

# Investigation on Knowledge Level of Rational Application of Antimicrobial Drug among Pharmacists in Medical Institutions in China's Shanxi province

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## Abstract

**OBJECTIVE:** To investigate the knowledge of rational use of antibiotics among pharmacists in medical institutions in China's Shanxi province, so as to find out the problems, then to provide support for the management of antibiotics. **METHODS:** A questionnaire survey was conducted, which included the basic information of the respondents, the basic knowledge of antimicrobial management and the related knowledge of antimicrobial. SPSS 25.0 was used for statistical analysis. **RESULTS:** 462 pharmacists were investigated. The average score of the knowledge related to rational use of antibiotics was (10.49±4.05). It showed that the hospital type, grade, pharmacist's education, professional title and working years all had effect on the pharmacists' mastery of antimicrobial related knowledge (P<0.05). Multivariate logistic regression analysis showed that hospital grade and pharmacist's education were the main influencing factors (P<0.05). **CONCLUSION:** Pharmacists have insufficient knowledge about the rational application of antibacterial drugs. It is essential to strengthen the training of management regulations and application of antibacterial drugs.

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**[ABSTRACT]** OBJECTIVE: To investigate the knowledge of rational use of antibiotics among pharmacists in medical institutions in China's Shanxi province, so as to find out the problems, then to provide support for the management of antibiotics. METHODS: A questionnaire survey was conducted, which included the basic information of the respondents, the basic knowledge of antimicrobial management and the related knowledge of antimicrobial. SPSS 25.0 was used for statistical analysis. RESULTS: 462 pharmacists were investigated. The average score of the knowledge related to rational use of antibiotics was  $(10.49 \pm 4.05)$ . It showed that the hospital type, grade, pharmacist's education, professional title and working years all had effect on the pharmacists' mastery of antimicrobial related knowledge ( $P < 0.05$ ). Multivariate logistic regression analysis showed that hospital grade and pharmacist's education were the main influencing factors ( $P < 0.05$ ). CONCLUSION: Pharmacists have insufficient knowledge about the rational application of antibacterial drugs. It is essential to strengthen the training of management regulations and application of antibacterial drugs.

**KEY WORDS** Medical institutions; pharmacist; knowledge of antimicrobial drug

## Introduction

Rational use of antimicrobial drug can effectively improve clinical effects, avoid or reduce adverse drug reactions or adverse drug events, lower medical costs, and reduce the incidence of bacterial resistance [1]. It is the work task that requires long-term adherence for medical institutions to continuously strengthen the management of clinical application of antimicrobial drug, so as to ensure medical quality and curb bacterial resistance. On April 24, 2012, the order, "Administrative Measures for Clinical Application of Antibiotics" was formerly issued by *Ministry of Health*, which was implemented formally on August 1, 2012 [2].

Since 2011, the *National Health and Family Planning Commission* had launched a three-year "Special Rectification Action for Clinical Application of Antibiotics" on a national scale. Since then, the management of antimicrobial drug has been normalized, which has achieved certain effects on decreasing the abuse of antimicrobial drug, delaying the bacterial resistance, and so on. To better promote the antimicrobial management, the *National Health Commission of the People's Republic of China* released the notice on continuously succeeding at work of management of clinical application of antimicrobial drug in 2020 [3], which required to change the pharmaceutical service model and exert the pharmacist's leading role in the management of antimicrobial drug. To let the pharmacists better play their role in the management of antimicrobial drug, from a pharmacist's point of view, this article investigated the knowledge level of rational use of antimicrobial drug in pharmacists in medical institutions at all levels in China's Shanxi province, hoping to provide references for decision-making of the related departments and for standardized management of hospitals.

## 1 Objects and methods

### 1.1 Research objects

The approximate random method was conducted and the respondents were the pharmacists from medical institutions in 11 cities in China's Shanxi province. The inclusion criteria of pharmacists: Hire date >12 months, on-the-job pharmacy professionals.

## 1.2 Research methods

### 1.2.1 Research tools

After checking the related literatures in the CNKI, Wanfang Data and Pubmed Database, and combining with the guiding principles for clinical application of antimicrobial drug[4] and relevant policy documents of management[5-7], the questionnaire survey was designed.

