

Effect of Information Platform-Based Consultation on Improving Patient Experience

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Purpose: An information platform consultation system was constructed to evaluate the effectiveness of the system on the patient experience. **Methods:** Based on the daily consultation process, the information platform-based consultation system was developed with three entrances: browser, app, and WeChat Official Account. It integrates two ports for medical and nursing staff and patients and function modules including pre-appointment, outpatient payment, consultation file, hospitalization file, daily expenditures, Online hospital, and hotspot push. We compared the rate of non-attendance and patient satisfaction rate before and after the application of the information platform-based consultation system. **Results:** The patient's missed appointment rate was significantly lowered ($P<0.05$), waiting time for consultation was significantly shorter ($P<0.05$), and the patient satisfaction was significantly higher than those before the implement of the information platform consultation system ($P<0.05$). **Conclusion:** Information platform consultation system can simplify the patient consultation process, promote the sharing and mutual recognition of medical information resources, reduce operating costs, increase patient satisfaction, and improve patient experience, and the platform can be widely promoted as an alternative for hospital management.

Keywords: information; platform; patient experience

Tob Regul Sci.™ 2021;7(4-1): 714-721

DOI: doi.org/10.18001/TRS.7.4.1.25

INTRODUCTION

National data estimated that China will enter a super-aged society in 2035, the demand for healthcare workers continues to increase, posing a serious challenge to China's medical service system [1]. The traditional on-site centralized registrations for appointments tend to peak in certain hours, and the long waiting time for patients during peak hours affects the efficiency of medical treatment, while during off-peak times, more doctors are available, wasting medical resources that are already strained [2, 3]. Due to the lack of systemicity in the traditional medical treatment model and mutual recognition of examination results from multiple hospitals, the long waiting time for making an appointment, and repeated examinations, more hospitals are exploring ways to improve the efficiency of hospital management [4, 5].

With the development of computer, cloud computing and big data technologies and domestic information technology, many enterprises have adopted information technology to change the traditional workflow, improve the overall efficiency and quality of work. The public health sector is

beginning to experiment with the use of big data and information technology to improve hospital management, patient experience and efficiency of medical services [6].

Many hospitals worldwide have adopted information technology to reform the hospital service system [7], such as Zocdoc, a New York City-based online medical appointment booking service, covers more than 2,700 cities around the world and 10 million active users every month. Patients can choose the time to visit the doctor through the doctor's schedule displayed on the platform, and when the platform sends a reminder for success appointment, they can visit the doctor accordingly [8]. The "medical smart card service system" enables functions such as authentication and E-payments [9]. Zesty is an online healthcare appointment booking service based in London, England and offers private GPs, physiotherapy, osteopathy, chiropractic, podiatry, sports massage, facial cosmetics, and sexual health services [10]. The DocDoc platform brings together high quality health care services in the Asia Pacific region and provides a free search service for patients. Patients could choose a doctor based on their condition, while the platform eliminates information

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asymmetry and allows patients to understand information about healthcare providers and related guidelines, which can make patients feel at ease [11].

The purpose of this study is to build an information platform consultation system that integrates the functions of appointment making, outpatient payment, medical consultation file, hospitalization file, daily expenditures, Online hospital, hotspot push, etc., and analyze the impact of the platform on patients' medical experience.

INFORMATION PLATFORM DESIGN

Technical architecture

- (1) Application layer
It includes routine applications such as: desktop applications, patient applications, medical staff applications, etc.
- (2) Core layer
It includes component management, software

framework, resource management, window management, system data components, installation package management, Libe and Webkit [12].

