

Research article

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The situation of the use of prophylactic antibiotics at Van Hanh General Hospital in 2022

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ABSTRACT

Introduction

Surgical site infections (SSIs) remain a major concern in hospitals. However, prophylactic antibiotics have been proven effective in reducing infection risks. This study provides a comprehensive analysis of prophylactic antibiotic utilization at Van Hanh General Hospital in 2022.

Materials and Methods

A retrospective analysis was conducted using patient records and drug inventory data from January 1 to December 31, 2022. Descriptive statistics were applied to assess demographics, usage trends, and ABC cost analysis.

Results

A total of 388 medical records meeting the inclusion criteria were analyzed. The majority of patients were female (67.8%) with a median age of 32 years. All patients had an ASA score < 3 and NNIS score < 2. The median surgical duration was 80 minutes, and 62.9% of patients had a hospital stay of two days.

Among the procedures, 66.2% were classified as clean surgeries, and 68.3% were open surgeries. Amikacin was the most frequently used antibiotic, accounting for 44.2% of cases. Prophylactic antibiotics were administered in 23.1% of cases before surgery and 76.5% during surgery.

Antimicrobial agents were the most commonly used drug category (22.1%). Cefoperazone + Sulbactam, classified as a Tier A medication, accounted for only 2.1% of the total inventory.

Conclusion

The analysis highlights a significant proportion of antimicrobial agents in the hospital's drug formulary, with three prophylactic antibiotics categorized as high-cost (Category A) drugs. To enhance antibiotic prophylaxis, strict monitoring, adherence to guidelines, and regular formulary reviews are essential for cost control and effective procurement planning.

Keywords: Van Hanh General Hospital, Prophylactic Antibiotics, Surgical Site Infections.

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1. INTRODUCTION

Hospital-acquired infections (HAIs) remain a significant challenge in healthcare, leading to high morbidity and mortality rates while increasing treatment costs [1]. Among HAIs, surgical site infections (SSIs) are among the most common types [1, 2]. According to a report from the European

Centre for Disease Prevention and Control (2016–2017), SSIs accounted for 18.4% of all HAIs and constituted one-third of HAI-related hospital admissions [2]. In Southeast Asian countries, the incidence of SSIs is approximately 7.8% [3], while at Bach Mai Hospital, the rate is 8.7%, ranking third among HAIs [4]. SSIs significantly increase

treatment costs and prolonged hospital stays, with an additional expenditure ranging from \$11,876 to \$15,243 per postoperative case, depending on the type of surgery [5].

Prophylactic antibiotic use (PAU) is an effective measure to reduce SSIs. According to Burke et al., appropriate PAU can reduce the risk of SSIs by at least 50% [6]. Umscheid et al. reported that 55% of SSI cases could be prevented through evidence-based practices [7]. In Vietnam, the Ministry of Health (MOH) issued guidelines for antibiotic use in 2015 [8], and updated hospital antibiotic stewardship guidelines in 2020 [9]. In 2023, the MOH released guidelines for SSI surveillance [10] to improve the quality of PAU in hospitals [10].

Van Hanh General Hospital performs thousands of surgeries annually and has implemented an antibiotic stewardship program [11]. This study aims to evaluate use of prophylactic antibiotics at Van Hanh General hospital in 2022, providing scientific data to enhance antibiotic management, prevent antimicrobial resistance, and optimize treatment costs and drug procurement in the hospital.

2. MATERIALS AND METHODS

2.1. Study design

This study retrospectively reviewed medical records of patients who received prophylactic antibiotic use (PAU) at Van Hanh General Hospital (VHGH) in 2022. According to the 2015 antibiotic use guidelines issued by the Vietnamese Ministry of Health [8], PAU is defined as the administration of antibiotics before an infection occurs, with the aim of preventing its development. PAU focuses on reducing the incidence of infections at the surgical site or organ being operated on, rather than preventing systemic or distant-site infections.

