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Prevalence and risk factors of Streptococcus pyogenes among Children Aged 3-15 years at Nyimbwa Health Centre IV, Luwero District: A Cross-Sectional Study.

Jameo Nabwami*, Richard Miiro, Francisco Ssemuwemba, Hasifa Nansereko, Anthony Ssekitoleko, Jane Frank Nalubega, Immaculate Prosperia Naggulu
Mildmay Institute of Health Sciences

Abstract

Background:

Acute pharyngitis is one of the diseases caused by *S. pyogenes*. The study aims to determine the prevalence of Streptococcus pyogenes, its associated clinical features, and contributing risk factors among children aged 3-15 years presenting with acute pharyngitis at Nyimbwa Health Centre IV in Luwero District.

Methodology:

The study was a descriptive cross-sectional study to determine the prevalence of *S. pyogenes* among children aged 3-15 years with acute pharyngitis and also identify associated risk factors of *S. pyogenes* among children aged 3-15 years with acute pharyngitis. The study was conducted from Nyimbwa Health Centre IV, which is a health Centre located in Nyimbwa County, Katikamu, Luwero District. Participants were selected using a convenience sampling method.

Results:

143 children aged 3-15 years who attended Nyimbwa Health Centre IV in Luwero District during the period of study were recruited for the study. 143 children were examined for *S. pyogenes;* only 16 had positive culture results, and 127 had negative culture results. The results indicate that the prevalence of *S. pyogenes* among children aged 3-15 years is 11.2%. 91.6% (131/143) of the children who complained of a sore throat, 93.8% (15/16) had positive cultures for S. pyogenes. 44.1% (63/143) of the children had a cough, of which 31.3% (5/143) had positive cultures for S. pyogenes. Sex of the child, sharing of beddings, and contact with a person with *S. pyogenes* had no significant association with the prevalence of S. pyogenes.

Conclusion:

The results also linked classic clinical symptoms such as sore throat, fever, and inflamed tonsils to S. pyogenes positivity, strengthening the evidence for clinical diagnosis.

Recommendation:

Caregivers should adopt preventive home practices, including avoiding indoor smoking, reducing overcrowding, encouraging proper hygiene, and seeking prompt medical care whenever children develop a sore throat or fever.

Keywords: *Streptococcus pyogenes, Group A Streptococcus, Acute pharyngitis, Strep throat, Children aged 3-15years, , Nyimbwa Health Centre IV, Luwero District*
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Corresponding author: *Jameo Nabwami.*
Mildmay Institute of Health Sciences.

Background

Streptococcus pyogenes (*S. pyogenes*) is a Gram-positive, extracellular, spherical bacterium that can grow on enrichment culture media (Ahmed *et al,* 2021). In 1933,
According to the group A carbohydrate, which is made up of N-acetyl glucosamine and connected to S. pyogenes cell wall antigens, Rebecca Lancefield classified S. pyogenes as Group A Beta-hemolytic streptococcus (GABHS) in her serologic classification of bacteria (Miller et al, 2022).
S. pyogenes is frequently implicated in Upper respiratory tract infections (URTIs), particularly pharyngitis (Ahmed *et al,* 2021), and often causes other mild illnesses like strep throat, which can
Later progress into severe complications such as acute rheumatic fever (ARF), glomerulonephritis, and invasive infections (Kate *et al,* 2022).
Transmission of *S. pyogenes* can be through direct contact, contaminated fomites, or foodborne contamination or droplets from those with pharyngeal infection or colonization (Kabede *et al,* 2021). It affects people of any age, but children are the most likely to be affected (Gashaw *et al,* 2025). Individuals who have this organism on their pharynx but show no symptoms may contribute to infection in households and public areas, including offices, schools, and daycare centers (Anja *et al,* 2019).
Acute pharyngitis is one of the diseases caused by *S. pyogenes*. It is an inflammation of the oropharynx mucous membranes or posterior pharynx and tonsils (Tadesse *et al,*

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2023) with different clinical manifestations such as sore throat, sudden onset of fever, red pharynx, enlarged tonsils, yellow or blood-tinged exudates, petechiae on the soft palate and posterior pharynx (Kebede *et al,* 2021).

