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Prevalence, Risk Factors and Circulating Species of Trachoma in East Pokot, Baringo County, Kenya

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Abstract

Trachoma is an eye disease caused by Chlamydia trachomatis which can lead to blindness. Objective of the study was to determine the prevalence and associated risk factors for trachoma among people residing in East Pokot, Baringo County, Kenya. A cross-sectional study conducted in November 2016 using a multistage and simple random sampling procedure. Samples were taken from all members from selected household. A structured questionnaire was used to collect social demographic data. An eye swab was collected from each consenting adult, transported to KEMRI laboratories and tested for trachoma infection using PCR. Data was analyzed using multivariate logistic regression to determine the relationship between predicator variables and active trachoma. Trachoma infection was present in 180 (44.44%) out of the 405 study participants. Of those, 57 (14.07%) were confirmed PCR positive. A total of 31 (7.65%) individuals were infected with C. psittaci, 14 (3.46%) with C. pneumonia and 12 (2.96%) with C. trachomatis. Dual infection with both C. trachomatis and C. psittaci was present

in 7 (12.28%) participants, while that with both C. psittaci and C. pneumonia was present in 5 (8.77%) participants. Secondary education was significantly associated with increased odds of chlamydia trachomatis infection (OR 5.15, 95% CI 1.01-26.28, p > 0.05) and chlamydia pneumonia (OR 5.74, 95% CI 1.11-29.74, p > 0.05). Ethnic religion was associated with increased odds of chlamydia trachomatis infection (OR 4.87, 95% CI 1.04-22.79, p > 0.05). Infection with chlamydia spp is common in East Pokot and is associated with the significant morbidity.

Key Words: *Trachoma, Prevalence, Risk factors, Kenya*

Abbreviations and Acronyms

AMREF	*African Medical and Research Foundation*
DBS	*Dry Blood Spot*
ELISA	*Enzyme Linked Immunosorbent Assay*
GET	*Global Elimination of Trachoma*
IgG	*Immunoglobulin G*
JKUAT	*Jomo Kenyatta University of Agriculture and Technology*
KEMRI	*Kenya Medical Research Institute*
KIHBS	*Kenya Integrated Household Budget Survey*
KNBS	*Kenya National Bureau of Statistics*
MOH	*Ministry of Health*
NUITM	*Nagasaki Institute of Tropical Medicine*
PCR	*Polymerase Chain Reaction*
SAFE	*Surgery Antibiotics Facial cleanliness and Environmental Improvement*
UIG	*Ultimate Intervention Goal*
WHO	*World Health Organization*

Introduction

Trachoma is the leading infectious cause of blindness worldwide. C*hlamydia trachomatis*, causes blindness slowly and painfully and irreversibly [1]. Many people in endemic areas have clinical signs of active trachoma [2]. Trachoma is highly contagious and is spread by direct contact with an infected person's eye and nasal secretions by hand, fomites such as towels and eye seeking flies[3].

The clinical features of trachoma include active disease which is commonest in children below 10 years and chronic disease which is characterized by scarring and is common in adults. Early infection causes folliculitis and inflammation of upper eyelids conjunctiva. The eyelids eventually turn inwards due to scarring. This entropion leads to trichiasis of the eye ball due to scarring from eye lashes. This trauma combined with secondary infection leads to blindness.

Trachoma is a neglected tropical disease most prevalent in areas with poor sanitation, crowded living conditions and inadequate clean water [4]. Areas with low rainfall have a higher prevalence of active trachoma [5]. Smoke exposure from indoor cooking is also a risk factor for trachoma [6]. Young children under the age of 15years are the reservoirs of trachoma. Women being caregivers to children are 3-4 times at a higher risk of trachoma infection and blindness compared to men [7]. Keeping cattle close to the home promote effective breeding sites for eye-seeking flies. The control of trachoma requires the use of surgery for trichiasis, antibiotics to eliminate infection, facial cleanliness to reduce transmission and environmental change to improve sanitation [8.] This SAFE

(Surgery, Antibiotics, Facial cleanliness and Environment improvement) strategy was established by WHO in 1997 with a view to eliminating trachoma by 2020.

