

# Optimize Outpatient Pharmacy Service Process: Shorten Waiting Time and Improve Patient Satisfaction

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## Technical advance

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# Abstract

**Background:** To provide scientific decision-making basis for managers to improve management methods, so about make outpatient pharmacy service flow smoother and more efficient, shorten the waiting time for patients to take medicine and improve patient satisfaction.

**Methods:** Based on the concept of BI, the existing data onto outpatient pharmacy in our hospital were analyzed in depth, and the time distribution rule of prescription dispensing was found. By real-time analysis of the number of patients in the upstream link to the medication withdrawal step, the early warning of the number of patients was realized. Regularity and real-time early warning of the number of medicines users should establish a flexible and efficient scheduling system for pharmacists, so about maximize the use efficiency of human resources in outpatient pharmacies. Mean while, rearranged the medicines shelves according to the relevancy analysis of medicines in the same prescription, to reduce the walking distance of staff.

**Results:** Based on the optimization of outpatient service process of large data, the waiting time for patients to take medicine was shortened from more than 15 minutes to less than 10 minutes, satisfaction increased from less than 65% to more than 85%, and the use of personnel was maximized.

**Conclusions:** Through in-depth analysis and deep excavation of the real-time monitoring of outpatient prescription volume, managers can improve the outpatient service process, and through the monitoring and early warning of outpatient prescription volume, employees can be arranged, which is helpful to realize the digital, refined and intelligent management of the hospital.

## Background

Among the factors influencing the comprehensive competitiveness of hospitals, more and more attention has been paid to the advanced service concept [1].As one of the important windows of hospitals, outpatient pharmacies provide better medical services for patients, which plays a very important role in gaining the trust in patients and alleviating the relationship between doctors and patients. According to the investigation of a third party company (Beijing Zero Point company) commissioned by the municipal Health and Family Planning Commission and relevant research[2,3,4,5,6 ], the main factors affecting the satisfaction of outpatient pharmacy focus on the several aspects, which are waiting time, medicines price, waiting environment and service attitude. Outpatient pharmacy is the last link patients' consultation. The long waiting time will reflect the level of hospital management and affect patients ' satisfaction with the hospital [7, 8, 9, 10]. Especially during peak visits, the smoothness of waiting process and the skill of window staff can affect patients 'mood and the image of the hospital [11] .It was found that the reasons for the long waiting time of taking medicine were the unreasonable space layout of the pharmacy, the uncomplicated process and the unreasonable personnel arrangement by the investigation[12]. This paper discusses how to shorten the waiting time of patients' taking medicine and improve the service satisfaction of pharmacy by improving the spatial layout and personnel scheduling of pharmacy .To this end, in February 2019, We introduced the BI concept to conduct in-depth analysis, real-time monitoring

and early warning of the existing data, so about establish a flexible and efficient scheduling system for pharmacists and maximize the use efficiency of human resources in outpatient pharmacies [13]. Also, the position of medicine shelves was adjusted to reduce the distance from deployment personnel and improve work efficiency. The present report is as follows.

## Methods

Use BI concept to make outpatient pharmacy service more efficient. By arranging the location of pharmacists and medicines, we can improve work efficiency and make the allocation of human resources and hardware resources more reasonable, so about shorten the waiting time for patients to take medicine, improve patient satisfaction.

## Large Data Analysis of Outpatient Prescription Volume

To sort out the prescription time points in the whole year of 2019, find out the law of peak number of medicines users, the frequency of medicines used and the correlation degree of medicines on the same prescription, and arrange the location of pharmacists and medicines.

## Real-time monitoring for outpatient prescription volume

According to the real-time monitoring of the amount of prescription to be dispatched—the amount of prescriptions in dispensing and the amount of prescriptions dispatched, the number of dispatching windows and the number of dispatched personnel should be adjusted in time to achieve the optimal dispensing ratio of the number of personnel of both ends of the medicines slide under the condition that the total number of existing pharmacists remains unchanged, minimizing patient waiting for medication. Real time monitoring data onto outpatient prescriptions (Fig. 1).

