

Community Scabies Outbreak Investigation and Risk Factors in Katondo Health Post, Kasenengwa District of Eastern Province: Unmatched Case Control Study

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Abstract: Scabies is a parasitic infestation caused by *Sarcoptes scabiei var hominis* which is a microscopic mite that burrows into the skin and lays eggs. Prevalence of the condition range from 0.2% to 71% globally. This study was therefore conducted to investigate the suspected community scabies outbreak in Katondo Health Post of Kasenengwa District and bring out the significant associated factors. Unmatched case control study was conducted (1:2 case control ratio). Suspected outbreak was identified through weekly notifiable report. Desk review of the Out Patient Register (OPD) was done to determine additional suspected cases. Structured questionnaire was administered to collect risk factors data. Total study participants were therefore cases with clinical signs of symptoms unmatched to controls within the area. Frequency tables were used to present demographic variables. Attack rate was used to measure morbidity. Odds Ratio (OR) with 95% confidence interval (CI) was used to determine risk factors. Total of 64 clinical scabies cases were recorded giving an attack rate of 1/100 people. Mandondo zone which was the index case zone recorded the highest attack rate of 3/100 people. Mean age of the cases was 18 with range of 11-56 years. Statistically significant factors associated with the outbreak were Low education ((OR=4.9, 95% CI=1.34-6.45, P-Value=0.014), record of exchanging clothes (OR=2.1, 95%CI=1.45-5.34, P value 0.001), Skin contact with suspected case (OR=2.5, 95% CI=0.74-8.68, P Value=0.012), bathing less than 3 times per week (OR=5.4, 95% CI=2.38-14.43, P value: 0.000). Protective factors were, use of soap for bathing (OR=0.34, 95% CI=0.21-2.71, P value=0.003), family member less than 5 (OR=0.12, 95% CI= 0.12-0.06, P Value=0.000). From the results, it can be deduced that scabies outbreak occurred in Katondo Health Facility. Low education, record of exchanging clothes, bathing less than 3 times per week, and skin contact with the suspected case were the risk factors associated with outbreak. Epidemic protective factors were, use of soap for bathing and belonging to a household with family members less than 5. Providing risk factors-based health education on prevention and controls especially, at health facility and community level were recommended.

Keywords: Community Scabies, Outbreak Investigation, Kasenengwa District

1. Introduction

1.1. Background

World Health Organization key facts on scabies [1] defines human scabies as parasitic infestation caused by *Sarcoptes scabiei var hominis* which is a microscopic mite that burrows into the skin and lays eggs. The laying of the eggs under the skin eventually triggers a host immune

response that leads to intense itching and rash. This eventually triggers a host immune response that leads to intense itching and rash. The common mode of transmission is direct skin-to-skin contact with a person who has scabies mites. However, the disease can also be transmitted indirectly through sharing clothing, towel or beds with people infected. Common signs of scabies are intense itching,

especially at night, and a papular skin rash that may cover a large portion of the body or be restricted to locations like the armpit, wrist, elbow, and interdigital region [2]. Scabies was included as a Neglected Tropical Disease (NTD) in the year 2017.

Globally, scabies is estimated to affect more than 200 million people at any time. Prevalence of the condition range from 0.2% to 71%. The estimated average prevalence of scabies in children is 5-10%. While scabies can be found anywhere in the world, it is particularly prevalent in hot, tropical regions and in densely populated areas [2, 1]. The most five individual countries with greatest scabies burden globally are Indonesia, China, Timor-Leste, and Fiji [3]. Sub-Saharan countries are not an exception to this public health problem of scabies. The disease prevalence is estimated at 33.7% [3]. This prevalence however varies from one country within the region from time to time and among different population groups. In Ethiopia, the prevalence of scabies was 14.5% in the year 2020 [4]. In the same year, Sierra- Lion recorded the prevalence of 34% [5]. Zambia where this outbreak investigation was conducted in not an exception to the problem of scabies. Despite no available research literature published on the burden of scabies to the country, different media have reported the existence of outbreaks in the country. Samfya district of Luapula province recorded the outbreak of the disease which was reported and confirmed by the district to the Public Nation television [6]. Chitambo district of Central province is another district that confirmed the epidemic of scabies through media statement [7].