In Kenya trachoma accounts for 19% of all blindness making it the second leading cause of avoidable blindness [7]. It is considered endemic in six counties namely Samburu, Narok, Kajiado, Meru, West Pokot and Baringo [9]. In Baringo the most affected sub-county is East Pokot which is semi-arid and inhabited by nomadic pastoralist. The major risk factors for trachoma are wide spread in East Pokot but there is little information on the disease in this marginalized community. Whereas surgery and antibiotic treatment are available at the main hospital, the SAFE strategy has never been comprehensibly implemented in the community.

Past studies on trachoma in Baringo County relied on clinical signs and symptoms but no laboratory testing to reach a diagnosis [10]. Although they could not speciate the causative agent or even confirm the presence of *Chlamydia*, they found significant levels of folliculitis and trichiasis which was suggestive of trachoma. Since then various organizations have implemented both curative and preventative interventions but there have been no follow up studies to update the extent of the problem. Ours is the first study conducted in East Pokot to describe the presence of *Chlamydia trachomatis, Chlamydia psittaci and Chlamydia pneumonia*.-Using the WHO diagnostic algorithm and a trained ophthalmologist, we determined that 44.44% of our study participants had clinical trachoma. This prevalence is much higher than that reported in previous studies. However, we observed in our study that, the overall accuracy of clinical diagnosis was only 56.79% and therefore was not a reliable measure of the overall prevalence. These is in spite of the fact that the WHO algorithm does not capture all the signs and symptoms of clinical trachoma.

The main aim of this study was to determine the prevalence and risk factors for trachoma infection among pastoralist in East Pokot. It was anticipated that the findings would help inform effective public health interventions in the community.

Statement of the Problem

Trachoma is a public health concern in the world as it is a leading infectious cause of blindness and many more people are at risk of infection and it is estimated to cause a loss of $2.9 billion in productivity globally [11.] WHO estimates that 98% of trachoma is found in developing countries, primarily in sub-Saharan Africa and the Middle East, with considerable pockets of endemicity in Mexico, Latin America and Asia. In Kenya, trachoma accounts for 19% of the blindness making it the second leading cause of avoidable blindness [7]. Trachoma was found to be endemic in six counties (former districts), namely; Samburu, Narok, West Pokot, Kajiado, Baringo and Meru North where it was a public health concern causing trachoma inflammation in children aged 9 years and below trichiasis which leads to blindness in adults aged 15 years and above [7]. A national blindness survey conducted in the 1980's indicated that trachoma may still be endemic in 18 out of the 73 districts in the country. The Pokot are among the most affected communities in Kenya [12.] A national blindness survey report showed that fifty percent of children aged less than ten years had active trachoma compared to other communities with a prevalence of less than twenty five percent [7.] This can be attributed to the nomadic lifestyle of the Pokot as well as closely linked to environmental practices that support the life cycle of the house fly, which is the main transmission vector for the disease.

Efforts in trachoma elimination have been focused on the use of antibiotics to treat infection and surgery for trichiasis with less emphasis on environmental improvement and facial cleanliness to reduce transmission of organism, contributing to increased prevalence of trachoma [3]. Trachoma accounts for 19% of blindness and is the second leading cause of avoidable blindness in Kenya [7]. Therefore, it is important to determine the prevalence of

trachoma in Kenya to facilitate support visual disabilities in terms of preventative and curable treatments. This study seeks to fill this gap by determining the prevalence and factors associated with trachoma in East Pokot, Kenya.

Purposes of the Study

It is anticipated that the findings of this study add to the information on molecular epidemiology of trachoma in East Pokot, Baringo County, Kenya. Molecular epidemiology studies are essential before new trachoma control projects are funded and existing ones continued.

