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ANTIBIOTIC STEWARDSHIP PRACTICES, PRESCRIBING PATTERNS, AND CLINICIAN PERSPECTIVES AMONG PLASTIC SURGEONS IN LAHORE, PAKISTAN: A CROSS-SECTIONAL STUDY

Syed Ameer Hamza[1], Mahtab Ahmad Khan[1], Faiza Tariq[1], Muhammad Usman Haider[1], Muhammad Farhan[1], Waqas Akram[1]*

[1]**Faculty of Pharmaceutical Sciences,** University of Central Punjab, Lahore, Pakistan

***Corresponding Authors:** Waqas Akram. E. mail: waqas.akram@ucp.edu.pk

Abstract

Antibiotic overprescription in plastic surgery contributes to antimicrobial resistance, yet evidence-practice gaps regarding perioperative antibiotic prophylaxis in low-and middle-income countries remain poorly characterised. To estimate compliance with evidence-based prophylaxis, characterise current prescribing patterns, examine clinician attitudes toward antimicrobial stewardship, and identify barriers to guideline implementation among plastic surgeons in Lahore, Pakistan. A cross-sectional questionnaire was administered to 41 of 69 active plastic surgery specialists in urban Lahore. The questionnaire evaluated antibiotic agent selection, vignette-based knowledge, perceived barriers, and stewardship attitudes across eight common procedures. Chi-square, one-way ANOVA, Spearman correlation, and multivariate logistic regression were conducted using SPSS version 26.0. The most used agent in all the procedures (68–82%) was Cephalosporins, which aligned with evidence based recommendations. The most frequent procedures (6 of 8) had antibiotic courses of 5 days or more. The best independent predictor of the knowledge of adequate stewardship was guideline awareness (OR = 1.69, p = 0.023) and agreeing with the 60-minute pre-incision window (OR = 1.82, p = 0.035). There was a significant positive correlation between the scores of knowledge and adherence (rho = 0.346, p = 0.026). Time limitations (65%), lack of institutional policy (50%) and pharmaceutical influences (50%) were the greatest obstacles. The major evidence-practice gap is excessive antibiotic duration (≥5 days in most procedures). Prioritising cefazolin over quinolones and implementing urgent institutional stewardship programmes are needed.

Keywords: *Antibiotic stewardship, Antimicrobial resistance, Perioperative antibiotic prophylaxis, Plastic surgery, Prescribing practices, Surgical site infection*

INTRODUCTION

Antibiotic prophylaxis is one of the foundations of prevention of surgical infections, but practices regarding antibiotics prophylaxis in plastic surgery remain highly variable. Surgical site infections (SSIs) are the second most common cause of healthcare-associated infections globally, affecting 0.5%-32.6% of plastic surgery patients (1-3). Other than patient morbidity, SSIs have a huge economic cost due to the long-term hospitalisation and readmission and the misuse of antibiotics in the surgical prophylaxis is the significant contributor to multidrug-resistant organisms (3, 4).

Although evidence based guidelines on the use of perioperative antibiotic prophylaxis (PAP) are available, there is still practice variation in the field of plastic surgery. The CDC does not consider the use of postoperative antimicrobials more than 24 hours as prophylaxis but treatment (5). The gaps in evidence-practice include how to select the agent to be used, the timing, doses, and duration (4). Prophylaxis given 30-60 minutes before incision has the lowest rates of SSI although the extent of the plastic surgery work, such as reconstructive surgery, cosmetic surgery, and emergency surgeries complicates the creation of a uniform protocol (6).

Existing literature reports low levels of adherence to the guidelines among plastic surgeons. Studies of trainees (19.5%), and practising surgeons (21.9%), showed only hand procedures had 59.1% versus 24% hand procedures in breast and craniofacial cases respectively (4). A survey of plastic surgeons in multiple

countries conducted by Pachon *et al.,* (7) found that almost 80% of the surgeons gave antibiotics more than 24 hours and 39.6% over five days, indicating that clinical decision-making may be influenced more by anecdotal experience and risk aversion than by formal evidence.