Approximately 18 million people suffer from severe *S. pyogenes*-related diseases worldwide, with 1.78 million new cases and at least 517,000 deaths occurring each year (Barth *et al,* 2020). In African countries, *S. pyogenes* was isolated from children with acute pharyngitis and the prevalence was 25.9% in Nigeria (Girbo *et al,* 2022), 15.1% in Zambia (Mwaba *et al,* 2020), 9.1% in Ethiopia (Kebede *et al,* 2021), 2.3 % in Kenya (Osowicki *et al,* 2019) and in Uganda, the prevalence of *S. pyogenes* infections among children with URTIs was found to be 29.1% (Kenyange *et al,* 2024).

There are many socio-cultural, demographic, and environmental risk factors that will predispose children to acquire acute pharyngitis (Gashaw *et al,* 2025). Some studies have highlighted that the education of the caretaker, living with other siblings, anyone smoking a cigarette, and the age of the child are factors significantly associated with having GABHS infections among children with acute pharyngitis (Kenyange *et al,* 2024). Additionally, studies have further shown several factors predictive of GAS carrier state, such as housing condition, gender, number of family members living in the same house, parents' education, economic status, nutritional status, tonsillar enlargement, and lymphadenopathy (Rahmadhany *et al,* 2020). The study aims to determine the prevalence of Streptococcus pyogenes, its associated clinical features, and contributing risk factors among children aged 3-15 years presenting with acute pharyngitis at Nyimbwa Health Centre IV in Luwero District.

METHODOLOGY

Study design

The study was a descriptive cross-sectional study to determine the prevalence of *S. pyogenes* among children aged 3-15 years with acute pharyngitis and also identify associated risk factors of *S. pyogenes* among children aged 3-15 years with acute pharyngitis.

A descriptive cross sectional is where a representative subset of the study population can be studied at a specific point in time. It was used because it enabled collecting quantitative data where both dependent and independent variables were assessed at the same time, fast and inexpensive when collecting data.

Study area

The study was conducted from Nyimbwa Health Centre IV, which is a health Centre located in Nyimbwa County, Katikamu, Luwero District. The health Centre offers Laboratory services, antenatal care, family planning, minor surgeries, and different specialized clinics. It has both the inpatient and outpatient departments receiving over 4500 patients on a monthly basis.

The study area was chosen because Nyimbwa Health Centre IV in Luwero being located in a rural area where resources are limited, there is difficulty in distinguishing *S. pyogenes* pharyngitis from viral pharyngitis making disease management difficult yet according to monthly reports, 15 out of 370 children aged 3-15 years report to the Centre with signs and symptoms of acute pharyngitis (Nyimbwa Health Centre IV monthly report of April 2025).

Study population

The study population consisted of children aged from 3 to 15 years receiving healthcare from Nyimbwa Health Centre IV in Luwero district, having signs and symptoms of acute pharyngitis during the study period.

Selection criteria

Inclusion criteria

All children aged 3-15 years receiving healthcare from Nyimbwa Health Centre IV in Luwero district, having signs and symptoms of acute pharyngitis during the study period, and consent to participate in the study were included.

Exclusion criteria

Children aged 3-15 years in need of emergency care were excluded from participating in the study.

Children aged 3-15 years who had used antibiotics within a period of 2 weeks were excluded from participating in the study.

Sample size determination

The sample size (N) was determined using the Kish & Leslie formula.

N =

Where;

N is the sample size required,

P is the expected prevalence of GABHS infections among children in Uganda, which was found to be 15.9% (DeWyer *et al,* 2020).

P = 15.9% (0.159)

D is the allowed error = 0.06

Z is the confidence interval (95%) = 1.96

Q=1-

P

N=

N = 143

Therefore, a sample size of 143 children was recruited.