2.2. Sampling size

This study employed a convenient

sampling method, selecting medical records (MRs) that met the inclusion and exclusion criteria at Van Hanh General Hospital (VHGH) in 2022. The sample size was determined using the single-population proportion formula [12]:

$$n = \frac{Z^2[p(1-p)]}{d^2}$$

Where:

- *n*: Required number of MRs
- *Z*: Confidence level coefficient, with $Z = 1.96$ for a 95% confidence interval
- *p*: Estimated proportion of successful sample selection, set at $p = 0.5$ to maximize variability, referencing a similar study by Kerebih Alamrew et al [12].
- *d*: Margin of error, set at ± 0.05

To account for a 10% potential exclusion due to incomplete medical records, the final calculated sample size was 422.58. Therefore, a minimum of 423 medical records was required to meet the study objectives.

2.3. Data collection

2.3.1. Characteristics of Patients Receiving Prophylactic Antibiotics

- Patient demographics: Age, gender, health insurance status, weight, BMI, comorbidities, allergy history, and discharge status.
- Surgical characteristics: Surgical duration, length of hospital stay, surgery classification, surgical procedure, surgical technique, and surgical group.
- Preoperative patient condition and incidence of surgical site infections (SSI).
- Antibiotic prophylaxis regimen: content (g), dosage (g), route of administration.
- Antibiotic consumption at hospital departments: Measured using the DDD/100 bed-days [13]:

$$\text{DDD/100 bed-days} = \frac{\text{Total gram used} \times 100}{\text{DDD} \times \text{Total bed-days}}$$

Where DDD is the defined daily dose

of a specific antibiotic, referenced from the WHO Collaborating Centre for Drug Statistics Methodology database [14].

- Antibiotic prophylaxis regimen compliance: Evaluated using the DOT/LOT ratio [15]:

+ DOT (Days of Therapy): Defined as the number of days a patient receives an antibiotic, regardless of dosage. If multiple antibiotics are administered simultaneously, the total DOT is the sum of each individual DOT.

+ LOT (Length of Therapy): Refers to the number of days a patient receives any antibiotic therapy, counted in days.

2.3.2. Analysis of the structure of the drug list used at Van Hanh General Hospital

Drug inventory composition: Analysis of SAP drugs by brand name, percentage of total consumption cost, and drug classification groups (A, B, C). Analysis of the drug list structure Using the ABC cost analysis method according to circular no. 21/2013/TT-BYT [16], including the following steps:

1. Recording the quantity and cost for each drug.
2. Calculating the total expenditure for each drug.
3. Determining the percentage contribution of each drug by dividing its cost by the total expenditure.
4. Ranking drugs in descending order of expenditure contribution.

Based on expenditure distribution, drugs are categorized as follows:

- Category A: Drugs accounting for 75–

80% of total cost.

- Category B: Drugs accounting for 15–20% of total cost.

- Category C: Drugs accounting for 5–10% of total cost.

2.4. Data analysis

Research data is collected from electronic medical records of patients and entered into a Microsoft Excel 365 database. Statistical analysis is conducted using SPSS Statistics 26.0 (SPSS Inc., Chicago, Illinois, USA). Diagnosis classification: Primary and comorbid diagnoses are coded according to the ICD-10 system. Descriptive statistics are presented in the following formats: Mean \pm standard deviation (Mean \pm SD); Median (Interquartile Range, IQR); Frequencies and percentages (%).

2.5. Ethical Considerations

The study was approved by the Ethical Committee of the Pham Ngoc Thach University of Medicine, Vietnam (1084/TĐHYKPNT-HĐĐĐ on 28/01/2022).

3. RESULTS

3.1. Characteristics of Patients Receiving Prophylactic Antibiotics

The patient selection process for this study is illustrated in Figure 1. A total of 423 medical records were collected in 2022. Among them, 3 records did not involve prophylactic antibiotic use, and 32 medical records had incomplete information. Consequently, 388 medical records meeting the inclusion criteria were included in the study (Table 1).

