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Pink eye outbreak in rural Borneo schools: The panic and the prompt public health response

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Abstract:

BACKGROUND: On September 28, 2022, a rural health clinic reported unusual eye symptoms in students from five schools in Sri Aman Sarawak, a rural region of Borneo. The objective of our investigation was to verify the diagnosis, identify the source of infection, conduct active case findings, and implement control and preventive measures.

MATERIALS AND METHODS: Our case definition included eye redness, discharge, or watering in students, staff, or their family members in Sri Aman since early September 2022. Descriptive epidemiology included active case finding and the construction of an epidemic curve. A retrospective cohort study was conducted to investigate the outbreak of conjunctivitis in students and staff in specific schools, allowing for the identification of exposed individuals and calculation of accurate attack rates.

RESULTS: We identified 228 cases of acute conjunctivitis in three boarding schools and four day schools, with an incubation period ranging from 24 to 78 hours. Most of the cases were secondary school students, comprising 56.6% of the total, with a nearly equal gender distribution of 51.3% male and 48.7% female. Bilateral involvement was observed in 61.8% of the cases. The overall attack rate was 8.5%.

CONCLUSION: Good personal hygiene, prompt isolation of unwell students, and efficient event-based surveillance systems in healthcare facilities are crucial for the prevention of the spread of infectious diseases in schools and the protection of public health through early detection and intervention.

Keywords:

Borneo, conjunctivitis outbreak, rural, Sarawak, schools

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Introduction

Conjunctivitis, commonly known as "pink eye," is a highly contagious condition that has considerable public health risks.[1] Outbreaks of conjunctivitis are relatively common, particularly in places where individuals gather, such as in hostels, classrooms, communal living spaces, military camps, and hospitals.[2,3] These outbreaks can have a notable impact on public health, the economy, and society at large. It is estimated that acute conjunctivitis affects approximately 6 million people globally each year. This condition is one of the most common causes of red eyes and affects patients of all ages and socioeconomic classes. Treating bacterial conjunctivitis alone costs an estimated $377 million to $857 million annually.

Conjunctivitis is an inflammation and swelling of the conjunctival tissue, engorgement of the blood vessels, with ocular discharge and pain. Symptoms of bacterial conjunctivitis can appear 24–72 h after exposure and 5–12 days for viral conjunctivitis. About 75% of bacterial conjunctivitis cases affect both

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eyes and have a mucopurulent discharge, while viral conjunctivitis typically affects one eye with watery discharge.[4] Conjunctivitis is usually spread through direct contact with the eyes via hands or objects contaminated with the virus or bacteria. It can also spread through respiratory tract droplets. Rare long-term complications and morbidity can include corneal ulceration and punctate keratitis, which impact the quality of life. Most cases resolve within 1–4 weeks without treatment. One of the environmental factors that contribute to the spread of conjunctivitis is poor personal and environmental hygiene.[5] Infrequent or hurried hand washing, sharing of personal items such as towels or pillows, or encountering contaminated surfaces can all spread the infection. A task force team from the Sri Aman Health Divisional Office, consisting of public health medicine specialists and medical officers, was formed to verify, investigate, and control this outbreak. The outbreak highlights the crucial role of primary care physicians in promptly identifying outbreaks of conjunctivitis, especially in close environments, such as schools and boarding facilities. Identifying groups of cases and promptly implementing public health measures can substantially decrease the spread of the infection. The participation of primary care in educating the community, promoting good hygiene practices, and ensuring timely referrals is vital in managing outbreaks before they escalate.

Despite its common occurrence, there is limited research on the epidemiology of conjunctivitis outbreaks in rural regions, especially in Southeast Asia. The aim of this report was to share the issue of a notable conjunctivitis outbreak in rural Borneo and its management, which provided valuable insights into the dynamics of the transmission of conjunctivitis and the effectiveness of public health interventions.

Materials and Methods

The investigation of the outbreak covered five primary and two secondary schools within the Sri Aman district from September 28, 2022, to October 22, 2022. The affected population included students and staff from boarding and nonboarding institutions. Case finding efforts were initiated in response to a notable increase in clinic visits for conjunctivitis. A case was defined as any individual presenting with redness of the eye, watery discharge, or discomfort. Conjunctival swabs were collected from symptomatic individuals for bacterial culture analysis. Data collection involved gathering demographic information, clinical symptoms, and exposure history. The analysis used version 27.0 of the Statistical Package for the Social Sciences (SPSS, IBM Corporation, NY, USA). Ethical clearance was obtained retrospectively from the Institutional Review Board via Letter No. NMRR ID-23-02601-MRY (IIR), dated 18/12/2023, and written informed consent was taken from the identified affected staff and parents of the affected students. Descriptive epidemiology was conducted following active case findings, along with the construction of an epidemic curve. A retrospective cohort study design was utilized to investigate this conjunctivitis outbreak, within a clearly defined and closed population, namely students and staff in specific schools. This setting allowed investigators to identify exposed individuals and facilitate the calculation of the exact attack rates. Consequently, this approach facilitated the direct computation of attack rates and relative risks, yielding clear epidemiological insights. To control confounding variables, we employed data stratification based on demographic factors such as age, gender, and type of residence. The validity of the data was ensured through rigorous verification processes, including cross-referencing reported cases with clinical records.

