



Research Article:

EFFECTIVENESS OF NURSES' EMPOWERMENT PROGRAM REGARDING ANTIBIOTIC STEWARDSHIP ON NURSES' COMPLIANCE IN SELECTED HOSPITALS, CHENNAI.

Prof. S. T. Mohana^{1,2*}, Dr. J Jaslina Gnana Rani², Prof. Hilda Rose Mary², Dr. K Vijayalakshmi², Prof. Shalin Gnana Priya^{1, 2}, Prof. M. Raja^{2,3}

¹CSI Kalyani College of Nursing, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, India.

²Apollo College of Nursing, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, India.

³Billroth College of Nursing, The Tamil Nadu Dr. M.G.R. Medical University, Chennai, India.

***Corresponding Author:** Prof. S. T. Mohana

Abstract:

Antibiotic resistance has emerged as one of the most serious global public health threats of the 21st century. The increasing prevalence of resistant microorganisms has led to treatment failures, prolonged illness, increased mortality, and a rise in hospital-acquired infections. In India, the situation is particularly alarming due to the widespread misuse and overuse of antibiotics, easy availability of medications without prescription, and inadequate adherence to infection control practices. National surveillance data from the Indian Council of Medical Research highlight a growing resistance among common pathogens, reducing the effectiveness of both first-line and last-resort antibiotics. Overall, the rising prevalence and serious consequences of antibiotic resistance highlight the urgent need for effective interventions such as antibiotic stewardship programs, strict infection control measures, and increased awareness among healthcare professionals, especially nurses who play a key role in monitoring antibiotic use and patient outcomes. Objectives: To assess the effectiveness of a Nurses' Empowerment on nurses' compliance with Antibiotic Stewardship practices. Methods: Quasi experimental research design was adopted for the study. The study was conducted among 60 nurses, with 30 in the control group and 30 in the intervention group working in selected hospital units. Observational checklist was used to assess nurses' compliance before and after the nurses empowerment



program. The Nurses' Empowerment Program included structured teaching sessions and educational materials related to antibiotic stewardship practices. Data were analyzed using descriptive and inferential statistics, including the Chi-square test. Results: The pre-test findings revealed that most nurses in both groups had moderate compliance (Control: 53.3%, Study: 56.7%), with none in the good category. In posttest compliance improved markedly in the study group, with 73.3% achieving good compliance compared to only 23.3% in the control group. Conclusion: The study concluded that the Nurses' Empowerment Program regarding Antibiotic Stewardship was effective in improving nurses' compliance with antibiotic stewardship practices. Nurses in the intervention group demonstrated significantly higher post-test compliance scores compared to the control group. The findings highlight the importance of continuous education and empowerment programs in promoting appropriate antibiotic use, strengthening infection control practices, and supporting efforts to reduce antibiotic resistance in healthcare settings.

Keywords: Antibiotic stewardship; Nurse empowerment program; Nurses' compliance; Antimicrobial resistance; Infection control

1. Introduction

Antibiotic resistance has emerged as one of the most serious global public health threats of the 21st century. It occurs when microorganisms such as bacteria evolve mechanisms that render antibiotics ineffective, making common infections harder to treat. According to the World Health Organization, at least 700,000 deaths occur each year due to drug-resistant infections, and this number is projected to rise dramatically if urgent actions are not taken. Resistant pathogens such as *Escherichia coli*, *Klebsiella pneumoniae*, *Staphylococcus aureus* (MRSA), and *Mycobacterium tuberculosis* are widely reported across both developed and developing countries. In India, the burden is particularly high due to widespread antibiotic misuse, over-the-counter availability, and high infectious disease rates (1–3).

The effects of antibiotic resistance are profound and multifaceted. Clinically, it leads to prolonged illness, increased severity of infections, higher risk of complications, and increased mortality. Patients infected with resistant organisms often require longer hospital stays, more expensive and



toxic medications, and intensive care support. This also increases the risk of hospital-acquired infections (HAIs), including infections like *Clostridioides difficile*-associated diarrhea. Economically, antibiotic resistance places a significant burden on healthcare systems due to increased treatment costs, extended hospitalizations, and the need for advanced therapies. Socially, it threatens the success of modern medical procedures such as surgeries, chemotherapy, and organ transplantation, where effective antibiotics are essential for infection prevention (4,5). Overall, the rising prevalence and serious consequences of antibiotic resistance highlight the urgent need for effective interventions such as antibiotic stewardship programs, strict infection control measures, and increased awareness among healthcare professionals, especially nurses who play a key role in monitoring antibiotic use and patient outcomes (6,7).

Antibiotic resistance in India has been extensively documented by the Indian Council of Medical Research through its Antimicrobial Resistance Surveillance Network (AMRSN), which monitors resistance trends across major hospitals. ICMR reports show a rapid increase in resistance among common pathogens such as *Escherichia coli*, *Klebsiella pneumoniae*, *Acinetobacter baumannii*, and *Staphylococcus aureus*, many of which are responsible for hospital-acquired and community infections.

Antibiotic stewardship programs (ASPs) are systematic, evidence-based approaches designed to promote the rational use of antibiotics, improve patient outcomes, and reduce the development of antimicrobial resistance. These programs focus on selecting the appropriate antibiotic, dose, duration, and route of administration to ensure effective treatment while minimizing adverse effects and resistance. The World Health Organization and the Indian Council of Medical Research strongly advocate the implementation of stewardship programs in healthcare settings, particularly in countries like India where antibiotic misuse is common. ASPs involve a multidisciplinary team including physicians, pharmacists, microbiologists, and nurses, with nurses playing a key role in antibiotic administration, monitoring patient response, identifying adverse drug reactions, and ensuring compliance with treatment protocols. Effective implementation of antibiotic stewardship programs has been shown to reduce inappropriate antibiotic use, decrease hospital-acquired infections, shorten hospital stays, lower healthcare costs, and ultimately improve patient safety and clinical outcomes (8,9).

