

ORIGINAL ARTICLE

Distribution Pattern of Trachoma in Pakistan and Monitoring the Effects of Water Availability upon Disease prevalence- case study of Khyber Pakhtunkhwa

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ABSTRACT

Background: Trachoma is the most crucial infectious disease and one of the biggest vectors leading to worldwide preventable blindness. After cataracts and glaucoma, being the most prevalent diseases, trachoma acquired a third place among the most common ocular diseases. It is among the seven most neglected tropical diseases and is accounted for 0.006 to 0.008 billion people (mostly women) suffering from optical deterioration predominantly living in poor resource habitats.

Aim: To estimate the permeation of active trachoma and measure its burden in four districts of Khyber Pakhtunkhwa (KP). Additionally, it is aimed to determine the distribution patterns of the infection while considering factors such as, age, gender, and dwellings.

Methodology: The sample size (n=3036) estimation is undertaken while considering the past minimal prevalence of trachoma in the country. The data based on structured questionnaire and observations' study collected from four districts of KPK. Detailed analyses were conducted using SPSS 24.0 by using descriptive analysis, correlation and Chi Square test of independence.

Results and conclusion: The first thing accomplished was the testing normality of data using the Shapiro Wilk test, and it is found that all the variables were abnormal. It is found that in most of the cases, the use piped water strongly influences the contamination and lead to increment in disease. The correlation result shows significant results stating the effect of decrease of animals in house improved trachoma grading.

Keywords: Trachoma, Blindness, KPK, Semi-Structural Interviews

INTRODUCTION

Trachoma: Trachoma is a kind of sub-acute or chronic kerato-conjunctivitis, causing cicatrization with severe visual disability^{1,2}. There is simultaneous affection of the cornea and conjunctive. The causative agent being *Chlamydia trachomatis*³. It is a neglected contagious disease and is the most common cause of corneal opacity and one of the major causes of irreversible blindness^{4,5}. Trachoma is an endemic in certain areas for a long period of time and mostly present in low economic countries including Pakistan. WHO took the initiative to eliminate trachoma from all over the world^{6,7}.

Trachoma is an overall the eighth-common blinding disease. It is a known communal health problem in more than 55 states of the world mainly including African countries located in Southern Sahara, the Middle Eastern, and Asian nations^{8,9}. The highest prevalence of trachoma was revealed in Ethiopia and Sudan, where the infection was often found in more than 50% of children under the age of 10 years while trichiasis is found in up to 19% of adults¹⁰.

Ocular strains of *Chlamydia trachomatis* are accountable mostly for this avoidable blindness. The bacterium belongs to a comparatively small group of obligatory intracellular prokaryotes that can replicate only within an inclusion in the cytoplasm of the host cell¹¹. The disease tends to cluster in certain communities and the pathogenic bacterium has been observed to show more tendency of inducing infection.

A Guide for the assessment of Trachoma: Trachoma is not a novel infection, instead it is afresh to the world, dating back to 8000 B.C. An Arabian medical practitioner, Ibn-e-Isa, was the first one to elaborate on the various stages of trachoma. Soon after the prevalence of the disease, many nursing homes were founded in various parts of America and Europe¹⁴. The development of antimicrobials in the mid-20th century marked an important achievement in treating the infection. With new and improved antibiotics and therapies, the infection became a more preventable epidemic. However, the disease was never fully eradicated and currently existing in almost all developing nations^{15,16}.

Figure 1: WHO Simplified Grading System:

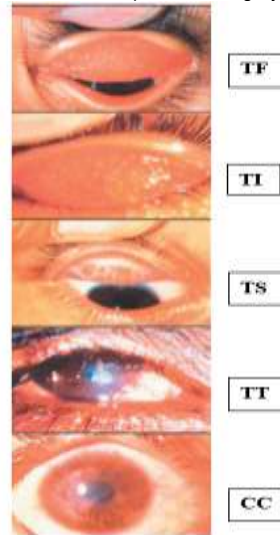


Table 1: Estimated number of globally affected individuals (in billions) with trachoma since 1981