According to world health organization [1], climate, weather conditions, social economic status, population density and treatment availability are global predisposing factors associated with the disease. Studies conducted in Africa have also brought out different predisposing factors associated with the disease. The study conducted in southern Ethiopia discovered that overcrowding, poor hygiene, poor nutritional status, immigration, homelessness and sexual contact were the common predisposing factors to the outbreak [8]. Findings for an outbreak investigation conducted in Ghana [9] brought out similar predisposing factors. According to the investigation, predisposing factors for the scabies outbreak were poor hygiene and overcrowding.

Kasenengwa district recorded a suspected outbreak of scabies on 22nd March, 2022 under Katondo Health Post. The outbreak was identified through the weekly notifiable diseases [10]. At the time of reporting, the health facility in charge also reported an observed unusual condition in the catchment. This report therefore provides detail of the scabies outbreak investigation, confirmation of the occurrence, identification of the risk factors and suggest practical prevention and control measures to alleviate the disease burden which were provided to the affected area.

1.2. Problem Statement

Kasenengwa district which is sitting in eastern province of

Zambia, has been recording outbreaks of suspected scabies. Over a short period of time, the district recorded suspected scabies cases from different health facilities catchment. In November 2021, the district recorded 34 cases of suspected scabies cases from Samuel Rural Health Centre. In the month of January 2022, the district recorded 56 suspected cases of scabies from Kadama Health post. In the same year, month of March the district again recorded 46 suspected cases of scabies from Kwenje Rural Health center [11].

Despite all these recorded epidemics of suspected scabies, no case was investigated nor samples collected for laboratory confirmation. The district has relied on mere speculations and provision of health education messages without scientific understanding of the occurring condition. No significant factors have been scientifically identified to be associated with the episodic reoccurrence of the disease.

Implementation of preventive and control measures should be backed with scientific evidence of the disease determining factors. This outbreak investigation therefore provided the much needed scientific understanding of factors associated with disease outbreak occurrence.

1.3. Objectives

- 1) To confirm the existence of the outbreak and the causative agent for the epidemic.
- 2) To determine the outbreak distribution and burden in affected community.
- 3) To identify the risk factors associated with the outbreak.
- 4) To provide scientific based prevention and control measures to alleviate the epidemic burden to the affected areas.

1.4. Investigation Questions

- 1) Does the outbreak exist and what is the causative agent to the disease?
- 2) How is the spread of the epidemic, how severe is the epidemic in the community?
- 3) What are the risk factors associated with the outbreak?
- 4) What are scientific based prevention and control measures that can be implemented to alleviate the epidemic in the affected area.

2. Methods

2.1. Study Design

The unmatched Case-Control investigation was done. However, to improve the power of the study, two unmatched controls were selected per each case (1:2 ratio of cases to controls).

2.2. Study Target

All clinically suspected cases of scabies were paired with controls selected based on the area of resident. Desk review of the OPD register and weekly reported cases accounted a total number to 64 cases hence 128 controls.

2.3. Outbreak Investigation Site

The disease investigation was conducted from Katondo Health Post. The health post has a population of 7336, located within Kasenengwa District of Eastern Province. The facility sits on the longitude of 32.37604957 and latitude of -13.63752217 [11].

2.4. Data Collection Methods and Tools

A structured questionnaire was used to collect data in relation to possible risk factors from the study participants. The questionnaire was developed based on the possible demographic, social, economic and hygiene factors that could be related to the epidemic. For the participants who were unable to read and write, an interview through administration of structured questionnaire was done. Guardians provided responses to children who were unable to respond for themselves. Desk review of the OPD cases was used to complete the outbreak line list. The index case was identified through the OPD register.

