Relative Burden of Neglected Tropical Diseases Among School-Age Children in Rural and Urban Slum Settings in Eastern Ethiopia

Getachew Kabew Mekonnen * , Fitsum Weldegebreal , Assefa Desalew , Temam Beshir Raru , Ukash Umer , Kedir Urgesa

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Article

Relative Burden of Neglected Tropical Diseases Among School-Age Children in Rural and Urban Slum Settings in Eastern Ethiopia

Getachew Kabew Mekonnen [1,*], Fitsum Weldegebreal [1,2], Assefa Desalew [3,4], Temam Beshir Raru [5], Ukash Umer [1] and Kedir Urgesa [1]

[1] School of Medical Laboratory Sciences, College of Health and Medical Sciences, Haramaya University, P.O. Box 235, Harar, Ethiopia
[2] Laboratory Bacteriology Research, Faculty of Medicine and Health Sciences, Ghent University, Corneel Heymanslaan 10, Ghent, Belgium
[3] Department of Pediatrics and Child Health Nursing, School of Nursing, College of Health and Medical Sciences, Haramaya University, Harar, Ethiopia
[4] Department of Obstetrics and Gynecology, Leiden University Medical Centre, Leiden University, the Netherlands
[5] School of Public Health, College of Health and Medical Sciences, Haramaya University, P.O. Box 235, Harar, Ethiopia
* Corespondence: gechmicro@gmail.com

Abstract: Introduction: Despite the determination to succeed in eliminating neglected tropical diseases, these have been increasing within certain endemicities, particularly in depriving region. **Objective:** This study aimed to assess the relative burden of neglected tropical diseases in rural and urban slum settings in Eastern Ethiopia. **Methods:** A comparative cross-sectional study was conducted from February 25 to April 30, 2024 with a multistage random sampling technique used. A survey tool with the integration of the spectrum was employed. Data were entered using Epi-Data version 3.1 and analyzed using STATA 16. Descriptive statistics and multivariable logistic regression analysis was used to identify the risk factors and the level for statistical significance was declared at p-value < 0.05 with 95 % CI. **Result:** The response rate was 93 % and the mean age of house heads was 31.6 (Range; 18. 63) with 5.7 average family size. The overall prevalence of NTDs among study participants was 22.6 % (95% CI; 20.2, 25.2); urban slum it was 15 % (95% CI; 12.2, 18.4) while it was 29.8 % (95% CI; 26, 33.9) in rural. Though there is no statistically significant difference, the relative prevalence of NTDs in rural to urban was two. The multivariable analysis provided that the risk factors associated with NTDs were government employment (AOR: 12.5 (1.17, 132.4)), good income (AOR: 0.13 (.03, 0.57)), Child playing with soil (AOR: 5.8 (1.52, 22.0)); child hand washing at critical times (AOR: 11.2 (1.7, 74.9)), presence of flies in the child faces (AOR: 20.3 (4.7, 88.6)) and type of drinking water sources (AOR: 0.11 (0.02, 0.73)). **Conclusion:** the burden of NTDs was moderate in the study area dominated by STH, Trachoma, and scabies. Socio economic and WASH factors were found to be associated with NTDs. Collaborated efforts among stakeholders are crucial to prevent and control NTDs.

Keywords: neglected tropical diseases; urban; rural; burden; risk factors; Ethiopia

1. Introduction

1.1. Background

The NTDs are deadly diseases which impact globally more than 1.7 billion people, with 40% of whom live in Africa while many of them are preventable [1] (Zaman et al., 2020). Neglected tropical diseases (NTDs) comprise a diverse group of communicable diseases and have proliferated fast in tropical and subtropical climates[2]. These diseases are termed "neglected" because they disproportionately affect the poor population of women and children, but NTDs have got limited

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attentions from the global health agenda and are almost ignored by global funding agencies [3]. They have long-term consequences, such as disfiguring, disability, blindness, and cause of malnutrition, cognitive impairment, and stunted growth for children, thus perpetuating the cycle of disease and poverty[4]. Many NTDs also impact individual quality of life, and many of the problems are related to impairments, stigma and poverty [5].

A number of NTDs share not only the geographical distribution, but also a common feature which are skin involvement, intimately associated with rural poverty, inadequate sanitation, limited clean water, and inadequate healthcare delivery and preventive measures; and dwellers live in proximity to pathogens and diseases vectors [6,7]. Globally, 200 million people are infected with schistosomiasis, and 120 million with lymphatic filariasis in 83 countries[8,9]. Onchocerciasis affects nearly 37 million people in 34 countries, and is most abundant in Africa, with small foci in southern and Central America[10], while trachoma affects 84 million people globally. M[11]ore than 4.5 billion people are at risk of infection and nearly 2 billion are infected with STHs[12].

A *Chlamydia trachomatis* bacterial infection causes trachoma, the most prevalent infectious eye disease cause of blindness in the entire world. Follicles on the tarsal conjunctiva are a result of this bacterial infection, which also manifests as redness, irritation, and sensitivity to light[13]. Hand-to-eye contact, mosquitoes, or flies searching for human eyes are the main methods of transmission for this illness[14,15]. Children less than 9 years of age are affected more seriously from Trachoma [16] and half of the global burden of active trachoma is distributed in five countries including Ethiopia [17]. Scabies infection is also among the leading NTDs that causes superficial burrows, itching especially at night, a generalized rash and secondary infection on the head, face, neck, armpit, elbow, wrist, palms, buttocks and soles[18]. It remains one of the commonest skin diseases seen in developing countries including Ethiopia [19].

Inequalities are multidimensional, and many interrelated layers can be recognized in NTDs. Firstly, the disease prevalence among disadvantaged people across the globe with little public voice contributes to their neglect and inequality in receiving attention. Stigma due to cultural and social factors is a major obstacle to sufficient awareness, timely help-seeking behavior, and proper treatment and this neglect has intensified during the COVID-19 pandemic[20]. These can result in high death tolls due to NTDs if control measures aren't prioritized now (Aborode et al., 2022). Rural and urban populations have disparate socio-demographic and economic characteristics, which have an influence on equity and their health seeking behavior (Begashaw et al., 2016). Moreover, there is a limitation of knowledge of NTDs' healthcare seeking behavior in these high risk communities [21].

