

# Construction and Practice of a Teaching System for Consumables Management in University-Affiliated Hospitals: Exploring Talent Cultivation Pathways for Value-Based Healthcare

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## Abstract

Constructing a scientific teaching system for hospital consumables management in university-affiliated hospitals to cultivate value-based healthcare (VBHC) talents is crucial for enhancing consumables management and optimizing healthcare service quality. This paper analyzes existing issues in current consumables management education, integrates the principles of VBHC, and establishes a diversified practical teaching platform combining simulated training, supply processing and distribution (SPD) model practice bases, and data-driven decision-making exercises. It explores strategies for building this teaching system-covering teaching objectives, curriculum design, practical training, and faculty development-and demonstrates its application outcomes. A multi-dimensional evaluation and feedback mechanism centered on value contribution is also established. Preliminary practice shows that the system significantly improves trainees' professional capabilities in whole-process cost control, clinical value assessment, and data-driven decision-making, providing an effective pathway for cultivating high-quality, value-oriented consumables management professionals.

## Keywords

Value-Based Healthcare, Consumables Management, Teaching System, Professional Talent Cultivation, SPD Model, Lean Management, Cost Control

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## 1. Introduction

Against the backdrop of global population aging, increasing burden of chronic diseases, and rising medical technology costs, escalating healthcare expenditures have become a critical challenge worldwide [1]. The concept of “Value-Based Healthcare” (VBHC) thus emerged, aiming to optimize the “cost-effectiveness ratio” of medical services-achieving better health outcomes at lower costs [2]. Driven by VBHC, hospital consumables management is transitioning from a cost center to a strategic resource. As a major component of medical costs-especially high-value consumables-the scientific and refined management of hospital consumables directly impacts costs, patient safety, and service quality, making it pivotal to VBHC implementation [3]. However, significant gaps exist in talent cultivation for consumables management as follows:

1) Urgent need for faculty optimization: Hospital consumables management is a highly interdisciplinary field, encompassing knowledge from medicine, management, economics, and other disciplines. This requires instructors to possess not only solid professional expertise but also substantial practical experience. However, most current instructors teaching hospital consumables management began their teaching careers directly after graduating from various academic disciplines. They lack hands-on experience working in hospitals and have insufficient understanding of the day-to-day operations and challenges in hospital consumables management. As a result, they struggle to integrate theoretical knowledge with real-world cases during instruction. This leads to a lack of practical substance in the teaching content, making it difficult to effectively stimulate students’ learning engagement and practical understanding.

2) Outdated teaching concepts: In the teaching of hospital consumables management at many institutions, the curriculum content is often outpaced by industry developments. It frequently fails to reflect the latest policies and regulations, management philosophies, and technological methodologies. Furthermore, there is insufficient coverage of interdisciplinary knowledge, such as health insurance policies, evidence-based medicine, cost accounting, and data analysis. The teaching lacks in-depth analysis and practical case studies on navigating complex clinical scenarios and emerging models like volume-based procurement (VBP). It also fails to provide systematic training in applying smart technologies (such as SPD, IT, and big data) and in making evidence-based decisions.

3) Weak practical training: Practical training is a crucial component for developing students’ operational skills and problem-solving abilities. However, in actual teaching practice, practical training is generally inadequate, particularly in non-university-affiliated hospitals. On one hand, resources for practical training are limited. There is a lack of laboratories and training facilities that simulate real hospital work environments, making it difficult for students to practice consumables management in authentic settings. On the other hand, the organization and guidance of practical training are insufficiently standardized. Clear objectives, content, and evaluation criteria for practical training are often missing. Current

practices overemphasize warehousing and logistics operations while lacking value-oriented approaches, clinical collaboration awareness, and whole-life cycle cost consciousness. Additionally, some instructors merely assign tasks during practical sessions without providing effective guidance or feedback, resulting in suboptimal learning outcomes for students.

