Trachoma and Associated Factors among School Age Children 4-9 Years in Dire Dawa Administration, Eastern Ethiopia

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Abstract

Background: Trachoma is the leading infectious cause of blindness worldwide. It greatly affects children particularly young children in developing countries. However, there is a paucity of information in Dire Dawa Administration. The aim of this study was to determine the prevalence of trachoma and its associated factors among school children aged 4-9 years in Dire Dawa, eastern Ethiopia.

Methods: School-based cross-sectional study was conducted from March 15-30, 2019 in Dire Dawa Administration. A total of 823 school children aged 4-9 years were examined to identify clinical signs of trachoma. Multistage stratified sampling techniques were used to select the study participants. The data were collected using a pretested structured questionnaire and observation check list. Data analysis were done using Statistical Package for Social Sciences Version 25. Bivariate and multivariable logistic regression analyses were used to identify the predictors of trachoma. Statistical significance was considered at a p-value of less than 0.05.

Results: The overall prevalence of trachoma was 4.3% (95% CI: 2.9, 5.7), of which 74.3% had Trachomatous inflammation – Follicular, and 25.7% had Trachomatous inflammation- Intense. Family size >5 (AOR=2.24; 95 % CI: 1.53, 8.53), presence of more than 3 school children in the household (AOR=3.30; 95 % CI: 1.37, 5.94), family monthly income <5000 Ethiopian birr (AOR=2.02; 95% CI:1.46,6.25), presence of nasal discharge (AOR=1.54; 95% CI: 1.01,3.37), latrine unavailability (AOR=4.66; 95% CI:2.77, 9.04), presence of flies around the latrine (AOR=6.16; 95% CI:3.67,13.52) and distance of latrine > 10 meters away from the main house (AOR=6.11; 95% CI: 2.41, 11.46) were the factors significantly associated with trachoma.

Conclusion: This study revealed that school children aged 4-9 years old were affected by Trachoma. Therefore, it is very crucial to implement the SAFE strategy components, particularly focusing on facial hygiene and environmental sanitation improvement to reduce the problem.

Keywords: *Associated Factor; Children Aged 4-9 Years, Dire Dawa; Prevalence; Trachoma*

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Introduction

Trachoma is the leading cause of preventable visual impairment globally (Hu *et al.*, 2010). *Chlamydia trachomatis*, the causative agent of trachoma, is probably transmitted from infected to uninfected individuals by direct spread from eye to eye during close contact, spread from fingers to eye, indirect spread through fomites and eye-seeking flies (Jones, 1975).

Trachoma is highly endemic in many of the poorest and remote areas of 51 countries including Africa, Asia, central, and south America, Australia and Middle East. It is estimated that 2.2 million people are visually impaired worldwide. An estimated 232 million people are living in highly endemic areas. More than 21 million people have active (inflammatory) trachoma whereas 7.3 million people need surgery for trachomatous trichiasis (WHO, 2018). Africa is the

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second-largest continent which is the worst affected continent by trachoma. It is estimated that 18 million cases of active trachoma and 3.2 million cases of trichiasis exist in 29 countries of Africa (CDC, 2008). In areas where trachoma is endemic, active trachoma is common among school-aged children, with prevalence rate of 60–90% (Buchan *et al.*, 2017). In Ethiopia, the prevalence of trachoma among school children ranges from 1.3%, to 22.85% (Assefa *et al*., 2017; Admasu *et al*., 2015).

Trachoma affects both individuals and communities (Jennifer *et al*., 2013). It causes disability, distress, isolation, and stigma. In addition, it causes economic burden on the affected individuals and communities which costs between US$ 2.9 - 5 billion annually, increasing to US$ 8 billion including trichiasis (WHO, 2013).

