

Research on the Optimization of the Intelligent Outpatient Service Process

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Abstract: This paper analyzes the current situation of 'three longs and one short' problem in the process of outpatient service and points out the deep-rooted problems causing it. By means of the business process reengineering and intelligent outpatient service method, this paper proposes the optimization goals and countermeasures for the outpatient service process. Through the comparative analysis of intelligent medical treatment and traditional medical treatment, it can be concluded that intelligent medical treatment can greatly shorten the waiting time of patients, improve satisfaction of patients, and bring positive benefits to hospitals and medical workers.

1. Introduction

'Difficult to see a doctor' is a serious problem of people's livelihood, the long queuing time, long waiting time, long payment time and short diagnosis time of the medical treatment are the main reasons causing the current low medical satisfaction. The patients waiting for diagnosis are usually in a depressed mood for the disease during the waiting process, and the long waiting time combined with the hospital's noisy waiting environment makes the patients more anxious. It is easy to get cross-infected for the patients especially in the flu season. After a long-time waiting, the doctors diagnose the patients for only a few minutes (less than 20 minutes). If you need further examination, then you have to wait longer. The whole process sometimes takes the patients a whole day in the hospital, which leads to the current tense relationship between doctors and patients.

In recent years, Business Process Reengineering (BPR) in enterprise management has been gradually applied to the hospital outpatient process. Through the analysis of the original process of the hospital and the optimization of the process from the perspective of patients, the efficiency of the value-added sections of the process has been improved and the time for non-value-added sections has been reduced. Improving the patients' entire medical treatment process ultimately brings positive benefits to patients, medical workers and hospitals.

2. Analysis on the hospital service process

2.1 Introduction of the Current hospital Service Process

According to the investigation and research, on average, patients need to queue at least four times to complete a visit including registration, waiting for payment, paying for the fee, and taking medicine. The average queuing period is 1.5 to 2.5 hours¹, and only about 15 minutes is used for diagnosis which patients care most. In general, patients spend more time waiting for non-value-added sections in the outpatients service process, and the time for diagnosis and other value-added sections is less. This also makes hospitals more crowded and patients are more likely to increase the probability of cross-infection of other diseases by waiting too long in the hospital. The hospital outpatient service process is shown in Figure 1:

¹ Data from *Optimizing the treatment process of public hospital* (Wei Li, 2016).

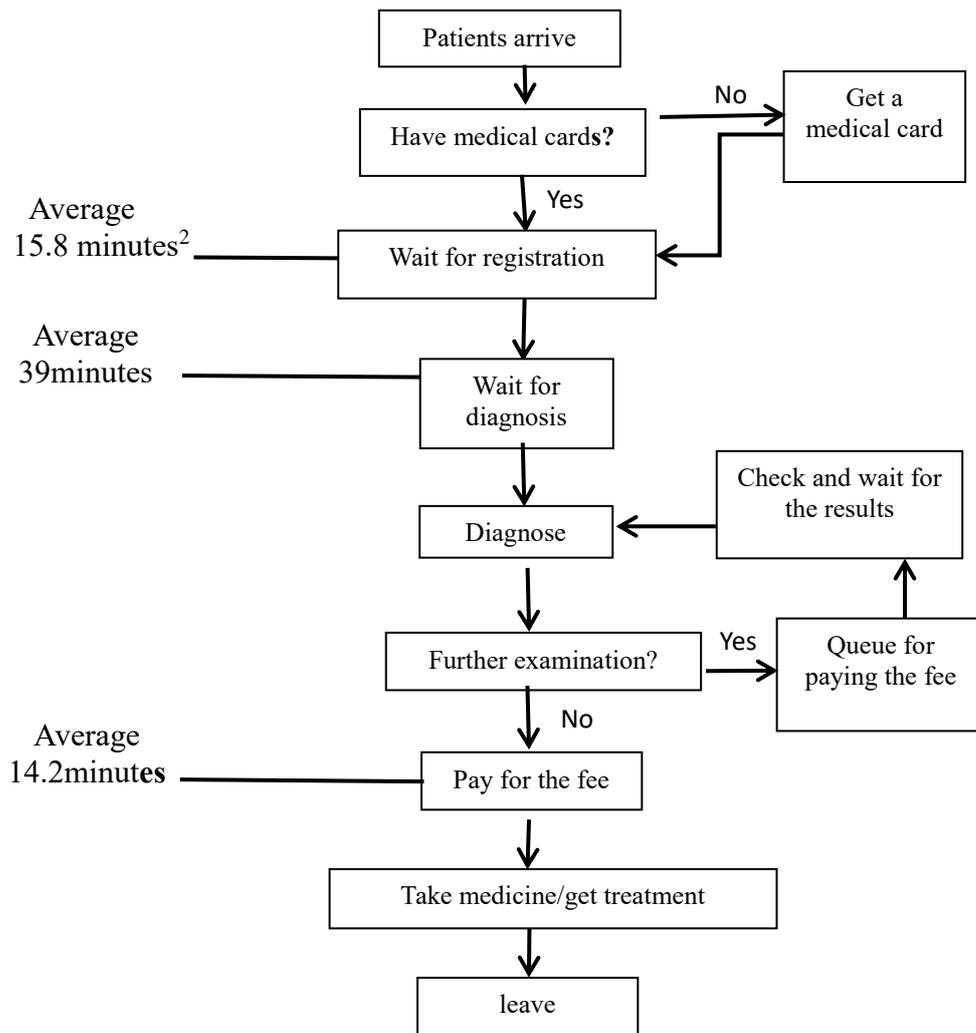


Figure 1 Outpatient Service Process

2.2 The Problems in the Outpatient Service Process

2.2.1 Most patients being unclear about the process

According to the research, many patients have experienced the process of going to hospital without a medical card - queuing for registration - being informed of the medical card - re-queuing for the registration. Most patients are unclear about the outpatient service process, and they are often lost in deciding which department to go to and how to pay for the fee.