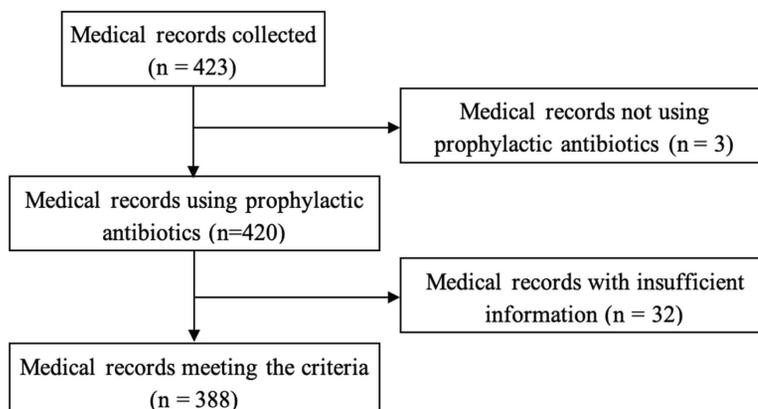


Figure 1. Patient selection process

Table 1. Patient demographics

Patient demographics		n	%
Age	Median (Interquartile Range, IQR)	32	(27 – 40)
Gender	Male	125	32.2
	Female	263	67.8
Health insurance status	Yes	0	0
	No	388	100
Weight	Median (Interquartile Range, IQR)	54.5	(50 – 68)
BMI	Median (Interquartile Range, IQR)	21.0	(19,5 – 24)
Comorbidities	Yes	0	0
	No	289	74.5
	Unclear	99	22.5
Allergy history	Yes	6	1.5
	No	379	97.7
	Unclear	3	0.8
Discharge status	Recovered	163	42.0
	Improved	224	57.7
	Unchanged	1	0.3

Note: n: Number; %: Percentage

The results indicate that the median operative time was 80 minutes (IQR: 50–120 minutes). The majority of patients had a postoperative hospital stay of 2 days (62.9%). Clean-contaminated surgeries accounted for

the highest proportion (66.2%), with 100% elective procedures and 68.3% open surgeries. Reconstructive surgery was the most common surgical category (66.0%), followed by orthopedic surgery (34.0%) (Table 2).

Table 2. Surgical characteristics

Surgical characteristics		n	%
Surgical duration	Median (Interquartile Range, IQR)	80	(50 – 120)
Length of hospital stay	1 day	18	4.6
	2 days	226	58.2
	3 days	135	34.8
	4 days	9	2.3
Surgery classification	Clean	130	33.5
	Clean-Contaminate	257	66.2
	Contaminated	1	0.3
Surgical procedure	Emergency	0	0
	Elective surgery	388	100
Surgical technique	Open surgery	265	68.3
	Laparoscopic surgery / Minimally invasive surgery	123	31.7
Surgical group	Reconstructive surgery / Plastic surgery	256	66.0
	Orthopedic surgery	132	34.0

Note: n: Number; %: Percentage

The study results indicate that preoperative patient status, assessed using the ASA classification system, was categorized into five levels. Among them, ASA I was the most common, observed in 276 cases (71.1%).

Preoperatively, only one case (0.3%) of surgical site infection (SSI) was recorded, specifically a deep SSI. No postoperative SSIs were reported (Table 3).

Table 3. Preoperative Patient Condition and Surgical Site Infection Rate

Characteristics		n	%
Preoperative Patient Condition (Based on ASA Score)	ASA Score 1	276	71.1
	ASA Score 2	112	28.9
Preoperative Patient Condition (Based on NNIS Score)	NNIS Score 0	168	43.3
	NNIS Score 1	220	56.7
Preoperative SSI Status	Yes	1	0.3
	No	387	99.7
Preoperative SSI Rate	Deep incisional SSI	1	0.3

Note: n: Number; %: Percentage

The study recorded 9 prophylactic antibiotics used with a total of 2,109 administrations across 388 patients. The routes of administration for prophylactic antibiotics are illustrated in Figure 2. The dosage, administration route, and prescribed doses of each prophylactic antibiotic are detailed in Table 4.

