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Original Research Article

KNOWLEDGE, ATTITUDE, AND PRACTICES REGARDING ANTIMICROBIAL RESISTANCE AND STEWARDSHIP AMONG NURSING PROFESSIONALS IN A TERTIARY CARE HOSPITAL: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Antimicrobial resistance (AMR) is a severe global health threat driven by the misuse of antibiotics. Nursing professionals, as primary caregivers, are essential to successful Antimicrobial Stewardship Programs (ASPs). This study evaluated the knowledge, attitude, and practices (KAP) of nurses regarding AMR and antibiotic stewardship to identify competency gaps.
Materials and Methods: An institutional cross-sectional study was conducted among 350 nursing professionals at a tertiary care hospital between September and November 2025. Using a comprehensive invitation-based sampling approach, all eligible nursing professionals were invited to participate. Data were collected via a validated, self-administered questionnaire. Variables were evaluated using descriptive statistics and Spearmen's rank order correlation to analyze the relationship between KAP domains.
Results: The cohort was predominantly female (80.0%) and aged 20–30 years (42.9%). Most nurses exhibited a positive, proactive attitude toward AMR mitigation (60.0% favourable), but overall theoretical knowledge was predominantly moderate (51.4%). This highlighted a significant theory-practice gap: while adherence to general infection control (e.g., hand hygiene) was excellent (90.0%), clinical stewardship practices were suboptimal. Only 45.7% of nurses consistently checked culture and sensitivity reports prior to antibiotic administration. A statistically significant positive correlation was identified across all domains ($p < 0.001$), indicating that better theoretical knowledge is strongly associated with improved self-reported clinical practices (rho = 0.510).
Conclusion: Despite favourable attitudes toward mitigating AMR, moderate pharmacological knowledge restricts the integration of evidence-based stewardship into routine nursing practices. Targeted clinical education and the formal inclusion of nurses into institutional ASP protocols are critical to bridging this gap.
Keywords: Antimicrobial Resistance; Antimicrobial Stewardship; Nursing Professionals; Knowledge, Attitudes, and Practice; Infection Control.

INTRODUCTION

Antimicrobial resistance (AMR) has rapidly evolved into one of the most profound public health and economic crises of the 21st century. Driven by the systematic overuse and misuse of antimicrobial agents across human medicine, agriculture, and animal health, the phenomenon threatens the core of modern medicine. Recent comprehensive global analyses estimate that in 2019 alone, bacterial AMR was directly responsible for approximately 1.27 million deaths and was associated with nearly 4.95 million deaths worldwide.[1] Beyond the severe mortality rates, the economic toll is staggering;

uncontrolled AMR is projected to cost the global economy over $100 trillion by 2050, an impact that experts note will profoundly disrupt global healthcare infrastructure and dwarf the economic devastation of the COVID-19 pandemic.[2]

The burden of AMR is notably asymmetrical, disproportionately affecting Low- and Middle-Income Countries (LMICs) where health systems face unique vulnerabilities. In these regions, the high prevalence of infectious diseases, coupled with structural healthcare challenges, significantly exacerbates the AMR crisis.[3] In India, a high infectious disease burden makes the availability of effective antimicrobials a critical necessity. However, factors such as diagnostic uncertainty, high patient volumes, and the overarching threat of multidrug-resistant pathogens heavily contribute to the rapid emergence of resistant strains. Consequently, controlling AMR in tertiary care environments requires urgent, localized, and multi-disciplinary interventions.

To mitigate the unchecked progression of AMR, international health agencies have issued global action plans emphasizing the urgent need to optimize the use of antimicrobial medicines. The implementation of Antimicrobial Stewardship Programs (ASPs) has subsequently emerged as a gold standard in hospital settings. ASPs encompass a coherent, system-wide set of actions aimed at promoting the responsible and evidence-based use of antimicrobials to ensure sustainable access to effective therapy.[4] These systemic strategies emphasize interventions such as the regular review of antimicrobial therapy, de-escalation based on culture sensitivities, and rigorous infection control measures. While formal stewardship guidelines have historically concentrated on the prescriptive practices of physicians and the dispensing roles of pharmacists, the operational reality of hospital care points to a critical missing link: the nursing staff.