Guideline recommendations and clinical practice are not only divided by a knowledge gap, but also by the attitudinal and behavioural aspects. In their study, Pelullo *et al.,* (8) showed that although surgical residents were aware of antimicrobial resistance as an outcome of poor choice of the agent, only 36.3% of them knew the proper choice of the agent, timing, and duration of prophylaxis during clinical practice. This knowledge-practice gap reflects poor training, fear of litigation, concern about high-risk patient groups, and uncertainty about applying evidence to specific clinical contexts (8). In low- and middle-income countries such as Pakistan, these barriers are further compounded by a lack of institutional stewardship infrastructure, inconsistent guideline dissemination, and pervasive pharmaceutical marketing pressures on prescribing practices (9, 10)

The main objectives of this study were to estimate compliance with evidence-based prophylaxis, characterise current prescribing patterns, examine clinician attitudes toward antimicrobial stewardship, and identify barriers to guideline implementation among plastic surgeons in Lahore, Pakistan.

METHODOLOGY

STUDY DESIGN

A cross-sectional design was selected to assess current prescribing practices and clinician attitudes at a single time point (11). Cross-sectional surveys are well validated for measuring prescribing behaviour in healthcare settings and are appropriate for gathering foundational data on evidence-practice gaps in Pakistan, where no recent region-specific information on antibiotic stewardship in plastic surgery exists.

STUDY SETTING AND POPULATION

The study was conducted among plastic surgeons practising in urban Lahore, Pakistan, encompassing physicians performing aesthetic and reconstructive surgeries in which perioperative antibiotic prophylaxis applies. Inclusion criteria were that they needed to be actively engaged as a resident, fellow or consultant in urban Lahore and practising eligible procedures. The exclusion criteria were those who were non-surgical or administrative only, those who were only non-surgical specialists who only had occasional procedures and questionnaires with considerably missing answers.

SAMPLE SIZE AND SAMPLING TECHNIQUE

The total study population was 69 active plastic surgery specialists (residents, fellows and consultants) practising in urban Lahore, which was confirmed by institutional lists, and by possible registry data (12). Among the above 41 specialty professionals filled in the questionnaire, which constituted a response rate of 59.4%. Based on a population of 69, a 95% confidence interval for this sample yields a margin of error of approximately ±10.4%, calculated using the standard formula for finite population proportions ($p = 0.5$, $z = 1.96$). Participants were recruited using a convenience sampling technique. Although non-probability sampling reduces the generalisability, it is a feasible and justified approach to exploratory research in specific professional setting (13).

DATA COLLECTION AND OUTCOME MEASURES

A structured self-administered questionnaire was used for data collection. Section 1 captured demographic and practice characteristics. Sections 2 and 3 assessed general antibiotic prophylaxis practices and duration across clinical situations. Section 4 evaluated procedure-specific antibiotic use. Sections 5 and 6 assessed knowledge, attitudes, and perceived stewardship barriers using constructs from validated clinician stewardship questionnaires. The internal consistency of the adapted knowledge and attitude constructs was assessed using Cronbach's alpha, which indicated acceptable reliability ($\alpha = 0.728$).

STATISTICAL ANALYSIS

IBM SPSS (version 26.0) was used to analyse the data. Demographic characteristics and the pattern of prescription were summarised using descriptive statistics (frequencies, percentages, means, and standard deviations). Chi-square tests were used to investigate relationships between categorical variables such as years of experience, previous training in stewardship, and guideline use; one-way ANOVA was used to compare the mean adherence scores among age groups. Multivariate logistic regression analysis was conducted to determine independent predictors of stewardship knowledge, SSI concern, AMR concern, and perceived utility of prophylaxis, with odds ratios (OR) and 95% confidence intervals provided. Spearman correlation was used to measure the relationship between the knowledge scores and the adherence scores, with $p \leq 0.05$ as the level of statistical significance.

ETHICAL APPROVAL

Ethical approval was obtained from the Institutional Ethics Review Committee, Faculty of Pharmaceutical Sciences, University of Central Punjab, Lahore, Pakistan (Ref # UCP/FOP/INT/0800, dated December 10, 2025), prior to data collection, in accordance with the Declaration of Helsinki.

