Research and Discussion on Diagnosis and Treatment Service Mode of Intelligent Hospital

Yang Xiao[1], Wenjun Tian[1], Junhua Zhong[1], Zifan Guo[1], Xuge Qi[1], and Bei Li[2(✉)]

[1] The 900Th Hospital of Joint Logistic Support Force, Fuzhou, Fujian, China
jackey_tian@126.com, xuge9899@163.com
[2] Fujian University of Traditional, Chinese Medicine, Fuzhou, Fujian, China
xuehuo1720@163.com

Abstract. In the process of building intelligent hospital, diversified information technologies such as mobile Internet, big data, cloud computing and artificial intelligence are integrated and applied to the intelligent clinic, intelligent ward and intelligent management to optimize the diagnosis and treatment service mode. It can realize the intelligence of the whole process of patient diagnosis and treatment service. The experience of patients seeking medical treatment has been greatly improved, and the work efficiency of medical staff has been continuously improved with the substantial increase in the number of patients. The construction and optimization of the diagnosis and treatment service model of the intelligent hospital has improved the patient satisfaction, reduced the burden of the medical staff, improved the management level of the hospital, and realized the win-win situation of all parties.

Keywords: Intelligent medical treatment · Intelligent clinic · Intelligent ward · Information technology

1 Introduction

With the rapid development of information technology, all major industries have been injected with "intelligent" elements, especially in the medical field [1, 2]. Intelligent hospital is not only the objective demand of promoting the process of hospital modernization, but also the advanced stage of hospital informatization development [3, 4]. The concept and definition of intelligent hospital have been changing with the deepening of research and practical application. At this stage, it can be explained as: the intelligent hospital takes the patient as the center, takes the clinical needs as the starting point, and applies big data, artificial intelligence, cloud computing, Internet of things and other technologies to the medical scene to improve the efficiency and quality of medical services in an all-round way. The scope of the intelligent hospital is mainly delineated in three major areas: the first is "intelligent medicine" for medical personnel, the second area is "intelligent service" for patients, and the third area is "intelligent management"

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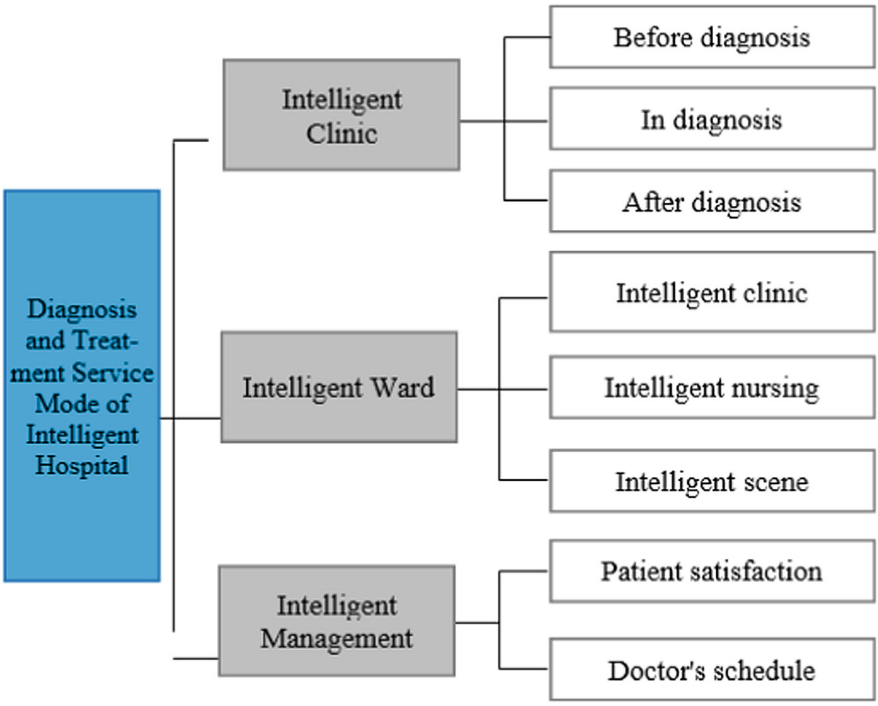

Fig. 1. Architecture of diagnosis and treatment service mode

for hospitals. The construction of intelligent hospital needs to establish an intelligent medical system of "trinity" of medical treatment, service and management, and further give full play to the important role of information technology in modern hospital construction and management. The architecture of diagnosis and treatment service mode in intelligent hospital can be shown in Fig. 1.

