

The Role of the Medical Engineering Department in Hospital Annual Equipment Planning and Budgeting

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Abstract: *The hospital annual equipment planning and budgeting (called budget planning for short) is not only a requirement of the comprehensive budget management system in public hospitals but also an important issue of modern hospital management. In this study, we demonstrated the responsibilities and functions of the relevant functional departments in budget preparation and pointed out the problems that still exist in budget preparation. A comprehensive and scientific annual equipment plan of budget planning can make the limited medical equipment resources get a reasonable allocation and effective use, and it is also one of the important symbols reflecting the level of hospital management under the new situation.*

Keywords: Annual Equipment Planning, Budget Planning, Medical Engineering Department, Hospital Management, Resources Allocation.

1. Introduction

Medical equipment is an essential tool for medical institutions to carry out daily medical examinations, clinical diagnosis and treatment, and is the basis for carrying out medical, scientific research and teaching work. The number and scale of medical equipment in a medical institution, as well as the advancement and rationality of its configuration, are not only directly related to whether the daily work of the medical institution can run smoothly [1], but also determine the overall strength and development prospects of the hospital. However, the departments using medical equipment have unlimited demand for the configuration of medical equipment, but the human, material and financial resources that the hospital can use to configure medical equipment are limited. Therefore, how to scientifically and rationally carry out the budget application, demonstration and approval of medical equipment, so that limited human, material and financial resources can be used to the best effect, has become an important topic that modern hospital managers must study.

2. Basic Steps of Annual Equipment budget planning

According to the regulations of the Provincial Department of Finance and the Health Commission, as well as the requirements of the hospital's financial budget system, public hospitals should prepare an annual budget for the next year. After the hospital's annual budget is prepared, it will be reviewed and approved by the Provincial Health Commission, the Provincial Department of Finance and the Provincial People's Congress in turn, and finally the hospital will complete the budget implementation process.

The annual equipment budget is an important part of the hospital's annual budget. Generally speaking, there are several steps for hospitals to prepare their annual equipment budget: 1) Application; 2) Research, demonstration and approval; 3) Decision-making and discussion; 4) Announcement.

2.1 Application

During the application process, the applicant department should conduct market research in advance to understand the historical purchase price, usage, charges, and consumables costs of the equipment. Subsequently, the usage and patient volume should be estimated based on the actual situation of the hospital and the department, and a preliminary economic benefit analysis should be conducted. Then, a special department meeting should be held to discuss the annual procurement plan of the department, discuss the procurement plan of the department, and clarify the procurement requirements of various equipment (equipment name, quantity, budget amount). Finally, the applicant fills in the "Professional Instrument and Equipment Purchase Application Form and Feasibility Demonstration Report" in the OA (Office Automation) system and submits the project application.

2.2 Research, Demonstration and Approval

This part is led by the Medical Engineering Department, and each functional department performs its duties, participates in research and demonstration, and circulates the approval opinions in OA. Among these functional departments, the Medical Affairs Department is mainly responsible for reviewing the rationality of the development of medical business. Specifically, it includes reviewing the legality and compliance of certain equipment in carrying out new business, as well as the authenticity and validity of the corresponding qualification materials; adjusting the internal friction that may be caused by different departments carrying out the same business, etc. The Medical Insurance Department is mainly responsible for reviewing and checking the charging of equipment. The Operation and Performance Management Department is responsible for predicting and evaluating the economic benefits of the applied equipment. How to regulate and evaluate the economic benefits throughout the life cycle of medical equipment establishment, configuration, and use, and let medical equipment resources tilt towards departments that create economic benefits more effectively, is an

important responsibility of the Operation and Performance Management Department. The Organization and Personnel Department and the Science and Technology Department are responsible for the review of talent funds and scientific research funds equipment respectively. In addition, the Science and Technology Department is also responsible for the necessity demonstration of all equipment used for scientific research, and at the same time, it is responsible for the construction and management of the hospital's scientific research equipment sharing platform. The Finance Department is responsible for financial audits; the Infrastructure Department and the Logistics Department are responsible for audits of water, electricity, gas, and venues; and the Infection Control Department is responsible for audits related to hospital infection management. In order to avoid corruption risks and protect the experts involved in the research and demonstration, the audit and discipline inspection departments need to participate in the entire process and internalize the details of the rules and regulations into every link of the entire budget preparation process from application to discussion and decision-making [2].

