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SHORT COMMUNICATION

Group A Streptococcus pharyngitis among schoolchildren in Mbulu District, Tanzania

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Abstract
Streptococcal pharyngitis continues to be one of the most common childhood illnesses throughout the world. Recent evidence indicates an increased incidence of group A Streptococcal (GAS) infections, which is a significant cause of mortality and morbidity on the global scale. The objective of this study was to determine prevalence of group A Streptococcus infection among primary schoolchildren in Mbulu district, northern Tanzania. This study was carried out in five primary schools, namely Mangisha, Gunyoda, Kainam, Hyloto and Tsaayo. GAS pharyngitis was diagnosed clinically and confirmed by laboratory investigation using a rapid test. A total of 320 study participants were recruited in the study. Overall, more than half (53.8%) of the children were females. The overall prevalence of Group a Streptococcal infection was 6.9% (95%CI [4.4-10.2]). The highest frequency of GAS infection was observed among children at Hyloto primary school (14.3%) while, none of the children in Tsaayo had GAS infection. This study potentially indicates that group A Streptococcal infection prevalent among schoolchildren in Mbulu district calling for the need of education to create awareness of the condition in the community.

Keywords: group A Streptococcus, pharyngitis, schoolchildren, Tanzania

Group A streptococcal (GAS) infections, including the group A streptococcal pharyngitis is the most common childhood illnesses throughout the world (Tewodros *et al.*, 1992; Jackson *et al.*, 2011; WHO, 2012; Ralph & Carapetis, 2013). The exactly global burden of disease caused by GAS is not known. Worldwide, it is estimated that >660,000 cases of invasive GAS infection occur each year;>95% of cases occur in resource-poor regions, and >160,000 patients die annually(Carapetis *et al.*, 2005). About 8% to 40% of children and 5% to 9% of adolescents who have sore throat, fever, and Pharyngitis have group A beta hemolyticus streptococcal (GABHS) infection(Jackson *et al.*, 2011).Repeated attack of untreated GAS causes Rheumatic Fever which may lead to complicated condition namely Rheumatic Heart Diseases. Statistics indicate that there are about 30 million children with Rheumatic Heart Diseases (RHD) in developing countries, compared with only 1.5 million in developed countries(Nandi *et al.*, 2001). Africa is experiencing the highest burden of the disease(WHO, 2005).

Group A streptococcal contain different virulence factors which include outer hyaluronic acid capsule and a layer of group A carbohydrate, a polymer of rhamnose with N-acetyl glucosamine side chains (Kotloff, 2008).Also have molecules of M protein which is attached to the bacterial membrane(Kotloff, 2008).The M protein is a major surface protein of GAS. It binds complement regulatory protein factor H and inhibit phagocytosis(Mora *et al.*, 2005).Other virulence factors expressed at the surface of Streptococcal pyogenes (GAS) are C5a peptidase and Serum opacity factor (SOF). The C5a peptidase, is an endopeptidase that cleaves the complement-derived chemotaxin C5a, inhibiting the recruitment of phagocytic cells to the site of infection

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whereas SOF binds apolipoprotein A1 and disrupts the structure of high density lipoproteins. Among other surface proteins are the fibronectin-binding proteins Sfb1, FBP54 and R28, which together with the M protein and the hyaluronic acid capsule, allow the bacterium to adhere to, colonize and invade human skin and mucus membranes(Bisno *et al.*, 2003;Gillen *et al.*, 2008). Attachment of GAS to pharyngeal or dermal epithelial cells is the key initial step in colonization of the host leading to inflammation of the pharyngeal(WHO, 2012).

In Tanzania, few studies have been conducted to account for the effect of GAS infection in children. A study done in Pemba reported a prevalence of GAS infection of 8.6% (Braito *et al.*, 2004). Although there is no study that has been carried out in northern Tanzania to establish the prevalence of GAS infection, findings indicate that a good number of individuals with GAS complication from Arusha and Manyara regions are attended at Muhimbili National Hospital in Dar es Salaam (Annon, 2010). Because GAS infections are associated with significant morbidity and mortality(Carapetis *et al.*, 2005), this study was conducted in Mbulu district, Manyara region to determine its prevalence among schoolchildren.

