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An outbreak of scabies in a fishing community in Hoima District, Uganda, February – June, 2022

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Abstract

Background Scabies, an infectious parasitic disease, is endemic in most resource-poor tropical areas, including Uganda. On May 21, 2022, the Ugandan Ministry of Health was notified of > 1,000 cases of scabies in Hoima District. We investigated to assess the scope of the outbreak, identify associated factors, and recommend interventions.

Methods We defined a suspected scabies case as the onset of an itchy pimple-like skin rash or crusting from January 2021 to July 2022 in a resident of Hoima District. We reviewed medical records, performed active community case-finding, and computed attack rates by age, sex, and village per 1,000 population. Using logistic regression, we compared exposures among 101 case persons and 99 unmatched controls living in Rwentale Landing Site in Hoima during June 2022.

Results We line listed 2,236 suspected cases in Hoima District. Children aged 5–14 years were more affected (AR = 64/1,000) than persons aged ≥ 15 years (AR = 8/1,000) ($p < 0.001$). Males (AR = 27/1,000) were more affected than females (AR = 15/1,000) ($p < 0.001$). Of the 54 affected villages, Rwentale Village had the highest attack rate (AR = 233/1,000 population). Rwentale Village includes a fishing area known as Rwentale Landing Site where 1,119 (50%) cases in Hoima District were identified. At this landing site, cases began in April 2022 shortly after the end of the peak fishing and trading season. Being aged 5–14 years (AOR = 4.9, 95%CI: 2.0–12), being male (AOR = 2.4, 95%CI 1.1–5.1), living with another case (AOR = 3.1, 95%CI: 1.5–6.2), and sharing three or more personal care items (towel, beddings, clothes, or sponges) (AOR = 2.2, 95%CI: 1.1–4.6) were associated with scabies.

Conclusion This scabies outbreak was likely initiated by person-to-person interactions during peak fishing and trading months at a landing site and propagated by close household interactions. Community sensitization on scabies, especially before fishing and trading seasons is recommended for prevention and early control of scabies in the region. Additionally, establishing a surveillance system for scabies, in high-risk areas such as fishing communities may facilitate timely detection and control of future outbreaks.

Keywords Scabies, *Sarcoptes scabiei*, Outbreak, Uganda

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Introduction

In 2024, about 12% of persons globally suffered from scabies at any time [1]. In 2021, scabies accounted for 5.3 million disability-adjusted life years [2]. The highest rates occur in hot tropical climates where the disease is endemic [1, 3, 4]. Scabies, an extremely itchy skin condition, is caused by the human itch mite *Sarcoptes scabiei* var. *hominis* [4]. Disruptions in the skin barrier from excessive scratching predispose persons with scabies to bacterial superinfection (commonly, *Streptococcus pyogenes* and *Staphylococcus aureus*) that can result in complications, including pyoderma, impetigo, cellulitis, rheumatic heart disease and kidney disease [5, 6].

The acute symptoms and secondary consequences associated with scabies infestation cause severe socioeconomic hardship for those who have it, their families, communities, and the healthcare system [7, 8]. The price of medications, institutional outbreaks brought on by hospitalization of cases, and lost productivity are the primary direct financial expenses of scabies [7, 8]. Owing to the morbidity and financial burden associated with scabies, the World Health Organization (WHO) recently designated scabies as a Neglected Tropical Disease (NTD) to emphasize the urgency of giving the illness top priority in low- and middle-income countries [9].

Direct human-to-contact with infested skin, is the main method of scabies transmission [9]. Transmission may also occur through contact with contaminated personal care items like clothing, bedding, and towels. The primary contributing factors to scabies infestation are overcrowding, poor sanitation and poverty [4, 10, 11]. As such, the incidence of the disease may increase during natural or man-made disasters.