Results

A total of 224 cases of conjunctivitis were identified, resulting in an overall attack rate of 8.3%. More than half of these cases (61.0%) were of residents of boarding schools, with an attack rate of 13.0%. In contrast, the attack rate for individuals not associated with boarding schools was 3.9% [Table 1]. Students and staff residing in boarding schools were approximately three times more likely to develop conjunctivitis compared to their counterparts in nonboarding schools. The patterns observed in the epidemic curve (propagated) suggest that the illness was transmitted from person to person [Figure 1]. The first recorded case which surfaced on September 18, 2022, involved a student from a secondary school. The epidemic curve indicated that the minimum incubation period was 24 h, the maximum was 72 h, and the median incubation period was 48 h. The outbreak predominantly affected individuals aged 13–18 (56.6%), followed by those aged 7–12 (32.4%). The distribution of cases was nearly equal between males (51.3%) and females (48.7%) [Table 2]. Most cases were students (93.0%), and the remainder comprised staff (4.4%) and family members (2.6%). The epidemic curve illustrated that the spread of the pathogen occurred from one susceptible person to another. It also indicated that the transmission happened directly (person-to-person) or through infected objects. None required hospitalization; they were treated as outpatients or given self-limiting treatment. The first case occurred on September 18, 2022, involving a 15-year-old secondary school boy at a boarding school. The transmission occurred among schools as a result of family and social contacts. All ten swabs taken for bacterial cultures reported no growth. Control activities started on September 30, 2022, and activities for active

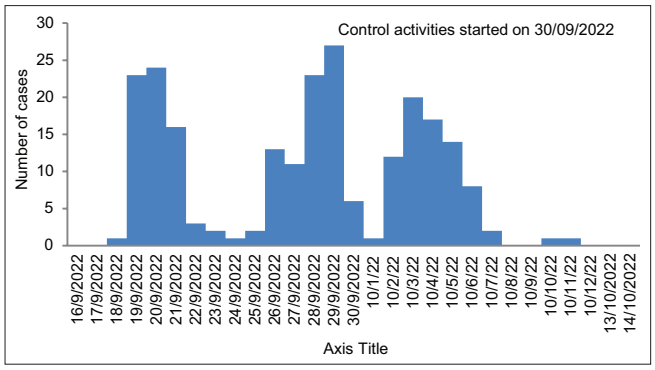

Figure 1: Epidemic curve (propagated) of conjunctivitis outbreak in Sri Aman indicating person-to-person transmission

case findings investigated 2455 contacts related to all seven schools of the students, the academic/supporting staff, and their family members. The outbreak was declared over on October 22, 2022.

Discussion

This institutional outbreak started from one boarding school and spread through the whole school and to other schools. Upon initial notification to the Communicable Disease Control Department of Sri Aman District Health Office, a significant accumulation of >50 conjunctivitis cases involving four schools had already been reported. Conjunctivitis is not on the list of notifiable diseases; therefore, there was a delay in the reporting and subsequent notification of the unfolding cases. This impeded the expeditious deployment of effective control and prevention measures, resulting in a heightened escalation of the severity of the outbreak.[6]

Bacterial conjunctivitis was initially suspected because of the shorter incubation period of the cases, the average symptoms of which developed 24–48 h after exposure. Swabs for bacterial culture are easily and readily available in rural districts. However, all ten conjunctival swabs tested for culture and sensitivity showed no growth. The lack of bacterial growth in conjunctival swabs suggested a viral etiology consistent with the epidemiological characteristics observed in this outbreak. The cause of this conjunctivitis outbreak was, therefore, viral in origin, like common viruses such as adenovirus, coxsackie, and enterovirus sp. It was evident from the epidemiological analysis of the acute conjunctivitis outbreak that residence in boarding schools was a significant risk factor.[7,8] Students residing in these facilities are approximately seven times more likely to contract conjunctivitis than their counterparts not in hostels. This increased susceptibility may be attributable to the combined effect of multiple variables, including shared living spaces with suboptimal personal hygienic practices, items for communal use, and the continuous proximity inherent in such settings of close living that facilitate efficient disease transmission.[1] In addition, the prevalence of interactions within and across various social and academic networks – including family members, classmates, and teachers – amplifies the transmission rate and thereby amplifies the overall size of the outbreak.