(3) Bottom layer

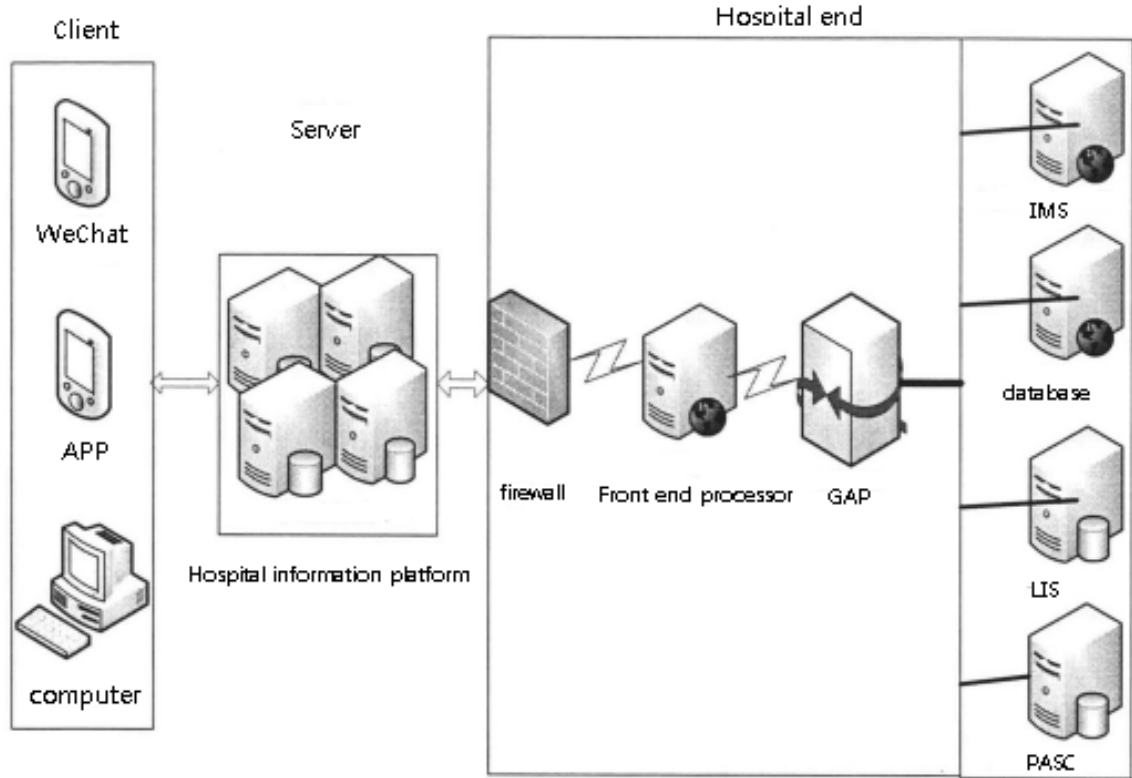
It includes the hardware layer including video and audio interfaces, GPS structure and call interface and the Linux kernel including process threads, drivers and power [13].

After the user sends a request via the application layer, the data is passed through the core layer to the underlying Linux interface and the result is finally displayed in the application layer.

Platform Network Architecture

The platform adopts C/S architecture, which is a network architecture model that is easy for classification management, system maintenance, and scalability. A peer-to-peer data connection is used, and firewalls and precursors are set for data filtering to improve data security [14, 15] (Figure 1).

Figure 1.
Platform network architecture.