2.2.2 The medical instructions between the floors being unscientific, lacking obvious signs.

The indicating signs in hospitals are not standardized enough, many patients first coming here often have to consult the medical staff at the front desk to find the department to be examined. This directly leads to many patients, especially elderly patients, blindly looking for the department between various buildings of the hospital.

2.2.3 Doctors' diagnosis being not so efficient

Doctors often need to check the paper medical records when they diagnose patients. The handwritten medical records are often difficult to distinguish, which increases the difficulty for doctors to read. After the diagnosis is over, the doctor has to fill in the new medical record, and the handwriting will take a long time again. Doctors may shorten the diagnosis time in order to diagnose more patients. In this case, misdiagnosis may happen.

2.2.4 The function departments being subdivided and information resources being difficult to share

The over detailed division of function departments of the hospitals directly increases the difficulty of information sharing among various departments of the hospitals. It will affect the validity and

² Data from The Study of Outpatient Process Management based on Business Process Reengineering Theory (Shen Tianjie, 2013), so as the waiting time of the traditional way in the following empirical data part.

continuity of information transmission to a large extent.

3. Optimization of outpatient service process

3.1 The Aim of optimizing the outpatient service process

The Aim of optimizing the outpatient service process including 5 aspects:reducing the waiting time of queuing, improving the efficiency and quality of diagnosis, improving the overall arrangement and environment, Realizing the informatization of the outpatient service process and Optimizing the management of hospitals.This paper uses the fishbone diagram to analyze the current hospital outpatient service process, and proposes optimization goals based on the links between the sections of the process. The overall optimization framework is shown in Figure 2.

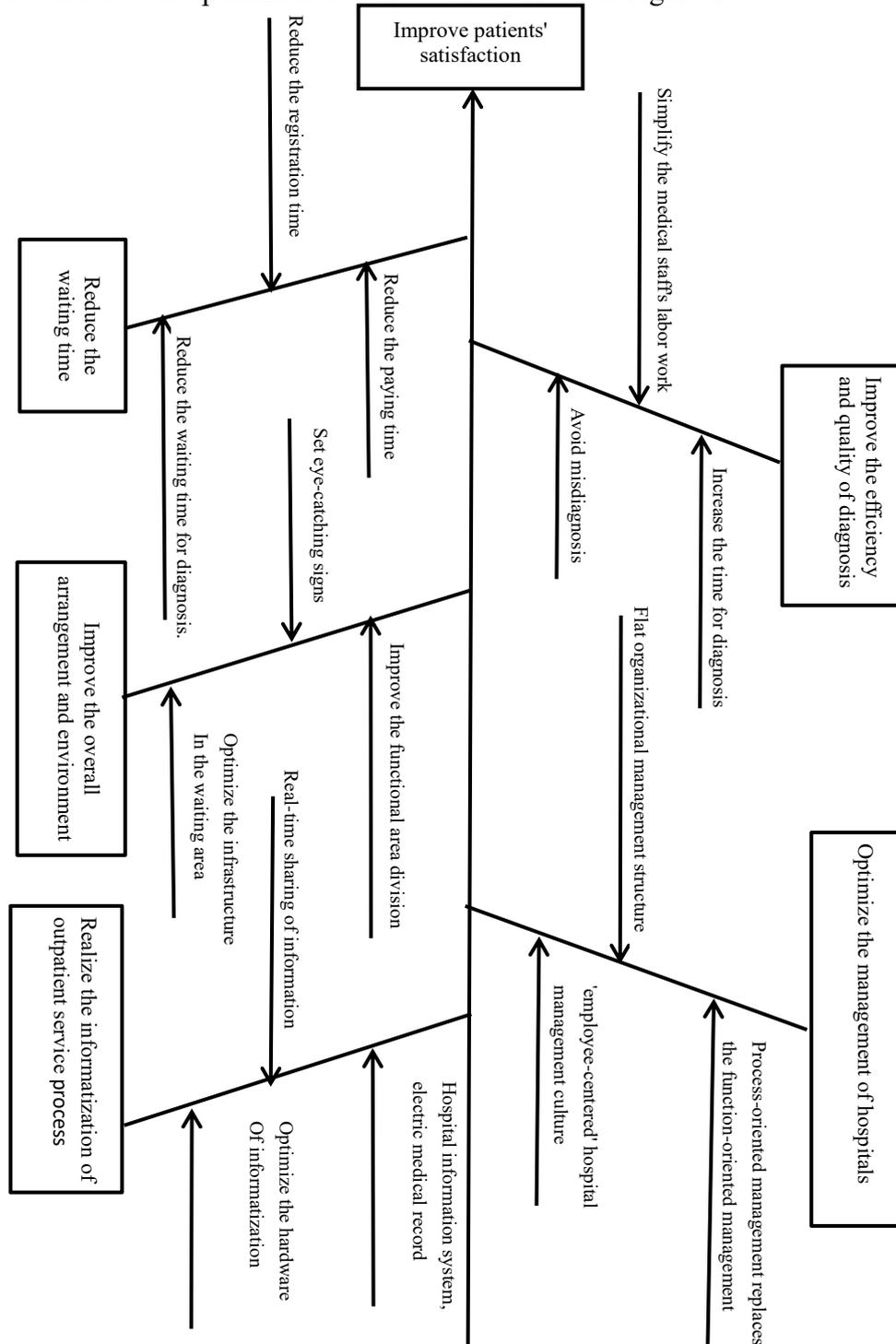


Figure 2 Analysis of the optimization of process

3.2 Suggestions on the solutions to the optimization of the outpatient service process

This paper is based on the business model of Zhejiang YuanTu Internet Technology Co., Ltd. As a third-party organization in the medical industry, YuanTu Internet Technology is trying to build a domestic Internet + health care regional service platform and provide patients with the whole process services of medical treatment by integrating online and offline resources. The company's self-developed product PIROS (Patients-oriented In-hospital Resource Optimization System), which is a patient-to-medical process optimization system, will create a full-process service optimization program for pre diagnosis-diagnosis-after diagnosis. In combination with the business model of YuanTu Internet Technology, this paper proposes some countermeasures for the problems in the outpatient service process. The recommendations are as follows:

