



# The Social-environmental Risk Factor for Conjunctivitis

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## Abstract

**BACKGROUND:** Conjunctivitis is one of the most common eye disorders in the worldwide. The incidence of conjunctivitis in Indonesia reached 73% of the population. Conjunctivitis cases in Yogyakarta City have increased from year to year.

**AIM:** This study purposed to identify the social-environmental risk factors that influence the incidence of conjunctivitis in Yogyakarta.

**METHODS:** Design study was an observational analytic method with a case-control research design. The population study was all the patients visited at the Eye Clinic of PKU Muhammadiyah Gamping Hospital and private hospital Yogyakarta in 2019. The total sample is 204 respondents who were divided into case and control. One hundred and four respondents were in a case while 100 were controlled. The case was a conjunctivitis patient treated at the Eye Clinic of PKU Muhammadiyah Gamping Hospital and private hospital Yogyakarta in 2019, while the control was a non-conjunctivitis patient who went to the same two hospitals as the case respondent. Data were collected by direct interviews using a structured questionnaire covering the respondents' demographics and social-environmental conditions. Then, the data were analyzed using SPSS 15.0 univariate and bivariate using Chi-square.

**RESULTS:** The results of the bivariate analysis showed that age, the distance between the house and the river, the distance between the place and the temporary garbage dump, contacted from a close friend, the windows of the house were always opened every day as risk factors affecting the incidence of conjunctivitis.

**CONCLUSION:** The study's decision is the social-environmental as a risk factor for conjunctivitis in Yogyakarta.

**Edited by:** Ksenija Bogoeva-Kostovska  
**Citation:** Suryani L, Setyandriana Y, Meida NS. The Social-environmental Risk Factor for Conjunctivitis. Open-Access Maced J Med Sci. 2021 Sep 20; 9(T4):319-323. <https://doi.org/10.3889/oamjms.2021.5787>  
**Keywords:** Conjunctivitis; Risk factor; Demographics; River; Temporary garbage dump  
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**Received:** 26-Jan-2021  
**Revised:** 27-Mar-2021  
**Accepted:** 10-Sep-2021  
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**Funding:** This study was supported by Grant No. 196/SK-LP3M/II/2019 of the Institute for Research, Publication and Community Service of the University Muhammadiyah Yogyakarta. Competing Interest: The authors have declared that no competing interest exists  
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## Introduction

The most common type of eye disease worldwide is conjunctivitis and 36% of cases occur in adult [1]. In Pakistan, as much as 19.2%, the prevalence of allergic conjunctivitis occurs in boys [2]. The incidence of conjunctivitis in Indonesia reaches 73% of people with eye disorders. Acute conjunctivitis is caused by infection and non-infection, mostly found in primary care and ophthalmology hospitals [3]. Bacteria, fungi, viruses, parasites, and allergies are some of the causes of conjunctivitis. [4]. Bacterial conjunctivitis is more common in children. About 15–40% of the incidence of conjunctivitis is due to allergies [5]. In subtropical countries, the incidence of allergic conjunctivitis tends to increase in spring [6]. In Mongolia, cases of conjunctivitis are more common in urban areas than in rural areas [7]. In the United States, viral conjunctivitis infects many adults and occurs most frequently in summer [8], [9], [10], [11].

Conjunctivitis is one of the top 10 conditions in outpatient hospital units in Indonesia [12]. Conjunctivitis due to bacterial infection can be transmitted from one eye to another and from the patient to another, either through direct contact or through objects in touch with

the infected eye [13]. Behaviors that are potential risk factors for conjunctivitis include washing hands, using towels, pillow/pillowcases, and handkerchiefs together. There are some symptoms of conjunctivitis. Symptoms that arise in acute bacterial conjunctivitis include redness of the eyes, feeling stuck, sore, discharge, when waking up, the eyelids are often sticky and challenging to open [14]. It can lead to acute conjunctivitis.

Acute conjunctivitis lasts 10–14 days; if appropriately treated, it will heal in 1–3 days. The complication will happen if it does not treat properly [15]. Apart from infection, conjunctivitis can also be caused by allergies. An inflammatory reaction in the conjunctiva that is mediated by a type 1 hypersensitivity reaction can cause allergic conjunctivitis [16], [17]. The tear film, eyelids, cornea, and conjunctiva are the parts of the eye that is affected by allergic conjunctivitis. The signs of conjunctivitis vary widely, influenced by genetics, environment, microorganisms, and immune status of the person [18]. Allergic conjunctivitis affects children in Ankara, Turkey, by 4.6%. Bacterial conjunctivitis affects adults by 36% in the United States. In Pakistan, 19.2% of boys aged 5–19 have allergic conjunctivitis. In Mongolia, more cases of allergic conjunctivitis are found in cities than in rural areas [19]. In the subtropics, vernal allergic conjunctivitis is expected in the spring.