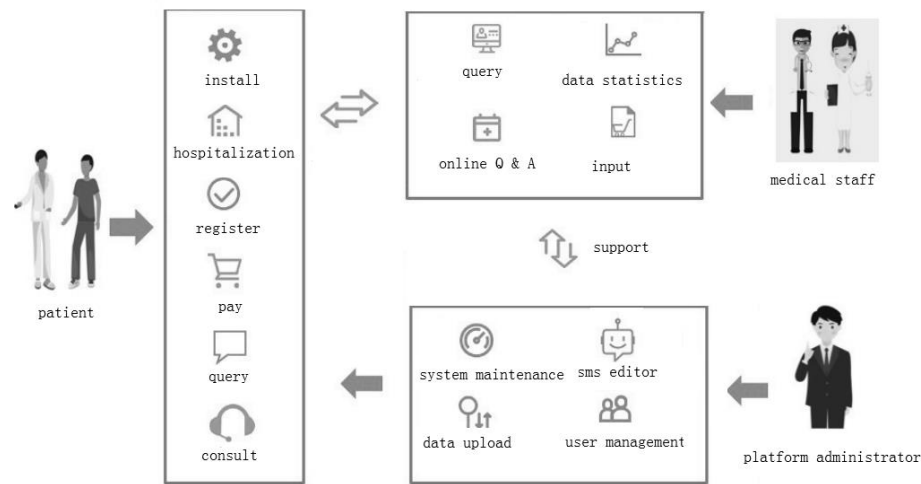


Platform Functional Architecture

The platform contains patient port, medical and nursing staff port and administrator port, providing three ways of entrances: browser, app and WeChat official number, and functions were assigned to users with different identity after logging

in. Patients and health care workers can perform online communication through the platform, and the treatment information is updated in real time. The medical records are permanently available, and the system maintenance personnel are responsible for supporting and maintaining the platform system to ensure the smooth operation (Figure 2).

Figure 2.
Functional relationship of platform modules.



Patient port
Patient management module

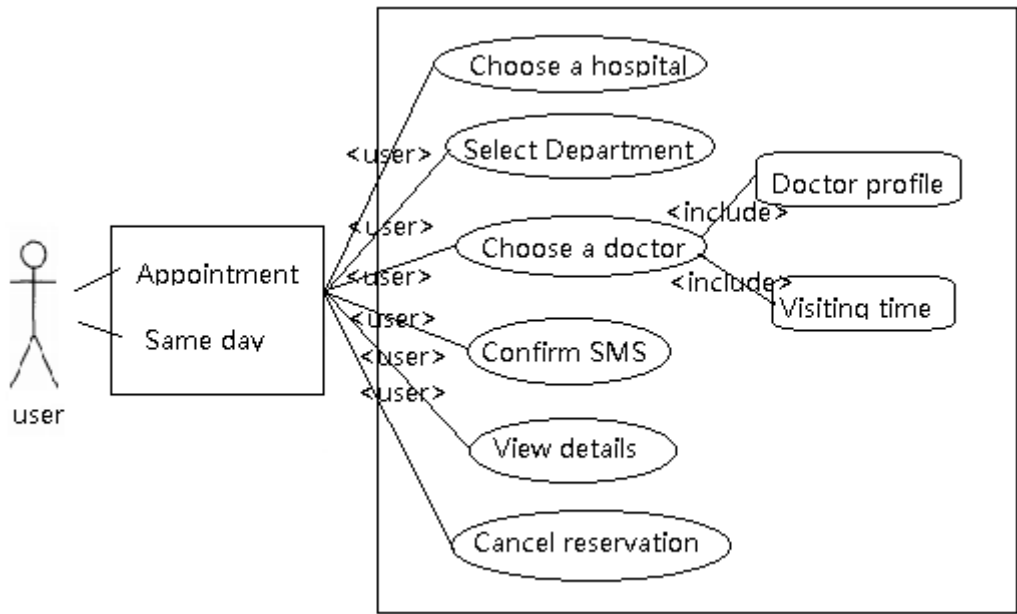
The patient management module includes the functions of adding and binding patients' medical insurance cards. When adding a new patient, you need to fill in the patient's name, ID number, mobile phone number, health insurance card number, and provide the Legal Notice and Privacy Policy for the patient to sign. When editing a patient, you can change the patient's health insurance card number, mobile phone number, etc. To delete a patient, go in and select the patient

information to be deleted and swipe to the left to unbind. Up to 10 patients can be bound to one account, and real name authentication can be achieved by binding the ID card number and the medical insurance card number. A patient can only be bound to one account, otherwise the binding cannot be completed.

