Research on Effective Utilization of Relevant Data Resources in Hospital Medical Equipment Information Management

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Abstract: With the rapid development of medical technology, hospital medical equipment as the core support of medical services, its management efficiency is directly related to the operating efficiency of the hospital, medical quality and patient satisfaction. The advent of the information age provides a new perspective and tool for medical equipment management. Through the efficient use of medical equipment-related data resources, equipment optimization, accurate maintenance, cost control and performance evaluation can be achieved, thus promoting the improvement of the overall management level of hospitals. This paper discusses the importance of hospital medical equipment information management, analyzes the construction of medical equipment information management platform, and puts forward strategies and paths for effective use of relevant data resources, so as to provide references for the modernization of hospital medical equipment management.

1. Introduction

In the medical field, medical equipment is not only the basis of diagnosis and treatment, but also an important symbol to measure the level of hospital modernization. With the continuous upgrading of medical equipment, its type, quantity and complexity have increased significantly, and the traditional manual management mode has been difficult to meet the efficient and accurate management needs of modern hospitals. The introduction of information technology, especially the application of big data, cloud computing, Internet of Things and other technologies, has brought revolutionary changes to medical equipment management. Through the construction of medical equipment information management system, the intelligent management of equipment procurement, storage, use, maintenance, scrap and other life cycle can be achieved, which can greatly improve management efficiency, reduce human errors, ensure the safe and stable operation of equipment,

and promote the reasonable allocation and utilization of medical resources.

2. The importance of medical equipment information management

In the process of medical institution management modernization, the introduction of information management system has become a key driving force to improve operational efficiency and service quality. With its powerful data processing ability, the system realizes the comprehensive innovation of equipment information management. Through the automated process, the rapid input of equipment information, efficient query and accurate statistical analysis can be seamlessly connected, which greatly reduces the cumbersome and error of traditional manual operation, and significantly improves the work efficiency. At the same time, this system also builds a real-time monitoring framework to continuously monitor the operating status of medical equipment, which can immediately capture the precursor of potential faults and automatically trigger the early warning mechanism, effectively preventing medical safety incidents that may be caused by sudden equipment failures and ensuring the safety and continuity of medical processes[1].

At the resource allocation level, the information management system based on big data analysis technology provides a scientific basis for equipment procurement planning, reasonable allocation and timely update. Through in-depth mining of equipment usage data, hospitals can more accurately predict equipment demand, avoid excessive procurement or resource idling, and realize the optimal allocation and efficient use of resources[2]. This data-based decision support not only helps to save costs, but also promotes the sustainable development of healthcare resources.

In addition, the system has become an important auxiliary tool in the decision-making process of the hospital management. By generating detailed equipment usage reports, cost-benefit analysis and other multi-dimensional data, the management can intuitively grasp the overall operation status and economic benefits of hospital equipment, providing solid data support for the formulation of long-term strategic planning and immediate management adjustment, and ensuring the scientific and forward-looking decision-making[3]. This series of improvements in management effectiveness is directly reflected in the optimization of the patient experience. The stable operation and efficient use of medical equipment not only improves the accuracy and efficiency of diagnosis and treatment, but also shortens the waiting time of patients and enhances the smoothness of diagnosis and treatment process. This series of positive effects jointly affect all aspects of patients' medical treatment, significantly improve patients' satisfaction and trust, and lay a solid foundation for building a harmonious doctor-patient relationship and promoting the promotion of hospital brand value.

3. Medical equipment information management platform

The medical equipment information management platform is composed of various modules, which is a key component to ensure the effective management of the full life cycle of medical equipment from procurement, use to maintenance and scrapping. These modules realize the efficient and accurate management of medical equipment through information means, and improve the management level and medical service quality of the hospital.

3.1 Planned procurement module

As the core component of medical equipment management, this module is fully responsible for a series of key processes from the initial planning demonstration to the final acceptance of goods. With the help of this module, the equipment management department can systematically plan the procurement needs of medical equipment, and through in-depth demand analysis and market

research, formulate a procurement plan that meets both the clinical service needs of the hospital and the financial budget. In this process, the module not only supports efficient data management and analysis, but also promotes collaboration and communication among internal teams to ensure scientific and rational purchasing decisions[4]. Entering the bidding and procurement stage, the module automatically handles the sorting of supplier information, the issuance of invitation to bid documents, the collection and preliminary screening of bidding documents, significantly improving work efficiency and reducing human errors. In the contract signing process, the module provides standardized contract templates and review processes to ensure that the contract terms are rigorous and legal, and effectively avoid potential legal risks. Once the contract is signed, the system immediately enters the cargo acceptance stage, supports real-time tracking of logistics information, and automatically compares the purchase list with the arrived equipment to ensure the fast and accurate acceptance process, thus ensuring that the medical equipment is put into use in a timely and intact manner.