Despite the determination to succeed in eliminating NTDs, these diseases showed re-emergence within certain endemicities, particularly in WASH deprived regions [22]. Measuring the specific burden of NTDs is an important in evaluating health-care interventions and treatments, and understanding the burden of diseases[23] (Eiser and Morse, 2001). To improve the surveillance and control of NTDs, the integrated approach is the new recommendation of the WHO[24]. Furthermore, benchmarking the current status of NTDs in the country is important to monitor and evaluate the progress in the implementation of interventions and their impact [25]. However, in Ethiopia, particularly in the current study area, a limited study was done on the burden of NTDs. Therefore, this study aimed to investigate the relative burden of Neglected Tropical Diseases among children in urban slums and rural settings in Eastern Ethiopia.

2. Materials and Methods

2.1. Study Setting

This study was conducted in the Babile District of Oromia regional state and the Amir Nur District of Harari Regional State. The two districts were randomly selected to represent the rural and urban slum communities. Harari Regional state is one of the regions in Ethiopia found 526 Km away from Addis Ababa to the east. This regional state includes nine districts. Amir Nur district is one of the urban districts in the Harari regional state that includes three urban Kebeles namely 01, 02 and 07 and it has 24, 215 total population. The population of 01, 02 and 07 Kebeles are10, 674, 7,713, and

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5,828, respectively. The urban kebele 01 has urban slum Ganda fero village and it includes 1178 households with 685 vulnerable under five children. The other rural study sites were Bisidimo and Ifadin Kebelles in Babile district which is found 540 Km away from Addis Ababa and 23 Km from Harar town to the eastern direction. The number of children aged from 1-15 of age in Bisidimo and Ifadin Kebeles are 3,582 as per the unpublished Babile district Administration Report, 2023.

2.2. Study Design and Period

A community-based comparative cross-sectional study was applied from February 25 to April 30, 2024.

2.3. Study Population

All households with children aged less than 18 years and their house heads living in the selected settings (districts) were the source population. All randomly selected households children in the Babile and Amir Nur districts and their house head who were available during the study period were our study population. Children less than 18 years old who lived in the selected kebeles with their family househead were included in the study. Seriously ill children, and whose age not known during data collection were excluded. For the parasitological investigation study, children taken deworming drugs within the past three months prior to the data collection period were excluded from the study.

2.4. Sample Size Determination and Sampling Techniques

The sample size was determined using a double population proportion formula by considering the following assumptions: 95% confidence level, 80% power of the study, and 10% non-response rate, and population ratio of 1:1 (two comparison groups): The overall helminths infection 36% detected in among rural schoolchildren in Tachgayint woreda, Ethiopia[26], and assuming the 23% prevalence of STH among school-age children in Jimma town[27] the sample size become 490. The calculated sample was doubled, with 2 design effect with 15 % non-compliance assumption, the final sample size was 1, 126.

Based on the purpose of the research we selected Amir Nur Urban slum district from Harar town, Harari region, and Bisidimo rural district from the nearby rural districts of East Harargie Zone, Oromia region. Then, two kebelles were randomly included in the study from the each of selected districts, and equivalent numbers of samples were allocated to both the rural and urban slum districts. Then, the sample size was distributed over the selected kebeles proportion to the target groups. The eligible households with children aged 1 to15 years old from each kebeles were selected by systematic random sampling technique and the kth value was used to determine interval of HH to be included in thestudy. Finally, the lottery method was used to select a child and in houses when more than one eligible child in the selected household. The house head of the child was also take part of the study.

2.5. Data Collection Method

2.5.1. Data Collection Tools

Accordingly, the required data for the study were collected using an integrated tool containing structured questionnaire, clinical checklists and standard laboratory investigations. Data were collected by trained nurses' and laboratory professionals in collaboration with local healthcare workers (health extension workers). This all-involved household mapping, selection of study households and children, rapid visual and clinical examination of the common NTDs, stool sample collection and laboratory investigations. Head of the selected HH were interviewed about their household socio-demographic characteristics, behavioural, environmental, and other clinical enabling factors including some healthcare-seeking behaviors for the sick child. Examinations were conducted in a systematic way of the skin (with the exception of the genital area), hair, nails and oral cavity and the child's name/address were recorded and sent to Hiwot fana University Specialized Hospital for further diagnosis and treatment, if the cild recognized with any skin lesion. A potassium

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hydroxide test was used to confirm some doubtful skin cases where as physical examination and grading of trachoma was carried out by trained nurses using the WHO simplified trachoma grading scheme[28].

At the same time, nurses were taking anthropomethric measurements in order to evaluate nutritional status of the study subjects. The levels of stunting (height for age z-scores), underweight (weight for age z-scores), and wasting (weight for height z-score) were calculated using Antro plus WHO software. Thus, children who were below − 2 standard deviations for height for age, weight for age, and weight for height were defined as stunted, underweight, and wasted, respectively. Wasting indicates recent weight loss, whereas stunting usually results from being chronically underweight[29].

For parasitological examination (STHs) children with gastrointestinal tract (GIT) complaints were requested to give about 2 grams of stool specimens with a clean stool cup. The collected stool samples were then processed and examiner using a sedimentation concentration technique. Finally, the research team (nurses, community healthcare workers and laboratory scientists) could trace, examine and treat all household contacts of children diagnosed with any NTDs [30].

2.5.2. Data Quality Control

The data collection tool was initially prepared in English scientific language and translated to local languages, Amharic Oromifa and Harari. Then, it backed to English language to check its consistency. A pretested was conducted in other similar communities and amendments were carried out in few ambiguous questions. We recrutted data collectors of well trained health professionals (Nurses, Health officers, and Laboratory Scientists and Environmental professionals) and training was given on the pupose and data collection techniques of the study. The data was checked regularly for any missing values, inconsistency, incompleteness and illegibility. Questionnaires found with missing values and inconsistencies were excluded and an imidate feedback was given to avoid similar errors. All laboratory procedures were carried using quality reagents and based on standard operating procedures. Supervisors were assigned to cosely assist the data collectors and take appropriate remidal actions.