Nurses are the central communicators and primary caregivers in the hospital ecosystem, maintaining the most consistent and continuous presence at the patient's bedside. Due to this sustained proximity, nurses are inherently positioned to act as "first responders" in the surveillance of antibiotic efficacy and infection control.[5] Their day-to-day responsibilities—ranging from verifying accurate allergy histories and obtaining early diagnostic cultures to administering timely intravenous antibiotics and monitoring 24-hour clinical progress—are foundational to the success of any stewardship initiative. Despite this immense potential, nurses have been largely underutilized and formally unrecognized in standard ASP operational guidelines, leading to a fragmented approach to antimicrobial management.[5]

At the study site, the current stewardship structure primarily relies on physician-led prescribing protocols and pharmacist oversight. Nurses operate largely in traditional administration and observation capacities, lacking a formal, defined role within the existing institutional ASP framework. For nursing professionals to fully embrace their potential role as active antimicrobial stewards, a comprehensive understanding of their current baseline competencies is required. The Knowledge-Attitude-Practice (KAP) model serves as a robust theoretical framework to evaluate and drive individual behavioural changes in healthcare settings. Recent literature highlights a concerning "theory-practice gap" among nursing professionals regarding antibiotic administration. While many nurses possess a generally positive attitude toward preventing resistance, significant knowledge deficits persist regarding basic pharmacology, resistance mechanisms, and their explicit role in preventing the spread of multidrug-resistant organisms.[6] Studies tracking single-hospital nursing populations have documented substantial knowledge gaps, revealing critical misconceptions regarding the efficacy of antibiotics against viral infections and the specific mechanisms of clinical stewardship.[7]

Addressing these specific KAP gaps is a crucial precursor to integrating nursing professionals into formal institutional ASPs. Tertiary care hospitals, given their complex case mixes and high antibiotic consumption, are critical arenas for such evaluations. By systematically mapping the KAP landscape, hospital administrators and public health educators can move beyond generic awareness campaigns and develop targeted, high-impact educational curricula tailored to the specific operational realities of their workforce.[6]

Therefore, this cross-sectional study aims to rigorously assess the knowledge, attitudes, and practices regarding antibiotic administration and AMR among the nursing staff. Located in a high-volume clinical environment, the research captured a comprehensive snapshot of the nursing workforce affiliated with a tertiary care medical college hospital. Executed between September and November 2025, this study utilized a modified comprehensive sampling approach to minimize selection bias. The insights generated from this localized data will serve as an evidence-based foundation to refine continuing medical education modules, empower nursing officers, and ultimately fortify the multi-disciplinary defence against the escalating threat of antimicrobial resistance within the institution.

Aim and Objectives

Aim

To evaluate the knowledge, attitude, and practices (KAP) regarding antimicrobial resistance and stewardship among the nursing workforce at a tertiary care hospital.

Objectives

1. To assess the baseline knowledge, attitude, and practices of nursing professionals regarding antibiotic administration, infection control, and antimicrobial resistance.
2. To analyze the correlation between the individual domains of knowledge, attitude, and practice to

identify if theoretical awareness translates into routine clinical habits.

MATERIALS AND METHODS

Study Design and Setting: An institutional cross-sectional descriptive study was conducted to assess the knowledge, attitude, and practices regarding antibiotic administration and resistance. The study was executed in a tertiary care hospital setting over a three-month period from September to November 2025.

Study Population: The study population comprised the entire universe of registered nurses and nursing officers currently employed at the selected tertiary care hospital. To ensure participants have adequate exposure to the hospital's specific protocols, nurses must have a minimum of six months of clinical experience in the current facility to be included in the study.

Sample Size and Sampling Technique: A comprehensive sampling approach targeting the eligible nursing population was utilized. The total workforce of nurses at the facilities was approximately 450. After applying the exclusion criteria (less than six months of clinical experience) and excluding participants involved in the pilot study, the remaining eligible individuals were invited to participate. A total of 350 individuals provided informed consent and completed the survey. No missing responses were identified as questionnaires with incomplete responses were excluded from final analysis.

Data Collection Instrument: Data was collected using a structured, self-administered questionnaire. The questionnaire design was adapted from previously validated instruments used in comparable studies. The tool is divided into four distinct sections:

1. **Demographics:** Information regarding age, gender, highest professional qualification, and total years of nursing experience.
2. **Knowledge Domain:** Multiple-choice questions assessing facts regarding basic pharmacology, antibiotic resistance mechanisms, and the prevention of resistance.
3. **Attitude Domain:** Statements evaluating the nurses' perceptions of their role in antibiotic stewardship and infection control, measured on a 5-point Likert scale (ranging from "Strongly Agree" to "Strongly Disagree").
4. **Practice Domain:** The practice domain focused primarily on routine bedside stewardship-related behaviours feasible for self-report assessment in the institutional setting.