## Statistical method

Applying SPSS21.0 statistical software to calculate the time median (least value largest value) [M(min-max)];The waiting time of patients before and after BI, the waiting time for patients to take medicine at different time after BI application and the distribution of people in different waiting time periods were also counted.

## Results

## Large Data Analysis of Outpatient Prescription Volume

### Distribution of Prescription Quantity throughout 2019

The peak period of medicine taking is 10:00–11:00 in the morning and 15:30 – 16:30 in the afternoon, as shown in Fig. 2., we have made corresponding adjustments to the scheduling of personnel (Fig. 3).

# Analysis of Medicines Association Degree and Frequency of Medicines Use

Through large data analysis, we found that out of 800 kinds of medicines in outpatient pharmacies, there are more than 120 kinds of medicines with high correlation degree, and more than 150 kinds of medicines appear in prescriptions much more than other varieties. The medicines with high correlation degree are close to each other and the medicines with high frequency are adjusted to the shelves near the dispensing table.

## Waiting time and satisfaction before and after BI application

Comparing the data onto four months before and after BI application, the waiting time for patients to take medicine decreased from more than 15 minutes to less than 10 minutes, satisfaction increased from less than 65% to more than 85% (Table 1).

Before application	After application							
	October	November	December	January	February	March	April	May
Average waiting time(min)	7.28	15.58	16.2	14.17	10.02	8.51	9.18	9.51
Patient satisfaction (%)	62.75	64.22	61.90	65.00	86.10	88.78	88.32	85.95

Table 1

Medicines waiting time before and after BI application (min)

## The waiting time for patients to take medicine at different time after BI application

The peak time of taking the medicine on normal working days is 10:00–11:00 in the morning and 15:30 – 16:30 in the afternoon. The waiting time for taking medicine is long (Table 2).

Table 2  
The waiting time for patients to take medicine at different time after BI application

Time slot	W Waiting time for taking medicineM(Min-Max)
08:00–09:00	8.59(1.33–12.50)
09:00–10:00	9.09(2.66–18.88)
10:00–11:00	10.81(1.45–14.32)
11:00–12:00	9.10(3.20-18.76)
12:00–12:30	3.98(0.85–8.62)
14:30 – 15:30	8.89(0.98–19.23)
15:30 – 16:30	11.00(2.54–13.36)
16:30 – 17:30	7.78(0.99–15.56)
17:30 – 18:30	5.46(0.45–10.77)

## Distribution of population in different waiting periods after BI application

88.93% of patients had access to the medicines within 16 minutes, and 61.11% had access to the medicines within 10 minutes (Table 3).

Table 3  
Population distribution in different waiting periods after BI application

Waiting time(min)	Person time	Composition than(%)
< 4	284	11.07
4–7	646	25.18
7–10	638	24.86
10–13	452	17.61
13–16	262	10.21
> 16	284	11.07

## Real-time Early Warning of Outpatient Prescription Quantity

Generally speaking, the waiting time for patients to take medicines = the time spent in dispensing prescriptions + the waiting time for dispensing medicines + the time for dispensing medicines. That is = the amount of prescriptions in the current stacked pharmacy \*the average time spent in dispensing each medicines / the number of dispatches + the average time of dispensing each medicine; the amount of

prescriptions in the current stacked pharmacy = the amount of prescriptions to be dispensed + the amount of prescriptions in dispensing; the number of dispatches = (the amount of prescriptions to be dispensed + the amount of prescriptions in dispensing) \* the average time of dispensing each medicine / (the waiting time for patients to take medicines - the average time of issuance)

A total of 64160 outpatients were selected from our hospital from January 1, 2019 to January 31, 2019. The data were collected from real-time monitoring of outpatient prescriptions. The average time of dispensed each medicines was calculated to be 50 seconds and the average time spent in dispensing each medicines to be 180 seconds. According to our target value, the waiting time for the patient to take medicine is shortened to less than 10 minutes, which is assumed to be 10 minutes. When we open three distribution windows, the number of dispatchers = (the amount of prescription to be dispensed + the amount of prescription to be dispensed) \* 180 / (600 - 50), that is:

The number of dispatches = (the amount of prescription to be dispensed + the amount of prescription to be dispensed) / 3

The amount of prescriptions dispatched = (the waiting time for patients to take medicines - the average time of dispensing each medicine - the average time of issuance) / time spent in dispensing each medicines \* number of dispensers  $\approx$  22. that is:

When the amount of prescriptions dispatched > 2, you need to increase the number of medicines dispensing personnel.

