



## Antibiotic Treatment Patterns in Conjunctivitis Patients based on Medical Records

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### Abstract

Conjunctivitis is the most common eye disease. The prevalence of conjunctivitis is influenced by gender, patient age, and season. This study aimed to determine the characteristics and patterns of antibiotic use among patients with conjunctivitis at PKU Gamping Hospital, Yogyakarta. This study design is descriptive. The sample size was 203 people, all outpatients treated at the Eye Clinic of PKU Muhammadiyah Gamping Hospital, Yogyakarta, from 2019 to 2021, who were diagnosed with conjunctivitis by an ophthalmologist. The instruments used in this study included a structured data collection form to record age, gender, education level, employment type, and the antibiotic therapy prescribed to patients, and the Chi-Square analysis to determine demographic variables as risk factors for conjunctivitis. The Ethics Committee has approved this study with approval number 217/EC-KEPK FKIK UMY/VIII/2020. There are more males than women; most people with conjunctivitis are under 20 years old (39.9%), have a high school education (37%), and work indoors (93%). The Chi-Square analysis test showed that age, education level, and type of work are risk factors for the characteristics of conjunctivitis ( $p < 0.05$ ). Meanwhile, gender is not a risk factor for conjunctivitis ( $p > 0.05$ ). The antibiotics most frequently used to treat conjunctivitis patients were Neomycin Sulfate (24.9%), Polymyxin B (21.5%), Ofloxacin (17.1%), Levofloxacin (8.9%), and Chloramphenicol (5.1%), respectively. The study shows that age, educational level, and occupation are risk factors for conjunctivitis in Yogyakarta. Certain age groups, lower education levels, and vulnerable types of work are at higher risk of developing conjunctivitis.

## Introduction

Conjunctivitis is an inflammatory condition of the conjunctiva, the transparent mucous membrane covering the sclera and lining the inner surface of the eyelids. This condition may present in acute or chronic forms and remains one of the most frequently encountered ocular diseases in both primary care and ophthalmology settings. Conjunctivitis affects individuals across all age groups, genders, races, and socioeconomic backgrounds, making it a significant public health concern worldwide. Its clinical manifestations range from mild conjunctival hyperemia with watery discharge to severe inflammation accompanied by purulent exudate, eyelid edema, and discomfort that can impair daily activities and quality of life. Due to its high

transmissibility and recurrent nature, conjunctivitis contributes substantially to healthcare utilization and antibiotic consumption, particularly in outpatient settings.

Globally, conjunctivitis is recognized as the most common eye disorder encountered in clinical practice. Jasim and Al-Jubory (2024) reported that conjunctivitis accounts for a considerable proportion of ophthalmic consultations, highlighting its persistent burden on health systems. Epidemiological patterns of conjunctivitis vary across regions and populations, influenced by demographic factors such as age, gender, and educational background, as well as environmental and seasonal conditions. In Taiwan, Chiang et al. (2012) demonstrated that women have a higher risk of developing conjunctivitis compared to men, suggesting potential behavioral, hormonal, or exposure-related differences. Age distribution also plays a critical role, with children and adolescents representing the most affected groups in several regions. Studies conducted in Taiwan and other Asian countries have consistently shown higher incidence rates among children and adolescents, likely due to close contact in school environments and suboptimal hygiene practices (Mahoney et al., 2023).

Similar trends have been observed in Indonesia. Research conducted in Jambi revealed that conjunctivitis cases predominantly occurred among adolescents aged 11 to 18 years, underscoring the vulnerability of this age group (Shakira et al., 2013). Educational level has also been identified as a contributing factor, with Elhams et al. (2022) reporting higher conjunctivitis prevalence among individuals with secondary education backgrounds. These findings indicate that conjunctivitis is not only a medical issue but also a condition shaped by social and behavioral determinants, including hygiene practices, environmental exposure, and access to health education.