Need for the study

Antibiotic resistance has emerged as a critical public health challenge worldwide, significantly



affecting patient safety and healthcare outcomes. In India, the situation is particularly alarming due to the widespread misuse and overuse of antibiotics, easy availability of medications without prescription, and inadequate adherence to infection control practices. National surveillance data from the Indian Council of Medical Research highlight a growing resistance among common pathogens, reducing the effectiveness of both first-line and last-resort antibiotics. Similarly, the World Health Organization emphasizes that antimicrobial resistance is one of the top global health threats requiring urgent and coordinated action (10).

Antibiotic Stewardship Programs (ASPs) have been introduced as a key strategy to promote the rational use of antibiotics, improve patient outcomes, and reduce resistance. However, the success of these programs depends largely on the active involvement and compliance of healthcare professionals, especially nurses. Nurses are at the forefront of patient care and are directly responsible for administering antibiotics, monitoring therapeutic responses, identifying adverse drug reactions, and ensuring adherence to prescribed treatment protocols. Despite their crucial role, studies indicate gaps in nurses' knowledge, attitudes, and compliance regarding antibiotic stewardship practices, which can negatively impact patient outcomes. Limited research has been conducted, particularly in the Indian context, linking nurses' compliance with antibiotic stewardship practices to patient outcomes. This highlights a significant gap in evidence that needs to be addressed (5).

Therefore, this study is essential to assess the effectiveness of antibiotic stewardship programs among nurses, evaluate their compliance, and determine their impact on patient outcomes. The findings of this study will help in identifying gaps in current practices, guiding targeted educational interventions, and strengthening stewardship efforts. Ultimately, it will contribute to improving the quality of patient care, promoting rational antibiotic use, and reducing the burden of antibiotic resistance.

Aim of the study

The aim of this study is to assess the effectiveness of nurses' empowerment program regarding antibiotic stewardship on nurses' compliance.

Objectives

1. To assess the level of Compliance on Antibiotic Stewardship among nurses before and after nurse's empowerment program regarding antibiotic stewardship in control and



intervention group.

2. To evaluate the effectiveness of Nurses Empowerment program regarding Antibiotic Stewardship on Nurses compliance.
3. To associate the selected background variables with the level of compliance on antibiotic Stewardship among nurses both in control and intervention group.
4. To assess the level of acceptability among nurses regarding empowerment program on Antibiotic Stewardship.

Research Hypotheses

- H1. There will be a significant difference between mean pretest scores and mean post test scores of compliances on antibiotic stewardship among nurses.
- H2. There will be a significant association between selected background variables and level of compliance on antibiotic stewardship among nurses.

2. Research methodology

Research approach

Quantitative study was used in this study.

Research Design

Non-Randomized Controlled Trial (Quasi experimental research design)

Setting

The study was conducted at selected hospitals

Population

Target population :Target population is the group population that the researcher aims to study and to whom the study findings will be generalized. In this study target population was staff nurses.

Accessible population: Registered nurses directly involved in patient care in the selected hospitals during the study period.

Sample: Samples consist of subset of the population. In this study sample was staff nurses who met the inclusion criteria.



Nurses: Those who are working in Medical, Surgical and ICU unit and meets the inclusion criteria.

Sample size: The samples size will be **60** (control group-30 nurses and intervention group -30 nurses) nurses who meet the inclusion criteria was chosen for the study.

Sampling Technique

Non probability Purposive sampling technique was used to select the participants who are accessible to the researcher and who meet the inclusion criteria of the study.

Sampling Criteria

Inclusion criteria:

- The study will include the staff nurses with GNM, B.Sc. (N) P.B.B.Sc. (N) or M.Sc.(N) qualification.
- Who will be present during the time of data collection.
- Nurses working in ward and ICU.

Exclusion criteria

Staff nurses who are not willing to participate in the study.

Variables

- **Independent Variables:** Independent variable of this study is Nurses empowerment program. Empowerment is the process of empowering the nurses regarding Antibiotic stewardship program.
- **Dependent Variables :** Dependent variables of this study is nurses' compliance on antibiotic stewardship.

3. Descriptions of the tools

Section A- Background variable proforma of nurses.

The background variable proforma consists of age, professional qualification, year of experience, designation, marital status, area of work and previous exposure to antibiotic stewardship program

Section B -Observation checklist for compliance on antibiotic stewardship for nurses

This checklist is based on the **World Health Organization (WHO)** framework for antibiotic



stewardship, which emphasizes proper antibiotic use, improving patient outcomes, reducing antibiotic resistance, and ensuring patient safety. It is designed to assess nurses' compliance with the core principles of antibiotic stewardship in healthcare settings. which consists of 25 items related to Clinical care practices including Culture collection and Verification of Antibiotic Orders, Patient Identification, Allergy and Contraindication Check, Timely Administration, Hand Hygiene and IPC, Aseptic Technique and Monitoring and stewardship practices including Accurate Documentation and communication, Monitoring and Reporting Adverse Events, Patient and Family Education, and Participation in AMS Activities. Maximum score 25 and minimum score 0.