In Uganda, current data on the nationwide prevalence of scabies is limited, with estimates in 2022 primarily derived from school-aged children in urban areas [12]. The pooled prevalence of 0.2% is likely an underestimate, as this does not account for rural populations or other at-risk groups [12]. Additionally, Uganda lacks a dedicated surveillance system for scabies. Instead, it is broadly classified under skin diseases in the health unit outpatient monthly reports. The absence of a scabies-specific surveillance system makes it challenging to accurately assess the true burden of the disease and track changes in its prevalence [13]. Uganda had five reported outbreaks from 2020 to 2022, two of which were in Hoima District [14–18]; in 2020, more than 2,000 persons were affected [17]. On May 21, 2022, the Ministry of Health (MoH) received an alert from the District Health Office of Hoima District of a suspected outbreak of scabies. More than 1,000 persons from 16 villages had reportedly been affected. We investigated this outbreak to determine the scope and identify risk factors to inform evidence-based interventions.

Methods

Study setting

Hoima District, located in the Mid-Western region of Uganda, is approximately 220 km from Kampala. It has a population of about 400,000 people across 13 sub-counties [19]. The district shares borders with several others and the Democratic Republic of the Congo across Lake Albert [19]. Subsistence farming is the main economic activity, while fishing at Lake Albert, which covers 38% of the district, also plays a significant role [10].

Case definition and finding

We defined a suspected scabies case as the onset of an itchy pimple-like skin rash, or crusting from January 2021 to July 2022 in a resident of Hoima District, Uganda, with lesions appearing in typical scabies distribution sites (such as finger webs, wrists, axillae, or genitals) and at least one of the following: (a) affected household member or close contact with similar symptoms, (b) a generalized itch that worsens at night [20].

Using a scabies case investigation form developed for this outbreak, we obtained data on patient demographic information (age, sex, parish, and sub-county of residence) and clinical information.

With the help of community health workers, we also conducted an active community case search in the affected sub-counties. We first oriented the community health workers on case definitions, and we then went door to door identifying cases.

Descriptive epidemiology

We assessed the distribution of cases over time by constructing epidemic curves. We computed attack rates by person (age and sex) and place characteristics (sub-county and village) using the Uganda Bureau of Statistics revised population projection from 2015 to 2030 for 146 districts [19]. We also drew a choropleth map of the district indicating the most affected sub-counties.

Hypothesis generation interviews

We conducted key informant interviews with four village leaders, and eight healthcare workers to identify possible factors associated with the outbreak. We conducted hypothesis-generating interviews of ten conveniently sampled scabies cases in the most affected village using a scabies case investigation form developed for this outbreak. We explored about number of persons per household, the number of personal care items shared, personal hygiene, being infested with scabies before, and having visitors during the peak fishing and trading months.

Case-control study

We conducted an unmatched case-control study at the most affected village to test our generated hypotheses.

We defined a scabies case as the onset of an itchy pimple-like skin rash or crusting in a resident of the Rwentale landing site from June 1 to 30, 2022. A control was the absence of the above symptoms in a resident of the Rwentale landing site from April to June 2022. This was done considering two incubation periods (two months) to minimize the chance of recruiting infested persons that were in the incubation period.

We estimated the sample size using the formula for comparison of two proportions [21]. We assumed a 5% level of significance and 80% power. Using sex as a significant factor, with 0.72 of cases and 0.52 of controls exposed and an odds ratio (OR) of 2.69 [11], a minimum of 144 participants was computed. We further adjusted for 10% non-response, increasing the sample size to 160 participants. However, we increased this sample size to 200 to improve power to detect differences between exposures for cases and controls.

We obtained data on age, sex, number of shared personal care items, number of visitors living with participant in their household from February to March 2022 (the peak fishing and trading months), living with a scabies case-person in the same household during two months before symptom onset and personal hygiene. We assessed personal hygiene using an adapted Global Health Survey Hygiene (GSHS) questionnaire [22] (Table 1). The GSHS questionnaire assesses ten core areas including hygiene, that are leading causes of morbidity and mortality among children and adults globally [22].The maximum possible score was 12; a score of 6 or more was graded as good personal hygiene while a score of 5 or less was graded as poor personal hygiene [23] (Table 1).