Several factors have been identified as associated factors. Some of them are lack of water, absence of sanitation facilities, living with a trachoma case, overcrowded living conditions, practice of open defecation and poverty (WHO, 2012; Nigussie *et al*., 2015; Kelema *et al*., 2012; Assefa *et al*., 2017). Similarly age 1-5 years, low monthly house hold income, infrequent face washing habit, not using soap during washing, inadequate practice of washing face, poor practice of waste disposal, maternal literacy and large family size are among the risk factors (Asres *et al*., 2016; Assefa *et al*.,2017; Kelema *et al*., 2012; Nigussie *et al*., 2015). But still there is scarcity of study on the prevalence of trachoma and its associated factors in Dire Dawa Administration. Therefore, this study was aimed to assess the prevalence and associated factors of trachoma among school children in Dire-Dawa Administration, eastern Ethiopia.

Materials and Methods

Study design and setting

This study was conducted in Dire Dawa Administration, which is located in the eastern part of Ethiopia. Based on the Central Statistical Agency Population Projections of 2013, the total population of Dire Dawa was 354,510. Based on the report of 2013, 90.76% of the population had improved drinking water; 69.61% of the rural and 99.48% of the urban inhabitants having access to water in less than or equal to 10 minutes' walk from the source. Male adult literacy was 68.2 % and adult women literacy was 54.7 % (CSA, 2013). According to Dire Dawa administration education bureau in 2017, there were a total of 113 primary schools. A total of 45,309 children aged 4 to 17 years were enrolled both in government and non-government urban schools; whereas 26,812 children aged 4 to 17 were enrolled in government rural schools. Our study was conducted from March 15-30, 2019.

Study design and population

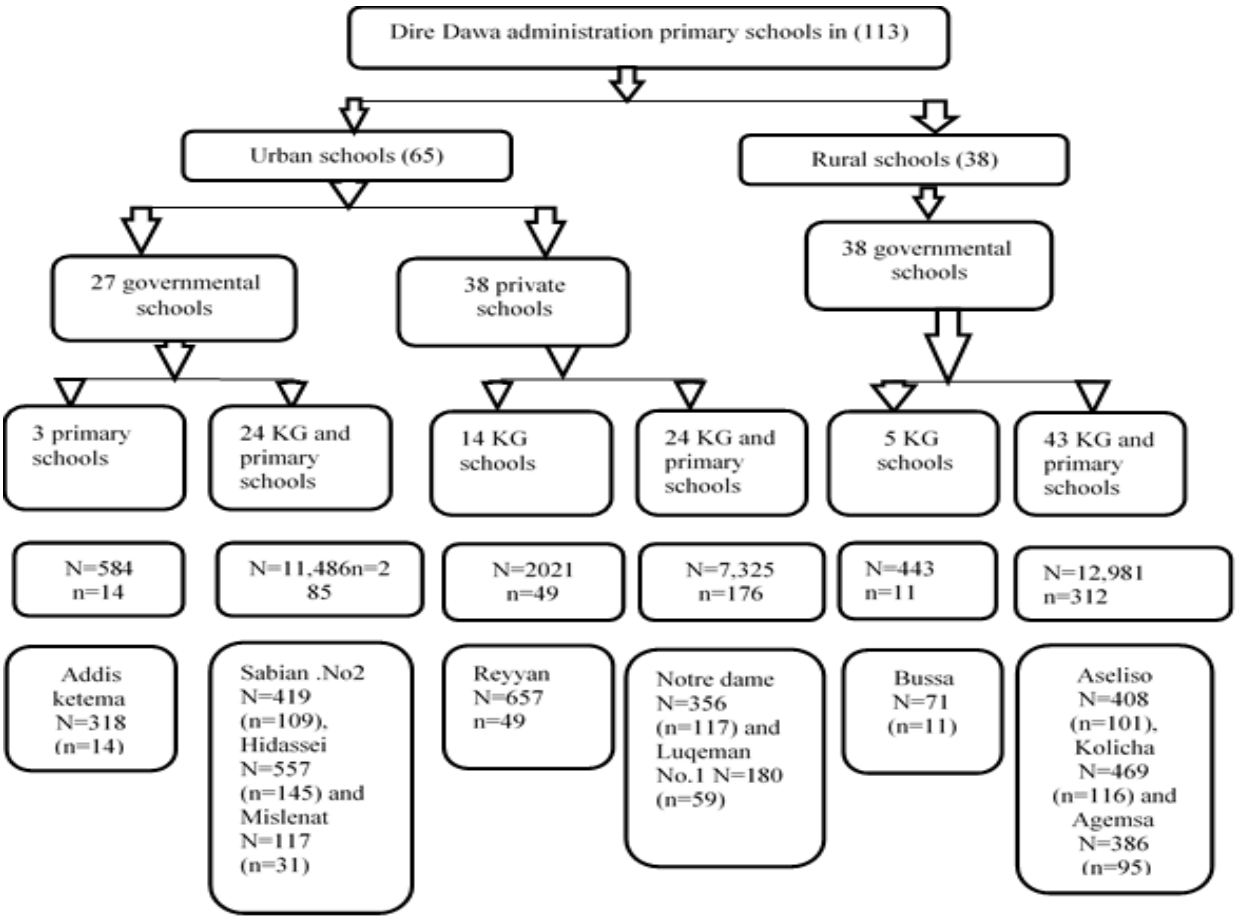
A school-based cross-sectional study was conducted among 4-9 years old children attending schools and their parents/guardian in Dire Dawa Administration.

