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Original Research Article

Nasal carriage, risk factors, antimicrobial resistance of *Staphylococcus aureus* and *Streptococcus pneumoniae* in children aged under 5 years with upper respiratory tract infections at Tiko CDC Cottage hospital, Cameroon: a cross-sectional study

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ABSTRACT

Background: Children aged under five years are known to harbor resistant strains of *Staphylococcus aureus* and *Streptococcus pneumoniae* causing respiratory tract infections. The study aimed at determining nasal carriage of these bacteria in children under five attending the Tiko CDC Cottage Hospital, and their susceptibility patterns to antibiotics.
Methods: A total of 155 nasal swabs were collected. Samples were cultured on mannitol salt and blood agar plates. Standard microbiological tests were used for identification and confirmation of isolates. Antibiotic susceptibility testing was carried out using Kirby-Bauer disc diffusion technique. Statistical analysis was done using SPSS version 25 and P <0.05 were considered significant.
Results: Of the 54 positive cases, *Streptococcus pneumoniae* 53.7% (29/54) was higher compared to *S. aureus* 35.2% (19/54). Co-infection with both *S. aureus* and *S. pneumoniae* was observed in 11.1% (6/54) participants. Gentamicin (84%) was the most sensitive for both organisms, while ciprofloxacin (84%) was the most resistant against *S. aureus* isolates and cefotaxime (62.7%) for *S. pneumoniae* isolates. $CIP^{R}CTX^{R}$ was the most resistant combination for both organisms. Age group of 3 to 5 years (p=0.01), and source of treatment (p=0.000), were statistically significant.
Conclusions: Colonization of both *Streptococcus pneumonia* and *Staphylococcus aureus* was recorded in this study with higher isolation reported for Streptococcus pneumonia. This study reported concerning resistance rates to antibiotics used to treat suspected bacterial respiratory tract infections. The work highlights the necessity to implement continuous antibiotic resistance surveillance.

Keywords: Antibiotic susceptibility, Nasal carriage, Risk factors, *Staphylococcus aureus*, *Streptococcus pneumoniae*,

INTRODUCTION

Globally, *Streptococcus pneumoniae* (*S. pneumoniae*) (pneumococcus) and *Staphylococcus aureus* (*S. aureus*) are amongst the major cause of morbidity and mortality in children worldwide, particularly in lower income countries like Cameroon.[1-3] Children under five years tend to have the highest colonization rates of these pathogens because of exposure to nasopharyngeal colonization (NP) shortly after birth with global prevalence estimates ranging from 20% to 50%.[2,3]

Several studies have reported nasal carriage of *S. pneumoniae* and *S. aureus* in children.[2,4,5] The nasopharynx serves as the primary ecological niche for *S. pneumoniae, S. aureus* and other respiratory bacteria. From this reservoir, these bacteria can translocate into the respiratory tract or bloodstream, potentially leading to severe invasive diseases such as pneumonia, sepsis, and meningitis in children under the age of five.[6,7] Nasal colonization of *S. pneumoniae* is not only a prerequisite for the development of pneumococcal disease but a reservoir for pneumococcal transmission in the community.[8,9] *S. pneumonia* is responsible for 15-50% of all episodes of community-acquired pneumonia, 30-50% of all cases of acute otitis media, and a significant proportion of bacteremia and bacterial meningitis.[10] *Streptococcus pneumoniae* remains the leading bacterial cause of pneumonia-related mortality, responsible for approximately 33% of such deaths among children under five years of age.[11] According to estimates by the World Health Organization, nearly one million children under five die from pneumonia annually.[12] Also, a systematic review meta-analysis from studies conducted around the globe found 20-93% of children in low- and middle-income countries (LMIC) carried pneumococci in their nasopharynx, which was responsible for URT infections.[13]

The last three decades have experienced a decline in childhood mortality due to *S. aureus* as a result of proper interventions and management strategies. Despite these gains, in 2018 about 80% of childhood mortality in sub-Saharan Africa and South Asia were as a result of *S. aureus*.[14] In LMIC, *S. aureus* is a significant contributor to childhood and neonatal morbidity and mortality.[15] The burden of *S. aureus* morbidity and mortality is made more substantial by the increasing prevalence of antimicrobial resistance and the lack of an effective vaccine. A systematic review found that approximately 25.1% of young children were asymptomatically colonized with *S. aureus,* with 3.4% carrying methicillin-resistant strains.[16] Studies conducted in Africa indicate high rates of *S. aureus* colonization and infection in children under five.[4,5,17,18] However, the information on the specific prevalence of *S. aureus* in children under the age of five years in various countries in Africa is limited.[19]