Table 1 Personal hygiene assessment questions and scores

Activity	Score
Number of times brushing teeth	
Irregularly	0
Once daily	1
Two or more times daily	2
Number of times taking bath with soap	
Irregularly	0
Once daily	1
Two or more times daily	2
Hand washing before eating with soap	
Yes	2
No	0
Hand washing after toilet with soap	
Yes	2
No	0
Wearing clean clothes	
Yes	1
No	0
Hair combed	
Yes	1
No	0
Are nails cut	
Yes	1
No	0
Are nails clean	
Yes	1
No	0

For each case-person, a control was chosen. A list of all 312 affected households obtained from the chairperson and community health workers was used as the sampling frame. A sampling interval was generated by dividing the total number of affected households by the number of cases to be selected from the village. A computer-generated random number was used to get the first household from which the interval was applied to get to the next household.

As such, every third household was sampled from the list of affected households. We obtained one case from each household. If more than one case was found in a household, we randomly selected the case. The household participants were told to choose from random slips of paper, and then the one with the lowest number was enrolled as the case. The procedure was repeated to obtain controls. However, because there were only 102 households that did not have a case, controls were enrolled consecutively.

Data were exported to and analyzed using Stata version 14.0 (Stata Corporation, College Station, Texas, USA). A stratified analysis based on case status was carried out for descriptive analysis of baseline characteristics of the study population. The distribution of participants' categorical characteristics (age, sex, having visitors during the peak fishing and trading months, personal hygiene, living with a scabies case patient, number of personal care items shared) was summarized as frequencies, proportions, and percentages and presented in form of contingency tables.

To determine factors associated with scabies infestation, ORs between individual predictors and scabies infestation at the bivariate level were assessed and those that were hypothesized to be associated with case status as well as those with a p value < 0.2 were considered for the multivariable analysis.

The presence of Interaction was assessed using the log-likelihood test by comparing full and reduced models. Confounding variables were assessed by comparing ORs of scabies infestation of unadjusted models and adjusted models. Variables that caused a difference between the ORs of both models of at least 10% were considered confounders. Variables with a p-value less than 0.05 were regarded as statistically significant, confounding variables as well as those that caused significant interaction were to be left in the model, however, these were not found.

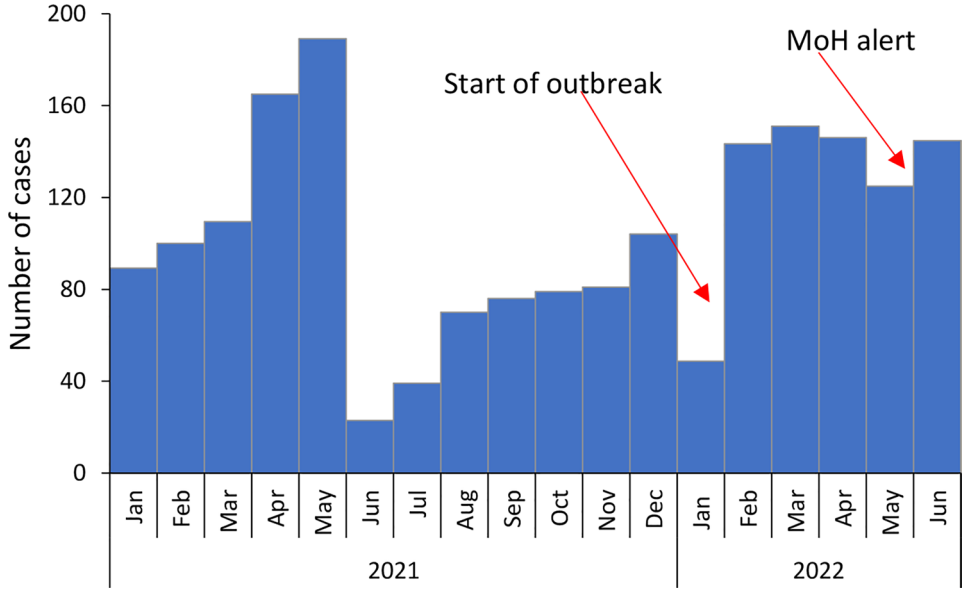


Fig. 1 Distribution of scabies cases by month of onset, Hoima District, Uganda, January 2021 to June 2022