Table 1: Compliance Indicator: Clinical Care, Monitoring, and Stewardship Practices

S.NO	Compliance indicator	No. of. Items	Items	Weightage in %
	CLINICAL CARE			
1	Culture collection and Verification of Antibiotic Orders	3	1,2,3	12
2	Patient Identification	3	4,5,6	12
3	Allergy and Contraindication Check	1	7	4
4	Timely Administration	1	8	4
5	Hand Hygiene And IPC Compliance (PPE	3	9,10,11	12
6	Aseptic Technique	4	12,13,14,15	16
	MONITORING AND STEWARDSHIP PRACTICES			
7	Accurate Documentation and communication	3	16,17,18	12
8	Monitoring and Reporting Adverse Events	2	19,20	8
9	Patient and Family Education	3	21,22,23	12



10	Participation in AMS Activities	2	24,25	8
	Total	25	1-25	100

Scoring Interpretation

19-25	75-100	Excellent compliance
13-18	50-74	Moderate compliance
<13	<50	Poor compliance

Section: C - Rating scale to assess the Level of Acceptability of empowerment program on Antibiotic Stewardship program among staff nurses.

Rating scale will be designed to assess the level of acceptance of Empowerment program on antibiotic stewardship. It will consist of 10 items scale and rated on 4-point rating scale

4. Data Collection Procedure

After obtaining permission from the concerned authorities and informed consent from the participants, the pretest was conducted among nurses in both the control and intervention groups using an observational checklist to assess the level of compliance regarding antibiotic stewardship practices. Following the pretest, the planned Nurse Empowerment Program regarding antibiotic stewardship was administered to the intervention group for 2 hours per day over a period of 3 consecutive days, while the control group received routine hospital practices. The teaching module was developed based on an extensive review of literature, including recent guidelines from the Centres for Disease Control and Prevention and World Health Organization regarding antibiotic stewardship practices. The educational intervention included PowerPoint presentations, printed handouts, group discussions, and clinical scenario-based learning sessions to enhance nurses' knowledge and compliance. A post-test was conducted after one month in both groups using the same observational checklist to assess the effectiveness of the Nurse Empowerment Program on the level of compliance regarding antibiotic stewardship practices. Data collection was performed in batches to ensure adequate



observation time and minimize observational errors. In addition, the level of acceptability of the program among nurses in the intervention group was assessed using a 4-point Likert scale.

5. Results

Frequency and percentage Distribution of Background Variables of Nurses

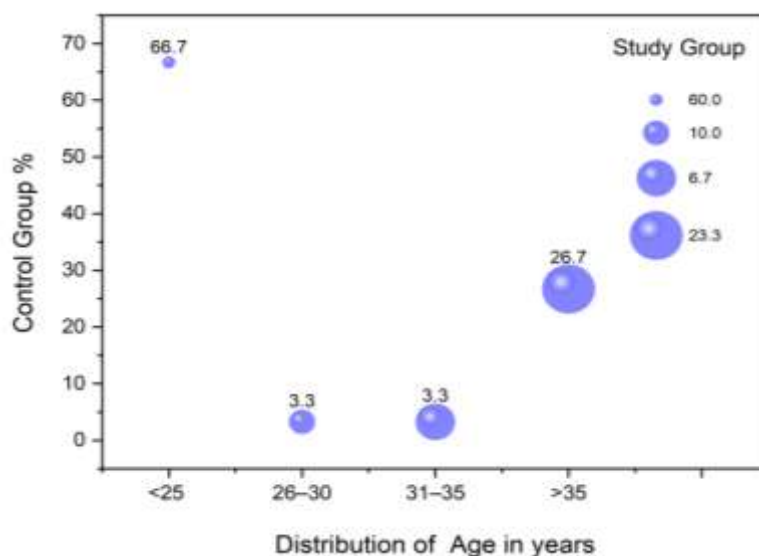


Fig. 1 Distribution of age in years of control and study groups

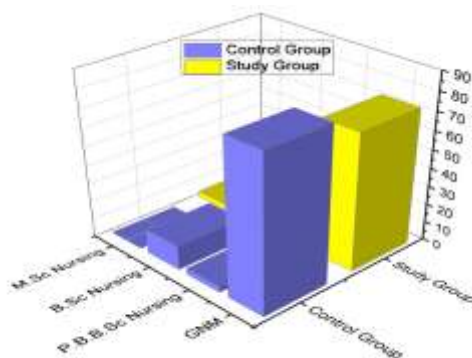


Fig. 2 Professional qualification % of the control and study groups

The analysis reveals that the majority of nurses in both groups were aged below 25 years



(Control: 66.7%, Study: 60.0%; $p = 0.681$) with less than 2 years of experience (Control: 60.0%, Study: 50.0%; $p = 0.724$). Most of them were GNM qualified (Control: 83.3%, Study: 73.3%; $p = 0.661$). With respect to designation, the majority were staff nurses (80% in both groups; $p = 1.000$). Regarding area of working, most were posted in medical wards (Control: 60.0%, Study: 56.7%; $p = 0.793$). In marital status, the majority were single (Control: 63.3%, Study: 60.0%; $p = 0.598$). Finally, most nurses reported no previous exposure to antibiotic stewardship programs (Control: 90.0%, Study: 93.3%; $p = 0.640$). Overall, there was no statistically significant difference between these groups ($p > 0.05$). Fig. 1 and 2 show the distribution of age and professional qualification in % among control and study groups. Hence, both groups were homogeneous with respect to all the background variables.