Sampling technique

The study participants were selected using a convenience sampling method where children aged 315 years with specific characteristics were selected according to the signs and symptoms related to acute pharyngitis.

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Sampling procedure

Study participants were obtained by clinicians assessing children for any signs and symptoms related to acute pharyngitis. Children with signs and symptoms related to acute pharyngitis qualified to participate in the study. This was done on every day of data collection till the required number of respondents was reached within the period of study.

The sampling method was used because it allowed selecting participants who are most relevant to the research and ensures data collected is specific and directly related to the study's objective, leading to more meaningful and focused findings. The sampling method is also inexpensive and easy to use.

Data collection method

Oral interviews using a pre-tested questionnaire were used to collect data from caregivers of children aged 3-15 years on socio-demographic characteristics and associated risk factors of *S. pyogenes*. All data collected was quantitative.

To obtain data on the prevalence of *S. pyogenes*, a throat swab was picked from children for examination and isolation of *S. pyogenes* from throat swabs.

Data collection tool

The main tools used for the data collection included a pre-tested questionnaire and a laboratory results sheet. These data collection tools allowed the collection of quantitative data.

Data collection procedure

The purpose of the study was explained to the caregivers of the selected study participants who had met the inclusion criteria and were asked to consent on behalf of their children to be recruited in this study.

Oral interviews using a pre-tested semi-structured questionnaire were conducted to collect information about demographic data, clinical signs and symptoms, and risk factors associated with s. pyogens among study participants.

A throat swab was collected by carefully rubbing a sterile cotton swab tip against both tonsils and the posterior pharyngeal wall, and moving the swab without touching the teeth, gums, or tongue laboratory personnel.

The results obtained were recorded on the data sheet.

Study variables

Independent variables

include social demographic characteristics, clinical signs and symptoms, and risk factors associated with *S. pyogenes*.

Dependent variable

The dependent variable was the prevalence of *S. pyogenes*.

Quality control

To ensure the validity of data collection, the data collection tool was given to the research supervisor to evaluate the relevance of the tool to the earlier stated research-specific objectives.

To establish reliability, a laboratory assistant was trained on how to collect and transport throat swabs to the laboratory for examination. Also, standard operating procedures were followed during the collection, processing, and transportation of throat swabs.

Data analysis and presentation

Data collected was checked and manually organized into a data entry form, sorted and manually computed using simple hand calculators, and then the whole information was fed into a computer Microsoft Excel program for analysis and presentation into statistical tables, pie charts, grouped bar graphs, and then discussed, printed, and the final copies were disseminated to relevant bodies by the principal investigator.

Ethical considerations

The principal investigator presented an introductory letter from the Mildmay Institute of Health Sciences research committee to the person in charge of Nyimbwa Health Centre IV, seeking permission to conduct this study.

The person in charge of Nyimbwa Health Centre IV granted the researcher permission and introduced the researcher to the clinicians, who also introduced the researcher to the study participants.

Informed consent was obtained from caregivers of the study participants before being recruited for the study. The names of the respondents did not appear anywhere in the result tally sheet; instead, study numbers were used on questionnaires to ensure the confidentiality of the study participants.

RESULTS

Social Demographic Data

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Table 1: Demographic characteristics of study participants

Characteristic	Category	Frequency (n=143)	Percentage (%)
Sex	Male	61	42.7
	Female	82	57.3
Age group (years)	3-6	64	44.8
	7-10	36	25.2
	11-15	43	30.0
Parent employment status	Un employed	54	37.8
	Self employed	16	11.2
	Salaried	13	9.1
	Farmer	60	42.0
Monthly income (shs)	50,000-150,000	71	49.7
	151,000 – 300,000	52	36.3
	Above 300,000	20	14.0

Source: Primary data

Table 1 shows that a total of 143 children aged 3-15 years who attended Nyimbwa Health Centre IV in Luwero District during the period of study were recruited for the study. Data obtained showed that the majority of the children were females, 57.3% (82/143), and the rest were male 42.7% (61/143). Age group 3-6 years was represented more 44.8% (64/143), followed by age group 1115 years 30.0% (43/143), and the least represented was age group 7-10 years 25.2% (36/143). Most of the parents were farmers, 42.0% (60/143), followed by those who were unemployed 37.8% (54/143), 11.2% (16/143) were self-employed, and 9.1% (13/143) were salary earners.