Registration module

The registration module includes two forms: per-registration and same-day registration (Figure 3).

Figure 3.
Example diagram of registration process.



The functions include selecting a hospital, a hospital district, a department, a doctor, doctor profile, viewing appointment details, and canceling an appointment.

Patients can select the hospital and hospital district according to their consultation needs, list all the departments, view the list of doctors under the departments, and obtain the basic introduction of

doctors, consultation time and availability of appointments in the doctor details. Patients can check the appointment details and cancel the appointment. When the appointment is successfully made, a confirmation SMS will be received, which includes the patient's name, the hospital to be visited, the department, the time of the visit, and a prompt to take a number within half an hour before the visit.

Payment module

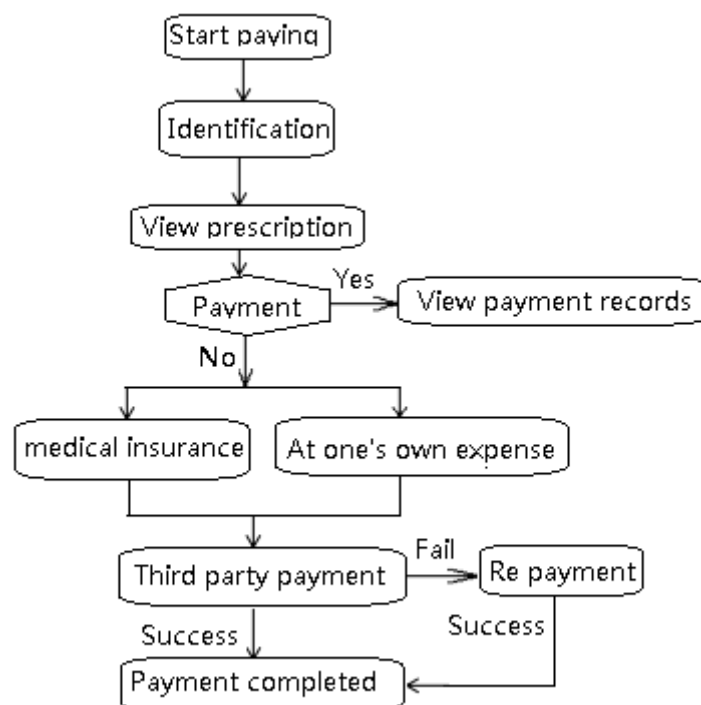
When making payment at outpatient clinic, patient identity confirmation will be made first, and the list of drugs prescribed by the doctor and

the payment status can be checked.

If the patient has already paid the fees, he can check the payment amount, payment time and other payment record through the port.

Patients who have not paid should firstly select self-payment or settlement through medical insurance and paid via the third-party payment platforms such as Alipay, UnionPay, and WeChat. The third-party platform needs to verify the patient identity, and successful payment will end the payment process, if not successful, you need to re-initiate payment (Figure 4).

Figure 4.
Example diagram of payment operations.



Inpatient module

Functions include department, ward, admission time, discharge time, hospitalization costs, daily expenditures, examination results, etc.

The admission record is generated by the platform immediately. The daily expenditures contain a detailed daily expenses, including bed fees, nursing fees, consultation fees, material fees, treatment fees, etc., for easy verification by the patient. The examination results are listed the items prescribed by the doctor during the hospitalization.

Smart imaging module

Imaging such as CT, MRI, etc. made during hospitalization can be viewed directly through the platform after the examination, and the images can be zoomed in and out for viewing.

On-line hospital module

This includes functions of finding a doctor, finding a hospital, and recommending a doctor.

Patients can search by doctor's name, disease type, etc. The list of doctors available for consultation is listed by date for each department, and the doctor's page indicates the doctor's profile, number of consultations to date, available date for consultation, and consultation fee. For patients who need consultation or follow-up, they can upload images, test results and descriptions to the doctor for remote consultation, saving patients' travel time and consultation costs.