Sample size determination

The sample size was determined by considering the prevalence of trachoma among 1-5 years old school children (23.9 %) and 6-9 years old school children (22 %) (Nigussie *et al*., 2017), 5% margin of error, non-response rate (6%) and 1.5 design effect. The final sample size was 847**.**

Sampling techniques

A multistage stratified sampling technique was employed to obtain the study participants. First, schools were grouped as urban and rural ones. Then, they were further stratified as kindergarten (KG), primary schools and both KG and primary schools. In this study, we selected 11 schools (7 urban and 4 rural) by simple random sampling techniques from total schools in Dire Dawa administration: one primary, two KG, and eight KG and primary schools. The sample size was allocated to the selected schools proportional to the number of their children. The first study participant was selected through simple random sampling technique (lottery method) and the rest were selected using systematic sampling method using class roster sheet as sample frame with intervals of six **(**Figure 1**)**.



Note: N= Total eligible students; n= sample of students

Figure 1: Schematic presentation of the sampling procedure

Data collection methods

Data were collected by trained data collectors via face to face interview with children's parents/guards using a structured questionnaire which was adapted from previous literature (Nigussie *et al*., 2017; Tadesse *et al*., 2017; Ferede *et al*., 2015; Kelema *et al*., 2012). Five BSc clinical nurses (data collectors) and two public health professionals (supervisors) participated in the data collection.

Clinical eye examination: After the interview, we made a detailed eye examination and trachoma grading by strictly following the WHO's simplified grading system standard methods and procedures (WHO, 1987). Initially child nose and eye observation were made by trained ophthalmic nurses. Then, both eyes were examined in the same sequence using an ophthalmoscope, pen torch and lens that had 2.5× magnifying power to identify clinical signs of trachoma: trachomatous inflammation-intense (TI), trachomatous inflammation-follicular (TF), trachomatous conjunctival scar (TS), trachomatous trichiasis (TT), and corneal opacity (CO). Aseptic technique with cotton tip applicators and alcohol was applied during eyelid eversion (turning out) (Thylefors *et al.*, 1987).

Observation: Data collectors observed eyes and nose for discharge, facial cleanness and presence of flies on a child's face, environmental sanitation such as the availability of latrine, its water supply and hand washing practice of the students, proper waste disposal system and the presence of flies in latrine area at the time of data collection.

Quality assurance

The questionnaire was prepared first in English then translated into local languages (Amharic, Somali and Afan Oromo) and back to English for consistency by different language experts. The data collection instruments were pre-tested before the actual data collection on 5% of the sample size out of selected schools and necessary amendments and corrections were made. A two day training was given for the data collectors and the supervisors by experienced ophthalmologists. They were trained by demonstration of selected pictures of different stages of trachoma with quizzes. Then, their diagnosis skill was assessed by an ophthalmologist. During the data collection, the data collectors were supervised at each site by health officer supervisors. The completeness of each questionnaire and other data collection instruments was checked on daily bases. Double data entry was used to ensure the accuracy and completeness of the data.