In areas with a high population density, there is a lot of phlyctenule conjunctivitis in children. In regions with geographic conditions that tend to be dry, hot, and dusty, trachoma cases are found, for example, in North India, North Africa, and West Africa [20]. Bacterial conjunctivitis affects a lot of children. The infection symptoms are sometimes systemic, such as fever, sore throat, otitis media, and diarrhea. In Medan, 78% prevalence of conjunctivitis occurred in people aged less than 30 years. An environment with a lack of sanitation or environmental hygiene is one of the risk factors that help spread quickly. The primary preventive measure in conjunctivitis is to avoid risk factors [21].

There has not been too much research on conjunctivitis risk factors in Indonesia. The study of demographic and behavioral risk factors associated with conjunctivitis has been carried out frequently in several countries. Thus, this research is important to do to identify the social-environmental risk factors that affect conjunctivitis in Yogyakarta. We hoped this study gave some information about risk factors associated with conjunctivitis.

## Methods

The study design was an analytic observational study with a case–control design. The period study was conducted from January to December 2019. The population study in both cases and control was all patients who were treated at the Eye Clinic of PKU Muhammadiyah Gamping Hospital and private hospital in Yogyakarta, based on a diagnosis made by an ophthalmologist. The case population was all patients who were declared conjunctivitis and the control population was all patients who were declared non-conjunctivitis. This study used a sample of 104 case respondents and 100 respondents as controls. Sampling was taken by total sampling, all patients treated at the Eye Clinic of PKU Muhammadiyah Gamping Hospital and private hospital Yogyakarta in 2019. Determination of case and control respondents was carried out by standard examinations that are usually carried out to determine the criteria for conjunctivitis in the eye clinic. Patients who became respondents were asked for consent by signing the informed consent.

Collecting risk factor data which include the characteristics and social-environmental risk factor of respondents, both cases and controls, were obtained through questionnaires. A set of checklists are made to record the respondents. The checklist contains demographic data, the distance between the house and the river, the distance between the house and the temporary garbage dump, being infected by a close friend, and the house windows are always open every day. The Chi-square test was done using SPSS

version 21.0, to calculate the odds ratio with a 95% confidence interval value ( $\alpha = 0.05$ ).

## Results

The categories of respondents based on gender, age, and type of occupation are presented in Table 1. The respondents of conjunctivitis cases aged 20–40 years were 44% and control respondents were over 40 years old 52%. Most cases and control respondents work indoors. The sex between cases and controls was mostly women. Of the three respondents' characteristics, age was a risk factor for the incidence of conjunctivitis in Yogyakarta ( $p < 0.05$ ).

**Table 1: Frequency distribution of case and control respondents based on age, type of occupation, and gender**

Demography	Cases (n = 104) (%)	Control (n = 100) (%)	p-value	CI 95%
Age (year)				
< 20	34 (33)	15 (15)	0.000*	2.03–2.24
20–40	46 (44)	33 (33)		
> 40	24 (23)	52 (52)		
Occupation				
Indoor	74 (71)	74 (74)	0.649	1.21–1.34
Outdoor	30 (29)	26 (26)		
Gender				
Men	46 (46)	39 (39)	0.449	1.35–1.48
Women	58 (56)	61 (61)		

\*Significant  $p < 5\%$ .

There are five social-environmental risk factors studied, as listed in Table 2. The majority of respondents live far from rivers and temporary garbage dumps, and their windows are always open every day. Just 35% of patients with conjunctivitis are infected by a close friend. The social-environmental risk factors that influenced the incidence of conjunctivitis in Yogyakarta include: The distance between the house and the river, the distance between the house and the temporary garbage dump, being infected by a close friend, and the house windows are always open every day.

**Table 2: Comparison of social-environmental risk factors for case and control groups in the incidence of conjunctivitis**

Social-environment variable	Cases (n = 104) (%)	Control (n = 100) (%)	p-value	CI 95%
Distance between house and river				
> 250 m	82 (79)	97 (97)	0.000*	1.08–1.17
< 250 m	22 (29)	3 (3%)		
Distance between the house and the temporary garbage dump				
> 250 m	90 (87)	97 (97)	0.007*	1.05–1.12
< 250 m	14 (13)	3 (3)		
Being infected by a close friend				
Yes	36 (35)	0	0.000*	1.77–1.87
No	64 (65)	100 (100)		
The window always opens daily				
Yes	82 (79)	95 (95)	0.001*	1.09–1.18
No	22 (21)	5 (5)		

\*Significant  $p < 5\%$ .