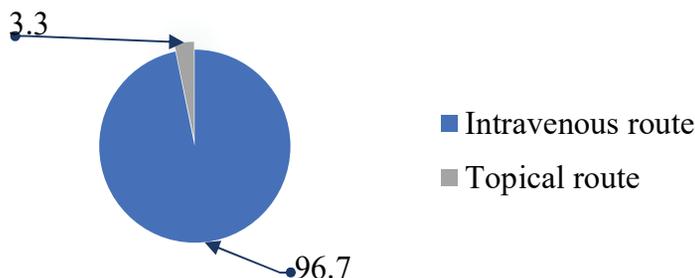


Figure 2. Routes of administration of prophylactic antibiotics

Table 4. Dosage, administration and route of administration of prophylactic antibiotics

Prophylactic antibiotics	Content (g)	Dosage (g)	Route of administration
Amoxicillin + Clavulanate	1.2	1.2	Intravenous route
Ampicillin + Sulbactam	1.5	3	Intravenous route
Ceftriaxone	1	2	Intravenous route
Cefoperazone + Sulbactam	2	2	Intravenous route
Ciprofloxacin	0.2	0.2	Intravenous route
Gentamycin	0.08	0.4	Topical route
Amikacin	0.5	0.5	Intravenous route
Clindamycin	0.5	0.6	Intravenous route
Metronidazol	0.5	0.5	Intravenous route

The survey recorded 9 prophylactic antibiotics used across 5 departments. Amikacin had the highest utilization rate (44.2%), while Clindamycin and Amoxicillin + Clavulanate had the lowest (0.1% each). In terms of departmental distribution, the

Outpatient department had the highest usage (46.1%), followed by the Surgery department (36.79%) and the Intensive Care Unit (14.4%). The Internal Medicine Department had the lowest usage rate, at only 0.8% (Table 5).

Table 5. Number of times using prophylactic antibiotics in departments

Prophylactic antibiotics	Department					Total	%
	Outpatient	Surgery	Intensive Care Unit	Obstetrics	Internal Medicine		
Amikacin	498	339	75	12	8	932	44.2
Ceftriaxone	239	156	57	10	6	468	22.2
Cefoperazone + Sulbactam	182	93	20	1	1	297	14.1
Ciprofloxacin	15	64	71	7	1	158	7.5
Metronidazol	14	57	70	7	0	148	7.0
Gentamicin	11	55	3	0	0	69	3.3
Ampicillin + Sulbactam	12	11	7	2	0	32	1.5
Amoxicillin + Clavulanate	0	1	1	1	0	3	0.1
Clindamycin	2	0	0	0	0	2	0.1
Total	973	776	304	40	16	2109	100
%	46.1	36.8	14.4	1.9	0.8		100

Note: %: Percentage

The two-drug prophylactic antibiotic regimen had the highest prevalence, accounting for 773 cases (66.18%). This was followed by monotherapy regimens, which constituted 26.20% (n = 306). The three-drug combination regimen had the lowest usage rate, with 89 instances (7.62%). The study identified six monotherapy regimens, 12 two-drug combinations, and nine three-drug combinations. The most

commonly used regimen was Amikacin + Ceftriaxone, representing 33.2% of cases. Other frequently used regimens included Amikacin monotherapy (20.4%), Amikacin + Cefoperazone/Sulbactam (17.9%), and Ciprofloxacin + Metronidazole (10.6%). All other regimens, including three-drug combinations, accounted for less than 4% of cases, with some regimens having usage rates below 1% (Table 6).