2.6. Methods of Data Analysis

Data was collected anonymously and directly on Google Android devices (ASUS Nexus 7) using the Open Data Kit (ODK) application. A unique identifying number was given to all participants in advance, so sensitive personal data of participants were removed before analysis. Data was cleaned and analyzed using STATA 16. Prevalence of NTDs was determined on the basis of combined results from the different clinical and laboratory diagnostic methods. The WHO Anthro Plus Software for assessing growth of the world's children and adolescents was utilized to determine the nutritional status of study participants[31].

For descriptive data, rate (percentage) was used to describe the characteristics of the studied population, including the prevalence of NTDs according to districts, age, gender, etc. Univariate statistical model was used to examine the relationship between the dependant variable and eac predictor variables autonomously. Then, all variables that have p value ≥ 0.25 were included in a logistic multivariate analysis using forward elimination model to identify the independent predictors of NTDs. The level of statistical significance was set as p<0.05 and for each statistically significant factor, an odd ratio (OR) with 95% confidence interval (CI) was computed.

2.7. Ethical Consideration

Ethical approval was obtained from the College of Health and Medical sciences Institutional Health Research Ethics Review Committee (IHRERC). Informed, voluntary, written and signed consent was provided by a parent or guardian for all participants less than 15 years of age. In addition, verbal assent was obtained from children aged 12-15 years. All positive cases have been linked to the nearby health facility for further clinical management. Health education was given for

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households with any identified NTDs case to halt its transmission among family members and the neighborhoods. All standard safety measures were implemented during the data collection process to protect data collectors and study participants.

3. Results

3.1. Socio Demographic Characteristics of the Households

The response rate was 93 % and the mean age of house heads was 31.6 (Range; 18. 63) with 5.7 average family size. Out of 1, 048 children who participated in the study, approximately half (523) of them were female and the mean age of the study participants was 7.4 (SD; ±4) years (Table 1).

Table 1. Socio demographic characterstics of households in urban slum and rural settings in Eastern Ethiopia.

Variable	Responses categories	Urban		Rural		Total	
		Freq.	%	Freq.	%	Freq.	%
Caregivers' age category	15 to 29 years	200	39	193	36	393	38
	30 to 44 years	256	50	313	58	569	54
	45 and above years	56	11	30	6	86	8
Caregivers' education status	No formal education	172	33	376	70	548	52
	Read and write	155	30	55	10	210	20
	Primary school	63	12	40	7.5	103	10
	Secondary school	14	3	39	7.5	53	5
	College and above	108	21	26	5	134	13
Caregivers' marital status	Single	0	0	1	0.2	1	0.1
	Married	455	89	509	95	964	92
	Separated/divorced	57	11	26	4.8	83	7.9
Occupation of caregivers	Farmer	6	1	244	45	230	22
	Merchant	160	31	23	4	183	34
	Employed	167	33	36	7	203	194
	Housewife	69	13	206	38	275	26
	Others	110	21	27	5	137	13
Monthly income	Low income	148	29	429	80	577	55
	Good income	364	71	107	20	471	45
Type of energy source for cooking	Wood/animal mud	268	52	532	99	800	76
	Electricity	244	48	4	1	248	24
Family size	0 to 5 years	324	63	205	38	529	50.5
	➢ 5 years	188	37	331	62	519	49.5
Number of children	1 to 3	372	73	253	47	625	60
	≥ 4	140	27	283	53	423	40
Child birth order	1st	172	33	152	28	324	309
	2nd	164	32	129	24	293	55
	3rd	115	22	115	21	230	22
	4th and above	61	12	140	26	201	19
Child sex	Male	273	53	252	47	525	50.1
	Female	239	47	284	53	523	49.9
Child age catagories	0 to 5 years	178	35	205	4	383	36
	6 to 10 years	207	40	225	42	432	40
	11 to 15 years	102	20	97	18	199	19
	16 to 18 years	25	5	9	1.5	34	3
Child education	Under School	91	18	114	21	205	19
	Primary School	293	57	301	56	594	57
	Secondary School	24	5	3	0.5	27	2
	Not Attending School	104	20	118	22	222	21

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3.2. Behavioural Characterstics of the Study Participants

It is a well stablished fact that social and behavioural characterstics of individuals notably contrubting to NTD infections. In line with this, 31.7 % of the study participants are not wearing sheos and 64.7 % of them are also sharing clothes. More than 58 % children had a habit of playing with soil while 47.3 % of the children's nails were not trimmed during the study. Disgracefully, about 46 % of children practices field defication and one-third of them wash their hands at only once a day (Table 2).

Table 2. Behavioural characterstics of children in selected urban slum and rural households in Eastern Ethiopia, 2024.