Frequency and Percentage Distribution of Levels of Compliance on Antibiotic Stewardship in Control and Study Group of Nurses

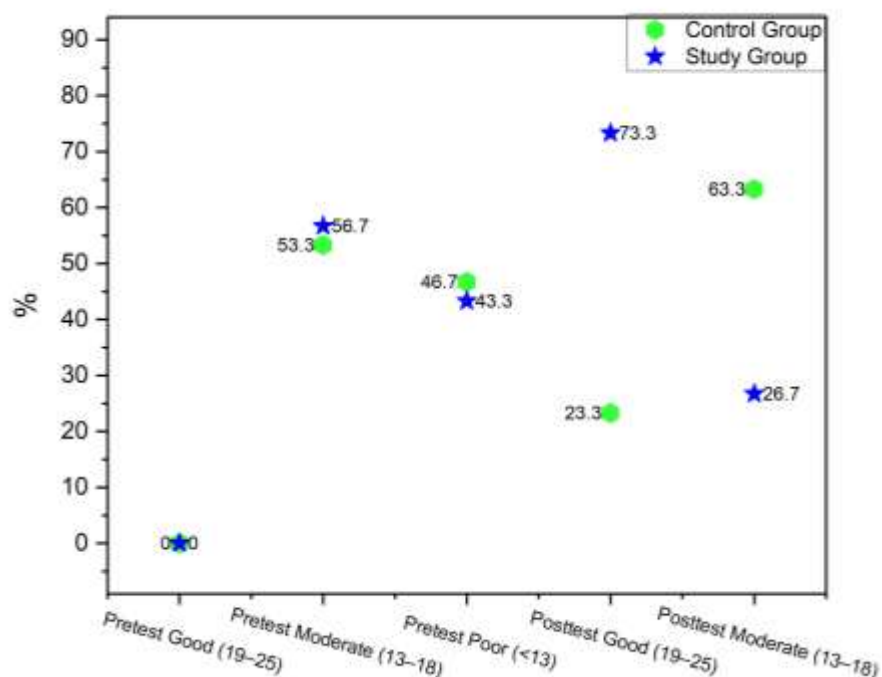


Fig. 3 Distribution of levels of compliance on antibiotic stewardship



Table 2 Frequency and Percentage Distribution of Levels of Compliance on Antibiotic Stewardship in Control and Study Group of Nurses

	Control Group (n=30)	Study Group (n=30)
	f (%)	f (%)
Pretest		
Good (19–25)	0 (0.0)	0 (0.0)
Moderate (13–18)	16 (53.3)	17 (56.7)
Poor (<13)	14 (46.7)	13 (43.3)
Posttest		
Good (19–25)	7 (23.3)	22 (73.3)
Moderate (13–18)	19 (63.3)	8 (26.7)
Poor (<13)	4 (13.3)	0 (0.0)

Table 2 reveals that, in terms of compliance levels, the pretest showed that most nurses in both groups had moderate compliance (Control: 53.3%, Study: 56.7%), with none in the good category. In posttest, compliance improved markedly in the study group, with 73.3% achieving good compliance compared to only 23.3% in the control group. Fig. 3 shows the distribution of levels of compliance with antibiotic stewardship. Overall, the findings indicate that while both groups started with moderate levels of knowledge and compliance, the study group demonstrated substantial improvement post-intervention, particularly in achieving adequate knowledge and good compliance, whereas the control group showed only minimal gains.



Comparison of Compliance Scores on Antibiotic Stewardship Between Pre- and Post-test among Control Group of Nurses

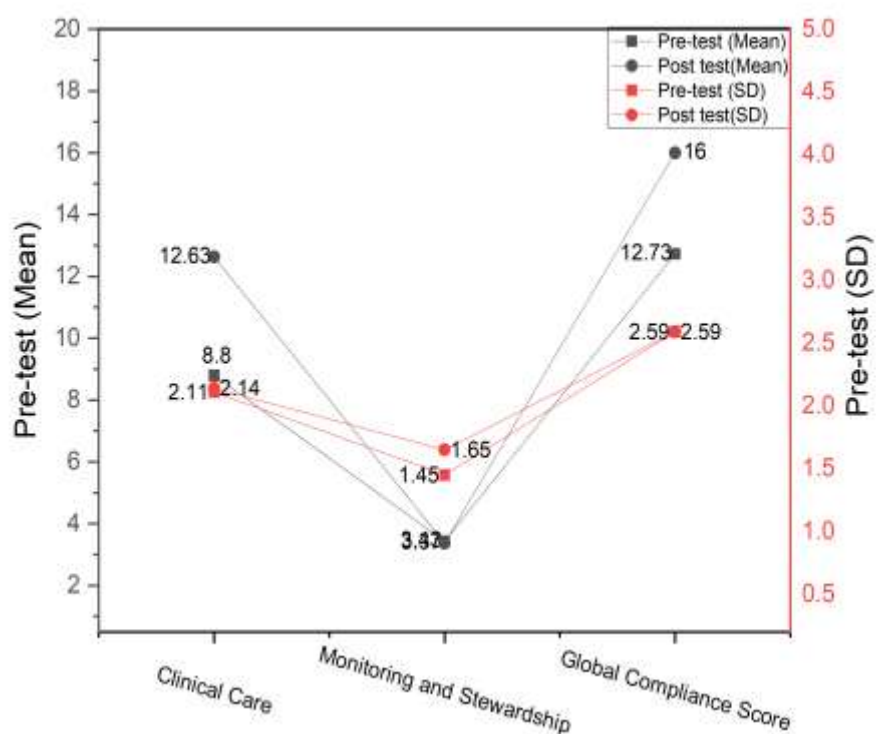


Fig. 4 Scores on antibiotic stewardship

Table 3: Comparison of Compliance Scores on Antibiotic Stewardship Between Pre- and Post-test among Control Group of Nurses.