Hotspot push module

Contents on health care, precautions on daily activities and medication for different diseases, health tips for different Solar terms and Climate features were pushed. The successful stories of patients who have been well recovered to boost

their confidence in overcoming them.

Medical staff port

Entry and editing module

Features include test result entry, prescription entry, and images entry.

After the patient completes the examination and consultation, the healthcare provider enters the patient's name and displays the entry interface, with all items set as drop-down options and the results were recorded in text. After the medical and nursing staffs have completed the entry, it is pushed to the platform for patients to check.

Online Q&A module

It includes automatic and manual Q&A.

AI answers are compiled into the system by medical staffs based on frequently asked questions during the patient's visit, and the system will automatically respond when the patient enters keywords on the mobile port.

Manual Q&A mode is to answer patients' questions online by the physicians on duty regularly.

Data statistics module

Number of patients, the number of hospitalized patients, the number of people waiting were visualized through bar charts, pie charts and other forms of presentation, which is easy for inquires.

PLATFORM FUNCTION EVALUATION

Baseline Data

Outpatient during January-December 2019 before and January-December 2020 after the implement of the information platform in our hospital were selected as the study subjects, with patients before the implement of the platform as the control group and patients after the implement of the platform as the study group. Telephone call-back, outpatient follow-up and questionnaires were used for statistical analysis.

Outcome Measurement

Waiting time for consultation

The waiting time for consultation was counted in two groups, and the efficiency of patients' consultation after the implement of the platform was assessed by the length of waiting time.

Missed appointment rate

Patients who had a successful appointment for treatment, admission, or surgery and who failed to come to the hospital for treatment on the day of

the appointment [16, 17] as scheduled were recorded.

Missed appointment rate = patients who did not attend the appointment as scheduled/total number of patients with appointments×100%

Satisfaction survey

The hospital compiled the patient satisfaction questionnaires, with questions designed to cover awareness of platform, comprehensiveness of functions, ease of use, and suggestions for improvement, ranging 0-100 points. Patients and family members were invited to fill in the form through a WeChat SR code or filling by hand at the clinic. On site staffs then performed the statistics. ≥ 80 : very satisfaction, 60-79: general satisfaction, <60 : dissatisfaction.

Satisfaction rate = (number of very satisfaction + number of general satisfaction)/total.

Statistical Methods

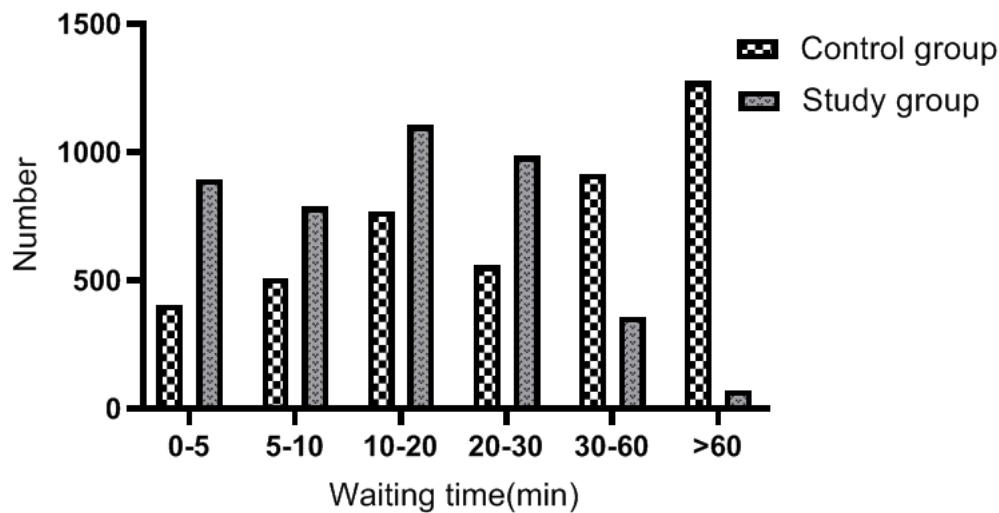
SPSS 22.0 software was used for data analysis. The measurement data were expressed as $(\bar{x} \pm s)$, with independent t-test between groups and paired t-test within groups. $P < 0.05$ indicated significant difference.