Despite the efforts towards reduction of under-five mortality in developing countries; sub-Saharan Africa is still amongst the regions in the world presenting the vast majority of cases.[20,21] *S. pneumoniae* was fourth leading cause of death in children less than five years of age in Yaoundé.[22] The introduction of pneumococcal conjugate vaccines has had a notable influence on the colonization dynamics of *S. pneumoniae*, reducing the burden of the disease in LMIC countries like Cameroon.[23] However, recent studies have isolated this bacterium in the URT of children visiting health facilities in the country calling on the need for tailored approaches aimed at preventing *S. pneumoniae* related morbidity and mortality.[22-24] All of these studies were carried out in Yaoundé, Cameroon and no study has been carried out in the South West region of Cameroon. Ndip and colleagues, reported a prevalence of *S. pneumoniae* and *S. aureus* of 15%, and 10% respectively in students attending different boarding schools within the Buea Municipality in the South West region of Cameroon.[25] This study though it looked at *S. pneumoniae* and *S. aureus* it is different from the current study because it wasn't focused on under five children. Cameroon being Africa miniature with different conditions prevailing in different regions of the country; it is extremely imperative to find out what is prevailing in south west region of Cameroon. Colonization by antimicrobial resistant *S. pneumoniae* and *S. aureus* has been increasing in different parts of the world.[17,18,25] Therapeutic approach in resource limited setting remains empiric because of the lack of rapid and accurate diagnostic tests. Moreover, in Cameroon antibiotics are purchased over the counter, from road side sellers and often the choices are guided by cost rather than effectiveness; these are factors that influence antibiotic resistance.

Understanding the nasopharyngeal carriage of *S. pneumoniae* and *S. aureus* in children under the age of five is crucial for effective prevention and control strategies, as well as informing treatment guidelines. This is more important in the south west region of Cameroon where there is lack of region-specific data both in the prevalence of these pathogens and antimicrobial surveillance data. Therefore, this study investigated the nasopharyngeal carriage, risk factors, and antibiotic susceptibility patterns of *S. pneumoniae* and *S. aureus* in children aged 0 to 5 years attending the Tiko CDC Cottage Hospital.

METHODS

Study area

This study was carried out from November-2022 to June-2023 at Tiko CDC (Cameroon Development Corporation) Cottage Hospital is located in the Likomba Health Area of the Tiko Health District, South West Region of Cameroon. It is located about 18km from Buea and has an estimated population of 334,647 people and a total surface area of 4,840 km^2. It is bounded to the West by Limbe, North by Buea, East by Dibombari and South by Bonaberi. Tiko CDC Cottage hospital has a microbiology unit with the facilities necessary to carry out this study.

Study design

This was a hospital-based cross-sectional study. The study participants were children referred to the facility's microbiology laboratory with the following characteristics: under the age of five years, body temperature ≥37.5°C, having catarrh and cough and of both sexes. Participant for the study were recruited for the study using convenience sampling technique.

Ethical considerations

The present study was approved by the institutional review board of the Faculty of Health Sciences, University of Buea, Cameroon (2023/03/UB/HOD/MLS/FHS). Administrative authorizations were obtained from the Regional Delegation of Public Health in the South-West Region of Cameroon (RII/MPH/SWR/RDPH/PS/622/522), District Medical Service Tiko, and the Tiko CDC Cottage hospital (TPPRR/RC/LBE/2016/B/0155). Participation in this study was voluntary, and the objectives of the study were explained to all the participants (parents and guardians). Children aged 0 to 5 years attending the Tiko CDC Cottage hospital, whose parent or legal guardian signed the assent forms for participation were included. Children with a history of antibiotic use in two weeks prior to enrolment were excluded from the study.

Sample collection

A total of 155 nasopharyngeal specimens were collected from each participant using labelled sterile swab sticks. A swab stick was inserted into both nostrils of the participant and rotated for 10 seconds each, one after the other, then inserted back into the labelled cap and taken to the microbiology unit of the laboratory. The specimens were kept at room temperature prior to processing and were processed within one hour after collection.