Estimated Years	Active Trachoma	Trichiasis	Blind	Low Vision
1981	0.5	---	0.002	---
1990	---	---	0.0029	0.0038
1990	---	---	0.0059	---
1990	---	---	0.0028	0.0039
1991	0.41	0.01	---	---
2000	---	---	0.0038	0.0053
2002	---	---	0.0013	---
2003	0.084	0.0076	---	---
2008	0.04	0.0082	---	---

Pakistan during the 1950s was believed to account for more than 60% of overall blindness in the nation because in the initial years of independence, public health services were inadequate. Currently, the country bearing a population of over 0.2 billion

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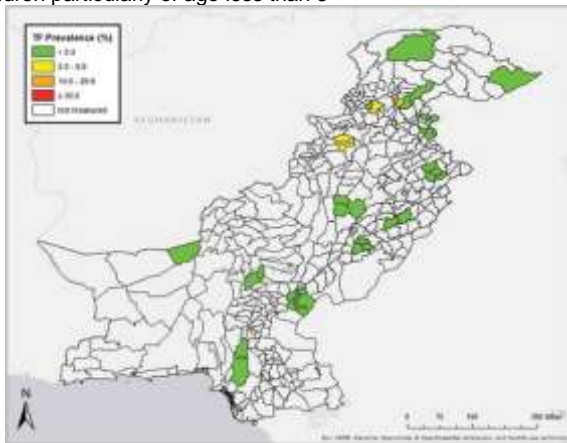
people comprises approximately 63% of the residents living in rustic areas⁵. From 2002 to 2004, the National Trachoma Task Force of Pakistan conducted a total of 233 Trachoma Rapid Assessments (TRAs) across the country. According to the findings, the highest prevalence of trachomatous inflammation was in children particularly of age less than five⁴.

In accordance with the analysis undertaken by Pakistan Facial & Environmental (F&E) situation in 2017, the threshold of disease is comparatively higher in those districts of the country where access to water and sanitation services are limited accompanied with poor hygiene and behaviors¹⁷.

Similarly, water scarcity is also a key factor in promoting transmission because of least water availability for basic hygiene majorly face washing². According to a case study conducted in Gambian village, water usage was compared among 18 families. Out of total, 16 families remained free from the disease while two of them, which were utilizing less water per person per day for cleaning children, suffered from active trachoma¹⁸.

Likewise, in Pakistan, several surveys have been conducted in the past that primarily estimated the frequency of existence and occurrence of this infection in the key areas where the percentage of affected population was expanded. Such types of programs have targeted their subject's overall nation wise whereas, the surveys that have been conducted with spotting specified districts are observed to be at infinitesimal levels¹⁹. Precisely, certain areas of Pakistan particularly in Khyber Pakhtunkhwa (KP) are least considered especially for the blinding disorder trachoma. One possible contributing factor for this negligence, among several can be the minimal resources for research which is not so common in developing countries.

Figure-2: Prevalence of trachomatous inflammation was in children particularly of age less than 5



Purpose of Study: In the current research, the prime objective is to estimate the pervasiveness of active trachoma and measure its burden in four districts of Khyber Pakhtunkhwa (KP). Additionally, it is aimed to determine the distribution patterns of the infection while considering factors such as, age, gender, and dwellings [20].

The results of this research work would be helpful for whole community of interest like students, researchers, policy planning, and public/private sector organizations in assessing and recommending health of the community to improve disease centered issues. Moreover, the findings will help to identify the key factors of Trachoma regarding living standards especially drinking water and toilet facilities and its impact on overall public health of the region. For this purpose, the present study aims to explore the effect of water-borne diseases on the health of people with the following objectives:

1. Impact of water sources upon trachoma
2. Water sources and their impact on overall public health
3. Time span required to bring water from source

MATERIALS AND METHODS

Study Area and Sample Size: The current research is conducted at district level in 4 districts of KPK inclusive, Kala Dhaka, Karak, Mansehra and Mardan. Preferably, RA methods are applied in communities or villages that more likely to be at socioeconomic disadvantage. The sample size estimation is undertaken while considering the past minimal prevalence of trachoma in the country (Section 3.2). The sampling technique is based upon a multistage method of CRS. In CRS clusters, sub populations are chosen based on geographical boundaries followed by the extraction of eligible participants from each cluster. The total sample that is 3036 taken at proportionally at all four districts.