Objectives of the Study

To determine the prevalence, risk factors and circulating species of trachoma in East Pokot, Baringo County.

1) To determine the prevalence of trachoma in East Pokot, Baringo County.
2) To determine the circulating species of trachoma in East Pokot, Baringo County.
3) To establish the risk factors associated with trachoma infection.

Research Questions

1) What is the prevalence of trachoma in East Pokot, Baringo County?
2) What are the circulating species of trachoma in East Pokot, Baringo County?
3) What are the risk factors associated with trachoma in East Pokot, Baringo County?

Research Methodology

Design of the Study

This was a descriptive cross-sectional study. The study design enabled determination of the prevalence of trachoma and associated factors.

Population of the Study

The study population comprised of people living in East Pokot, Baringo County who were present in their homes at the time of the study. East Pokot sub-county, Baringo County is located in mid-west part of Kenya where most of the areas are in the arid and semi-arid land (ASAL).

Sample and Sampling Techniques

This was a cross-sectional study carried out in April 2019 and all participants hailed from villages in East Pokot, Baringo County. Google earth was used to map out a sampling area in the target location in East Pokot and selection was based on homesteads which are visible from google maps. The sub-locations were selected on the basis of the security situation as provided by the County administration. To achieve the most precise prevalence approximation, random sampling was done at both household and village levels for the reason that trachoma is known to cluster at the household and village level. The sample size was calculated as 400 people and all persons in selected households were sampled to get the sample size. To begin with, a region was selected in East Pokot and obtained from the county administrative office a list of all sub-locations in the selected study area. Cluster random sampling of 10 sub-locations was conducted and a simple random sampling within the clusters was done to select one village from each sub-location and a total of 10 villages were selected. Each village had community Health worker (CHW) who had a comprehensive list of all the households in their village and so using simple random sampling, 8 households per village were chosen at random from a hat. The sample size was 400 people, there is an average of 5 persons per household, a total of 10 villages were sampled and 8 households from each village were selected. The study team

visited the selected homesteads, provided information on the study and then sought consent. Parents and guardians gave consent for the children to participate in study. Villagers who had received treatment for trachoma in the last two years and those who came from households outside the selection were excluded as they would have biased the study on prevalence. Also, MDA campaigns are accompanied with health education and behavior change.

Instrument for Data Collection

A structured questionnaire was used to collect social-demographic data for each household and information on factors predisposing the participants to trachoma. The head of household responded to the questionnaire. The questionnaires were translated into the local language and the researcher assisted the participants to fill in the questionnaires.

Prior to the main study, a pre-test was undertaken in the neighboring Central Pokot which had similar characteristics to East Pokot but was not part of the study. The questionnaire was pre-tested among 10% of the study sample size to determine Validity and reliability. The questionnaire was supported by an observation check list. The tool was found to be valid to test what it was intended and a reliable tool to consistently measure the study variables. Necessary corrections, adjustments and paraphrasing of questions was done to have a better comprehension of the tool.

The questionnaire was administered by field assistants who were drawn from the Fred Hollows eye clinic in Chemolingot sub-district hospital. All research assistants were trained on the ground on how to administer the questionnaire, interview and collect data prior to study commencing. Both the questionnaire and the consent form were translated into both Kiswahili and the local Pokot dialect. The research assistants who were both conversant in both Kiswahili and Pokot dialect explained information in the consent form and questionnaire and asked for their consent.

An observation checklist was used to collect data on the environmental hygiene and cleanliness within the compound of the households of the survey, latrine coverage and usage, distance to water sources, cleanliness of children faces, density of flies, water storage at the household level and the presence of cattle within the compound supported by an observation checklist.

