

# Development and application of information-assisted decision-making system for centralized procurement of pharmaceuticals in the context of standardized procurement policies

Li Li<sup>a</sup>, Guanxing Zheng, Han Gao, Jing Li, Hang Feng, Yaning Zhu\*, Peng Zhang

Pharmacy Department, Shaanxi Provincial People's Hospital, Xi'an, China

<sup>a</sup>lily329329@163.com

\*Corresponding author

**Abstract:** As the national drug procurement initiatives become a regularized practice, there is an urgent demand for the further advancement and transformation of hospital-based centralized procurement information systems. The establishment of a tailored information system for centralized drug procurement, aligning with the operational models and drug usage patterns of individual hospitals, has emerged as a focal challenge. In response to this, our hospital has autonomously developed a Centralized Procurement Drug Information Decision Support System. The system comprises six modules in its data structure diagram and has been successfully integrated into our operational workflow. It effectively addresses the data processing requirements associated with drug procurement in our hospital, providing a streamlined and efficient approach to the implementation of our centralized procurement initiatives. This system facilitates the realization of refined management practices for centrally procured drugs.

**Keywords:** Centralized drug procurement; Information-assisted decision-making system; Informatization module; Development and application

## 1. Introduction

With the rapid advancement and normalization of drug centralized procurement<sup>[1-2]</sup>, an increasing number of centrally selected drugs are being included in the scope of quantity-based procurement. The situation where multiple drugs with similar pharmacological effects are simultaneously included in the selected range is becoming more common. This has brought significant challenges to the operational management and clinical medical work of hospitals due to the extensive and complicated nature of the tasks<sup>[3]</sup>. Meanwhile, compared to the initial implementation of drug centralized procurement policies where all efforts were mobilized to ensure the completion of various tasks, the manpower and resources invested in drug centralized procurement during the normalization phase are limited<sup>[4]</sup>.

Therefore, targeted construction of an information platform has been initiated to simplify the most cumbersome, time-consuming, and error-prone tasks. This not only saves manpower but also ensures accuracy and efficiency of the work. It also meets the timely information acquisition needs<sup>[5]</sup>. As the provided by HIS systems of various medical institutions differ, and different medical institutions face different problems in the background environment and implementation of centralized procurement, the systems developed by each hospital have their own characteristics in solving problems<sup>[6, 7]</sup>. A complete and widely applicable system program has not yet been formed, making it challenging to be broadly promoted. Hence, the establishment of a centralized procurement information system tailored to the specific needs of each hospital has become a focal point and a challenging aspect for many hospitals<sup>[8]</sup>.

Our hospital, considering our actual operational model and the current status of centralized procurement drug usage, has independently developed a Centralized Procurement Drug Information Assistant Decision System, which has been applied in practical work.

## 2. Introduction of information-assisted decision-making system

### 2.1 Design of the centralized procurement drug informatization-assisted decision solution

Utilizing the existing drug procurement and usage data in the hospital's Hospital Information System (HIS), a local database is established. Following the national centralized drug procurement policy and the information requirements of tertiary public hospitals, relevant drug data is collected, organized, summarized, and analyzed to assist in decision-making for subsequent optimized drug reporting in centralized procurement and comprehensive drug evaluations. The system adopts a Client/Server (C/S) network system, utilizes PowerDesigner for database business process analysis and modeling, uses the SQL SERVER 2000 database management system, employs the PowerBuilder 11 programming tool for database frontend development, and incorporates a modular structure design to maximize compatibility with existing data analysis and collection workflows.

### 2.2 Modules of the centralized procurement drug informatization-assisted decision system

The data structure consists of the following six modules:

① Centralized procurement of drugs batch completion module: This module primarily reflects the completion status of various batches of centrally procured drug projects, including the timeline and overall completion status. The procurement quantities are monthly tallied within a procurement cycle. The format for compiling project timelines is based on project batches, project start times, and project end times. Due to the encouragement of inter-provincial alliances for centralized procurement at the national level, aimed at facilitating patients to the greatest extent, the existing procurement projects are subdivided into nationally organized centralized drug procurement and provincial alliance drug centralized procurement. The former is numerically arranged; for example, the first batch is labeled as 1.0, the first batch's first renewal as 1.1, the first batch's second renewal as 1.2, and so on. The latter, provincial-level alliances, are alphabetically arranged for easy and efficient differentiation of drug batches during the actual statistical process.