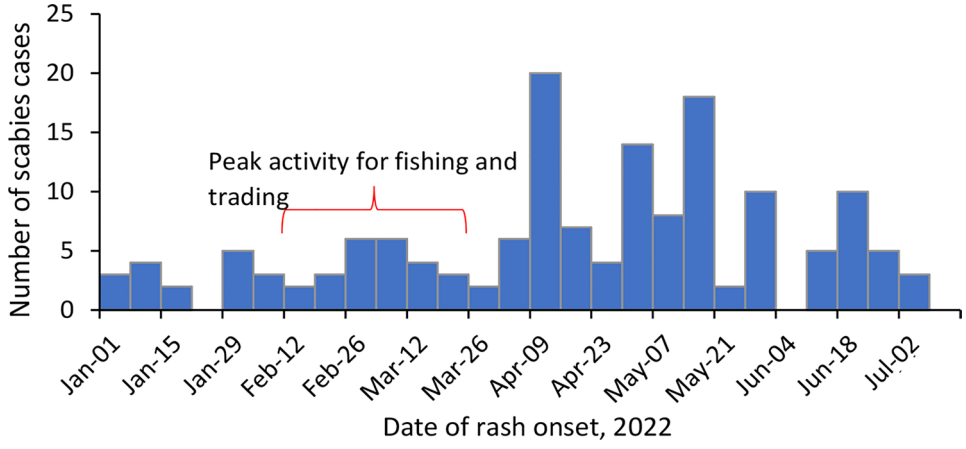


Fig. 2 Distribution of scabies cases by date of onset, Rwentale Village, Buseruka sub-county, Hoima District, Uganda, July 2022

The goodness of fit of the regression model to the data was assessed using the Hosmer-Lemeshow test.

Results

Descriptive epidemiology

We line listed 2,236 suspected scabies cases in Hoima District from January 2021 to July 2022. The overall attack rate of scabies in Hoima District was 21/1,000 population with no deaths. Children 5 to 14 years old were the most affected (64/1,000), followed by children < 5 years (36/1,000), and least affected was persons ≥ 15 years (8/1,000). Males (27/1,000) were more affected than females (15/1,000).

The epidemic curve of the scabies outbreak in Hoima District showed peaks in the number of scabies cases from January to May in 2021 and February to June in 2022. Although the outbreak in 2022 started in February, the Ministry of Health was alerted on May 28, 2022 (Fig. 1).

The epidemic curve for Rwentale village, Buseruka sub-county (the most affected area), Hoima District revealed a propagated outbreak with probable periods of exposure occurring between February 26 to March 5, 2022. This coincided with the peak fishing and trading activity which occurs from early February to April (Fig. 2).

In Hoima District, Buseruka Sub-county, which has the principal landing site, had the highest attack rate (AR, 97/1,000) (Fig. 3A and B).

Of the seven villages in Buseruka sub-county, Rwentale landing site village was most affected (AR 233/1,000 persons), followed by Fofo (AR, 205/1,000 persons), Kyakaboga B (AR, 111/1,000 persons), Resettlement (AR, 50/1,000 persons), Hoimo (AR, 11/ 1,000 persons), Tonya