	Max Score	Pre test Mean $\pm$ SD	Post test Mean $\pm$ SD	Mean Diff	Paired t Value	p-value
Clinical Care	18	8.80 $\pm$ 2.11	12.63 $\pm$ 2.14	-3.83	15.964	0.000



Monitoring and Stewardship	7	3.43 ± 1.45	3.37 ± 1.65	0.07	0.297	0.769
Global Compliance Score	25	12.73 ± 2.83	16.00 ± 2.59	-3.27	-14.89	0.000

Table 3 reveals that compliance scores in the control group of nurses showed a significant improvement in clinical care ($p = 0.000$) and in the global compliance score ($p = 0.000$) between pre and posttest. However, the change in monitoring and stewardship was not statistically significant ($p = 0.769$). Fig. 3 shows the scores on antibiotic stewardship.

Table 4: Comparison of Compliance Scores on Antibiotic Stewardship Between pre and posttest among Study Group of Nurses

Components	Max Score	Pretest Mean ± SD	Posttest Mean ± SD	Mean Dif	Paired t Value	p-value
Clinical Care	18	9.47 ± 2.33	14.97 ± 1.73	5.50	10.57	0.000
Monitoring and Stewardship	7	3.47 ± 1.38	5.47 ± 1.38	2.00	6.32	0.000
Global Compliance Score	25	13.60 ± 3.35	20.43 ± 2.25	6.83	11.34	0.000

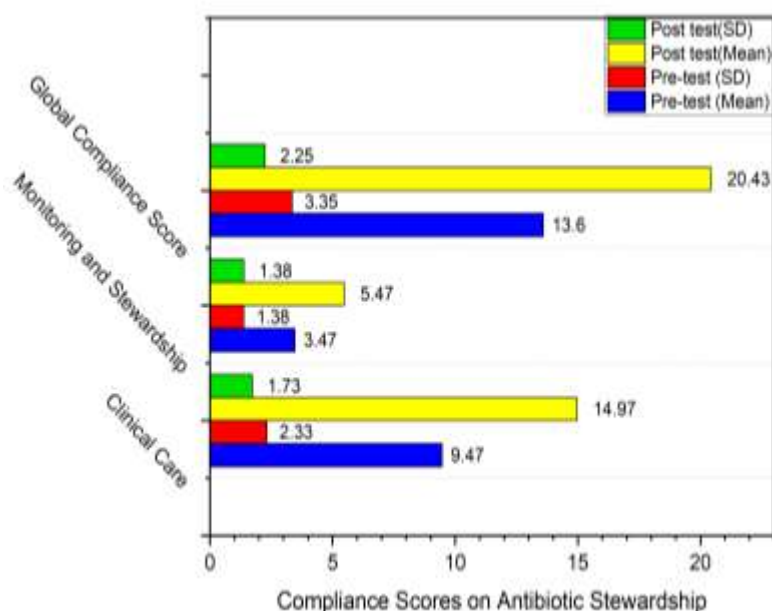


Fig. 5 Compliance scores on antibiotic stewardship

Table 4 reveals that in the study group of nurses, compliance scores improved significantly across all components and the global score between pre and posttest. For clinical care, the mean score rose from 9.47 ± 2.33 in pretest to 14.97 ± 1.73 in posttest, with a mean difference of 5.50, which was highly significant ($p = 0.000$). For monitoring and stewardship, scores increased from 3.47 ± 1.38 to 5.47 ± 1.38 , showing a mean difference of 2.00, again statistically significant ($p = 0.000$). The global compliance score improved from 13.60 ± 3.35 to 20.43 ± 2.25 , with a mean difference of 6.83, also highly significant ($p = 0.000$). Fig. 5 shows the compliance scores on antibiotic stewardship

In summary, all components and the overall compliance score demonstrated statistically significant improvement ($p < 0.001$) in the study group following intervention, highlighting the effectiveness of the program in enhancing compliance practices.

Comparison of Compliance Scores on Antibiotic Stewardship Between Control and Study Group of Nurses