2.5. Data Analysis

Data was analyzed using descriptive and inferential statistics. Frequency tables, graphs and means were used to summarize demographic data of the participants. Attack rate was used to determine epidemic burden at Neighborhood Health Committee (NHC) level. To determine risk factors associated with the outbreak, Odds Ratios (ORs) and logistic regression analysis was done between variables. The significance level used was 0.05 (5%). All this was done using Statistical package for social science (SPSS) version 21 and excel.

2.6. Case Definition

The following were the developed case definitions for the

outbreak investigation. Case definitions were modified from Maryland Department of Health guidelines for control of scabies [12].

Confirmed case: a person who has a skin scraping with identified mites, mite eggs, or mite feces microscopically.

Suspected case: Resident of Katondo clinic catchment or surrounding areas with symptoms of superficial burrows, intense pruritus especially at night and generalized rash from March to April 2022.

2.7. Inclusion and Exclusion Criteria

Inclusion

Cases: Any Resident of Katondo clinic catchment with or had symptoms of superficial burrows, intense pruritus especially at night and generalized rash from March to April 2022.

Controls: Any Resident of Katondo clinic catchment area who didn't have symptoms of superficial burrows, intense pruritus especially at night and generalized rash from March to April 2022.

Exclusion

Cases: None residents of Katondo Clinic were excluded.

Controls: Members of the same household with the case were excluded.

2.8. Ethical Consideration

Participants were further at liberty to choose to participate or not in the investigation. Written informed consent was obtained from all individual participants. For the participants who consented, data collection tools were anonymized in order to ensure confidentiality of the information provided. All participants who had not attained the age of eighteen had consent forms completed by their parents after details of the investigation were provided.

3. Results

3.1. Outbreak Confirmation

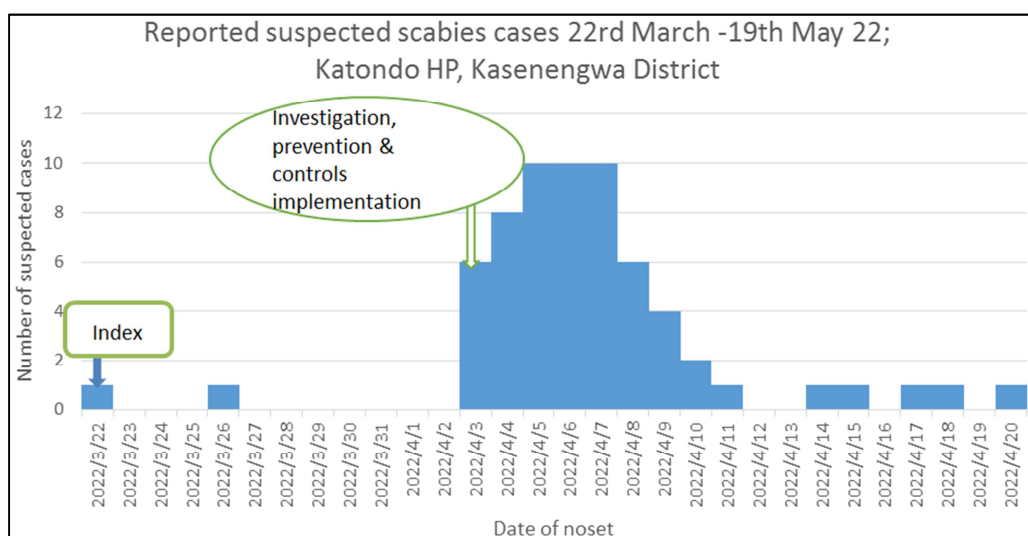


Figure 1. Epidemiological curve of cases.

Figure 1 presents the epidemiological curve of the clinical suspected scabies cases. The index case of the outbreak was recorded from Chinjobvu Village of Mandondo NHC on 22nd March, 2022. This was a 20 year old male. The second case to the index was reported days after the first case on the 26th March, 2022. An increase in the number of cases was observed on the 3rd of April 2022. This prompted launch of an

investigation to identify other existing suspected cases. Based on the desk review from the Outpatient register and active community case finding, the number of the cases recorded increased from 4th to 8th April 2022. Last case of the outbreak was recorded on the 20th April, 2022. A total number of 64 clinical scabies cases were therefore recorded between 22nd March and 20th April, 2022.