Operational definitions

Clean face: a child who did not have an eye discharge or nasal discharge and fly on the face at the time of visit.

Corneal opacity (CO): Easily visible corneal opacity over the pupil (WHO, 1987).

Liquid waste around the house: Domestic wastewaters come from a day-to-day living (generated from food preparation, washing, bathing and toilet usage).

Proper liquid waste disposal: Collecting the waste liquid into a closed place and dispersing it at the front of the main door of the house on a wide area at the night since the housefly is inactive at the night time.

Trachomatous conjunctival scar (TS): The presence of scarring in the tarsal conjunctiva (WHO, 1987).

Trachomatous inflammation-follicular (TF): Five or more follicles of >0.5 mm on the upper tarsal conjunctiva (WHO, 1987).

Trachomatous inflammation-intense (TI): Pronounced inflammatory thickening of the tarsal conjunctiva that obscures more than half of the deep normal vessels (WHO, 1987).

Trachoma negative: Children that do not have signs of active trachoma like a trachomatous conjunctival scar (TS), trachomatous trichiasis (TT) Trachomatous inflammation-intense (TI), Trachomatous inflammation-follicular (TF) and corneal opacity (CO) (WHO, 1987).

Trachomatous trichiasis (TT): At least one lash rubs on the eyeball (WHO, 1987).

Unclean face: Having any discharge on eyes, nose and/or fly on the face at the time of visit.

Data analysis

The data were cleaned and entered using EpiData Version 3.1 and exported to the Statistical Package for Social Sciences (SPSS) Version 25 software for analysis. Descriptive statistics were used to determine the prevalence of trachoma and logistic regression analyses was undertaken to assess the associated factors. Variables with a P-value of less than 0.25 in the bivariate analysis were considered as candidates for the multivariable logistic regression analysis. Variables with P-value of less than 0.05 at 95% confidence interval (CI) in multivariable logistic regression analysis were considered as factors associated with trachoma.

Ethics approval and consent to participate

The study was ethically approved by the Institutional Health Research Ethics Review Committee of the College of Health and Medical Sciences, Haramaya University. The purpose, risk and benefit of the study were well explained to the study participants and parents/guardians. Study participants were enrolled to this study after they had given their written informed consent/assent. Children with signs of active trachoma (TF, TI) were treated free of charge with 1% tetracycline eye ointments.

Results

Socio-demographic characteristics

In this study, 823 study participants were included, with 97.2% response rate. Majority (507 (61.6%)) of them were selected from urban school. Their mean (±SD) age was 6.9(±1.43) years. Two hundred eighty two (34.3%) and 270 (32.8%) were from KG and grade 1, respectively. A large number of the school children, 697(84.7%), were living in a household having less than or equal to 3 school children. Three hundred ninety-three (47.6%) were from family size of less than or equals to five individuals. Three hundred thirty-five (40.7%) mothers cannot read and write and four hundred forty-eight (54.4%) had a monthly income of ≤5000ETB (Table1).

Table 1: Socio demographic characteristics of the children aged 4-9 years and their parents /guardians from selected schools, Dire Dawa administration, Ethiopia, 2019 (n=823).

Characteristics		Number	Percent
Residence	Urban	507	61.6
	Rural	316	38.4
Age (years)	4-6	300	36.5
	7-9	523	63.5
Gender	Male	481	58.4
	Female	342	41.6
Educational status	KG	282	34.3
	Grade 1	270	32.8
	Grade 2	183	22.2
	Grade 3	88	10.7
Family size	<5	392	47.6
	≥5	431	52.4
Monthly family income (in ETB)*	≤5000	448	54.4
	>5000	375	45.6
Number of school children	≤3	697	84.7
	>3	126	15.3
Educational status of the mother/ guardian	Cannot read and write	335	40.7
	Read and write	140	17.0
	1-8	98	11.9
	9-12	220	26.7
	College and above	30	3.7
Father's job/occupation	Farmer	180	21.8
	Merchant	142	17.3
	Government worker	121	14.7
	NGOs	117	14.2
	Daily worker	221	26.9
	Others ***	42	5.1

