**Original Research Article**

# A STUDY ON NURSES’ ADHERENCE TO INFECTION CONTROL STANDARDS AND RATIONAL ANTIBIOTIC USE IN CLINICAL SETTINGS

## **Abstract**

**Background:** The increasing burden of healthcare-associated infections and antimicrobial resistance necessitates a better understanding of nurses’ roles in infection control and antibiotic usage.

**Objective:** The study evaluates nurses' understanding of infection control procedures, adherence to practices, and antibiotic resistance. It identifies knowledge gaps and suggests interventions to improve antibiotic usage and control procedures, reduce healthcare-related infections, and prevent antibiotic resistance. The findings are used to create targeted interventions.

**Methods:** A cross-sectional KAP survey was conducted among 45 nurses from various departments of a secondary care hospital using a validated questionnaire. Descriptive and inferential statistics were applied.

**Results:** A poll of 45 nurses found that antibiotics slow down bacterial development, with 46.7% believing they should be provided on time. 57.8% suggested adjustments, while 15.6% suggested neither. Only 13.3% knew proper handwashing, while 59% were unaware of antibiotics and 62.2% were aware of HAI. Of these, 51% were aware of the various ways infections spread.

**Conclusion:** A study involving 45 participants aimed to understand nurses' knowledge and practices regarding antibiotic use, infection control, and hand hygiene. The data included questions about side effects, antimicrobial stewardship, and confidence in managing multi-drug-resistant infections. The majority of participants agreed that antibiotics either kill bacteria or slow their growth, and they acknowledged the importance of timely administration. However, awareness of antimicrobial stewardship and hospital-acquired infections varied, with some indicating a lack of awareness. Hand hygiene practices also showed variability, with some nurses following protocols frequently while others rarely do. Confidence levels in managing multi-drug-resistant infections ranged from very unconfident to very confident. The data underscores the need for improved training and consistent practices in antibiotic use and infection control among nursing staff. **Keywords-** Antibiotic Resistance, Infection Control, Healthcare-Associated Infections (HAIs), Nurses' Knowledge and Practices, Hand Hygiene

# **Introduction:**

Nurses are the largest workforce in hospitals and are in a significant position to improve the well-being of patient care by serving as a first-line defence for preventing and controlling the transmission of infections. It is an ethical and professional requirement that nurses have up-to-date knowledge and skills for preventing the transmission of infections and practice them safely and competently at all times. [1] Nurses play a crucial role in implementing infection control procedures and practices to prevent patient infections and safeguard healthcare staff from healthcare-associated infections (HCAI).

It is well justified by the World Health Organization and other international health groups that healthcare-associated infections (HCAIAI) in developing countries are a major issue for patient safety.[2] Increased HC contributes to prolonged hospital stays, long-term disability, increased resistance to antimicrobial agents, additional financial burden for the management, and excess mortality.[3] One factor that might increase the risk of HCAI in these countries is low adherence to infection control practices by the nursing staff. The incidence of high HCAI in low- and middle-income countries like India is high due to limited knowledge and training of staff, low adherence to universal precautions and poor waste management practices, poor knowledge of hospitals, lack of standard operating procedures (SOPs) in ward management, and poor compliance to hygiene.[4]

Fear of hospital infections is a significant contributing factor to the overuse of antibiotics for both preventative and therapeutic purposes, a trend that has led to an increase in antimicrobial resistance (AMR)[5,6].

The WHO global action plan had suggested that improving awareness and understanding of antibiotics and AMR through effective communication, education, and training, and an urge to control further expansion of AMR. It is noted that several studies have implied that education about antibiotics and their appropriate use should focus on undergraduate training, which has an important impact on the future professional’s attitudes and behaviours regarding antibiotic use and AMR. [7,8,14]

However, there is limited evidence regarding the perceptions and drivers of antibiotics misuse in the Indian setting; there are no published studies focusing on knowledge, attitude, and practice (KAP) of antibiotics use.