2 Practice of Intelligent Diagnosis and Treatment Service Model

As a large-scale comprehensive "Grade 3A Hospital" which integrates prevention, medical treatment, health care, teaching and scientific research, our hospital integrates intelligent equipment, mobile Internet, big data and artificial intelligence. Starting with "intelligent clinic" and "intelligent ward", we have carried out exploration and practice in the construction of diagnosis and treatment service of intelligent hospital, reconstructed diagnosis and treatment process, and intelligently served both ends of doctors and patients. Some results have been achieved.

2.1 Intelligent Clinic

Outpatient service as the earliest and most complex service for the hospital to contact patients, the service quality is not only directly related to the overall image of the hospital, but also reflects the management level of the hospital [5]. Through diversified

technologies such as mobile Internet and artificial intelligence, the intelligent outpatient clinic breaks through the traditional outpatient mode, and realizes the automation and intellectualization of the whole process, such as booking registration, calling diagnosis and treatment, checking and taking medicine, payment and settlement. Through deep mining of the data such as the number of visits, appointment rate and drug proportion, it not only provides the management with scientific decision-making basis, but also provides safe, efficient and convenient medical services for patients. It can improve patient satisfaction and enhance the comprehensive competitiveness of the hospital [6].

2.1.1 Before Diagnosis

1. Multi-channel appointment: establish a full reservation service system, build a unified number source pool relying on the Internet hospital platform, patients can make reservations through telephone, website, self-service machine, mobile APP, Wechat and other channels. With the integration of electronic medical insurance vouchers, patients can easily and quickly complete the business of card handling, booking, registration, registration, inquiry and so on without waiting in line. Through the "queuing waiting system", the online official account and offline calling screen can automatically prompt and guide the patients, reduce the bad phenomena such as crowding and noise, and provide a convenient and quiet environment for diagnosis and treatment. The software interface is shown in Fig. 2.
2. Full-process intelligent guidance: through online official account, APP or offline intelligent guidance robot, combined with the use of "intelligent guidance system" based on big data analysis, patients, condition can be analyzed in advance, accurate recommendations from departments and doctors can be obtained, standardized guidance and scientific medical treatment can be realized.

2.1.2 In Diagnosis

1. Seamless convergence of diagnosis and treatment process: The hospital builds a patient identification system based on electronic vouchers, and the patient realizes identity identification by scanning the code of electronic vouchers. With the help of "outpatient doctor workstation", doctors can first view the previous examination reports of patients in their own hospital or other public hospitals in the province, issue electronic prescriptions according to patients' conditions, or initiate examinations, tests and treatment applications to relevant medical and technical departments. The inspection report realizes real-time viewing on mobile phone based on "Cloud Image" and Wechat official account, reduces patients' repeated queues and doctors' workload, optimizes the connection between medical technology departments. The efficiency of patient consultation has also been improved.
2. Accurate guidance of medical decision-making: doctors make medical decisions with the help of "medical decision support system". The system will rely on the mature data resource database combined with electronic medical record information analysis, within the range of pre-set rules, through intelligent reasoning to assist the clinic, to form an accurate and personalized treatment plan. Based on all kinds of ready-made doctor-ordered packages, prescriptions can be issued quickly, which can reduce the

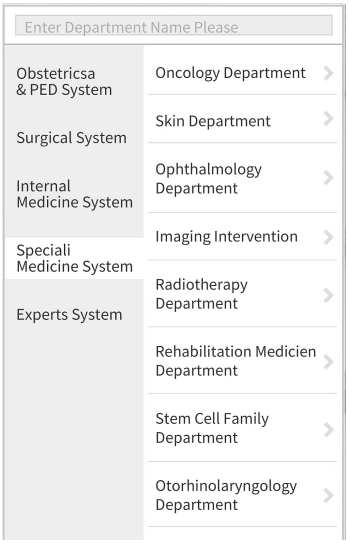

Fig. 2. Appointment system

misdiagnosis rate of doctors and improve the level and efficiency of clinical diagnosis and treatment.

