



■ Original Research Article

## Practice of Prophylactic Antibiotic for Caesarean Section Among Physicians In Maternity Units In Northern Nigeria

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### ABSTRACT

**Background:** Caesarean section is a crucial obstetric intervention, especially in developing countries. However, postoperative infection remains a concern due to the inconsistent use of prophylactic antibiotics. **Objective:** The study's objective was to determine the practice of prophylactic antibiotics use for caesarean section among physicians working in maternity units in northern Nigeria. **Material and methods:** Medical doctors in Obstetrics and Gynaecology departments across northern Nigeria were sent online self-administered questionnaires to assess their practice of prophylactic antibiotics during caesarean delivery. They were asked about their ages, experiences, professional ranks, practice locations, and the monthly average of caesarean deliveries. The primary outcome was adherence to the WHO recommendation of administering pre-incision antibiotics for caesarean sections. The study also asked whether there was a departmental or hospital-written policy on prophylactic antibiotic use during caesarean delivery. **Results:** Of the 315 that responded, only 233 (78.5%) gave routine pre-incision prophylactic antibiotics in all caesarean sections. Of those that give routine prophylaxis, 109(46.9%) gave only one dose, 39(16.7%) will gave two doses, while the remaining 85 (36.4%) gave three or more doses. More than 90% of the respondents would prescribe additional antibiotics aside from the prophylactic dose for a period ranging from 1 to 10 days. Ceftriaxone was the most common prophylactic antibiotic used by 84.1%, and another 53.5% used ceftriaxone-sulbactam combination. Amoxicillin + clavulanic acid + metronidazole and amoxicillin + clavulanic acid only were used by 82.3% and 67.1%, respectively. Only 36.7% attested to using cefuroxime, 13.7% of the respondents have protocols on prophylaxis for caesarean section in their place of work, and 14.9% know about the antibiotic policy in their hospitals. **Conclusion:** The most common prophylaxis antibiotic for caesarean section is ceftriaxone, followed by Amoxicillin + clavulanic acid + metronidazole and amoxicillin + clavulanic acid only, respectively. Almost 4/5<sup>th</sup> of doctors gives pre-incision antibiotic prophylaxis as recommended by the WHO. However, there is a need for departmental protocols to guide the use of prophylactic antibiotics in maternity units.

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## INTRODUCTION

Caesarean section remains a critical obstetric intervention to reduce maternal mortality, especially in developing countries. Significant advancements have been achieved in the refinement of the procedure, enabling its safe implementation in several hospitals, including those in remote areas, as part of comprehensive emergency obstetrics care. Nonetheless, postoperative infection has remained a significant concern, primarily due to inadequate adherence to prophylactic antibiotic protocols or suboptimal medications.

Caesarean section is associated with a 5-fold increased risk of puerperal sepsis compared to vaginal delivery.<sup>1</sup> The post-caesarean section infection can occur at the incision site, endometritis, pelvic abscesses, bacteraemia and septic shock, which can lead to maternal death.<sup>2</sup> Severe post-caesarean section infections typically require therapeutic antibiotics, prolonged hospital stays and sometimes additional surgery with consequent complications and additional financial implications.<sup>3,4</sup> Post-caesarean section infection can profoundly threaten neonatal survival and negatively affect mother-baby bonding within the first few days after delivery.<sup>3</sup> Additionally, women who survive maternal infective morbidities may suffer long-term complications, including chronic pelvic pains and infertility.<sup>4</sup> Appropriately timed prophylactic and therapeutic antibiotics use remains an important strategy to prevent morbidity and mortality associated with the infection. Various studies have firmly established the efficacy of prophylactic antibiotics in mitigating postoperative infection, and the effectiveness is more pronounced when administered before skin incision as opposed to after cord clamping.<sup>5,6</sup> Also, a review by Smaill and Hofmeyr showed that using prophylactic antibiotics in caesarean section procedures has demonstrated a notable decrease in wound infection, endometritis, and severe infectious complications, amounting to a reduction of 60% to 70%. This substantial complication reduction provides a valid rationale for the widespread implementation of prophylactic antibiotics in all cases.<sup>7</sup>