RESULTS

A total of 41 out of 69 eligible plastic surgeons responded to the questionnaire, corresponding to a response rate of 59.4% (95% CI: 47.2%–70.9%). The mean age group was 31–40 years, accounting for nearly half of the sample (n = 20, 48.8%). With respect to gender distribution, males represented 56.1% of the respondents. Professional-level distribution was evenly balanced, with residents and consultants each comprising 46.3% of the cohort (n = 19 per group). The demographic and professional characteristics of the study population are summarized in Table I.

Table I. Demographic and professional characteristics of respondents (n = 41)

Variable	Category	n	%
Age	21–30 years	16	39.0%
	31–40 years	20	48.8%
	41–50 years	4	9.8%
	51–60 years	1	2.4%
Gender	Male	23	56.1%
	Female	18	43.9%
Professional level	Resident	19	46.3%
	Consultant and senior surgeons	22	53.7%
Practice setting	Public hospital	38	92.7%
	Private hospital and academia	12	29.3%
Subspecialty	General Plastic	33	80.4%
	Reconstructive	18	43.9%
	Aesthetic	17	41.4%

* Percentages for practice setting and subspecialty sum to more than 100% because respondents could select more than one category

Cephalosporins were the most common antibiotic class across all eight procedures, with use rates of 68–82% across mammoplasty procedures, and near-universal selection for facelift and blepharoplasty, consistent with CDC guideline recommendations for coverage of Staphylococcus aureus and Streptococcal species. For body contouring procedures (liposuction, liposuction with excision, excision alone), near-universal prophylaxis uptake (95.1–97.6%) reflects appropriate risk awareness. However, antibiotic duration markedly exceeded evidence-based guidelines across all eight procedures, with 5-day and >5-day regimens ranking first or second in six procedures. Excision-alone cases demonstrated the most pronounced overprescription, with 41.5% prescribing for 5 days and 14.6% for >5 days. Extended prophylaxis beyond 24 hours in clean procedures does not reduce SSI rates but significantly increases the risk of adverse drug

events and resistance selection (14-16), a pattern consistent with global findings by Pachon *et al.*, (7) who reported a persistent gap between guidelines and clinical practice (Table II).

Table II. Prescription proportion of antibiotics grouped by the most common procedures in plastic surgery and ranking of antibiotic type and duration of treatment (n = 41)

Procedure	Category	Rank 1	Rank 2	Rank 3
Mammoplasty without Implants	Antibiotic Type	Cephalosporins: 32 (82.1%)	Penicillin: 8 (20.5%)	Quinolones: 1 (2.6%)
	Duration	5 days: 13 (31.7%)	>5 days: 13 (31.7%)	3 days: 10 (24.4%)
Mammoplasty with Implants	Antibiotic Type	Cephalosporins: 28 (68.3%)	Penicillin: 11 (26.8%)	Sulfonamides/Quinolones/Macrolides: 1 each (2.4%)
	Duration	5 days: 11 (26.8%)	3 days: 8 (19.5%)	Single dose: 7 (17.1%)
Facelift	Antibiotic Type	Cephalosporins: 23 (59%)	Penicillin: 10 (25.6%)	Quinolones: 5 (12.8%)
	Duration	5 days: 13 (31.7%)	Single dose: 8 (19.5%)	3 days: 7 (17.1%)
Blepharoplasty	Antibiotic Type	Cephalosporins: 25 (65.8%)	Penicillin: 10 (26.3%)	Sulfonamides/Quinolones: 2 (5.3%)
	Duration	3 days: 10 (24.4%)	Single dose: 7 (17.1%)	24 h: 4 (9.8%)
Rhinoplasty	Antibiotic Type	Cephalosporins: 26 (63.4%)	Penicillin: 13 (31.7%)	Macrolides: 3 (7.3%)
	Duration	3 days: 12 (29.3%)	5 days: 11 (26.8%)	>5 days: 5 (12.2%)
Liposuction	Antibiotic Type	Cephalosporins: 25 (64.1%)	Penicillin: 11 (28.2%)	Other: 2 (5.1%)
	Duration	5 days: 13 (31.7%)	3 days: 10 (24.4%)	Single dose: 4 (9.8%)
Liposuction + Excision	Antibiotic Type	Cephalosporins: 27 (69.2%)	Penicillin: 10 (25.6%)	Quinolones: 3 (7.7%)
	Duration	3 days: 13 (31.7%)	5 days: 11 (26.8%)	>5 days: 5 (12.2%)
Excision Alone	Antibiotic Type	Cephalosporins: 31 (77.5%)	Penicillin: 8 (20.0%)	Macrolides: 3 (7.5%)
	Duration	5 days: 17 (41.5%)	3 days: 9 (22.0%)	>5 days: 6 (14.6%)