Conjunctivitis may be classified etiologically into infectious and non-infectious types, with infectious conjunctivitis further divided into bacterial and viral forms, while allergic conjunctivitis represents a major non-infectious subtype. The distribution of these subtypes varies geographically. Allergic conjunctivitis affects approximately 4.6 percent of children in Ankara, Turkey, while bacterial conjunctivitis accounts for about 36 percent of adult cases in the United States. In Pakistan, allergic conjunctivitis has been reported in 19.2 percent of school-aged boys, indicating substantial regional variability (Staphit et al., 2011). Urbanization also plays a role, as studies from Mongolia have shown higher rates of allergic conjunctivitis in urban areas compared to rural settings, possibly due to increased exposure to pollutants and allergens.

Seasonal variation further influences conjunctivitis incidence. In subtropical regions, cases of vernal allergic conjunctivitis are more common during the spring, coinciding with increased allergen exposure. In Indonesia, Suryani et al. (2021) reported that conjunctivitis cases in Yogyakarta City peak during the dry season, when dust and environmental irritants are more prevalent. These seasonal and environmental patterns emphasize the multifactorial nature of conjunctivitis and the importance of contextual factors in disease occurrence (Zhang et al., 2026; Yan et al., 2025; Duarte et al., 2026).

Bacterial conjunctivitis remains a major clinical concern due to its contagiousness and the need for antibiotic therapy (Kiełczewska et al., 2025; Osei Duah Junior et al., 2025). *Staphylococcus aureus* has consistently been identified as the predominant bacterial pathogen responsible for conjunctivitis across various settings (Asbell et al., 2008). Other commonly isolated bacteria include *Streptococcus pneumoniae*, *Haemophilus influenzae*, and various Gram-negative organisms, each exhibiting distinct antimicrobial resistance patterns. Transmission of bacterial conjunctivitis occurs easily through direct contact with ocular secretions or indirectly via contaminated objects such as towels, pillowcases, and handkerchiefs (Suryani et al., 2021). Behavioral factors, particularly poor hand hygiene and the sharing of personal items, have been shown to significantly increase the risk of infection. A study conducted in Bandung

demonstrated a clear association between personal hygiene behaviors and the incidence of conjunctivitis (Wibowo et al., 2022).

Microbiological studies in Indonesia have revealed considerable diversity in the bacterial agents causing conjunctivitis. In Manado, isolates included non-hemolytic *Streptococcus*, *Bacillus subtilis*, *Proteus* species, *Staphylococcus albus*, and *Pseudomonas aeruginosa* (Lolowang, 2014). These findings highlight the complexity of bacterial conjunctivitis and the need for appropriate antibiotic selection based on local pathogen profiles. Antibiotic susceptibility patterns also vary across regions. Research in Banjarmasin showed that tobramycin, gentamicin, and polymyxin were highly active against conjunctivitis-causing bacteria (Atmawati et al., 2017). In Manado, bacterial isolates remained sensitive to meropenem but exhibited resistance to erythromycin (Matandung et al., 2014). More recently, studies in Makassar demonstrated that combination antibiotic formulations containing neomycin, polymyxin B, and gramicidin were effective against a broad spectrum of Gram-positive and Gram-negative bacteria (Wahyuni et al., 2025).

Despite the abundance of clinical and microbiological studies, research on conjunctivitis in Indonesia has largely focused on clinical presentation, etiological agents, and laboratory findings. Pharmacoepidemiological investigations, particularly those utilizing medical record data to analyze antibiotic prescribing patterns, remain limited. Moreover, few studies have comprehensively examined the relationship between patient sociodemographic characteristics and the types of antibiotics prescribed for conjunctivitis. This gap is significant, as inappropriate or excessive antibiotic use contributes to antimicrobial resistance and undermines treatment effectiveness.

