

Knowledge on The Criteria for Preoperative Antibiotics Administration- A Questionnaire Survey

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ABSTRACT

Antibiotics have been used for prophylaxis in surgical patients with the hope of reducing the rate of postoperative wound infections. Animal studies first defined the scientific basis for the preoperative use of antimicrobial agents in the prophylaxis of surgical wound infection. A survey was conducted amongst the undergraduate students in Saveetha Dental College and Hospitals. A total of 145 responses were obtained from the students. The questionnaire was prepared and circulated among the undergraduate students. Results were analysed and compared using the SPSS Statistical Software by doing both the frequency tests and correlation tests. The participants included 28 (19.3%) third years, 35 (24.1%) final years and 82 (56.6%) interns. Regarding the awareness on surgical antibiotic prophylaxis (SAP), this study showed that 75 (51.7%) were somewhat aware of SAP while 39 (26.9%) had no awareness about the topic and 31 (21.4%) were fully aware of it. When the association between the year of study and the awareness of SAP criteria was analysed, it showed statistical significance ($p=0.05$). Within the limits of our study, undergraduates of Saveetha Dental College showed an average understanding about the general knowledge of surgical antibiotic prophylaxis (SAP) and its criterias.

Keywords: oral surgery, preoperative, antibiotics, prophylaxis, criteria, surgical antibiotic prophylaxis (SAP)

INTRODUCTION

Surgical antibiotic prophylaxis (SAP) is defined as a brief course of antibiotics that is initiated before the start of any operative procedures with the aim of reducing the occurrence of postoperative surgical site infections (SSIs). [1] A majority of the cases that are commonly encountered by maxillofacial surgeons, often are associated with a high rate of morbidity. [2] Thus, the occurrence of SSIs will result in more significant burden to the rate of morbidity, mortality and the overall healthcare costs in the future. [3] In cardiac patients, the use of antibiotic prophylaxis before the start of the treatment is highly recommended because dental procedures can lead to risks especially in susceptible patients. [4]

In surgical dental procedures, blood and saliva are always present, which may contain infectious pathogens and microorganisms. [5] As a result of this, one of the most common nosocomial infections frequently seen in patients that undergo surgery is post-operative wound sepsis. [6] This form of sepsis is a significant factor to which illness occurs and with the recurrence of its symptoms, [7] it can directly result in the extended duration of hospital stay and an increase of medical care cost, serving as an inconvenience to both patients and their families. [1] Postsurgical tissue swelling as well as inflammation of the tongue, uvula, and pharynx is also a common immediate occurrence post surgery. [8]

Although extractions are considered to be one of the basic dental procedures, [9] in cases of surgical extractions, there are some side effects of postoperative pain, inflammation, infection, and wound healing. [10] Such findings should be addressed as a main concern of the dentist to minimize the experience of pain and its consequences after dental extractions. [11] With the presence of pain, ultimately it can result in dental anxiety as well as fear; [12] which is also common in patients especially when it comes to even dental extractions. [13]

Regardless of the age group, children are also subjected to this routine pre surgical procedure. The reason behind this is because according to a study done by Packiri S et al, it showed that during the surgical management of ranula in a paediatric patient, postoperative wound infections are a common occurrence. [14]

To provide maximum efficacy in prophylaxis, SAP should be used when indicated and the prescribed agent should be within the spectrum in which microbes can contaminate the wound. [15] The administration of these antibiotics should be in a sufficient concentration in order to keep the bactericidal minimal inhibitory concentration in the serum, tissues and surgical wound at a stable condition during the whole time that the incision is open. [16] At the same time, it could also reduce the intraoperative blood loss and operating time allowing the oral mucosa to regain its normalcy after a particular surgical therapy. [17]

Animal studies done in the past first defined the scientific basis for the perioperative use of antimicrobial agents in the prophylaxis of surgical wound infection. [18] Clinical confirmation firmly established the efficacy of antibiotic prophylaxis in preventing wound infection. [19] Previously our team has a rich experience in working on various research projects across multiple disciplines The [20–22][8,23–33].

The aim of this study was to analyse the level of understanding among undergraduate students in regard to preoperative antibiotic prophylaxis including its criterias. The main purpose being that by determining the level of understanding, it can help improve the future usage of SAPs in the hospital setting. In a way, it will also help guide the hospital in proper preoperative antibiotic usage in the future.

MATERIALS AND METHODS

Study Setting

This cross-sectional study was done among undergraduate students (includes third years, final years, interns) of Saveetha Dental College and Hospitals. A total of 145 students participated in this study.

Study Subjects

A total of 145 students participated in this study of which 28 (19.3%) were third years, 35 (24.1%) were final years and the remaining 82 (56.6%) were interns.

Methodology

A survey was conducted through an online standard questionnaire with 15 multiple choice questions sent via a Google Form application. The questionnaire consisted of questions about their knowledge regarding the criteria of preoperative antibiotic prophylaxis. Adequate time was provided to fill the questionnaire. The responses of the students were recorded, analysed for flaws, checked for completeness and were taken up for assessment.

Statistical Analysis

After data was collected and coded, the statistical analysis was done using IBM SPSS Statistical Software package (Version 26.0). All the frequency tests were carried out and the Chi-square test was done at a significance level.

RESULTS

A total of 145 students participated in the study, 96 (66.2%) were males and the remaining 49 (33.8%) were females [Figure 1]. The participants included 28 (19.3%) third years, 35 (24.1%) final years and 82 (56.6%) interns [Figure 2].

Assessment of their awareness on surgical antibiotic prophylaxis (SAP) showed that 75 (51.7%) were somewhat aware of SAP while 39 (26.9%) had no awareness about the topic and 31 (21.4%) were fully aware of it [Figure 3]. In regards to the aim of practicing SAP, 79 (54.5%) agreed that it was practiced to decrease the risk of postoperative infections at the surgical site, 39 (26.9%) believed that it acts as a routine administration for presurgical use, 19 (13.1%) agreed that it was used to treat early infections and the remaining 8(5.5%) did not agree to any of the options given [Figure 4]. When inquired about the organisms that caused surgical site infections, 15 (10.3%) agreed that it was caused by *staphylococcus aureus*, 24 (16.6%) agreed that it was caused by *staphylococcus epidermidis* while 68 (46.9%) accepted that both organisms were responsible for these infections. The remaining 17 (11.7%) believed that *cutibacterium acnes* caused the infections and 24 (16.6%) accepted that all three mentioned organisms were responsible [Figure 5].

Analysis of the students' awareness on the criteria of SAP showed that 89 (61.4%) were not aware of the criterias while 48 (33.1%) were somewhat aware and 8 (5.5%) were fully aware of all the criterias [Figure 6]. When inquired regarding the purpose of using the anatomic region as one of the criteria for preoperative antibiotic selection, 34 (23.4%) believed that it was to have the concentration in the tissues at its highest at the start and during surgery, 10 (6.9%) believed that it was to achieve a relatively narrow spectrum of activity as well as to ensure that most common organisms are targeted and the remaining 91 (62.8%) agreed to all of the mentioned reasons [Figure 7].

