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Effect Evaluation under the Control of Connotation Construction of Antimicrobial Use Density after Multiple Strategic Interventions

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Abstract: *Objective*: To evaluate the effect of connotation construction control on antimicrobial use density (AUD) after the application of multiple strategic interventions. *Methods*: The experimental subjects were discharge data from Dehong Prefectural People's Hospital, with the scope of this study spanning from January 2024 to December 2025. Comprehensive data from 2024 were included in the pre-intervention group, while comprehensive data from 2025 were included in the post-intervention group. A set of antimicrobial management systems was constructed, characterized by precision, standardization, and systematization, and multiple measures were implemented (including organizational system restructuring, information-based precise control, personalized indicator management, dynamic authorization and training of prescription rights, and multidisciplinary collaboration (MDT), etc.). The following indicators before and after the intervention were statistically analyzed and compared: AUD, antimicrobial use rate, etiological examination submission rate, and irrational prescription rate. *Results*: The post-intervention AUD was significantly lower than that before the intervention [(39.46 ± 2.08) DDDs/(100 person-days) vs (36.79 ± 0.22) DDDs/(100 person-days)], and the post-intervention antimicrobial use rate, proportion of special-grade antimicrobials used, and irrational prescription rate showed a lower trend compared to those before the intervention ($p < 0.05$); the etiological examination submission rate for therapeutic medications showed a higher trend compared to that before the intervention ($p < 0.05$). *Conclusion*: By focusing on connotation construction and implementing multiple strategic interventions, a shift from simple indicator control to precise diagnosis and treatment and rational medication use was achieved, significantly reducing the antimicrobial use density and improving the rationality of medication use.

Keywords: Connotation construction; Antimicrobial use density; Comprehensive intervention; Clinical pharmacy; Effect evaluation

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1. Introduction

The "Antimicrobial Use Density (AUD)" of inpatients is one of the crucial criteria for evaluating the rational use of clinical antimicrobials and has consistently been a key indicator for antimicrobial management in medical institutions [1]. It also serves as a core indicator for rational drug use in the performance assessment of public hospitals. In recent years, although China has achieved initial success in controlling AUD through administrative measures, some medical institutions tend to "meet targets for the sake of meeting targets"; many clinicians are only familiar with the term but do not understand its true meaning, failing to truly grasp the essence of rational drug use. Consequently, it is challenging to establish a long-term mechanism for controlling the intensity of use indicators, which may even impact the quality of medical care [2]. Against this backdrop, mere administrative orders are insufficient, and a shift towards refined management centered on "content construction" is necessary. Content construction emphasizes quality control throughout the entire process of antimicrobial use, from "source, process, to outcome", with the core aim of promoting standardized and precise clinical diagnosis and treatment behaviors, making the reduction of AUD a natural outcome of improved medical quality [3,4]. This study aims to systematically elaborate on a series of comprehensive intervention strategies implemented by our hospital based on the concept of content construction and scientifically evaluate their control effects on AUD and other indicators of rational drug use.

2. Materials and methods

2.1. General information

This study is a single-center retrospective study. The study subjects are the antimicrobial use data of all discharged patients in our hospital from January 1, 2024, to December 31, 2024. The data for the entire year of 2024 were set as the pre-intervention control group, and the data for the entire year of 2025 were set as the post-intervention observation group. Through the Hospital Information System (HIS) and PASS Clinical Pharmacy Management System, data were collected on the total number of inpatients, the number of patient-days admitted during the same period, antimicrobial consumption, antimicrobial use rate, pathogen testing status, approval status of special-use antimicrobials, and irrational drug use issues identified in prescription reviews for both groups. There were no significant differences between the two groups in terms of age, gender composition, and distribution of major diseases ($p > 0.05$), making them comparable.

2.2. Methods

Starting from January 1, 2024, our hospital built a management system centered on content construction based on the existing management framework and implemented a series of comprehensive intervention strategies integrating administration, technical guidance from clinical pharmacists, and training, specifically including:

2.2.1. Organizational system and institutional construction: Shifting from formal construction to authoritative implementation

The hospital established a specialized, substantive AMS management team: led by hospital-level leaders, it formed a cross-departmental (medical affairs, pharmacy, hospital infection, laboratory) collaborative management approach, achieving a top-down linkage model; the hospital and each department signed responsibility letters for the rational use of antimicrobials, with AUD and use rate set as core indicators directly linked to performance assessments. Failure to meet these indicators resulted in a veto, to consolidate management responsibilities at all levels from the root.