In 2021, the WHO recommended that a single dose of cephalosporin or penicillin antibiotics be used as prophylaxis for women undergoing caesarean section. The drug should be given 30-60 minutes before skin incision. In addition, WHO discouraged the use of third-generation cephalosporin in view of its lower efficacy as prophylactic antibiotics compared to the first and second-generation cephalosporins.<sup>8</sup> Furthermore, the choice of prophylaxis should not be rigid but guided by the local antibiotic resistance pattern, bacteriological cause of post-caesarean section infection, cost, availability, safety profile and the clinician's experience because of evolving bacterial characteristics.<sup>8</sup>

In Nigeria, many healthcare practitioners do not consistently use prophylactic antibiotics during caesarean sections despite ample evidence and professional guidelines advocating for their use.<sup>2,3,7,8</sup> Many use prophylactic antibiotics for elective cases and therapeutic dosages for emergencies. Individual surgeons may sometimes decide on the type, dosage, and duration of prophylactic treatment depending on their experience in particular circumstances. The correct choice of prophylaxis is critical in developing nations that have a dual challenge of limited resources and a significant load of diverse infectious pathogens that can cause post-caesarean section infection.<sup>1,9</sup>

This study aims to determine the extent to which physicians working in maternity units in northern Nigeria include prophylactic antibiotics in their caesarean section practices.

## MATERIALS AND METHODS

Online self-administered pretested and validated questionnaires were sent to medical doctors working in the Obstetrics and Gynaecology departments of the states across northern Nigeria, having obtained their phone numbers through the departmental WhatsApp groups. Two weeks after the initial post was sent out, a reminder was sent to the same cohort to complete the online questionnaire. Subsequently, the questionnaire was taken offline two weeks following the reminder messages.

This was to assess their practice of prophylactic antibiotics during caesarean delivery. Both open ended and closed ended questions were asked. Respondents were asked regarding their age, length of experience in a maternity unit, professional rank, practice location, and the monthly average of caesarean deliveries they perform.

The respondents were asked if they routinely give prophylactic antibiotics in all instances of caesarean delivery, including the timing of administration, dosage, and any differences in prescription between elective and emergency caesarean sections.

Participants were requested to indicate the five frequently utilised antibiotics for prophylactic purposes within the past year in sequential order of preference. Respondents were also asked what factors influence their prophylactic antibiotic selection and whether they had a departmental and/or hospital-written policy on prophylactic antibiotic use during caesarean delivery. The questionnaire was pre-tested with other doctors in southern Nigeria. After a comprehensive explanation of the study objectives, the first question requested participants' consent, advising them that they should only respond if they had granted explicit consent to partake in the research.

The primary outcome of interest was adherence to the WHO recommendation of administering pre-precision antibiotics for caesarean sections and the recommended antibiotics.

Survey response data were presented as numbers (percentages). Means and standard deviation, as well as proportions with 95% confidence interval, were calculated for summary analyses.

**RESULTS**

The questionnaires were sent to 605 medical doctors, and 315 responded, giving a response rate of 52.1%. The Mean ( $\pm$ SD) of the respondents was 38.33 ( $\pm$ 17) years, 209 (92.0%) were either in residency training or were specialist obstetricians and gynaecologists, as shown in Table 1. Only 297 (94.3%) of the respondents had performed at least one caesarean section within the last year, of which 193(64.8%) performed more than five caesarean sections every month

Table 1: Sociodemographic Characteristics, Years of Practice and Number Of Caesarean Sections Performed by Respondents.