3.2.1 Making appointment of registration and examination through multi-channels and diverting the peak visit of patients

The important reason for the difficulty in seeing a doctor in China is that most patients come to the hospital almost at the same time and most patients even do not know the ways to make appointment online. Therefore, the hospital can strengthen the propagation of the ways of the appointment registration, continuous to set more ways to register in advance, and make full use of modern information technology to allow patients to make appointment registrations through apps, WeChat, Alipay and provide advice on the time of coming to the hospital. The hospital registration APP can monitor the hospital waiting queuing process in real-time, lead patients to go to hospital in different time and finally reduce patients' waiting time. At the same time, in order to ensure a good appointment order, the appointment platform can take restrictions on patients who break off his engagement.

Taking the appointment registration platform developed by Yuantu Internet Technology as an example, patients can see the work time and corresponding medical expenses of the general and specialist doctors in the various departments of the networked hospital through the HuiYi APP. Patients can make appointments according to their own medical needs. It is worth noting that in order to standardize the appointment registration order, the platform will monitor the patients' rate of breaking off his engagement. If the number of breaking appointments reaches a certain number, the patient will be put into the blacklist of the hospital which will limit the patient's medical treatment. Yuantu Internet Technology will provide on-line medical examination appointment technology soon. Users can make online appointment for each examination through HuiYi App, WeChat, Alipay service window and see the number of appointments and queuing status of each department in real-time, and make reasonable appointments based on the information above in the department's queuing situation. It can effectively alleviate the peak of the examination flow and reduce the waiting time for patients. Table 1 gives a comparative analysis of the two appointment methods:

Table1 Comparative Analysis of the Two Appointment Methods

Appointment Methods	Comparative Analysis
Offline(manual windows, self-service machine, during diagnosis)	Appointments must be made at the venue, and the appointment number is often placed behind the person who made the appointment online in advance; the dynamic queuing information cannot be seen and patients should come to hospital as soon as possible. It takes long time.
Online (app, WeChat , Alipay)	Make appointments anytime, anywhere, not restricted by time and space; watch the dynamic queuing information in real-time, and come to the hospital according to the recommended time of visit; saving waiting time.
Other ways (official website, telephone, etc.)	Restricted by time and space to some extent, and it is impossible to observe the queuing information in real-time.

3.2.2 Reasonably optimizing overall arrangement and environment for outpatient service.

Hospitals should set clear and eye-catching signs of medical indications and strengthen the management of the hospital departments so as to help patients find the doctor efficiently. Firstly, the

hospital can divide the service area according to functions, and establish functional service areas such as specialized medical treatment, specialized examination, and patient self-help area, and each service area is rationally planned according to the patients' medical treatment process so as to minimize patients' movement times and round-trip time and provide efficient and convenient services for patients. Secondly, hospitals should continue to monitor and evaluate the rationality and realistic adaptability of the hospital outpatient arrangement, and make timely and appropriate adjustments to maximize the convenience of patients; Thirdly, hospitals should optimize the outpatient service environment as much as possible, and put waiting chairs and health knowledge brochures in the waiting room for patients to read. The waiting room should be kept clean and equipped with facilities such as boiling water rooms and clean toilets. Fourth, the waiting area sets a medical worker to maintain the waiting order, and help patients who have difficulties solve problems in time, and create a quiet and comfortable waiting environment.

3.2.3 Optimizing patients' service order and realizing an orderly visit for patients.

Many patients are unclear about the hospital outpatient service process, and it takes a lot of time to go back and forth to ask the hospital workers, and it also increases the workload of medical staff. In response to this phenomenon, the navigation-to-diagnosis platform and the smart outpatient dividing system developed by Yuantu Internet Technology help to optimize the order of hospital visits and provide convenient medical services for patients.

1. Navigation-to-diagnosis platform

In response to the fact that the internal structure of hospital outpatient departments is relatively complicated and there are a large number of various departments and the medical workers have an overloaded job to provide consultation and guidance to patients, the medical navigation guide platform can provide the departments and the way to get to the departments information for patients. It helps to find the department you want to go quickly and save patients' time and energy of continuously asking for directions. At the same time, the navigation guide platform has greatly eased the pressure of the consultation work of the front consultants, and now they have more time to provide better services.

2. Intelligent outpatient dividing system

The intelligent outpatient dividing system is designed to solve the phenomenon of 'lost in hospital' and disorderly waiting according to the actual problems of the hospital queuing by appointment number. It will reduce the manual cost of hospitals in maintaining the medical service order and create an orderly environment for patients. This system has important positive significance for patients, medical workers and hospitals through the rational arrangement of overall hospital outpatient space, effective placement of hardware equipment, back-end software control combined with manual counseling. Patients wait in line by number information of the instruction screen to realize effective time management and road planning; Through this system, medical workers can see in real-time patients' waiting situation, arrange the diagnosis time reasonably, and always diagnose one patient in one time and improve the quality of service; The hospital administrator can dock the system with the hospital information system and other systems, and grasp the queuing information of the outpatient registration and medical treatment dividing area, drug collection information of the pharmacy, and the department guidance information in real-time, and realize overall control and timely adjustment of the whole hospital for scientific management.