In this link, the Medical Engineering Department coordinates with various functional departments to check at every level and perform the duties of each functional department. It conducts research, demonstration and review of the applied projects item by item from the aspects of application reasons, funding sources, business volume, performance, benefits (economic benefits, social benefits and scientific research benefits), personnel qualifications and venues, etc. Each functional department has the right to directly return the projects that have not passed the approval on OA. At the same time, the approved projects will be formed into an annual equipment plan budget draft and submitted to the next link for discussion. The research and demonstration link of each functional department is very important, and it is the source of information and basis for reasonable decision-making at all levels of decision-making discussions.

2.3 Decision-making Discussion

In order to fully understand the reasons for the application and reflect the openness and transparency of decision-making, for projects with a certain budget (RMB 500,000 and above in our hospital), a presentation and discussion meeting will be held to discuss and decide. The meeting is organized by the Medical Engineering Department, and the deputy director in charge of medical equipment and the heads of key functional departments such as the Medical Affairs Department, Medical Insurance Department, Operation Department, and Finance Department attend the meeting. During the meeting, the project applicants first state the reasons for the project application, the problems to be solved, and explain the economic and social benefits, etc. [4]. Subsequently, the director, the director of the relevant platform, the head nurse, and the heads of the relevant administrative functional departments will make suggestions and participate in the discussion based on the information from the previous survey from the aspects of medical business development, medical quality management, performance management, procurement legality and compliance review, medical fee legality and compliance review, and financial review. The opinions of the presentation and discussion meeting formed at the meeting

will be reflected in the draft of the annual equipment plan budget [5].

The draft of the annual equipment plan budget will be discussed and approved by the hospital medical equipment management committee, budget management committee, dean's office meeting, and hospital party committee in turn. Discussion meetings at all levels will discuss each project in the draft procurement plan and give a clear conclusion on whether most projects should be approved. Items that cannot be clearly concluded due to differences of opinion will be recorded in the meeting minutes and will be discussed and decided at the next stage of the discussion. The final annual equipment budget of the hospital needs to be reported to the Finance Department for approval by the superior.

2.4 Announcement

In line with the principle of information disclosure and transparency, and to ensure the smooth implementation of the annual equipment plan budget, the Medical Engineering Department will be responsible for announcing the annual equipment plan budget internally and externally after the budget is issued. Internally, the results will be fed back to the applying department, and each project will be assigned to the corresponding demonstration engineer, so that the applying department and the demonstration engineer can communicate in time to promote the project; externally, it will be announced through the government procurement website to facilitate social supervision and sales personnel of each project to contact engineers and provide product information, so as to conduct bidding openly, fairly and impartially [6].

3. The Role of the Medical Engineering Department in the Annual Equipment Budget planning Process

As mentioned above, the Medical Engineering Department was involved throughout the process of drafting the annual equipment plan budget and played an irreplaceable role. In the research, demonstration and approval stages, the Medical Engineering Department was the leading department, mainly responsible for synthesizing the opinions of various functional departments, conducting preliminary review, classification and sorting of information on application projects; investigating and verifying the objective conditions of personnel and installation; assisting in the overall allocation of general equipment and platform equipment; and conducting special research on certain equipment according to needs in order to facilitate subsequent demonstration and decision-making [7]. In the decision-making discussion and announcement stage, the Medical Engineering Department, as the main organizing department, was responsible for coordinating the participation of heads of various departments in the meeting and providing relevant information to help decision makers determine the preliminary opinions of each project, and promptly feedback to various departments and society after the draft was passed, actively and impartially promoting each project.

3.1 Preliminary Review of Information

As a Class-A tertiary comprehensive hospital, all clinical,

medical technology, scientific research, and teaching departments are users and applicants of medical equipment. Therefore, the medical equipment applied for purchase each year is also of various types and large in quantity. Taking the preparation of the equipment plan budget for 2021 of our hospital as an example, during the project application period, a total of 564 project applications were received, with an application amount of 406.5828 million yuan.