This was a community based prospective cross sectional study, part of a larger project on an integrated mobile service clinic using Mobile Health tools, rapid diagnostics and portable cardiac ultrasound to detect and treat Group A haemolytic streptococci and rheumatic heart disease among children in Mbulu district, Manyara in northern Tanzania. Mbulu district, located at 03°45'S, 35°30'Ehas a total population of 320, 279 individuals. There are 120 primary schools in the district and each school is about 5km from a nearby health facility.

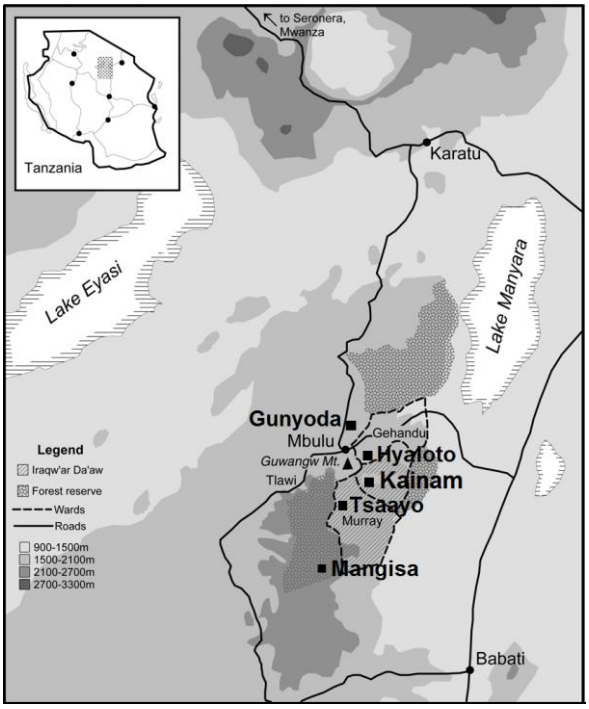

Figure 1: A map of Mbulu district and study villages

This study was carried out in April 2012. A random selection of primary school was employed and children from selected schools were also randomly selected to participate in the study. The schools were Mangisa and Gunyoda located in non-mountainous area (hot climate) and Hyloto, Kainam and Tsaayo located in mountainous area (cool climate) (Figure 1). In each school, nine children from each class were selected hence a total of 64 study participants were recruited from each school. A minimum of 307 primary school children was sufficient for detection of 28 percent GAS infection at 95% confidence interval with a power of 90%.

Structured questionnaire was used to collect demographic information. Children were clinically examined for GAS infection; simply examining the presence or absence of the following

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signs and symptoms: sore throat, pain while swallowing, high fever (>38° C), redness, hyperaemia, oedema, and exudates (yellow flecks or pus pockets) of the pharynx, punctuate haemorrhages in the soft palate and sudden onset of symptoms/ signs.

Group-A Streptococcus rapid diagnostic test, CLIAwaived™ Inc. Rapid Strept A Test (CLIAwaived™ Inc., San Diego, CA 92121)as described elsewhere was employed(Annon, 1998).The strep A rapid test device is a lateral flow immunoassay for the detection of strep A carbohydrate antigen in a throat swab. In this test, antibody specific to Strep A carbohydrate antigen is coated on the test line region of the device(Annon, 1998).Briefly, swabbing of the posterior pharynx, tonsil and other inflamed area was done while avoiding touching the tongue, cheeks and teeth with the swab. Then testing for GAS was performed immediately after specimens have been collected.

Data analysis was done by using Statistical Package for the Social Sciences (SPSS) version 16.0 (IBM Corp, Stanford, USA). Descriptive statistics was done by cross tabulating explanatory variables against the outcome variable. Chi square test or Fisher's test was used to test the association between exposure variables and the outcome variable. Different regression models were used to assess the association between GAS infection and independent variables. *P value* <0.05 was considered to be statistically significant. This study sought and received ethical approval from the Kilimanjaro Christian Medical Institutional review board.

Children who were diagnosed with GAS infection received immediate treatment according to standard procedure for treatment of Strep A infection, which includes 10 days' course of Penicillin (or Erythromycin for children identified to have potential allergy to penicillin in a previously-provided medical counselling session).