RESULTS

Comparison of Waiting Time for Patients

The waiting time of patients for consultation was significantly reduced after implement of information platform. In the traditional consultation mode, only about 50% of patients waited more than half an hour for consultation. However, after implementing the information platform, 20% of patients waited less than 5 min for consultation and about 90% of patients waited less than half an hour for consultation. The difference in waiting time between the two groups was significant ($P < 0.05$) (Figure 5), demonstrating that by using the information platform, patients can make appointments for registration in time slots, and patients go to the hospital to take a number for consultation, avoiding the phenomenon of centralized registration in the morning and queuing for consultation on the same day, improving the efficiency of patients' consultation.

Figure 5.
Comparison of waiting time for consultation between two groups of patients (P<0.05).

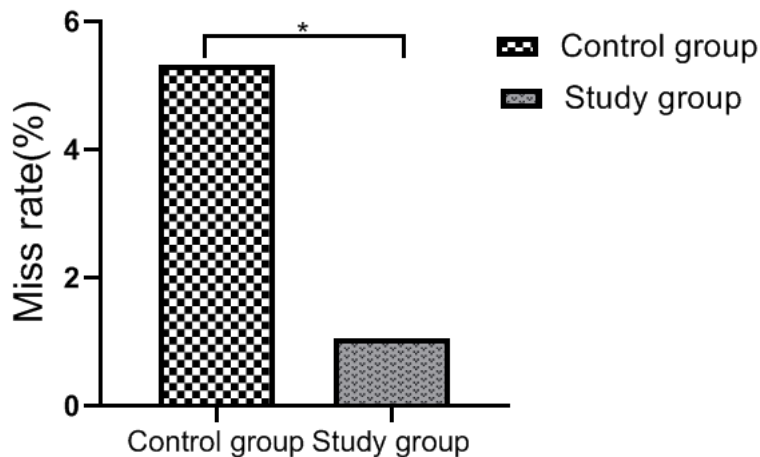


Comparison of Missed Appointment Rate

Missed appointment rate was significantly reduced because of the information platform; In the traditional mode, about 5% of patients have missed appointments, and only 1% of patients have

missed appointments after adopting the information platform. The difference in the missed appointment rate between two groups was significant (p<0.05) (Figure 6).

Figure 6.
Comparison of missed appointment rate between two groups (* represents P<0.05 for comparison between groups after the intervention).