Moreover, when assessed about the other criterias for SAP, 49 (33.8%) believed it to be bacteriocidal activity, 21 (14.5%) accepted it to be the ease of administration and 10 (6.9%) believed it to be the timing of initial dose and the cost while the remaining 55 (37.9%) agreed to all the above options [Figure 8]. In cases where adults are involved, 22 (15.2%) agreed that cefazolin was administered according to the weight-based dosage and 18 (12.4%) believed it to be vancomycin while 67 (46.2%) accepted that both types of the mentioned antibiotics was administered based on the weight. The remaining 10 (6.9%) agreed that it was clindamycin and 28 (19.3%) accepted that all the mentioned antibiotics were applicable [Figure 9].

On the other hand, for children, 112 (77.2%) agreed that it was necessary for antibiotics to be administered based on milligrams per kilogram body weight while the remaining 33 (22.8%) agreed that it was not necessary to do so [Figure 10]. In regard to the common routes of administration used for SAP, 51 (35.2%) believed it to be intravenously, 21 (14.5%) believed it to be through the intramuscular route, 30 (20.7%) agreed that it was through both oral and rectal while the remaining 43 (29.7%) agreed to all of the mentioned routes of administration [Figure 11].

When inquired about which antibiotic had a short half life, 65 (44.8%) agreed that it was beta-lactams, 41 (28.3%) believed it to be tetracyclines and the remaining (26.9%) agreed that it was fluoroquinolones [Figure 12]. In regard to the factors that influence the half-life of an antibiotic, 24 (16.6%) accepted that it was affected by the volume of distribution, 21 (14.5%) believed it to be the pathophysiological state of the individual, 31 (21.4%) accepted that the functional status of the clearance organs affects the half life while the remaining 69 (47.6%) agreed to all of it [Figure 13].

Furthermore, when inquired about the duration in which an antibiotic should be discontinued if there are no known infections, 81 (55.9%) believed it should be within 24 hours, 53 (36.6%) agreed that it should be within 48 hours and the remaining 11 (7.6%) agreed that it should be within 72 hours [Figure 14]. A majority of the students (83.4%) agreed that more knowledge about surgical antibiotic prophylaxis (SAP) and its criteria is necessary in the future [Figure 15].

When the association between the year of study and the awareness of SAP criteria was analysed, it showed statistical significance ($p=0.05$). From this we can perceive that interns and final years had more understanding of the SAP criterias.

DISCUSSION

This cross-sectional study was used to assess the knowledge among students of Saveetha Dental College regarding surgical antibiotic prophylaxis (SAP) and its criteria of administration. A majority of the participants admitted that the main aim of practicing SAP is to decrease the risk of postoperative infection at the surgical site. This statement can be supported by a study done by Hutchinson A et al in which the routine administration of preoperative antibiotic prophylaxis helped reduce the absolute risk of wound infection by over 80% compared to patients treated with no prophylaxis.[34]

Based on the survey done, most of the participants agreed that both *staphylococcus aureus* and *staphylococcus epidermidis* commonly cause surgical site infections. According to Tan TL et al, although both organisms are involved in such infections, *cutibacterium acnes* can also be found but characteristically when it is isolated in the setting of postoperative infections following shoulder surgery.[35]

In regard to the criteria of preoperative antibiotic administration, more than half of the participants agreed that timing of initial dose, cost, ease of administration and bacteriocidal activity influences its administration. According to Marsha F et al, other criterias also include safety, pharmacokinetic profile and the hospital resistance patterns.[36]

For the dosage of antibiotics particularly in adults, majority of the participants are aware that both cefazolin and vancomycin are administered using weight-based dosing. As stated by Marsha F et al, for patients receiving cefazolin, 2 g is the current recommended dose except for patients weighing greater than or equal to 120 kg, who should receive 3 g instead. On the other hand, clindamycin is always maintained at a fixed dosage of 900mg in adults. [36]

In surgical cases where children are involved, all prophylactic antibiotics for pediatrics are dosed based on milligrams per kilogram body weight. It is crucial that pediatric surgical prophylaxis doses should not exceed the usual adult dose.[36] As India is known to practice well-established protocols, [37] it comes to no surprise that a majority of the participants are also aware that pediatric patients especially, require specific doses.

Based on the half-life of the antibiotic, more than half of the participants from this survey agreed that beta-lactams have relatively short half-lives and such properties are influenced by the volume of distribution, the pathophysiological state of an individual (age, gender, obesity, pregnancy) and the functional status of clearance organs (liver, kidneys). Kumar S et al stated that the clinical dosage of drugs varies in different parts of the body. Therefore, with this factor in mind, each dosage should be given safely.[38] According to Yartsev A et al, in an individual who has renal failure, fluid overload results in an increased volume of distribution. This results in less antibiotic being available; thus the half life might end up being reduced. [39]Our institution is passionate about high quality evidence based research and has excelled in various fields ([40–50]

During the duration of this study, there were some limitations that were encountered, which included limited participants. In the future, to provide an even better outcome, a bigger sample size should be obtained.

CONCLUSION

Within the limits of the study, undergraduates of Saveetha Dental College showed an average understanding about the general knowledge of surgical antibiotic prophylaxis (SAP) and its associated criterias. However, they have shown a profound interest in learning more about this topic in the future.

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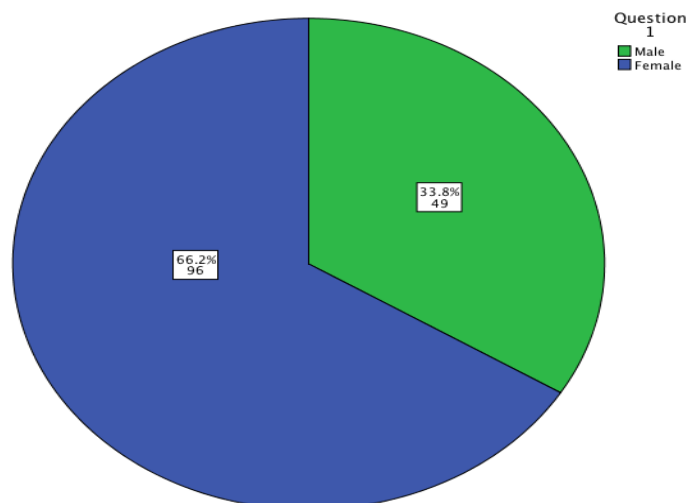


Figure 1: This pie chart depicts the gender of the undergraduate students. 66.2% of the respondents were females. 33.8% of the respondents were males.