49.7% (71/143) of parents had a monthly income between 50,000-150,000 Ugandan shillings, 36.3% (52/143) received an income between 151,000-300,000 Ugandan shillings, and the rest
14.0% (20/143) had a monthly income above 300,000 Ugandan shillings.

Prevalence of *S. pyogenes* among children with acute pharyngitis

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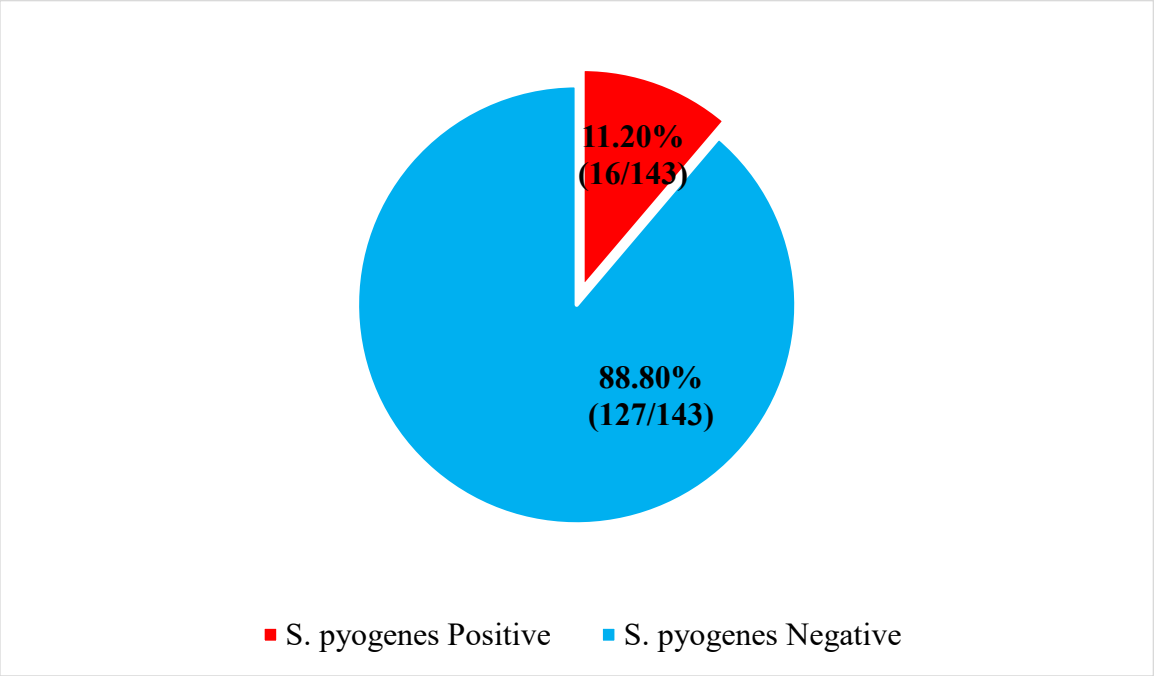
Figure 1: Prevalence of S. pyogenes among children



Source: Primary data

Figure 1 shows that, out of the 143 children examined for *S. pyogenes,* only 16 had positive culture results and 127 had negative culture results. The results indicate that the prevalence of *S. pyogenes* among children aged 3-15 years is 11.2%.