Table 1: Attack rates for pink eye in rural Borneo by school type, September 2022

School type	Total population (*n*)	Number of cases	Attack rate (%)
Boarding schools	1050	137	13.0
Nonboarding schools	1405	87	3.9
Overall	2455	224	8.3

Calculation of attack rate (overall): 224/2455×100=8.3%. Calculation of RR: Attack rate (boarding school)/attack rate (nonboarding school)=13.00%/3.9%=3.33. RR=Relative risk

Table 2: Characteristics of pink eye cases fulfilling the case definition in rural Borneo, September 2022 (*n*=228)

Variables	*N* (%)
Age	
Below 6	11 (4.8)
7–12	74 (32.4)
13–18	129 (56.6)
Above 18	14 (6.2)
Gender	
Male	117 (51.3)
Female	111 (48.7)
Occupation	
Students	212 (93.0)
Staffs	10 (4.4)
Others (family members)	6 (2.6)
Affected eye	
One side	89 (39.0)
Both side	139 (61.0)
Type of residence	
Boarding school	141 (61.8)
Nonboarding school	87 (38.2)

In response to the rising cases of conjunctivitis in Sri Aman district, several strategic measures have been implemented across various sectors. Initially, memos and letters were distributed to all health facilities, including clinics, hospitals, private practices, and the divisional pharmacy office, to inform them of the situation. Simultaneously, a comprehensive health education campaign was launched to improve awareness of personal and residential hygiene through multiple channels, such as school-based health talks, radio broadcasts, and social media outreach. The district education office was notified, leading to instructions issued to all teachers in Sri Aman District schools to undertake "gatekeeping" responsibilities. Furthermore, the divisional pharmacy office ensured that there was a consistent supply of Chloramphenicol

ointment (CMC) and eye drops in clinics and guaranteed availability of essential medical supplies.

Acute conjunctivitis is highly contagious, but it is not a life-threatening condition, and its transmission can be easily stopped if detected early. Event-based surveillance (EBS) is crucial in infectious disease epidemiology and control. EBS incorporates collecting, evaluating, and responding to data related to public health events that pose a substantial risk to human health by providing an early warning.[9,10] In Malaysia, conjunctivitis is not on the list of diseases that require mandatory notification. However, any abnormal occurrences, such as many ill individuals in a facility, warrant investigation. The primary advantage of EBS is its early detection capability.[11-13] EBS strategies strive to identify potential health threats at the earliest possible stage, often before the causative agent has been confirmed or transmission becomes widespread. As a result, such early detection paves the way for prompt and timely responses, effectively limiting the likelihood of widespread transmission of infectious diseases.

Students and staff living in boarding schools have about a three times higher likelihood of developing conjunctivitis than those in nonboarding schools. This markedly increased risk highlights the fact that boarding schools functioned as a key environment for the spread of disease, probably because of closer interactions, shared personal belongings, and communal living areas. Such findings underscore the importance of enhanced hygiene practices, early detection, isolation strategies, and targeted health education within boarding schools to reduce transmission during future outbreaks. Health education and awareness should be carried out regularly in schools and educational district offices emphasizing the role and importance of gatekeeping in schools. Upon detecting any infectious disease in a school, prompt isolation of the affected students can prevent rapid transmission of communicable diseases such as hand, foot, and mouth disease, measles, and COVID-19 among school children.[14] An unwell student should be advised to seek medical treatment and avoid attending class. Besides, schools with hostels should be advised to have frequent general cleaning in hostels and dorms, regularly using disinfectant properly. Hostels should have isolation rooms for sick students living in the hostel, especially for students far away from their homes.

The study acknowledges the potential for biases and other factors influencing the results. One potential bias is the reliance on self-reported symptoms, which may have led to underreporting or misclassification of cases. In addition, the lack of bacterial growth in conjunctival swabs could be attributed to inadequate sampling techniques or prior antibiotic use, potentially impacting the results.[15] To address these limitations, future studies should employ more rigorous sampling methods and consider the timing of sample collection with regard to the use of antibiotics.

The findings of this study have several important implications for primary care policy and practice. First, conjunctivitis should be added to the list of notifiable diseases to ensure prompt reporting and the rapid implementation of control measures. Prompt notification is critical in preventing the spread of infectious conjunctivitis, particularly in close-contact settings such as schools, where outbreaks can escalate quickly.[16-19] Health authorities must establish clear guidelines for the early detection and management of conjunctivitis outbreaks. These should include standard protocols for isolating and treating affected individuals to attenuate transmission.[18]

Conclusion

Epidemiological links, such as close contact with infected classmates and family members, contribute to outbreaks. Learning institutions should isolate cases during infectivity and emphasize regular health education and hygiene practices to prevent future outbreaks. Schools and health authorities should collaborate on awareness programs focusing on personal hygiene, including handwashing, avoiding infected individuals, and seeking early medical advice for symptoms. Primary care physicians play a crucial role in diagnosing and managing conjunctivitis, and effective communication between healthcare providers and public health authorities can strengthen outbreak control. Integrating conjunctivitis management into primary care policies can improve patient outcomes and protect community health.

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Conflicts of interest

There are no conflicts of interest.

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