3. Real-time and efficient clinic settlement: the "clinic settlement system" can directly calculate the price in the background after the doctor has completed the diagnosis and treatment, and initiate a deduction prompt to the patient. Patients only need to scan the code offline or pay online through third-party payment platforms such as Alipay and Wechat, providing a convenient settlement experience for patients. The pressure on the manual toll window has also been reduced [7].

2.1.3 After Diagnosis

1. Patients are self-service in taking medicine: When taking medicine, patients only need to go to the drug swiping machine in advance to swipe the card to confirm. The pharmacy "automatic dispensing system" will automatically distribute the medicine after receiving the confirmation information, and the drug will be distributed by the system, which greatly reduces the time for patients to wait in line to pick up and pass the medicine. The confirmation link of the self-service machine also avoids the embarrassing situation that the automatic dispensing system directly puts out the medicine after the doctor prescribes the medicine, and the patient fails to receive it in time, which leads to the accumulation of drugs [8].
2. Full coverage of post-diagnosis follow-up: patients can interact with our hospital through online channels such as mobile APP, Wechat official account, Alipay Life account and so on. They can experience online consultation of experts, revisit, online lecture hall of famous doctors, appointment of accompany, distribution service, online evaluation of medical staff, complaint suggestions and other services at any time. Online consulting of experts can be shown in Fig. 3.

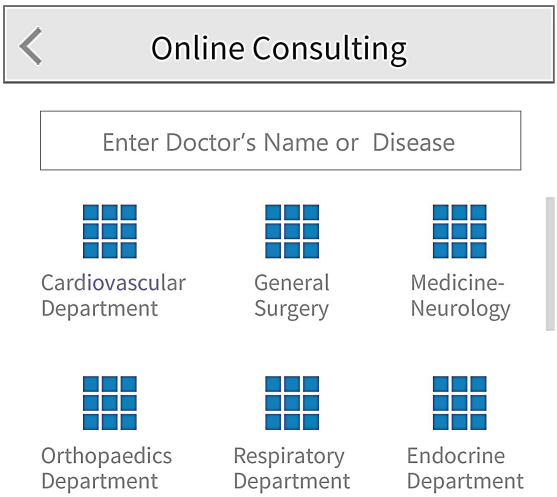

Fig. 3. Online consulting of experts

2.2 Intelligent Ward

Intelligent ward to achieve effective interaction among patients, medical care, medical equipment, medical places and so on. The goal of our hospital is to realize the exchange of perceptual data through the information network, which aims to optimize the patient's nursing experience in the hospital, simplify the medical and nursing work flow, realize active risk detection, timely early warning and early intervention, and achieve the effect of safer, faster, more accurate and more systematic disease observation and control.

2.2.1 Intelligent Clinic

Intelligent clinic mainly relies on clinical path management and remote diagnosis and treatment system to achieve accurate and standardized treatment of patients in hospital.

1. Information management of clinical pathway: The functions of clinical path definition editing, patient condition evaluation and clinical path selection are embedded in the electronic medical record system. Doctors carry out diagnosis and treatment under the standard guidance of clinical path, improve the quality of medical service, and realize the standardization and refinement of clinical management [9].
2. Remote linkage diagnosis and treatment: By integrating the remote linkage diagnosis and treatment platform in the resident doctor workstation system, the patient's difficult condition can directly realize remote consultation in the ward and between hospitals, realize the integration and complementarity of medical resources, and provide patients with more high-quality medical security.

2.2.2 Intelligent Nursing

Intelligent nursing includes central monitoring, intelligent guardianship, intelligent infusion, intelligent interaction, full closed-loop infusion monitoring and other systems.

Through the hardware cooperation of intelligent sickbed, medical mobile plate, bedside intelligent tablet and so on. Intelligent nursing is interconnected with hospital HIS system and nurse workstation system, which can quickly transmit and query data.