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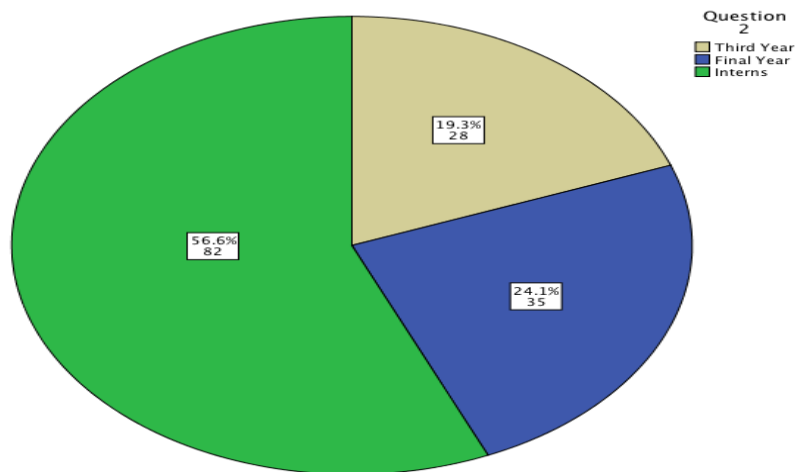


Figure 2: Pie chart showing responses to the question among the undergraduates based on their year of study. 19.3% of the respondents were third years. 24.1% of the respondents were final years. 56.6% of the respondents were interns.

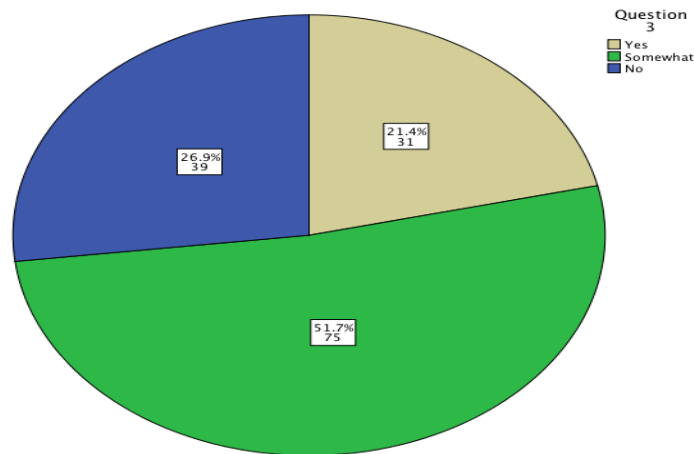


Figure 3: Pie chart showing responses to the question, “Are you aware of surgical antibiotic prophylaxis (SAP)?”. 51.7% of the respondents were somewhat aware of surgical antibiotic prophylaxis (SAP).

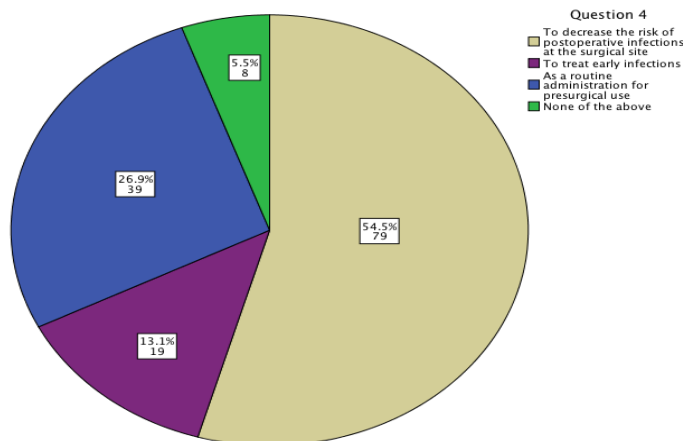


Figure 4: Pie chart showing responses to the question, “What is the aim of practicing surgical antibiotic prophylaxis (SAP)?”. About 54.5% of the respondents stated that the aim of practicing surgical antibiotic prophylaxis (SAP) was to decrease the risk of postoperative infections at the surgical site.

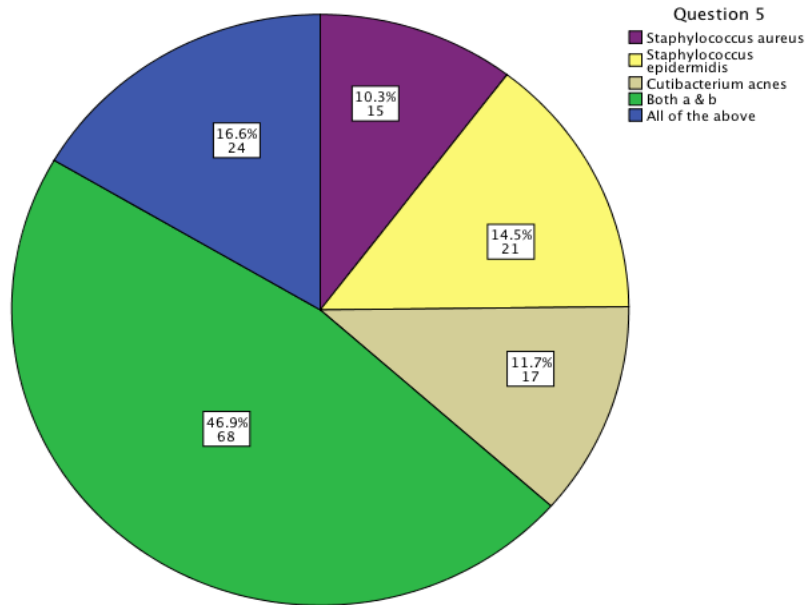


Figure 5: Pie chart showing responses to the question, “Which of these organisms are implicated as causes of surgical site infections (SSIs)?”. About 46.9% of the respondents stated that both staphylococcus aureus and staphylococcus epidermidis were organisms implicated as causes of surgical site infections (SSIs).