Culture and identification of Streptococcus pneumonia and Staphylococcus aureus

The specimens were inoculated in duplicate by streaking on Mannitol salt and blood agar plates which were prepared following manufacturers instruction. One of each Mannitol salt agar and blood agar plates were incubated aerobically and anaerobically respectively, for 24 to 48 hours at 37°C. The presence of yellow colonies on Mannitol salt agar plates indicated positive growth of *S. aureus*. On the blood agar plates, the presence of small, grey, moist and flattened colonies with depressed central portions, and a zone of alpha hemolysis indicated positive growth of *S. pneumoniae*. Gram staining was carried out as previously described by Tripathi and colleagues.[27] Briefly, a drop of normal saline was placed on a clean glass slide and a suspect colony was emulsified and allowed to dry. This was later viewed using oil immersion eye piece. *S. aureus* was identified as gram positive cocci, appearing as irregular grape-like clusters while *Streptococcus pneumoniae* were identified as Gram-positive cocci, typically in pairs (diplococci) or short chains, with a characteristic lancet shape. Biochemical characterization was carried using the catalase and oxidase test, and *S. aureus* was positive for both test.[28] An optochin sensitivity test was carried out on alpha-hemolytic colonies on blood agar to confirm the identification of *Streptococcus pneumoniae*, which is sensitive to optochin. A positive result was indicated by the presence of a zone of inhibition measuring 14 mm or greater around a 5-µg disk, serving as presumptive identification of pneumococci.[29]

Antibiotic susceptibility testing

The Kirby-Bauer disc diffusion technique was used to test for antimicrobial susceptibility testing and interpreted according to Clinical and Laboratory Standards Institute (CLSI) guidelines. Antibiotics used for susceptibility testing were ciprofloxacin (5 µg), clindamycin (2 µg), vancomycin (30 µg), gentamycin (10 µg), amoxicillin/clavulinic acid (30 µg), cefotaxime (30 µg), and chloramphenicol (30 µg). Mueller-Hinton agar with 5% of sheep blood was used for AST of *S. pneumoniae* while Mueller-Hinton agar without blood was used for *S. aureus*. The agar plates were inoculated aseptically with bacterial suspension at McFarland 0.5 and incubated aerobically and 5% of CO_2 for 18-24 hours for *S. aureus* and *S. pneumoniae*, respectively. Antibiogram results were reported as susceptible, intermediate or resistant with respect to Clinical and Laboratory Standards Institute (CLSI) guidelines.

Data sources and measurements

Data were sourced from a structured questionnaire administered to participants during face-to-face interviews. The predicator variables age and sex, household size, source of drinking water, waste disposal technique and frequency of hand washing, number of meals per day, duration of infections signs and symptoms, source of treatment were obtained using a structured interviewer administered questionnaire. The outcome variable *S. aureus* or *S. pneumonia* positivity was measured viable culture.

Data analysis

Data was analyzed using SPSS version 25. Descriptive statistics (mean, standard deviation, frequency, and percentage) were used to summarize continuous and categorical variables. The Chi square test was used to assess for association between the independent variables and the dependent variable. The dependent variable for the study was being laboratory confirmed positive for either *S. aureus* or *S. pneumonia* via sample culture. Independent variables included, participant age and sex, household size, source of drinking water, waste disposal technique, frequency of hand washing, number of meals per day, duration of infections signs and symptoms, source of

treatment. A p value <0.05 was considered to be statistically significant.

RESULTS

Socio-demographic characteristics of participants

A total of 155 participants were recruited for this study. There were more females 60% (93/155), compared to males 40% (62/155). The mean age of the participants was 3.27±1.00 years. Eighty percent 80% (124/155) of participants were within the age group of three to five years.

Prevalence of Staphylococcus aureus and Streptococcus pneumoniae

Of the 155 samples that were cultured 54 had growth of which S. pneumoniae had a higher prevalence of 53.7% (29/54) compared to S. aureus with a prevalence of 35.2% (19/54). There was co-infection of both *S. aureus* and *S. pneumoniae* in 11.1% (6/54) of the participants. Participants within the age group 3 to 5 years had a higher prevalence for either one of the two pathogens 39.5% (49/54) compared to those within the age group 0 to 2 years with a prevalence of 16.1% (5/54). The difference was statistically significant (p=0.01).

