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COMBATING ANTIBIOTIC RESISTANCE: NURSES KNOWLEDGE AND ATTITUDE TOWARDS ANTIBIOTIC USE AND PREVENTION OF ANTIBIOTIC RESISTANCE AT PUBLIC SECTOR HOSPITALS, AZAD JAMMU AND KASHMIR (AJK)

Misbah Rasool[*1], Zubia Kalsoom[2], Amir Sohail[3], Mutiha Rasool[4]

*[*1]RN, Midwifery, Post RN, MSN, Nursing Officer DHQ Hospital Bhimber AJK*
[2]RN, Midwifery, Post RN, MSN, Assistant Professor/Principal II- TECH College of Nursing, International Institute of Technology Culture and Health Sciences Gujranwala, Punjab
[3]MBBS, FCPS (Anesthesia), MSc (Pain Medicine), HOD Anesthesia and pain management CMH Rawalpindi Pakistan
[4]BS Hons English, MS Applied Linguistic, Student Foundation University Rawalpindi

[*1]silahrasool100@gmail.com

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Corresponding Author: *
Misbah Rasool

Abstract

Objective: *The study aims to assess the knowledge and attitude of nurses towards antibiotic use and prevention from its resistance and highlighting the significance of their knowledge and attitudes towards antibiotic stewardship.*

Method: *The cross-sectional study was conducted in 2024.The data were gathered from 242 nurses of different public sector hospitals of Kashmir region of Pakistan through validated and reliable questionnaire ($\alpha > 0.70$). Descriptive and Inferential statistical analysis were applied to analyze the data.*

Results: *The Findings showed that 66.9 % nurses have good knowledge and 65.7% have positive attitude towards antibiotic use and resistance prevention. But more than half of nurses were unaware about resistance mechanism of antibiotics and stewardship strategies to tackle antibiotic resistance. There was no significant correlation of knowledge and attitude observed ($p>0.05$).*

Conclusion: *Nurses play a significant role in combating antibiotic resistance. The research pinpoints knowledge gap among nurses regarding resistance mechanisms of antibiotic and stewardship strategies to tackle antibiotic resistance burden, emphasizing the need for constant professional development and directed training programs.*

INTRODUCTION

The initial antibiotic, Salvarsan, was familiarized in 1910. Over a century, antibiotics have changed into modern medicine, increasing 23 years the average lifespan of human. In 1928 the innovation of penicillin propelled a golden period of natural product antibiotic research, which peaked in the mid-1950s. Since then, there has been a reduction in discovery and development of antibiotics, as well as the evolution of drug resistance in many human infections, contributing to the current antimicrobial resistance dilemma [1].Antimicrobial resistance is a worldwide issue that affects both developed and developing countries, need a prompt global response. According to worldwide estimates, antimicrobial

resistance might kill 10 million people each year by 2050 and cost the economy $100.2 trillion if not approached adequately [2]. The 2022 Global Antimicrobial Resistance and Use Surveillance System (GLASS) report reveals concerning data on the rising resistance among bacterial pathogens. In 76 countries, the median resistance rate for E. coli against third-generation cephalosporin's stands at 42%, while methicillin-resistant Staphylococcus aureus (MRSA) has a resistance rate of 35%. This situation is particularly worrisome. For urinary tract infections (UTIs) caused by E. coli, 20% of cases in 2020 showed reduced susceptibility to commonly used antibiotics such as ampicillin, co-trimoxazole, and fluoroquinolones. This highlights the growing challenge of antimicrobial resistance in treating common infections. A study by university of Oxford,2022 highlighted that widespread are more common in lower-middle-income countries such as Pakistan and India, however higher-income countries such as the United States and France are also reporting distressingly high levels of antibacterial resistance leading to a rise in mortality rates. Research shows that nurses are mostly aware of the antibiotic resistance issue, their understanding of appropriate antibiotic usage and specific resistance mechanisms are often insufficient. A study survey in Nigeria revealed that many nurses lacked comprehensive knowledge of antibiotic stewardship and antimicrobial resistance which is necessary for decreasing the misuse of antibiotics [3].Another research is conducted in West bank regarding assessment of the nurses' knowledge and practice of antibiotic use. The results provide ground to develop education and stewardship programs to increase nurses' skills in using antibiotics to decrease the antibiotic resistance [4]. Qualitative interviews with nurses in healthcare facilities of Qatar revealed few key issues related to antibiotic stewardship programs. These comprised a general lack of knowledge about antibiotic stewardship, poor communication between multidisciplinary teams, and inadequate chances for engagement across disciplines. Additionally, there was a lack of formal education and training regarding antibiotic stewardship program and many nurses sensed unprepared due to a lack of defined roles and competencies within antibiotic stewardship program policies[5].