Understanding antibiotic utilization patterns in conjunctivitis management is crucial for promoting rational drug use and informing evidence-based policy development. Medical record-based studies offer valuable insights into real-world prescribing practices and patient characteristics, enabling the identification of trends, gaps, and potential areas for intervention. However, such approaches have been underutilized in the Indonesian context, particularly at the hospital level.

Therefore, this study aims to analyze the characteristics and patterns of antibiotic use among patients diagnosed with conjunctivitis at PKU Gamping Hospital, Yogyakarta. By examining medical records, this research seeks to provide a comprehensive overview of patient demographics, clinical features, and antibiotic prescribing practices. The findings are expected to contribute to a better understanding of conjunctivitis management in routine healthcare settings and to support the development of rational antibiotic use strategies tailored to local epidemiological and clinical contexts.

## Methods

This study employed a descriptive retrospective design to examine the characteristics of patients with conjunctivitis and the patterns of antibiotic use in a hospital setting. A retrospective approach was considered appropriate because it allows the analysis of existing medical record data to describe real clinical practices over a defined period without intervening in patient management. This design provides an overview of patient demographics and treatment patterns as they occurred in routine healthcare services.

The study was conducted at the Eye Clinic of PKU Muhammadiyah Gamping Hospital, Yogyakarta, a secondary referral hospital that provides specialized ophthalmology services. The study period covered three years, from 2019 to 2021, enabling the inclusion of a sufficient number of cases to reflect conjunctivitis management trends over time. During this period, all patients who attended the outpatient clinic and were diagnosed with conjunctivitis by an ophthalmologist were considered for inclusion in the study.

A total sampling technique was applied, in which all eligible patients were included as study participants. Using this approach, the final sample consisted of 203 outpatients diagnosed with conjunctivitis. Total sampling was chosen to minimize selection bias and to ensure that the findings accurately represent the population of conjunctivitis patients treated at the study site during the specified timeframe.

The inclusion criteria comprised all patients diagnosed with conjunctivitis who had complete medical record data, including age, address, gender, and type of employment. Patients with incomplete or missing information in their medical records were excluded from the study to maintain data quality and analytical reliability. This ensured that all variables required for demographic and treatment analysis could be consistently assessed.

Data collection was carried out using a structured data extraction form designed specifically for this study. The form was used to record key variables such as age, gender, education level, employment type, and the antibiotic therapy prescribed to each patient. All data were obtained from patients' medical records, ensuring consistency and accuracy in data recording without direct patient contact.

Data analysis involved both univariate and bivariate approaches. Univariate analysis was used to describe the distribution of demographic characteristics and antibiotic use among patients with conjunctivitis. Chi-square analysis was employed to examine associations between demographic variables and conjunctivitis-related characteristics. Ethical approval for this study was obtained from the Ethics Committee, with approval number 217/EC-KEPK FKIK UMY/VIII/2020, ensuring that the research was conducted in accordance with ethical standards for studies involving medical record data.

## Result and Discussion

### Sociodemographic Characteristics of Conjunctivitis Patients

Table 1 presents demographic information on conjunctivitis patients at PKU Muhammadiyah Gamping Hospital in Yogyakarta, including their numbers, sex, education level, and occupation. There are more males than women, but the only difference is the number of people who answered the question.

Table 1. Association between demographic characteristics and the prevalence of conjunctivitis respondents (N=203)

Variables	Number	Percentage	p-value	95%CI
<b>Gender</b>				
Male	102	50.2	0.787	0.588-1.496
Female	101	49.8		
<b>Age (years)</b>				
<20	81	39.9	0.000*	1.58-6.71
20-40	46	22.7		
>40	76	37.4		
<b>Education level</b>				
Non formal education	61	30	0.000*	1.58-6.71
Primary education	24	11.8		
Secondary education	10	4.9		
Tertiary education	75	37		
Higher education	33	16.3		
<b>Type of occupation</b>				
Indoor working	189	93	0.001*	1.582-6.71
Outdoor working	14	7		

\*Significant at level  $\alpha=5\%$

A total of 203 outpatient medical records of conjunctivitis patients treated at the Eye Clinic of PKU Muhammadiyah Gamping Hospital, Yogyakarta, from 2019 to 2021 were included in the analysis. The sociodemographic profile of respondents encompassed gender, age, educational attainment, and type of occupation, as presented in Table 1.