Table 1: Antibiotic susceptibility profile of *Staphylococcus aureus* isolates from the nasopaharynx of children aged 0-5 years at the Tiko CDC Cottage Hospital southwest region, Cameroon.

Antibiotics	Resistance (%)	Susceptibility (%)	Intermediate (%)
Ciprofloxacin	21 (84)	-	4 (16)
Clindamycin	3 (12)	16 (64)	6 (24)
Vancomycin	-	15 (60)	10 (40)
Gentamicin	-	21 (84)	4 (16)
Amoxicillin-clavulanic acid	-	14 (56)	11 (44)
Cefotaxime	12 (48)	-	13 (52)
Chloramphenicol	2 (8)	9 (36)	14 (56)

Table 2: Antimicrobial susceptibility of *Streptococcus pneumoniae* isolates from the nasopaharynx of children aged 0-5 years at the Tiko CDC Cottage Hospital Southwest Region, Cameroon.

Antibiotics	Resistance N (%)	Susceptibility N (%)	Intermediate N (%)
Ciprofloxacin	21 (60)	-	14 (40)
Clindamycin	-	24 (68.6)	11 (31.4)
Vancomycin	-	23 (65.7)	12 (34.3)
Gentamicin	-	27 (77.1)	8 (22.9)
Amoxicillin-clavulanic acid	-	25 (71.4)	10 (28.6)
Cefotaxime	22 (62.7)	-	13 (37.3)
Chloramphenicol	9 (25.7)	9 (25.7)	17 (48.6)

Table 3: Multidrug resistance pattern of *Staphylococcus aureus.*

Patterns	N	%
CIP^RC^R	2	14.3
CIP^RCTX^R	8	57.2
CTX^RC^R	1	7.1
CIP^RCLN^R	1	7.1
$CIP^RCLN^RCTX^R$	2	14.3
	14	100

CTX= cefotaxime, C= chloramphenicol, CIP= ciprofloxacin, CLN= clindamycin.

Table 4: Multidrug resistance pattern of *Streptococcus pneumoniae.*

Patterns	N	%
CTX^RC^R	2	13.3
CIP^RC^R	3	20
CIP^RCTX^R	6	40
$CIP^RCTX^RC^R$	4	26.7
	15	100

CTX= cefotaxime, C= chloramphenicol, CIP= ciprofloxacin.

Antibiotic susceptibility patterns of Staphylococcus aureus isolates

A total of 25 isolates were positive for *S. aureus*. Of this, gentamicin was the most susceptible (84%). Sixty percent of isolates were susceptible to vancomycin while 36% were susceptible to chloramphenicol. High resistance was noted to ciprofloxacin (84%) and cefotaxime (48%) (Table 1).

While of a total of 35 isolates positive for *S. pneumoniae*, gentamicin 77.1% (27/35) was the most sensitive antibiotic. Cefotaxime 62.7% (22/35) recorded the highest resistance (Table 2).

Multidrug resistance of S. pneumoniae and S. aureus

Multidrug resistance was observed in this study. Some *S. aureus* and *S. pneumoniae* isolates were seen to demonstrate this. A total of five patterns were observed for *S. aureus*. These were CIP^RCTZ^R 57.2% (8/14), $CIP^RCLN^RCTX^R$ 14.3% (2/14), CIP^RC^R 14.3% (2/14), CTX^RC^R 7.1% (1/14) and CIP^RCLN^R 7.1% (1/14) (Table 3). Four patterns were observed for *S. pneumoniae*, CIP^RCTX^R 40% (6/15), $CIP^RCTX^RC^R$ 26.7% (4/15), CIP^RC^R 20% (3/15) and CTX^RC^R 13.3% (2/15) (Table 4). Overall, the most resistant antibiotic combination for *S. aureus* and *S. pneumoniae* was CIP^RCTX^R and the least was CTX^RC^R.

Table 5: Factors associated with *Staphylococcus aureus* and *Streptococcus pneumoniae* positivity among participants at the Tiko Cottage Hospital southwest region, Cameroon.