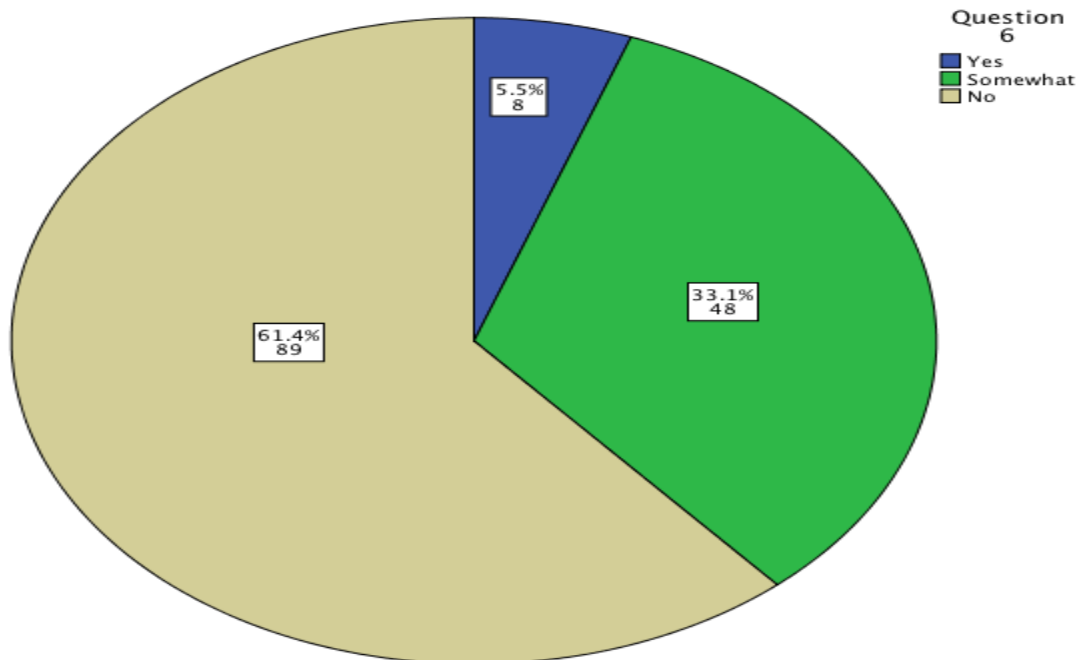


Figure 6: Pie chart showing responses to the question, “Are you well-informed regarding all the criteria for surgical antibiotic prophylaxis (SAP)?”. About 61.4% of the respondents stated that they are not informed of all the criterias for surgical antibiotic prophylaxis (SAP).

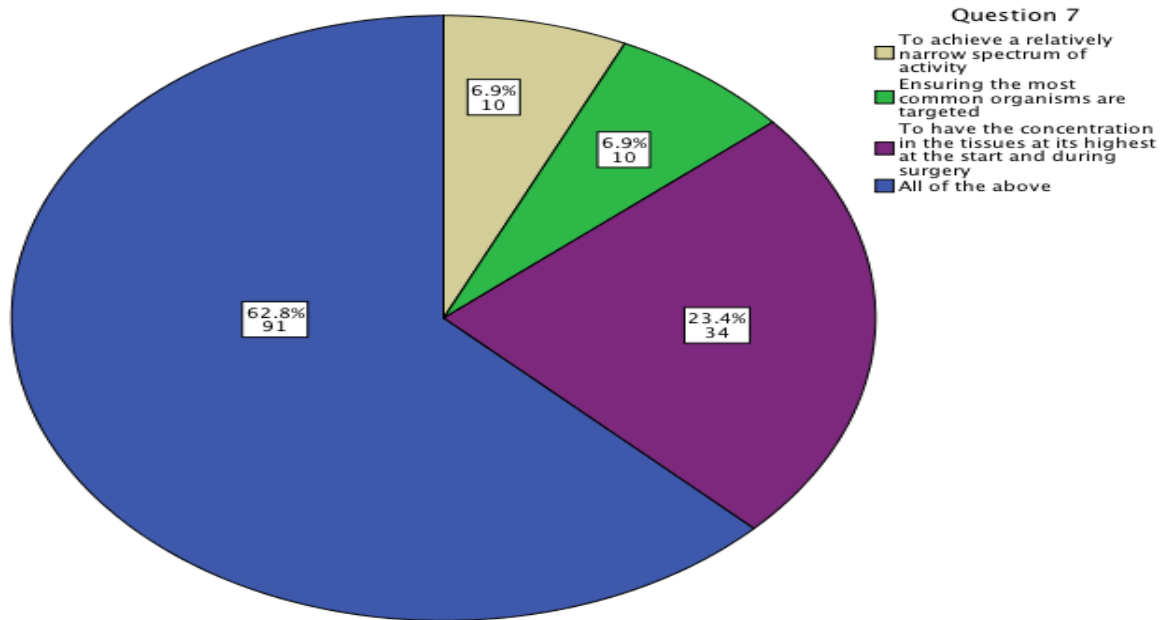


Figure 7: Pie chart showing responses to the question, “Why should the preoperative antibiotic selection be based on the anatomic region that is undergoing surgery?”. 62.8% of the respondents stated that it was done to achieve a relatively narrow spectrum of activity, to ensure the most common organisms are targeted and to have the concentration of antibiotics in the tissues be at its highest at the start and during surgery.

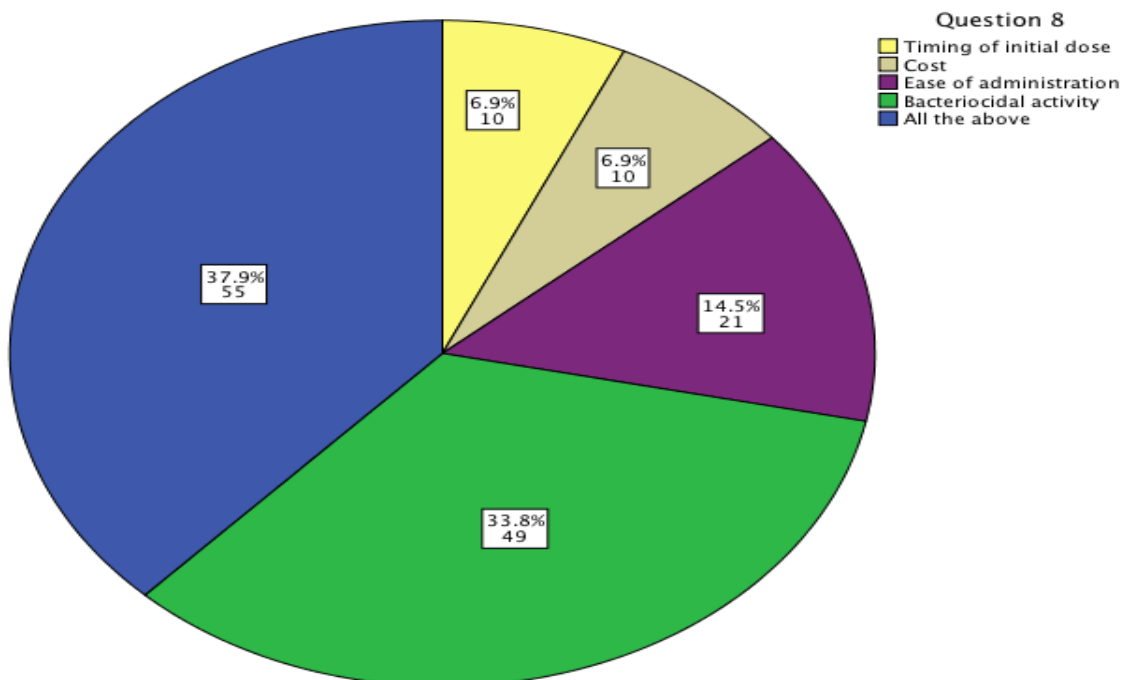


Figure 8: Pie chart showing responses to the question, “What are the other criteria followed for surgical antibiotic prophylaxis (SAP)?”. 37.9% of the respondents stated that the timing of initial dose, cost, ease of administration and bacteriocidal activity are the other criterias for SAP.

