HEALTH FOR ALL PROSPERITY FOR ALL

Enhancing Quality of Patients Care and Improving Patient Experience in China with Assistance of Artificial Intelligence

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Abstract Improving health of Chinese people has become national strategy according to the *Healthy China 2030*. Patient experience evaluation examines health care service from perspective of patients; it is important for improving health care quality. Applying artificial intelligence (AI) in patient experience is an innovative approach to assist continuous improvement of care quality of patient service. A nursing quality platform based on patient experience data which is empowered by AI technologies has been established in China for the purpose of surveillance and analysis of the quality of patient care. It contains data from nearly 1300 healthcare facilities, based on which portraits of nursing service qualities can be drawn. The patient experience big data platform has shown potentials for healthcare facilities to improve patient care quality. More efforts are needed to achieve the goal of enhancing people's sense of health gain.

ACCORDING to the Healthy China Initiative, to safeguard people's health in all-round and full-cycle has become the priority of the country's development. Enhancing people's sense of health gain is currently regarded as the value orientation of the Chinese healthcare system.^[1]

In the 13th Five-Year Plan and the "Healthy China

2030" Plan Outline, terms such as "medical diagnosis innovation", "smart healthcare", and "artificial intelligence" (AI) are frequently mentioned, which reflects the country's tremendous emphasis on innovative technologies.^[2] As of the current fact that healthcare resources in China are relatively inadequate compared to the increased incidence of chronic diseases and the increased demands for medical service, medical institutions in China are facing great challenges in improving capabilities and quality of healthcare service. Particularly, patient's perception of the medical service they received has been generally

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underestimated.^[3] Evaluation of patient experience and utilization of patient experience data can play important roles in quality management and continuous improvement of the quality of medical service, and thereby help to improve patients' sense of health gain.

Patient experience and evaluation

There is a full range of rational and emotional interactive experience between patients and healthcare providers. It includes comprehensive perception, experience, observation, satisfaction, and psychological feelings of patients in five aspects: sense, emotion, thinking, action, and connection. It is shaped by the concept, organization, culture, technology, service, and management of healthcare facilities.^[4]

Patient experience evaluations have been widely used to examine the healthcare service from the perspective of patients in many developed countries.^[5] In 1940s, the National Health Service System (NHS) was established in Britain.^[5] One of the three core dimensions in NHS, the Performance Assessment Framework (PAF), provided the best practice guidance for all kinds of healthcare facilities and played a crucial role in planning, quality improvement, and monitoring of healthcare service in Britain. In the late 1990s, "patient satisfaction" evaluation and monitoring were applied in all public hospitals in the Victoria state of Australia.^[7-9] This evaluation frame contained six dimensions: the accessibility of healthcare services, respect, dignity, in-hospital conditions, information and education, as well as patients' participation in decision-making, discharge, and follow-up. At the same period, hospitals in France utilized a seven-dimensional questionnaire for evaluation of in-patient experience, including medical information, nursing quality, hospitalization environment, discharge management, coordination, doctor's work quality, and convenience. In 2002, the United States officially launched the first national, publicly reported survey of patients' perspectives of hospital care, namely Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS), which conducts standardized investigation on in-patients' satisfaction in terms of nurse-patient communication, doctor-patient communication, patient demand response, pain management, medication communication, discharge instructions, hospital environment, and overall evaluation of hospital.

Since 2013, Peking University People's Hospital has initiated continuous standardized monitoring for in-patient experience in cooperation with a third-party

independent evaluation agency for five consecutive years. This project covered 562 hospitals in 28 provinces, municipalities, and autonomous regions of China, generated the first standardized, large-scale population-based data on patient experience. In September 2017, under the supervision of the National Health Commission (NHC) of People's Republic of China, the National Doctor-Patient Experience Research Base was established at Peking University People's Hospital, aiming to improve patients care performance and further explore hospital management with big data and advanced technology. It was a milestone in the field of patient experience in China. At present, patient experience evaluation is highly valued in many Chinese hospitals, and has become a common feature of an excellent hospital in China.

Applying AI to improve patient experience

The quality evaluation of nursing service, an important part of patient care, used to mainly examine aspects such as documentary recording of examinations, statistics, analysis, and feedback; it lacked caring patient experience, and no patient's perspective was included when evaluating the quality of nursing service. Based on a profound study on patient experience data, the theory and evaluation criteria for nursing-related patient experience and nursing care quality were introduced and the first patient experience big data platform has been successfully established with data from nearly 1300 large and medium-sized healthcare facilities in 28 provinces. The patient experience data include 17 indexes in 5 dimensions, i.e. nursing quality, nursing safety management, environment and facilities, nursing ethics and style, and health education and guidance. Empowered with AI technologies, 4 billion pieces of data on nursing related patient experience and nursing service quality from more than 10 million patients can be analyzed effectively.

AI assists to process multi-source heterogeneous data, enhances continuous surveillance of the process of patient care, and generates decisions which helps to improve quality of patient care. By applying deep-learning, a dynamic ontology model of nursing service experience and a Data-Ontology-Decision data technology architecture can be built to connect multi-source heterogeneous data (including quality supervising data, patient experience data, staff satisfaction data, scientific research data, and follow-up data, etc.) with each other to realize the multi-

dimensional and multi-level analyses. In the process of data collection, cleaning, analyzing, tracking, and decision-making, blockchain technique ensures that the data are unique and traceable. At the same time, all data are categorized in knowledge graph, which forms a huge network of patient experience and care quality. Natural language processing (NLP) helps to categorize the result data into 4 classes, i.e. nursing service quality indicators, check questions, point deductions, and departments, that is essential for monitoring and managing quality of nursing service in a healthcare facility. Meanwhile, it contributes to generate a quality report which helps a nursing manager to identify the key indicators and the relevant details to improve the service quality. The statistical analysis and reporting can be automatically completed by AI in a few seconds with much higher accuracy and efficiency than manual work.

With empower of big data and AI, the quality of medical care service and patient experience of a healthcare facility can not only be studied longitudinally, but also can be rated in the setting of regional healthcare system, as the performance of patient experience of multiple hospitals can be overseen and integrated into a holographic image. Representative research showed that in the hospital applying patient experience evaluation, with standardized rules in ward rounding and inspection, the one-time success rate of venipuncture increased from 93.90% to 98.02%, the satisfaction rate of bed cleaning increased from 79.81% to 93.32%, and the satisfaction rate of nurses inward inspection increased from 82.75% to 96.11%,^[10] which indicated the continuous improvement of nursing quality.

CONCLUSION

It can be seen that, with improved patient experience and satisfaction to the medical care, patients receive safe and high-quality medical service, and this will bring reputation and loyalty to healthcare facilities as rewards. More efforts are needed to improve patient experience in the processes of medical care service in China. The development of novel technology and AI promote the advances of theoretical system and technical methods of patient experience evaluation, and will make a full play of patient experience data in the improvement of medical care quality and public healthcare administration. We call for more studies on patient experience to develop effective and scientific approaches that improve

the quality of medical care, and thus enhance the sense of health gain of the masses in China.

Conflict of Interests Statement

No financial conflicts disclosed.

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