1. With the "central monitoring system" of the intelligent hospital bed and the "intelligent guardianship system" of mobile intelligent wearable monitoring equipment, the patient's physical condition can be monitored, guarded and alarmed in real time around the clock to ensure safety.
2. The accurate monitoring and closed-loop management of the whole infusion process are realized through the "full closed-loop infusion monitoring system". Nurses only need to use the nurse workstation or mobile plate to remotely check the dripping speed and remaining fluid volume of patients' infusion, and the system intelligently reminds the time of needle extraction and abnormal infusion, which effectively ensures the safety of infusion and improves work efficiency [10].
3. Patients can query all kinds of personal information in hospital, such as medication information, cost information, examination appointment and so on, through the "intelligent interactive system" on the bedside smart tablet. At the same time, it can also receive all kinds of inspection and medication tips, carry out multimedia entertainment, nutritious meal ordering, learning health education and other operations.
4. Medical staff can quickly upload the data measured by patients during hospitalization, such as physical sign data, treatment, medication and infusion, and reduce the workload. The background of the system automatically combs and analyzes the massive data such as hospitalized diseases and treatment effects, so as to provide a more scientific basis for diagnosis and treatment decision-making.

2.2.3 Intelligent Scene

Smart scenarios are mainly used in patients' lives, relying on connecting relevant smart home devices to meet the needs of patients and health care workers.

1. According to all kinds of scene settings in advance, linkage with relevant smart home equipment, the lighting system in the ward will be automatically turned on and adjusted according to the time of morning and evening, and the night light will be turned on automatically according to the patient's action route at night. Automatic curtains, bed curtains and other devices can be controlled by mobile phones according to the needs of patients to protect personal privacy. Nurses can adjust all kinds of intelligent ward equipment through workstations or mobile terminals to provide patients with a comfortable diagnosis and treatment environment to achieve better treatment and health care.
2. The intelligent drug delivery robot not only carries a lot of sensing and monitoring, but also has a strong handling and carrying capacity, which can automatically transport drugs, specimens and surgical instruments through remote monitoring. After the medical staff place an order at the system terminal, the robot will pick up the goods and deliver them according to the route preset by the system, which not only reduces the labor cost, but also saves a lot of time for the medical staff.

2.3 Intelligent Management

Intelligent management is used to provide hospital logistics staff with intelligent management services such as patient satisfaction survey, doctor scheduling, equipment operation monitoring and so on.

2.3.1 Patient Satisfaction Survey

The use of hospital interactive equipment and mobile phone application mobile phone patient experience feedback, so that the hospital has a more comprehensive understanding of patients' satisfaction with hospital services. It can help hospitals to effectively improve the quality of service and patient satisfaction.

1. Various carriers: In order to collect patients' feedback on their medical treatment experience in many ways. Various information exchange devices can be used to receive questionnaires. It can also dock the hospital Wechat official account, hospital APP, and so on.
2. Authentication: To ensure the authenticity of the respondents, the hospital support multiple ways of identity authentication, including ID card, medical card, medical insurance card, hospitalization number, etc.
3. Data statistics: It responsible for collecting the results of the questionnaire, calculating and generating the satisfaction score report of each department and doctor.

2.3.2 Doctor's Schedule

Through the doctor scheduling system, the doctor schedule of each department can be generated quickly, and the display screen can be displayed to the public. It is convenient for patients to timely understand the information of visiting doctors on the same day and arrange follow-up plans. It plays a role in reminding patients, evacuating the flow of people and improving the environment for medical treatment.

1. Data statistics: It supports to count the number of visits of each shift and the length of visits of each doctor on a weekly basis, so as to facilitate managers to adjust the schedule.
2. Multi-scene use: It choose the template flexibly according to the location of the equipment to realize the different applications of different scenes, such as number source residual table, department doctor visit table, famous doctor introduction form, etc.
3. Joint screen display: Through the assembly of floor-mounted LCD all-in-one machine, the display content is displayed coherently, and the page is turned at the same time, giving people an integrated visual effect.

3 Conclusion

With the continuous development and progress of science and technology, after the digital hospital has solved the problems of generation, transmission, interaction and application of information, it has become a general trend to build an intelligent hospital

with Chinese characteristics. Based on the integrated platform, the hospital introduces and applies diversified technologies such as big data and artificial intelligence, which are deeply integrated with medical and health services, focusing on the deep mining of medical information and the creation of new value, so as to realize intelligent medicine. In the process of construction, the hospital insists on taking patient service as the center, combining medical function with medical environment, so as to create a warm, comfortable, efficient and convenient diagnosis and treatment environment for patients. While the hospital is convenient for patients, it can effectively improve the level of management, save operating costs, improve medical efficiency and service capacity, and play an important role in deepening medical reform and improving medical public services.

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