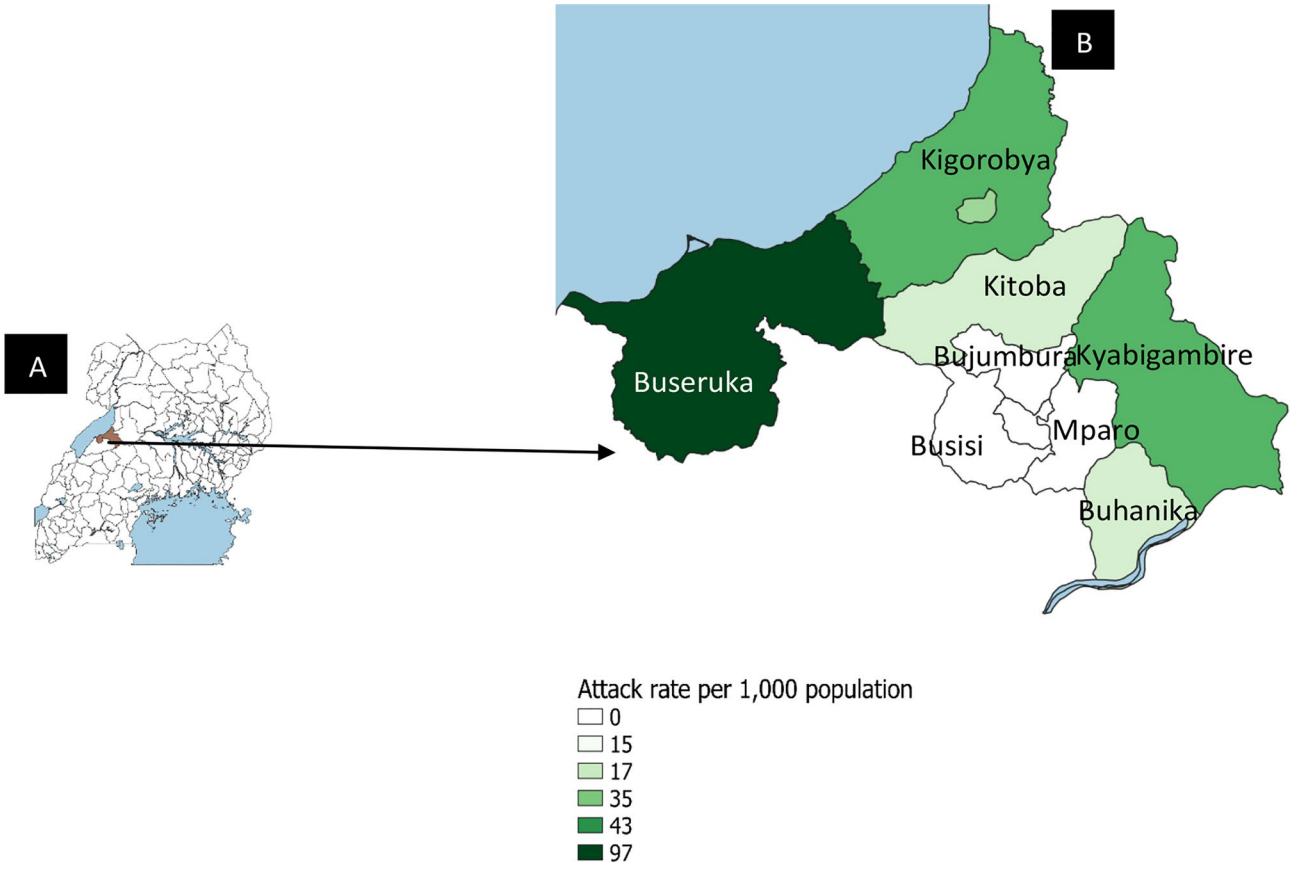


Fig. 3 **A**: Location of Hoima District in Uganda highlighted in brown. **B**: Attack rates per 1,000 persons by sub county, Hoima District, January 2021?June 2022

B (AR, 7/1,000 persons), and Kyakaboga A (AR, 6/1,000 persons).

Hypothesis generation interview findings

Key informant interview findings

Three major themes emerged as drivers for the scabies outbreak in Rwentale Village: poor personal hygiene, increased interaction during business seasons, and sharing personal care items.

Increased human interaction during business seasons

The participants provided qualitative information on the link between increased scabies cases and peak fishing and trading months. They said that during this time, there are many people that gather from different areas and this was likely why the cases increased. A participant noted, "*You see, during the business season, when the fishing season comes, many people come here, some come with the disease… people mix a lot… that is why I think the people with this disease are many now.*" Village leader.

Poor personal hygiene

The participants said that there were increased cases due to poor personal cleanliness. They believed that the illness was from organisms in the soil and dirty water. Thus, persons that did not bathe regularly, wash their clothes, or had dirty hair likely harboured the organism. A participant noted, *"It is this tribe X who do not bathe, they never wash their clothes… even when they bathe, they use water from the lake which has the organism that brings this disease."* Village leader, Rwentale Village.

Sharing personal care items

The participants noted that sharing personal care items was likely a driver of the outbreak. A participant said, *"Our people are very communal people, they share everything. even towels, basins. As they share these things, they pass on the parasite to other people"* Healthcare worker.