Antibiotic resistance is a severe and rising issue which will results in unwanted individual, local, and national concerns if unimpeded [6].In the healthcare sector, it causing an extensive threat to patient outcomes and public health. This problem manifests in increased cases of prolonged hospital stays, prevalence of infections that are challenging to treat and higher mortality rates in local context. According to World Health Organization, 2023 healthcare intuitions are struggling with the growing incidence of multidrug-resistant organisms, which complicates the protocols of treatment and leads to higher healthcare costs. As it is stated by Centers for Disease Control and Prevention,2022 the nurses are the major force of healthcare facility play critical role in educating patients regarding antibiotic use and proper antibiotic administration. However, gaps in nurses' knowledge and attitudes towards antibiotic use and resistance hamper effective antibiotic stewardship, which is important for combating this global issue.

The main goal of this study is to assess and improve the knowledge and attitudes of nurses towards antibiotic use and prevention of its resistance through directed educational interventions in Kashmir region of Pakistan. This aim also highlights the current state of knowledge among nurses, identify gaps, and recommend evidence-based approaches to enhance their understanding and engagement in antibiotic stewardship.

2 Methodology

2.1 Study Design and Setting

A cross-sectional study design was used to evaluate the knowledge and attitude of nurses towards antibiotic use and resistance from January 2024 to June 2024. This design allows for the collection of data at a single point in time to assess the current state of knowledge and attitudes among nurses in 04 public sector hospitals in Kashmir region of Pakistan.

2.2 Study Participants

Participants were selected by using a convenience sampling technique. A sample size of 242 was calculated for finite study population through single portion formula. The study gained a 96% response rate, with 242 responses to 252 questionnaires that were given. Nurses who were unwilling to take part were omitted from the assessment.

2.3 Data Collection

Data were collected using validated questionnaire. The questionnaire was adapted from study (7).The questionnaire included three parts. Part 01 included participant's demographic information. part 02 was related to nurse's knowledge comprised 20 items, that were further categorized into three dimensions: antibiotic resistance, prevention of antibiotic resistance and facts about antibiotics. All items were in format of three options yes, no and don't know with one correct answer. Each right answer was given a score of 1, while a wrong answer was awarded a 0 score. A score of 12 was used as the cut-off point to decide the level of knowledge; a score more than 15 was categorized good knowledge.

Part 03 was related to the attitude level of nurses towards prevention of antibiotic resistance comprised 15 items. The items were assessed on a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). A score more than 3 labeled good attitude and less than 3 labeled poor attitude. A pilot study with sample size 0f 20 was conducted to check the reliability and validity of the questionnaire. The content validity was done by 3 field experts and modifications were incorporated. The reliability of the tool was confirmed by using Cronbach's alpha value which was 0.71. Written consent was obtained from study participants. Hard copies of questionnaire were circulated to the nurses and collected back after completion of questionnaire.

2.3 Data Analysis

The data were analyzed by using Statistical Package for Social Science (SPSS) Version 27. Normal Distribution of data was not found. Descriptive statistic was used to analyze the demographic variables. The spearman correlation analysis was used to understand the relationship between knowledge and attitudes towards antibiotic use and antibiotic resistance.

2.4 Approval of Institutional Review board.

IRB approval was obtained in the study settings area. All participants were informed about the purpose of study. Anonymity and confidentiality were maintained throughout the study.

3 Results

3.1 Demographic Characteristics

The study comprised participants with varying levels of education, age, working institutions, and years of experience. The mean age of participants was 33.4 years.

The majority 58.3%), had a Nursing Diploma, while the rest (41.7%) had a Nursing degree. Participants worked at different institutions: setting A (28.9%), setting M (26.9%), setting B (19%), setting K (24.8%), and setting N (0.4%). Experience levels diverse, with 35.1% having less than 5 years, 37.2% having 5 to 10 years, 14.9% having 11 to 15 years, and 12.8% having more than 16 years of experience (Table 1)