Variable	Responses catagories	Urban		Rural		Total	
		Freq.	%	Freq.	%	Freq.	%
Sharing clothes	Yes	270	52.7	408	76	678	64.7
	No	242	47.3	128	24	370	35.3
Waring shoes	Yes	381	74.4	335	62	716	68.3
	No	131	25.6	201	38	332	31.7
Child nail trimmed	Yes	308	60	244	45	552	52.7
	No	204	40	292	55	496	47.3
Child playing habit with soil	Yes	217	42.4	396	74	613	58.5
	No	295	56.6	140	26	435	41.5
Raw vegitable eating habit	Yes	319	62	208	39	527	50.3
	No	193	38	328	61	521	49.7
Number of critical times of child hand washing	One critical time	79	15	279	52	358	34
	Two critical times	223	43	193	36	416	40
	Three or more critical times	210	42	64	12	274	26
Frequency of washing child face per day	Once	79	15	319	59	398	38
	Twowice	202	39	144	27	346	33
	Three or more times	231	45	73	14	304	29
How do the child wash his/her face	Water only	238	46.5	416	78	654	62
	Water and soap	274	53.5	120	22	394	38
Are there flies on child face?	Yes	126	24.6	337	63	463	44
	No	386	75.4	199	37	585	56
Where does the child deficate last time?	Potty/diaper	101	19.6	10	1.9	111	10.6
	Toilet	18	3.4	7	1.3	25	24
	Open ground	123	24.3	365	68.1	488	45.6
	Others	270	52.7	154	28.7	424	40.4
When does the water container cleaned?	Today or yesterday	37	7	43	9	80	7.6
	Three to seven days before	269	52	196	36	465	44.4
	Before a week	193	38	168	31	361	34
	Don't remember	13	3	129	28	142	13.5
Are all water containers clean?	Yes	344	67	231	43	575	55
	No	168	33	305	57	473	45
Where does the child take bath usually?	Bathroom	18	3.5	4	0.7	22	2
	Toilet	177	34.5	22	4	199	19
	Inside home	265	52	293	55	558	53
	Others	52	10	217	40	269	26
How do you wash kitchen utinsils?	With cold water only	144	28	405	75	549	52
	Hot water only	16	3	9	1.7	25	2.1
	Cold water with soap	343	66.8	121	22.6	464	44
	Hot water with soap	9	0,2	1	0.2	10	0.9
Do you often buy food from street venders for your children?	Yes	205	40	143	26.7	348	33
	No	307	60	393	73.3	700	67
Do you use animal face fertilizer?	Yes	13	30	345	83	358	78
	No	30	70	70	17	100	22

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3.3. Environmental Factors

Nearly, 85 % of the study participant have got drinking water from improved water source and 89 % of them obtained greater than or equal to 20 L water per capita per day which is above the recommended volume. According to our study, 77 % of the study participants do not have latrine their compound indicating that field defication is rampant in the study community and faces was observed in 55 % of participants residence compound (Table 3).

Table 3. Environmental factors of selected urban slum and rural households in Eastern Ethiopia, 2024.

Variable	Responses catagories	Urban		Rural		Total	
		Freq.	%	Freq.	%	Freq.	%
Type of drinking water source	Improved	502	98	386	72	888	84.7
	Unimproved	10	2	150	28	160	15.3
Type of water container used	Noarrow mouthed	353	69	502	94	855	81.6
	Wide mouthed	20	3.9	11	2	31	3
	Both type	139	27.1	23	4	162	15.4
Does all water containers covered?	Yes	261	51	176	32.8	437	41.7
	No	239	46.7	336	62.7	575	54.9
	Some only	12	2.3	24	4.5	36	3.4
Methods of withdrawing water	Pouring	342	66.8	464	86	806	77
	Dipping with cup	9	1.7	30	5.6	39	3.7
	Both pouring and dipping	138	2.7	39	7.3	177	16.9
	Using spigot/tap	23	4.5	3	0.6	26	2.5
Amount of water used per day per capita	< 20 litter	464	90.6	474	88	938	89
	≥ 20 litters	48	9.4	62	11	110	10.5
Do you treat your drinking water?	Yes	128	25	14	2.6	142	13.5
	No	384	75	522	97.4	906	76.5
Did you experience any water shortage within the previous one months?	Yes	420	82	278	51.9	698	66.6
	No	92	18	258	48.1	350	33.4
Have you satisfied with the existing water service	Yes	43	8.4	275	51	318	30.3
	No	469	91.6	261	49	730	69.7
Availability of latrine?	Yes	416	81	388	72	804	76.7
	No	96	19	148	28	244	23.3
Type of latrine in use?	Improved latrine	205	49	54	38	259	24.7
	Unimproved latrine	211	51	334	62	545	75.3
Latrine distance from home	< 50 meters	416	100	375	96.6	791	98.4
	≥50 meters	0	0	13	3.4	13	1.6
Latrine distance from the sirect water source	< 250 meter	414	99.5	193	49.7	607	75.5
	≥ 250 meters	2	0.5	195	50.3	197	24.5
Faces in the latrine ground	Yes	89	21.4	198	63	287	35.7
	No	327	78.6	190	37	517	64.3
Flies in the latrine	Yes	224	53.8	357	92	581	72
	No	192	46.2	31	8	223	28
Are there feces on the ground of the compound?	Yes	333	65	245	25	578	55
	No	179	35	291	75	470	45
Presence of animal dung in the compound	Yes	79	16	415	77	494	47
	No	433	84	121	23	554	53
Presence of liquid west in the compound	Yes	206	40	367	68	573	54.7
	No	306	60	168	32	474	45.3
Availability of hand washing set up	Yes	2	0.4	8	1.5	32	3
	No	488	99.6	528	98.5	1,016	97
Presence of livestock	Yes	43	8.4	415	77	458	43.7
	No	469	91.6	121	23	590	55.3

3.4. Clinical Characterstics of Children

In this study, 3.6 % of the study participants had recent trauma. About 15 % of children were previously contracted NTD where as 25 % of their family members have been diagnosed with NTDs. Nearly, 68 % of the house heads are aware about NTDs and 53 % have got the information from healthcare workers followed by mass media (23 %) (Table 4).

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Table 4. Clinical factors of children in selected urban slum and rural households in Eastern Ethiopia, 2024.

Variable	Responses catagories	Urban		Rural		Total	
		Freq	%	Freq.	%	Freq.	%
Presence of any trauma	Yes	12	97.6	26	4.8	38	4
	No	500	2.4	510	95.2	1,010	96
History of NTDs	Yes	57	11	100	18.7	157	15
	No	455	89	436	81.3	891	85
Dewarming/anti parasitic drug within the previous two weeks	Yes	480	95	501	93	981	93.6
	No	32	5	35	7	67	6.4
Does any family member have beed diagnosed any NTD?	Yes	77	15	185	34	262	25
	No	435	85	351	66	786	75
Are you regular user of health insurance?	Yes	283	55	493	92	776	74
	No	229	45	43	8	272	26
Does the cost significantly influence your health care service?	Yes	322	63	245	45.7	567	54
	Some what	169	33	212	39.6	381	36.5
	No	21	4	79	14.7	100	9.5
Awarnes about NTDs	Yes	383	74	326	60.8	709	67.6
	No	129	26	210	39.2	339	32.4
From where you frequently got health care information	Health workers	161	31	396	74	557	53
	Mass media	234	46	10	2	244	44.3
	Others	17	3	11	2	28	2.7
Do any of the children have NTD in the previous two months?	Yes	61	12	86	16	147	14
	No	451	88	450	84	901	86

The nutrional statuses of children were evaluated and 17 % and 49 % of them were wasted and stanted, respectively. Similarly, 32 % of children were suffering from obesity whereas 13.6 % of them were underweight (Figure 1).