2.2.2. Informatization empowerment: Shifting from post-hoc statistics to real-time intervention

Informatization empowerment is of positive significance for management efficiency. In the hospital's existing electronic medical record system, new antimicrobial use rules were added, focusing on the timing of perioperative prophylactic medication, medication duration, and precautions. Real-time reminders were implemented when prescribing, or non-compliant prescriptions were intercepted to reduce irrational drug use from the source. Simultaneously, a dynamic monitoring platform for antimicrobial use density was established: all AUD indicators were visually displayed and comprehensively analyzed in conjunction with data such as the number of discharged patients and the number of surgeries, making indicator monitoring and analysis more scientific and effective.

2.2.3. Antimicrobial use density: Shifting from a hospital-wide unified model to department-specific differential management

Based on the specific conditions of each department (disease structure, surgical types, etc.), benchmark values and management targets for antimicrobial use density were formulated according to the department's actual situation. For high-risk departments, such as the ICU and Infectious Diseases Department, where patients have complex conditions and high infection risks, higher target benchmark values were set, but with a clear requirement for an annual decreasing trend to ensure management effectiveness. Based on this, the assessment of antimicrobial use for treatment and prophylactic antimicrobial use intensity was separated to help clinicians recognize the importance of rationality in therapeutic drug use, with drug selection and duration as key aspects of management.

2.2.4. Professional capacity building: Shifting from general training to precise individualized empowerment

There is a direct link between physicians' professional capabilities and the quality of antimicrobial use. A dynamic adjustment and hierarchical management system for antimicrobial prescription rights was implemented: prescription rights were not only linked to physicians' titles but also comprehensively evaluated based on their assessment scores and actual prescription quality, with a comprehensive review conducted annually. Measures such as demotion or suspension of prescription rights were taken to address those who did not meet the standards. Simultaneously, the training model was further upgraded to align with clinical practice, with regular organization of physicians for learning and discussion on irrational medical records, CMI, etc.

2.2.5. Diagnosis and treatment model: Shifting from empirical medication to precise antimicrobials

The shift in the diagnosis and treatment model lies in providing evidence for medication. The pathogen testing rate before therapeutic medication was used as a core evaluation indicator, closely linked to rapid detection technologies. Therefore, vigorous promotion of PCT, G/GM tests, etc., was undertaken to minimize blind medication in clinical practice. For complex patients, such as those with multidrug-resistant bacterial infections, multidisciplinary consultations were conducted as required and regulations to optimize treatment plans and help patients recover as soon as possible.

2.2.6. Education and training: Shifting from hospital-wide popularization to precise departmental alignment

To enhance the professional skills and comprehensive qualities of physicians and pharmacists hospital-wide, quarterly specialized training on the latest clinical guidelines, industry policies, and the current status of bacterial resistance was required. The Pharmacy Department compiled key departmental indicators and provided feedback

to department heads in a report format, with special guidance provided for abnormal data.

2.3. Evaluation indicators

The primary indicator was Antimicrobial Use Density (AUD), calculated as (antimicrobial consumption [cumulative DDDs]/total bed-days occupied by discharged patients during the same period) × 100.

The secondary indicators included the following four: antimicrobial use rate, pathogen testing rate for therapeutic medication, proportion of special-use antimicrobials, and irrational prescription review rate.

2.4. Statistical methods

Data analysis was performed using SPSS 22.0 software. Measurement data were expressed as mean ± standard deviation ($\overline{x} \pm s$), and comparisons between groups were made using the *t*-test; count data were expressed as rates (%), and comparisons between groups were made using the χ^2 test. A p-value < 0.05 was considered statistically significant.

3. Results

3.1. Changes in antimicrobial use density (AUD) and use rate

After the intervention, the hospital-wide AUD significantly decreased from (39.46 ± 2.08) DDDs/(100 person-days) before the intervention to (36.79 ± 0.22) DDDs/(100 person-days), with a statistically significant difference (*t*-value, $p < 0.05$). See **Table 1** for details.

Table 1. Comparison of AUD and use rate before and after intervention ($\overline{x} \pm s$)

Group	Number of discharged patients	AUD (DDDs/100 person-days)
Pre-intervention group	79,948	39.46 ± 2.08
Post-intervention group	74,746	36.79 ± 0.22
t value		349.126
p value		< 0.001

3.2. Comparison of AUD in the entire hospital and key departments before and after the intervention

After the intervention, the AUD in both the entire hospital and key departments significantly decreased, with statistically significant differences ($p < 0.05$). See **Table 2**.