It included 2 parts. The first part was the information of the respondents, including the hospital grade, department, professional title, age and working years. The second part was the pharmacists' mastery of antimicrobial related knowledge. This part consisted of 3 items, national countermeasures for antimicrobial drug, administrative rules, regulations and guiding principles of antimicrobial drug, and related knowledge of rational use of antimicrobial drug, respectively. Among them, there were 2 questions about the management strategy of antimicrobial drug, 8 questions about the administrative rules, regulations and guiding principles of management of antimicrobial drug, 10 questions about the related knowledge of rational use of antimicrobial drug, 20 questions in total.

They were single-choice questions and multiple-choice questions. One point is awarded for each correct answer, but no point if missing or wrong answer. There were 20 scores in total. In order to ensure the validity and correctness of the questionnaire, the contents of the questionnaire had been verified by vice-senior or superior experts in antimicrobial drug management in our hospital. Before the formal survey, 50 pharmacists were randomly selected for the pre-survey, and the questionnaire was modified according to the problems found in the pre-survey results. The final questionnaire was determined, and the reasonable completion time was estimated.

### 1.2.2 Investigation method

Before investigation, the researchers contacted the hospital's pharmacy department on the phone to obtain permission and support. The designed questionnaire was imported into the Sojump Technology Network platform, and the link of the questionnaire was sent to the head of pharmacy department of the hospitals participating in the study by WeChat and they would then forwarded it to the pharmacist to fill in anonymously. Before the investigation, the respondent's permission should be obtained and the purpose of the investigation should be explained to them. The investigation should be anonymous and be not connected to the performance appraisal of the department. The logical errors, duplicates, missing items, important information filled incorrectly and other unreasonable data would be deleted.

### 1.2.3 Quality Control of Questionnaire Survey

The respondent using the same IP address can only answer the survey once. The respondents should be aged between 18 and 60 years, and their answers should not have logical errors. According to the completion time of the pre-survey collected, the questionnaire with the completion time of the whole piece less than 3 minutes would be screened out, so as to ensure the quality of it.

### 1.2.4 Evaluation standard of the questionnaire results

The answer to the knowledge point in the questionnaire about the rational application of antimicrobial drug was calculated and analyzed term by term. Among them, "the correct answer rate" (hereinafter referred to as CAR) was the proportion of pharmacists who answered the questions correctly. The calculation formula was: the correct answer rate (%) = the total number of the pharmacists who answered the questions in this part correctly / (the number of questions in this part × the number of the qualified respondents) × 100%. The total score of the questionnaire on antimicrobial related knowledge was 20 points. The questionnaires would be divided into high-score group and low-score group according to the score [?]50% (10 points).

### 1.3 Statistical method

SPSS 25.0 software was used for statistical analysis. Demographic characteristics were described as classified variables. According to the score, the high-score group and low-score group were divided. With the score as dependent variable and the demographic characteristic and medical institution type as independent variables, single variate analysis was performed first by Chi-square test. Factors with  $P < 0.05$  were selected for unconditioned multivariate logistic regression analysis ( $\alpha$  ingress = 0.05,  $\alpha$  deletion = 0.10) to analyze the influences of different demographic characteristics and medical institution type on scores.

## 2 Results

### 2.1 Basic characteristics of the respondent

This survey started on March 1, 2019 and ended on March 15. 475 questionnaires were collected in total, of which 13 were excluded and 462 were valid with an efficient response rate of 97.26%. Among them, the male pharmacists accounted for 24.46% and the female accounted for 75.54%, with the working years mainly concentrating in 5-9 years and 20-29 years accounting for 28.14% and 23.59%, respectively. Their age was mainly from 25-34 years old and from 35-44 years old (38.53% and 29.65%, respectively), and their education backgrounds were Bachelor's degree accounting for 62.99%, Master's degree or higher accounting for 14.94%, and others accounting for 22.08%. Pharmacists from tertiary medical institutions accounted for 61.47% in the entire population, and pharmacists from second-class medical institutions or lower accounted for 38.53%. Among them, pharmacists from general hospitals accounted for 63.85%, pharmacists from specialized hospitals accounted for 20.35%. The pharmacists investigated with a primary professional title accounted for 33.12%, intermediate 30.09% and senior 4.39%.