Key informants: Most often, a two-phase design was used. In the first phase, selection of clusters is conducted and in the former phase, field visits were initiated⁴. For field trials, the selected areas were geographically highlighted on the map and the information about the population per district under study was acquired from reliable sources. Furthermore, participants from target community for survey were selected considering defined inclusive and exclusive criteria for them.

Study Period: Study conducted from April 2018 to June 2019.

Field Trails- Trachoma Rapid Assessment (TRA): TRA was created in 1999 and advertised as a quick and easy way to examine environmental risk factors, active trachoma in children, and trichiasis in women. This technique uses a convenience sample to pinpoint high-risk areas. It is focused on community involvement and has been promoted to be a useful method of deciding whether or not an area has an endemic case of blinding trachoma. TRA has been promoted as a practical approach for rating communities and prioritizing actions in the most severely afflicted areas²².

Collection of samples: Data gathering was regulated by designing open-ended questionnaires in combination with RA methods to obtain qualitative data in all the related domains in a more precise manner. In addition to the questionnaires, the research survey was spilt into structured interviews and observations that provided an insight of the landscape of trachoma prevalence in the selected areas. Data collection for rapid assessments can be done via,

- Existing (in literature) or designed (form past studies) questionnaires
- Semi-structured interviews or random ones as in group discussions
- Direct observations made during the field work
- Examinations performed in selected age groups

Data collection for this study was terminated after attempting for every possibility to reach the saturation point.

Clinical Outcomes: There were two main outcomes of the current research,

- Positive outcome
- Negative outcome

The positive fallouts were to treat the infection in time to prevent further complications. Upon early diagnosis, the patient if treated would be capable of eliminating the impacts of Trichiasis and the consequential corneal opacity accompanied with blindness.

Conversely, negative outcomes of this disease are to cause Trichiasis and then blindness due to corneal opacity in later stages. The results of this project provided an authentic prevalence report of active trachoma in Khyber Pakhtunkhwa and its relationship with environment.

Inclusion Criteria:

- Participants of age group six (6) months and above for both genders, six months of age is chosen because at this age children have their maternal immunity which can protect them from trachoma.
- Participants from Four districts of Khyber Pakhtunkhwa were selected randomly, subject to homogeneity in same area.
- Willingness

Exclusion Criteria:

- > Children of age group less than 6 months.
- > Children with different geographical domains.
- > Other ocular diseases such as follicular conjunctivitis, VKC etc.

Statistical Analysis: For conducting such interviews, checklist of trachoma akin questions was prepared in advance²¹. Most of the questions were inquired via semi-structured interviews that encouraged the key informants to communicate in an unconfined style. For analyzing the collected data, normality tests in addition to the statistical analysis were conducted using the SPSS version 21.

RESULTS AND DISCUSSION

In statistical analysis, normality tests (Table 1) were used to determine that either the data will be modeled by normal distribution or not. Two famous approaches are there to test the normality using SPSS, that is, the Shapiro-Wilk test Kolmogorov-Smirnov test.

For large samples, the Shapiro-Wilk test is preferred. The testing criteria for the Shapiro-Wilk test was the test value being greater than 5% or 0.05, only then the data is considered normal. In table 1.0, it can be observed that all the variables are abnormal

as values of the Shapiro-Wilk test are less than 0.05. By the virtue of this analysis, it was concluded that for the testing purpose, we must use the non-parametric approach that is, Chi-Square distribution for the purpose of association and independence.

Descriptive statistics were utilized to depict the fundamental highlights of the examination and to premise essentially every quantitative investigation. The results shown in table 2 were obtained by using medium as the measure of average and presents the average time of accessing the water.