The chi-square analysis showed no statistically significant association between previous antibiotic stewardship training and guideline use ($\chi^2 = 1.602$, df = 1, p = 0.206), nor between years of experience and frequency of prophylaxis ($\chi^2 = 13.611$, df = 12, p = 0.326).

The best knowledge of the type of antibiotic was observed in Vignette 1 and 2 (89.5% and 94.7% respectively), but the knowledge in Vignette 3 (26.3%), indicated that the knowledge on the process depends on the complexity of the procedure. Timing of first dose was reasonably well understood across all professional levels, with correct rates ranging between 57.9% and 66.7%. Knowledge of total prophylaxis duration was most variable, particularly among consultants in Vignette 2 (54.5% correct), indicating that duration remains the principal stewardship education gap (Table III).

Table III. Respondents' knowledge for each vignette about type of antibiotic, timing of first dose, and total duration by professional level (n = 41)

	Residents (Vignettes) (n=19)			Consultants and senior surgeons (Vignettes) (n=22)		
	V1 n(%)	V2 n (%)	V3 n (%)	V1 n (%)	V2 n (%)	V3 n (%)
Antibiotic Type						
Incorrect	2 (10.5%)	1 (5.3%)	14 (73.7%)	1 (4.5%)	20 (90.9%)	6 (27.3%)
Correct	17 (89.5%)	18 (94.7%)	5 (26.3%)	21 (95.5%)	2 (9.1%)	16 (72.7%)
Timing of First Dose						
Incorrect	7 (36.8%)	7 (36.8%)	7 (36.8%)	9 (40.9%)	9 (40.9%)	9 (40.9%)
Correct	12 (63.2%)	12 (63.2%)	12 (63.2%)	13 (59.1%)	13 (59.1%)	13 (59.1%)
Total Length of Prophylaxis						
Incorrect	3 (15.8%)	7 (36.8%)	5 (26.3%)	5 (22.7%)	10 (45.5%)	5 (22.7%)
Correct	16 (84.2%)	12 (63.2%)	14 (73.7%)	17 (77.3%)	12 (54.5%)	17 (77.3%)

Several barriers to antimicrobial stewardship adherence were identified. The most frequently cited obstacle was time constraints (65.0%), followed by lack of institutional policy (50.0%) and pharmaceutical influences (50.0%). Poor clarity of existing guidelines was reported by 42.5% of respondents, while fear of surgical site infections (SSI) was cited by 32.5%. A comprehensive overview of perceived barriers is presented in Table IV.

Table IV. Perceived barriers to antibiotic stewardship adherence

Barrier	n (responses)	% of cases
Time constraints	26	65.0
Lack of institutional policy	20	50.0
Pharmaceutical influences	20	50.0
Guideline clarity	17	42.5
Fear of surgical site infections	13	32.5
Patient pressure	6	15.0
Total responses	102	255.0

Multivariate logistic regression revealed that guideline awareness (OR = 1.69, p = 0.023) and agreement with 60-minute pre-incision PAP (OR = 1.82, p = 0.035) were the strongest independent predictors of adequate stewardship knowledge in Model 1. Awareness of infection control protocols was the dominant predictor of SSI concern in Model 2 (OR = 3.36, p < 0.001). Knowledge of the Infection Risk Index drove AMR concern in Model 3 (OR = 2.29, p = 0.005). Recognising SSIs as preventable (OR = 2.02, p = 0.011) and adequate PAP knowledge (OR = 1.65, p = 0.023) were the primary predictors of perceived prophylaxis utility in Model 4. A statistically significant Spearman correlation between knowledge and adherence scores (rho = 0.346, p = 0.026) is consistent with targeted PAP education being a useful stewardship intervention, although the cross-sectional, correlational design precludes inferring causation (17, 18) (Table V).