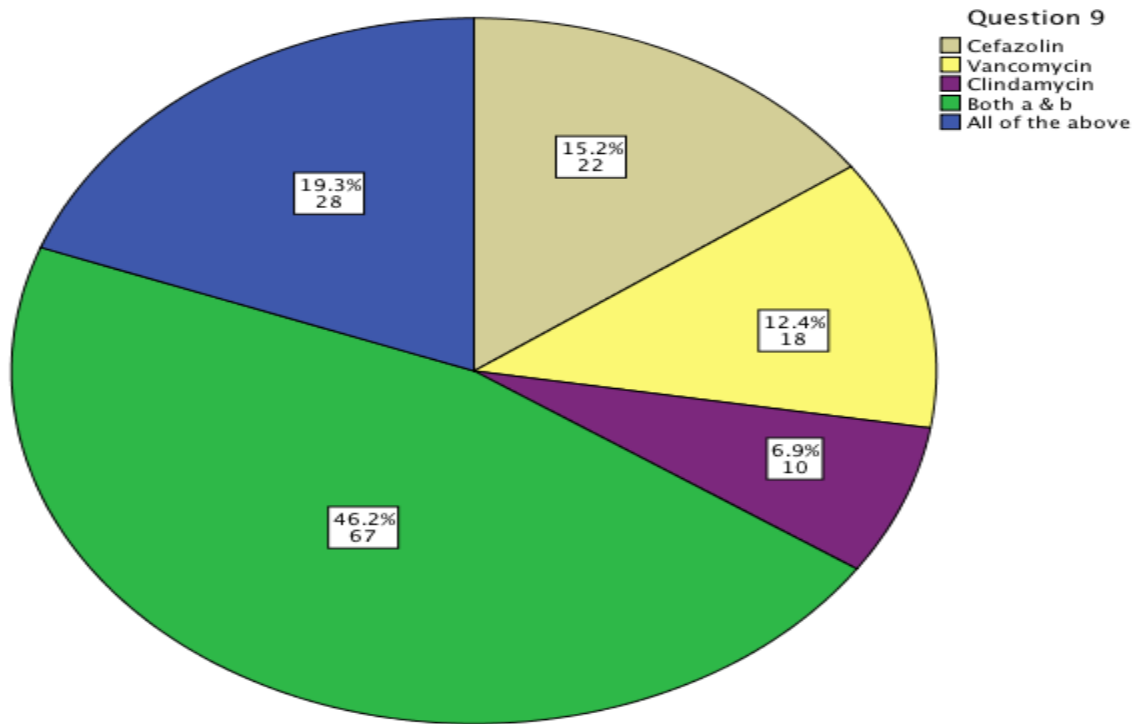


Figure 9: Pie chart showing responses to the question, “In adults, which of these antibiotics are administered according to weight-based dosage?”. About 46.2% of the respondents stated that both cefazolin and vancomycin were administered according to weight-based dosage.

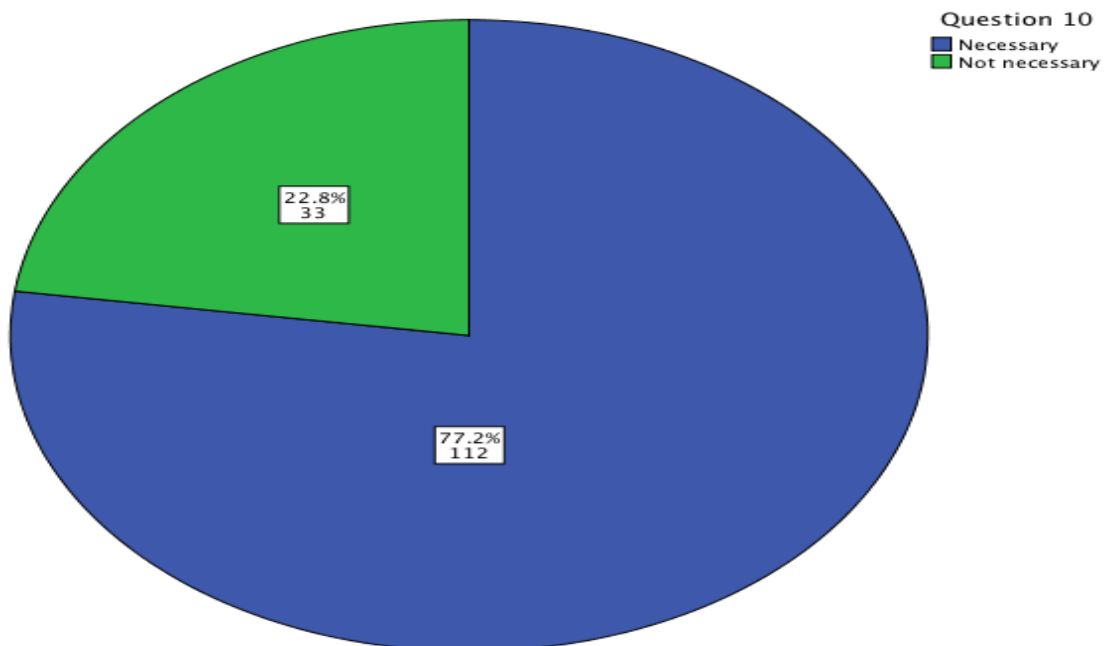


Figure 10: Pie chart showing responses to the question, “Is it necessary that all prophylactic antibiotics for pediatrics be given based on milligrams per kilogram body weight?”. About 77.2% of the respondents stated that it was necessary to administer antibiotics based on milligrams per kilogram body weight.