## Discussion

At present, the automation of hospital pharmacy and medical information technology have been used in clinical pharmacy services, and the work efficiency and quality of pharmaceutical services had also been improved [14, 15]. After Lin lewei [16] studied the sale of automation system in his hospital, it was found that the annual return on investment were only 0.15%, which indicated that the average number of outpatient visit per day was less than 4000, and the economic efficiency of using automated dispensing system was not obvious. Because automation can't be spread in a large area in a short period of time, most hospital pharmacies still use people-centered dispensing mode at present. With the deepening of artificial intelligence and information technology, pharmacies will develop towards intelligence and automation in the future [17, 18]. So, we have made a thorough analysis of the data available in the outpatient pharmacy and made full use of the intelligent control system to improve the efficiency of pharmacists and shorten the waiting time for patients to take medicine, improve service satisfaction of outpatient pharmacy.

First of all, we comb through the prescription time points of 2019 throughout the year, and find that the average peak daily occurrence time is (10:00–11:00) in the morning and (15:30 – 16:30) in the afternoon. For this reason, we make flexible shifts according to the peak period, increase the number of staff during peak period, and timely transfer of staff during low period. If the peak period is ahead or wrong, we will

check and warn the outpatient prescription volume, and adjust the proportion of dispatchers and dispatchers according to the amount of prescription to be dispatched—the amount of prescriptions in dispensing and the amount of prescriptions dispatched, so about make the ratio of dispatchers and dispatchers and, so about shorten the waiting time for patients to take medicines.

Through data analysis, the distribution frequency of each medicines and the correlation degree of each prescription is sorted out, and the medicines are rearranged, so that the medicines with high frequency are closer to the dispensing table and the medicines with high correlation degree are closer to each other, thus reducing the labor intensity of dispensing by pharmacists and reducing the walking steps of dispensing each prescription.

## **Conclusions**

Through more than a year of practice, we have now achieved that the average waiting time of patients has been reduced from more than 15 minutes to less than 10 minutes ,satisfaction increased from less than 65% to more than 85%,that with the total number of pharmacists unchanged, and this is still on the basis of the increasing number of outpatient clinics in hospitals.

In the future, we will continue to use information technology to sort out Pharmacists' work efficiency curve according to each time point of the process of taking medicines. We will learn about each Pharmacists ' work efficiency area so as to arrange personnel more reasonably, improve work efficiency and save more time. At the same time, we will continue to strengthen pharmaceutical personnel training in order to improve overall quality of the pharmaceutical personnel and reduce errors.

It is also possible to optimize the operation process and strengthen the division of labor and cooperation among staff members by adding pharmacy services such as auditing posts, medicines consulting office and safety knowledge publicity, so about keep them in good working condition [19]. Improve the quality and quality of pharmacy service, so about improve patient satisfaction.

## **Abbreviations**

BI: Business Intelligence

## **Declarations**

## **Ethics approval and consent to participate**

Not applicable.

## **Consent for publication**

Not applicable.

## Availability of data and materials

The data that support the findings of this study are available from the third party company (Beijing Zero Point company) and information center of the fifth hospital of Xiamen but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the third party company (Beijing Zero Point company) and information center of the fifth hospital of Xiamen.

## Competing interests

The authors declare that they have no competing interests.

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## Authors' contributions

WQ, QX and FL contribute to the concept and research design of the paper. WQ and QX collected and analyzed the data. JY and FL play a key role in data analysis. FL is statistically analyzed. WH wrote the first draft of the article. In terms of data analysis and interpretation .WQ, QX, JY, FL and other authors have made great contributions to the final data analysis and interpretation, and made critical modifications to the paper. WQ and FL reviewed and edited the paper. All authors read and approved the final manuscript.