Table 6. Prophylactic antibiotic regimens

Regimens	No	Prophylactic antibiotics			n	%
		1	2	3		
Monotherapy	1	Amikacin			238	20.4
	2	Cefoperazone + Sulbactam			36	3.1
	3	Ampicillin + Sulbactam			17	1.5
	4	Ceftriaxone			7	0.6
	5	Ciprofloxacin			5	0.4

Dual therapy or Combination of two agents	6	Amoxicillin + Clavulanate		2	0.2	
	7	Metronidazol		1	0.1	
	1	Amikacin	Ceftriaxone	388	33.2	
	2	Amikacin	Cefoperazone + Sulbactam	209	17.9	
	3	Ciprofloxacin	Metronidazol	124	10.6	
	4	Cefoperazone + Sulbactam	Ciprofloxacin	13	1.1	
	5	Amikacin	Ampicillin + Sulbactam	13	1.1	
	6	Cefoperazone + Sulbactam	Metronidazol	11	0.9	
	7	Ceftriaxone	Ciprofloxacin	6	0.5	
	8	Ceftriaxone	Metronidazol	4	0.3	
	9	Amikacin	Ciprofloxacin	2	0.2	
	10	Amikacin	Clindamycin	1	0.1	
11	Ciprofloxacin	Gentamycin	1	0.1		
12	Amikacin	Amoxicillin + Clavulanate	1	0.1		
Triple therapy or Combination of three agents	1	Amikacin	Ceftriaxone	Gentamicin	50	4.3
	2	Amikacin	Cefoperazone + Sulbactam	Gentamicin	17	1.5
	3	Amikacin	Cefoperazone + Sulbactam	Ceftriaxone	11	0.9
	4	Ciprofloxacin	Metronidazol	Gentamicin	4	0.3
	5	Ampicillin + Sulbactam	Ciprofloxacin	Metronidazol	2	0.2
	6	Ceftriaxone	Ciprofloxacin	Metronidazol	2	0.2
	7	Amikacin	Ceftriaxone	Clindamycin	1	0.1
	8	Amikacin	Ceftriaxone	Metronidazol	1	0.1
	9	Amikacin	Ciprofloxacin	Metronidazol	1	0.1
Total				1168	100	

Note: n: Number; %: Percentage

The timing of the first prophylactic antibiotic dose is presented in Figure 3.

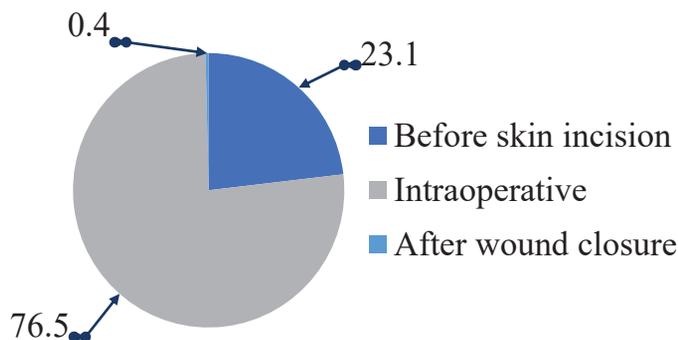


Figure 3. Timing of first dose of prophylactic antibiotics

3.2. Analysis of the structure of the drug list used at Van Hanh General Hospital

An analysis of 388 medical records identified 26 therapeutic drug groups. Among them, the antiparasitic and anti-infective group accounted for the highest proportion of total drug utilization (22.1%), followed by gastrointestinal drugs (17.1%) and cardiovascular drugs (14.3%). Within the anti-infective category: Antibacterial drugs were the most widely used, comprising 77.4% of the total drug items and 86.9% of total expenditure; Antiviral drugs accounted for 10.5% of items and 9.7% of total cost; Antifungal drugs made up 10.0% of items and

3.1% of total cost.

A further breakdown of prophylactic antibiotic utilization based on ABC cost analysis revealed the following: Group A included six antibiotics, with Ceftriaxone (Rocephin 1.1%, Vietcef 0.5%) and Cefoperazone + Sulbactam (Basultam 2.1%) as key contributors; Group B contained one drug, Amoxicillin + Clavulanate (Axuka 0.1%); Group C included ten drugs, each contributing less than 0.1% of total expenditure, such as Unasyn, Gentamicin Vidi, Dalacin C, and Metronidazole Mkp (Table 7).