Pilot Study: Prior to the main rollout, a pilot study was conducted on a subset of the target population (n = 35) to evaluate the content validity, clarity, and cultural appropriateness of the questionnaire. Minor refinements were made to item wording based on this pilot feedback. Pilot participants were excluded from the primary analysis. The internal consistency of the finalized tool was confirmed with a Cronbach's alpha of 0.78, indicating acceptable reliability.

Ethical Considerations: Institutional Review Board (IRB) approval (Letter No. SIMS/IRB/Approval/079/25, Dated: 13/07/2025) was taken before commencing the study. Written informed consent was obtained from all participants.

Scoring System: Knowledge was assessed using 5 items (scored 1 for correct, 0 for incorrect/unsure). Scores were categorized as Poor (<50%), Moderate (50-74%), and Good (≥75%). Attitudes were measured via 4 items on a 5-point Likert scale (scored 1 to 5), categorized as Unfavourable (<60%), Neutral (60-79%), and Favourable (≥80%). Practices were evaluated using 4 items (scored 0 to 2), categorized as Poor (<50%), Moderate (50-74%), and Good (≥75%). Overall mean scores and standard deviations for each domain were calculated to evaluate the central tendency of the cohort.

Data Processing and Statistical Analysis: The collected data was validated, coded, and entered into a spreadsheet, then exported to statistical software (e.g., Epi info version 7.2) for comprehensive analysis.

- **Descriptive Statistics:** Continuous variables were summarized using means and standard deviations, while categorical variables were presented as frequencies and percentages.
- **Inferential Statistics:** Spearman's correlation coefficient (rho) was computed to understand the relationship between the knowledge, attitude, and practice scores. A p-value of < 0.05 was considered statistically significant.

RESULTS

A cross-sectional study was conducted among 350 nursing professionals at a tertiary care hospital to assess their knowledge, attitudes, and practices regarding antibiotic administration and antimicrobial resistance.

Table 1: Socio-demographic and Professional Characteristics

Demographic Variable	Frequency (n = 350)	Percentage (%)
Age (Years)		
20–30	150	42.90%
31–40	140	40.00%
> 40	60	17.10%
Gender		
Female	280	80.00%
Male	70	20.00%
Professional Qualification		

Diploma in Nursing (GNM)	120	34.30%
Bachelor's Degree (B.Sc)	195	55.70%
Master's Degree (M.Sc)	35	10.00%
Work Experience		
< 5 Years	110	31.40%
5–10 Years	140	40.00%
> 10 Years	100	28.60%

[Table 1] outlines the socio-demographic and professional characteristics of the study participants (N = 350). The cohort was predominantly female (80.0%, n = 280) and primarily fell within the 20 to 30 years age bracket (42.9%, n = 150). In terms of professional qualification, more than half of the respondents held a Bachelor's degree in Nursing (55.7%, n = 195), while one-third were diploma holders (34.3%, n = 120). Regarding clinical exposure, the workforce demonstrated a relatively balanced distribution, with a plurality of the nursing professionals (40.0%, n = 140) reporting between 5 and 10 years of clinical experience.

Table 2: Knowledge Regarding Antibiotic Use and Resistance

Knowledge Statement	Correct Answer (n, %)	Incorrect / Unsure (n, %)
Antibiotics are effective against viral infections like the common cold (False)	210 (60.0%)	140 (40.0%)
Inappropriate use of antibiotics leads to antimicrobial resistance (True)	315 (90.0%)	35 (10.0%)
Missing an antibiotic dose can increase the risk of resistance (True)	260 (74.3%)	90 (25.7%)
Handwashing is the most effective way to prevent the spread of infections (True)	330 (94.3%)	20 (5.7%)
Antibiotics can destroy normal body flora causing secondary infections (True)	245 (70.0%)	105 (30.0%)

The participants' baseline knowledge regarding antibiotic use and resistance mechanisms is detailed in [Table 2]. An overwhelming majority of the cohort correctly identified fundamental infection control principles, with 94.3% recognizing handwashing as the most effective preventative measure and 90.0% acknowledging that inappropriate antibiotic use drives antimicrobial resistance. However, a significant knowledge deficit was observed regarding the clinical indications for antimicrobials; 40.0% of the nurses incorrectly believed, or were unsure, that antibiotics are effective against viral infections such as the common cold. Furthermore, nearly one-third of the participants (30.0%) failed to identify the destructive impact of antibiotics on normal bodily flora.