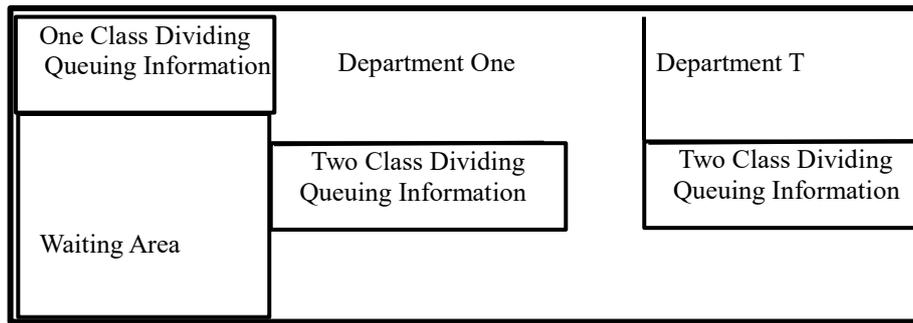


Figure 3 the two class dividing system

3.2.4 Making more payment methods effective to form a secure, convenient and efficient payment system.

Traditional outpatient service process made patients go through several payment sections. Card registration, taking medical examination and taking medicines are all required to be queued for payment. Sometimes if patients meet a peak time, they need to wait longer. Therefore, it is necessary to optimize the payment model to increase the satisfaction of patients. The unified payment platform and the inter-diagnosis payment system developed by Yuantu Internet Technology can greatly simplify the payment section of patients in the outpatient service process, and there is no waiting time for online payment.

1. Unified payment platform

Hospitals apply unified payment platform to the management of all payment methods that may be used by patients including Alipay, WeChat, medical insurance card, bank card, hospital self-service card prepayment, cash and so on to meet the diverse payment needs of patients. The mobile application or self-service machine realizes a one-time payment avoiding the non-value-added sections of queuing many times, and it brings patients much convenience of payment; Through the open service platform, it also provides a more unified payment method for other third-party payment companies, and aggregates the transaction data on the platform to facilitate the reconciliation between the hospital and the payment parties.

2. Inter-diagnosis payment system

The inter-diagnosis payment self-service machine is connected with the hospital information system. Patients can check-in for the queue, make payment and skim through the doctors' information. It can greatly save the patients' waiting time required for the process of waiting for diagnosis, taking medical examination, etc. For the hospital, it can improve the daily operational efficiency and quality of service. To make this machine really make a sense in the outpatient service process, first, it is necessary to train medical workers to improve their skills and update their thoughts. At the same time, hospitals should improve the corresponding performance appraisal for medical workers, and let the doctors actively help patients make payments. It is particularly important for older patients who are not familiar with the use of machines.

3.2.5 Optimizing hardware facilities

Among the patients who come to the hospital for treatment, a large number of patients are middle-aged and elderly people whose physical fitness declines with age, and they are not accustomed to using smart phones due to traditional pattern of thought and they even can't use self-service machines in hospitals. Therefore, while setting up a multi-functional self-service machine, it is necessary for hospitals to set volunteers next to the machine or special workers to guide the elderly to use the machines which can save a lot of queuing time of going to the manual window. The self-service machines which have the function of registration, making payment, printing report and others have greatly eased the pressure of the workers in the manual windows.

The operation and maintenance monitoring platform and outpatient self-service machines developed by Yuantu Internet Technology can greatly improve the hardware facilities of hospitals. First, the operation and maintenance monitoring platform can monitor and detect the

number of online self-service machines and the number of broken machines and offline machines in real-time. For broken machines, alarms can be issued in time and maintenance workers can get there to repair it as soon as possible to ensure outpatient services work properly. Second, outpatient self-service machines are multi-functional covering the vast majority of the outpatient service process. Patients can use the second-generation ID card to get a medical card and can recharge the balance by bank card transfer or cash. Patients can also make self-service registration, appointment, payment, printing report, barcode scanning and referral service through the self-service machines. With the intelligent biometric identification system such as fingerprint identification system and face recognition system which realize card-free operation, the self-service machines are convenient and safe and good-looking with the beautiful and generous design and they can greatly meet patients' need for the optimization of outpatient service process.

3.2.6 Optimizing the performance appraisal system

Hospitals can actively change the traditional doctors' performance appraisal system, especially change the traditional thought pattern of handwritten medical records, inspire doctors to actively use electronic medical records, and incorporate patient satisfaction into the assessment criteria for doctors and use performance incentives to enable doctors to provide patients with additional services such as making payment, appointments, etc. These actions can improve the quality of doctors' services.

The screen evaluation system developed by Yuantu Internet Technology allows patients to evaluate the service of the attending doctors. This not only increases the patients' authority to express his satisfaction for the quality of the doctors' services, but also enables doctors to improve the quality of services. It also provides valuable advice for other patients seeking medical treatment. The screen evaluation system includes the registration window screen evaluation system and the inter-department evaluation system. The registration window screen evaluation system can show the characteristics of the hospitals and introduction of department information, and patients can learn disease prevention knowledge and health knowledge from it. It also introduces some basic information of workers working in the windows and payment information, and patients can evaluate the medical staff of the hospital through this system which is of great benefit to improving the quality of window service; In addition to the hospitals' characteristics and health knowledge, the inter-department evaluation system also shows the doctors' basic information and expertise as well as the patients' required examination items and drug price information, and eventually improve the experience feeling of the patients' diagnosis in multiple dimensions.