Despite the median values being satisfactory, the greater number of affected people tend to portray the other side of the picture. Thus, a possible explanation of this is that the deadly disease has the high prospect of passing the infection even from a small portion of affected beings spreading the disease rapidly²².

In accordance with the data given in table 3.0 and the analysis represented in figure 1.0, in most of the cases, piped water is employed for all purposes of use. This indicates that if piped water gets contaminated then ultimately it will lead to an increment in disease, as any damage to the pipes will enhance the fire of disease, which will be hard to find and repair. The scenario of tube wells is almost similar as the same issue may arise in addition to the mixing of toxic materials in the underground water.

Table 2: Test of Normality

Trachoma Grading	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
	.520	3035	.000	.322	3035	.000
Water source	.213	3035	.000	.906	3035	.000

Tests of Normality

Table 3: Distribution of water resources

Water source	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
Piped water into dwelling	426	14.0	14.0	14.0
Piped water into yard/plot	885	29.2	29.2	43.2
public tap/ standpipe	281	9.3	9.3	52.4
tube well	866	28.5	28.5	81.0
dug well	314	10.3	10.3	91.3
spring water	264	8.7	8.7	100.0
Total	3036	100.0	100.0	

Table-4 Correlations Matrix

Spearman's rho		B	Animalsinhouse	Housenature	Watersource
Trachoma grading	Correlation Coefficient	1.000	-.114**	-.169**	.032
	Sig. (2-tailed)	.	.000	.000	.082
	N	3036	3036	3035	3036
Animals in house	Correlation Coefficient	-.114**	1.000	.328**	.027
	Sig. (2-tailed)	.000	.	.000	.137
	N	3036	3036	3035	3036
House Nature	Correlation Coefficient	-.169**	.328**	1.000	-.125**
	Sig. (2-tailed)	.000	.000	.	.000
	N	3035	3035	3035	3035
Water source	Correlation Coefficient	.032	.027	-.125**	1.000
	Sig. (2-tailed)	.082	.137	.000	.
	N	3036	3036	3035	3036

** Correlation is significant at the 0.01 level (2-tailed).

The above correlation matrix provides us with another clear picture of our objectives. The significant results are Trachoma Grading with Animals in house. This result is significant with negative correlation stating that as the number of animals in house decreases then trachoma grading gets better results. This finding has already been proven by various studies that animals at home cause attraction to flies and this leads to an increased number of trachoma infections. Therefore, this finding is important in this regard to conclude that in our targeted districts, the same situation is prevailing.

The other finding in the above correlation matrix is that nature of the house has significant correlation with trachoma grading. It helps us to conclude that if house nature is improved (better in structure), it will have low trachoma grading, that is trachoma grading will provide us better results.

This study highlighted that an important trigger in disease outbreak is water availability. It had been observed majorly that in all the districts, piped water was employed for almost all daily life activities. This indicated that the contamination of piped water can have big and long-term negative impacts on the health of residents. Less than 50% of inhabitants were even found devoid of piped water, and they had to bring useful water from distant places which imposes more threats of trachoma transmission. Additionally, water deprivation compels the inhabitants to use less water than required for maintaining personal hygiene. Along with clean water, other basic facilities were also found to be lacking, particularly in remote areas like Kala Dhaka and Karak in the present scenario. Comparatively, conditions were found to be better in Mansehra and Haripur as those areas have been better facilitated.

CONCLUSION

The idea behind this research is to explore the prevalence of Trachoma, impact of burden factors leading to health-related quality of life among Trachoma Patients. This research was conducted in four districts of KPK including Karak, Mardan, Kala Dhaka and Mansehra. The targeted community is homogenous in nature and socio-economic factors are almost the same except Mansehra. Mansehra is a comparatively developed area as compared to the other three districts and this was clearly visible in results.

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Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of ethical approval: Ethical approval was given by the University Institute of Public Health Committee and the Research Ethics group of the University of Lahore.