3.2 Warehouse Management module

This module is the center of medical equipment inventory management, which fully controls the core links such as warehousing, warehousing, allocation and inventory, to ensure the accuracy and real-time update of inventory information. The system provides hospitals with a comprehensive and traceable inventory history by recording the details of each device's origin, specific quantity, specific time of arrival, and specific destination after departure. This module integrates the intelligent inventory warning function. Once the inventory reaches the preset safety lower limit, it will immediately send an alarm to the management staff to remind them to arrange supplementary purchase in time, thus effectively avoiding the impact of inventory shortage on medical services[5]. This not only optimizes the level of inventory management, but also significantly reduces unnecessary inventory overstocking and resource waste, promotes the efficient circulation and maximum utilization of medical equipment, and lays a solid foundation for improving the quality and efficiency of medical services.

3.3 Device Maintenance Module

This module integrates the full range of functions such as daily inspection, regular maintenance and fault repair, and automatically sends maintenance reminders to relevant personnel through the intelligent setting of the maintenance cycle of the system, ensuring that each equipment can be timely and professional care. At the same time, the module also records each maintenance history and repair process in detail, providing valuable data support for the long-term management of the equipment. Through this series of refined management measures, it not only effectively extends the service life of medical equipment, but also significantly reduces the frequency of failure, thereby improving the overall reliability and safety of medical services, and creating a more secure and efficient diagnosis and treatment environment for patients.

3.4 Quality Management module

Through in-depth evaluation and continuous monitoring of equipment performance, safety and reliability, the module ensures that every medical equipment put into use can strictly comply with relevant industry standards and specifications. In this process, the system can timely capture and handle any potential adverse event reports, respond quickly and take measures to continuously improve the overall quality of the equipment, and fundamentally provide patients with a safer and more reliable medical service environment. The implementation of this module effectively protects

the life safety and legitimate rights and interests of patients, demonstrating the hospital's great attention to the quality management of medical equipment and unremitting efforts.

3.5 Measurement Management Module

This module integrates a series of functions such as information registration, publication, classification, management and inquiry, aiming to build a comprehensive and accurate measuring equipment management system. Through strict process control, the system ensures that the information of each measuring equipment is accurate, and tracks its calibration and identification status in a timely manner. For instruments that need to be re-evaluated, the system will immediately issue alerts to ensure their continued accuracy and reliability[6]. This management mechanism is crucial to the medical process, because it is directly related to the accuracy and credibility of the measurement data, providing doctors with a solid scientific basis, thus ensuring the accuracy of diagnosis and treatment, further improving the quality of medical services and patient treatment.

3.6 Information Management Module

As the core hub of file management and information inquiry, this module undertakes the important task of transforming traditional manual records into digital files. Through the efficient computer input process, the system not only establishes a detailed and structured file system, but also realizes the classification, sorting and strict inspection of information to ensure the integrity and accuracy of data[7]. Users and nursing staff can quickly query and call the required equipment information through this module with just a click of the mouse, which greatly simplifies the information query process and improves the convenience and efficiency of information acquisition. The realization of this function not only improves the overall level of the hospital's internal information management, but also promotes the effective sharing and utilization of information resources, laying a solid information foundation for the continuous optimization and improvement of medical services.

3.7 Section Management module

This module comprehensively covers multiple key links such as equipment allocation, application for use, and approval process. Through the highly flexible custom permission setting function, the system can accurately match the responsibilities and needs of different user roles, ensuring that each employee can work efficiently and orderly within the scope of their authority. This design not only simplifies the tedious approval process, accelerates the decision-making process, but also effectively avoids the risk of authority abuse and information disclosure.

3.8 Data analysis and report generation module

By mining multi-dimensional data such as equipment use, maintenance and inventory, and using advanced statistical analysis technology, the module automatically generates a series of detailed and intuitive reports, including but not limited to equipment use report, maintenance cost report, equipment failure rate report, etc.[8]. These reports are highly customizable and easy to export, giving managers the flexibility and convenience to easily access the data they need for in-depth analysis and scientific decision-making. Through this module, the hospital management can obtain comprehensive and accurate data support, so as to more accurately grasp the status quo of equipment management, optimize management strategies, improve management efficiency, and lay a solid foundation for the sustainable development of the hospital and the improvement of patient

service quality.

4. Strategies for effective use of medical equipment-related data resources

The data resources of medical equipment are a comprehensive and complex set, covering multiple dimensions such as equipment basic information, usage data, patient diagnosis and treatment information and operation and management information. These data not only record the basic information such as the model, specifications, and use status of the equipment, but also contain the key diagnosis and treatment information such as the patient's physiological parameters, image data, and diagnostic results, as well as the procurement, inventory, and financial management data generated in the operation process of the medical institution. With the development of medical informatization, these data resources show the characteristics of multi-source heterogeneity and massive growth, which puts forward higher requirements for data collection, sorting, analysis and utilization. By deeply mining the data resources of medical equipment, the potential knowledge and value can be mined, which provides strong support for improving the quality of medical services, promoting medical research, and optimizing the allocation of medical resources. In order to make better use of relevant data resources, some measures need to be taken.