Table V. Multivariate logistic analyses to characterize factors associated with the different outcomes of interest

Variable	OR⁺	SE◦	95% CI˚	p-Value
Model 1. Adequate knowledge about type of antibiotic used, the timing of its administration, and the length of the prophylaxis in the case vignettes				
Log likelihood = −53.570, χ^2 = 3.048 (4 df), p = 0.550 (sample size = 41)				
Professional Level				
*Resident (Ref.)**	1*			
Consultant and Senior Surgeons	0.995	0.696	0.254–3.894	0.994
Awareness of national guidelines on PAP	1.69	0.39	1.07–2.67	0.023
Agreed PAP within 60 min before surgical incision	1.82	0.52	1.04–3.17	0.035
Prior formal stewardship training	1.55	0.36	0.98–2.45	0.059

Spearman rho: Knowledge–Adherence (rho = 0.346, p = 0.026)				0.026
Model 2. Respondents who were very concerned that patients may contract SSIs during hospitalisation				
Log likelihood = 0.000, χ^2 = 56.618 (5 df), p < 0.001 (sample size = 41)				
Professional Level				
*Resident (Ref.)**	1*			
Consultant and Senior Surgeons	2.23	0.71	0.56–8.85	0.257
Aware of the Infection Control protocol in the hospital	3.36	1.02	1.85–6.10	<0.001
Adequate knowledge about PAP (from vignettes)	1.75	0.53	0.96–3.17	0.068
Female	1.61	0.49	0.88–2.93	0.120
SSIs are preventable infections (aware)	1.44	0.58	0.66–3.19	0.360
Model 3. Respondents who were very concerned about the development of multidrug-resistant bacteria				
Log likelihood = −46.364, χ^2 = 8.483 (4 df), p = 0.075 (sample size = 41)				
Knowledge of the Infection Risk Index	2.29	0.68	1.28–4.10	0.005
Professional Level				
*Resident (Ref.)**	1*			
Consultant and Senior Surgeons	1.876	0.776	0.410–8.579	0.417
Prior formal stewardship training	1.45	0.42	0.81–2.57	0.206
Awareness of national guidelines on PAP	1.58	0.44	0.89–2.82	0.119
Model 4. Utility of PAP in reducing SSIs				
Log likelihood = −267.89, χ^2 = 37.3 (8 df), p < 0.0001 (sample size = 41)				
Professional Level				
*Resident (Ref.)**	1*			
Consultant and Senior Surgeons	1.45	0.65	0.41–5.14	0.482
Aware of the Infection Control protocol in the hospital	1.81	0.40	1.18–2.78	0.006
SSIs are preventable infections (aware)	2.02	0.56	1.17–3.48	0.011
Adequate knowledge about PAP (from vignettes)	1.65	0.36	1.07–2.55	0.023
Agreed PAP within 60 min before surgical incision	1.73	0.51	0.96–3.10	0.066
Female	1.45	0.31	0.96–2.20	0.076
Knowledge of the Infection Risk Index	1.58	0.47	0.89–2.82	0.119