Table 3: Attitudes Towards Antibiotic Stewardship and Resistance

Attitude Statement	Agree (n, %)	Neutral (n, %)	Disagree (n, %)
Antimicrobial resistance is a severe global public health issue.	290 (82.9%)	40 (11.4%)	20 (5.7%)
I feel confident in my role to educate patients on proper antibiotic use.	240 (68.6%)	80 (22.9%)	30 (8.6%)
Patient demand frequently contributes to the over-prescription of antibiotics.	275 (78.6%)	50 (14.3%)	25 (7.1%)
Strict infection control practices reduce the spread of resistant bacteria.	310 (88.6%)	25 (7.1%)	15 (4.3%)

[Table 3] summarizes the participants' attitudes toward antimicrobial stewardship. Overall, the nursing staff exhibited highly favourable and proactive attitudes. A vast majority (88.6%) agreed that strict infection control practices reduce the spread of resistant bacteria, and 82.9% recognized AMR as a severe global public health crisis. Furthermore, 78.6% of respondents acknowledged that patient demand frequently contributes to over-prescription. Notably, while a strong proportion felt confident in their role to educate patients on proper antibiotic use (68.6%), nearly one-third (31.5%) expressed neutrality or disagreement, highlighting a potential area for targeted confidence-building and communication training.

Table 4: Practices Regarding Antibiotic Administration

Practice Statement	Always (n, %)	Sometimes (n, %)	Never (n, %)
I check the culture and sensitivity reports before administering antibiotics.	160 (45.7%)	140 (40.0%)	50 (14.3%)
I verify the dosage and dilution guidelines before IV administration.	280 (80.0%)	60 (17.1%)	10 (2.9%)
I advise patients to complete their full course even if they feel better.	295 (84.3%)	45 (12.9%)	10 (2.9%)
I perform strict hand hygiene before and after handling a patient.	315 (90.0%)	30 (8.6%)	5 (1.4%)

Self-reported clinical practices related to antibiotic administration and stewardship are presented in [Table 4]. Compliance with routine, individual-level infection control measures was exceptionally high, with 90.0% of nurses reporting that they always perform strict hand hygiene before and after patient contact. Similarly, verifying dosage guidelines (80.0%) and advising patients to complete their full antibiotic courses (84.3%) were established routine practices. Conversely, engagement with microbiology data was suboptimal; less than half of the participants (45.7%) reported always checking patient culture and sensitivity reports prior to administering antibiotics, indicating a critical gap in

the integration of nurses into evidence-based clinical stewardship.

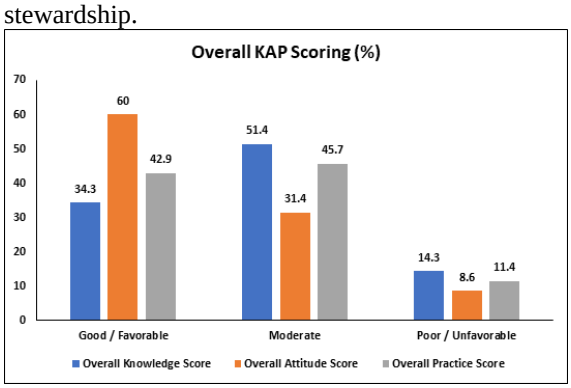

Figure 1: Overall KAP Scoring

The categorization of the overall Knowledge, Attitude, and Practice scores is depicted in Figure 1. The data reveals a clear 'theory-practice gap' within the study population. While a majority of the participants demonstrated a favourable attitude toward AMR mitigation (60.0%), their theoretical knowledge was predominantly categorized as moderate (51.4%). Consequently, these moderate knowledge levels reflected in their daily routines, with the highest proportion of nurses falling into the moderate practice category (45.7%), and only 42.9% achieving an optimal, good practice score.