Table 1. Participant demographics Variable	Categories	Frequency (%)
Education	Nursing Diploma	(141) 58.3%
	Nursing degree	(101) 41.7%
Age	22-32 years	(121) 50%
	33-42years	(97) 40.1%
	Above 43 years	(24) 9.9%
Name of working Institute	Setting A	(70) 28.9%
	Setting M	(65) 26.9%
	Setting B	(46) 19%
	Setting K	(60) 24.8%
	Setting N	(1) 0.4%
Experience	Less than 5 years	(85) 35.1%
	5 to 10 Year	(90) 37.2%
	11 to 15 years	(36) 14.9%
	Above 16 year	(31) 12.8%

3.2 Nurses Knowledge

Concerning the facts about prevention of antibiotic resistance, applying infection prevention and control practices is the vital action that a nurse should take to inhibit resistant infections and their spread. This item rated the highest score of 97.1%. The lowest score was of 25.5% observed in the item of 'antibiotic resistance', which is Antibiotic resistance spread through animal and human. A total of 5 items were found below 60% seen in table 2.

Table 2: Nurses Knowledge about Antibiotics Facts, Antibiotics Resistance facts and prevention of Antibiotic resistance.

No	Question	Correct Answer%
1.	1 Antibiotic is a medication that kills or slows down the growth of bacteria	94.2%
2	Antibiotics can have side effects, like allergic reactions and diarrhea	94.2%
3	The common side effects of antibiotics are rash, nausea, vomiting, and diarrhea	93%
4	The microorganism that can be killed by antibiotics is normal and infectious flora.	46.7%
5	The effectiveness of antibiotics will be reduced if the full course is not completed	81.4%
6	Nosocomial infection is the type of infection acquired in the health care setting.	81%
7	Antibiotic resistance is defined as bacteria changes in a way that reduces or eliminates the effectiveness of antibiotics.	85.5%
2.	8 Developing new generations of antibiotics is not considered a cause of antibiotic resistance.	41.3%
9	Antibiotic resistances can affect any age group	90.9%
3.	10 Overuse of antibiotics is the most important factor leading to antibiotic resistance around the world	88%
4.	11 Infections caused by antibiotic-resistance are difficult and sometimes impossible to treat.	74.4%
5.	12 Antibiotic resistances spread through animal and human	25.5%
13	Treating a viral infection with an antibiotic is an example of improper use of antibiotic therapy.	84.7%
6.	14 Effective handwashing is the most important procedure for the prevention of infection from microorganisms.	95.5%
7.	15 Immunization and infection prevention are considered as the most important factor in preventing antibiotic resistance	67.8%
16	The antibiotic stewardship program aims to improve the use of antibiotics and prevent antibiotic resistance.	65.7%
8.	17 Antibiotic therapy should be started ideally when there is a positive microbiological result.	90.9%
9.	18 A patient expressing that antibiotics can be taken when symptoms are gone indicates a lack of knowledge	51.7%
10.	19 Implementing infection prevention and control practices is the key action that a nurse should take to prevent resistant infections and their spread.	97.1%
11.	20 Prospective audit, formulary restriction, and preauthorization and guidelines, and clinical pathways are considered as antibiotic stewardship strategies to combat antibiotic resistance.	55.4%
12.		

3.3 Nurses Attitude

Participants attitudes were measured by using 5-point Likert scale, with score ranging from 01 (strongly agree) to 5 (strongly disagree). The attitude of nurses towards antibiotic usage for general symptoms of the flue a mean score 1.5, self-use of antibiotics a mean score of 1.3 and 1.9 score to kept antibiotics in stock. All these showed poor attitude of Nurses towards prevention of antibiotic resistance. A good mean score of 4.2 found that participants read and understood the instructions before using antibiotics. As for the nurses' attitude towards strategies to prevent antibiotic resistance, their responses resulted in a mean score of 4.1. This indicates their attitude toward taking part in infection-control activities such as sanitation, hand washing, food, and water safety, and vaccination, all of which aim to minimize spread of antimicrobial resistance. Also, a mean score of 3.7 was seen in escalated issues related to misuse of antibiotics. Half of all participants, with a mean score of 4.0, advised patients to complete the prescribed antibiotic course. A mean score of 4.1 showed how respondents saw themselves playing an active role in educating patients and families about the risk of AR. In the present survey, a mean score of 4.2 was reported that the respondents are advising other healthcare professionals as the appropriate use of antibiotics is important. Moreover, a mean score of 3.6 showed respondents attitude toward their active contribution to institutional policies and guidelines focusing to control antibiotic resistance, which is the responsibility of a nurse. The respondents advocated the use of new generations of antibiotics that can fight diseases more effectively with caution with a mean score of 3.8. Those respondents were also recommending computer-based surveillance facilitating good antibiotic stewardship is important (mean score 3 . 7). Further, those agreed that advising incorporating active interventions along with education to prevent antibiotic resistance is necessary one (mean score = 4.3). It is the responsibility of a nurse to follow clinical pathways in the management of infectious diseases is the responsibility of a nurse (mean score = 4.2) (Table 3)