Structured interview findings

Of the 10 case-persons interviewed, 9 (90%) reported sharing personal care items, 8 (80%) had poor personal hygiene, 8 (80%) had been infested with scabies before, and 8 (80%) had visitors during February to March (the peak fishing and trading months). We hypothesized that having visitors during the peak fishing and trading seasons, poor personal hygiene and sharing personal care items were associated with case status.

Table 2 Factors associated with Scabies infestation among residents of Rwentale village, Hoima district, June 2022

Characteristic	Cases (*n* = 101)		Controls (*n* = 99)		COR	CI	AOR	CI
	n	(%)	n	(%)				
Visitors- Feb to Jun								
No	57	(56.4)	54	(55.7)	1		1	
Yes	44	(43.6)	43	(44.3)	1.0	0.6–1.7	0.7	0.3–1.5
Age category								
< 5	32	(31.7)	11	(11.2)	5.6	2.6–12.3*	4.2	1.7–10.2*
5 to 14	29	(28.7)	10	(10.2)	5.6	2.5–12.6*	4.9	2.0–12.0*
>=15	40	(39.6)	77	(78.6)	1		1	
Sex								
Female	55	(54.5)	82	(82.8)	1		1	
Male	46	(45.5)	17	(17.2)	4.0	2.1–7.8*	2.4	1.1–5.1*
Personal hygiene								
Good	62	(61.4)	65	(65.7)	1		1	
Poor	39	(38.6)	34	(34.4)	0.8	0.5–1.5	1.3	0.6–2.9
Number of shared personal care items								
< 2 items	43	(42.6)	65	(65.7)	1		1	
≥ 3 items	52	(51.5)	28	(28.3)	2.8	1.5–5.1*	2.2	1.1–4.6*
Living with a scabies case-person in the same house								
No	41	(40.6)	74	(75.5)	1		1	
Yes	60	(59.4)	24	(24.5)	4.5	2.5–8.3*	3.1	1.5–6.2*

*$p < 0.05$, COR- crude odds ratio, AOR- adjusted odds ratio, Hosmer Lemeshow test, $p = 0.395$

Case-control study findings

The case-control study had 101 cases and 99 controls. Among the cases, 40 (39.6%) and compared to 77(78.6%) of controls were 15 years or older. In multivariable analysis, being aged < 5 years (Adjusted OR [AOR] = 4.2, 95%CI: 1.7–10) and 5 to 14 years (AOR = 4.9, 95%CI: 2.0–12), having shared four personal items compared to two (AOR = 8.9, 95%CI: 2.2–36.2), being male (AOR = 2.4, 95%CI: 1.1–5.1), and having a previous scabies diagnosis (AOR = 3.1, 95%CI: 1.5–6.2) were associated with case-status (Table 2).

Discussion

We investigated the scabies outbreak in Hoima District, Uganda in June 2022. The outbreak in Hoima District started in February 2022. The most affected sub-county was Buseruka, while the most affected village in Buseruka was Rwentale Landing Site. The scabies outbreak in Rwentale Village started in April approximately two months after the peak fishing and trading months. Being less than15 years old, male, living with another case, and sharing personal care items with persons infested with scabies were associated with case status.

Although the most recent outbreak in Hoima District started in February 2022, the Ministry of Health received an alert on May 28, 2022. Additionally, the MoH did not receive an alert of the 2021 scabies outbreak. In Uganda, there is no formal scabies-specific surveillance system. Scabies is reported generically as a skin disease in the health unit outpatient monthly report. Without a scabies-specific surveillance system, it may be difficult to monitor the true burden of the disease and changes in its occurrence [13].

Buseruka was the most affected sub-county in Hoima District. This is likely because of its location as a border sub-county. The most affected village, Rwentale, is located in Tonya parish which is a principal landing area. Rwentale, being the most active landing site village and densely populated, likely has more person-to-person interactions which facilitated the spread of scabies [4, 24]. The outbreak in Rwentale Landing Site started in April 2022. This was approximately two months after the peak fishing and trading activity occurred at the landing site, which brings high levels of business and visitors to the area [4]. The two months period following peak fishing and trading activity coincided with the incubation period for scabies infestation [4]. Population movements have been identified as a key factor in scabies transmission. Data suggests that scabies incidence correlates with population movements, suggesting that the movement of people leads to a higher incidence in the general population due to increased risk of social interaction with persons with scabies [25–28]. These findings emphasize the need for targeted public health interventions in areas with high mobility and crowded living conditions. The World Health Organisation recommends that mass drug administration of ivermectin may be considered as an effective control measure of scabies in communities with a prevalence of at least 5% [29]. Mass administration of ivermectin has been shown to be effective in reduced the incidence of scabies in endemic communities including fishing communities [30–32]. The Uganda Ministry of