### 2.2 Correct answer rate of rational application of antibiotics

The results showed that the average CAR of the first item about management strategy of antimicrobial drug was 86.91%, the average CAR of the second item about administrative rules, regulations and guiding principles of antimicrobial drug was 64.75%, the average CAR of the third item about related knowledge of rational use of antimicrobial drug was 35.76%, and the average total CAR was 52.47%. The CAR of question 11, 12, 14, 17 and 19 was 23.59%, 23.81%, 16.67%, 22.08% and 23.81%, respectively, and all were lower than 30%. Among them, question 8, "How long does it take to complete the related procedures of skip-level application of antimicrobial drug for special use?" the CAR of which was the highest, 90.91%. Question 14, "What are the following circumstances under which you think the combined use of antimicrobial drug is required?" the CAR of which was the lowest, 16.67%. See Table 1 for details.

### 2.3 The statistics of score of rational application of antimicrobial drug

In this survey, the average score of relevant knowledge of antimicrobial drug of respondents was  $10.49 \pm 4.05$  (the highest score: 20 scores, the lowest score: 4 scores).

The answers of the investigated pharmacists were analyzed in this survey in 7 aspects, including sex, degree of education, medical institution type, professional title, working years, age and hospital grade, and the conclusions were drawn: (1) There was no significant difference between the score and the pharmacists' sex. (2) There was significant difference between the degree of education of the pharmacists and their scores ( $P < 0.05$ ). The higher the degree of education of the pharmacists was, the higher the score was. But there was no significant difference of the score between the pharmacist with an undergraduate degree and the pharmacist with a Master's degree. (3) There was significant difference among different types of medical institutions ( $P < 0.05$ ). The pharmacists from general hospitals and specialized hospitals overall scored higher than them from the TCM hospitals and other medical institutions. (4) There was significant difference among the pharmacists with different professional titles ( $P < 0.05$ ). From the assistant pharmacist to deputy-chief pharmacist, the higher their professional title was, the higher they scored. There was no significant difference among the pharmacist-in-charge, deputy-chief pharmacist and chief pharmacist. (5) There was significant difference among the investigated pharmacists with different working years ( $P < 0.05$ ). As a whole, the longer the pharmacists had worked, the higher they scored. But the pharmacists having worked for over

30 years didn't score higher. (6) The pharmacists at different ages showed no significant difference in scores. (7) There was significant difference between the hospital grades and scores ( $P < 0.05$ ). The pharmacists from tertiary hospitals scored higher than them from other medical institutions. See Table 2 for details.

#### 2.4 Single variate analysis of the influence factors of the knowledge level of rational use of antibacterial drug

The analysis of the single variate of the respondent, general demography and medical institution type was conducted, except for the sex and working years showing no statistical significance, other variables all had an effect on the knowledge level of antibacterial drug.

#### 2.5 Multivariate analysis of the influence factors of the knowledge level of rational use of antibacterial drugs

The indexes of Chi-square test results with statistical significance were included in the multivariate model. The model was built with the stepwise regression method, and with the -2 Log likelihood value of 586.154 and Chi-square value of 0.360,  $P < 0.001$ . See table 3 for the variable and assignment with the logistic regression analysis method. Multivariate logistic regression analysis was carried out with the score as the dependent variable (0=low-score group, 1=high-score group), and with the independent variables of education, medical institution type, professional title, working years and hospital grade. The result showed the medical institution type, hospital grade and education were associated with the higher knowledge level of rational use of antibacterial drug. See the table 4 for details.

### 3 Discussion and suggestions

#### 3.1 Knowledge level of rational use of antibacterial drug of the pharmacist

Knowledge level of rational use of antibacterial drug of the pharmacist knowledge is a significant factor that influences the rational use of antibiotics [8]. The results of this survey reflected that the current knowledge level of antimicrobial drug of pharmacists desperately needed to be improved. Our findings regarding poor knowledge about antibiotics are similar to findings from other studies conducted in different countries [9-12]. According to the results, the CAR of usage indications for antimicrobial drug, prophylactic medication and drug combination, the dosage adjustment of antimicrobial drug for patients with liver and renal insufficiency, the selection of antimicrobial drug for common diseases of the pharmacists, was relatively low, especially for the clinical medication, the knowledge of which was extremely lack. For example, the CAR for the combined use of antimicrobial drug, and the CAR for the use of antimicrobial drug and the prophylactic use of antimicrobial drug. It indicated that the respondents generally lacked knowledge about the clinical use of antimicrobial drug. Analyzing the causes: the positions of pharmacists in hospitals included drug dispensing, hospital preparations, clinical pharmacy, pharmaceutical research and so on, and their work nature was quite different [13], and they mastered different pharmaceutical knowledge. Pharmacists also did not focus on the study of clinical use in their work practice.