Variable	Frequency	Percentage
<b>Age range</b>		
20-30	36	11.4
31-40	167	53.0
41-50	83	26.4
51-60	29	9.2
Total	315	100.0
<b>Rank</b>		
House Officers	9	2.9
Medical Officers	15	4.8
Registrars	109	34.6
Senior Registrars	104	33.1
Consultants	77	24.6
Total	315	100
<b>Place of Practice</b>		
Government Hospital only	245	77.8
Private Hospital only	5	1.6
Both	65	20.6
Total	315	100
<b>Duration of practice in years</b>		
1-4	113	36.0
5-9	106	33.7
$\geq$ 10	95	30.3
Total	315	100.0
<b>Average number of CS per month</b>		
1-4	104	35.2
$\geq$ 5	193	64.8
Total	297	100.0

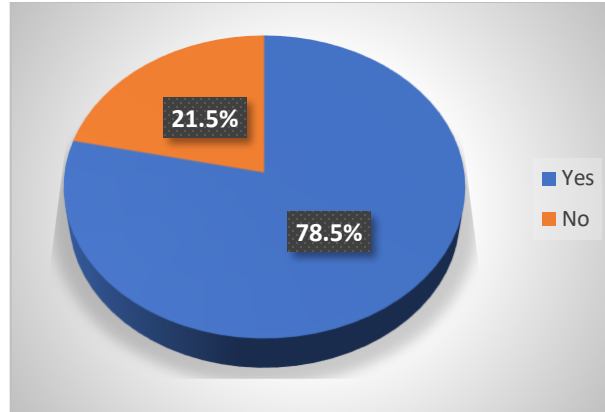


Figure 1 shows the use of routine prophylaxis for Caesarean section.

A total of 233 (78.5%) of the doctors give routine prophylactic antibiotics for all their caesarean sections, while 64 (21.5%) do not give prophylactic antibiotics routinely for all their caesarean deliveries.

Of the doses of the routine prophylactic antibiotics used, 109 (46.9%) give only one dose, 39(16.7%) will give two doses, while the remaining 85 (36.4%) will give three or more doses.

The practice of prescribing additional antibiotics after the prophylactic dose was common, and the prescription differed for elective and emergency caesarean sections, as shown in Table 2.

Table 2: Practice of Prescribing Antibiotics after CS

Variable	Frequency	Percentage
<b>Elective CS</b>		
Days		
0	32	10.1
1	66	21.0
2-5	154	48.9
$\geq$ 6	63	20.0
Total	315	100.0
<b>Emergency CS</b>		
Days		
0	20	8.5
1	73	31.3
2-5	148	63.5
6-10	74	31.7
Total	315	100

The respondents use a variety of antibiotics as prophylaxis for caesarean sections. The most common antibiotic was Ceftriaxone (84.1%), followed by the Amoxicillin + Clavulanic acid with Metronidazole combination, which was used by 82.3%. Cefuroxime was used by 36.7% of the respondents as prophylaxis, as shown in Figure 2.

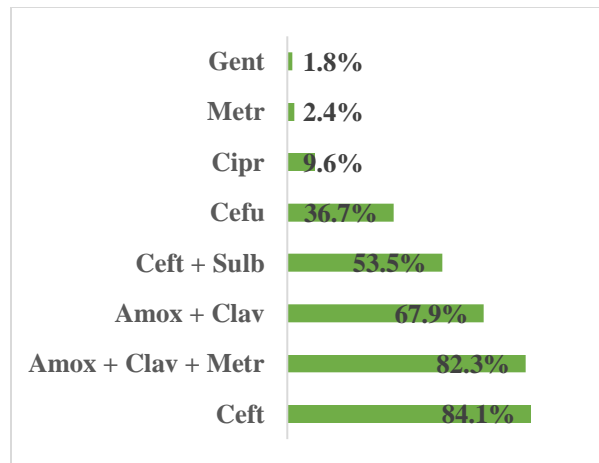


Figure 2: Choice of prophylactic antibiotics among the respondents

**Key:** Amox = Amoxicillin, Ceft = Ceftriaxone, Cefu = Cefuroxime, Clav = Clavulanic acid, Cipr = Ciprofloxacin, Gent = Gentamycin, Metr = Metronidazole.