3.2.7 Replacing function-oriented management with process-oriented management

Public hospitals are the main force in China's medical system and they have obvious public welfare nature. With the rapid development of China's market economy, private capital and foreign capital are constantly pouring into China's medical industry, which brings great competitive pressure to public hospitals. China's public hospitals cannot blindly compete in the market for profit, but they need to be aware of the market competition. It is especially important to actively improve their service levels. With China's medical reform and Chinese people's old thought pattern of 'difficult to get medical treatment' deeply rooted, public hospitals must actively carry out reforms, take patient satisfaction as the basis of reform and optimize the service processes to change the state of 'three longs and one short' problem. In the past, hospital management was mainly function-oriented, the dean of the hospital issued instructions which passed through from the higher class to the lower class one by one, and it was inefficient for information spreading. In today's Internet era, informationization is the only way to realize the modernization of hospital management. No more limited by time and space, and informationization of hospitals can establish a flat organizational structure with many unnecessary intermediate layers removed, and greatly improve the efficiency of hospital management. Hospital information system (HIS system), electronic medical record system, laboratory information system, picture archiving and communication system, pharmacy management system and other information systems contribute greatly to realizing the hospital outpatient service process reengineering, inpatient drug delivery process reengineering and administrative management process reengineering. The informationization of hospitals improve the

efficiency of hospital management and the satisfaction of patients seeking medical treatment and also brings convenience to the medical workers, which is a three-pronged approach.

4. Analysis on the Effect of Optimizing the Outpatient Service Process

4.1 Comparison of traditional way and intelligent way

Table 2 shows the comparison of traditional outpatient service process and intelligent outpatient service process.

Table 2 Comparison of traditional way and intelligent way

Sections	Traditional way	Intelligent way	Analysis of the comparison
Appointment of Registration	Manual windows, telephone, inter-diagnosis	APP, Self-service machine, manual windows, Telephone ,inter-diagnosis	<p>1. Patients can not make sure the time of going to hospital in advance through the traditional way, which is easy to cause the peak of hospital visits, while the APP appointment through the intelligent way can monitor the number of appointments in real time and give advice about the actual time of coming to hospital, and thus shorten the waiting time and alleviate the patients flow of hospitals.</p> <p>2. The application of the self-service machines makes it unnecessary for the patient to queue up in the manual windows, and the self-service machines can be flexibly placed so that patients can be registered at the door of the visiting department, which is convenient for the public.</p>
Waiting for diagnosis	Waiting by order	Intelligent outpatient dividing system.	<p>1. In traditional way, patients can only wait by order in the waiting room to avoid missing the queue, while in intelligent way patients can see the list of patients being diagnosed and waiting for treatment on the screen which helps patients to reasonably manage the time and make plans, and ensure that each doctor diagnoses one patient a time.</p> <p>2. Intelligent way can help the hospital staff know patients' queuing conditions better and reasonably arrange medical services and improve service quality.</p> <p>3. The outpatient dividing system is connected with the hospital information system allowing the hospital to see the patients' visiting information in real-time and take actions to adjust to it in time to promote scientific management.</p>
Diagnosis	Ask about the symptoms, read and write the illness information on the paper record.	Electronic Record System	<p>1. In traditional way, doctors need to check the patients' medical paper record whose writing is usually unclear and patients always unclearly describe their symptoms and it turns out to be easily misdiagnosed. In intelligent way, doctors can quickly read the electronic medical record avoiding wasting time and cost of repeated examination, and the illness information can be quickly record and have more time to communicate with the patient about his illness.</p> <p>2. The time saved by reducing a lot of repetitive manual work can be used to communicate with patients to improve service quality.</p>

Medical examination	Waiting for the result written by doctors.	Download the result online or using self-service machine	Traditionally, waiting for the doctor's handwritten report takes a long time. Printing through self-service machine can improve efficiency and watching the report online without the restriction of time and space brings patients much convenience.
payment	Cashier windows	Cashier windows, self-service machine, app, alipay, wechat, bank cards, medical insurance	1. Payment like app and alipay enables patients to pay for the fee without the restriction of time and space and greatly reduce the waiting time for payment. Patients also don't need to bring cash, it is much safer. 2. Payment like app and self-service machine can save the cost of manual payment windows and avoid cashiers doing repeated simple work and improve the whole efficiency of the hospital's work.

Figure 4 is a flow-process diagram of comparison of traditional outpatient service process and intelligent outpatient service process. It can be seen from picture 4 that in the traditional way patients need to go through card building, queuing registration, waiting for being diagnosed, queuing for payment (multiple times), waiting for examination, taking the report of examination, being diagnosed again, taking medicine and leaving the hospital. In the intelligent way, the registration and payment can be completed through app which eliminating the waiting time in the queue. The app registration can be done flexibly without the restriction of time and space according to the queuing information and the recommended time. Report of examination and illness record can be viewed online at any time and anywhere which brings patients much convenience

Indication: in intelligent outpatient service process, patients make appointment for registration through app in advance and go to the doctor's department according to the recommended time directly; Patients make payment through app or self-service machine which saves the waiting time of queuing in the manual payment window.