Health could consider implementing mass drug administration of ivermectin in line with WHO guidelines. Integrating this strategy into national scabies control efforts, particularly in high-risk areas, could help reduce transmission and improve overall community health.

Males had about thrice the odds of contracting scabies compared to females. This is likely because men dominate commercial activities in Uganda [33]. As such, they may participate more than females in commercial activity during the peak fishing and trading months which increases person-to-person contact [34]. Additionally, men are more likely to migrate for income-related work while women engage primarily in subsistence work, potentially reducing their exposure to persons infested with scabies [35, 36]. This means more person-to-person interaction for men which drives the spread of scabies. It could also be because males are less likely to be concerned with personal cleanliness than females [37–39]. Our findings agree with those of several studies conducted in similar low-resource setting [11, 40–42]. However, a systematic review of 70 studies in low- and high-income countries in 2024 reported a weak association between being male and scabies case-status [1]. This was likely due to contextual differences in exposure and behavior. While men may have higher prevalence in communal living settings like barracks or prisons, women may be at greater risk in some contexts due to their role as primary caregivers, leading to prolonged contact with children who are common scabies carriers [43].

Although scabies infestation can occur in any age group, it is more common in younger ages [4]. In our investigation, children 5 to 14 years were the most affected age group. This is likely because of greater socialization, personal contact and sharing of personal items within these age groups [44]. It could also be because children in this age group have less awareness or ability to maintain personal hygiene especially in resource constrained settings [45, 46]. A systematic review of 13 studies among school going children in low-income countries from 2000 to 2013 reported that younger children (less than 15 years) were more likely to contract scabies [47]. Similar findings have been reported in non-school settings in Ethiopia, Norway, and Ghana [48–51].

Living with a scabies-infested person increased the odds of contracting scabies. This is likely because sharing a house with an infested person means that there is likely greater physical contact as well as sharing personal items with them [10]. In a meta-analysis of 12 studies in Ethiopia in 2020, persons who had contact with a scabies case-person had higher odds of being infested with scabies compared to those that had no contact with a scabies case patient [10]. Although most studies indicate that living with a person infested with scabies increases the risk of transmission due to prolonged skin-to-skin contact and shared personal items, some research suggests that other factors like overcrowding and poor sanitation may also play significant roles in scabies transmission, potentially diminishing the perceived impact of household contact alone [43, 52].

A meta-analysis and systematic review of twelve studies in Ethiopia reported a 3.1 increased odds of scabies infestation among persons in large family size households compared to smaller family size households [53]. However, we did not find the number of people in the household to be associated with case status. One possible explanation could be that Rwentale Village was a densely populated area hence this exposure is likely similar among the cases and controls [19]. It may therefore be helpful to adopt a holistic approach that addresses not only household-level transmission but also underlying structural conditions such as housing, sanitation, and health education.

Persons who shared three or more personal care items had about three times the odds of being a scabies case patient compared to those that shared two personal items or less. Personal items can spread the scabies mites if these have been in contact with a person who has scabies. Adult mites can exit the stratum corneum, attach to clothing, and live outside the human body for about three days in dry hot climate conditions, long enough to transmit scabies [37]. Studies have shown that female mites can survive for up to seven days at 59 °F (approximately 15 °C) when relative humidity exceeds 75% [54]. During the wet season in Hoima District, average temperatures range between 16.5 °C and 33 °C, and relative humidity can reach 60–85% [55]. These conditions likely extend the viability of scabies mites in the environment, particularly during the fishing season, thereby increasing the potential for transmission through shared personal items. In a systematic review of 14 studies in boarding schools in 2020, sharing of personal items was significantly associated with being a scabies case-person [56]. Other studies have reported similar findings [37, 57].