Table 7. Structure of the list of prophylactic antibiotics

No	Prophylactic antibiotics	Brand-name drug	Percentage of usage value (%)	Group
1	Amoxicillin + Clavulanate	Axuka	0.1	B
2	Ampicillin + Sulbactam	Unasyn	< 0.1	C
3	Ceftriaxone	Rocephin	1.1	A
		Vietcef	0.5	A
		Ceftriaxone Panpharma	< 0.1	C
		Triaxobiotic	< 0.1	C
4	Cefoperazone + Sulbactam	Basultam	2.1	A
5	Ciprofloxacin	Ciprobay (lo)	0.7	A
		Ciprobay (chai)	0.2	A
6	Gentamicin	Gentamicin	< 0.1	C
		Gentamicin Vidi	< 0.1	C
7	Amikacin	Selemycin	0.5	A
8	Clindamycin	Dalacin C	< 0.1	C
		Clindacine	< 0.1	C
		Metronidazol B.Braun	< 0.1	C
9	Metronidazol	Moretel	< 0.1	C
		Metronidazol Mkp	< 0.1	C

4. DISCUSSION

4.1. Characteristics of Patients Receiving Prophylactic Antibiotics

The study findings indicate that the majority of patients receiving prophylactic antibiotics (KSDP) were female (67.8%), with a median age of 32 years (IQR: 27–40 years). This is consistent with Tao Thi Ha's 2023 study, which reported a median age of 33 years and a female proportion of 70.1% [17]. In our study, the mean BMI of patients was 21.0 (IQR: 19.5–24 kg/m²), indicating a normal weight range. Obesity (BMI > 25 kg/m²) has been associated with a 60% increased risk of surgical site infection (SSI)[18]. Additionally, Cho Mina et al. (2014) identified a BMI < 18.5 kg/m² as a predictive factor for SS [19].

Notably, no comorbidities were reported in patients receiving prophylactic antibiotics. This may be attributed to the young age group and the predominant indication for plastic and orthopedic surgeries. Over half of the patients received KSDP for two days, with surgery performed on the day of admission, which may have contributed to reducing hospital-acquired infections, particularly from multidrug-resistant bacteria [20]. These findings align with a systematic review of 18 studies, which highlighted that adherence to the guideline recommending discontinuation of prophylactic antibiotics within 24 hours postoperatively was among the least followed principles [20].

Regarding surgical classification, 68.3% of procedures were clean-contaminated surgeries, 33.5% were clean surgeries, and 0.3% were contaminated surgeries, in accordance with Vietnam's 2015 Antibiotic Guidelines. Prophylactic antibiotics were recommended for clean-contaminated surgeries and were only selectively used in major clean surgeries [8].

The median surgical duration was 80 minutes (IQR: 50–120 minutes). According to the 2013 ASHP guidelines, surgeries lasting >120 minutes pose a higher risk

of SSIs [21]. The relatively short surgical durations at Van Hanh General Hospital may contribute to reduced SSI risks, aligning with the characteristics of plastic and orthopedic surgeries, the most common procedures at this hospital. All prophylactic antibiotics were administered intravenously (IV), which is consistent with recommendations for achieving rapid and high plasma concentrations [22]. Among the prophylactic regimens, Amikacin was the most commonly used antibiotic (44.19%), which aligns with Kristina Skender et al.'s 2022 study (37%) [23]. The study identified 7 single-drug regimens (26.2%), 12 dual-drug regimens (66.2%), and 9 triple-drug regimens (7.6%).

Only 23.1% of patients received prophylactic antibiotics before the surgical incision, a lower rate than reported by Nguyen Phuc Cam Hoang et al., who evaluated an antimicrobial stewardship program (ASP) at Binh Dan Hospital, where adherence to appropriate timing before and after intervention was 81.0% and 94.9%, respectively [24].