The broad-spectrum nature of the prophylactic antibiotic guided 92% of the respondents' choice of antibiotic, departmental protocols guided 29% of them, and only 3% used the WHO guideline on prophylaxis for caesarean section as shown in figure 3.

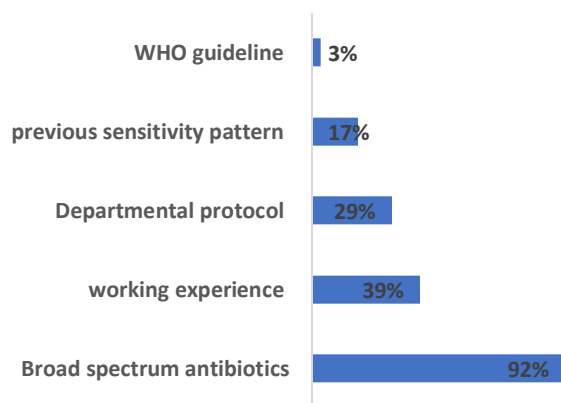


Figure 3: Guideline on the choice of prophylactic antibiotics

The majority of respondents (66.4%) stated that their department did not have a plan for prophylactic antibiotic use during caesarean sections. However, 20% of the respondents were unsure whether there was a protocol in their department, as shown in Figure 4.

As shown in Figure 5, 85.1% of respondents were aware of their hospital's policy on antibiotic use, while the remaining 14.9% were unaware of any such policy.

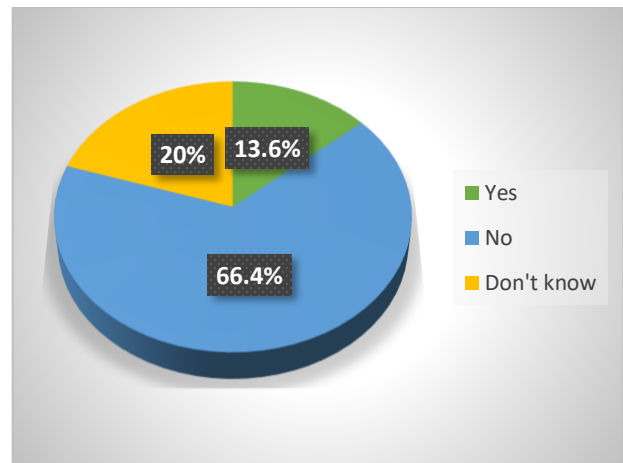


Figure 4: Availability of a departmental protocol on CS antibiotic prophylaxis

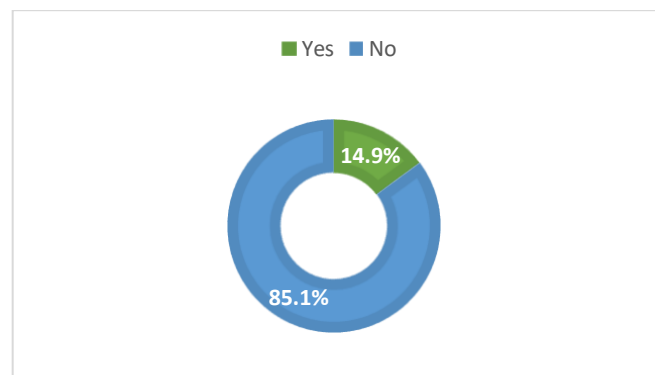


Figure 5: Awareness on the availability of hospital antibiotic policy

## DISCUSSION

This study further affirms that caesarean section is a highly prevalent obstetric procedure, with 64.8% of the sampled physicians performing more than five cases per month. Furthermore, 64% of these physicians have over five years of practice in the maternity units. It is, therefore, essential to ascertain that this important surgical operation, which aims to lower maternal mortality, is safe and does not result in any unnecessary morbidity or fatality.<sup>7</sup> The physicians must familiarise themselves with the latest information regarding prophylactic antibiotic coverage to ensure a successful operation.<sup>10</sup> Caesarean section poses a substantial risk of puerperal sepsis which is one of the three primary causes of maternal mortality in Nigeria.<sup>1</sup> The risk can be reduced through control of underlying morbidity, sound surgical techniques, topical antiseptic agents, and an effective dose of prophylactic antibiotics.<sup>8</sup> The prophylactic