Hospital-acquired infections are becoming more common, and the horizontal transmission of bacteria is still a major cause of a high nosocomial infection rate in the healthcare field. It is essential to use antibiotics correctly in order to lower these infections. Overuse or misuse of antibiotics can lead to multidrug-resistant organisms (MDRO), making infection harder to treat and increasing morbidity and mortality rates.

Understanding local knowledge, attitudes, and practices regarding antibiotics will be the first step in creating a focused intervention for effective antibiotic use and effective infection control measures. Such a format is essential in planning future interventions for antibiotic resistance throughout India. This study addresses these gaps in the literature with a web-based survey on the usage of antibiotics and nurses. [9-11]

# **Methodology:**

A self-column 2-column KAP evaluation was conducted in a 24-hour time period that has been provided to the staff nurses working in different specialties at the secondary care hospital in order to establish the knowledge, attitude, and practice related to antibiotic use. We briefed the nurses with the comprehensive explanation of this study’s nature and their purpose. Verbal consent was obtained from those who volunteered to participate.

We carefully planned a structured questionnaire, integrating the contributions of various ideas to concentrate on a comprehensive and multidimensional approach. After developing the first draft with the help of self-ideology and references, it underwent an extensive literature review to strengthen the relevance, clarity, and scientific rigor. We pretested the final format of the questionnaire before initiating the data collection process. The questionnaire encompassed a wide range of domains, aiming to assess participants' knowledge, attitudes, and practices (KAP) related to antibiotic prescription behaviour.[12] This included the majority of the most critical aspects: common indications for antibiotic therapy, awareness of antimicrobial resistance, adherence to prescription guidelines, and factors influencing prescribing patterns. In addition, external determinants were analysed: healthcare infrastructure, accessibility, and regulatory influences, to shed a broader picture of the topic. The structured approach ensures that all the more critical elements relating to antibiotic stewardship and prescribing practices were examined, which makes for a robust and insightful analysis of participant responses.

* 1. **Recruitment and Sampling:**

The study employed a convenience sampling approach to recruit participants, considering the resource constraints and feasibility of data collection. Nurses play a critical role in patient care and infection control; this study specifically targeted nurses working in healthcare settings.[13] The selection criteria included registered nurses actively engaged in direct patient care across multiple hospital departments, including medical, surgical, intensive care, and emergency units.

* 1. **Sample Size Determination:**

The sample size was based on a 50% chance that nursing staff would misuse antibiotics and not follow infection control rules, which was based on previous research looking at antibiotic stewardship in clinical settings. Using a 95% confidence level (*α* = 5%), a design effect of 1.0, and a margin of error of ±5%, the minimum sample size required for statistical significance was 384 nurses. However, because they were easier to reach and more practical, the final samples were only 45 nurses. These gave us a first look at nurses' knowledge, attitudes, and practices (KAP) about using antibiotics and preventing infections.

* 1. **Sampling Framework:**

The study systematically enlisted nurses from various tertiary care hospitals, secondary care hospitals, and primary healthcare centres to ensure a diverse representation of clinical experiences. The inclusion of nurses from multiple departments allowed for an assessment of variations in knowledge and practices across different specializations. Participants were approached during shift hours, and informed consent was obtained prior to the survey administration.

To ensure a representative distribution, the sample was stratified based on the following criteria:

* Experience level (junior nurses with <3 years vs. senior nurses with years)
* Work department (general ward, gynaecology and obstetrics, surgery unit, emergency, etc.)
* Healthcare setting (ESI hospital)
  1. **Recruitment Process**

Hospital administration announcements, in-person interactions, and peer referrals all served to invite and instruct participants. We conduct the study in a confidential and anonymous manner to foster honest responses. To ensure an objective interpretation of their knowledge without any prior influence, a survey of 45 nurses was conducted in an unannounced manner to evaluate their knowledge, attitudes, and practices (KAP) regarding the use of antibiotics and infection control. Also, because the survey was not announced beforehand, we were only able to gather 45 responses in a single day. The data collection process involved structured questionnaires covering aspects of antibiotic knowledge, infection control adherence, and antimicrobial resistance awareness. The recruitment approach ensured that the study captured a broad spectrum of nursing perspectives, laying the groundwork for future-scale research to strengthen infection control and antibiotic stewardship training.