******Shop Keepers, Gate Keepers of Business Centers and Bajaj Drivers* 1$=28 Ethiopian Birr***

Environmental Health related factors of participants

Majority (86.1%) of the study participants' families had to travel about 10 minutes to fetch water. More than half of the participants (58.4%) used less than 20 liters of water per capita per day, 95.4% had a latrine and 70.8% had proper liquid waste disposal. Three hundred twenty-six (39.6%) of the children washed their face once per day. Flies were observed in the thirty five (4.5%) of the visited latrines (Table 2).

Eye and nose observation

Seven hundred thirteen (86.6%), 763 (92.7%), 745(90.5%) and 709(86.1%) of the study participants had a clean face, no flies on their face, no eye discharge and no nasal discharge, respectively (Table 3).

Prevalence of Trachoma

The overall prevalence of active trachoma among the school children aged 4-9 years was 4.3 % (95%; CI: 2.9, 5.7). Among those who were trachoma positive, twenty six (74.3%) and nine (25.7 %) had trachomatous inflammation-follicular and trachomatous inflammation-intense, respectively.

Factors associated with trachoma

In the bivariate analysis, variables considered as candidates for multivariable analysis were age of the child, family size, number of school children living in the house, family income, presence of nasal discharge**,** time taken to fetch water, latrine availability, latrine distance to main house, presence of flies around the latrine, and methods of liquid waste disposal.

Table 2: Environmental related factors associated with trachoma among children aged 4-9 years from selected schools at Dire Dawa administration, Ethiopia, 2019 (n=823).

Characteristics		Number	Percent
Distance from water sources (in minutes)	≤10	584	70.9
	>10	239	29.1
Number of litters of water used per capital per day	<20	342	41.6
	≥20	481	58.4
Latrine availability	Yes	785	95.4
	No	38	4.6
Distance of latrine from main house (in meter) (n=785)	≤10	555	70.7
	>10	230	29.3
Flies around the latrine(n=785)	Present	35	4.5
	Absent	750	95.5
Ways of liquid waste disposal	Proper	583	70.8
	Improper	240	29.2
Liquid waste around the house	Present	169	20.5
	Absent	654	79.5
Child face washing frequency with water per day	1	326	39.6
	2	439	53.4
	≥3	58	7.0

Table 3: Findings from nose, eye and face observation of children aged 4-9 years from selected schools at Dire Dawa, Ethiopia, 2019 (n=823).

Characteristics		Frequency	Percent
Hygienic condition of the child's face	Clean	713	86.6
	Unclean	110	13.4
Flies on child's face	Present	60	7.3
	Absent	763	92.7
Eye discharge	Present	78	9.5
	Absent	745	90.5
Nasal discharge	Present	114	13.9
	Absent	709	86.1

In the multivariable analysis, children from a household with greater than 5 family size were 2.24 times more likely (AOR=2.24; 95 % CI: 1.53, 8.53) to develop trachoma compared to those from a household with less than 5 family size. The children living in the household with more than 3 school children in the household were 3.3 times more likely (AOR = 3.30; 95 % CI: 1.37, 5.94) to develop trachoma compared to the children living with less than or equal to 3 school children. The children from a household with latrine to main house distance greater than 10 meter were 6.11 times more likely (AOR=6.11; 95% CI: 2.41, 11.46) to develop trachoma as compared to their counterparts. The children whose families earn less than or equal to 5000 Ethiopian Birr per month were 2.02 times more likely (AOR=2.02; 95% CI: 1.46, 6.25) to develop trachoma as compared to the children whose families monthly income was greater than 5,000 Ethiopian Birr. Children who had a nasal discharge at the time of physical examination were about 1.54 times more likely (AOR=1.54; 95% CI: 1.01, 3.37) to develop trachoma as compared to those without nasal discharge. Children from a household with no latrine were 4.66 times more likely (AOR=4.66; 95% CI: 2.77, 9.04) to develop trachoma as compared to those with a latrine. The children from household with the presence of flies around their latrines were 6.16 times more likely (AOR=6.16; 95% CI: 3.67, 13.52) to develop trachoma as compared to those with absence of flies around their latrines (Table 4).