Table 5: Correlation between Knowledge, Attitude, and Practice

Variables	Spearman's Correlation Coefficient (rho)	P-value
Knowledge & Attitude	0.425	< 0.001
Attitude & Practice	0.38	< 0.001
Knowledge & Practice	0.51	< 0.001

[Table 5] illustrates the Spearman's correlation coefficients (rho) analyzing the relationship between the three distinct domains. The bivariate analysis revealed a statistically significant, moderate positive correlation across all variables ($p < 0.001$). The strongest correlation was observed between the Knowledge and Practice domains (rho = 0.510), suggesting that a robust theoretical understanding of AMR principles is strongly associated with better self-reported clinical routines. Additionally, positive attitudes were significantly associated with both higher knowledge scores (rho = 0.425) and improved adherence to standard practices (rho = 0.380), underscoring the interconnected nature of the KAP framework."

DISCUSSION

The present cross-sectional study aimed to evaluate the knowledge, attitude, and practices (KAP) regarding antimicrobial resistance (AMR) and stewardship among the nursing workforce at a high-volume tertiary care hospital. Our findings reveal a critical "theory-practice gap" within the nursing cohort. While the participants demonstrated a highly favourable attitude towards AMR mitigation, their theoretical knowledge and self-reported clinical practices were predominantly categorized as moderate. Notably, the study identified a significant positive correlation between knowledge and practice, suggesting that robust theoretical comprehension of antimicrobial principles is strongly associated with greater adherence to evidence-based clinical routines. These results underscore the urgent need to formally integrate nursing professionals into Antimicrobial Stewardship Programs (ASPs) by addressing specific educational deficits.

A concerning finding from the current research is the prevalent misconception regarding the clinical indications for antimicrobials. Specifically, 40.0% of the surveyed nurses incorrectly believed or were unsure about the efficacy of antibiotics against viral infections such as the common cold. This fundamental gap in basic pharmacology is not an isolated phenomenon but resonates heavily with global literature. For instance, an investigation by Jayaweerasingham et al,[8] revealed strikingly similar misconceptions among nursing trainees in Sri Lanka, where 37.2% of the participants erroneously believed that administering antibiotics during a viral cold would prevent clinical deterioration, and nearly 40% felt it would accelerate recovery. The persistence of such foundational misunderstandings across different healthcare settings highlights a systemic flaw in standard nursing curricula. If front-line communicators harbour these misconceptions, it severely compromises their ability to educate patients, thereby exacerbating the widespread issue of patient-driven, over-the-counter antibiotic misuse. Furthermore, the present study identified that nearly one-third of the nursing staff failed to recognize the destructive impact of broad-spectrum antibiotics on normal bodily flora. This specific knowledge deficit aligns perfectly with the operational blind spots described by Rábano-Blanco et al. in their evaluation of nursing students in Spain. Their research demonstrated that while future nurses possessed a generic awareness of antibiotics, they exhibited profound ignorance regarding specific resistance mechanisms, efflux pumps, and the collateral damage of antimicrobial agents on the human microbiome. Rábano-Blanco et al,[9] emphasized that such theoretical deficiencies directly translate to inadequate clinical decision-making, leaving nurses ill-equipped to identify adverse pharmacological effects or to actively participate in vital de-escalation protocols. Addressing these specific pharmacological deficits is essential before nurses can effectively function as autonomous antimicrobial stewards at the bedside.

When evaluating overall theoretical competence, the current cohort predominantly fell into the moderate knowledge category (51.4%). This distribution is highly consistent with the observations made by Lalithabai et al,[10] who assessed nurses in a tertiary healthcare setting in Saudi Arabia. In their study, a comparable 54.3% of the nursing workforce demonstrated moderate knowledge, with only 26.4% achieving a good knowledge score. Lalithabai et al,[10] noted that despite acknowledging the overarching severity of AMR, many nurses lacked the in-depth epidemiological and microbiological understanding required to actively prevent it in their daily workflows. The replication of these moderate competency levels across distinct international cohorts suggests that traditional, generalized awareness campaigns are inherently insufficient. Instead, healthcare institutions must pivot towards targeted, high-impact continuous medical education that focuses on the specific mechanisms of resistance and the explicit roles nurses must play in mitigating them.