Conducting a preliminary review of a large amount of data and information to ensure that the application information is accurate, true and comprehensive is the basis for subsequent work. One of the responsibilities of the Medical Engineering Department is to conduct a preliminary review of the information to ensure the following:

3.1.1 The basic information is accurate.

The name, amount, and quantity of the equipment applied for are accurate. Sometimes, due to the habit of daily naming, the applicant will add a specific brand or model to the name of the equipment applied for, such as Olympus gastroscope, etc., which must be adjusted to the standard name during the preliminary review stage. The quantity and amount also need to be verified.

3.1.2 The approval information is complete.

The complete approval information mainly includes three requirements. First, the application form submitted by the applicant must be reviewed and approved by the department director or head nurse. Second, if the total amount of the single budget of the application project exceeds a certain value (the limit in our hospital is 50,000 yuan), it must be discussed and decided by the department affairs meeting of the application department. Therefore, the minutes of the department affairs meeting must be uploaded. Third, if the equipment applied for is planned to be used by other departments, the specific department that uses it must be identified and approved by the department director/head nurse of the department that uses it. For example, some surgical equipment applied for surgery must be used in the operating room. It must be approved by the head nurse of the operating room during the application stage so that the head nurse of the operating room can make overall arrangements for the equipment of the entire operating room platform and control the operating costs caused by the depreciation of operating room assets.

3.1.3 The feasibility study information is complete.

When the total budget of a single project exceeds a certain amount (the limit in our institute is 50,000 yuan), the applicant is required to conduct a feasibility study on the equipment applied for. The feasibility study mainly includes sufficient market research, preliminary economic benefit analysis, and existing objective conditions such as personnel and site.[8]

3.2 Classification and Sorting

After the initial review, the Medical Engineering Department will continue to classify and sort out the projects to facilitate overall understanding and improve the efficiency of

subsequent decision-making discussions.

First, the projects are classified preliminarily according to the reasons for the purchase application. The common reasons are as follows:

- 1) As the business volume increases, additional equipment of the same type needs to be configured;
- 2) To develop disciplines or start new businesses, advanced equipment is required;
- 3) Replace the old with the new. Existing equipment is aging or cannot be repaired and needs to be updated;
- 4) Equipment required by the latest regulations related to medical safety or improving medical quality;
- 5) Equipment required for scientific research or teaching.

Secondly, according to the hospital's work priorities for the next year, optimize the allocation of financial resources based on priorities. The common priority principles are as follows:

- 1) Projects related to hospital construction goals are prioritized: for example, projects necessary for the construction of a new hospital campus are prioritized;
- 2) Priority is given to projects necessary for clinical medical technology to carry out first aid and life support;
- 3) Projects with outstanding economic benefits will be given priority;
- 4) Priority will be given to key hospital development projects.

3.3 Investigate and Verify Objective Conditions

The normal use of medical equipment usually requires certain objective conditions to be met. The Medical Engineering Department shall investigate each item of the equipment applied for purchase and confirm whether the objective conditions required for the normal use of the equipment are currently met or whether they can be met when the equipment is in place.

3.3.1 Configure licensing.

When the equipment applied for belongs to Class A or Class B large medical equipment, you must first apply for configuration permission from the relevant departments in accordance with the requirements of the "Large Medical Equipment Configuration and Use Management Measures (Trial)", "Class A Large Medical Equipment Configuration Permit Management Implementation Rules", "Zhejiang Province Class B Large Medical Equipment Configuration Permit and Supervision Management Measures" and other documents. Only after obtaining the configuration permission can you purchase it. Of course, there is no strict order between the process of medical institutions applying for configuration to their superiors and the medical institutions themselves formulating annual plans. As long as the purchase is completed within 18 months after obtaining the configuration permission, it can be purchased.

3.3.2 Operational qualifications.

Certain medical equipment requires that its users have certain qualifications, such as hyperbaric oxygen chambers, ultrasound diagnostic equipment, autoclaves, etc. In recent

years, more and more specialists have applied to purchase ultrasound diagnostic equipment. The Medical Engineering Department should pay attention to understand the specific purpose from the applicants - if it is used for ultrasound diagnosis, the department is required to have operators whose medical scope is ultrasound imaging; if it is used for ultrasound-guided puncture and other treatments, there is no such requirement, but at the same time, medical charges related to ultrasound diagnosis cannot be made [9].