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## References

1. Lee SYD, Chen WL, Weiner BJ. Communities and Hospitals: Social Capital Community Accountability, and Service Provision in U.S. Community Hospital Health Serv Res. 2004 Oct; 39(5): 1487–1508.
2. Liu JI, Mao Y. Patient Satisfaction with Rural Medical Services: A Cross-Sectional Survey in 11 Western Provinces in China. *Int J Environ Res Public Health*. 2019 Oct; 16(20): 3968.
3. Hussain A, Sial MS, Usman SM, Hwang J, Jiang Y, Shafiq A. What Factors Affect Patient Satisfaction in Public Sector Hospitals: Evidence from an Emerging Economy. *Int J Environ Res Public Health*. 2019 Mar; 16(6): 994.
4. Dargahi H, Khosravi SH. Hospitals Pharmacy Quality Assurance System Assessment in Tehran University of Medical Sciences, Iran. *Iran J Public Health*. 2010; 39(4): 102–113.
5. Abdrrahman SS, Teni FS, Girmay G, Moges E, Tesfa M, Abraha M. Satisfaction of clients with the services of an outpatient pharmacy at a university hospital in northwestern Ethiopia: a cross-sectional study. *BMC Health Services*. 2015; 15: 229.
6. Geberu DM, Biks GA, Gebremedhin T, Mekonnen TH. Factors of patient satisfaction in adult outpatient departments of wing and regular services in public hospitals of Addis Ababa, Ethiopia: a comparative cross-sectional study. *BMC Health Serves*. 2019;19: 869.
7. Loh BC, Wah KF, Teo CA, Khairuddin NM, Fairuz FB, Liew JE. Impact of value added services on patient waiting time at the ambulatory pharmacy Queen Elizabeth Hospital. *Pharm Pract (Granada)*. 2017 Jan-Mar; 15(1): 846.
8. Sundmacher L, Kopetsch T. Waiting times in the ambulatory sector - the case of chronically ill patients. *Int J Equity Health*. 2013;12: 77.
9. Aziz MM, Ji WJ, Masood I, Farooq M, Malik MZ, Chang J, Jiang M, Atif N, Fang Y. Patient Satisfaction with Community Pharmacies Services: A Cross-Sectional Survey from Punjab; Pakistan. *Int J Environ Res Public Health*. 2018 Dec; 15(12): 2914.
10. Helbig M, Helbig S, Kahla-Witzsch HA, May A. Quality management: reduction of waiting time and efficiency enhancement in an ENT-university outpatients' department. *BMC Health Serves*. 2009;9: 21.
11. Al Fraihi KJ, Famco D, Famco F, Latif SA. Evaluation of outpatient service quality in Eastern Saudi Arabia: Patient's expectations and perceptions. *Saudi Med J*. 2016 Apr; 37(4): 420–428.
12. Nigussie S, Edessa D. The Extent and Reasons for Provided With Pharmacy Services at Two Hospitals in Eastern Ethiopia. *Front Pharmacology*. 2018; 9: 1132.
13. Juffali LAA, Knapp P, AL-Aqeel S, Watson MC, Lobna Abdullah Al Juffali, Peter Knapp, Sinaa Al-Aqeel, Margaret C Watson. Medication safety problems priorities in community pharmacy in Saudi Arabia: a multi-stakeholder Delphi study using the human factors framework. *BMJ Open*. 2019; 9(11): 032419.
14. Schumock GT, Ursan ID, Crawford SY, et al. Pharmacy practice of small and rural hospitals in irinoi - 2011. *Am J Health Syst Pharm*. 2013;70(13):1144-1152.
15. Walsh KE, Chui MA, Kieser MA, Williams SM, Sutter SL, Sutter JG. Exploring the impact of an automated prescription-filling device on community pharmacy technical workflow. *Am Pharm*

Assoc.2011;51(5):613-618.