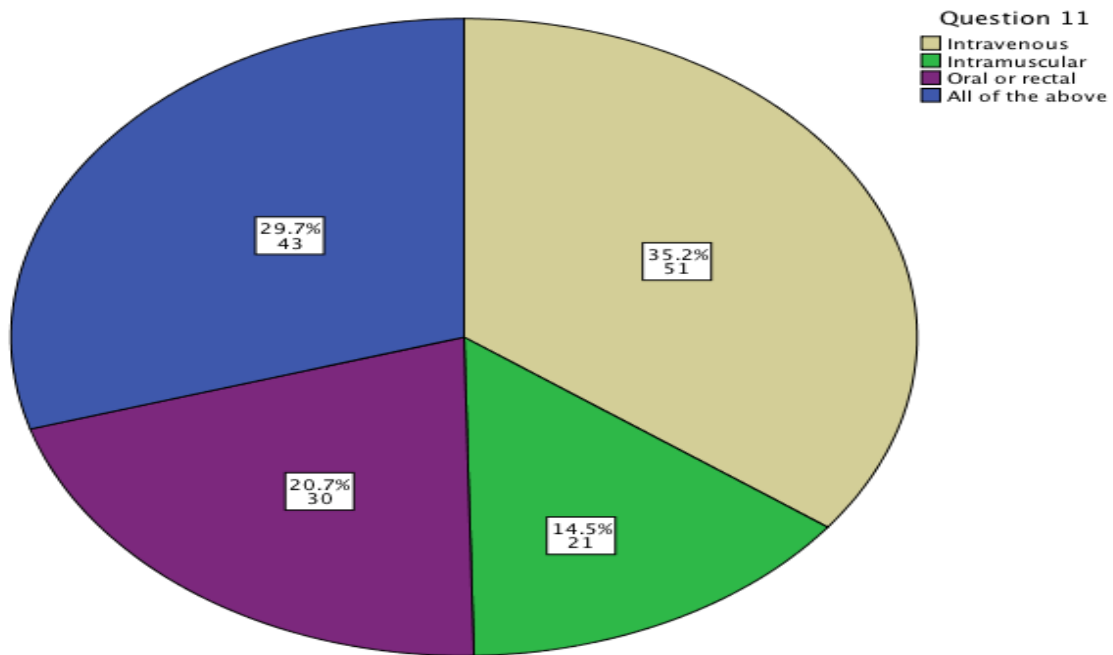


Figure 11: Pie chart showing responses to the question, “Which of these are the commonly used routes of administration for surgical antibiotic prophylaxis (SAP)?”. About 35.2% of the respondents stated that the common route of administration for surgical antibiotic prophylaxis (SAP) is intravenously.

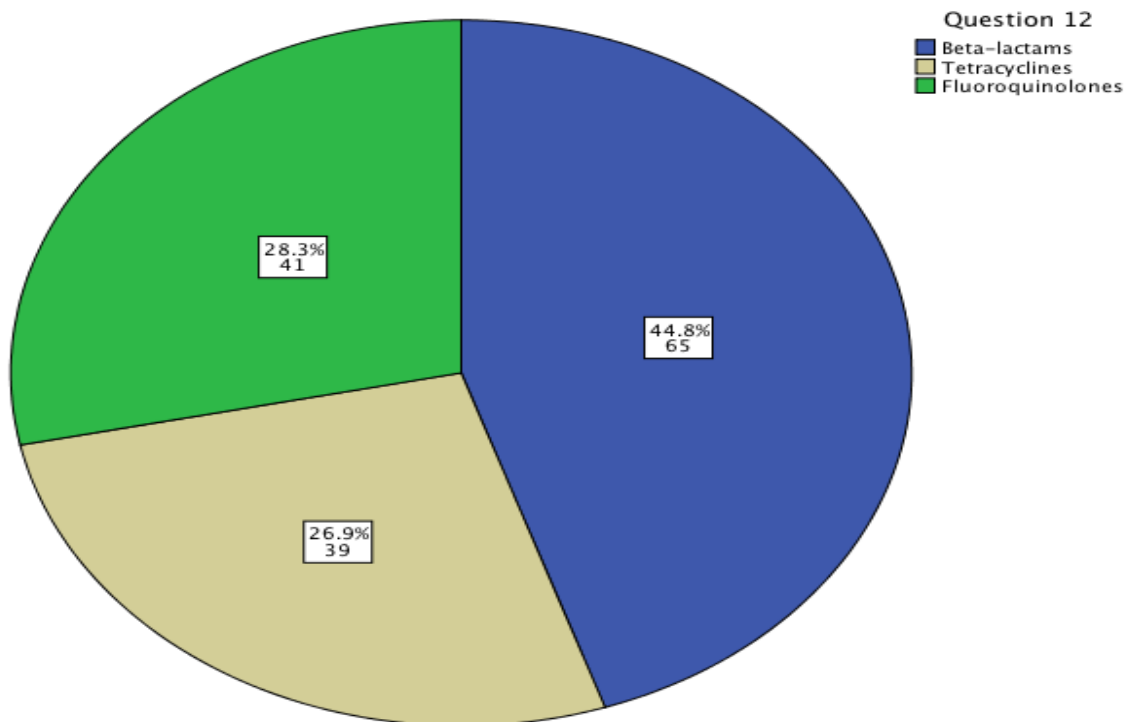


Figure 12: Pie chart showing responses to the question, “Which of these types of antibiotics requires redosing as a result of short half-lives?”. About 44.8% of the respondents stated that beta-lactams requires redosing as a result of a short half-life.

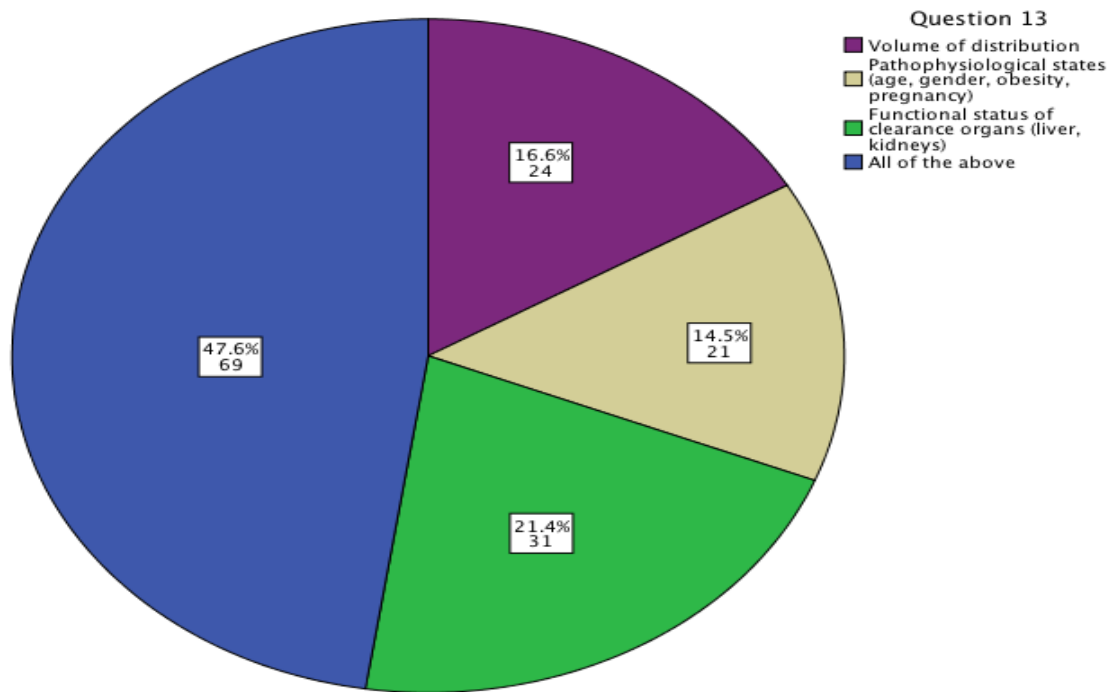


Figure 13: Pie chart showing responses to the question, “What factors influence the half-life of an antibiotic?”. 47.6% of the respondents stated that the volume of distribution, the pathophysiological state and the functional status of the clearance organs influences the half-life of an antibiotic.