② Centralized procurement drug purchase records module: This module contains monthly inventory data for previously related centrally procured drugs within the HIS system of healthcare institutions, ensuring traceability of data sources.

③ Centralized procurement drug completion module: This module involves the creation of a detailed table based on the batches of drug procurement projects. It includes various fields such as task quantity, task amount, completion quantity, completion amount, and others. The module periodically reads relevant inventory data line by line and writes it into the list, completing the data statistical work. Additionally, it allows for querying the overall completion results for each batch in the drug completion table. In the drug inventory table, you can perform queries based on multiple fields such as drug name to find completion quantity, completion rate, and more for each drug. This provides relevant data support for the adjustment of drug procurement and usage policies by the Committee on Pharmacy Management and Pharmacotherapy.

④ Centralized procurement drug departmental usage module: The Drug Centralized Procurement Departmental Usage Table contains data on the monthly usage of centrally procured drugs by various clinical departments in the hospital's Health Information System (HIS). Through the analysis of the usage quantity of each drug and comparing it with the assigned quantity for that drug, the module aims to statistically analyze the historical usage of centrally procured drugs in each department. This analysis provides a basis for the allocation of drug procurement tasks in the hospital and offers data support for the comprehensive evaluation of drugs.

⑤ Centralized procurement substitute drug usage statistics module: The data for this module is sourced from the hospital's Health Information System (HIS) and includes the monthly purchase quantity of centrally procured substitute drugs. The module aims to establish a correspondence between centrally procured drugs and non-centrally procured drugs with the same generic name. By querying the relevant information of centrally procured drugs, the module analyzes and controls the usage of substitute drugs in the same procurement cycle. This analysis is of significant importance for completing the procurement tasks of centrally procured drugs and is convenient for national and regional administrative departments to extract data on the usage of non-centrally procured drugs.

⑥ Centralized procurement drug usage ratio module: Since the introduction of the performance assessment for tertiary public hospitals by the National Health Commission in 2019, the usage of

centrally procured drugs has been a crucial indicator for the performance assessment of the pharmacy department. In the latest 2022 version of the performance assessment for tertiary public hospitals, the indicator for centralized procurement has shifted from assessing the purchase amount of centrally procured drugs to assessing the usage ratio of centrally procured drugs. This ratio is the geometric mean of the usage ratios of various centrally procured drugs. This change aims to provide a more comprehensive and objective assessment of the usage of centrally procured drugs in healthcare institutions. The system achieves this by searching for centrally procured drug codes to identify substitute drugs with the same generic name and establishes a table for the usage ratio of centrally procured drugs.

### ***2.3 Application of information-assisted decision-making system***

With the assistance of the information-based decision-making program and the comprehensive drug evaluation system, our hospital's efficiency in the work of centralized drug procurement has increased, and the data accuracy has improved. Since March 25, 2019, a total of 219 varieties of drugs have been procured through centralized procurement, amounting to 161 million yuan. In 2021, the evaluation of the usage ratio of centrally procured drugs in tertiary public hospitals was 91.44%. The first three batches of centrally procured drugs have secured 4.69 million yuan in leftover medical insurance funds for the hospital.

## **3. Discussion**

### ***3.1 Limitations of the centralized procurement informatization assistance system***

Currently, our independently developed centralized procurement informatization assistance system exhibits certain limitations. Firstly, the system requires developers to have a clear understanding of the national and provincial requirements for various centralized procurement batches. It necessitates knowledge of drug data among different batches in healthcare institutions and an understanding of the medical insurance data associated with each batch of centrally procured drugs. A high level of familiarity with the intricacies of centralized procurement policies is also essential. Secondly, the proficiency of developers in utilizing various development management tools is crucial. Additionally, variations in data content provided by different HIS systems in healthcare institutions result in disparities in the final implementation of the system. As of now, it has not evolved into a complete end product system and faces challenges in widespread adoption<sup>[9]</sup>. Lastly, the current auxiliary decision-making system only offers analytical and statistical functionalities, making it challenging to effectively implement real-time restrictions on the use of centrally and non-centrally procured drugs during drug utilization. This represents a limitation in its practical application.