3.2. Outbreak Distribution

3.2.1. Demographic Characteristics of the Cases and Controls

Table 1. Demographic Characteristics of the Participants.

Category	Characteristics	Frequency	
		Cases (n=64)	Controls n=(128)
Sex	Male	35 (54%)	76 (59%)
	Female	29 (45%)	52 (41%)
Marital Status	Single	49 (77%)	115 (90%)
	Married	15 (23%)	13 (10%)
Neighborhood of the participant	Chandawiri NHC	3 (4.6%)	6 (5%)
	Chiwayu NHC	1 (1.5%)	2 (1%)
	Chongo NHC	6 (9.3%)	6 (5%)
	Luona NHC	13 (20.3%)	20 (16%)
	Mandondo NHC	41 (64%)	94 (73%)
Level of Education	Junior Secondary	11 (17%)	19 (15%)
	Primary	50 (78%)	6 (5%)
	Secondary	3 (4.6%)	103 (80%)

Table 1 present the demographic characteristics of the participants. The mean age of the participants was 18 years, with the minimum age of 11 and maximum age of 56 years. Majority of the cases and controls were males 35 (54%) and 76 (59%) respectively. Single cases accounted for 49 (77%) of the participants were as single controls accounted for 115 (90%) of the participants. Mandondo Neighbourhood Health (NHC) had the majority of the cases 41 (64%) while Chiwayu NHC had the minority of the cases 1 (1.5%). Majority of the controls were from Mandondo NHC 94 (73%) were as Chiwayu NHC had the minority of the participants 2 (1%). Other NHCs from which the cases were recorded were Luona 13 (20.3%), Chongo 6 (9.3%) and Chandawiri 3

(4.6%). Majority of the cases had attained primary level of education 50 (78%) were as majority of the controls had attained secondary level of education 103 (80%).

3.2.2. Outbreak Spot Map

Figure 2 presents the distribution of the cases within Katondo Health Post catchment. According to the catchment, the southern area were the index case was recorded from had more observed clinical cases. The epidemic also affected the central part of the facility catchment with some cases recorded in the eastern part.

Map generated using QGIS version 3.28.2 [13].



Figure 2. Cases distribution.

3.2.3. Attack Rate Per NHC

Table 2 presents the epidemic attack rate in the

neighborhood health committee (NHC). Total number 5 NHCs were affected by the epidemic. The most affected NHC

was Mandondo with 2.7% attack rate. This was the NCH from which the index case was recorded. Luona NHC recorded 1.0% attack rate, Chongo 0.4% attack rate, Chndawiri 0.2% attack

rate with the least NHC attacked being Chiwayu with 0.1% attack rate. Overall facility attack rate based on the affected NHCs was 1 case per 100 people.

Table 2. Attack rate per Neighborhood Health Committee.

NHC Name	Population	Cases N=64	Attack rate per 100
Mandondo NHC	1515	41	2.7
Luona NHC	1357	13	1.0
Chongo NHC	1404	6	0.4
Chendawiri NHC	1348	3	0.2
Chiwayu NHC	683	1	0.1
Facility	6301	64	1.0

3.3. Epidemic Risk Factors

Table 3 presents logistic regression for epidemic risk factors. The results of the investigation indicated a significant association between education level and having scabies (p-value=0.014), history of skin contact with scabies person and developing scabies (p-value=0.012), record of exchanging clothes with suspected scabies case in last two weeks and developing scabies (p-value= 0.001), use of soap when bathing and developing scabies (p-value=0.003), bathing number of times and developing scabies (p-value=0.000), number of family members in the household with developing scabies (p-value=0.000).