Table 3. Attitude about antibiotic use and prevention from its resistance *s.no*	Mean	SD
1.Antibiotic can be taken for the flu to get better quickly	1.57	0.877
2.Antibiotics can be taken without a prescription	1.36	0.616
3.Instructions are read and understood before taking antibiotics.	4.29	0.909
4.Antibiotics can be kept in stock to be used whenever feeling sick.	1.93	1.136
5.Participation in infection control activities help in minimizing the spread of antimicrobial resistance.	4.14	1.054
6.Reporting and escalating issues related to misuse of antibiotics is the responsibility of a nurse.	3.76	1.201
7.Advising patients to complete the prescribed antibiotic course even if they feel better quickly is necessary.	4.08	1.096
8.Participation in special training on antibiotic resistance is recommended for all health care professionals.	4.26	1.057
9.Advising other healthcare professionals in the appropriate use of antibiotics is important.	4.20	1.079
10.Playing an active role in educating patients and families on the risk of antibiotic resistance is the responsibility of a nurse.	4.11	1.069
11.Active contribution to institutional policies and guidelines which aim to control antibiotic resistance is the responsibility of a nurse.	3.62	1.200
12.Advocating the use of new generations of antibiotics that can fight diseases more effectively with caution.	3.84	1.072
13.Recommending computer-based surveillance to facilitate good antibiotic stewardship is important.	3.74	.893
14.Advising incorporating active interventions along with education to prevent antibiotic resistance is necessary	4.32	3.421
15.Following clinical pathways in the management of infectious diseases is the responsibility of a nurse.	4.22	1.049
Valid N 242 (listwise)		

3.4 Overall knowledge and attitude of nurses regarding antibiotic use and it resistance prevention

The overall knowledge and attitude of Nurses towards antibiotic use and resistance, knowledge was categorized into three high level with score percentage (66.9%), moderate level with score percentage (25.2%) and low-level score parentage was (7. 9%). Attitude level also have three categories positive attitude (65.5%), neutral attitude (28.5%) and negative attitude (5.8%) Table 4

Table 4

Knowledge	High Level	15 – 20 (80% to 100%)	162	66.9%
	Moderate Level	12 – 15 (60 to 79 %)	61	25.2%
	Low Level	Less than 12 (< 60%)	19	7.9%
Attitude	Positive Attitude	4 – 5 (80 to 100%)	159	65.7%
	Moderate Attitude	3 (79 to 60 %	69	28.5%
	Negative attitude	Below then 3(< 60%)	14	5.8%

3.5 Correlation between knowledge and attitude

A Spearman correlation analysis was performed to check the relationships between various dimensions of knowledge and attitude. The overall knowledge shows significant positive correlations with knowledge fact (0.612**), knowledge resistance (0.764**), and knowledge prevention resistance (0.660**). Attitude has, non-significant correlations with overall knowledge (0.024), knowledge fact (0.032), knowledge resistance (0.042), and knowledge prevention resistance (0.095). Knowledge fact significantly correlates with knowledge resistance (0.301**) and knowledge prevention resistance (0.149*). Knowledge resistance also correlates significantly with knowledge prevention resistance (0.275**) (table 5)

Table 5 Correlation between knowledge and Attitude		1	2	3	4	5
Spearman's rho	1) Overall Knowledge	~				
	2) Attitude	0.024	~			
	3) Knowledge fact	0.612**	0.032	~		
	4) Knowledge Resistance	0.764**	0.042	0.301**	~	
	5) Knowledge Prevention Resistance	0.660**	0.095	0.149*	0.275**	~