Table 4: Factors associated with trachoma among children of aged 4-9 years in Dire Dawa Administration, Ethiopia, 2019 (n = 823).

Characteristics		**Trachoma**		**COR(95% CI)**	**AOR (95% CI)**
		Yes N (%)	No N (%)		
Age of the child	4-6	7(2.3)	293(97.7)	0.35(0.14, 0.85)	1.13(0.42, 3.08)
	7-9	28(5.4)	495(94.6)	1	1
Family size	≤5	11(2.9)	381(97.1)	1	1
	>5	24(5.6)	407(94.4)	2.04(0.99, 4.23)	2.24(1.53, 8.53)
Number of school children living in the household	≤3	21(3.0)	676(97.0)	1	1
	>3	14(11.1)	112(88.9)	4.02(1.99, 8.15)	3.30(1.37, 5.94)
Monthly family income (in Ethiopian Birr)	≤5000	24(5.4)	424(94.6)	1.87(0.91, 3.88)	2.02(1.46, 6.25)
	>5000	11(2.9)	364(97.1)	1	1
Distance from water sources (in minutes)	≤10 walk	22(3.8)	562(96.2)	1	
	>10 walk	13(5.4)	226(94.6)	1.60 (0.79, 3.22)	1.45(0.07, 3.05)
Latrine availability	Yes	29(3.7)	756(96.3)	1	1
	No	6(15.8)	32(84.2)	4.89(2.90, 12.61)	4.66(2.77, 9.04)
Distance of latrine from main house (in meter) (n=785)	≤10	7(1.3)	548(98.7)	1	1
	>10	23(10)	207(90)	7.70(2.68, 20.577)	6.11(2.41, 11.46)
Flies around the latrine (n=785)	Present	7(20)	28(80)	7.10(3.04, 0.26)	6.16(3.67, 13.52)
	Absent	23(3.1)	731(96.9)	1	1
Liquid waste around the house	Present	11(6.5)	158(93.5)	1.83(0.88, 3.81)	1.16(0.36, 3.75)
	Absent	24(3.7)	630(96.3)	1	1
Nasal discharge	Present	9(7.9)	105(92.1)	2.25(1.03, 4.938)	1.54(1.01, 3.37)
	Absent	26(3.7)	683(96.3)	1	1

COR: Crud Odds Ratio; AOR: Adjusted Odds Ratio; CI: Confidence Interval

Discussion

In this study the overall prevalence of trachoma was 4.3%. Of which 74.3% had Trachomatous inflammation–Follicular, and 25.7% had Trachomatous inflammation-Intense. Family size, presence of more than 3 school children in the household, monthly income, presence of nasal discharge, latrine availability, the presence of flies around the latrine and latrine distance to main house were the factors significantly associated with trachoma.

The prevalence of trachoma in this study is higher than the ones found in studies conducted in Harar, Ethiopia (1.3%) (Assefa *et al*., 2017) and Gambia (2.5%) (Hording-Esch *et al*., 2018). The higher prevalence in our study may be due to the lack of direct interventions against trachoma like mass chemoprophylaxis and health education by the Ministry of Health and non-governmental organizations in Dire Dawa. However, this finding is lower than those reported by previous studies conducted in Dawro Zone, Ethiopia (22.85%) (Admasu *et al*., 2015), Kenya (18.6%) (Nyamwaro, 2016), Nigeria (17.5%) (Mpyet *et al*., 2012) and Car-Nicobar Island, India (6.8%) (Malhotra *et al*., 2016). This difference might be due to the better availability of water in Dire Dawa and the expanded health service coverage and utilization in the town.