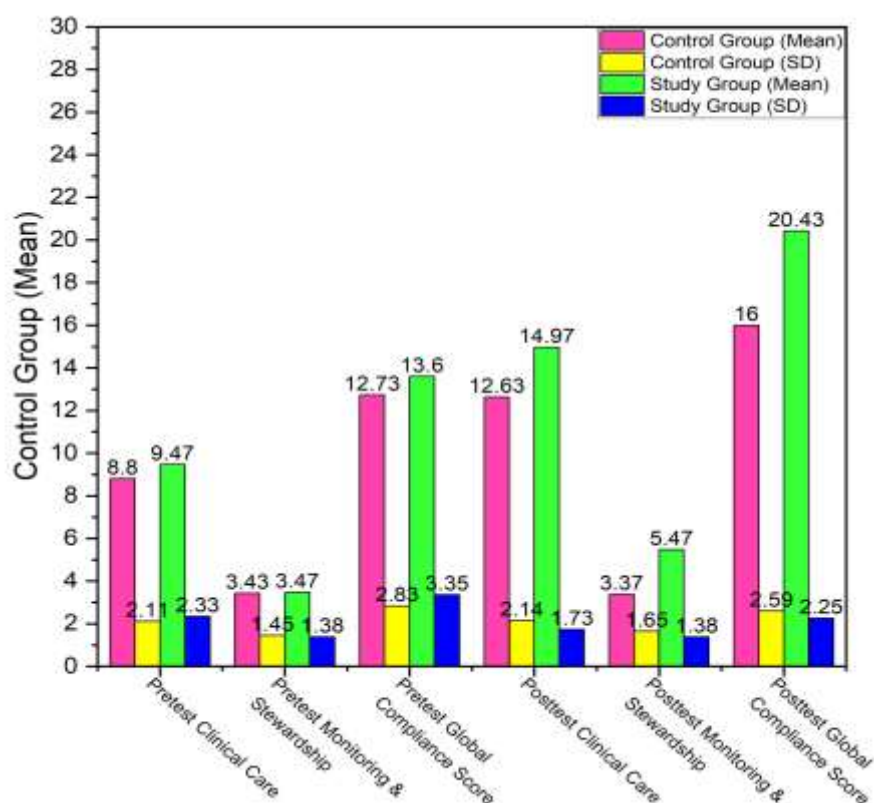


Fig. 6 Compliance scores on antibiotic stewardship between control and study groups

Table 5: Comparison of Compliance Scores on Antibiotic Stewardship Between Control and Study Group of Nurses

Assessments	Max Score	Control Group (n=30)	Study Group (n=30)	Mean Diff	Ind t Value	p-value
		Mean ± SD	Mean ± SD			
Pretest						
Clinical Care	15	8.80 ± 2.11	9.47 ±	-0.67	-1.162	0.250



			2.33			
Monitoring & Stewardship	10	3.43 ± 1.45	3.47 ± 1.38	-0.03	-0.091	0.928
Global Compliance Score	25	12.73 ± 2.83	13.60 ± 3.35	-0.87	-1.083	0.283
Posttest						
Clinical Care	15	12.63 ± 2.14	14.97 ± 1.73	-2.33	-4.641	0.000
Monitoring & Stewardship	10	3.37 ± 1.65	5.47 ± 1.38	-2.10	-5.342	0.000
Global Compliance Score	25	16.00 ± 2.59	20.43 ± 2.25	-4.43	-7.077	0.000

Table 5 and Fig. 6 shows comparison of compliance scores, baseline differences were not significant (pretest, $p > 0.05$). In posttest, the study group demonstrated significantly higher scores in clinical care ($p = 0.000$), monitoring and stewardship ($p = 0.000$), and global compliance ($p < 0.001$) compared to the control group. In summary, while both groups were comparable at baseline, the study group showed highly significant improvements ($p < 0.001$) in compliance scores after intervention, confirming the effectiveness of the program.



Association of compliance with Antibiotic Stewardship and Selected Background Variables among Nurses in Control Group during pretest

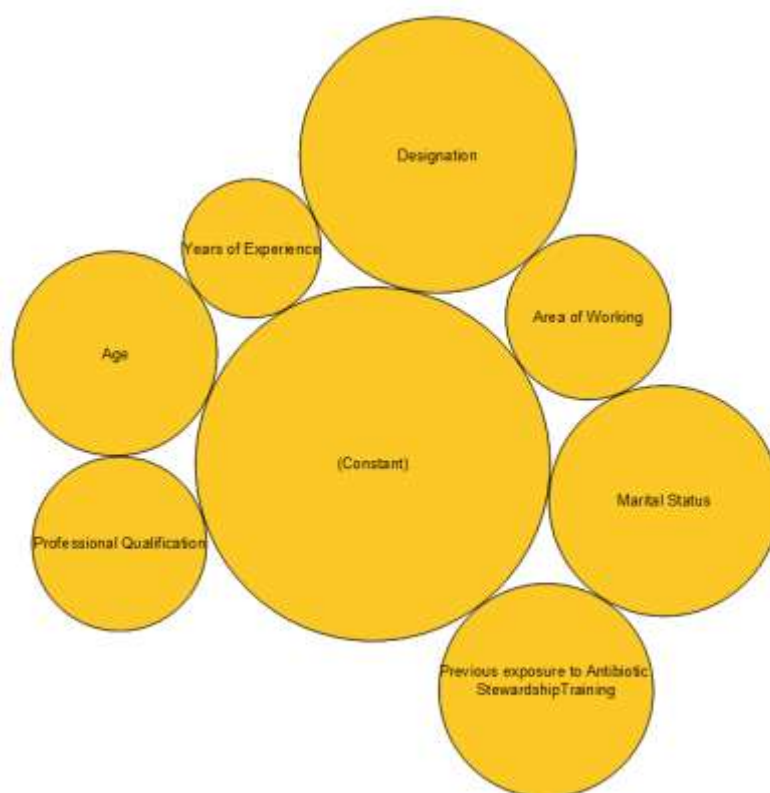


Fig. 7 Compliance with antibiotic stewardship and selected background variables in Control Group during pretest

The analysis revealed that none of the background variables were significantly associated with compliance scores in the control group, pretest ($p > 0.05$), indicating that compliance levels remained independent of demographic and professional characteristics. Fig. 7 depicts the Compliance with antibiotic stewardship and selected background variables.