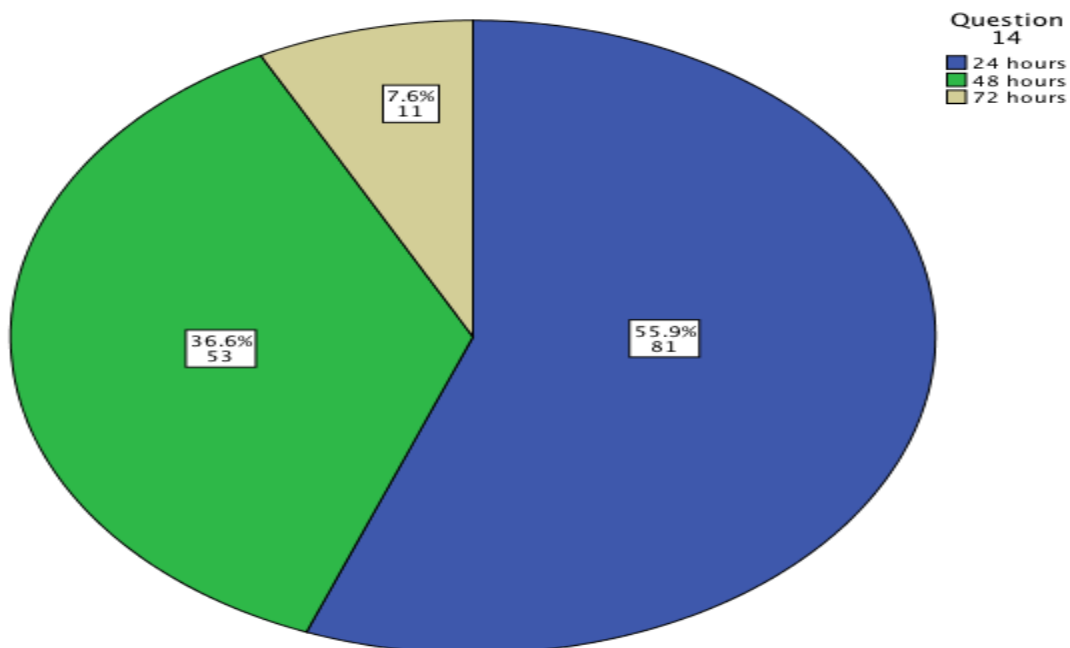


Figure 14: Pie chart showing responses to the question, “In cases where there are no known infections, the prophylactic antibiotics should be discontinued within?”. About 55.9% of the respondents stated that prophylactic antibiotics should be discontinued within 24 hours if there is no known infections.

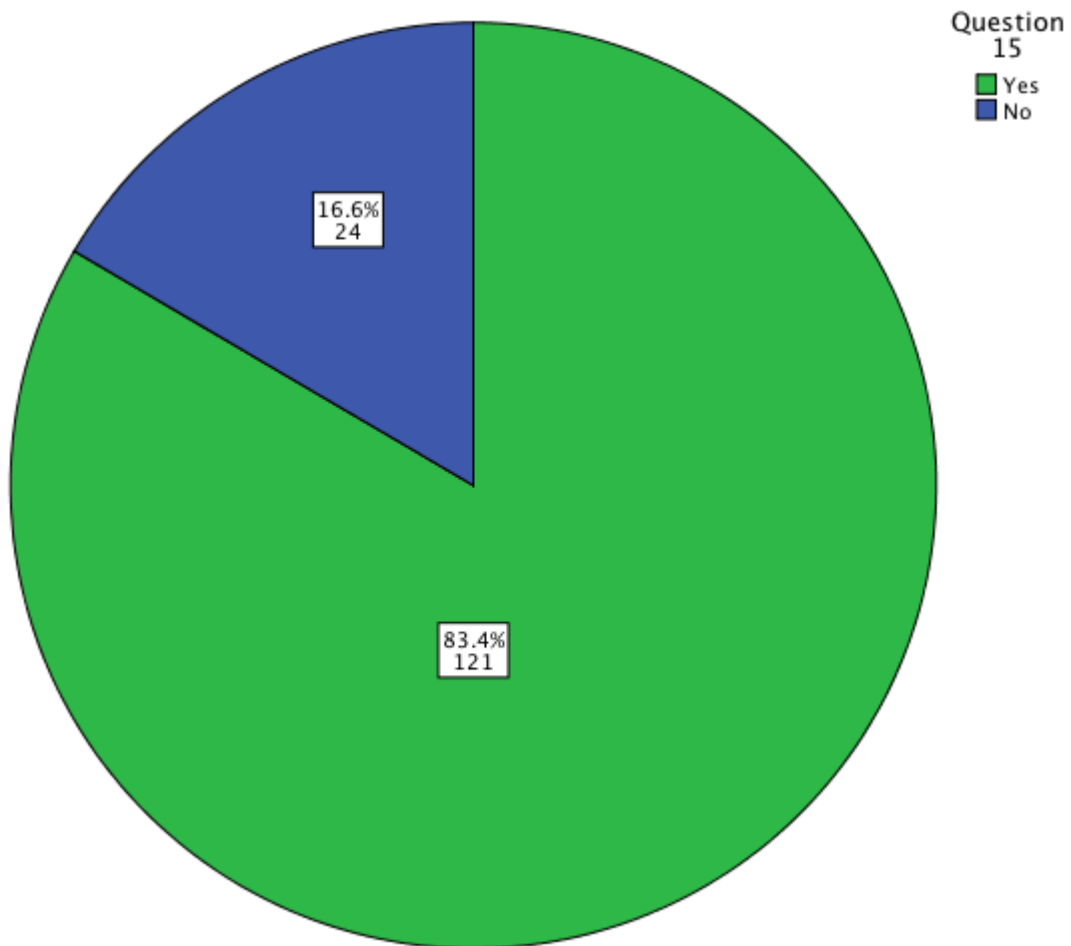


Figure 15: Pie chart showing responses to the question, “Is more knowledge on surgical antibiotic prophylaxis (SAP) and its criteria necessary?”. About 83.4% of the respondents agreed that they need more knowledge on SAP and its criterias.