The CAR for the theme for 2011 World Health Day, "No action today, No cure tomorrow", was slightly high, and the reason of which was that the theme for World Health Day was advertised in different ways and there was higher awareness rate in pharmacists. We can see the importance of advertisement. Pharmacists in hospital had changed their work mode from drug-centered to patient-centered model of pharmacy service, which needed to improve the professional level of pharmacists. It was suggested to increase the frequency of training and assessment in the medical institutions, and train the pharmacists at different positions and levels according to their requirements [14]. Meanwhile, the pharmacists should actively take part in the study. For the contents, the medical institutions should emphasise on the training of clinical use of antimicrobial drug.

#### 3.2 Influence of educational background and professional title on knowledge level of antimicrobial drug

The education background and professional title of pharmacists would mainly affect their knowledge level of antimicrobial drug. The higher the education degree of pharmacists was, the better they master the knowledge of antimicrobial drug. This indicated that the highly-educated pharmacists had a more solid knowledge reserve and had a more accurate understanding of antimicrobial knowledge in all aspects, and they were also the main work force of the current pharmacist team.

The professional title also had an effect on the knowledge level of antimicrobial drug. Pharmacists lack of knowledge of antimicrobial drug might be related to less years of clinical work, less experience, and less mastery and application of knowledge. The pharmacist-in-charge had worked in the front line for a long time, so they had more opportunities to have access to relevant knowledge of theoretical knowledge and practical application of antimicrobial drug. Because the deputy-chief and chief pharmacists were mainly engaged in management work in the hospital, they applied the knowledge of antimicrobial drug use relatively less. Therefore, it required to strengthen the continuing education and training of pharmacists based on their positions, put what they had learned into practice, learn at work, and apply what they had learned to work.

### 3.3 Influence of the grade and nature of medical institutions on the knowledge level of antimicrobial drug

It was found in this survey that pharmacists from medical institutions of different grades and different nature had different knowledge level of antimicrobial drug. Pharmacists from tertiary hospitals had relatively higher knowledge level of antimicrobial drug, which may partially explain unnecessary use of antibiotics in rural China in earlier studies[15]. According to the survey, hospitals at different grades showed uneven talent distribution. The highly-educated pharmacists mainly concentrated in tertiary hospitals[16]. It was also shown the similar results in this survey. They focused on continuing education and training of pharmacists in Tertiary hospitals, so as to make the pharmacists have access to the latest theoretical knowledge and knowledge of rational drug use.

However, there were almost no highly-educated talents in community hospitals, and they also had few opportunities for continuing education. Due to the knowledge structure and work nature of TCM hospitals, they had a poor knowledge of application of antibacterial drug [17]. It was particularly urgent to carry out education and training on knowledge updating of antibacterial drug in small and medium-sized hospitals [18].

This article conducted a questionnaire survey of 462 pharmacists, including the basic situation of the survey subjects, basic knowledge and use of antibacterial drug management. Analysis shows that hospital type, level, pharmacist's educational background, professional title, and working years will affect the pharmacist's knowledge of antibacterial drugs. The results suggest that pharmacists have insufficient knowledge about the rational application of antibacterial drugs and need to strengthen antibacterial drug management regulations and drugs Training in use. Through a large number of investigations, specific results have been obtained. This is helpful for pharmacists to use antibacterial drugs rationally and is beneficial for patients to restore their health. Through this research, it is very helpful to directly predict the level of pharmacists in the future, so as to conduct reasonable training and reduce medical accidents.

Bacterial resistance and rational use of antimicrobial drug are the problems to be solved urgently by medical institutions and they would be also the major concerns in the society. If pharmacists want to play a role in promoting the rational application of antimicrobial drug, and to improve themselves in the opportunity of pharmacist transformation, it is imperative to improve the knowledge of antimicrobial drug. The survey is conducted on the network platform. While maximizing the efficiency of information acquisition, there are still disadvantages, such as answer interference, under-representation for the entire population of the samples (such as the uneven distribution of the pharmacist numbers in hospital at all levels), which will lead to certain restrictions to the extrapolation of the conclusion. More efficient investigation method could be developed in the future based on the internet technology, so as to provide important support for the later research.

#### Competing interests

The authors declare that they have no competing interests.

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Ethics approval and consent to participate

This study was approved by Ethics Committee of Shanxi Children's Hospital.

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