Distribution of signs and symptoms associated with the prevalence of *S. pyogenes* among children

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Table 2: Relationship between clinical signs and symptoms and prevalence of S. pyogenes among children

Sign and Symptoms	**Frequency N=143 (%)**		***S. pyogenes* pharyngitis n = 16 (%)**
Headache	Present	99 (69.2)	11 (68.7)
	Absent	44 (30.8)	5 (31.3)
	Total	**143 (100)**	**16 (100)**
Fever	Present	104 (72.7)	13 (81.3)
	Absent	39 (27.3)	3 (18.7)
	Total	**143 (100)**	**16 (100)**
Sore throat	Present	131 (91.6)	15 (93.8)
	Absent	12 (8.4)	1 (6.2)
	Total	**143 (100)**	**16 (100)**
Cough	Present	63 (44.1)	5 (31.3)
	Absent	80 (55.9)	11 (68.7)
	Total	**143 (100)**	**16 (100)**
Inflamed tonsil	Present	87 (60.8)	13 (81.3)
	Absent	56 (39.2)	3 (18.7)
	Total	**143 (100)**	**16 (100)**

Source: Primary data

Table 2 shows that 69.2% (99/143) of the children who complained of headache, 68.7% (11/16) had positive cultures for S. pyogenes. 72.7% (104/143) of the children who had fevers, only
81.3% (13/16) had positive cultures for S. pyogenes. 91.6% (131/143) of the children who complained of a sore throat, 93.8% (15/16) had positive cultures for S. pyogenes. 44.1% (63/143) of the children had cough of which 31.3% (5/143) had positive cultures for S. pyogenes. 60.8% (87/143) of the children had inflamed tonsil of which 81.3% (13/16) had positive cultures for S. pyogenes.

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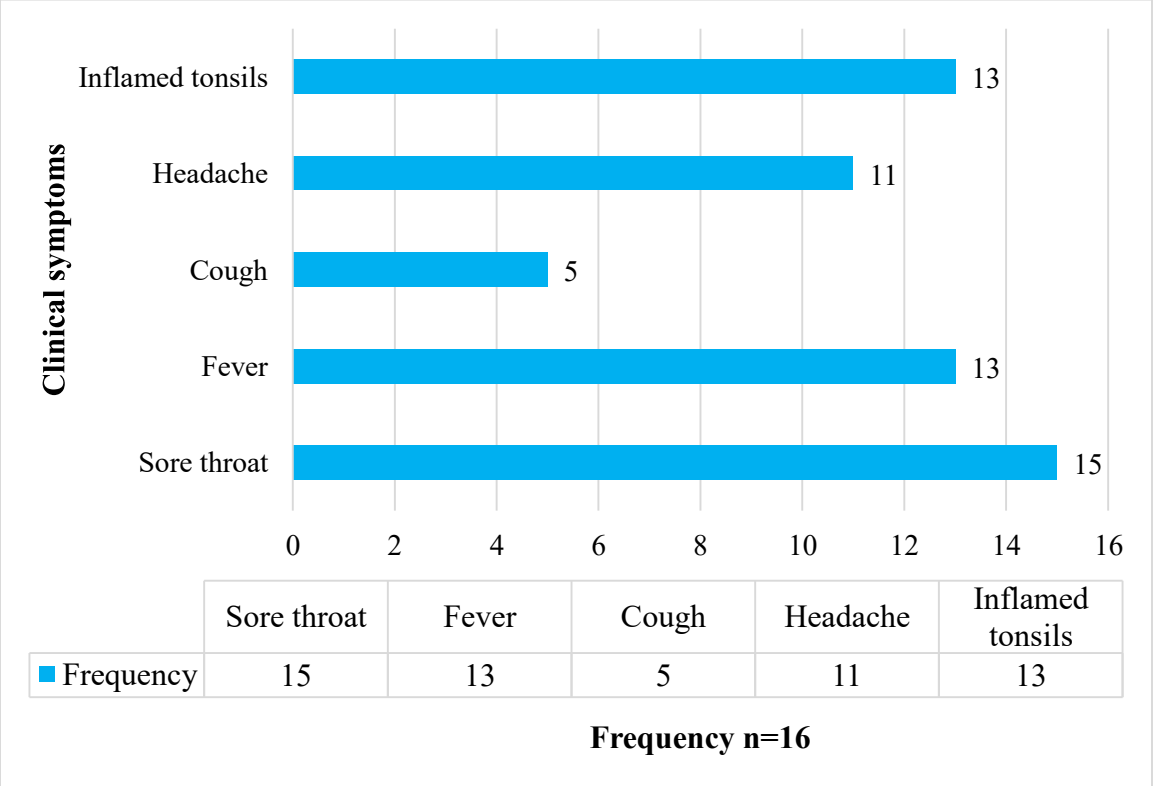
Figure 2: Distribution of signs and symptoms associated with the prevalence of S. pyogenes among children