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

4 Discussion

Antibiotic resistance prevention needs a multi-sectoral approach, and everyone has an important role in this context. Nurses are frontline healthcare professionals, play a significant role in the effort to prevent this global calamity. The understanding and approach of nurses has an influence on caregiving and education of patients. A study done in Jordon concluded that nurses must be educated on the correct use of antibiotics and the occurrence of antibiotic resistance [8]. The present research directed to measure the awareness and attitudes of nurses towards the prevention of antibiotic resistance. There are several important findings in our study. The findings of this study demonstrate the important factors for both effective use of antibiotics and avoiding antibiotic resistance, especially in terms of nurse practices. A high percentage of the data indicated that nurses were aware about basic antibiotic functionality, which was 94% identified of killing or inhibiting bacterial function. Similarly, mostly knew that antibiotics could have potential side effects including allergic reactions and diarrhea. These results support evidence from previous studies that suggest health professionals, especially nurses, and other non-prescribers possess basic knowledge regarding antibiotic therapy. Our findings opposed a similar another study findings reported that nurses did poorly on a survey of knowledge, attitudes, and practices related to antibiotic use [9] .our findings also support that of two studies in which nurses displayed good

understanding with antibiotics [10] and knowledge of antibiotics [11]

25% of nurses provided correct answer regarding resistance mechanism of Antibiotic. Its indicate critical knowledge gap among nurses. This issue is concerning point because nurses play major role in patient care, administration of antibiotic and infection control practices. The misuse and over use of antibiotics in both human and animal agriculture is a serious worldwide health hazard known as antibiotic resistance. Humans can become infected with resistant bacteria through direct contact with animals, environment or eating contaminated food products[12] Contradictory views of nurses and medical residents regarding the prerequisite for antibiotics were conveyed in yet another study [13]. To address these issues and thus enhance the central role of nurses in antibiotic resistance prevention approaches, these findings collectively highlight the need for training.

Half of nurses were unaware about the programs aimed to improve antibiotic use and lower resistance. This suggests that further training is required on stewardship measures such as formulary restrictions, audits and clinical pathway development. Recent studies have demonstrated that 94.4% of respondents support the use of these stewardship approaches and have good knowledge about antibiotic stewardship strategies [7]. A study conducted in China found that enhancing education and training, along with fostering better-quality multidisciplinary communication and collaboration, can significantly improve nurse engagement in antibiotic stewardship strategies[(14)].

Nurses attitudes regarding the use of antibiotics and resistance are an important factor to combat this issue. Results of this study demonstrate that 65.7% respondents in general show positive attitude for correct antibiotic usage, they still need to increase their attitude on certain topics so as to be better positioned in combating resistance crisis. This finding was reliable with a study that reported participants (76.7%) had a fair attitude towards antibiotic use and the prevention of antibiotic resistance [(7)]. The belief that antibiotics can be taken for the flu to get better quickly, with poor response indicates a considerable misunderstanding about the nature of antibiotics. Antibiotics are ineffective against viral infections such as the flu. This misconception aligns with findings from a study conducted in china on nursing students [(15)]which noted that most of students mistakenly believes that antibiotics can treat viral infections, thereby contributing to inappropriate antibiotic use and resistance. Lastly, the belief that antibiotics can be kept in stock to be used whenever feeling sick had poor score. Keeping antibiotics for future use can lead to inappropriate self-medication. Another study found that 37.2% of respondents kept leftover antibiotics instead of discarding them, highlighting their attitudes toward antibiotic use [(16)]. In contrast, the current study shows that nurses had a positive attitude toward antimicrobial stewardship programs (ASPs) and related actions. Similarly, a study in Pakistan reported that most healthcare professionals, including nurses, had a positive attitude towards hospital-based ASPs, despite having limited awareness about these program[(17)].

4.1 Limitations

There are some limitations to this study. Firstly, the cross-sectional study design confines our capability to create connectedness between the intervention and perceived alterations in knowledge and attitudes. Secondly, the study was conducted within a single region, which may affect the generalizability of findings. Thirdly, self-reported data on behavioral changes and attitudes are matter to social prestige bias, which may miscalculate the positive impacts of the intervention. Lastly, the lack of a longitudinal follow-up means we cannot assess the long-term retention of knowledge and sustained behavioral changes

4.2 Conclusion

Nurses frequently serve as patients' first point of contact; it is important that they must understand antibiotic resistance mechanism in order to stop the spread of resistant germs. The present study revealed that nurses themselves are not fully aware of the mechanism of antibiotic resistance and the strategies to be employed in its prevention. The results emphasize the need for targeted interventions to enhance not only the knowledge but also the attitudes of nurses towards responsible antibiotic practices. In conclusion, this research provides valuable insights into the current state of antibiotic stewardship among

nurses in Kashmir region of Pakistan and highlights the importance of ongoing education and policy support to combat antibiotic resistance effectively.

Other Information

As there were no funding organizations involved, they played no role in the design, implementation, interpretation, or reporting of this study. The authors assume full responsibility for all aspects of the research process and the content of this study.

Conflict of interest

No conflict of interest to proclaim

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