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REFERENCES

- Marques, A.P., et al., *The economics of vision impairment and its leading causes: A systematic review*. E Clinical Medicine, 2022. **46**: p. 101354.
- Organization, W.H. *WHO/Department of control of neglected tropical diseases. World Health Organization Prevention of blindness and deafness. Trachoma simplified grading card*. 2020; Available from: https://www.who.int/health-topics/trachoma#tab=tab_1.
- Wright, H.R., A. Turner, and H.R. Taylor, *Trachoma*. Lancet, 2008. **371**(9628): p. 1945-54.
- Khan, A.A., et al., *Prevalence of Trachoma in Pakistan: Results of 42 Population-Based Prevalence Surveys from the Global Trachoma Mapping Project*. Ophthalmic Epidemiol, 2020. **27**(2): p. 155-164.
- Khokhar, A.R., S. Sabar, and N. Lateef, *Active trachoma among children of District Dera Ghazi Khan, Punjab, Pakistan: A cross sectional study*. J Pak Med Assoc, 2018. **68**(9): p. 1300-1303.
- Salmon, J., *Kanski's Synopsis of Clinical Ophthalmology-E-Book*. 2022: Elsevier Health Sciences.
- Hasaballah, A.I., *Impact of paternal transmission of gamma radiation on reproduction, oogenesis, and spermatogenesis of the housefly, Musca domestica L. (Diptera: Muscidae)*. Int J Radiat Biol, 2021. **97**(3): p. 376-385.
- Rottenberg, M.E., A. Gigliotti-Rothfuchs, and H. Wigzell, *The role of IFN-gamma in the outcome of chlamydial infection*. Curr Opin Immunol, 2002. **14**(4): p. 444-51.
- Tanywe, A.C., H. Green, and R. Fernandez, *Perceptions and practices of community members relating to trachoma in Africa: a qualitative systematic review*. JBI Evid Synth, 2022. **20**(10): p. 2445-2474.
- Ngondi, J., et al., *Blinding Trachoma in Postconflict Southern Sudan*. PLOS Medicine, 2006. **3**(12): p. e478.
- Wang, H., W. Zhang, and Y.W. Tang, *Clinical microbiology in detection and identification of emerging microbial pathogens: past, present and future*. Emerg Microbes Infect, 2022. **11**(1): p. 2579-2589.
- Regassa, K. and T. Teshome, *Trachoma among adults in Damot Gale District, South Ethiopia*. Ophthalmic Epidemiol, 2004. **11**(1): p. 9-16.
- Négrel, A.D., et al., *Guidelines for rapid assessment for blinding trachoma / A.-D. Négrel, H. R. Taylor and S. West*. 2000, World Health Organization: Geneva.
- Marques, A.P., et al., *Global economic productivity losses from vision impairment and blindness*. EClinicalMedicine, 2021. **35**: p. 100852.
- Aragie, S., et al., *Water, sanitation, and hygiene for control of trachoma in Ethiopia (WUHA): a two-arm, parallel-group, cluster-randomised trial*. Lancet Glob Health, 2022. **10**(1): p. e87-e95.
- Sams, K.C., *The Elimination of Blindness: An Ethnographic Exploration of the Fight Against Trachoma in Niger*. 2013: University of South Florida.
- Malik, M., et al., *Exploring eye care pathways, patient priorities and economics in Pakistan: A scoping review and expert consultation study with thematic analysis*. Ophthalmic Physiol Opt, 2022. **42**(4): p. 694-716.
- Saber Osman, D., et al., *Mothers' Knowledge and Practices regarding Care of their Children Suffering from Blinding Trachoma*. Journal of Nursing Science Benha University, 2022. **3**(1): p. 165-177.
- Quesada-Cubo, V., et al., *The elimination of trachoma as a public health problem in Mexico: From national health priority to national success story*. PLoS Negl Trop Dis, 2022. **16**(8): p. e0010660.
- He, J., et al., *Time trends and heterogeneity in the disease burden of trachoma, 1990-2019: a global analysis*. Br J Ophthalmol, 2023. **107**(3): p. 337-341.
- Magaldi, D. and M. Berler, *Semi-structured Interviews*. Encyclopedia of Personality and Individual Differences, 2020. <2022wyperphd.pdf