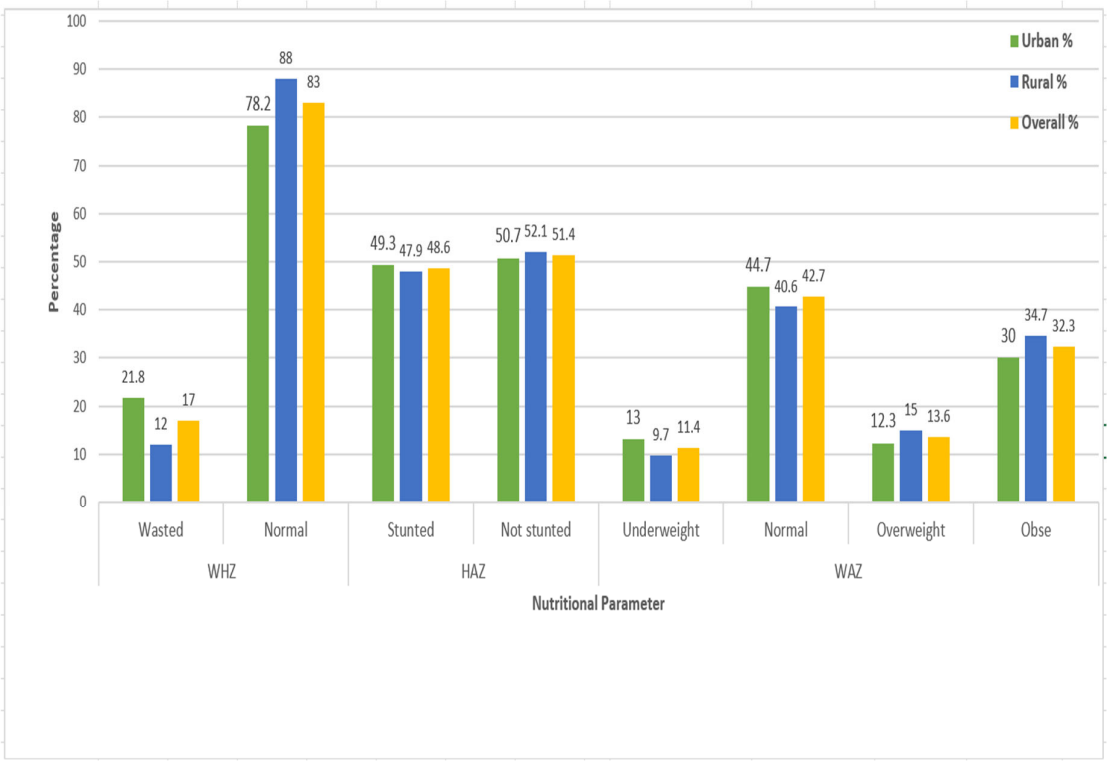

Figure 1. Nutrional statuses of children in selected urban slum and rural households in Eastern Ethiopia, 2024.

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3.5. Relative Burden of NTDs Among Urban Slum and Rural Children

Based on the standard clinical examination and laboratory investigations nine types of NTDs were diagnosed. Sole burden of STH infection was 8.7 % followed by eye infection (Trachoma, 4.6 %), skin diseases (3.4 %), mixed infections (3.2 %) and protozoan parasites (2.6 %). The most commonly identified NTDs were *H. nana*, Trachoma and Scabies while the least detected NTD was Leprosy (Table 5).

Table 5. Types of NTDs diagnosed among children in selected urban slum and rural households in Eastern Ethiopia from February 25 to April 30, 2023.

Category of NTDs	Type of NTD diagnosed	Urban (Freq.)	Rural (Freq.)	Total (Freq.)
STH	*H. nana*	19	43	62
	Hookworm	3	6	9
	A. lumbricoides	6	7	13
	E. vermicularis	1	6	7
Protozoa	*E. histolytica/dispari*	5	13	18
	G. lamblia	8	1	9
Eye infection	Trachoma	13	35	48
Skin diseases	Scabies	9	26	35
	Leprosy	0	1	1
Mixed infections	*A. lumbricoides* and *H.nona*	4	0	4
	A. lumbricoides and Scabies	0	4	4
	H. nana and Scabies	2	3	5
	H. nana and Trachoma	3	5	8
	E. histolytica/dispari and *G. lamblia*	3	0	3
	E. histolytica/dispari and Trachoma	0	3	3
	E. histolytica/dispari and Scabies	0	3	3
	Hookworm and Scabies	0	1	1
	Trachoma and Scabies	1	1	2
	Leprosy, Scabies and Trachoma	0	1	1
Total NTD positive cases		**77**	**159**	**236**

The overall prevalence of NTDs among study participants was 22.6 % (95% CI; 20.2, 25.2); in it urban slum was 15 % (95% CI; 12.2, 18.4) while it is 29.8 % (95% CI; 26, 33.9) in rural indicating that the prevalence ratio of NTDs in rural communities to Urban slum is two. The major NtDs identified both in rural and urban slum communities were H. nana (79), Trachoma (62) and Scabies (51). Prevalence of coinfections with two or more NTDs was 3.2 % (Figure 2).