# **Collection and Analysis:**

The data collection process was conducted over a period of 4 weeks, following an initial one-month phase of planning and field mapping. Hospital administrations, direct invitations, and peer referrals approached participants during this collection process. Given the sample size constraints, 45 nurses were surveyed using a structured questionnaire designed to assess knowledge, attitudes, and practice (KAP) related to antibiotic use and infection control.

All data were collected through anonymous and confidential surveys, where participants were assigned the survey questionnaire, the responses were compiled into Excel spreadsheets, and analysed using SPSS software. Descriptive statistics, including mean, standard deviation, and frequency distributions, were used to evaluate responses. A Chi-Square test of independence with Monte Carlo simulation was used to look at the relationship between the variables because the sample size was small and there were expected counts below five.

**The statistical analysis approach**

* Chi-square The test of independence was initially considered but was unacceptable due to the small expected counts.
* Monte Carlo simulation was applied to obtain accurate p-values for hypothesis testing.
* Significance Level: A *p*-value < 0.05 was considered statistically significant.
* Confidence Interval: We computed a 95% confidence interval (*CI*) for all key findings.

# **Results**

The study divulged a statistically significant association between nurses’ awareness of antimicrobial stewardship (AMS) practices and their impact on antimicrobial resistance (AMR).

* 1. Key Statistical Findings
* Pearson Chi-Square Test: *χ²*(4) = 49.093, *p* = .020 (95% *CI*: 0.017–0.023)
* Likelihood Ratio Test*: p* = 0.035
* Fisher-Freeman-Halton exact test*: p* = 0.035

Since all p-values were below 0.05, the findings confirm a strong statistical relationship between AMS awareness and AMR prevention strategies among nurses. This focus on the significance of enhancing AMS training programs to improve infection control measures in clinical practice areas.

* 1. Survey Findings
* 46.7% o% of nurses thought that timely administration of antibiotics was necessary.
* % showed changes in antibiotic usage practices, while 15.6% did not suggest any modifications.
* Only 13.3% demonstrated correct handwashing techniques, indicating a major gap in infection control practices.
* 59% were unaware of antibiotics classification and their appropriate use.
* 62.2% were aware of healthcare-associated infections (HAIs), yet only 51% understood the different modes of transmission.

**Figure 1: Antimicrobial Stewardship Awareness**

**Figure 2: Assessment of the Appropriateness and Regulation of Antibiotic Use in Daily Life**

**Figure 3: Effectiveness and Confidence in Managing Multidrug-Resistant Infection**

* 1. Composite KAP Score Analysis

We developed a composite scoring system based on Knowledge, Attitude, and Practice (KAP) scores related to antibiotic use and infection control. ed using a Likert scale. The question was assigned a maximum of 5 points for the most accurate response and 1 point for the least accurate response, where responses were graded based on correctness and adherence to best practices. We categorized the total scores as follows:

* (K) Knowledge section: Maximum score = 32
* (A) Attitude section: maximum score = 45.
* (P) practice section: maximum score = 20
* Total composite KAP score: maximum score = 97

**Table 1:** **Composite Knowledge, Attitude and Practice [KAP] Score Analysis**

|  |  |  |  |
| --- | --- | --- | --- |
| KAP | AVERAGE SCORE | PERCENTAGE SCORE% | INTERPRETATION |
| KNOWLEDGE | 15.8/32 | 49.3% | Moderate Understanding |
| ATTITUDE | 23.4/45 | 52% | Partially positive attitudes |
| PRACTICE | 7.6/20 | 38% | Poor adherence to best practices |
| TOTAL KAP SCORE | 46.8/97 | 48.2% | Below average overall performance |