4) Lack of systematic evaluation: Currently, teaching evaluations in hospitals primarily focus on clinical and medical technology departments, while consumables management education lacks a systematic assessment framework. The evaluation methods are singular, predominantly relying on examination scores, and neglect to assess students' learning processes, practical abilities, innovative thinking, and other dimensions. This one-sided approach fails to comprehensively and objectively reflect students' learning outcomes or teaching quality, hindering improvements in educational standards and students' holistic development.

Therefore, establishing a value-based, healthcare-oriented professional teaching system for hospital consumables management in university-affiliated hospitals has urgent practical significance and far-reaching implications. Such a system would cultivate interdisciplinary talent equipped with strategic vision, lean thinking, data literacy, and clinical communication skills. This paper aims to explore the framework, core components, and implementation pathways for constructing this teaching system.

## 2. Core Competency Model for VBHC Talents

Based on VBHC principles and consumables management trends, new consumable management talents need to have the following core capabilities:

1) A deep understanding of the essence of VBHC enables professionals to evaluate the role of consumables management from a hospital's strategic perspective, balancing cost, quality, efficiency, and patient experience. At its core, VBHC is patient-centered, optimizing resource allocation to reduce healthcare costs while ensuring quality and safety—thereby enhancing the cost-effectiveness of medical services. VBHC emphasizes the outcomes and value of care rather than merely the volume and expense of services [4]. Under this framework, hospital consumables management must transition from a traditional supply-driven approach to a value-oriented model, prioritizing rational utilization and cost-effectiveness.

2) Professional talent in hospital consumable management must excel in the entire process of lean management, including the selection, access, procurement, storage, distribution, use, traceability, adverse event management, and waste disposal. They should possess a strong sense of responsibility and professional ethics, strictly adhere to national laws, regulations, and industry standards, and ensure the quality and safety of medical consumables throughout their life cycle. Additionally, they should be familiar with theories and methods of quality management, cost management, and supply chain management, effectively apply scientific management techniques to continuously optimize the consumable management process, and have the ability to manage compliance, monitor adverse events,

and prevent risks.

3) Clinical value assessment and evidence-based decision-making skills require a solid foundation in medical knowledge, familiarity with the diagnostic and treatment protocols for common diseases, to accurately understand the role and demand of medical consumables in clinical settings. It also involves collaborating with multiple departments to use health technology assessments (HTAs), cost-effectiveness analyses (CEAs), and other methods to scientifically evaluate the clinical and economic values of consumables, supporting evidence-based decision-making. Additionally, proficiency in using hospital information systems (HIS), SPD supply chain management systems, and big data analysis platforms is essential for monitoring consumable usage, conducting cost analyses, optimizing inventory, and providing predictive warnings.

4) Interdisciplinary communication and collaboration skills are essential for hospital consumable management professionals. They must possess strong practical, innovative, and communication skills, particularly in collaborating with clinical nursing, procurement, financial information centers, medical insurance, and other departments to establish a collaborative governance mechanism. Additionally, they should be familiar with medical insurance payment reform policies such as DRGDIP, understand how these reforms impact the use of consumables, and be able to develop corresponding strategies to address these changes.

### **3. Teaching System Construction Strategies**

1) To clearly define the teaching objectives based on the requirements of value-based healthcare for hospital consumable management professionals, the goal is to cultivate high-quality, applied talents who possess a solid foundation in medical management and economics, understand the theories and methods of hospital consumable management, have strong practical skills, innovation capabilities, and communication and collaboration abilities, demonstrate good professional ethics and service awareness, and are capable of working in consumable management roles in hospitals and other medical institutions, thereby supporting value-based healthcare.