Source: Primary data

Figure 2 shows that having a sore throat was highly related to having *S. pyogenes* at 15/16 (93.8%), followed by having a fever and having inflamed tonsils, each at 13/16 (81.3%), followed by having a headache, 11/16 (68.7%), and the least common sign was having a cough, 5/16 (31.3%).

Factors associated with the prevalence of *S. pyogenes* among children

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Table 3: Factors associated with the prevalence of S. pyogenes among children

Factor	Category	Frequency n=143 (%)	Culture results	
			Positive N (%)	Negative N (%)
Sex	Male	61 (42.7)	7 (11.5)	54 (88.5)
	Female	82 (57.3)	9 (11.0)	73 (89.0)
Age	3-6	64 (44.8)	4 (6.3)	60 (93.7)
	7-10	36 (25.2)	7 (19.4)	29 (80.6)
	11-15	43 (30.0)	5 (11.6)	38 (88.4)
Monthly income (shs)	50,000-150,000	71 (49.7)	11 (15.5)	60 (84.5)
	151,000 – 300,000	52 (36.3)	4 (7.7)	48 (92.3)
	Above 300,000	20 (14.0)	1 (5.0)	19 (95.0)
House hold size	3-5 people	23 (16.1)	2 (8.7)	21 (91.3)
	6-8 people	31 (21.7)	4 (12.9)	27 (87.1)
	> 9 people	89 (62.2)	10 (11.2)	79 (88.8)
Share beddings	Yes	126 (88.1)	14 (11.1)	112 (88.9)
	No	17 (11.9)	2 (11.8)	15 (88.2)
Previous infection	Yes	87 (60.8)	11 (12.6)	76 (87.3)
	No	56 (39.2)	5 (8.9)	51 (91.1)
Passive smoker	Yes	21 (14.7)	3 (14.3)	18 (85.7)
	No	122 (85.3)	13 (10.7)	109 (89.3)
Contact with a person with S. pyogenes	Yes	9 (6.3)	1 (11.1)	8 (88.9)
	No	134 (93.7)	14 (11.2)	120 (89.6)

Source: Primary data

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Table 3 shows that age group 7-10 years 19.4%, a monthly income between 50,000-150,000 Ugandan shillings 15.5%, a household size of 6-8 people 12.9%, previous infection 12.6%, and a child being a passive smoker 14.3% were factors associated with the prevalence of S. pyogenes. Sex of the child, sharing of beddings, and contact with a person with *S. pyogenes* had no significant association with the prevalence of S. pyogenes.

DISCUSSION

Prevalence of S. pyogenes among children with acute pharyngitis

The objective of the study was to determine the prevalence of *S. pyogenes* among children with acute pharyngitis who attended Nyimbwa Health Centre IV in Luwero District. Findings from the study showed that out of 143 children examined for S. pyogenes, 16 of them had *S. pyogenes*, hence a prevalence of 11.2%. The observed prevalence is comparable to study findings from a study done in Ethiopia among children that found a prevalence of *S. pyogenes* of 10.7% (Tadesse *et al*, 2023).