Method of Data Collection

Eye swabs were taken using a sterile swab. The participant was asked to look upwards and the ophthalmologist gently parted the eyelids. The swab was placed on the inner part of the conjunctiva and gently rolled towards the outer part over the conjunctival sac inside the lower lid to collect epithelial cells. Gloves were changed between participants or at any time there was suspicion of contamination. The swab was placed back inside a covered lid. To check for contamination, three people were randomly selected at each village to receive an air swab. The swab was passed 5cm away without making contact with the participant. The samples were taken to the laboratory and PCR assays done to isolate the chlamydia pathogen. Participants who were picked out as having active trachoma (TF and/or trachomatous inflammation intense (TI) in one or both eyes) were supplied with two tubes of 1 % tetracycline eye ointment and taught how to apply it. Participants with trichiasis were referred for management by trained ophthalmologists. All samples were handled as hazardous material and on arrival at the laboratory stored at -30^{o}C.

Method of Data Analysis

Data was cleaned and validated by examining the questionnaire for completeness and consistency. All data was then entered into a compute spread sheet, Microsoft Excel and analyzed using XLSTAT. Descriptive statistics were

used to summarize demographic profiles and determine prevalence expressed as mean (±SD), range, frequencies and percentages. Data was presented using graphs and frequency tables. Univariate and bivariate analysis using Chi-square for categorical variables. Multiple regression analysis to assess the independent effect of each determinant risk factor after controlling for all other factors and a T-test and Chi-square was used to compare means from the different populations. Statistical significance was set at $P<0.05$.

Results

Participants Characteristics

Four hundred and five participants who met the inclusion criteria were enrolled in this study. Of those, 184 (45%) participants were male and 221 (55%) participants were female. The age of the participants ranged from 3 days old to 82 years, with a mean of 14.7 years and a median of 8 years. A total of 345 (85%) participants had no formal education, while 45 (11%) had primary education and 15 (4%) had secondary education. Whereas 196 (48%) of the participants were Christians, 209 (52%) practiced traditional religion. Of the homesteads, 342 (84%) were pastoralist, 32 (8%) were traders, 19 (5%) were charcoal burners, 8 (2%) were farmers, and 4 (1%) were teachers. A total of 367 (91%) participants used water from a river, 21 (15%) used public tap water, 7 (2%) used water from a protected public well and 10 (3%) used water from an open public well. For cooking fuel, 383 (95%) participants used charcoal while 22 (5%) used wood. A total of 369 (91%) participants lived in houses with earthen floors while 36 (9%) lived in houses with cemented floors. Three hundred and sixty (89%) participants lived in houses with thatched roofs, 31 (8%) in houses with corrugated iron roofs and 14 (4%) in houses with tin roofs. Three hundred and eighty (96%) participants used bush as a toilet facility, while 17 (4%) used owned a latrine in the homestead.

Clinical diagnosis

A total of 180 (44.44%) of the eligible study participants were diagnosed as having trachoma while 225 (55.56%) had no symptoms of trachoma.

Laboratory diagnosis of trachoma

Eye swabs were taken successfully from all the 405 enrolled participants and shipped to the laboratory. Using Polymerase chain reaction (PCR), a total of 57 (14.07%) samples tested positive for either *Chlamydia trachomatis, Chlamydia psittaci* or *Chlamydia pneumonia*. Of these, 12 (2.96%) tested positive for *Chlamydia trachomatis*, 31 (7.65%) for *Chlamydia psittaci,* and 14 (3.46%) for *Chlamydia pneumonia*. Seven (7) participants had dual infection with both *Chlamydia psitacci and Chlamydia trachomatis,* while five (5) had dual infection *Chlamydia psitacci* and *Chlamydia pneumonia.* None of the participants had dual infection with *Chlamydia trachomatis* and *Chlamydia* pneumonia. None of the 405 study participants was infected concurrently with the three chlamydia species.