2) To optimize the curriculum system, professional courses should cover all aspects of hospital consumable management, including an overview of medical consumables, procurement management, inventory management, distribution management, quality management, cost management, and information management. Basic medical courses should include popular science lectures to introduce students to the fundamental principles of medicine and the mechanisms of common diseases, laying a solid foundation for understanding the clinical application of medical consumables. Additionally, foundational courses in management and economics should be included to develop students' management thinking and economic analysis skills. In the information management course, the application and development trends of hospital consumable management information systems should be introduced to broaden students' knowledge and perspectives. Courses

such as medical device regulations and supervision, and medical big data analysis and application should be selectively offered to help students understand the cutting-edge knowledge and interdisciplinary knowledge in hospital consumable management, thereby enhancing their overall quality and competitiveness.

3) Strengthen the construction of practical teaching platforms by collaborating with medical device companies and other organizations to establish stable, practical teaching bases [5]. The smart consumable management simulation training center is equipped with a simulated HIS and SPD system, intelligent storage racks, mobile terminals, and other design elements that cover the entire process from requisition, inspection, receipt, warehousing, picking, distribution, billing, traceability, inventory counting, and emergency situations such as urgent consumable shortages and quality complaints. Trainees deeply participate in the actual operations of the SPD center under the guidance of instructors, completing specific job tasks. They focus on observing and learning about clinical department collaboration, lean process optimization, cost control points, and information management practices. Organize simulated management meetings for plan presentations and defenses. Clinical department rotation internships are arranged for trainees to undergo short-term internships at key departments such as the surgical center and interventional center, where they will understand the actual application scenarios of consumables in clinical diagnosis and treatment, key control points, and healthcare needs.

4) To strengthen the faculty team, we actively recruit professionals with practical experience in hospital consumable management to enhance the faculty's practical skills and professional standards. We also focus on the ongoing development of our current faculty by regularly sending them to hospitals and enterprises for on-the-job training, allowing them to participate in real-world projects and gain valuable practical experience. Additionally, we encourage faculty members to attend various academic seminars and training courses to continuously update their knowledge and improve their teaching skills. Furthermore, we establish an incentive mechanism for teachers, formulating policies that recognize and reward those who excel in teaching reform, practical teaching, and research. This encourages faculty members to actively engage in teaching research and curriculum development, thereby enhancing their enthusiasm and creativity in teaching.

5) The 5 teaching evaluation and feedback mechanisms involve establishing a diversified evaluation method that combines formative and summative evaluations, focusing on value contribution [6]. This system establishes a multi-dimensional evaluation framework for process, outcome, knowledge, skills, and qualities. The system primarily covers the following areas: process evaluation, classroom participation, simulation operation completion and quality, internship report logs, case analysis reports, knowledge evaluation, theoretical exams, policy and legal tests, information system operation assessments, ability evaluations, including project practice, data decision-making reports, scenario simulation performance evaluations, and content evaluations such as the optimization of SPD

projects, cost savings, process improvements, etc. It also evaluates the quality, logic, and feasibility of reports based on data analysis. In simulated management meetings and clinical communication scenarios, it assesses performance in professional ethics, values, medical concepts, communication and collaboration skills, problem-solving abilities, and continuous learning awareness. Summative evaluation requires a comprehensive graduation design thesis that addresses a real consumable management issue and assesses its potential value contribution, such as cost savings, efficiency improvements, and safety enhancements. Graduates and employers provide feedback, and an alumni network is established to regularly track graduates' career development and work effectiveness, collecting information on their career development and employer evaluations to form a closed-loop feedback system for teaching effectiveness, driving the continuous improvement of the teaching system.