Limitations

This study had some limitations. First, the assessment of personal hygiene was by self-report. This could have biased the association between scabies case status and personal hygiene toward the null. Secondly, we asked the participants about having had visitors from February to March which could have resulted in imperfect recall. Third, a longer assessment period showing scabies outbreaks in Hoima District would have strengthened our findings, but the absence of a scabies-specific surveillance system in Uganda limited access to long-term data. However, multiple data sources—including qualitative interviews—consistently indicated a reliable link between fishing seasons and increased scabies transmission.

Lastly, although we relied on clinical signs and symptoms to make a diagnosis of scabies, in line with the International Alliance for the Control of Scabies criteria, we were unable to obtain laboratory confirmation of case-status. This could have led to misclassification bias.

Conclusion

The outbreak in Rwentale landing site village was likely propagated by increased human interaction during the peak fishing and trading months. Case-status was associated with sharing personal care items and living in the same household as an infested person. Being under 15 years of age and being male were also associated with case-status, as these factors may relate to behaviors or circumstances—such as poor hygiene practices or closer physical contact—that increase susceptibility to scabies infection.

We recommend that community leaders and health workers consider educating communities about scabies transmission especially during the peak fishing and trading months. Future research could also consider the role of sexual transmission of scabies as this could guide prevention and control strategies. The MoH should consider establishing a scabies-specific surveillance system to understand the true magnitude of the problem, and hence plan for appropriate interventions. Finally, mass drug administration of ivermectin may be considered as an effective control measure of scabies in communities with a prevalence of at least 5% [29].

Abbreviations

AOR	Adjusted Odds Ratio
AR	Attack Rate
CDC	Centers for Disease Prevention and Control
CI	Confidence Interval
GSHS	Global Health Survey Hygiene questionnaire
IRB	Institutional Review Board
MoH	Ministry of Health
NTD	Neglected Tropical Disease
OR	Odds ratio
WHO	World Health Organisation

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Author contributions

AR, BA, SNK, PCK, and JFZ participated in the conception, design, analysis, and interpretation of the study and wrote the draft manuscript; RM reviewed the report, reviewed the drafts of the manuscript for intellectual content, and made multiple edits to the draft manuscript; RM, DK, BK, LB, and ARA reviewed the manuscript to ensure intellectual content and scientific integrity. All authors read and approved the final manuscript for publication.

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Data availability

The datasets upon which our findings are based belong to the Uganda Public Health Fellowship Program. For confidentiality reasons, the datasets are not publicly available. The datasets can however be availed upon reasonable request from the corresponding author with permission from the Uganda Public Health Fellowship Program.

Declarations

Ethical approval and consent to participate

This study, conducted in response to a national public health emergency, was approved under a memorandum of understanding and an umbrella protocol (project ID: 0900f3eb81f96394); the study was waived the full Institutional Review Board (IRB) review. The Uganda Public Health Fellowship Program, part of the National Rapid Response Team, was authorized by the Ministry of Health to access and analyze surveillance data from the District Health Information System-2, along with other relevant data, to inform outbreak control and public health programs. The Ministry also granted permission for the dissemination of findings through scientific publications. In agreement with the International Guidelines for Ethical Review of Epidemiological Studies by the Council for International Organizations of Medical Sciences (1991) [58] and the Office of the Associate Director for Science, CDC/Uganda, it was determined that this activity was not human subject research and that its primary intent was public health practice or disease control activity (specifically, epidemic or endemic disease control activity). The authors sought administrative clearance to conduct the investigation from the District Health authorities of Hoima District. Clearance was also sought from the administrators of the health facilities to access data about patients who had visited the facility or been admitted with a scabies diagnosis. Verbal informed consent was obtained from the participants before the start of each interview. Parental/legal guardian verbal informed consent was obtained on behalf of all the children before the start of each interview since they were aged less than 10 years. Data which was collected did not contain individual personal identifiers as a way of ensuring confidentiality. Individuals who were clinically diagnosed with scabies were given benzyl benzoate lotion 25% to apply to the whole body from the scalp to the soles of the feet as per Uganda clinical guidelines [59].

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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