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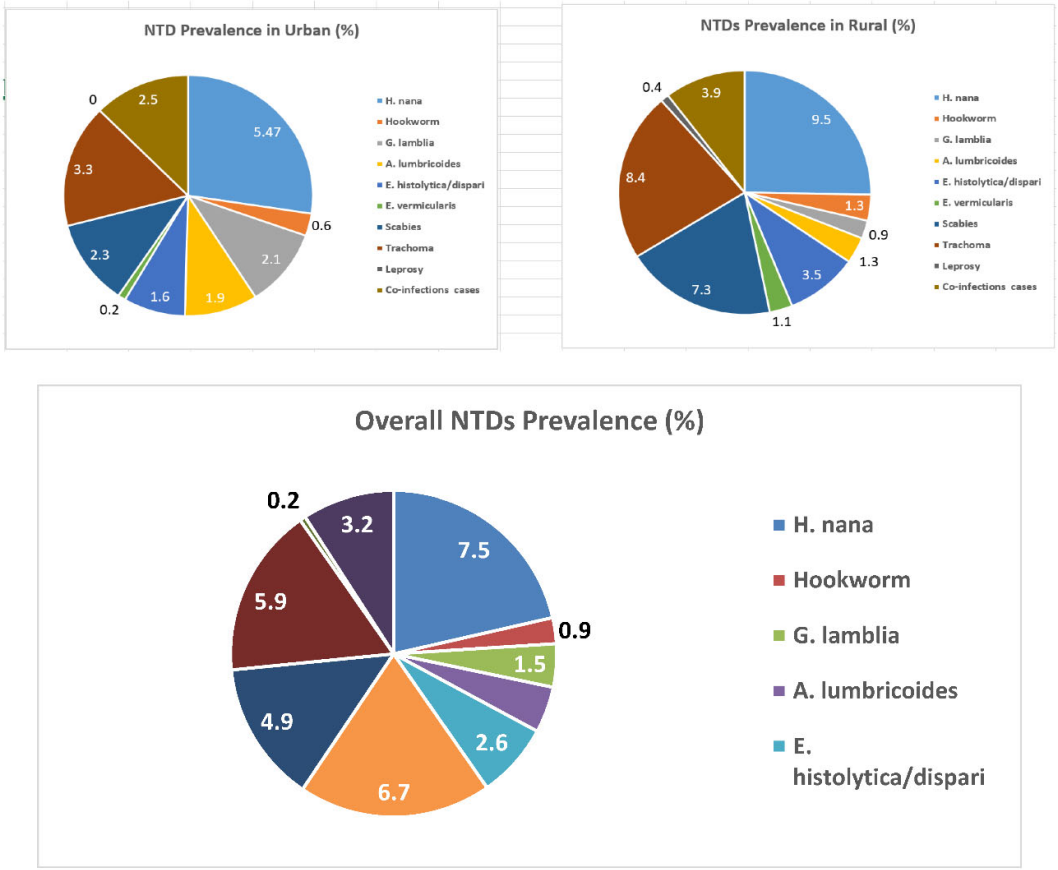

Figure 2. Prevalence of NTDs in Urban slum and rural communities in Eastern Ethiopia, 2024.

3.6. Univariate and Multivariable Logistic Regression Models for Risk Factors Associated with NTDs

The univariate analysis revealed that most of the socio-demographic, behavioural, environmental and clinical variables have association with NTDs. Multivariable logistic regression was carried out to identify potential risk factors after adjusting for confounding. Therefore, varaiables such as government employement (p = **0.036)**, monthly income (p = **0.007**), child habit of playing with soil (p = 0.010), handwashing at three or more critical times (p = 0.013), presence of flies in child faces (p = 0.000), unimproved drinking water source (p = 0.022) and lack of cleaning drinking water container (p = 0.007) found to be significantly associated with niglected tropical diseases. However, known predictors like household education, child age, child nutritional status, lack of improved latrine, eating raw vegitables and lack of awareness didn't show association with NTDs in the current study.

Table 6. Univariate and multivariable logistic regression models for risk factors associated with NTDs among children in selected urban slum and rural households in Eastern Ethiopia, 2024.

Variable	*Responses*	*NTD (n = 1048)*		*COR (95 % CI)*	*P value*	*AOR (95 % CI)*	*P value*
		Positive	**Negative**				
Residence	Urban	77	435	1		1	
	Rural	160	376	2.4 (1.8, 3.3)	0.000	4.3 (0.28. 63.5)	0.291
Highest educational level of the house head	Can't read and write	144	404	1		1	
	Read and write	33	177	0.5 (0.3, 0.79)	0.0020.8	0.55 (0.15 2.0)	0.363
	Primary school	26	77	0.9 (0.6, 1.5)	0.826	0.17 (0.02, 1.4)	0.104
	Secondary school	14	39	1.0 (0.5, 1.9)	0.983	0.34 (0.027, 4.2)	0.400