3.3.3 Personnel situation.

Certain medical equipment requires qualified users to be present throughout the operation. For this type of equipment, the Medical Engineering Department should conduct a survey on the personnel situation to avoid the situation where the equipment is idle due to insufficient personnel after the equipment is in place, and to ensure the safe and compliant use of medical equipment. For example, intraoperative nerve monitors are usually used in surgical operations such as neurosurgery and spinal surgery. They are generally required to be operated by electromyograph technicians and continuously monitored on site during the operation. Therefore, the Medical Engineering Department needs to estimate the usage of the equipment after the number of equipment is increased. First, it is necessary to understand whether the neurosurgery and spinal surgery or operating rooms have a sufficient number of electromyograph technicians responsible for the operation of the equipment. If this is not possible, it is necessary to confirm whether it is feasible to borrow technicians from the electromyograph room. In addition, it is necessary to verify with the Organization and Personnel Department whether there is a recruitment plan.

3.3.4 Installation requirements.

Some medical equipment requires specific installation conditions and usage requirements, such as: floor space, location required for entry and transfer, heat dissipation and other space requirements; load-bearing requirements; water inlet and outlet, sewage and wastewater discharge requirements; power supply and gas supply requirements, etc. The Medical Engineering Department should learn about the detailed installation requirements from the manufacturer of the recommended product based on the preliminary information filled out by the applicant, and then conduct further research and confirmation with the relevant functional departments. For example, confirm with the Infrastructure Department whether a certain site is for the use of the application department (generally, confusion is prone to occur during the preparation stage of the new hospital); confirm with the General Affairs Department whether the site's load-bearing, water inlet and outlet, power supply and other current conditions can be met.

For situations that require major adjustments and renovations to meet the needs, the Medical Engineering Department needs to submit the survey results for discussion during the decision-making discussion stage so that the decision-makers can comprehensively consider the cost of renovation and the necessity of purchasing equipment and make the best decision. This will avoid passive situations after the equipment is in

place, such as the site is too small to fit, the corner is too narrow to transport it in, there are load-bearing problems and a new place has to be found to put the equipment, or the equipment is idle waiting for site renovation.

3.4 Overall Coordination

The need for additional general equipment, such as multi-parameter monitors, micro-injection pumps, defibrillators, etc., can be solved through departmental allocation. The Medical Engineering Department can investigate the use of general equipment in each department, and with the assistance of the Nursing Department and other departments, conduct secondary allocation of general equipment in individual departments to allocate resources more reasonably [10].

For the additional configuration of certain platform-based common equipment, such as operating room laparoscopic systems, surgical microscopes and other equipment, engineers from the Medical Engineering Department can count and investigate the specific usage of existing equipment (frequency and duration of use, personnel usage preferences, time spent on disinfection, etc.), and help the operating room head nurse to more reasonably arrange common equipment in each operating room and on each surgical day.

3.5 Special Research

In the budget preparation work, we will encounter some advanced equipment purchase applications with outstanding clinical or scientific research effects and advanced technology, but with huge purchase amounts and poor immediate economic benefits. Whether such equipment is approved or not needs to be comprehensively considered in combination with various information. For example, the Department of Spine Surgery of our hospital applied for the purchase of a mobile O-arm and intraoperative navigation system project with an application amount of 20 million yuan. The project is used to carry out complex and difficult spinal surgery. During the operation, a mobile O-arm scan is used, and it is seamlessly connected with the navigation system to complete the monitoring of the screw position and image verification, so as to achieve accurate and efficient screw placement in spinal surgery. The equipment has extremely high clinical value and social benefits, but there is no charging project for the time being, and the economic benefits are poor. Therefore, in addition to the economic benefit analysis, the Medical Engineering Department needs to coordinate with the application department to further investigate the procurement of the benchmark hospitals and brother hospitals of spinal surgery; understand the equipment operation and charging of hospitals that have been equipped with the equipment; investigate the estimated number of patients with this disease, as well as the number of patients in the surrounding areas that the equipment can radiate, and make special special investigation and explanation in the decision-making discussion stage for experts to make judgments.