Table 1: Age distribution and each stage of trachoma

	Disease		
Age	Chlamydia trachomatis	Chlamydia psittaci	Chlamydia pneumonia
Children 9 years and below	5 (1.23%)	19 (4.69%)	3 (0.74%)
Adults above 9 years	7 (1.73%)	12 (2.96%)	11 (2.72%)

Agreement between laboratory and clinical diagnosis

A total of 180 (44.44%) out of the 405 participants were diagnosed as clinically chlamydia positive. Of these, 25 (13.89%) tested laboratory positive. On the other hand, 225 (55.56%) were diagnosed as clinically chlamydia negative and of these 20 (8.89%) tested chlamydia negative in the laboratory. The overall concordance between the clinical diagnosis and laboratory diagnosis was therefore 56.79%.

Table 2: Agreement between laboratory and clinical diagnosis

	Disease		
PCR	Present	Absent	Total
Positive	205	155	360
	(56.94)	(43.06)	100
Negative	20	25	45
	(44.44)	(55.56)	100
Total	225	180	405
	(55.56)	(44.44)	100

Factors Associated with Chlamydia positivity

Participants aged above nine years had significantly higher odds (OR 1.44, 95% CI 1.07- 14.12, p< 0.05) of having *Chlamydia pneumonia* infection when compared with those below nine years. Those who had secondary education had significantly higher odds of having *Chlamydia trachomatis* (OR 5.15, 95% CI 1.02-25.94, p<0.05) and *Chlamydia pneumonia* (OR 5.74, 95% CI 1.13-29.29, p<0.05) infection than those who had had no formal or primary education. Participants who practiced ethnic religions had significantly higher odds (OR 4.87, 95% CI 1.05-22.53, P<0.05) of being infected with *Chlamydia trachomatis* than those who practiced Christianity. Occupation, drinking water, cooking fuel, floor type, toilet facility and roof type were not associated with positivity.

Table 4.3a: Factors associated with Chlamydia Positivity

			Chlamydia trachomatis			***Chlamydia psittaci***			***Chlamydia pneumonia***		
Characteristic (n=405)	**Description**	**Freq (%)**	**OR**	**CI**	**P Value**	**OR**	**CI**	**P Value**	**OR**	**CI**	**P Value**
Gender	Female	221 (55)	Ref	-	-	-	-	-	-	-	-
	Male	184 (45)	0.85	0.27-2.74	0.79	1.51	0.72-3.14	0.27	2.22	0.73-6.75	0.16
Age	Less than` 9 years	204 (51)	Ref	-	-	-	-	-	-	-	-

	Above 9 years	201 (49)	1.44	0.45-4.60	0.54	0.62	0.29-1.31	0.21	3.88	1.07-14.12	***0.04**
Education Level	No Formal school	345 (85)	Ref	-	-	-	-	-	-	-	-
	Primary	45 (11)	1.00	-	-	0.88	0.25-3.02	0.834	2.67	0.69-10.24	0.153
	Secondary	15 (4)	5.15	1.02-25.94	***0.047**	1.89	0.40-8.81	0.419	5.74	1.13 - 29.29	***0.035**
Occupation	Charcoal	19 (4.69)	Ref	-	-	-	-	-	-	-	-
	Pastoralist	342 (84.44)	0.54	0.07-4.47	0.570	1.67	0.21-12.95	0.625	1.22	0.16-9.68	0.847
	Trader	32 (7.9)	0.58	0.03-9.86	0.707	0.58	0.03-9.86	0.707	-	-	-
	Farmer	8 (1.98)	1	-	-	1	-	-	-	-	-
	Teacher	4 (0.99)	1	-	-	1	-	-	-	-	-

*1. CI- Confidence interval 2. Freq- Frequency 3. OR- Odds Ratio

Table 4.3b: Factors associated with Chlamydia Positivity

			Chlamydia trachomatis			***Chlamydia psittaci***			***Chlamydia pneumonia***		
Characteristic (n=405)	**Description**	**Freq (%)**	**OR**	**CI**	**P Value**	**OR**	**CI**	**P Value**	**OR**	**CI**	**P Value**
Religion	Christian	196 (48)	Ref	-	-	-	-	-	-	-	-
	Ethnic	209 (52)	4.87	1.05-22.53	***0.043**	1.53	0.72-3.24	0.264	0.51	0.17-1.55	0.234