#### 4. Practical & Preliminary Outcomes

Research subject: Students of the pilot class of "Hospital Consumables Management Direction" majoring in Biomedical Engineering at a certain medical university ( $n = 15$ ). Methods: On the basis of the original professional curriculum system, core courses such as "Value-based Healthcare and Consumables Management Strategy", "SPD Model Operation and Optimization", and "Medical Big Data Analysis" have been newly added. A fully functional simulation training center for hospital consumables management has been established in the directly affiliated hospitals of universities. Multi-dimensional assessment is adopted: ① Practical ability assessment: Expert scores are given on the completion degree of trainees' practical projects, the quality of data analysis reports, and their performance in scenario simulations (each item is out of 100 points). ② Cognitive level assessment: Through pre- and post-test questionnaires (with a total score of 100 points), the cognitive changes of trainees regarding the "value-based medical concept" and the "strategic value of consumables management" are evaluated. ③ Summative evaluation: comprehensive description and evaluation of students' quality, graduation thesis and third-party feedback. Statistical analysis: The assessment of practical ability mainly adopts descriptive statistical analysis (means  $\pm$  standard deviations) to present the results. The scores of the cognitive level questionnaire before and after the teaching intervention were analyzed using the paired sample t-test. Results: The completion score for practical projects was ( $83.33 \pm 3.9$ ) points, the quality score for data analysis reports was ( $81.47 \pm 3.44$ ) points, and the performance score for scenario simulation was ( $79.87 \pm 3.7$ ) points. After the teaching intervention, the cognitive levels of the trainees regarding the "value-based medical concept" and the "strategic value of consumables management" were significantly improved. The score on cognitive assessment before the intervention was ( $77.8 \pm 3.03$ ), and the score after the intervention was ( $80.53 \pm 3.98$ ). The difference between the two was statistically significant ( $t = 2.11, p = 0.04$ ). The students were generally satisfied with their graduation design, which had a positive impact on their actual work. They could quickly undertake

their work, be familiar with clinical procedures and requirements, pay attention to cost-effectiveness, make judgments based on data, and put forward personal opinions on optimizing the management of secondary libraries and designing closed-loop traceability schemes for high-value consumables.

## 5. Challenges & Prospects

The current teaching of hospital consumable management faces numerous severe challenges. There is a significant shortage of professional teachers who not only have a solid theoretical foundation but also practical experience in value assessment using the SPD model, making it difficult to meet the teaching needs. Obtaining high-quality, desensitized real-world hospital teaching data is challenging, which significantly limits the practicality and authenticity of the teaching. Additionally, rapid technological advancements, such as the IT and AI, are constantly innovating in the field of consumable management, requiring the teaching content to be continuously updated to keep pace with industry developments. Furthermore, integrating knowledge from multiple disciplines, such as medical management, economics, and informatics, for in-depth teaching design is challenging and it is difficult to achieve organic integration across disciplines.

To address the aforementioned issues, future efforts can be made from multiple dimensions to deepen collaboration between medical education and industry. This includes promoting joint teaching platforms and faculty teams by universities, teaching hospitals, industry associations, and medical device management software companies. The dual mentor system should be promoted to leverage the strengths of all parties, providing students with more comprehensive and professional guidance. Advanced technologies such as the Internet of Things, artificial intelligence, and blockchain should be actively introduced and applied in simulation training and data analysis teaching [7] [8]. Attention should also be paid to how these technologies can enhance internal management efficiency and meet regulatory requirements, such as traceability. Additionally, evidence-based research should be strengthened, with educational effectiveness assessments and the exploration of optimal teaching models conducted. Scientific evaluation and research should provide strong support for teaching reforms, ensuring that the direction and measures of these reforms are more precise and effective. Cooperation with domestic and international professional organizations should be expanded to establish a vocational ability certification system that meets the requirements of value-based healthcare, providing students with broader career development opportunities and better protection. Sustainable development and ethical considerations should be integrated into teaching content, including green medical ethics decision-making, to cultivate students' social responsibility.

## 6. Conclusion

Constructing a VBHC-aligned consumables management teaching system is a strategic initiative for talent cultivation, cost optimization, and healthcare quality

enhancement. This framework-integrating value-driven objectives, lean practices, data intelligence, and clinical collaboration-provides a replicable model for universities and hospitals. Future efforts should deepen industry-education-research synergy, embrace smart technologies, and establish evidence-based evaluation systems to cultivate globally competitive, innovative talents advancing healthcare toward greater efficiency, safety, and sustainability.

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## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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