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	College and above	20	114	0.5 (0.29, 0 .8)	0.007	0.58 (0.05 7.1)	0.669
Occupation	Farmer	101	149	1		1	
	Merchant	26	157	0.2 (0.15, 0.4)	0.000	0.88 (0.06, 12.6)	0.923
	Government employed	28	175	0.24 (0.15, 0 .4)	0.000	12.5 (1.17, 132.4)	**0.036**
	Housewife	45	230	0.29 (0.19, 0.4)	0.000	1.41 (0.18, 7.1)	0.884
	Others	37	100	0.5 (0.35, 0 .8)	0.009	0.9 (0.07, 12.3)	0.945
Monthly income	Low income	175	402	1		1	
	Good income	62	409	0.35 (0.25, 0.5)	0.000	0.13 (.03, 0.57)	**0.007**
Household size	One to five	111	418	1		1	
	Greater than five	126	393	1.2 (0.9, 1.6)	0.203	2.66 (0.5, 13.9)	0.245
Enrergy source for cooking	Wood/Mud	210	590	1		1	
	Electiricity	27	221	0.34(0.22, 0.5)	0.000	0.89 (0.02, 36.3)	0.949
Number of children	One to three	133	492	1		1	
	Greater than three	104	319	1.2 (0.9, 1.6)	0.210	1.4 (0.26, 7.7)	0.681
Age of the child	0 to 5 years	94	289	1		1	
	6 to 10 years	102	330	1.01 (0.67, 1.5)	0.940	1.002 (0.24, 4.1)	0.997
	11 to 18 years	41	192	0.68 (0.4, 1.1)	0.159	1.04 (0.17, 6.4)	0.968
Educational status of the child	Under school	58	147	1		1	
	Primary or secondary school	131	490	0.68 (0.47, 0.97)	0.034	1.3 (0.26, 6.3)	0.758
	Not attending school	48	174	0.7 (0.45, 1.0)	0.112	0.83 (0.17, 4.1)	0.819
WHZ	Wasted	26	110	1		1	
	Normal	157	509	0.77 (0.4, 1.4)	0.416	1.6 (0.3, 9.1)	0.567
HAZ	Stunted	108	392	1		1	
	Not stunted	124	405	0.87 (0.6 1.3)	0.472	0.46 (0.15, 1.4)	0.182
WAZ	Underweight	30	87	1		1	
	Normal	98	341	0.73 (0.38, 1.4)	0.352	0.74 (0.14 3.9)	0.722
	Overweight	35	105	0.86 (0.4. 1.8)	0.703	0.6 (0.08, 4.3)	0.616
	Obse	69	264	0.71 (0.37 1.4)	0.316	0.5 (0.07, 3.7)	0.520
Sharing clothes	Yes	173	505	1.6 (1.19, 2.2)	0.003	0.62 (0.16, 2.3)	0.479
	No	64	306	1		1	
Wearing shoe	Yes	172	544	1.3 (0.9, 1.8)	0.110	1.8 (0.55, 5.8)	0.337
	No	65	267	1		1	
Child playing with soil	Yes	178	435	2.6 (1.9, 3.6)	0.000	5.8 (1.52, 22.0)	**0.010**
	No	59	376	1		1	
Raw vegitable eating habit	Yes	94	433	0.57 (0.4, 0.77)	0.000	0.42 (0.13, 1.3)	0.140
	No	143	378	1		1	
Child hand washing critical times	One critical time	95	263	1	0.059	1	
	Two critical times	87	329	1.04 (0.7, 1.5)	0.831	0.35 (0.1, 1.2)	0.097
	Three or more critical times	55	219	2.04 (1.17, 3.6)	0.012	11.2 (1.7, 74.9)	**0.013**
Frequency of washing child face per day	Once	94	304	1		1	
	Twowice	85	261	1.05 (0.7, 1.5	0.763	1.7 (0.6, 4.86)	0.285
	Three times	58	246	0.76 (0.5, 1.1)	0.149	0.47 (0.09, 2.4)	0.369
Hygiene condition of child face	Clean	94	511	1		1	
	Unclean	143	300	2.6 (1.9, 3.5)	0.000	0.74 (0.2, 2.8)	0.663
Presence of flies in the child faces	Yes	162	301	3.7 (2.7, 4.98)	0.000	20.3 (4.7, 88.6)	**0.000**
	No	75	510	1		1	
Presence of animal dung in the compound	Yes	146	348	2.1 (1.6, 2.9)	0.000	1.9 (0.3, 11.2)	0.488
	No	91	463	1		1	
Type of drinking water source	Improved	209	679	0.42 (0.26, .66)	0.000	0.11 (0.02, 0.73)	**0.022**
	Unimproved	28	132	1		1	
Are all the water containers clean?	Yes	138	437	1.2 (0.89, 1.6)	0.237	0.63 (0.2, 1.9)	0.414
	No	99	374	1		1	
	< 20 liter	202	736	1		1	

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Vulume of water used per capita per day	≥ 20 liter per day	35	75	1.7 (1.1, 2.6)	0.016	2.04 (0.5, 7.8)	0.296
Do you treat your drinking water	Yes	20	122	0.52 (0.3, 0.8)	0.010	0.42 (0.03, 5.2)	0.506
	No	217	689	1		1	
Water shortage in the previous one month	Yes	131	567	0.5 (0.4, 0.7)	0.000	0.59 (0.17, 2.0)	0.402
	No	106	244	1		1	
Satisfaction with the current water service	Satisfied	105	213	1		1	
	Not satisfied	132	598	0.45 (0.3, 0.6)	0.000	4.3 (0.84, 22.4)	0.080
Presence of feces in the floor of the toilet	Yes	92	195	2 (1.4, 2.7)	0.000	0.56 (0.19, 1.6)	0.293
	No	100	417	1		1	
Presence of flies in the toilet	Yes	165	416	2.9 (1.8, 4.4)	0.000	1.5 (0.19, 12.0)	0.694
	No	27	196	1		1	
Presence of faces in the ground of the compound	Yes	106	472	1		1	
	No	131	339	1.7 (1.3, 2.3)	0.000	1.9 (0.59, 6.3)	0.278
Do the family use animal dug as fertilizer?	Yes	89	269	0.3 (0.22, 0.5)	0.000	0.33 (0.1, 1.1)	0.077
	No	49	51	1		1	
Presence of waste water discharge in the compound	Yes	162	411	2.1 (1.5, 2.8)	0.000	1.7 (0.52, 5.5)	0.385
	No	75	399	1		1	
Often use street vender food	Yes	90	258	1.3 (0.97, 1.77)	0.077	1.5 (0.5, 4.7)	0.454
	No	147	553	1		1	
Presence of flies in the kitchen	Yes	192	551	2 (1.4. 2.9)	0.000	0.44 (0.09, 2.3)	0.330
	No	45	260	1			
Are you a regular health insurance user?	Yes	193	583	1.7 (1.19, 2.4)	0.003	1.7 (0.27, 10.3)	0.585
	No	44	228	1		1	
Does the health care cost influnces the choice of health institution?	Yes	116	451	1		1	
	Some what	99	282	1.4 (1.0, 1.8)	0.047	1.8 (0.56, 5.5)	0.333
	No	22	78	1.1 (0.6, 1.8)	0.726	1.7 (0.28, 10.2)	0.556
Awerness about NTDs	Yes	45	102	1.6 (1.1, 2.4)	0.013	1.6 (0.5, 5.1)	0.395
	No	192	709	1			
Did the child have any NTD within the previous two months	Yes	45	102	0.7 (0.45, 1.2)	0.241	2.8 (0.85, 9.1)	0.091
	No	192	709	1		1	

4. Discussions

The current integrated and comprehensive study covered considerable epidemiologically relevant NTDs and all the potential risk factors. The study also tried to compare the NTDs burden and distribution among four kebelles of urban and rural areas in which inequalities could be minimized. According to the study, about 39 % of the house heads had never attended formal education which is in line with the national data that underline illitracy remains a major problem that hinders community health in many aspects[32]. In line with this, one–fifth (22 %) of the child are not going to school at their seven-year age. More than three-fourths of the study participants do not have the latrine in their compound indicating that field defication is rampant in the study community. Aproximately, family members of 44 % households are living with livestock at home which could increase the chance of spreading zonotic diseases in inadequate safety conditions and humans may contract diseases like respiratory infections, acute febrile illnesses, and diarrhea[33].