Factors	*S. aureus* or *S. pneumoniae* related URT infection		Chi-square	P value
	Negative (%)	Positive (%)		
Sex				
Male	41 (66.1)	21 (33.9)	0.043	0.865
Female	60 (64.5)	33 (33.5)		
Age (years)				
0 to 2	26 (83.9)	5 (16.1)	5.975	0.01
3 to 5	75 (60.5)	49 (39.5)		
Household size				
1 to 3	19 (76.0)	6 (24.0)	1.6	0.449
4 to 6	63 (63.6)	36 (36.4)		
7 and above	19 (61.3)	12 (38.7)		
Source of household drinking water				
Borehole	36 (64.3)	20 (35.7)	1.09	0.58
Tap water	63 (64.9)	34 (35.1)		
Well	2 (100.0)	0 (0.0)		
Household waste disposal method				
Burning	18 (69.2)	8 (30.8)	0.228	0.406
Dustbin	83 (64.3)	46 (35.7)		
No. of times hands are washed before eating				
1 to 3	39 (67.2)	19 (32.8)	0.177	0.405
4 and above	62 (63.9)	35 (36.1)		
Children on antibiotics				
Yes	80 (63.0)	47 (37.0)	1.457	0.162
No	21 (75.0)	7 (25.0)		
Duration of common cold				
1 to 2 days	42 (63.6)	24 (36.4)	0.118	0.431
3 to 4 days	59 (66.3)	30 (33.7)		
Child regular number of sleeping hours				
8 to 9 hours	86 (67.7)	13 (46.4)	2.022	0.115
10 and above	15 (53.6)	41 (32.3)		
Number of child's meals per day				
2 to 3 times	91 (65.0)	49 (35.0)	0.017	0.571
4 and above	10 (66.7)	5 (33.3)		
Source of treatment				
Hospital	28 (60.9)	18 (39.1)	12.619	<0.001
Self-medicated	73 (67.0)	36 (33.0)		

URT; Upper respiratory tract.

Association of risk factors and presence of Staphylococcus aureus and Streptococcus pneumoniae in study participants

Of the variables assessed for association with *S. aureus* and *S. pneumoniae* related infection among participants, only age (χ^2=5.975, p=0.010) and source of treatment (χ^2=12.619, p<0.001) were significantly associated (Table 5).

DISCUSSION

Nasopharyngeal colonization by *S. pneumonia and* S. aureus is common among young children and plays a critical role in both disease pathogenesis and transmission.[8,9] The prevalence of these pathogens is influenced by multiple factors, including age, source of drinking water, household size, concurrent respiratory illnesses, and nutritional status.[18] This study investigated the nasal carriage, risk factors, and antibiotic susceptibility patterns of *S. pneumonia* and *S. aureus* isolated from children aged 0 to 5 years attending The Tiko CDC Cottage Hospital, located in the South West region of Cameroon.

Multiple studies conducted across diverse geographic regions have reported considerable variation in the nasopharyngeal carriage rates of *S. pneumonia* and *S. aureus*. [4,30,17] The findings of this study revealed that a substantial number of participants carried *S. pneumoniae* and *S. aureus*, 53.7% and 35.3% respectively, with 11.1% being co-infected with both pathogens. The nasal carriage of *S. pneumoniae* in this study was closely similar to that of a study carried out by Rutebemberwa and colleagues, where they reported carriage of 58.6% of S. pneumoniae in rural Uganda children.[18] Also, the 53.7% carriage rate of S. pneumoniae was found in our study is consistent with the 51-60% prevalence found in coastal Kenya.[31] However, it is much lower than the 97% observed in Gambian infants.[32] Other studies from children in hospital settings in southern Africa generally showed higher carriage rates.[18] These findings differ from that of Quintero and colleagues, who reported a lower isolation rate of *S. pneumoniae* and higher isolation rate of *S. aureus* 28% and 56%, respectively in children aged 2 to 5 years.[4] Co-colonization of *S. pneumoniae* and *S. aureus* was observed in children in their study as was the case in this study though the percentages differ given the current study recorded 11.1% for both pathogens while theirs was 16%. An under-five year old study in Burkina Faso reported 96.1% carried *S. aureus*, 3.2% had *S. pneumonia*, and 0.6% carried both bacterial infections in their URT, which was contrary to the findings in this study where more children had *S. pneumoniae* and the percentage with co-infections is also higher.[5]