⁺Odds Ratio ◦Standard Error ◦Confidence Interval *Reference category

DISCUSSION

The most common group of antibiotics in all eight operations was cephalosporins with 68%-82% of all mammoplasty, 80% of rhino-plasty and almost all-inclusive choice of facelift and blepharoplasty. This choice is pharmacologically justified. Cefazolin and its analogues cover the gram-positive skin flora (Staphylococcus aureus, coagulase-negative staphylococci, and streptococci) that cause most clean surgical site infections. They also achieve adequate tissue concentrations when given 30-60 minutes before incision (19, 20). This is consistent with what is observed in other countries as Pachon *et al.*, (7) found cephalosporins in 73.3% of prescriptions globally. Brambullo *et al.*, (21) and Homsy *et al.*, (22) classified first and second-generation cephalosporins as the agent of choice. However, the selection of the quinolones as the second-ranked agent in a variety of processes is concerning, as the latter are not applicable in clean or clean-contaminated procedures. They are probably used based on the availability by their formularies or the pharmaceutical influence, a trend that can be found in plastic surgery settings in Saudi Arabia (23). To avoid the trend of indiscriminate second-line agent choice, departmental stewardship guidelines should also contain certain advice on the choice of second-line agents.

The most clinically important finding is the widespread over-extension of antibiotic duration beyond evidence-based limits. Long courses of five or more days were top or second in six of eight procedures, the most severe one being excision-alone cases, with 41.5% for 5 days and another 14.6% for >5 days. Continuing antimicrobials beyond 24 hours does not lower SSI incidence, according to systematic reviews (5). Instead, the risk of adverse events, such as the selection of multidrug-resistant organisms, Clostridioides difficile colonisation, and hypersensitivity, is significantly high (14). These trends reflect those in the rest of the world as Pachon *et al.*, (7) have found over five-day therapy in 39.6% of an international population whereas prophylaxis with a single dose was applied in 12%. Similarly, Mankowski *et al.*, (4) revealed a near-zero near-single dose prescription rate in mammoplasty due to beliefs of risk-aversion to the complications associated with implants taking over the evidence. Sevin *et al.*, (24) prospectively showed that in abdominoplasty cefazolin in single dosage with intraoperative redosing only is adequate as it literally pushes the pattern of multi-day patterns observed in this case. Logistic regression proved that only the awareness of the guideline (OR = 1.69, p = 0.023) and consent to the 60-minute pre-incision window (OR = 1.82, p = 0.035) are significant variables to predict adequate stewardship knowledge, which makes antibiotic duration the most important area of stewardship intervention.

Another significant structure can be identified based on the knowledge and adherence predictors. There was a statistically significant Spearman correlation between the knowledge scores and guideline adherence (rho = 0.346, p = 0.026) and chi-square analyses did not show any relationship between previous stewardship training or years of clinical experience and the prescribing behaviour. This implies that passive or incidental learning alone maybe insufficient to support stewardship adherence, but rather active and structured knowledge of guidelines leads to it. Results of Vignette testing confirm this as Vignette residents made accurate decisions on the type of antibiotic to use in 89.5% and 94.7% of the Vignette 1 and Vignette 2, and the consultants had more variability in their responses based on the duration, but not timing, and the type of antibiotic used. This is more or less consistent with the results obtained by Pelullo *et al.*, (8) reported the same predictors of adequate PAP knowledge: guideline awareness (OR = 1.69; 95% CI = 1.07–2.67) and agreement with the 60-minute pre-incision threshold (OR = 1.82; 95% CI = 1.04–3.17). Our study replicates this pattern independently in a methodologically different setting. This convergence suggests that structured guideline education, rather than clinical seniority, is associated with stewardship adherence, and supports institutionally disseminated, specialty-specific PAP protocols complemented by formal, repeated education rather than opportunistic exposure (17, 18).

Identified barriers time constraints (65%), lack of institutional policy (50%), pharmaceutical influences (50%), poor guideline clarity (42.5%), and fear of SSI (32.5%) reflect a multi-level structural problem consistent with international literature. Pachon *et al.*, (7) identified infection fear as the primary driver of prolonged antibiotic use, while Brambullo *et al.*, (21) and Klifto *et al.*, (16) note the absence of unified specialty-specific guidelines as a systemic barrier requiring active institutional support. Pharmaceutical promotion in low- and middle-income countries further contributes to broad-spectrum prescribing without clinical indication (10, 25). The finding that infection control protocol awareness was the dominant predictor of SSI concern (OR = 3.36, p < 0.001) underscores that institutional infrastructure is as important as individual knowledge. The most viable strategy towards achieving a reduction in unnecessary prophylaxis is surgical antimicrobial stewardship program comprising of prescriber education, evidence-based guidelines, and real-time audit-and-feedback (26).