The results further indicated that participants who had attained level of education less or up to the tenth grade were 4.9 times more likely to develop scabies than those who had

attained level of education higher than grade ten (OR=4.9, 95% CI=1.34-6.45). The odds of developing scabies in the participants that had a history of skin contact with the suspected scabies person were higher than those that did not have a record of skin contact (OR=2.5, 95% CI=0.74-8.68). Participants that recorded exchanging of clothes with the suspected scabies cases in last 2 weeks were more likely to develop scabies than those who did not have record of exchanging clothes with suspected scabies cases (OR=2.1, 95%CI=1.45-5.34). Participants that bathed less than 3 times in a week were more likely to develop scabies (OR=5.4, 95% CI=2.38-14.43). On the other hand, participants who used soap for bathing were less likely to develop scabies (OR=0.34, 95% CI=0.21-2.71). Participants who were from households with less than 5 members were less likely to develop scabies (OR=0.12, 95% CI= 0.12-0.06).

Table 3. Logistic regression for epidemic risk factors.

Factor	Scabies status		P Value (α 0.05)	OR	95.0% C.I. for EXP	
	Case	Control			Lower	Upper
Low education status (less grade 10)						
Yes	61	103				
No	3	25	0.014	4.9	1.34	6.45
Skin contact with scabies person						
Yes	6	5				
No	58	123	0.012	2.5	0.74	8.68
Record of exchanging clothes with suspected scabies cases in last 2 weeks						
Yes	25	30				
No	39	98	0.001	2.1	1.45	5.34
Use of soap when bathing						
Yes	25	83				
No	39	45	0.003	0.34	0.21	2.71
Bathing less than 3 times						
Less than 3 times	46	41				
3 times or more	18	87	0.000	5.42	2.38	14.43
Family members less than 5						
Less than 5	19	98				
5 People and more	45	30	0.000	0.12	0.06	0.25

4. Discussion

4.1. Confirmation of the Outbreak and the Causative Agent

In a period of one month, the facility recorded a total number of 64 clinical scabies cases from different zones. This indicated a deviation from normal number of expected number of scabies cases per month. For the past three years

since 2020, the facility has recorded an average number of 5 cases per year [11]. Recording of 64 cases in a month therefore signified an existence of scabies outbreak in the study area.

4.2. Outbreak Distribution and Burden

The study results indicated that the mean age of the clinical scabies cases was 18 years. The findings of the study

therefore agree with the study conducted in Ghana where the average age range affected by scabies was between 15-20 years [14]. Globally, the study investigation findings are in line with study findings in Timor-Leste [15] where the average age range of the affected cases 11-20.

Cases were distributed in all the zones of the facility. However, the zone which recorded the index case had the highest number of the cases recorded. The same zone had the highest attack rate compared to the other zones. The spread of the cases was therefore from the hotspot area (zone with the index) to the other zones in the facility catchment. Findings of the investigations are therefore in line with the findings of the study conducted in Southern Ethiopia [16] and Ghana [17] indicated that areas with the index case had the highest disease burden and the epidemic spread to the surrounding areas due to different risk factors.

4.3. Risk Factors Associated with the Outbreak

There are different risk factors which were associated with the spread and occurrence of the outbreak. Education level of the individual was a risk factor associated with the outbreak. Individuals that had attained low education level (attained less than 10th grade of education) were 4.9 times more likely to develop scabies than the counterparts. The findings of the investigations are therefore in line with investigation done in Southern Ethiopia [18] where the risk of developing scabies was two times higher in individuals that had attained low education. In the article neglected category of poverty-associated plagues by Feldmeier [18], the article indicates that education level is associated with the spread of scabies. This association could be due to low comprehension of the necessary preventive and control measures associated with scabies such as good hygiene practices by participants of low education level.