The elevated values in this study may reflect underlying health vulnerabilities- including unrecognized immunosuppressive condition among children attending The Tiko CDC Cottage hospital. These children represent a critical reservoir for horizontal transmission and maybe at risk of developing pneumococcal disease. This underscores the urgent need to strengthen pneumococcal conjugate vaccine (PCV) coverage, improve nutritional support services, and implement routine carriage surveillance, particularly in vulnerable populations in Cameroon at large. Such measures would not only reduce colonization rates but also curtail disease burden and community-level spread. Although the 13-valent pneumococcal vaccine was introduced in Cameroon in July 2011, a previous study by Njuma and colleaugues, in Yaoundé showed that the vaccine has not led to complete elimination of the disease probably due to low coverage because of vaccine hesitancy especially with the advent of COVID-19 virus that lead to vaccine skeptism.[23] The results of the current study carried out four years after the study by Njuma and colleagues, showed pneumococcal causative pathogens are still prevalent in Cameroon.[23] The current study was carried out the south west region in Cameroon, one of the regions undergoing going armed conflict crisis. The on-going crisis seemingly has hindered the effectiveness of several delivery schemes including vaccines as people are scared to go out for fear of losing their lives. As such children could probably stay unvaccinated.

Some participants were exposed to predisposing factors such as common cold, untreated water sources, household size, and number of child's meals per day which could lower body resistance to pathogenic bacteria already present in the respiratory passages to strive. However, the risk factors that showed statistical significance were the age group of 3 to 5 years (p=0.01), and source of treatment (hospital and self-medication) p<0.001. The age group 3 to 5 years had more participants. This could be due to the fact that they interact more with the environment and their peers, both in their communities and at school.

The study was restricted to phenotypic resistance assessment of the isolated bacteria. More advanced phenotypic (automated systems) or genotypic (polymerase chain reaction) methods to determine antibiotic susceptibility with the possibilities of bringing out more findings are unfortunately still out of reach for many laboratories in low- and middle-income countries (LMICs), including Cameroon. The results of the antibiotic susceptibility patterns generally revealed that gentamycin was the most effective antibiotic against the two pathogens. Eighty-four percent of *Staphylococcus aureus* isolates while 77.1% of *S. pneumoniae* isolates were sensitive to gentamicin. Clindamycin, vancomycin and amoxicillin-clavulanic acid were also found to be highly susceptible to both organisms. These results are in accordance with those of Bonko and colleagues whose study in Burkina Faso showed that gentamicin and vancomycin, were still effective alternative treatment options in their study area.[5]

The high resistance rates of *S. aureus* to several commonly used first-line antibiotics are of concern. Ciprofloxacin

(84%) was the most resistant against S. aureus isolates meanwhile cefotaxime (62.7%) was the most resistant against *S. pneumoniae* isolates. In this study area with high self-prescription and over the counter purchase of drugs once it is notice that an antibiotic is highly effective there is a high tendency of its misuse and this is probably the case of ciprofloxacin and cefotaxime. Notably, 71.4% of *S. pneumoniae* isolates were susceptible to amoxicillin-clavulinic acid. WHO had revised treatment guidelines for pneumonia in children, which recommended the use of amoxicillin over co-trimoxazole, and the results of the current study showed that amoxicillin-clavulanic acid is effective in treating these infections.[33]

The treatment of most positive cases who previously suffered from upper respiratory tract infections were self-administration. Thus, over-the-counter therapy is still widely practiced in the Tiko community, resulting in the high resistance rates of commonly used antibiotics. For multidrug resistance, ciprofloxacin and cefotaxime were found to be the most resistant combination against the two organisms. Multidrug resistant isolates make many antibiotics clinically inefficient and, thereby, reduces treatment options.[34] This study is however limited in that the isolates were not serotype making it impossible to determine the coverage rate of the PCV vaccine against these strains. Secondly, the hospital-based design means the findings may not represent actual *S. pneumoniae* and *S. aureus* carriage rates in the general community.

CONCLUSION

S. aureus and *S. pneumoniae* were isolated in children aged 0 to 5 years attending the Tiko CDC Cottage hospital. The prevalence of *S. pneumoniae* was higher compared to *S. aureus*. Gentamicin was the most sensitive antibiotic for both pathogens in this setting while ciprofloxacin was the most resistant antibiotic. The most multidrug resistant combination against *S. aureus* and *S. pneumoniae* isolates was ciprofloxacin and cefotaxime. Participant's age group, receiving treatment at the health facility or at home were found to be associated with either *S. pneumoniae* or *S. aureus* infections. This study thus, provides baseline data for future studies, especially as no such data have been reported in this locality despite the very high rate of pneumococcal causing pathogens reported in different parts of the world with their associated antibiotic resistance results.

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