Despite these moderate knowledge levels, the attitudes toward AMR and stewardship in our study were highly proactive, with 82.9% recognizing AMR as a severe global crisis and 78.6% acknowledging the role of patient demand in over-prescription. Interestingly, while 68.6% felt confident in educating patients, nearly a third expressed hesitation, pointing to a distinct need for targeted communication training. This juxtaposition of high general concern but variable personal confidence is vividly mirrored in the research conducted by Teague and co-workers in South Africa.[11] Teague et al. found that an overwhelming majority (87.9%) of final-year nursing students considered their role in curbing AMR as crucial; however, a staggering 66.9% had never even heard of formal Antimicrobial Stewardship Programs (ASPs). This highlights a systemic operational failure across global health systems: nurses inherently possess the motivation and positive attitude required to champion stewardship, but they are systematically excluded from the formal ASP frameworks and terminologies that would empower them to act decisively.

In terms of clinical practice, our findings present a stark dichotomy: while routine, individual-level infection control measures like hand hygiene were almost universally adopted (90.0%), engagement with evidence-based microbiological data was alarmingly low. Less than half of the participants (45.7%) reported consistently checking patient culture and sensitivity reports before administering antibiotics. This suboptimal engagement with diagnostic data severely limits the nurse's role in timely antibiotic de-escalation. A similar pattern of procedural compliance coupled with weak advanced clinical practice was documented by Karimian and colleagues among Intensive Care Unit (ICU) head nurses in Iran. Karimian et al,[12] reported that despite positive attitudes toward infection control, the actual practices regarding the management of multidrug-resistant (MDR) organisms were predominantly weak. Their study highlighted that procedural tasks are often performed by rote, but advanced stewardship practices—such as integrating microbiological reports into daily care plans or isolating patients based on specific pathogen profiles—are frequently neglected due to a lack of targeted training and systemic administrative support.

Finally, the bivariate analysis of our study confirmed the interconnected nature of the KAP framework, revealing a statistically significant, moderate positive correlation across all variables, with the strongest link observed between knowledge and practice ($r = 0.510$, $p < 0.001$). This metric strongly indicates that improved theoretical understanding is directly proportional to enhanced clinical habits. This statistical relationship is powerfully corroborated by Sahu and Sahu et al,[13] who investigated nursing professionals across various institutes in Chhattisgarh. They also identified a highly significant correlation between knowledge and practice scores ($p < 0.01$), reinforcing the premise that behavioural changes in antibiotic administration cannot be achieved through passive policy mandates alone. Instead, as both studies unequivocally suggest, cognitive empowerment through rigorous, localized educational interventions is the foundational prerequisite for translating positive attitudes into concrete, evidence-based stewardship practices at the bedside.

CONCLUSION

This study reveals that nursing professionals in the study setting possess favourable attitudes toward antimicrobial resistance and stewardship but demonstrate only moderate knowledge and inconsistent application of key stewardship practices. While adherence to basic infection control measures such as hand hygiene was high, engagement with microbiological data (e.g., culture and sensitivity reports) was suboptimal.

The findings emphasize the importance of targeted educational interventions focusing on clinical pharmacology, resistance mechanisms, and evidence-based stewardship practices. Formal integration of nurses into institutional Antimicrobial Stewardship Programs is recommended to bridge existing gaps and leverage their central role in patient care for more effective AMR containment.

Recommendations

To address the identified competency gaps, it is highly recommended that hospital administrators and public health educators collaborate to design and implement tailored, continuous nursing education modules focused specifically on clinical pharmacology, resistance mechanisms, and evidence-based stewardship protocols. Furthermore, institutional guidelines must be proactively updated to formally integrate nursing staff into multi-

disciplinary Antimicrobial Stewardship Programs (ASPs). This structural integration should empower nurses with direct engagement in microbiological data interpretation and establish clear, standardized protocols for their active involvement in routine antibiotic reviews, de-escalation processes, and patient education.

Limitations

The primary limitation of this study is its reliance on a self-administered questionnaire. This inherently introduces the risk of social desirability bias, which may lead to inflated self-reported frequencies for practices like hand hygiene. Consequently, these self-reported behaviours should be interpreted cautiously and not strictly equated with directly observed clinical practice. Furthermore, the assessed practice domain was relatively narrow. While it effectively captured critical routine tasks like hand hygiene and dosage verification, it did not comprehensively evaluate broader nursing stewardship behaviours, such as allergy verification, monitoring adverse events, or IV-to-oral transition support.

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