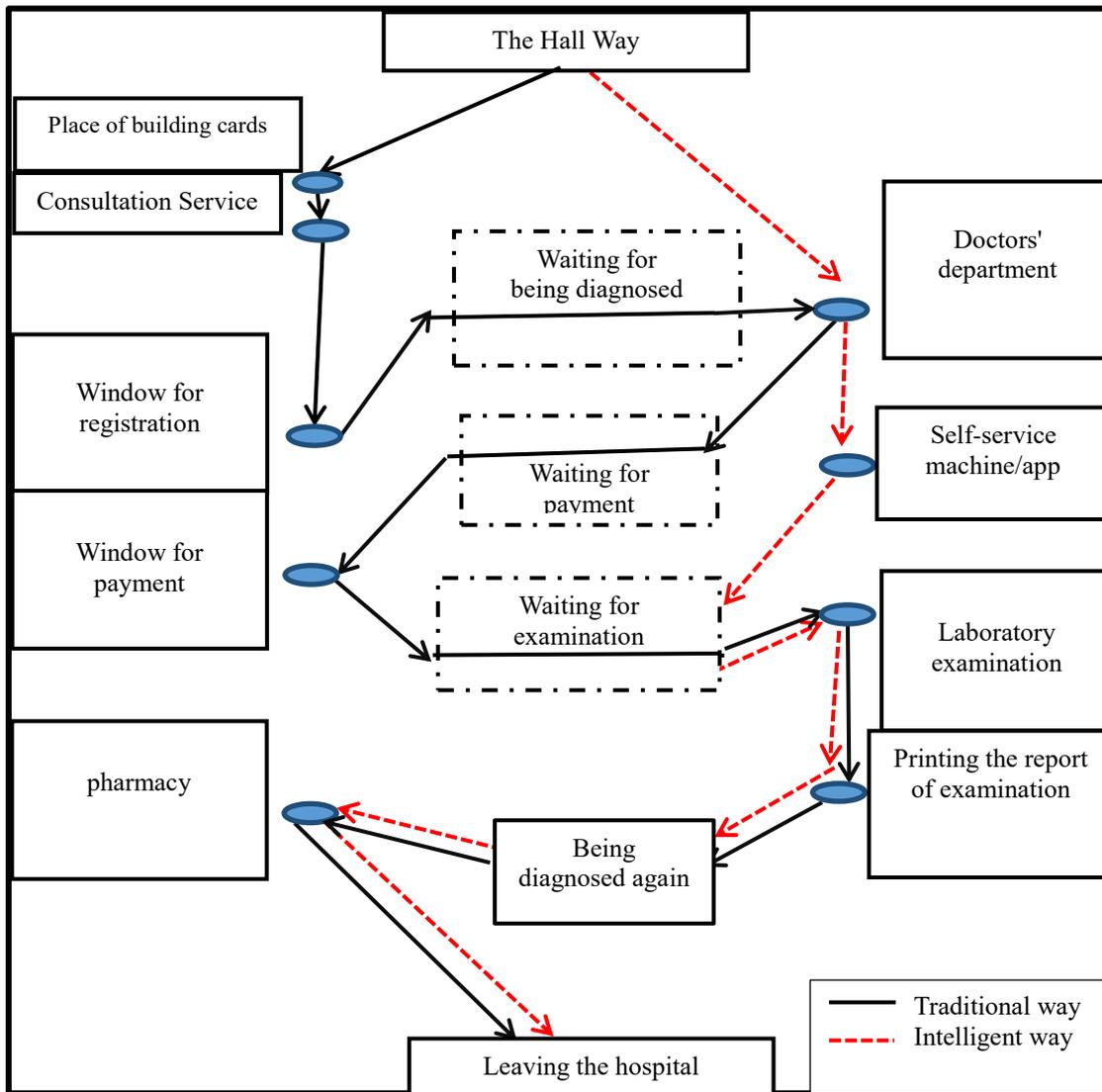


Figure 4 process diagram of comparison of traditional way and intelligent way

4.2 Empirical data

4.2.1 Optimization of ways of registration and payment.

The data of this part of paper comes from Qingdao Women and Children's Hospital, which is a combination of Qingdao Maternity Hospital, Qingdao Maternal and Child Health Hospital, Qingdao Children's Hospital and Qingdao Family Planning Research Institute. It is also a Grade III A hospital with advanced equipment, integrating medical care, health care and scientific research. The online and offline medical products of Yuantu Internet Technology fully cooperated with this hospital. The study selected the outpatient information from December 3 to December 9 as sample data according to the self-service machine during the time period. The daily average outpatient volume was 5,590 and the average volume of times of daily payment is 12004³. Figure 5 and Figure 6 are the proportion pictures of registered channels and payment channels.

³ The empirical data are all from the internal statistics of Zhejiang Yuantu Internet Technology Co., Ltd except for the waiting time of the traditional methods.