4.2. Analysis of the structure of the drug list used at Van Hanh General Hospital

The analysis of the hospital's drug formulary revealed that the antiparasitic and anti-infective drug group accounted for the highest proportion of total drug expenditure (22.1%), comprising 190 drug items (14.6%) out of the total formulary. Within this category, antimicrobial agents had the highest expenditure share (86.9%), encompassing 147 drug items. These findings align with the study by Nguyen Phuoc Bich Ngoc on antibiotic cost analysis at Military Hospital 268 in 2016, where antibiotics represented 21.9% of total drug expenditure [25]. However, the proportion was lower compared to Nguyen Tuan Quang et al.'s study in 2022 [26]. This variation may be attributed to differences in disease patterns and treatment protocols among hospitals. Nevertheless, the relatively low antibiotic expenditure is a

positive indicator in the context of rising drug costs and antimicrobial resistance (AMR) in many hospitals today.

The structural analysis of prophylactic antibiotic use is crucial for evaluating economic efficiency and optimizing healthcare resources. Adherence to Vietnam's Ministry of Health guidelines (2015) [8] regarding antibiotic selection, dosing, and duration is essential to reduce surgical site infection (SSI) risks, shorten hospital stays, lower treatment costs, and mitigate antimicrobial resistance. To enhance efficiency, hospitals should prioritize cost-effective antibiotics, update treatment regimens based on clinical evidence, and implement regular surveillance programs to optimize antibiotic use and control costs.

5. CONCLUSION

Clean-contaminated surgeries were the most prevalent among surgical cases, with plastic and orthopedic surgeries being the predominant procedures. Preoperative SSI rates were extremely low.

Regarding antibiotic use, dual-antibiotic regimens were the most commonly employed, with Amikacin being the most frequently used drug. Formulary analysis revealed that anti-infective drugs accounted for a significant proportion of the hospital's drug utilization. Notably, three prophylactic antibiotics were classified as Category A drugs, requiring close monitoring due to their high costs.

To optimize prophylactic antibiotic use, it is essential to:

- Enhance compliance with clinical guidelines,
- Strengthen surveillance systems, and
- Regularly review the hospital formulary to control costs and prevent antimicrobial resistance.

6. REFERENCES

1. Alemkere, G., Antibiotic usage in surgical prophylaxis: A prospective observational study in the surgical ward of Nekemte referral hospital. *PLoS One*, 2018. 13(9): p. e0203523.
2. Control, E.C.f.D.P.a., Point prevalence survey of healthcare associated infections and antimicrobial use in European acute care hospitals, 2016-2017. 2023: Stockholm: ECDC.
3. Ling, M.L., A. Apisarnthanarak, and G. Madriaga, The Burden of Healthcare-Associated Infections in Southeast Asia: A Systematic Literature Review and Meta-analysis. *Clinical Infectious Diseases*, 2015. 60(11): p. 1690-1699.
4. Nguyễn Việt Hùng, T.A.T., Tỷ lệ, phân bố, các yếu tố liên quan và tác nhân gây nhiễm khuẩn bệnh viện tại bệnh viện Bạch Mai năm 2012. *Tạp chí Y học thực hành* (869) - Số 5/2013, 2013: p. 167 - 169.
5. Schweizer, M.L., et al., Costs Associated With Surgical Site Infections in Veterans Affairs Hospitals. *JAMA Surg*, 2014. 149(6): p. 575-81.
6. Altermeier A., B.J.F.e.a., Definitions and classifications of surgical infections. *Manual on control of infection in surgical patients*, 1993.
7. Garcell, H.G., et al., Impact of a focused antimicrobial stewardship program in adherence to antibiotic prophylaxis and antimicrobial consumption in appendectomies. *Journal of Infection and Public Health*, 2017. 10(4): p. 415-420.
8. Bộ Y tế, Quyết định 708/QĐ-BYT ngày 02 tháng 3 năm 2015 về việc ban hành tài liệu chuyên môn Hướng dẫn sử dụng kháng sinh. 2015: Hà Nội.
9. Bộ Y tế, Quyết định 5631/QĐ-BYT ngày 31 tháng 12 năm 2020 về việc ban hành tài liệu Hướng dẫn thực hiện quản lý sử dụng kháng sinh trong bệnh viện. 2020: Hà Nội.
10. Bộ Y tế, Quyết định 1526/QĐ-BYT ngày 24 tháng 3 năm 2023 ban hành Hướng dẫn giám sát nhiễm khuẩn vết mổ. 2023: Hà Nội.
11. Hạnh, B.v.Đ.k.V. Lịch sử hình thành.