The gender distribution of conjunctivitis patients was nearly equal, with male patients accounting for 50.2% ( $n = 102$ ) and female patients comprising 49.8% ( $n = 101$ ). Statistical analysis using the Chi-square test demonstrated no significant association between gender and the occurrence of conjunctivitis ( $p = 0.787$ ; 95% CI: 0.588–1.496), indicating that gender did not constitute a demographic risk factor within the study population.

In contrast, age distribution revealed marked variation among conjunctivitis patients. Individuals under 20 years of age represented the largest proportion, accounting for 39.9% ( $n = 81$ ) of cases, followed by those aged over 40 years at 37.4% ( $n = 76$ ), and patients aged 20–40 years at 22.7% ( $n = 46$ ). The Chi-square analysis confirmed a statistically significant association between age and conjunctivitis prevalence ( $p < 0.001$ ; 95% CI: 1.58–6.71), suggesting that age plays a substantial role in influencing susceptibility to conjunctivitis among outpatients in Yogyakarta.

Educational background also showed considerable variation. The majority of patients had completed secondary education (high school), accounting for 37% ( $n = 75$ ), followed by non-formal education at 30% ( $n = 61$ ). Patients with higher education represented 16.3% ( $n = 33$ ), while primary and tertiary education groups constituted smaller proportions at 11.8% ( $n = 24$ ) and 4.9% ( $n = 10$ ), respectively. Statistical testing demonstrated a significant relationship between education level and conjunctivitis occurrence ( $p < 0.001$ ), indicating that educational attainment is a relevant sociodemographic factor associated with conjunctivitis.

Regarding occupational characteristics, the majority of patients worked in indoor environments, accounting for 93% ( $n = 189$ ), while only 7% ( $n = 14$ ) were engaged in outdoor occupations. The association between type of occupation and conjunctivitis was statistically significant ( $p = 0.001$ ; 95% CI: 1.582–6.71), indicating that work environment constitutes a significant demographic risk factor.

### Patterns of Antibiotic Use in Conjunctivitis Management

Table 2. Distribution of Antibiotic Use Among Conjunctivitis Patients

Antibiotic	n	Percentage (%)
Neomycin Sulfate	51	24.9
Polymyxin B	44	21.5
Ofloxacin	35	17.1
Levofloxacin	18	8.9
Chloramphenicol	10	5.1

Figure 1 shows the types of antibiotics used to treat patients at PKU Muhammadiyah Gamping Hospital, Yogyakarta. The antibiotics most frequently used to treat conjunctivitis patients were Neomycin Sulfate (24.9%), Polymyxin B (21.5%), Ofloxacin (17.1%), Levofloxacin (8.9%), and Chloramphenicol (5.1%), respectively.

This study shows that age, education level, and employment type are demographic risk factors for conjunctivitis in Yogyakarta, whereas gender is not. So, this is consistent with research at Indera Hospital in Denpasar, where conjunctivitis cases were more common among men (Suryathi et al., 2018). However, at Haji Adam Malik Hospital, conjunctivitis was more common in women (Hartati et al., 2021). At Raden Muttaher Regional General Hospital in Jambi, conjunctivitis was more common in women (Shakira et al., 2013). Research in Hong

Kong found no significant difference in the number of conjunctivitis cases between men and women (Sun et al., 2025). Several possible causes of this difference are related to lifestyle, work environment, and hygiene conditions (Yurt, 2023). In Karachi, more boys suffer from allergic conjunctivitis than girls, although this is not statistically significant (Baig et al., 2010).