History of skin contact with a scabies case in the previous 2 weeks was another factor associated with the outbreak. Participants that had skin contact with scabies case were 2.5 times more likely to develop scabies than their counterparts. The findings of the study are in line with the world health organization fact sheets presentation indicating that skin contact with the scabies person increase risk of disease occurrence [1]. Furthermore, a study conducted in southern Ethiopia [16] indicated that record of skin contacts with scabies person increased the risk of developing scabies by three times. Review of scabies in developing world article [19] further indicated that record of skin contact with scabies person increases risk of developing the disease. This could be because the transmission mode of the disease-causing agent is through direct contact. Hence, skin contact with a case transmit the agent from the old to the new host.

Record of exchanging clothes was another factor associated with the outbreak. The risk of developing scabies was 2.1 times more in participants that exchanged clothes with scabies person in the last two weeks than their counterparts. This is therefore in line with World Health organization [1] fact sheets on scabies that indicates that sharing of clothing, beddings and towels increases the risk of

developing the disease. The findings of the study are in line with on a study conducted in Timor-Leste [15] where it was discovered that the scabies disease spread was highly associated with exchange of clothes.

Number of bathing in a week was significantly associated with the outbreak occurrence. Participants that bathed less than 3 times in a week were 5.4 times more likely to develop scabies than their counterparts. This simply intel that individual that had poor personal hygiene practices were more likely to develop the disease. The investigation therefore is in accordance with the findings of the study conducted in Southern Ethiopia [16], North western Ethiopia [20]. However, a study on problems in diagnosing scabies revealed that personal hygiene may not influence the spread of scabies [21]. The difference in the findings of the articles could be as a result of difference in perspective of personal hygiene. Hand washing alone may not have a significant contribution in affecting the spread of the disease as compared to whole body bathing which was considered in this investigation.

On the other hand, family size and use of soap when bathing were protective factors to the spread of the outbreak. Participants that belonged to family size of less than 5 members were 0.1 times less likely to develop scabies. The risk of developing scabies reduced when a participant used soap for bathing by 0.3 times. The findings of the investigation are in accordance to the study done in Northern Ethiopia [16] and Iran [22] which indicated that family size was a significant factor associated with the spread of the disease. It is possible that this association occurs because the smaller the family size, the lesser the chances of body contact. In most cases especially in developing countries, bigger facilities share beddings and sometimes clothes. This in turn can result in spread of scabies [2]. Study conducted in South Ethiopia [16] further indicated that personal hygiene such as use of soap when bathing was a protective factor to the spread of scabies.

5. Conclusion

Based on Clinical diagnosis, Scabies outbreak occurred in Katondo Health Post catchment. The index case to the outbreak was from Mandondo zone. The zone from which the index case was reported had the highest attack rate among other zones. Risk factors associated the occurrence and spread of the outbreak were education level, skin contact with the scabies person in the last two weeks, record of exchanging clothes with suspected scabies case and bathing number of times. Use of soap when bathing and belonging to a family of less than 5 members were protective factors to the outbreak.

6. Recommendations

Based on the risk factors identified during the outbreak investigation, the following were the recommendations.

Community level

Engagement of traditional leaders to suspend community

activities that involves exchange of clothes. These are activities such as ball games and traditional ceremonies.

Facility level

- 1) Conduct risks-based health education sessions focusing on transmission, prevention and control of scabies.
- 2) Conduct active surveillance and case follow up on all suspected cases.

Limitations

Cases were classified based on the clinical signs. No microscopic confirmation was done from the cases. Therefore, the causative agent could not be isolated and determined.