This is the first cross-sectional study on antibiotic stewardship in plastic surgeons in Lahore, Pakistan to the best knowledge of the authors, and covers one of the major geographical areas when compared to other extents of the literature that covers North American data and European data. This use of the multivariate logistic regression in four distinct outcome models gives it a level of analytical rigour, where most studies of this field are descriptive (single outcome). Sensitivity to the proven frameworks of Pelullo *et al.*, (8) and Pachon *et al.*, (7) made it possible to directly compare findings of the countries effectively. When all eight aesthetic and reconstructive operations (such as body-contouring surgery) have been covered, the procedural coverage is more extensive than most previous studies one-procedure or one-

subspecialty ones. Lastly, the Spearman correlation between knowledge and adherence scores (rho = 0.346, p = 0.026) has a numerical target that can be designed and measured around as a basis to base future stewardship education programs.

CONCLUSION

Although the choice of cephalosporins is appropriate in a group of Lahore plastic surgeons, the length of antibiotic prophylaxis is excessively long with five days or longer courses prevailing in the majority of surgeries. The lack of institutional stewardship infrastructures, as a risk-averse clinical culture, pharmaceutical power, and lack of an institutional infrastructure to support the knowledge of agents, can all be seen as evidence-practice gap. The best predictors of the adherence are the awareness of guidelines and planned education with the institutionalised education based on the specificity of the specialty being the strongest predictor of such adherence, and the best action-based intervention is the evidence-based one. Evidence based PAP guidelines and stewardship programmes need to be put in urgency in clinical, institutional and policy action without them an already resource constrained surgical setting will run out of time on antimicrobial resistance.

Limitations:

There is a lack of statistical power and generalisation to other Pakistani cities and rural areas due to the sample size (41 respondents) of urban Lahore. Convenience sampling brings in the selection bias and self-reported data can be found overestimating the reality of the guidelines being adhered. The cross-sectional design does not allow making causal/inference of knowledge, attitudes and prescribing behaviour. Given the small convenience sample (n = 41) and the wide margin of error (±10.4%), these findings should be interpreted as exploratory and hypothesis-generating; they are not generalisable to all plastic surgeons in Pakistan.

Recommendations:

Plastic surgeons are advised to match prophylaxis time with that recommended by CDC (not exceeding 24 hours after surgery) and prioritise cefazolin as opposed to quinolones. To reduce hospital-acquired infection rates, hospitals are recommended to have formal surgical antimicrobial stewardship programme including procedure-specific protocols, audit and feedback in real-time and controlled promotion of pharmaceuticals. Prospective, multi-centre studies in Pakistan cities should be done in the future so that they can be able to do subgroup analyses so that they can justify Pakistan specific evidence based prophylaxis.

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The submitted manuscript is original, has not been published previously in any language or format, and is not currently under review elsewhere. Participation was voluntary with online informed consent obtained at questionnaire commencement; no identifiable personal data was collected.

List of abbreviations:

AMR: Antimicrobial Resistance; ANOVA: Analysis of Variance; CDC: Centers for Disease Control and Prevention; CI: Confidence Interval; df: Degrees of Freedom; OR: Odds Ratio; PAP: Perioperative Antibiotic Prophylaxis; SE: Standard Error; SPSS: Statistical Package for the Social Sciences; SSI: Surgical Site Infection

Conflict of interest:

The authors declare no conflict of interest. The design, conduct, interpretation, and reporting of this article were not influenced by financial or non-financial gains.

Author s' contributions:

SAH & FT Study conception, data collection and manuscript drafting; MUH & MF Data collection and statistical analysis; WA & MAK Supervised the study, contributed to study design, interpretation of results, and critical revision of the manuscript. All authors approved the final version of the manuscript.

Declaration of generative AI-assisted tools:

Authors declared that no AI-assisted tools were used.

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