However, the results of this study are relatively high compared to findings from South Africa, where the overall prevalence of *S. pyogenes* among children was 9.0% (Engel *et al*, 2023), and findings from Ethiopia by Kebede *et al* (2021), who found a prevalence of *S. pyogenes* among children to be 9.1%. The results were lower compared to findings from studies done in Italy by Cinicola *et al* (2024), Palestine by Basha *et al* (2024), Turkey by Candan *et al* (2022), Zambia by Mwaba *et al* (2020), Nigeria by Girbo *et al* (2022), and in Uganda by Kenyange *et al* (2024), who found the prevalence of *S. pyogenes* among children to be 20.3%, 23.4%, 12.3%, 14.9%, 15.1%, 25.9% and 29.1% respectively. The observed variations in the prevalence of *S. pyogenes* among children with acute pharyngitis are attributed to different study designs, study populations, geographical locations, and the sampling techniques employed in each study.

Signs and symptoms associated with the prevalence of *S. pyogenes* among children

The study found that having a sore throat 93.8%, having a fever 81.3% and having inflamed tonsils 81.3% were highly related to having s. pyogenes. The findings of the study were in agreement with the findings from a study done in Ethiopia (Tadesse *et al*, 2023) and in Uganda (DeWyer *et al*, 2020), where both studies found similar clinical signs and symptoms associated with the prevalence of *S. pyogenes* among children with acute pharyngitis.

However, they differed from the findings of the study done in Palestine, where patients who presented with cough had a high prevalence of *S. pyogenes* 13.1% followed by sore throat and fevers, with each having a prevalence of 4.7%, and the least prevalence was among those with other complaints (Reem *et al*, 2023).

Factors associated with the prevalence of *S. pyogenes* among children

Findings from the study showed that the age group 7-10 years 19.4% was associated with the prevalence of S. pyogenes. The study findings are disagreed with the findings from a study done in Turkey by Candan *et al*, (2022) who found a higher prevalence of 52.4% among age group 3-6 years, a study from Nigeria by Girbo *et al*, (2022) who found a higher prevalence of 32.1% among age group 11-14 years and a study from Ethiopia by Kebede *et al*, (2021) who showed a higher prevalence among age group 5-10 years to be 5.2%. However, a study done in Uganda showed no significant difference between children 5–9 years of age (16.7%) and those 10–16 years of age.
(15.3%) (DeWyer *et al*., 2020).

A household size of 6-8 people, 12.9%, was associated with the prevalence of *S. pyogenes*, and the findings agreed with the findings from a study done in Nigeria that indicated that the risk of *S. pyogenes* acute pharyngitis increased with an increase in the family size (Girbo *et al*, 2022). This might be due to the fact that group living for a longer time and a crowded living style will allow the *S. pyogenes* transmit easily to other susceptible individuals. However, a study done in Ethiopia showed no significant association between prevalence of *S. pyogenes* acute pharyngitis and family size, 10.9% for a small household (< 5 children) and 10.0% for a large household having 5-10 children (Tadesse *et al*, 2023).

Previous infection with *S. pyogenes* 12.6% was associated with the prevalence of S. pyogenes. This was in agreement with the findings from a study done in Ethiopia that showed pediatric patients with a history of recurrence were 5.87 times more likely to have acute pharyngitis caused by *S. pyogenes* compared to those who did not have recurrence (Kebede *et al*, 2021). A child being a passive smoker 14.3% was associated with the prevalence of S. pyogenes. This was in agreement with a study from Ethiopia that showed pediatric children living in the presence of any smokers in the home were 7.11 times more likely to develop *S. pyogenes* acute pharyngitis than those living in the absence of any smokers in the home (Kebede *et al*, 2021).

However, the study findings showed that the sex of the child, sharing of beddings, and contact with a person with *S. pyogenes* had no significant association with the prevalence of S. pyogenes. This finding are in agreement with a study from done in Uganda where the overall prevalence of GAS carriage was 15.9% (79/496, 95% CI 12.8–19.5%), showed no significant difference seen between males (38/234, 16.2%) and females (41/261, 15.7%) (DeWyer et al., 2020) and are in disagreement with the findings of the studies from Turkey by Candan *et al*, (2022), in Nigeria by Girbo *et al*, (2022) and in Ethiopia by Kebede *et al*, (2021) who found out that

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S. pyogenes prevalence among children was associated with sex.