antibiotics are indicated to assist in reducing the quantity of infectious bacteria during surgery to a level that the patient's innate immune system can control. It is essential to administer the drugs before pre-incision for maximum benefit.<sup>5,11</sup> Our finding showed that only 78.5% of the physicians give routine pre-incision prophylactic antibiotics in all caesarean sections they perform. This finding contradicts that of Dohou et al., who studied women that underwent caesarean delivery and found only 31.2% of them received optimum antibiotic prophylaxis.<sup>12</sup> It is, therefore, essential that physicians should collaborate with other health professionals to ensure that the prophylactic antibiotic is administered correctly at the appropriate time.

It is worrisome that about a fifth of the respondents miss the 'golden time' for prophylactic antibiotic administration, and this is despite the WHO recommendation that prophylactic antibiotics be given during all surgeries and before skin incisions.<sup>8</sup> In addition, the Cochrane review showed an absolute risk reduction of more than 50% of maternal infectious morbidity when the prophylactic antibiotic is given before skin incision compared to administering it after cord clamping.<sup>7</sup> There is also a reduction in both clinically diagnosed endometritis and wound sepsis, which have been linked to sepsis and maternal mortality.<sup>7</sup> It is absolutely unacceptable that we are failing to convert the third leading cause of maternal mortality in our context, and this will seriously impede our progress towards achieving SDG5.

Another disturbing fact is that 57.7% of the physicians sampled were specialist Obstetricians who are almost at the zenith of their careers and expected to give the best care. They should be at the vanguards of evidence-based medicine and embody high-quality practice. Regular updates and checks are necessary to guarantee that the practices consistently adhere to the standards. The mandatory continuous medical education by the Medical and Dental Council of Nigeria can be leveraged to bring physicians up to speed on such practices.

Ideally, the choice of prophylactic antibiotic should be long-acting, low-cost, and with minimal side effects; this is invaluable in a resource-constrained environment where most medical bills are paid out-of-pocket. Faulty or inappropriate choice of antibiotics will not only waste valuable resources but will lengthen hospital stays and disrupt family lives. Most of the physicians studied chose the prophylactic antibiotics based on their cover spectrum and working experience rather than previous sensitivity patterns or departmental protocols. It is recommended that physicians should choose prophylactic antibiotics based on local recommendations on antimicrobial resistance, the bacteriologic patterns of post-caesarean infectious

morbidity in the area, the safety profile of the antibiotic class, the clinician's experience with that specific class of antibiotics, as well as the availability and cost.<sup>10</sup> Therefore, departments should regularly monitor the susceptibility patterns of the main bacteria causing wound sepsis and establish protocols to inform their choice of prophylactic antibiotics. Additionally, they should use the recommended WHO guideline as one of the highest levels of evidence to treat their patient. Our study found that only 3% of the respondents use the WHO guidelines.

The dosage is an additional component in the usage of antibiotics for prophylactic purposes. While the WHO guideline recommends one dose and the second dose to be given if the operation lasts longer than four hours, only 46.9% of the respondents give the correct dose, and the remaining give more than the recommended dose, thereby wasting resources and aiding antimicrobial resistance.<sup>13-15</sup> Furthermore, the WHO guideline recommends that additional doses or treatment with antibiotics may be warranted under certain clinical circumstances, such as high maternal body mass index, prolonged labour, prolonged duration of surgery, extensive surgical manipulation or massive blood loss that places the woman at an increased risk of developing post-caesarean infections.<sup>8</sup> Antibiotic use can be individualised, and physicians may use higher or multiple doses based on clinical judgment. Physicians should strive to utilise antibiotics accurately and appropriately to mitigate the likelihood of developing resistance, which may necessitate using costlier alternatives with more severe side effects.<sup>10</sup>