However, the design philosophy remains valuable as a reference for healthcare institutions and information departments. Future efforts will focus on further enhancing the visual management of the Centralized Procurement Drug Assistance Decision System, incorporating additional graphical functionalities. This aims to present centralized procurement drug information in a clear and intuitive manner, facilitating rapid transitions and visualizing the procurement and usage status of centrally procured drugs. This will aid in improved management of centrally procured drugs.

### ***3.2 The necessity of the centralized procurement informatization assistance system***

In order to better implement the requirements of the drug quantity-based procurement policy, public hospitals should carefully consider how to promote the stability and long-term effectiveness of the policy, benefiting a larger number of patients without resorting to simplistic and harsh interventions. Apart from methods such as policy promotion, training, and inclusion in assessments, leveraging information technologies like big data is essential for strengthening the monitoring of drug selection, non-selected drug usage, and substitute drug usage in clinical departments. This approach guides clinicians to prioritize the use of selected drugs, enhances pharmaceutical services, promotes the rational use of selected drugs, and encourages and improves patient compliance. Standardizing, regulating, making scientific, and homogenizing the clinical comprehensive evaluation of centrally procured drugs can help medical institutions enhance the quality of pharmaceutical services. This ensures the supply and rational use of essential drugs in clinical settings while also alleviating the burden on national medical insurance. The Pharmacy Department of our hospital, as the main body responsible for drug management, oversees various aspects, including scientific reporting, supply

assurance, and data monitoring and analysis. However, with the increasing number of procurement batches, a broader range of centrally procured drugs, a growing list of drugs with similar indications, diverse dosage forms, and factors such as national assessment policies, the scientific, rapid, and reasonable analysis of centrally procured drug data has become a challenging aspect of high-quality pharmacy management.

In the process of drug procurement, whether in the initial reporting phase or in later usage supervision, a significant amount of data extraction and calculation is involved. The informatization of drug procurement work is undoubtedly an inevitable trend for its regular development. The targeted construction of an information platform simplifies the most tedious, time-consuming, and error-prone tasks, greatly saving manpower, ensuring the accuracy and efficiency of the work, and meeting the timely information retrieval needs.

### ***3.3 Importance of the centralized procurement informatization assistance system***

Our hospital, utilizing the Centralized Procurement Informatization Assistance System, monitors the usage of centrally procured drugs. For drugs where the completion ratio is below 50% six months after the procurement batch, we report to the Rational Drug Use Control Committee. Following a comprehensive assessment by the committee, measures are taken, such as restricting or temporarily halting the procurement and usage of non-centrally procured drugs under the same generic name. Furthermore, we conduct a detailed analysis of the usage in each department, considering the actual usage in the previous year and implementing measures like task breakdown. For centrally procured drugs that do not show significant improvement even after implementing the aforementioned measures, we classify them based on complete or partial substitutability. This information is then reported to the Rational Drug Use Control Committee for categorized restriction and control. Regular assessments and dynamic management are performed to facilitate the completion of centralized procurement tasks.