A total of 320 study participants were recruited in the study. Overall, more than half (53.8%) of the study participants were females. The age of the study participants ranged 5 to 15 years old; the mean age being 10.3 (SD= 2.5) years-old (Table 1).

Table 1: Demographic characteristics of the study population (N=320)

Variable	Number	Frequency (%)
Mean age in years (SD)	320	10.3(2.5)
Sex		
Female	172	53.8
Male	148	46.2
Primary school		
Gunyoda	64	20.0
Hyloto	63	19.7
Kainam	65	20.3
Mangisa	64	20.0
Tsaayo	64	20.0
Age group (years)		
5-8	101	31.6
9-12	142	44.4
13-15	77	24.0

SD= Standard deviation

The overall prevalence of Group A streptococcal infection was 6.9% (95% CI [4.4-10.2]). The highest frequency of GAS infection was observed in Hyloto primary school (14.3%) followed by Kainam (10.7%) and none was found in Tsaayo primary school (Table 2). Individuals of 5-8 years-old had the highest prevalence of GAS infection (10.9%). However, the difference was not statistically significant (Fisher's exact, p = 0.156). In relation to sex, the prevalence of GAS between females (7.6%) and males (6.1%) was comparable (Chi-square=0.271, p=0.603) (Table 2).

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Table 2: Prevalence of Group A Streptococcal infection by school, age and sex

Variable		Frequency
Primary school	Gunyoda	7.8
	Hyloto	14.3
	Kainam	10.7
	Mangisa	1.6
	Tsaayo	0
Age group (years)	5-8	
	9-12	
	15-15	
Sex	Female	6.1
	Male	7.6

The findings of this study confirms the presence of GAS infection in Tanzania as was previously reported on Pemba Island (Braito *et al.*, 2004).However, the prevalence of GAS infection reported in this study is lower compared to that of Pemba Island(Braito *et al*., 2004). Lower GAS infection prevalence rates have been reported in India (Nandi *et al*., 2001) and Kenya (Seale *et al.*, 2016). The difference in the prevalence between the studies may be attributed to the sample size. A similar GAS infection prevalence has been reported from a study in Tunisia(Mzoughi *et al.*, 2004).

Group A streptococcal infection have been shown to be related to several factors such as sex, age and season(Mzoughi *et al.,* 2004; Beaton *et al.*, 2012).The findings of this study show that the prevalence of GAS infection was similar between female and male children. This finding is in agreement with the observations by Sarkar *et al.* (1988) in India. However, another study in Delhi India has reported that the prevalence of beta-haemolytic streptococcal was higher in females than in males (Reed *et al.*, 1990). On the other hand, a study in Ethiopia (Tewodros *et al.,*1992) found a higher prevalence among males than in females. This contradicting results may be attributed to difference in ratio between male and female participants and calls for further researches with large sample sizes to investigate the influence of sex in GAS infection.

Age has been associated with GAS infection elsewhere. Some studies have reported that the peak incidence of GAS pharyngitis occurs in children aged 5–10 years (Martin, 1988; Van Cauwenberge & Vander Mijnsbrugte, 1991). This is in agreement to findings of our study indicating that the most affected age was between 5 to 8years. However, older age (11 years) has been reported in a study in India (Nandi *et al.*, 2001).The difference in observations among the studies may be due to different in GAS serotypes (Ogunbi *et al.*, 1978)

Studies in Egypt and India have shown that the prevalence of GAS pharyngitis differ in areas with different climatic conditions (Rotta *et al.,* 1989; Nandi *et al*., 2001). This is further confirmed in this study where Kainam and Hyloto primary schools located in mountainous area had higher prevalence of GAS pharyngitis than other schools. However, the absence of GAS infection in Tsaayo primary school warrant further investigation.

In conclusion, group A streptococcal infection is prevalent among schoolchildren in northern Tanzania. A longitudinal cohort study is needed to establish the extent of the disease burden in this population. Furthermore, there is a need of mass education to create awareness in the community on GAS infection.

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Conflict of interest

The authors declare that they have no conflicts of interest.

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Annon(1998) CLIA stands for Clinical Laboratory Improvement Amendments, a set of U.S. federal regulatory guidelines for laboratory operation involving human testing, passed in 1988.

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