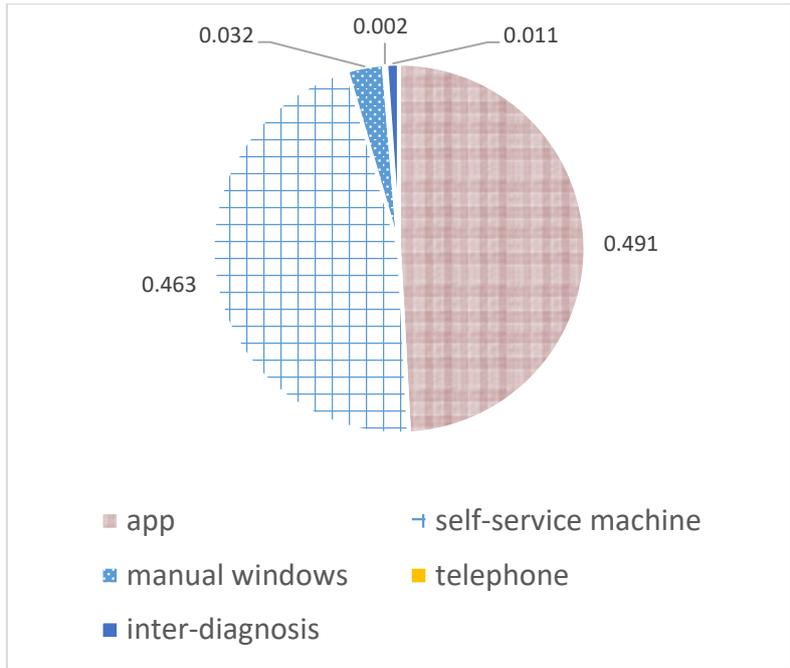


Figure 5 proportion pictures of registered channels

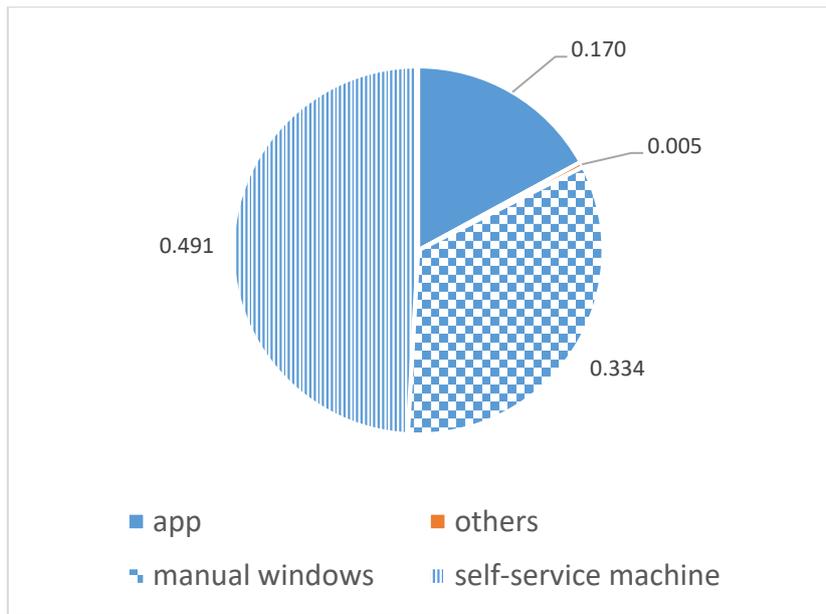


Figure 6 proportion pictures of payment channels

As can be seen from the above picture, first, the traditional appointment registration only accounts for 4.55% of the total registration volume, that is 254 person-times, while intelligent devices such as self-service machines and apps account for 95.46%, or 5,336 person-times, which indicates the intelligent outpatient service process of the Internet era has helped most patients to make registration more conveniently and reduce the waiting time for queuing in the manual window. It can also relieve the manual registration pressure of the manual window and save labor costs for the hospital. Second, the traditional way of payment through manual window only accounts for 33.37% of the total payment, that is 4,006 person-times, while intelligent devices such as self-service machines and apps account for 66.63%, or 7,988 person-times. This shows that the majority of patients agree with the intelligent payment method and it also brings them much convenience and saves the waiting time of queuing many times in the outpatient service process. After paying for the fee, patients take the medicine or directly leave the hospital which alleviates the peak flow of the hospital, reduces the cost of the manual window for hospitals and reduces the chance of cross-contamination of patients.

4.2.2 Shortening the waiting time of the non-value-added sections.

1. The waiting time of each section of registering, making payment and waiting for diagnosis.

Table 3 The waiting time of each section in traditional and intelligent ways (minutes)

Section	Traditional way	Intelligent way	Time saved
Waiting for registration	15.8	2.1	13.7
Waiting for diagnosis	39	11.9	27.1
Waiting for making payment	14.2	2.5	11.7

As shown in the above table, the intelligent way saves 13.7mins, 27.1mins and 11.7mins respectively in waiting for registration, diagnosis, and making payment compared with the traditional way, which improves the efficiency of patients' visits and eases patients from anxiety in the long waiting time and reduces the chance of cross-infection of infectious diseases such as influenza, and improves patient satisfaction; At present, the older generations are not accustomed to using smart phones and still insist on making registration through manual windows or self-service machine, and thus makes the average waiting time for intelligent outpatient service process longer. In the near future, suppose everyone uses the app to register and pay for fees, and no one need to queue for registration and payment, and the waiting time for registration and making payment will be close to 0. The time of coming to the hospital will be indicated by the app according to the queuing situation. The patient will go directly to the doctor's department according to the recommended time, and the waiting time will be greatly reduced.

2. Empirical data.

From the opening time to November 18, 2018, the online product Huiyi app of Yuantu Internet Technology has been networked with 13 hospitals affiliated to National Health and Family Planning Commission and 6 hospitals affiliated to the city government. The number of registered users has surpassed 5.57 million and the number of serviced people has exceeded 59.11 million. Due to the application of software system such as intelligent online app and hardware system such as offline self-service machines, patients' average stay time in the hospital is reduced from 3 hours to 45 minutes (make appointment in advance) and 2 hours (non-Appointment), the average number of repeated queuing in the outpatient service process is reduced from 5 to 2 times.

4.3 Analysis on the effect of the optimization of outpatient service process

4.3.1 From the patients' perspective

1. Reducing patients' cost of time and money. After the optimization of process, patients can directly make an appointment online through app, visit the hospital according to the recommended time, and pay for the fee online, which greatly shortens the queuing time and reduces the time cost of visiting the hospital. During the diagnosis, the doctor can review the patient's health record including the examination report to avoid repeated examinations and reduce the patient's money cost.

2. Improving safety. The optimization of the outpatient service process can effectively reduce the waiting time of patients and reduce the whole stay time in the hospital, this is of special importance in the season when influenza virus is spreading.

3. Promoting the fairness of sharing medical resources. Long-distance diagnosis is carried out through Internet and smart phones, patients in rural areas and remote mountainous areas can share high-quality medical resources in large cities. Therefore, patients in these areas don't need to go through a hard way to big cities to get expert medical resources. The optimization of hospital outpatient service process, especially hospitals' network cooperatives with the medical insurance in rural and remote mountainous areas, helps patients enjoy medical reimbursement for medical treatment, which greatly reduces their economic pressure and greatly promotes the equal chance of sharing high-quality medical resources in the whole society.