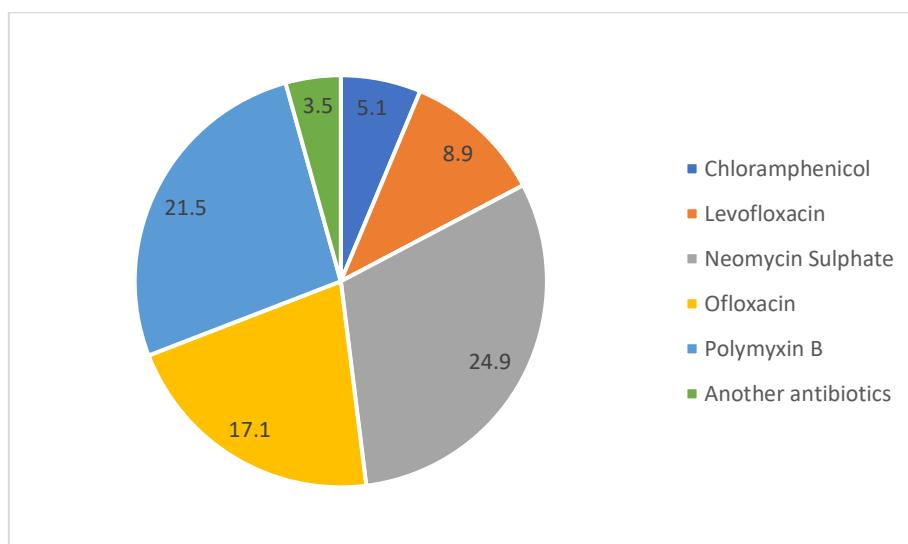


Figure 1. Pie chart percentage of antibiotic use for the treatment of conjunctivitis

In Yogyakarta, the largest proportion of conjunctivitis cases occurred among individuals under 20 years of age, with 81 patients falling into this group. This finding aligns with the study by Shakira et al. (2013), which reported that conjunctivitis most frequently affected adolescents aged 11 to 18 years. However, variations in age distribution have been observed across different regions and healthcare settings. Studies conducted at Dr. Pirngadi Regional Hospital in Medan showed that conjunctivitis was more common among individuals aged 21 to 30 years (Hartadhi et al., 2023), while research at Indera Hospital in Denpasar and Haji Adam Malik General Hospital in Medan reported higher incidence among patients aged 31 to 40 years (Insani et al., 2017; Hartati et al., 2021). These differences suggest that age-related risk is context dependent and influenced by local environmental exposure, hygiene practices, and immune status. As noted by Suryani et al. (2021), age plays an important role in conjunctivitis incidence through its interaction with environmental factors, personal hygiene behavior, and body resistance. Supporting this view, a study in Karachi demonstrated a significant association between age and allergic conjunctivitis, indicating higher susceptibility in certain age groups (Baig et al., 2010).

The majority of conjunctivitis patients in Yogyakarta had a high school education, accounting for 75 respondents. This pattern is consistent with findings from Dr. Pirngadi Regional General Hospital in Medan, where conjunctivitis cases were most prevalent among individuals with a high school educational background (Hartadhi et al., 2023). Educational level may influence health-seeking behavior, awareness of eye hygiene, and understanding of disease prevention and treatment. Limited knowledge about eye health can lead to delayed treatment, inappropriate self-medication, and poor adherence to therapy. Ormsby et al. (2012) emphasized that inadequate health literacy is associated with suboptimal disease management, which may increase the risk of infection and complications, including recurrent conjunctivitis.