## Discussion

This study shows that age is a risk factor for conjunctivitis in Yogyakarta, while sex and occupation

have no relationship with the incidence of conjunctivitis. It is in line with the conjunctivitis research in the other place in Indonesia [22]. The findings of this study differ from those of Taiwan. In Taiwan, women were at a higher risk than men [23]. In the United States, 36% of conjunctivitis cases occur in adults [1]. In Pakistan, as much as 19.2%, the prevalence of allergic conjunctivitis occurs in boys [2]. Bacterial conjunctivitis affects adults by 36% in the United States. In Pakistan, 19.2% of boys aged 5–19 have allergic conjunctivitis. Several species of bacteria cause conjunctivitis, from the Gram-positive and -negative groups. Bacterial infectious conjunctivitis is transmitted from one eye to the other eye and another person, through direct contact and objects in contact with the infected eye [13].

About 35% of people with conjunctivitis get it from a close friend. Conjunctivitis transmission occurs if someone comes in direct contact with a person with conjunctivitis. This condition is supported by the fact that most respondents have activities in the room. The most common causes of conjunctivitis in the world are bacteria and fungi [4]. The bacteria that cause conjunctivitis are several species, among which are *Haemophilus influenzae*, *Moraxella catarrhalis*, *Staphylococcus epidermidis*, *Streptococcus viridans*, *Staphylococcus aureus*, *Streptococcus pneumoniae*, and Gram-negative bacteria [24], [25], [26]. *S. aureus* is Gram-positive cocci bacteria that are mostly found in conjunctivitis cases [16]. The microbe that causes conjunctivitis influences the spread of conjunctivitis infectious. There are many mechanisms of conjunctivitis transmission, including contact transmission, droplet transmission, water transmission, and vector transmission. *S. aureus*, *S. pneumoniae*, *H. influenzae*, and *Neisseria gonorrhoeae* cause acute and hyperacute conjunctivitis [27], [28], [29], [30]. Adenoviruses of the subgenus D, coxsackieviruses of the Picornaviridae family, and herpes (HSV1) are the most common causes of acute hemorrhagic conjunctivitis [27].

Touching the eye with unclean hands was one way to spread bacterial conjunctivitis. The eye has natural defenses in the form of normal flora, immunoglobulins, and enzymes. The normal flora in the eye includes *Streptococcus*, *Staphylococcus*, and *Corynebacterium* bacteria. If the body's immunity decreases, the number of normal flora will increase and infection will occur. Furthermore, bacteremia and the organs around the infected eye can spread to the eye. Picornavirus, adenovirus, *Herpes simplex*, *Poxvirus*, and *Varicella zoster* are some virus that causes conjunctivitis. Viruses are transmitted through respiratory droplets and contact with objects contaminated with viruses. Allergic conjunctivitis is caused by many allergens in the environment, such as pollen, animal hair, and mold spores. Atopic conjunctivitis attacks patients who have a history of atopic dermatitis.

Study on social-environmental risk factors for conjunctivitis has not been widely used. In this study,

the social-environmental risk factors that influence the incidence of conjunctivitis are the distance between the house from the river and a temporary garbage dump. Houses close to rivers and temporary garbage dumps usually have poor sanitation. River water can pollute well water which is usually used to meet the daily needs of the people of Yogyakarta. The existence of temporary garbage dumps that are very close to residential areas also contributes to creating a dirty environment. About 29% of conjunctivitis sufferers live near rivers. In Yogyakarta, four rivers are flowing in the middle of residential areas: Gajah Wong, Code, Winongo, and Manunggal. During the rainy season, river water overflows and inundates residential areas close to the river. Flood water pollutes the well; consequently, the well water is contaminated with various kinds of pathogenic microorganisms. It is necessary to analyze the microbes isolated from well water to ensure the source of infection is from the patient's well water or other sources. The findings were then compared between microbial isolates from well water and conjunctivitis isolates. The metagenomic approach is used to study the microbes that cause conjunctivitis. Microorganisms that are difficult to identify with conventional culture methods can be detected using metagenomics [31], [32]. In ophthalmology, metagenomics has been used to detect infectious pathogens of proliferative disorders, classify pathogens from infectious keratitis [33], and analyze vitreous samples of endophthalmitis after cataract surgery [34]. The downstream bioinformatics data show detailed findings based on metagenomics data [32].

The limitations of this study include the study did not examine the microbes that cause conjunctivitis. Hence, the cause of conjunctivitis in patients is not known with certainty, and the determination of the distance between the house to the river and the temporary garbage dumps was only based on interviews with respondents.

## Conclusion

It was observed that age was a risk factor for conjunctivitis in Yogyakarta. Besides that, the social-environment as risk factor for conjunctivitis in Yogyakarta was the distance between the house and the river, the distance between the house and the temporary garbage dump, being infected by a close friend, and the window always opens daily. This study proves the recommendations that the government needs to rearrange the temporary landfill places and regulations for disposing of garbage to the temporary landfills. People who live near rivers are more vigilant about personal hygiene to prevent conjunctivitis infection.

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