting time of patients on the Cytotoxic compounding service system before the improvement was 110.01 minutes. It was found that time lost was mainly caused in Step 1 which was the process that the pharmacist received the



fax and verified the accuracy of the prescription, which was 78.78 minutes, representing 71.61 percent of the total waiting time.

Therefore, the waiting time was in the process of receiving fax and checking the accuracy of the prescription took the longest time to all the processes of the Cytotoxic compounding service system. Thus, this study aimed to shorten the waiting time for chemotherapy by reducing the amount of time in the process of receiving fax and checking the accuracy of the prescription in order to primarily improve the Cytotoxic drug compounding service system for the outpatients at Nakara Hospital.

From the analysis the causes of the problems, it was found that about 80 percent of the causes were from the unclear copy of the prescription (61.9 percent) and not sending the prescription right away and forgetting to send the prescription (17.5 percent). The problems of not sending the prescription right away and forgetting to send the prescription must be resolved by making the understanding with the personnel at the outpatient examination rooms. Therefore, the pharmaceutical unit focused on solving the problem of unclear prescription in order to shorten the time of the process of fax receiving and accuracy checking of the prescription.

After that, the Pareto Chart was used to consider the possible causes of the problems. It was found that the problem that can possibly be solved was the unclear copy of the prescription. So the solution focused on the cause of the unclear copy of the prescription.

Then the approach of the improvement was set and the primary improvement of the Cytotoxic compounding service system was done. The time in the process of fax receiving and accuracy checking was reduced by adding the improvement into this process. The C order ViewerB scanning was used instead of the fax machine to send the prescriptions from the outpatient examination rooms. The flow process chart of the work procedure after the improvement was also done and it was found that the processes of the Cytotoxic compounding service system consisted of 8 process as that of before the improvement. It only changed the way of sending prescriptions from sending through the fax machine to the C order ViewerB scanning. After that, the time in each process of the Cytotoxic drug compounding service system after the improvement was collected by using timesheet from March 1, 2014 to April 31, 2015. It was found that the average waiting time of patients on the process of the Cytotoxic compounding service system reduced to 75.54 minutes while that of before the improvement was 110.01 minutes, considering 31.33 percent of reduction. Moreover, the duration of the procedure that the pharmacist received and checked the prescription reduced to 41.07 minutes while that of before the update was 78.78 minutes, considering 47.87 percent of reduction. It was 54.37 percent of the total waiting time while that of before the improvement was 71.61 percent. In addition, the number of complaints from patients reduced from the average of 50 cases per month to 11 cases per month, considering 78 percent decrease from the previous complaints.

## 2. Recommendations

The information system is extremely important in improving the work procedure. Therefore, the information system should be provided to all the processes of providing treatments for patients. This allows the work procedure to improve. The doctor can prescribe chemotherapy via the information system. Then, the pharmacist at the Cytotoxic compounding

service receives the prescription. Also, the staff at the chemotherapy unit is also able to see the prescription of the doctor as well, so drugs and chemotherapy equipment are prepared in advance. As a result, the patient can be administered with chemotherapy immediately. These can help reduce the waiting time, the medication errors and the disputes within the service unit about the failure of sending prescriptions and forgetting to send prescriptions. This improvement is in the progress. Moreover, knowledge management of the staff should be administered. For example, skill training for accessing to the system correctly should be provided. The staff should be allowed to monitor the work of their own in order to work effectively.

However, the time spent in the study was limited. In fact, the data of the prescribing error, the drugs compounding error and the dispensing error should be collected in order to assess the quality of the performance. The data collection of the worthiness of the improvement of the Cytotoxic compounding service system should also be done by the estimated cost of the patients staying overnight or coming back to receive treatment the next day. Furthermore, the satisfaction of the patients, the personnel at the examination rooms, the personnel at outpatient chemotherapy service and the personnel at the Cytotoxic compounding service unit toward the improved service should be assessed to understand the attitudes of both internal and external customers in order to improve the quality of the Cytotoxic compounding service which will lead to continuous improvement.

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**Table1:** The waiting time of patients on the process of the Cytotoxic compounding service before the improvement

Process	Average time (minutes)	percentage
The pharmacist received fax of the prescription and checked its accuracy.	78.78	71.61
The pharmaceutical officer recorded the prescription and printed the drugs preparation documentation and label.	3.02	2.74
The pharmacist checked the accuracy of the drugs preparation documentation and label.	1.20	1.09
The officers prepared the drugs, fluid and equipment.	5.03	4.57
The pharmacist checked the accuracy of the drugs, fluid and label before submitting them to the Cytotoxic drugs compounding room.	1.00	0.91
Drugs were waited for the compounding.	3.00	2.73
The pharmacist compounded the drugs.	16.42	14.93
The pharmacist verified the accuracy of the pharmaceutical dosage.	1.56	1.42
<b>Total</b>	<b>110.01 minutes</b>	<b>100</b>

**Table 2:** The waiting time of each process of the Cytotoxic drug compounding service after the improvement

Process	Average time (minutes)	percentage
The pharmacist received fax of the prescription and checked its accuracy.	41.07	54.37
The pharmaceutical officer recorded the prescription and printed the drugs preparation documentation and label.	2.95	3.91
The pharmacist checked the accuracy of the drugs preparation documentation and label.	1.10	1.46
The officers prepared the drugs, fluid and equipment.	4.12	5.45
The pharmacist checked the accuracy of the drugs, fluid and label before submitting them to the Cytotoxic drugs compounding room.	0.34	0.45
Drugs were waited for the compounding.	0.45	0.59
The pharmacist compounded the drugs.	25.01	33.11
The pharmacist verified the accuracy of the pharmaceutical dosage.	0.50	0.66