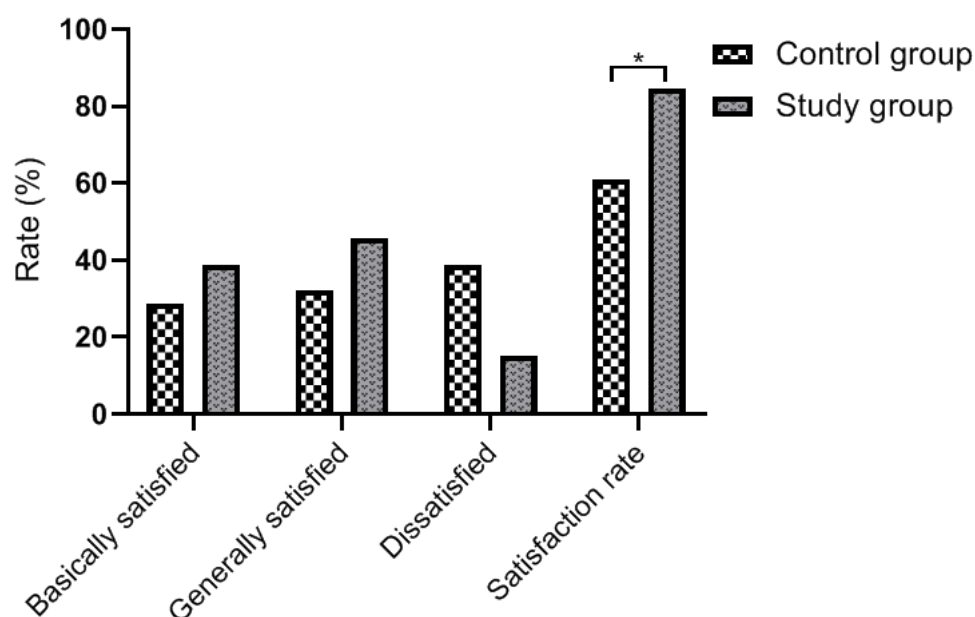


By using the information platform, patients can refund and change their appointments according to their schedules before the consultation. Since the platform sets the rule that when there are three missed appointments in a month, online appointment is not available in the following month. Therefore, patients will make appointments for consultation according to their actual situation, avoiding the waste of medical resources.

Comparison of Patient Satisfaction

The comparison revealed an overall increase in patient satisfaction with the adoption of the information platform and a significant increase in satisfaction rate compared to the control group (p<0.05) (Figure 7), showing that patients are more likely to have a more convenient experience of access to care through the information platform.

Figure 7.
Comparison of patient satisfaction between the two groups * $P < 0.05$ for comparison between two groups after the intervention).



DISCUSSION

The traditional on-site registration and consultation model has many drawbacks, and patients often feel uneven time assignment, long waiting time, and insufficient consultation time, which can cause anxiety, depression, and other adverse emotions in patients, and even lead to doctor-patient disputes and negative impact on the hospital [18]. Studies by scholars worldwide have confirmed that patient waiting time is negatively correlated with their satisfaction towards medical consultation [19, 20]. Survey has shown that convenient registration services and the efficiency of outpatient visits are main concerns of patients [21].

In the 1950s, computer technology was introduced into hospital management in Western countries, and over the years, HIS systems were greatly improved and developed, which integrate multiple functions such as financial management and patient information management, meeting the needs of daily hospital management [22, 23]. The outline of Outline of the National Informatization Development Strategy clearly states that the pace of informatization development of the medical management system should be accelerated to provide patients with more diverse ways of accessing medical care [24]. In response to the call, several hospitals in China have explored the use of information technology to improve efficiency of hospital management. Beijing Hospital of Traditional Chinese Medicine introduced a mobile consultation service system through Android system and handheld mobile devices to meet the needs of patients [25]. Shanghai Zhongshan Hospital

developed a WeChat-based medical service platform using cloud computing and Json. However, the platform is less versatile due to the use of Json [26]. Foshan First People's Hospital uses "cloud" technology to develop a intelligent APP-based consultation service system [27].

This study relies on the information platform to design and build a multi-functional information platform consultation system that integrates registration, payment, file inquiry, On-line hospital, hotspot push, etc. The results show that after adoption of this information platform system, the waiting time of patients in the study group for consultation was significantly shortened, and the missed appointment rate was reduced, which improved the efficiency of consultation. [28] Since the system requires real-name registration, it avoids the dilemma of scalpers selling numbers at high prices, and improves patient satisfaction. The results of this study are consistent with those obtained by other hospitals in China using the information technology platform, which proves that the platform is feasible for patient consultation services and can be promoted on a large scale.

The shortcoming of this study is that it has not been verified by most hospitals.

FUNDING

Guangxi Academic Degree and Postgraduate Education Reform Project In 2020: Exploration and practice of collaborative innovation mechanism of public management discipline under the background of industry education integration (project No.: JGY2020044)

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