16. Mahmoodabadi AD, Langarizadeh M, Mehrjardi MHM, Emadi S. Development of Managerial Key Performance Indicators for A Hospital Pharmacy Digital Dashboard.Iran J Pharm Res. 2019 Autumn; 18(4): 2124–2130.
17. Boyd AM, Chaffee BW, et al. Critical Evaluation of Pharmacy Automation and Robotic Systems: A Call to Action.Hosp Pharm. 2019 Feb; 54(1): 4–11.
18. Uy RCY, Kury FP, Fontelo PA. The State and Trends of Barcode, RFID, Biometric and Pharmacy Automation Technologies in US Hospitals.AMIA Annu Symp Proc. 2015; 2015: 1242–1251.
19. Meng RT ,Li JJ, Zhang YQ, Yu Y, Luo Y, Liu X, Zhao YX, Hao YT, Hu Y, Yu CH. Evaluation of Patient and Medical Staff Satisfaction regarding Healthcare Services in Wuhan Public Hospitals .Int J Environ Res Public Health. 2018 Apr; 15(4): 769.

## Figures

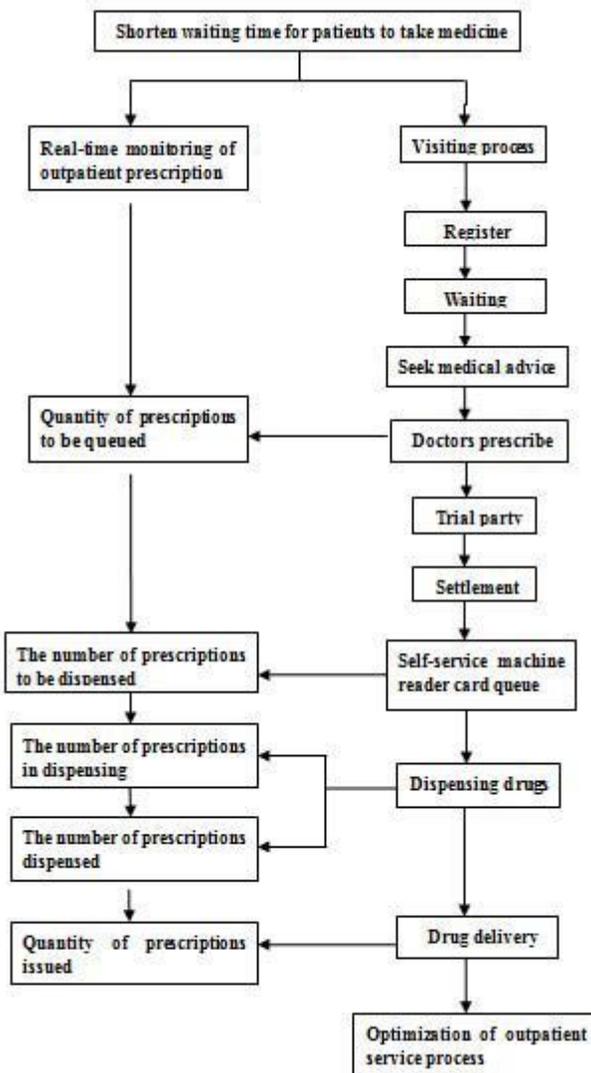


Fig1. Flow chart of real-time monitoring data for outpatient prescriptions

Figure 1

## Flow chart of real-time monitoring date for outpatient prescriptions

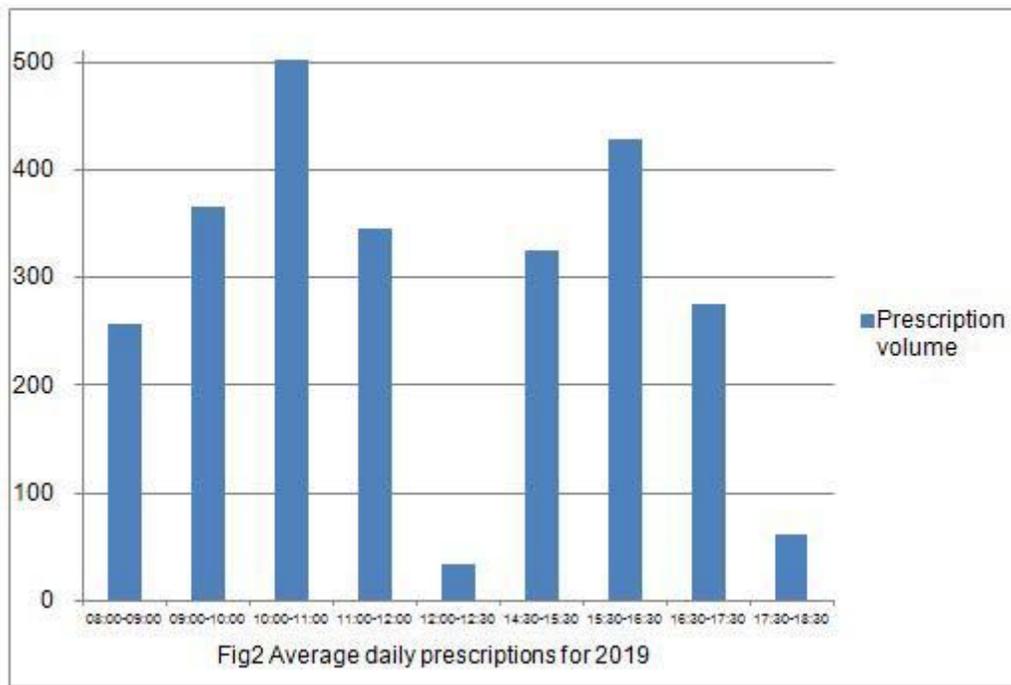


Figure 2

## Average daily prescriptions for 2019

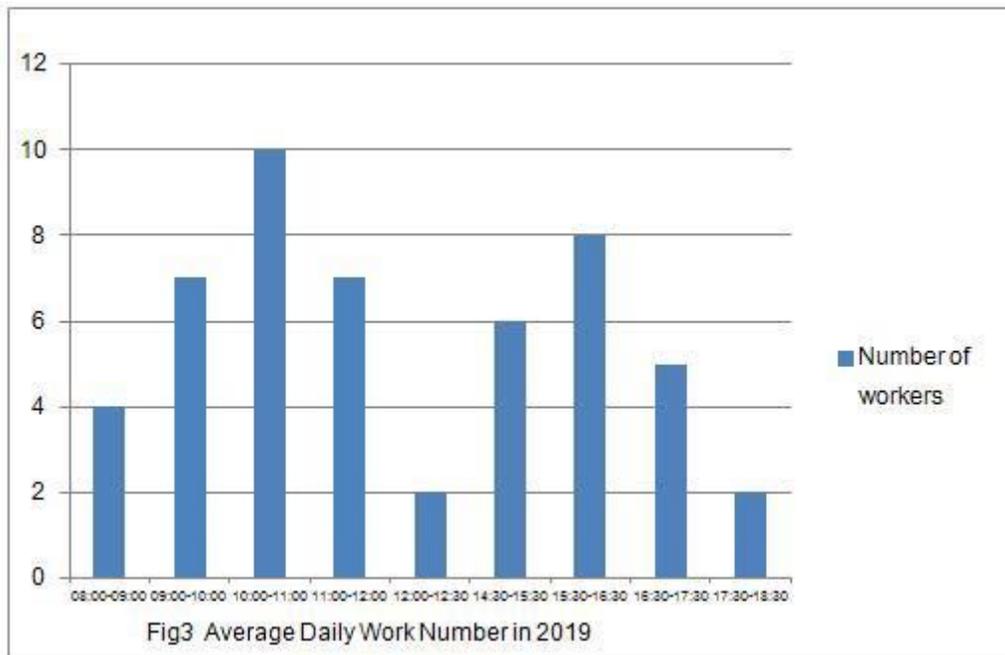


Figure 3

## Average Daily Work Number in 2019