Most conjunctivitis patients in this study were indoor workers, with 189 respondents reporting occupations primarily conducted indoors. This finding is comparable to earlier research at Haji Adam Malik General Hospital in Medan, where the majority of conjunctivitis cases were reported among housewives and other indoor workers (Hartati et al., 2021). Changes in indoor

and outdoor environments due to urbanization, industrialization, and climate change have been shown to affect both the incidence and management of conjunctivitis, particularly allergic forms. Rising temperatures, increased rainfall, and extreme weather events contribute to longer pollen seasons and enhanced survival of indoor and outdoor molds, increasing allergen exposure (Alves et al., 2023). In addition, unhygienic indoor environments and poor ventilation may facilitate the spread of infectious conjunctivitis. Occupational conjunctivitis may also result from exposure to allergens, chemical irritants, and infectious agents in the workplace, especially when personal protective equipment is inadequate or working conditions are suboptimal (Garzón Duque et al., 2021).

Regarding treatment patterns, the most frequently prescribed antibiotics for conjunctivitis were neomycin sulfate and polymyxin B. Neomycin sulfate, an aminoglycoside antibiotic, accounted for 24.9 percent of prescriptions. It exerts a bactericidal effect by inhibiting bacterial protein synthesis through interaction with the 30S and 50S ribosomal subunits, resulting in reversible inhibition of protein production. Neomycin sulfate is considered a narrow spectrum antibiotic with primary activity against gram negative bacteria (Amiriantz et al., 2024). Polymyxin B, prescribed in 21.5 percent of cases, is a polypeptide antibiotic that disrupts bacterial cell membrane permeability, leading to leakage of intracellular contents and bacterial cell death. Its antimicrobial activity is mainly directed against gram negative organisms (Yang et al., 2024).

Previous studies support the effectiveness of these antibiotics in the management of conjunctivitis. Atmawati et al. (2017) reported that polymyxin exhibited a sensitivity rate of 80.95 percent against aerobic bacteria isolated from conjunctivitis cases. Combination antibiotic preparations containing polymyxin B sulfate, neomycin sulfate, and dexamethasone have also been shown to accelerate clinical recovery, with significantly shorter healing times compared to other regimens (Meriyani et al., 2020). These findings suggest that combination therapy may provide broader antimicrobial coverage while also reducing inflammation, thereby improving clinical outcomes.

Levofloxacin was also used in a smaller proportion of cases and remains an important option in conjunctivitis treatment. Keating (2009) reported that levofloxacin demonstrated full sensitivity against *Staphylococcus aureus*, one of the most common causative agents of bacterial conjunctivitis. However, regional variations in bacterial susceptibility have been documented. In the eye clinic of Ulin Banjarmasin Hospital, the sensitivity of aerobic bacteria causing conjunctivitis to levofloxacin was reported to be 61.90 percent (Atmawati et al., 2017). Levofloxacin is a fluoroquinolone antibiotic with bactericidal activity, acting by inhibiting bacterial topoisomerase enzymes essential for DNA replication. These findings highlight the importance of considering local resistance patterns when selecting antibiotic therapy for conjunctivitis to ensure effective and rational treatment.

This study was limited by the lack of examination for the bacteria that cause conjunctivitis and the lack of sensitivity testing to various antibiotics. Furthermore, the observed variables were limited to sex, age, education, and occupation. Behavioral, social, and other variables could not be examined. Medical record data is highly dependent on the accuracy of data entry personnel, and data may be missing or incomplete.

This study provides an interpretative understanding of conjunctivitis occurrence and antibiotic prescribing practices in an outpatient ophthalmology setting in Yogyakarta, Indonesia. By examining sociodemographic factors alongside treatment patterns derived from medical records, the findings extend existing literature that has largely focused on clinical manifestations and microbiological profiles, while offering a population-based perspective on conjunctivitis management.

The significant association between age and conjunctivitis underscores age as a critical determinant of susceptibility. Higher vulnerability among younger individuals may be attributed to behavioral factors such as close interpersonal contact, inadequate hand hygiene, and frequent eye touching, particularly in school environments. These behaviors facilitate the transmission of infectious conjunctivitis and have been consistently reported in prior epidemiological studies (Shakira et al., 2013; Mahoney et al., 2023). At the same time, the presence of conjunctivitis among older age groups suggests that age-related physiological changes, including reduced tear film stability and immune response, may also increase susceptibility, supporting previous observations that conjunctivitis affects multiple stages of the life course rather than a single age group (Suryani et al., 2021).