Below-average overall performance

* KAP score distribution among participants:
* KNOWLEDGE SCORE: The average knowledge score among nurses was 18.4/32 (57.5%), indicating moderate awareness of antibiotic use and infection control.
* ATTITUDE SCORE: The mean attitude score was 27.1/45 (60.2%), reflecting a generally positive perception toward antimicrobial stewardship (AMS) but lacking strong conviction in some areas.
* PRACTICE SCORE: The practice score was 8.3/20 (41.5%), highlighting significant deficiencies in adherence to infection control and antibiotic administration protocols.
* OVERALL COMPOSITE KAP SCORE: The total mean KAP score was 53.8/97 (55.5%), suggesting that while nurses had basic knowledge and a relatively positive attitude, their actual implementation of best practices was under par.

# **Discussion**

FINDINGS:

* KNOWLEDGE AND AWARENESS ARE PRESENT BUT INCOMPLETE:
* The majority of nurses understood the basic role of antibiotics and their importance in patient care, but they lacked deeper knowledge of antibiotic resistance mechanisms and stewardship guidelines.
* 13.3% demonstrated proper hand hygiene techniques, revealing a major gap in infection control practices.
* 59% of participants lacked structured training in pharmacology, as evidenced by their ignorance of antibiotic classifications.
* DEFICIENCIES IN PRACTICAL IMPLEMENTATION
* Despite While the knowledge was moderate, the practical adherence to guidelines was poor, resulting in a low practices score of 41.5%.
* We observed non-compliance with hygiene, improper administration of antibiotics, and a lack of standardization in infection control protocols.
* Confidence levels in handling multi-drug-resistant (MDR) infections were low, with several nurses feeling unprepared to manage such cases.
* THE ATTITUDE TOWARD AMS AND INFECTION CONTROL IS POSITIVE BUT NOT PROACTIVE.
* 57.8% of participants suggested changes in antibiotics usage policies, indicating a willingness to improve current practices.
* However, a significant portion (15.6%) did not perceive the necessity for modifications, indicating either complacency or reluctance to implement new infection control strategies.
* THERE IS A STATISTICALLY SIGNIFICANT ASSOCIATION BETWEEN AMS AWARENESS AND AMR PREVENTION.
* The square test (*χ*² (4) = 49.093, *p* = 0.020) confirmed that greater awareness of AMS significantly improved antibiotic resistance management.
* However, the low practice score suggests that awareness alone is insufficient—practical training and reinforcement are crucial.
  1. Areas of Focus for Future Research and Training
* addressing the knowledge-practice gap
* Despite moderate knowledge levels, actual adherence to proper infection control measures remains low.
* Future research should investigate barriers preventing nurses from implementing best practices and develop strategies to bridge this gap.
* Strengthening surveillance and feedback mechanisms
* Create real-time feedback loops that provide nurses with immediate corrective guidance when they detect inappropriate antibiotic practices.
* Multidisciplinary collaboration
* Nurses should work closely with pharmacists, infection disease specialists, and microbiologists to improve interdisciplinary communication regarding antibiotic prescriptions and infection control.
* Institutional policy revisions
* Hospitals should integrate AMS policies into daily nursing workflows and ensure standardized guidelines are readily available.
  1. Areas for Improvement and Key Focus Areas:
* Strengthening antimicrobial stewardship (AMS) training
* Regular workshops and training sessions to educate nurses on rational antibiotic use, resistance mechanisms, and AMS guidelines
* Development of hospital-specific AMS policies to guide nurses on proper antibiotic administration and infection control.
* Enhancing the practical application of knowledge.
* Scenario-based training using real-world case studies to help nurses apply AMS knowledge to patient care.
* We are incorporating infection control drills and antibiotic prescription simulations into routine nurse training.
* Improving infection control compliance
* Implementation of mandatory hand hygiene audits and real-time monitoring of handwashing compliance.
* Introduce infection control drills and antibiotic prescription simulations into routine nurse training.
* Addressing knowledge gaps through continuing education
* We are introducing certification programs for antibiotic resistance and infection control.
* We are encouraging participation in AMR-focused nursing conferences and research initiatives.
* Implementing policy changes at the hospital level
* Hospitals should introduce mandatory AMR and infection control policies for nursing staff.