The overall prevalence of NTDs was 22.6 % (95% CI; 20.2, 25.2) with rural to urban prevalence ratio of 2. This finding revealed that NTDs burden is still high, particularly in rural areas in developing countries like Ethiopia[34]. The predominant NTDs diagnosed among children was STH, 105 cases (10 %) and this finding is concordant with other similar studies done elsewhere in developing nations[27,35,36].

In our study, eye infection (Trachoma) was the second most prevalent NTD, 5.9 % which is consistant with some studies [37–39]. However, this finding is by far lower than the studied done in many parts of Ethiopia [40–42]. Better access to safe water, improved sanitation and health facilities

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in areas where this study was conducted compared to the previous studies. In addition, some communities in other study areas are repeatedly drought-affected and food-insecure, which is attributed to the high prevalence of trachoma[43]. But, the prevalence was higher compared to the studies done in different corner of the world [44–49]. The possible reason for such trachoma burden variation might be due to the endemicity of the disease in the district, lower coverage of water and sanitation facilities, climatic conditions, and living conditions of the study area population. This implies that the finding of the current study confirmed that trachoma is still a disease of public health importance in both urban and rural communities in the study areas.

The sum prevalence of scabies infestations among the study participant was 4.9 % and it is concordant with studies conducted in Africa[50]. This finding is lower than other similar stududies conducted in Indonisia (77 %) and Ghana (71 %)[51], Weldaya (24 %)[52] and Meta Robi (19 %)[53]. High rates of scabies are usually found in communities and milieus where overcrowding and poverty are highly prevalent, perhaps this prevalence discrepancy might be attributed to family size variation, educational status variation, and might also be related to variation in sociodemographic characteristics of the study population, level of awareness, and health-seeking behavior across these populations[54].

The combined protozoan parasites, G. lamblia and E. hystolitica/dispari prevalence in school age children was 3.4 % (95 CI; 12, 34). This finding virtually lower than most protozoan parasitic studies conduted in sub-Saharan Africa and this could be due to the fact that our study population was school age children with gastro intestinal discomfort wheras diarrhic children is the inclusion criteria for others[55,56]. As usual in most studies conducted in NTDs endemic areas prevalnet of mixed infections was common, 3.2 % and it could be due to common requirements between neglected tropical infections[57].

The multivariable analysis showed tha**t** poverty were positively associated with common childhood illnesses in the sub-Saharan African countries[58]. Children of households with greater than average income of the study community have 87 % less likely to contract NTDs than those children from household of low monthly income. This finding is consistent with other NTD studies[59] and it is noticeable that the magnitude of communicable diseases varied with socio economic inequality, but often, the odds of infection or disease were twice as high among socioeconomically disadvantaged groups[60]. Children with government emplyeed mother's/caregiver's were tewelve times more likely to have NTDs compared to those caregivers of farmer in the study areas. This may happen as the development trend for cash crops over the last decade in Eastern Ethiopia is clearly positive for farmers, with chat being the leading crop, followed by vegitables & coffee[61]. In contrast, govrnement employeers are apparently relaying on their salary in the face of fast currency depreciation that could have a direct relashinp with poverty and NTDs vulnerability[62]. Children who are playing with soil are six times likely to have NTDs than the counterparts which is in agreement with similar studies[63]. Warm and moist environmental conditions such as soil and water bodies favour the long-term existence of eggs and larval stages[64].

Children who are washng their hand at critical times are significantly at lower risk of NTDs Correspondingly, children those household utilized improved water source 89 % lower probality of NTDs compared to those who use unimproved water source whereas, children from households where flies are present in its toilet are 20 times more likely than the counter parts. These all are found to be the very common predictors seen in most communicable diseases studies[65] and it revealed that Key WASH-related behaviours can prevent burden of NTDs[66,67]. Some of the common recognized independent predictors of NTDs like residence, educational level and nutritional status had no statstically significant association. These could be due to the fact that the community sociodemographic, culture and environmental variability which were not considered in these studies.

5. Conlusions

The increased incidence of neglected tropical diseases recognized as public health threats in Ethiopia. Though there is no significant difference in burden and in its type between urban slum and rural communities, NTDs are moderately endemic in the study area. Poverty related and WASH

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related factors are mainly associated risk factors of NTDs, Improving socioeconomic and environmental situation through collaborative effort is vital. The health sector should increase community awareness and health seeking behaviours about NTDs in order to promot prevention and control of NTDs in the country. Researchers should design and conduct a more comprehensive and analytical studies to figure out the specif NTDs burden and identify its complex risk factors. Therefore, policy makers, officials, program implementers and acadamicians could have better understanding in prevention and controlling stratagies of NTDs.

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Abbreviations and Acronyms

CDLQI	Children's Dermatology Life Quality Index
COVID-19	Coronavirus Disease-19
HCFs	HealthCare Facilities
HHCs	Household Contacts
HRQoL	Health-Related Quality of Life
NTDs	Neglected Tropical Diseases
SAFE	Surgery, Antibiotics, Facial Cleanliness, and Environmental Hygiene
SDG	Sustainable Development Goals
sNTD	Skin Related Neglected Tropical Diseases
STHs	Soil-Transmitted Helminthiases
WASH	Water, Sanitation and Hygiene
WHO	World Health Organization

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