Drinking water	open public well	10 (2.47)	Ref	-	-	-	-	-	-	-	-
	protected public well	7 (1.73)	5.95	0.65-54.15	0.113	1.94	023-16.69	0.545	-	-	-
	public tap	21 (5.19)	1.79	0.22-14.64	0.589	0.58	0.08-4.49	0.605	-	-	-
	river	367 (90.62)	1	-	-	-	-	-	-	-	-
Cooking fuel	Charcoal	383 (94.57)	Ref	-	-	-	-	-	-	-	-
	Wood	22 (5.43)	0.62	0.08-5.04	0.656	1.78	0.23-13.73	0.578	0.32	0.07-1.54	0.157
Floor type	Cement	36 (8.89)	Ref	-	-	-	-	-	-	-	-
	Earth	369 (91.11)	0.47	0.099-2.24	0.347	0.90	0.26-3.13	0.873	0.57	0.12-2.65	0.476
Roof Type	Corrugated Iron	31 (7.65)	Ref	-	-	-	-	-	-	-	-
	Thatched	360 (88.89)	0.37	0.08-1.80	0.219	0.73	0.21-2.55	0.618	0.5	0.11-2.34	0.379
	Tin Roof	14 (3.46)	1.12	0.09-13.42	0.931	1	-	-	-	-	-
Toilet facility	Bush	388 (95.8)	Ref	-	-	-	-	-	-	-	-
	Own Latrine	17 (4.2)	1	-	-	-	-	-	-	-	-

*1. CI- Confidence interval 2. Freq- Frequency 3. OR- Odds Ratio

PCR positive gel results

Agarose gel image below shows an example of a positive results of PCR amplification of chlamydia genomic DNA for clinical diagnosis. Bands show presence of different chlamydia species run on 2.5% agarose gel. MW represent 100bp molecular weight. PC represents positive controls: *C. trachomatis* 461bp, *C. psittaci* 355bp and *C. pneumonia* 181bp and NC is the negative control. Lane 2 shows a positive band for *C. pneumonia*, lane 5 positive band for *C. psittaci* and lane 9 shows a positive band for *C. trachomatis* as shown in figure 1 below.