In this study, the family size and the presence of more than 3 school children in the household were significantly associated with the occurrence of trachoma. This finding is supported by the previous study conducted in west Gojjam zone, North West Ethiopia (Nigussie *et al*., 2015) and two Gambian regions (Hording-Esch *et al*., 2018). The reason might be the fact that the number of individuals living in the house increase the burden of work load to the caregivers and fail to give hand and face hygienic care for their children who could not care themselves. Those infected children might play together with close contact which can facilitate for transmission of trachoma.

In the present study, the households' monthly income of less than 5000 ETB was significantly associated with the occurrence of trachoma. This finding is in line with the ones found by studies conducted in Ethiopia in BasoLiben district (Kelema *et al*., 2012), Gondar (Asres *et al*., 2016), and Harari Region (Assefa *et al*., 2017).The possible explanation could be the effect of poverty on health care accessibility, affordability of buying hygienic materials (like Soap), and high chance of sharing tools (like towels or /and eyeglass).

In this study, lack of latrine was significantly associated with the risk of trachoma. This finding is supported by previous studies conducted in Ethiopia; in Gonji Kolella district (Nigussie *et al*., 2015), Amhara region (Tadesse *et al*., 2017), Baso Liben District (Kelema *et al*., 2012), Dera district (Almayeho *et al*., 2015) and Zala district (Mengistu *et al*., 2016). The absence of latrine at the household level may facilitate open field defection and creates an opportunity for flies to bread in the surrounding environment, which contributes to the occurrence of trachoma.

In the current study, latrine distance greater than 10 meters from the main house was significantly associated with the risk of trachoma. This finding is similar to the findings by other studies conducted in Ethiopia i.e. Gonji Kolella district, West Gojjam zone (Nigussie *et al*., 2015), North and South Wollo Zones of Amhara Region (Tadesse *et al*., 2017) and Zala district Gamo Gofa Zone, Southern Ethiopia (Mengistu *et al*., 2016).The far distance of the latrine from the main house may increases open defecation particularly by children and old persons at night and this leads to increment the burden of fly in the environment, which results in higher transmission rate of trachoma.

In the present study, the presence of flies around the latrine was significantly associated with the risk of trachoma. This finding is in line with the report from a study conducted in Bijago's Archipelago, Guinea (Last *et al*., 2014). This could be due to the presence of flies around the latrine carry contaminants or bacteria that increase the chance of trachoma transmission and acquiring.

In this study, the presence of nasal discharge was significantly associated with the occurrence of trachoma. This finding is consistent with other previous studies conducted in two Gambian regions (Hording-Esch *et al*., 2018) and North and South Wollo Zones of Amhara Region (Tadesse *et al*., 2017).The reason could be that nasal discharge increases the chance of contact with flies on face which would result in increment of the transmission of trachoma.

The strength of this study is relatively the sufficient sample, the multiple data collection strategies and the generating of locally relevant evidence regarding trachoma and its predictors Nevertheless, due to the cross-sectional nature of the study, it was impossible to establish causal relationship between the dependent and the independent variables. In addition, bacteriological laboratory test was not used for confirmation of clinical diagnosis.

Conclusion

The study found that the overall prevalence of trachoma infection among school children in the Dire Dawa Administrative was low compared to the WHO thresholds (>10%). Trachoma Follicular and Trachoma Intense were found from this study. The factors significantly associated with trachoma were family size, number of school children living in the household, latrine inaccessibility, low household income per month, unavailability of latrine, presence of flies around the latrine and presence of nasal discharge. Therefore, it is very crucial to implement the SAFE strategy components particularly focusing on facial hygiene and environmental sanitation improvement to reduce the problems.

Acknowledgements

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Conflict of Interest

We declare that we have no conflict of interest.

Authors' contributions

HM, FW, JM and AG designed the study, participated in data collection, analysis, interpretation, and write-up, drafted the manuscript. All authors read and approved the final manuscript.

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