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References

- [1] World Health Organisation (WHO). Key Facts Scabies. [Online].; 2020. Available from: <https://www.who.int/news-room/fact-sheets/detail/scabies>.
- [2] Centre for Disease Control (CDC). Parasites-Scabies. [Online].; 2010 [cited 2022 June 13. Available from: <https://www.cdc.gov/parasites/scabies/index.html>.
- [3] Karimkhani C, Colombara DV, Drucker AM, Norton SA, Hay R, Ennelman D, et al. The global burden of scabies: a cross-sectional analysis from the Global Burden of Disease Study 2015. *Lancet Infect Dis*. 2017 December; 1247 (1254).
- [4] Azene AG, Aragaw AM, Wassie GT. Prevalence and associated factors of scabies in Ethiopia: systematic review and Meta-analysis. *BMC Infect Dis*. 2020 May; 20 (380).
- [5] Sanei-Dehkordi A SAMZMJS. Risk factors associated with scabies infestation among primary schoolchildren in a low socio-economic area in southeast of Iran. *BMC Pediatr*. 2021 May; 21 (1) (249).
- [6] Zambia National Broadcasting. Samfya hit by Scabies outbreak. Online.; 2022.
- [7] Zambia Daily Mail. Scabies 'outbreak' worries Chitambo residents. Online. Chitambo.; News; 2022.
- [8] Enbiale W, Ayalew A. Investigation of a Scabies Outbreak in Drought-Affected Areas in Ethiopia. *Trop Med Infect Dis*. 2018 October; 29; 3 (4) (114).
- [9] Bisrat M, Solomon GN, Gebrie GN. Prevalence and determinants of scabies among school-age children in Central Armachiho district, Northwest, Ethiopia. 2022 June; 17 (6).
- [10] Zambia Electronic Disease Surveillance System. [Online].; 2018 [cited 2022 March. Available from: <http://zambia-eidsr.org/>.
- [11] District Health Managment Inform System (DHIS2). [online].; 2018 [cited 2022 March. Available from: <https://dhis2.moh.gov.zm/hmis/>.
- [12] Maryland Department of Health (Scabies Control). Maryland.org. [Online].; 2018 [cited 2022 November 12. Available from: <https://health.maryland.gov/phpa/Pages/scabies-guidelines.aspx#:~:text=Case%3A%20A%20confirmed%20case%20of%20a%20persistent%20pruritic%20rash>.
- [13] QGIS 3, 22. [Online].; 2018 [cited 2022 April 30. Available from: <https://www.qgis.org/en/site/forusers/download.html>.
- [14] Ofori-Amoah J, Addai SO, Ampratwum O, Adjei MR, Asare G, Mensah JA, et al. Scabies outbreak investigation and treatment in the Sekyere East District, Ghana. *Cogent Medicine*. 2021 July 30; 8 (1).
- [15] Santos MMd, Amaral S, Harmen SP, Joseph HM, Fernandes JL, Counahan ML. The prevalence of common skin infections in four districts in Timor-Leste: a cross sectional survey. *BMC Infectious Diseases*. 2010 March; 10 (61) (2010).
- [16] Wochebo W, Asnake YHS. Scabies outbreak investigation and risk factors in Kechabira district, Southern Ethiopia: unmatched case control study. *BMC Research Notes*. 2019 May 18; 12 (305).
- [17] Kaburi BB, Donne Kofi Ameme GAA, Dadzie D, Tender EK, Addeh SV, Aryyee T, et al. Outbreak of scabies among preschool children, Accra, Ghana, 2017. *BMC Public Health*. 2019 June; 19 (756) (2019).
- [18] Feldmeier H, Heukelbach J. Epidermal parasitic skin diseases: a neglected category of poverty-associated plagues. *Bull World Health Organ*. 2009 February; 87 (2) (152-9).
- [19] Hay RJ, Steer AC, D Engelman SW. Scabies in the developing world--its prevalence, complications, and management. *Clin Microbiol Infect*. 2012 April; 4 (313-23).
- [20] Sar J, Haji Y, Gebretsadik A. Scabies Outbreak Investigation and Risk Factors in East Badewacho District, Southern Ethiopia: Unmatched Case Control Study. *Hindawi*. 2018 June 26; 2018.
- [21] Walton SF, Currie BJ. Problems in diagnosing scabies, a global disease in human and animal populations. *Clin Microbiol Rev*. 2007 April; 2 (268-79).
- [22] Sanei-Dehkordi A, Soleimani-Ahmadi M, Zare M, Jaberhashemi SA. Risk factors associated with scabies infestation among primary schoolchildren in a low socio-economic area in southeast of Iran. *BMC pediatric*. 2021 May; 21 (249) (2021).