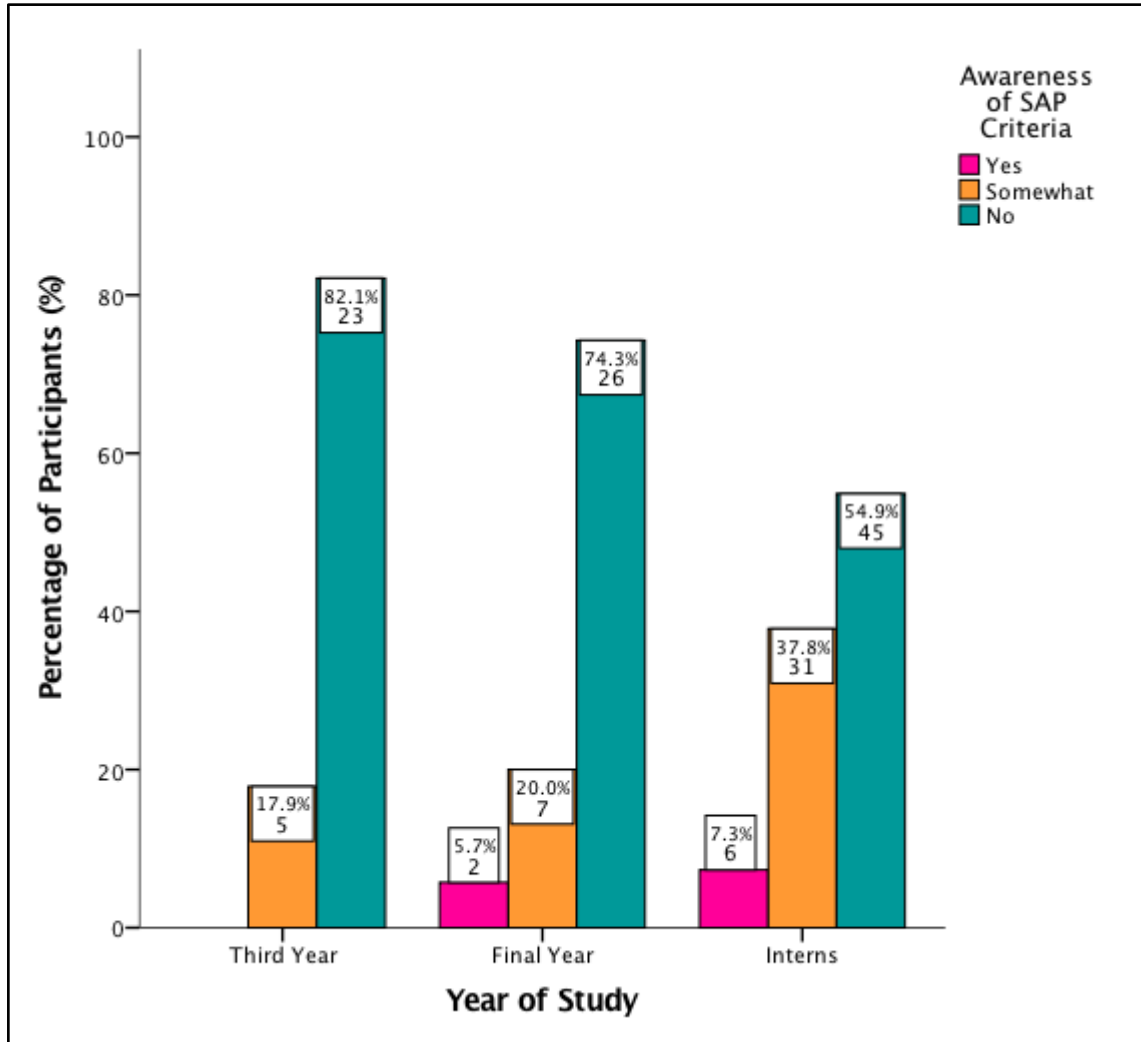


Figure 16: Bar chart depicts the comparison of responses based on the year of study and the awareness of all the SAP criterias. X-axis denotes the year of study of the participants and Y-axis denotes the percentage distribution of the participants’ response to the question, “Are you well-informed regarding all the criterias for surgical antibiotic prophylaxis (SAP)”. Pink bars denote the participants are fully aware of all the criterias, orange bars denote the participants are somewhat aware of the criterias and green bars denote the participants are not at all aware of the criterias. It was observed that interns showed a higher awareness towards all the criterias of surgical antibiotic prophylaxis (SAP). This was found to be statistically significant when the chi-square test was used with a p-value of 0.05.

LEGENDS

Figure 1: This pie chart depicts the gender of the undergraduate students. 66.2% of the respondents were females. 33.8% of the respondents were males.

Figure 2: Pie chart showing responses to the question among the undergraduates based on their year of study. 19.3% of the respondents were third years. 24.1% of the respondents were final years. 56.6% of the respondents were interns.

Figure 3: Pie chart showing responses to the question, “Are you aware of surgical antibiotic prophylaxis (SAP)?”. 51.7% of the respondents were somewhat aware of surgical antibiotic prophylaxis (SAP).

Figure 4: Pie chart showing responses to the question, “What is the aim of practicing surgical antibiotic prophylaxis (SAP)?”. About 54.5% of the respondents stated that the aim of practicing surgical antibiotic prophylaxis (SAP) was to decrease the risk of postoperative infections at the surgical site.

Figure 5: Pie chart showing responses to the question, “Which of these organisms are implicated as causes of surgical site infections (SSIs)?”. About 46.9% of the respondents stated that both staphylococcus aureus and staphylococcus epidermidis were organisms implicated as causes of surgical site infections (SSIs).

Figure 6: Pie chart showing responses to the question, “Are you well-informed regarding all the criteria for surgical antibiotic prophylaxis (SAP)?”. About 61.4% of the respondents stated that they are not informed of all the criterias for surgical antibiotic prophylaxis (SAP).

Figure 7: Pie chart showing responses to the question, “Why should the preoperative antibiotic selection be based on the anatomic region that is undergoing surgery?”. 62.8% of the respondents stated that it was done to achieve a relatively narrow spectrum of activity, to ensure the most common organisms are targeted and to have the concentration of antibiotics in the tissues be at its highest at the start and during surgery.

Figure 8: Pie chart showing responses to the question, “What are the other criteria followed for surgical antibiotic prophylaxis (SAP)?”. 37.9% of the respondents stated that the timing of initial dose, cost, ease of administration and bacteriocidal activity are the other criterias for SAP.

Figure 9: Pie chart showing responses to the question, “In adults, which of these antibiotics are administered according to weight-based dosage?”. About 46.2% of the respondents stated that both cefazolin and vancomycin were administered according to weight-based dosage

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