4. Improving patient satisfaction and ease the tense relationship between doctors and patients. Through the optimization of the whole process, the phenomenon of long registration time,

long queuing time, long time to pay for medicine and short diagnosis time are greatly improved, which brings great convenience to patients. Online appointment of registration, viewing health reports, health consultation and other services help patients easily enjoy modern medical services at home. The problem of 'three longs and one short' can be effectively solved by optimizing the outpatient service process. Patients can reduce the waiting time and can have more time to communicate with the doctor and improve the relationship between doctors and patients, which is of great significance for promoting social harmony.

4.3.2 From the medical workers' perspective

1. Reducing cumbersome repetitive manual labor to improve work efficiency. First, the informatization of hospitals has enabled medical workers to be freed from the simple and laborious manual work of the past and spend more time on patients' medical treatment and improving service quality; Second, file systems such as electronic checklists and electronic medical records can effectively avoid repeated examinations and log of information and reduce the relative pressure on medical workers; Third, informatization of hospitals can promote communication between the various departments of the hospital such as the pharmacy, examination department and inpatient department, so that medical workers in various departments can avoid running back and forth due to inefficient information exchange and finally improve work efficiency.

2. The performance appraisal system based on patient satisfaction makes medical workers to take the initiative to consider more from the perspective of patients in order to reduce complaints, optimize services, ease the contradiction between doctors and patients, and reduce conflicts and make the environment of medical workers more comfortable.

3. The software and hardware systems and equipment have greatly optimized the office environment of medical workers, and it is convenient for medical workers to carry out various tasks, and it has improved their job satisfaction to some extent.

4.2.3 From the perspective of the hospital

1. It is conducive to improving the efficiency of hospital work, optimizing the hospital management and enhancing the brand effect. First, providing online appointment of registration, making payment, satisfaction evaluation, health consultation and other functions and offline self-service machines to realize the full optimization of outpatient services greatly reduces the workload of manual service windows and simplifies a large number of repeated recording of information. It makes the hospital's medical order standardized and the outpatient management modernized. Second, intelligent medical treatment greatly improves the efficiency of the outpatient service process. This contributes to strengthening the medical services of medical institutions, especially public hospitals, in the context of current medical reform and can also enhance the competitive advantages of the brand of hospitals in all aspects. Third, the hospital gradually changes from function-oriented management to process-oriented management, changing the low efficiency of distorted transmission of information in the past. All work is managed according to the process which reduces the operating costs of hospitals and improves the overall management of the hospital.

2. Reducing the cost of hospitals. First, a variety of self-service machines and online appointment of registration, payment and other services allows hospital departments to share patients' information through the information system avoiding doctors running back and forth with the patient's report and it greatly saves the cost of paper and other materials; Second, after the process is optimized, the patient's stay time in hospital is shorter and thus saves the hospital's water and electricity and cleaning workload; Third, the application of self-service machines can reduce the manual windows and thus reduce the labor cost of the workers in the manual windows every year. Take Qingdao Women and Children Hospital as an example. In 2017, the number of manual windows before the import of the card was 25, and the number decreased to 10 after the introduction, online appointment of registration, payment and other functions can save 20 full-time workers working for these sections and 6 workers working for the business of examination report. Due to the average salary level of Qingdao, calculated by 60,000 yuan per year, the labor cost can

be saved for the hospital every year is more than one million yuan.⁴

3. The medical information is open to the public. Basic information such as electronic medical records, various examination applications, medical documents and surgical consultations will contribute to medical research and informative visits.

5. Conclusion

Public hospitals are the main force of China's medical industry and the first choice for patients seeking medical care. The prominent problems in outpatient service process and the deep-rooted problems causing the tension between doctors and patients are serious problems that must be settled by the new medical reform. This paper analyzes the sections in detail of the outpatient service process, and uses the business process reengineering, intelligent medical treatment methods and the business model of Yuantu Internet Technology to propose optimization strategies in the outpatient service process, and draws the following conclusions: First, intelligent outpatient service process can greatly bring convenience to patients seeking medical care. Patients can make appointments on app at anytime and anywhere, view the queuing information in real-time and arrange their plan accordingly. Paying through app allows patients with no need to queue. Hospital information system, diagnosis navigation system, patients dividing system and self-service machines can help the hospital maintain the waiting order and patients can get orderly medical treatment; Secondly, intelligent outpatient service process has greatly shortened the waiting time for patients which can effectively solve the problem of 'three longs and one short'. The average time for each patient's visit is shortened from 3 hours to 45 minutes through app appointment, which greatly improves the patient satisfaction; Third, the optimization of service process and intelligent medical treatment can improve the efficiency of hospitals and medical workers. The management of hospitals has changed from function-oriented management to process-oriented management, the medical workers can view the situation of patients' queuing in various departments in real time and this greatly promotes information sharing and improves the work efficiency of hospitals. Systems such as Electronic Medical Records, Laboratory Information System and Picture Archiving and Communication System make medical workers more effective and help them improve the efficiency of diagnosis. The intelligent medical treatment is a subversion of the traditional medical treatment which can greatly improve the efficiency of patients' medical treatment, and has a great effect on alleviating the conflict between doctors and patients. The innovation of this paper is to combine the intelligent medical treatment with the business process reengineering, and propose the solutions subverting the traditional medical treatment such as the real-time monitoring of queuing information brought by the intelligent medical treatment to the patients in the hospital and making payment through app without the constrict of time and space. Combining with the products of Yuantu Internet Technology, this paper tries to propose countermeasures to optimize the outpatient service process and improve the patient satisfaction.

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⁴ Data from Zhejiang Yuantu Internet Technology Co., Ltd.'s internal statistics, scholars in need can ask the author.

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