Association of compliance with Antibiotic Stewardship and Selected Background Variables among Nurses in Control Group during posttest

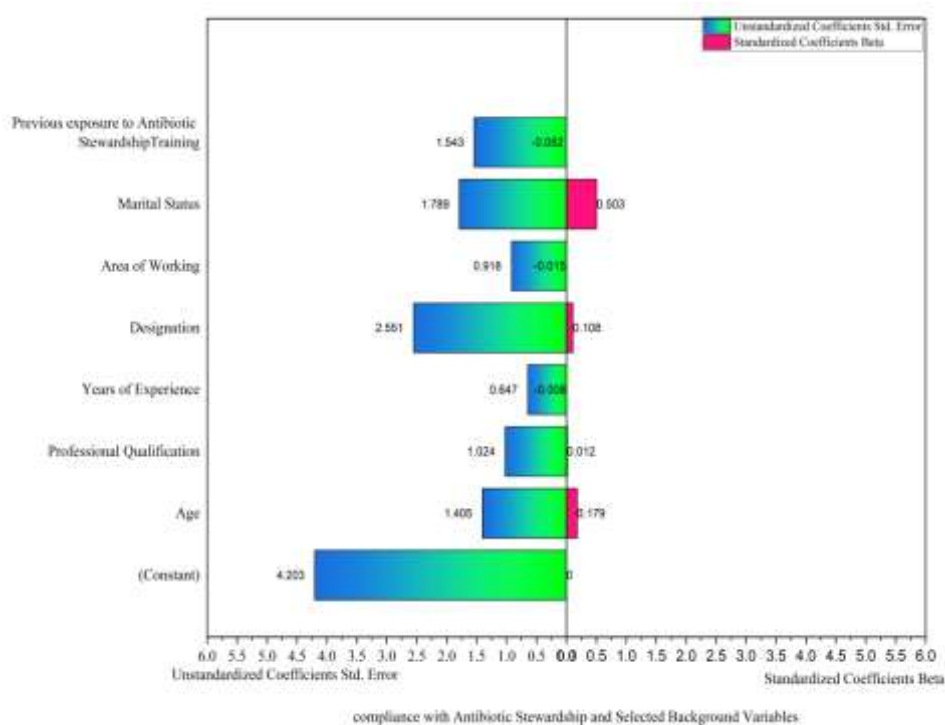


Fig. 8 Compliance with antibiotic stewardship among background variables in control group during posttest.

The study revealed that none of the background variables were significantly associated with compliance scores in the control group, posttest ($p > 0.05$), indicating that compliance levels remained independent of demographic and professional characteristics.



Association of compliance with Antibiotic Stewardship and Selected Background Variables among Nurses in study Group during pretest.

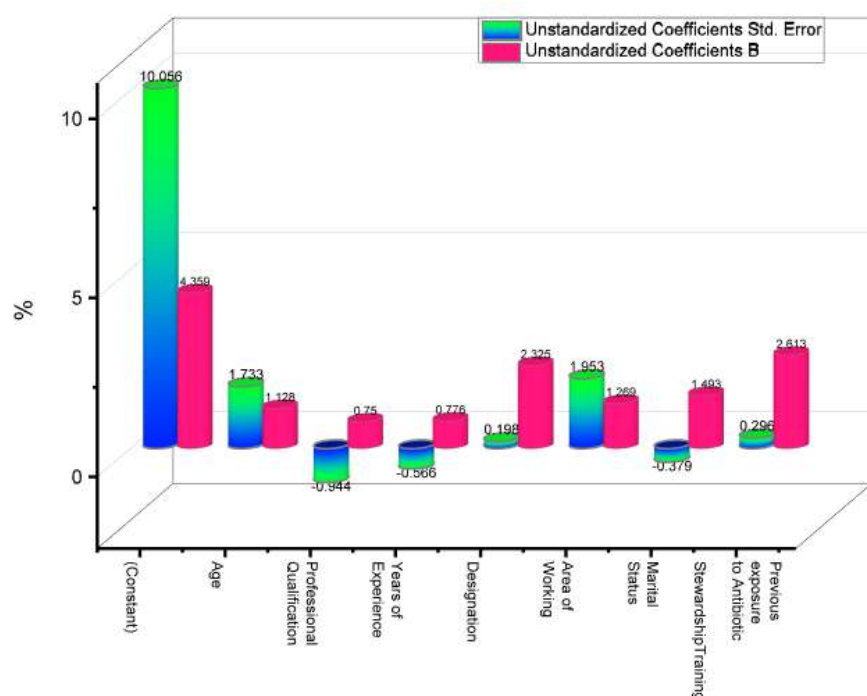


Fig. 9 Association of compliance with Antibiotic Stewardship and Selected Background Variables among Nurses in study Group during pretest.

The study revealed that none of the background variables were significantly associated with compliance scores in the study group, pretest ($p > 0.05$), indicating that compliance levels remained independent of demographic and professional characteristics.

Association of compliance with Antibiotic stewardship and Selected Background Variables among Nurses in study Group during posttest

Table 6: Association of compliance with Antibiotic Stewardship and Selected Background Variables among Nurses in study Group during posttest.