Therefore, the importance of the application of the centralized procurement informatization assistance system in medical institutions is evident in the following aspects: ① Data Integration and management: The centralized procurement informatization system can integrate and manage large amounts of medical data, including drug procurement, usage patterns, departmental needs, and more. Through systematic data management, hospitals can better understand and control drug procurement and usage, enabling more scientific medication management. ② Optimization of centralized procurement processes: The information system enables the optimization of centralized procurement processes, including drug demand assessment, tendering processes, contract management, etc. The system enhances procurement transparency, reduces manual operations and paper documentation, and improves the efficiency and accuracy of procurement. ③ Task quantity and completion statistics: The system can statistically track the task quantities and completion status of each batch according to the centralized procurement projects and timelines. This is crucial for hospital management to timely understand the hospital's performance in centralized procurement, providing data support for decision-making. ④ Monitoring of departmental usage: The information system can monitor the usage of centrally procured drugs in various clinical departments within the hospital. By monitoring usage, hospitals can promptly identify issues, optimize drug usage strategies, and ensure the rational use of centrally procured drugs. ⑤ Data comparison between centralized procurement and departmental usage: The system can compare data between centrally procured drugs and drugs actually used by departments. This helps identify instances of irrational or excessive usage, providing a basis for hospitals to ensure rational drug use. ⑥ Decision support: The centralized procurement informatization system can provide data support for hospital management to better formulate and adjust centralized procurement strategies. Through data analysis, hospitals can make more informed decisions regarding procurement, inventory, and usage. ⑦ Compliance and transparency: The use of information systems can enhance the compliance and transparency of centralized procurement, making the entire procurement process more fair, standardized, and in line with regulatory and policy requirements.

In summary, the centralized procurement informatization assistance system, through digital management and data analysis, comprehensively supports hospital centralized procurement, improves management efficiency, ensures rational drug use, and contributes to the sustainable development of hospitals.

## **4. Conclusion**

Centralized procurement, as a crucial measure in the national healthcare reform, is a long-term

initiative. The centralized procurement drug assistance system that we have developed represents an initial exploration, addressing certain issues. In the future, leveraging the functionalities of the healthcare centralized procurement platform and utilizing various methods, we aim to promote the efficient implementation of this work. Through the means of institutionalization and informatization, we anticipate providing significant assistance for the high-quality development of pharmaceutical services.

## References

- [1] Luo X. Y., Lai H., Wang M. Y., Xu W., Yuan Q. (2022) *Comparative Study of Provincial Drug Centralized Volume-based Procurement Models*. *Health Economics Research*, 39, 7-11.
- [2] Chen M. X., Wu Q. Y., Xu Y., He A., Jin C. L. (2022) *Ongoing Exploration and Enlightenment of National Drug Centralized Volume-based Procurement under Regularization*. *China Medical Insurance*, 08, 61-66.
- [3] Zhang Y. D., Hu Y. X. Dong, Z. M., Ding N., Wei L., Chen W. (2022) *Reform Strategies and Path Selection for Promoting High-Quality Development in Large Public Hospitals*. *Chinese Hospital Management*, 42, 1-5.
- [4] Jiang Y., Tan Z. X. (2023) *Implementation Effect of China's Drug Volume-based Procurement Policy and Optimization Suggestions*. *Chinese Health Services Management*, 39, 287-291.
- [5] Chen W. M., Yang S. F., Chen Z. Y., Chen J. Y. (2023) *Discussion on the Construction of the Digital Control Platform for Centralized Procurement of Drugs and Related Issues*. *Hospital Management Forum*, 01, 61-63.
- [6] Zheng J. Y., Yang J. Y., Gan L. M. (2021) *Implementation of Clinical Monitoring of Drugs Centralized Procurement Using BI Decision Support System*. *China Hospital Pharmacy Journal*, 41, 750-752.
- [7] Wei Y. Y., Liu D., Yin X. Z., Yang H. B., He G. F., Li F., Chen S. D., Gong X. P. (2022) *Practice of Standardized Process and Informatization Platform Construction for Drug Centralized Volume-based Procurement*. *China Pharmacy*, 33, 1136-1140.
- [8] Zhuo Q. W., Sun T. Li X. T. (2022) *Practice and Thinking of Big Data Empowering the Full-process Monitoring System of Centralized Procurement of Drugs*. *China Medical Insurance*, 4, 78-82.
- [9] Li X. D., Li X., Yu Q. (2021) *Practice and Effect Analysis of National Drug Centralized Procurement Based on Informatization Means*. *Chinese Pharmaceutical Affairs*, 35, 138-143.