4.1 Establish a unified data management platform

Build a cloud-based medical equipment information management platform, which aims to realize centralized and standardized storage of medical equipment data and ensure unified data management and seamless sharing. Through the design of data exchange standards and interface specifications, the platform can effectively break the traditional information island, promote the data flow between different systems, and realize the real interconnection. In terms of data security and privacy, the platform will integrate advanced encryption algorithms and refined access control policies to provide comprehensive security protection for sensitive medical data (Table 1).

Table 1 Key points of data management platform strategy

Strategic point	Description
Data centralization	Realize unified storage and management of medical equipment data
Data standardization	Develop data exchange standards and interface specifications to promote data flow
Data security	Integrate encryption algorithms and access control policies to protect sensitive medical data

4.2 Strengthen data analysis and application

The powerful ability of big data technology is utilized to conduct in-depth analysis of medical equipment usage data, including but not limited to key indicators such as frequency of use, failure mode, and maintenance cost (Table 2). The purpose of this process is to discover the potential laws and future trends behind the data, and provide scientific basis for the management and maintenance of medical equipment. Based on these analysis results, medical organizations can accurately adjust equipment configuration strategies and develop more scientific and reasonable maintenance plans, thus significantly improving the use efficiency and life cycle of equipment. In addition, predictive data analysis can also provide insight into changes in equipment demand in advance to provide accurate data support for purchasing decisions and avoid resource waste[9].

Table 2 Key indicators of medical equipment data analysis

Data analysis key indicators	Description	Aim
Frequency of use	The number of times the device is used per unit time	Evaluate equipment utilization and optimize resource allocation
Failure mode	Type and frequency of device failures	Identify the root cause of the failure and develop preventive measures
Maintenance cost	Equipment maintenance costs	Evaluate the economics of equipment maintenance and optimize the maintenance budget
Predictive maintenance requirements	Equipment maintenance prediction based on historical data analysis	Schedule maintenance in advance to reduce unplanned downtime

4.3 Promote the application of Internet of Things technology in equipment management

Actively introduce the Internet of Things technology to equip every piece of medical equipment with smart sensors and labels, and build a comprehensive coverage and real-time response equipment monitoring network. This network can not only remotely monitor the operating status of the equipment, achieve fault warning and rapid response, but also track the location and use records of the equipment in real time, providing detailed data support for fine management. The application of Internet of Things technology also promotes the interconnection between medical devices, lays a solid foundation for the automation and intelligent transformation of diagnosis and treatment processes, and greatly improves the efficiency of medical services and patient experience.

4.4 Strengthen personnel training and team building

According to the demand of talents in the field of medical equipment information management, a systematic talent training plan is formulated. Through the organization of professional training, the introduction of high-level talents and other ways to continuously improve the team's professional quality and technical innovation ability. At the same time, an interdisciplinary cooperation mechanism should be established to promote the deep integration of medical care, information technology, management science and other fields, stimulate innovative thinking, and form a good ecology of collaborative innovation. Such a team building strategy will provide a steady stream of talent power for the sustainable development of medical equipment information management.

4.5 Encourage technological innovation and model innovation

In order to promote the continuous innovation and development in the field of medical equipment information management, it is necessary to actively create an open, cooperative and win-win industry ecology. Medical institutions are encouraged to establish close cooperative relations with scientific and technological enterprises, universities and research institutions, and jointly carry out technology research and development, product innovation and model exploration.

Activities such as setting up innovation funds and holding innovation competitions can stimulate the innovation vitality and creativity of the whole society[10]. At the same time, strengthen exchanges and cooperation with international counterparts, introduce advanced management concepts and technical achievements, and promote the rapid improvement of domestic medical equipment information management level. Through these efforts, we will jointly build a more efficient, intelligent and safe medical equipment information management ecosystem.

5. Conclusion

Hospital medical equipment information management is an important way to improve hospital management efficiency and guarantee medical quality. Through the effective use of relevant data resources, equipment can be optimized configuration, accurate maintenance, cost control and performance evaluation. However, the current management practice still faces many challenges, and it is necessary for the government, hospitals, science and technology enterprises and other parties to work together to strengthen the top-level design, technological innovation and personnel training, and promote the development of medical equipment information management to a higher level. In the future, with the continuous emergence and application of new technologies such as artificial intelligence and blockchain, medical equipment information management will be more intelligent, automated and precise, contributing to the sustainable development of the medical industry.

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