(n=30)

Variables	Unstandardize d Coefficients		Standardize d Coefficients	t	Sig .	95.0 Confidence Interval for B	
	B	Std. Error	Beta			Lower Boun d	Upper r Boun d
(Constant)	20.901	2.405		8.690	.000	15.913	25.889
Age	1.567	.622	.893	2.518	.020	.276	2.857
Professional Qualification	-.181	.414	-.069	-.438	.666	-1.039	.677
Years of Experience	-.364	.428	-.228	-.850	.405	-1.252	.524
Designation	-1.312	1.283	-.237	-1.022	.318	-3.973	1.349
Area of Working	-.740	.700	-.165	-1.057	.302	-2.192	.712
Marital Status	.596	.824	.180	.723	.477	-1.113	2.304
Previous exposure to Antibiotic Stewardship Training	-.615	1.442	-.069	-.427	.674	-3.605	2.375

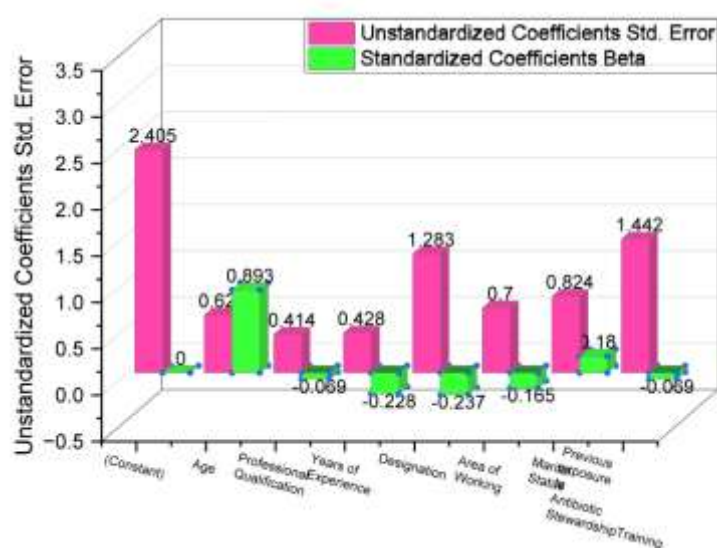


Fig. 10 Association of compliance with Antibiotic Stewardship and Selected Background Variables among Nurses in study Group during posttest

Table 6 reveals that in the study group of nurses (posttest), only age showed a statistically significant association with compliance scores on antibiotic stewardship ($B = 1.567$, $p = 0.020$). This indicates that increase of age had a positive influence on compliance levels. All other background variables—professional qualification ($p = 0.666$), years of experience ($p = 0.405$), designation ($p = 0.318$), area of working ($p = 0.302$), marital status ($p = 0.477$), and previous exposure to antibiotic stewardship training ($p > 0.674$)—were not significantly associated with compliance scores. In summary: age was the only variable significantly associated ($p < 0.05$), while all other background factors showed no significant relationship.

Table 7: Frequency and Percentage Distribution of Level of acceptability of nurses on antibiotic stewardship program in study group

S.NO	Level of Acceptability	Intervention group F (%)
1	Highly Acceptable	30(100)
2	Acceptable	-
3	Unacceptable	-
4	Highly Unacceptable	-
1	Highly Acceptable	-

Table 7 revealed that all nurses in the intervention group 30 (100%) rated the intervention



as highly acceptable. This indicates a very high level of acceptability of the intervention among the nurses in the intervention group.

6. Discussion

The present study demonstrated that the Nurses Empowerment Program significantly improved nurses' compliance with antibiotic stewardship practices. This finding is consistent with evidence by Handy et al., 2023 (11) that nurse-focused educational interventions can strengthen stewardship-related knowledge, perception, and practice, especially when the content is practical, structured, and aligned with bedside responsibilities. In the current study, the intervention group showed a marked rise in good compliance after the program, whereas the control group improved only minimally, indicating that routine exposure alone is insufficient to produce substantial change.

The observed improvement may be explained by the fact that nurses are key frontline professionals in antibiotic administration, infection prevention, patient monitoring, and documentation. Previous studies have shown that nurses are willing to participate in stewardship activities, but they require clear role definition and targeted education to translate that willingness into sustained practice by Carter et al., 2018 (12). The present program likely enhanced compliance by reinforcing correct antibiotic-order verification, timely administration, allergy checking, hand hygiene, and monitoring/reporting responsibilities, all of which are core elements of stewardship-linked nursing care.

The significant association between age and post-test compliance in the intervention group suggests that older nurses may have better professional judgment, clinical exposure, or readiness to integrate new practices. However, the lack of association with most background variables indicates that the empowerment program was broadly effective across different qualifications and work experience levels. This supports the view by Huizen et al., 2021 (13) that stewardship education can benefit nurses regardless of their baseline demographic profile.

Overall, the findings emphasize that nurse empowerment through focused stewardship education is an effective strategy for improving compliance and supporting antimicrobial resistance prevention. Similar interventions should be incorporated into continuing nursing education and hospital quality-improvement initiatives to sustain better antibiotic-use practices and patient safety.



7. Conclusion

The Nurses Empowerment Program regarding Antibiotic Stewardship was effective in improving nurses' compliance with antibiotic stewardship practices in selected hospitals, Chennai. It strengthened key behaviors such as correct antibiotic-order verification, timely administration, hand hygiene, documentation, monitoring, and patient education, which are essential for safe and rational antibiotic use. The intervention group showed significantly higher post-test compliance than the control group, confirming that structured education and empowerment can produce meaningful practice change. Age was the only background variable significantly associated with post-test compliance, while professional qualification, experience, designation, area of work, marital status, and prior exposure to stewardship training were not significant. The program was also highly acceptable to all nurses in the intervention group, suggesting good feasibility for routine implementation. Overall, the study supports integrating nurse-focused antibiotic stewardship education into continuing professional development and hospital quality-improvement initiatives to reduce antimicrobial resistance and improve patient safety.

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Data Availability Data will be made available upon request made to the corresponding author.

Competing Interests All authors confirm that they do not have any conflicts of interest to disclose.

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