Study limitation

Collection of throat swabs for isolation of *S. pyogenes* was hard since children had a fear of the sample collection process.

There were also other limitations to this study were many respondents were reluctant to give information on learning that there were no incentives for them in this study.

Conclusion

The study set out to determine the prevalence of S. pyogenes and identify the signs, symptoms, and associated factors among children with acute pharyngitis at Nyimbwa Health Centre IV.

The findings revealed a prevalence of 11.2%, which aligns closely with several regional studies, supporting the study purpose and confirming that S. pyogenes remains an important cause of acute pharyngitis among children.

The results also linked classic clinical symptoms such as sore throat, fever, and inflamed tonsils to S. pyogenes positivity, strengthening the evidence for clinical diagnosis.

In addition, several socio-demographic and environmental factors (age group 7–10 years, low household income, large household size, previous infection, and passive smoking) were shown to be associated with infection, supporting the problem statement that multiple modifiable factors contribute to disease burden.

Overall, the findings successfully address the study objectives and reinforce the need for targeted prevention, early diagnosis, and improved management strategies.

Recommendations

To the Ministry of Health

The Ministry should strengthen school-based and community screening programs for sore throats among children aged 7–10 years, ensuring early diagnosis and timely treatment of S. pyogenes.

This will directly reduce complications such as rheumatic fever.

To Nyimbwa Health Centre IV

The hospital should improve laboratory diagnostic capacity by ensuring consistent availability of throat swab culture materials and rapid antigen detection kits to support accurate and timely identification of S. pyogenes.

To Caregivers / Respondents

Caregivers should adopt preventive home practices, including avoiding indoor smoking, reducing overcrowding, encouraging proper hygiene, and seeking prompt medical care whenever children develop a sore throat or fever.

To Future Researchers

Future studies should consider using larger sample sizes and molecular diagnostic methods to compare bacterial strains and assess antibiotic resistance patterns of S. pyogenes further.

comprehensive epidemiological monitoring.

AKNOWLEDGMENT

I thank the almighty God who has granted me the gift of life, knowledge, understanding, strength, and also opened financial doors to help me pursue my academics smoothly, and to do this piece of work for preserving and helping the community and the entire country at large. I am so grateful, dear LORD.

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Lastly, I thank the administration of Nyimbwa Health Centre IV for allowing me and granting me an opportunity to carry out this academic research. Thank you so much!

Abbreviations

S. pyogenes: Streptococcus pyogenes
GABHS: Group A Beta-hemolytic Streptococcus
GAS: Group A Streptococcus
ARF: Acute Rheumatic Fever
URTIs: Upper Respiratory Tract Infections
HC IV: Health Centre IV
CI: Confidence Interval

Source of funding

The study was not funded.

Conflict of interest

The author did not declare any conflict of interest.

Author contributions

Jameo Nabwami was the principal investigator.
Richard Miiro supervised the research.
Francisco Ssemuwemba supervised the research.
Hasifa Nansereko supervised the research.
Anthony Ssekitoleko supervised the research.
Jane Frank Nalubega supervised the research.

Data availability

The data is available upon request.

Author Biography

Jameo Nabwami is a student pursuing a Diploma in Medical Labaratory Technologist at Mildmay Institute of Health Sciences.
Richard Miiro is a research supervisor at Mildmay Institute of Health Sciences.
Francisco Ssemuwemba is a research supervisor at the Dean's School of Allied Health Sciences.
Hasifa Nansereko is a research supervisor at Mildmay Institute of Health Sciences.
Anthony Ssekitoleko is a research supervisor at Mildmay Institute of Health Sciences.
Jane Frank Nalubega is a research supervisor at Mildmay Institute of Health Sciences.

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