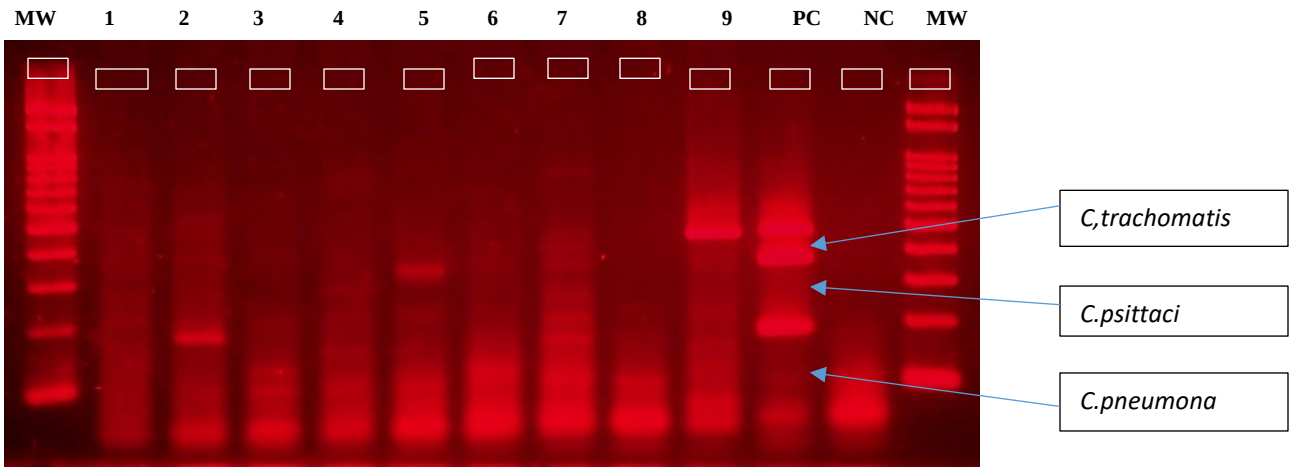

Fig 1: Chlamydia PCR positive gel results

Discussion

Our laboratory tests showed that a total of 45 (11.11 %) participants tested Chlamydia positive out of the 405 participants recruited for the study. This prevalence is still higher than previously reported but is a more accurate indicator of the extent of the problem. Of these 45, 25 had signs and symptoms suggestive of trachoma while 20 had been declare trachoma negative by the clinician. This means that the clinician could accurately detect trachoma in less than a fifth of those who actually had it, and detect the absence of trachoma in 91.11% of those who actually did not have trachoma. This suggests that the existing WHO guidelines used are much better at identifying non-cases and not nearly as good for detecting cases. The addition of a sensitive and specific point of care diagnostic tool would greatly enhance the ability of the clinicians to confirm their diagnosis and implement the right treatment and follow-up.

This suggests that the WHO algorithm has sub-optimal specificity and sensitivity even in experienced hands. Regardless the approach, trachoma is highly prevalent and a major cause of morbidity in East Pokot. The study used PCR to identify the different chlamydia species circulating in East Pokot. Seven (7) participants had dual infection with both *Chlamydia psitacci and Chlamydia trachomatis,* while five (5) had dual infection *Chlamydia psitacci* and *Chlamydia pneumonia.* None of the participants had dual infection with *Chlamydia trachomatis* and *Chlamydia pneumonia* and none had triple infection. It appears to us that multiple strains of chlamydiaceae are associated with trachoma. In Nepal a study reported the first evidence of involvement of multiple chlamydiaceae species in ocular trachoma. The bacteria they detected include *C. trachomatis*, *C. psittaci* and *C.pneumoniae* (13). In our study, we found that age had no effect on prevalence of *Chlamydia trachomatis* and *Chlamydia psittaci*. However, we found that the odds of having Chlamydia pneumonia were significantly higher in children above 9 years and adults (OR 1.44, 95% CI 1.07- 14.12, $p< 0.05$). This differs from previous studies that indicate that children less than 9 years are more likely to be affected by chlamydia (14). The reason for this is unclear and calls for further research. A previous study conducted in a similar region with the same geographical and climatic conditions also found trachoma to be significantly higher among children less than 10 years compared to other ages (Karimurio et al., 2006). Children above nine years old could be moving in and out of the village to school and herd cattle making them lose their immunity when not exposed to trachoma and small children could be getting cleaned by the mother more. Other people have found children under 9 years are the main reservoirs of the bacteria for trachoma; children under this age cannot take care of themselves but in our study age was of no consequence. People

from illiterate households were more likely to have active trachoma than literate households. This result is consistent with a study conducted in Ethiopia with similar findings reported from Tanzania. The likelihood of children been infected by active trachoma may be due to the effect of illiteracy of the mothers/fathers who are caregivers of the children. Compared with uneducated mothers, educated mothers may be more aware of the benefits of hygiene practices to the good health of their children.

Being a Christian was associated with the decreased odds of having trachoma (OR 4.87, CI 1.05-22.53, P<0.05). It was noted that Christians tended to live near the town where there was running water and other amenities and the economic situation appeared to be better. Those who lived in the interior were more likely to be practicing an ethnic religion. It is also possible that Christians had better knowledge on hygiene practices and received informal education from the church. The churches that we saw had amenities that were accessible to it congregants. A study done in Tanzania in a similar setting also found that those who practice Muslim religion had significantly lower odds of having trachoma infection (6). The Muslim faith requires its followers to frequently follow cleansing rituals so as to say their prayers which would mean they maintain a clean face. Our findings also show that those who attended formal education had significantly higher odds of having *Chlamydia trachomatis* (OR 5.15, 95% CI 1.02-25.94, p<0.05) and *Chlamydia pneumonia* (OR 5.74, 95% CI 1.13-29.29, p<0.05) infection than those who had had no formal or primary education. This is difficult to explain considering that formal education is expected to improve hygiene. On the other hand, one child with trachoma in a school can expose many others. Trachoma is highly contagious would be easily spread in a school setting.