- [cited 2023 18/6]; Available from: <https://benhvienvanhanh.vn/gioi-thieu/lich-su-hinh-thanh/>.
12. Alamrew, K., et al., Surgical Antimicrobial Prophylaxis and Incidence of Surgical Site Infections at Ethiopian Tertiary-Care Teaching Hospital. *Infect Dis (Auckl)*, 2019. 12: p. 1178633719892267.
 13. Grau, S., et al., How to measure and monitor antimicrobial consumption and resistance. *Enferm Infecc Microbiol Clin*, 2013. 31 Suppl 4: p. 16-24.
 14. WHO Collaborating Centre for Drug Statistics Methodology. ATC/DDD Index 2024. 2024 [cited 2024 20 Dec]; Available from: https://atcddd.fhi.no/atc_ddd_index/.
 15. Nguyễn Trọng Khoa, Thực trạng sử dụng kháng sinh hợp lý và hiệu quả can thiệp tại một số bệnh viện đa khoa tuyến tỉnh. 2021.
 16. Bộ Y Tế, Quy định về tổ chức và hoạt động của hội đồng thuốc và điều trị trong bệnh viện. 2013: Hà Nội.
 17. Hà, T.T., Phân tích tình hình sử dụng kháng sinh trên bệnh nhân phẫu thuật tại Bệnh viện đa khoa huyện Quan Sơn, tỉnh Thanh Hóa. Luận văn Dược sĩ Chuyên khoa cấp 1, 2023.
 18. Almasaudi, A.S., et al., The relationship between body mass index and short term postoperative outcomes in patients undergoing potentially curative surgery for colorectal cancer: a systematic review and meta-analysis. 2018. 121: p. 68-73.
 19. Cho, M., et al., Underweight body mass index as a predictive factor for surgical site infections after laparoscopic appendectomy. *Yonsei Med J*, 2014. 55(6): p. 1611-6.
 20. Gouvêa, M., et al., Adherence to guidelines for surgical antibiotic prophylaxis: a review. *Braz J Infect Dis*, 2015. 19(5): p. 517-24.
 21. Bratzler, D.W., et al., Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Am J Health Syst Pharm*, 2013. 70(3): p. 195-283.
 22. Bratzler, D.W., et al., Clinical practice guidelines for antimicrobial prophylaxis in surgery. *American Journal of Health-System Pharmacy*, 2013. 70(3): p. 195-283.
 23. Skender, K., et al., Antibiotic Use, Incidence and Risk Factors for Orthopedic Surgical Site Infections in a Teaching Hospital in Madhya Pradesh, India. *Antibiotics (Basel)*, 2022. 11(6).
 24. Bùi Hồng Ngọc, N.T.D., Nguyễn Phúc Cẩm Hoàng, Đánh giá hiệu quả chương trình quản lý kháng sinh trong sử dụng kháng sinh dự phòng tại các khoa ngoại - bệnh viện Bình Dân. *Tạp chí Y học TP. Hồ Chí Minh - Phụ bản tập 22 - Số 1 - 2018*, 2018: p. 148 - 150.
 25. Ngọc, N.P.B., T.T. Trang, and P.T. Bình, PHÂN TÍCH CHI PHÍ THUỐC KHÁNG SINH SỬ DỤNG TẠI BỆNH VIỆN QUÂN Y 268 NĂM 2016.
 26. Quang, N.T., et al., Phân tích danh mục thuốc sử dụng tại Bệnh viện Đa khoa tỉnh Quảng Ninh năm 2021. 2022. 47(9): p. 13-25.