* Regular performance reviews and feedback systems should be put in place to assess nurses’ adherence to best practices.
  1. Limitations of the Study:
* *n* = 45—a small sample size.
* The study only included 45 nurses, so the validity of the results depends on a more general healthcare environment.
* Self-reported data bias
* To ensure that self-reported activities are accurate, future research should include direct observational studies. Self-reported surveys, potentially influenced by recall bias or social desirability, provided the responses for this study.
* Limited hospital representation
* Restricted hospital representation: the study was carried out in a few chosen healthcare environments; hence, results might not fairly reflect all hospital environments, rural areas, or private clinics.
* Future research should comprise a more varied spectrum of medical facilities and hospitals.
* Lack of objective skill assessment
* The study mainly focused on knowledge, attitudes, and self-reported practices; actual clinical performance was not assessed.
* Future research requires practical skill evaluation to measure real-time antibiotic stewardship and infection control adherence.
* The scope of the infection control evaluation
* Future research should assess hand hygiene adherence rates, PPE compliance, and environmental sanitation practices. Although the study focused on AMS awareness, it did not fully assess compliance with hospital infection control protocols.
* Longitudinal follow-up
* The study lacks a longitudinal follow-up. The study provides a cross-sectional overview of nurse KAP levels without evaluating the long-term effects of interventions on practice improvement.
  1. Identified Knowledge Gap:
* Limited understanding of Antimicrobial Stewardship (AMS)
* Despite their crucial role in patient care, a significant number of nurses lack formal training in antimicrobial stewardship (AMS) methods. The term "knowledge gap" describes this situation.
* There was a clear comprehension gap between practice and understanding, which led to inconsistent infection control and antibiotic administration.
* Deficiencies in infection control protocols
* There are insufficient measures in place to control the infection.
* There is poor adherence to hospital infection control protocols and irregular usage of personal protective equipment (PPE).
* Lack of awareness of antibiotic resistance consequences
* Despite nurses' recognition of the dangers of HAIs, their understanding of antibiotic resistance mechanisms and stewardship interventions remained inadequate.
* Gaps in Practical implementation
* Nurses exhibited the individual’s theoretical knowledge of appropriate antibiotic use but failed to apply these principles in real-world scenarios.
* An over-reliance on empirical treatments rather than evidence-based antimicrobial therapy.

# **Conclusion:**

The study uncovers important gaps in nurses’ knowledge, attitudes, and practice understanding about infection prevention and antibiotic use. The results highlight the critical need for organized training programs, improved infection control compliance, and more rigorous antimicrobial stewardship in healthcare settings by revealing a notable gap between theoretical understanding and actual application. With an average knowledge score of 49.3%, nurses have a moderate awareness of antibiotic use; nevertheless, their practical application of this information is still lacking, as only 13.3% of nurses follow recommended hand hygiene guidelines. The statistical analysis revealed a significant correlation between effective AMR prevention and AMS awareness, underscoring the importance of ongoing education and planned interventions. However, the majority of nurses (62.2%) recognized the hazards of hospital-acquired infection (HAIs); only 51% showed an awareness of infection transmission routes, highlighting variation in infection control strategies. These discrepancies imply that although nurses are cognizant of the difficulties posed by AMR, they do not have the requisite education or instinctive support to successfully apply optimal practices. Healthcare organizations must implement focused, diligent infection control practices and create hospital-wide policies that require adherence to evidence-based antibiotic use in order to address these gaps. The implementation of defined norms, real-time audits, and practical skill-based training is also necessary to close the knowledge gap.[15] Investigations should focus on increasing the study's direct observational evaluations and calculating the long-term effects of AMS training on patient outcomes. To address the global problem of antibiotic resistance and improve the quality of healthcare overall, nurses' roles in infection control and AMR mitigation must be strengthened.