We noted that the general population has little access to medical services and therefore, chlamydia infection goes untreated. Although the study was not designed to identify blindness, the study team noted several instances in which blind adults were guided by young children, suggesting that many of those infected at an early age go on to become blind in later life. Clearly, access to clean water, prevention and treatment for chlamydia infection should be made a priority by the County Health ministry. We observed several of the factors that are traditionally known to increase the likelihood of getting trachoma, including high domestic fly density, scarcity of water, open defecation and living close to domestic animals. Indeed, the study team spent significant amounts of time devising means to avoid the clouds of flies perching on every exposed part of the body. The fact that so many are actively infected is of major concern, and blindness in old age is a distinct risk for many. Every effort must be made to provide treatment, and also routine prophylaxis such as using azithromycin. Furthermore, programs to supply clean water and to teach basic hygiene should be started and sustained. Open defecation ought to be discouraged. The pastoral nature of life in East Pokot could be replaced in some instances with sedentary agricultural activities. Finally, since trachoma is so prevalent, mass drug administration should be implemented regularly.

Conclusions

i. The clinical prevalence of trachoma was 44.44% while PCR test confirmed 14.07% to have active trachoma.
ii. The three species of trachoma; *Chlamydia trachomatis, Chlamydia psittaci* and *Chlamydia pneumonia*, were found to be in circulation in the study area. There was presence of dual infections but none of the study participants had triple infection.
iii. Adults and children who were 9 years and above, those practicing ethnic religion and having secondary level education were at higher odds of having trachoma infection.

Recommendations

- Trachoma is still a public health concern in East Pokot. The high prevalence is above the WHO target for elimination of trachoma in 2020. The prevalence was 44.44% contrary to WHO recommended threshold of 10%. This indicates a need for a rigorous health education and promotion activities for trachoma awareness creation in the study area in order to control and prevent trachoma transmission and bring the prevalence levels down to below the <10% WHO threshold.
- The need for county government of Baringo in collaboration with the National government to invest in accessible healthcare facilities as some communities have to travel for long distances to access the nearest sub-county hospital which is Chemolingot hospital.
- The need for mass drug administration is important in attaining the WHO's goal of trachoma elimination by 2020 but they need to be cost effective in order to be a sustainable long term intervention tool. While administering MDA programs, it is important to assess whether transmission has decreased enough to stop treatment without resurgence of disease and in areas with low prevalence, this requires additional specific and sensitive surveillance tools.

Significance of the Study

Global elimination of trachoma is a priority on the World Health Organization elimination agenda. It is anticipated that the findings of this study add to the information on molecular epidemiology of trachoma in East Pokot, Baringo County, Kenya. Molecular epidemiology studies are essential before new trachoma control projects are funded and existing ones continued. The results of this study will help establish distribution of trachoma in East Pokot at the sub-district level with certainty thus ensuring trachoma endemic areas in East Pokot are not missed out and non-endemic areas are not included in mass drug treatment which takes place nearly annually. Trachoma is an infectious disease and hence detailed data on distribution is a valuable tool in the control and development of public health policies for trachoma. The data on distribution is useful in assessing the magnitude of the disease, determining priority areas, monitoring changes and advocacy. The lack of data in many countries remains an obstacle to trachoma control efforts.

Limitation of the Study

This study did not sample all homesteads from East Pokot because of security concerns and therefore may not provide the true prevalence of trachoma in the area. Secondly, other pathogens associated with eye infection were not studied and yet they are important differential diagnosis but this study only looked at *Chlamydia trachomatis* so this study cannot explain other causes of blindness.

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