Another common practice found in this study is prescribing additional antibiotics besides the prophylactic dose. More than 90% of the respondents would prescribe additional antibiotics aside from the prophylactic dose for a period ranging from 1 to 10 days. The practice also differs between elective and emergency, with the emergencies being given antibiotics for a longer period. This injudicious use of antibiotics should be discouraged as it is both wasteful and unnecessarily breeds resistant strains of bacteria.<sup>10</sup> This is in addition to the inconveniences of pills load on the patients. Many studies have questioned the need for this additional antibiotic treatment after the prophylactic injections,<sup>13-15</sup> but this unhealthy practice still lingers in our environment. More emphasis should be placed on strict adherence to asepsis and other infection prevention measures during caesarean section and saving patients the trouble of taking so many unnecessary drugs and bothersome side effects like diarrhoea and candida infections due to the side effects of the broad-spectrum antibiotics.<sup>10,16</sup> Additional therapeutic antibiotics should only be used when indicated and guided by sensitivity patterns.<sup>5</sup>

One of the third-generation cephalosporin, Ceftriaxone is the most common prophylactic antibiotic used, followed closely by the combination of amoxicillin + clavulanic acid + metronidazole and amoxicillin + clavulanic acid only. Our finding is at variance with the WHO guideline recommendation of first or second-generation cephalosporin being preferred over the third-generation group. This is because of the limited effectiveness of third-generation cephalosporins against *Staphylococcus aureus* bacteria, which is one of the common causes of puerperal sepsis in our setting.<sup>9,16</sup> Our finding showed that only 36.7% attested to using cefuroxime, a second-generation cephalosporin, as a prophylactic antibiotic, and cefuroxime has more than 93% effectiveness in treating the microbial isolates of puerperal sepsis in northeastern, Nigeria.<sup>9</sup> Amoxicillin + clavulanic acid is an acceptable penicillin for prophylaxis but should be avoided in preterm caesarean section because of the risk of necrotising enterocolitis. For preterm caesarean section, the prophylaxis can be delayed until after clamping of the umbilical cord.<sup>6</sup> The ceftriaxone-sulbactam combination is another good combination and has been reported by 53.5% of the respondents. It is the preferred prophylactic antibiotic for caesarean sections in Shandong, China.<sup>17</sup> However, this drug is quite expensive, and its use may not be cost-effective in our setting.

An essential method for guaranteeing consistency in practice is providing a local protocol that guides the utilisation of prophylactic antibiotics. A departmental protocol is unavailable, or the physicians do not know of it, as attested by 86.4% of the respondents in this study. The departmental protocol is a vital guide on antimicrobial stewardship and minimises misuse of antibiotics and the emergence of resistant strains of infective bacteria. For optimum benefits, there should be regular updates to the protocol in accordance with the prevailing bacteria pathogens and their antibiotic susceptibility. In this study, only 13.7% of the respondents have protocols on prophylaxis for caesarean section in their place of work.

In the same vein, hospitals should have antibiotic policy documents that govern the utilisation of antibiotics for nearly all infections that may be encountered in the hospital setting. This policy document serves as a crucial manual for achieving a more efficient and economical use of antibiotics. Only a small percentage of responders (14.9%) know about the antibiotic policy in their hospitals. The antibiotic policy document should be available in all hospitals as a legal document that supports the use of specific antibiotics for a specific infection.<sup>10,12</sup>

The major strength of this research is that it is the first research on the use of prophylaxis antibiotics among doctors working in maternity units who are at the

forefront of the fight to reduce maternal mortality. It highlighted a significant gap in the practice that needs to be resolved to achieve the much-desired impact on maternal morbidity and mortality.

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