Educational level emerged as a significant factor associated with conjunctivitis, indicating that education may act as a proxy for health literacy. Individuals with lower or secondary educational attainment may have limited access to health information or a reduced understanding of preventive eye-care practices. Prior research has demonstrated that inadequate knowledge and attitudes toward eye health contribute to delayed treatment-seeking behavior and improper hygiene practices, which can exacerbate the spread of conjunctivitis (Ormsby et al., 2012; Elhams et al., 2022; Tanywe et al., 2022). These findings suggest that educational disparities may indirectly influence conjunctivitis risk through behavioral pathways rather than through biological mechanisms.

The association between occupation type and conjunctivitis highlights the importance of environmental exposure in ocular health. Although indoor workers constituted the majority of cases, this finding should not be interpreted as indicating lower risk among outdoor workers, but rather reflects the potential impact of prolonged exposure to enclosed environments with limited ventilation, artificial lighting, and airborne irritants. Urban indoor settings may increase exposure to allergens and microbial contaminants that contribute to ocular surface inflammation (Alves et al., 2023). Similar findings have been reported in occupational health studies showing that conjunctivitis can arise from both indoor and outdoor work environments when protective measures are inadequate (Garzón Duque et al., 2021).

In contrast, gender was not significantly associated with conjunctivitis in this study, suggesting comparable risk between male and female patients. This finding aligns with population-based studies reporting no consistent gender disparity in conjunctivitis incidence (Sun et al., 2025). The variability observed across different studies may be influenced more by sociocultural roles, occupational exposure, and healthcare-seeking behavior than by inherent biological differences, indicating that gender-related risk is context-specific rather than universal (Hartati et al., 2021).

The antibiotic prescribing patterns observed in this study reflect prevailing clinical practices in ophthalmic outpatient care. The predominance of Neomycin Sulfate and Polymyxin B suggests a preference for antibiotics targeting Gram-negative bacteria, which are frequently implicated in bacterial conjunctivitis. These agents have long been used in topical ophthalmic formulations due to their bactericidal properties and established clinical efficacy (Amiriantz et al., 2024; Yang et al., 2024). The use of fluoroquinolones such as Ofloxacin and Levofloxacin indicates an inclination toward broader-spectrum coverage, particularly in cases where empirical treatment is deemed necessary. However, routine use of broad-spectrum antibiotics raises concerns regarding antimicrobial resistance, especially in the absence of microbiological confirmation (Petrillo et al., 2021; Okeke et al., 2024; Timsit et al., 2024; Chiş et al., 2022).

The absence of bacterial culture and sensitivity testing in routine outpatient practice presents a challenge for rational antibiotic use. Empirical therapy remains common due to the difficulty of clinically distinguishing bacterial from viral conjunctivitis, which may lead to unnecessary antibiotic exposure (Staphit et al., 2011; Shivaji, 2024). These findings emphasize the

importance of antimicrobial stewardship initiatives that promote judicious antibiotic use, supported by local resistance data and standardized treatment guidelines. Incorporating periodic microbiological surveillance could enhance evidence-based prescribing and reduce the risk of resistance development.

## Conclusion

This study shows that age, educational level, and occupation are risk factors for conjunctivitis in Yogyakarta. Certain age groups, lower education levels, and vulnerable types of work are at higher risk of developing conjunctivitis. Preventive measures must be taken by productive age groups and children through health promotion, such as Clean-Living Behavior, and teaching children not to touch their eyes with dirty hands. Regular health education activities regarding conjunctivitis and its prevention, especially in communities with limited access to health information. Workers in risky environments, such as welders and online motorcycle taxi drivers who are exposed to pollution, are required to wear protective glasses.

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