Table 2. Comparison of AUD in the entire hospital and key departments before and after the intervention ($\overline{x} \pm s$)

Department	Pre-intervention (2024)	Post-intervention (2025)	*t* value	*p* value
Whole hospital	39.46 ± 2.08	36.79 ± 0.22	349.126	< 0.001
Intensive care unit	130.54 ± 0.45	123.67 ± 3.26	589.878	< 0.001
Respiratory department	96.30 ± 0.43	86.38 ± 9.51	294.619	< 0.001
First orthopedics department	49.42 ± 0.50	41.52 ± 0.53	3016.631	< 0.001
Infectious diseases department	95.66 ± 2.77	89.41 ± 10.36	164.409	< 0.001
Obstetrics ward	25.81 ± 3.31	23.00 ± 1.61	210.029	< 0.001

3.3. Changes in other indicators of rational drug use

After the intervention, the usage rate of antimicrobial agents, the proportion of special-grade antimicrobial use, and the rate of irrational prescriptions all significantly decreased ($p < 0.05$); in contrast, the etiological examination submission rate for therapeutic medications significantly increased ($p < 0.01$). See **Table 3**.

Table 3. Comparison of other indicators of rational drug use before and after the intervention (n/%)

Indicator	Pre-intervention (2024)	Post-intervention (2025)	χ^2 value	*p* value
Antibiotic usage rate	35,841 (44.83%)	30,252 (40.47%)	299.719	< 0.01
Pathogen testing rate for therapeutic antibiotic use	69,355 (86.75%)	65,303 (87.37%)	13.019	< 0.01
Proportion of special-grade antibiotic use	2,287 (2.86%)	2,008 (2.69%)	4.342	0.037
Irrational prescription rate	74,560 (93.26%)	67,388 (90.16%)	492.475	< 0.01

4. Discussion

By conducting this experiment and implementing measures centered on connotation construction, our hospital has witnessed a significant reduction in AUD and a notable enhancement in the efficiency of antimicrobial management. The success can be attributed to the alignment of the measures with actual clinical needs, ensuring high feasibility and operability.

4.1. Connotation construction promotes the transformation of management from supervision to optimization guidance

Traditional management models primarily focus on restraint and supervision, resulting in low enthusiasm and initiative among clinical healthcare professionals. This paper introduces a departure from the conventional approach by implementing a series of connotation construction strategies, including setting individualized departmental goals, providing real-time information support, and offering multidisciplinary team technical guidance. These strategies shift the management focus from “supervision and control” to “professional guidance”, addressing practical clinical challenges and further enhancing healthcare professionals’ enthusiasm for participating in rational drug use initiatives [5].

4.2. Precision control as the core element in reducing AUD

The implementation of intelligent information review has effectively curbed some irrational drug use behaviors. Simultaneously, implementing sub-item assessments for AUD in therapeutic and prophylactic medication guides clinical efforts toward optimizing drug use, particularly by shortening excessive antibiotic courses during surgical perioperative periods, thereby contributing to the overall reduction in AUD across the hospital [6,7].

4.3. Capacity building and incentive mechanisms support sustainable management

The dynamic prescription authority combined with case-based training has significantly enhanced physicians’ prescribing capabilities. Linking assessment results directly to performance has established effective positive incentives and negative constraints, facilitating the long-term implementation and execution of various intervention measures [8,9].

4.4. Challenges in sustainable management

Firstly, it is essential to remain vigilant against the potential manipulation of drug use data due to assessment pressures. A reduction in AUD will continue to impact the hospital's resistance rates and patient outcomes, necessitating ongoing monitoring [10]. Secondly, with the significant advancements in medical technology in recent years, there has been an increase in immunocompromised patients due to tumor chemotherapy and organ transplantation. These patients present complex infection scenarios, requiring more scientific and effective antimicrobial management. Going forward, our hospital's antimicrobial management will transition from simple indicator control to individualized and refined management, such as enhancing dose adjustments based on therapeutic drug monitoring (TDM) and further promoting faster molecular diagnostic techniques.

5. Conclusion

In summary, after implementing multiple strategic interventions, significant progress has been achieved in controlling the connotation construction of antimicrobial use intensity. This approach not only effectively controls the intensity of antimicrobial use but also fundamentally promotes more standardized and precise clinical practices, leading to a qualitative leap in antimicrobial management. This management model can be applied to other medical institutions and lays a solid foundation for implementing China's future action plan to curb bacterial resistance.

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Disclosure statement

The authors declare no conflict of interest.

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