# **Ethics Approval and Consent to Participate:**

Ethical approval was not sought for this study because it was conducted as a minimal-risk, anonymous, observational survey of healthcare professionals, and according to the institutional policy of [Vels institute of Science, Technology and Advanced Studies (VISTAS)], such studies are exempt from ethics committee review. Verbal informed consent was obtained from all participants.

# **References:**

1. Kotwal A, Taneja DK. Health care workers and universal precautions: Perceptions and determinants of non-compliance. Indian J Community Med. 2010;35(4):526–8.
2. Burke JP. Infection control-a problem for patient safety. N Engl J Med. 2003;348(7):651–6.
3. World Health Organization. Report on the global burden of healthcare-associated infections. Clean Care is Safer Care. Geneva: WHO; 2011. Available from: http://whqlibdoc.who.int/publications/2011/9789241501507\_eng.pdf
4. Allegranzi B, Bagheri Nejad S, Combescure C, Graafmans W, Attar H, Donaldson L, et al. Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis. Lancet. 2011;377(9761):228–41.
5. Laxminarayan R, Duse A, Wattal C, Zaidi AK, Wertheim HF, Sumpradit N, et al. Antibiotic resistance—the need for global solutions. Lancet Infect Dis. 2013;13(12):1057–98.
6. Ventola CL. The antibiotic resistance crisis: Part 1: Causes and threats. P T. 2015;40(4):277–83.
7. Hawkings NJ, Wood F, Butler CC. Public attitudes towards bacterial resistance: a qualitative study. J Antimicrob Chemother. 2007;59(6):1155–60.
8. Kotwani A, Wattal C, Joshi P, Holloway K. Knowledge and perceptions on antibiotic use and resistance among high school students and teachers in New Delhi, India: A qualitative study. Indian J Pharmacol. 2016;48(4):365–71.
9. Trampuz A, Widmer AF. Hand hygiene: a frequently missed life-saving opportunity during patient care. Mayo Clin Proc. 2004;79(1):109–16.
10. World Health Organization. The burden of health care-associated infection worldwide. Geneva: WHO; 2010. Available from: http://www.who.int/gpsc/country\_work/summary\_20100430\_en.pdf
11. World Health Organization. Infection prevention and control during health care when COVID-19 is suspected: Interim guidance, 19 March 2020. Geneva: WHO; 2020. Available from: http://WHO-2019-nCoV-IPC-2020
12. Centres for Disease Control and Prevention. CDC encourages safe antibiotic prescribing and use. 2017. Available from: https://www.cdc.gov/media/releases/2017/safeantibioticprescribing.html
13. Bashir A, Abbas Z, Farhat S, Tandon V, Singh Z, et al. Rationalizing antibiotic use to limit antibiotic resistance and novel antimicrobials. JK Pract. 2012;17(4):1–6.
14. Ministry of Health & Family Welfare, Government of India. National Action Plan on Antimicrobial Resistance (NAP-AMR) 2017–2021. New Delhi: MOHFW; 2017. Available from: https://care.gu.se/digitalAssets/1623/1623654\_national-action-plan-on-a
15. Zucco R, Lavano F, Anfosso R, Bianco A, Pileggi C, Pavia M. Internet and social media use for antibiotic-related information seeking: Findings from a survey among the adult population in Italy. Int J Med Inform. 2018; 111:131–9.