3.6 Plan Formulation

The scientific and effective preparation of the annual equipment plan budget can optimize the allocation of the

hospital's limited human, material and financial resources. After multi-faceted and multi-level evidence collection and discussion by the Medical Engineering Department, a budget preparation plan was finally drawn up. Taking our hospital as an example, a total of 564 projects were applied for approval during the 2021 equipment plan budget preparation application period, with a total budget of approximately 406.5828 million yuan. Finally, based on the results of multi-party surveys integrated by the Medical Engineering Department, our hospital identified 310 projects that met the hospital's development needs, and increased their budget by 650,000 yuan based on actual business needs and market price fluctuations. Considering the insufficient number of operators and business demand for some projects, the purchase quantity of 13 projects was reduced, and the budget was finally reduced by 6.618 million yuan. According to the work priorities and development direction of the hospital in the second year, the Medical Engineering Department conducted in-depth exchanges with relevant departments and made reasonable adjustments to the budgets of 84 projects, ultimately reducing the budget by 22.4819 million yuan. After

communicating and analyzing with relevant departments and experts, the Medical Engineering Department of our hospital found that 111 projects could not be purchased temporarily due to reasons such as the lack of space, which saved our hospital 106.7756 million yuan in budget, accounting for 50.26 % of the total budget cut. In addition, after comprehensively considering the market and economic benefits, the Medical Engineering Department of our hospital found that 41 projects could meet the business needs of our hospital by leasing instead of purchasing. This measure reduced the budget by 77.2378 million, accounting for 36.35% of the total budget cut. Overall, the Medical Engineering Department of our hospital saved a total of 212.4633 million yuan in budget for our hospital this year, accounting for 52.26% of the initial total budget. This achievement enabled our hospital to save a lot of financial resources in 2021 while vigorously promoting the development of its core business, expanding its business scope and achieving significant economic benefits, playing an indelible role in promoting the development of the hospital.

Table 1: 2021 xx Hospital Annual Medical Equipment Budget Planning Table

	Total	Purchase	Reduce quantity	Reduced budget	Temporary	Suspension	Lease
Number of subscription items	564	310	13	84	5	111	41
Proportion	100%	54.96%	2.30%	14.89%	0.89%	19.68%	7.27%
Purchase budget amount (ten thousand yuan)	40658.28	7914.04	1313.00	8839.90	4190.00	10677.56	7723.78
Proportion	100%	19.46%	3.23%	21.74%	10.31%	26.26%	19.00%
Number of projects to be established	453	310	13	84	5	0	41
Proportion	100%	68.43%	2.87%	18.54%	1.10%	0.00%	9.05%
Proposed project budget amount (ten thousand yuan)	19346.95	7914.04	651.20	6591.71	4190.00	0.00	0.00
Proportion	100%	40.91%	3.37%	34.07%	21.66%	0.00%	0.00%
Budget cuts (10,000 yuan)	21311.33	0	661.80	2248.19	0.00	10677.56	7723.78
Proportion	100%	0%	3.11%	10.55%	0.00%	50.10%	36.24%
The proportion of project budget to application budget	47.58%	100%	49.60%	74.57%	100.00%	0.00%	0.00%

4. Summary

Based on the annual budget planning of medical equipment in recent years, combined with the experience of other sister hospitals, our hospital has carried out a series of improvements and explorations on budget preparation work, and has achieved certain results. Through the bottom-up, layer-by-layer summary and multi-departmental participation budget preparation model, the rigor, standardization and openness of the project establishment have been greatly increased. At present, there are still some problems in this work, such as the lack of understanding of the role and goals of budget preparation by participants in the budget preparation process, and therefore lack of participation and subjective initiative [3]. In future work, the Medical Engineering Department of our hospital will continue to improve the budget preparation work in collaboration with various functional departments, such as assessing the results of project execution, linking the use of the applied equipment with the responsibilities of each applying department and the application in the following year; and improving the closed-loop feedback and analysis and evaluation system. The annual budget planning of medical equipment is arduous and the journey ahead is long.

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