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Determination of *Staphylococcus Aureus* Isolates and Their Antimicrobial Susceptibility Pattern From Toilet Door Handles Of Hospitals and Secondary Schools in Sodo Town, Southern Ethiopia

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Abstract:

Background: Microorganisms are ubiquities and constitute chief part of the ecosystem. They are responsible to cause different diseases to human. Among them is *Staphylococcus aureus.* Unhygienic use of the toilet facilities can promote the spread of the pathogen between the users and contaminants. The adaptation of the organism to commonly used antimicrobial pressure is raised as a series problem.

Objective: This study was aimed to determine the prevalence of *S. aureus* isolates and test their antimicrobial susceptibility pattern from toilet door handles of hospitals and selected secondary schools in Sodo town, southern Ethiopia.

Methods: A cross sectional prospective study was carried out from December 2017 to May 2018. A total of 348 samples were collected and the swab samples were cultured on blood agar and β-hemolytic colonies were identified and sub-cultured on manitol salt agar and incubated for 24 hours at 37^0c. Gram staining and biochemical tests were carried out to confirm pure isolate. Antimicrobial susceptibility test was done by disc diffusion method on Muller Hinton agar.

Result: From the total 348 samples, 104 (29.88%) showed *S.aureus* growth. Out of this, 65 (37.35%) were isolated from hospitals samples and the remaining 39 (22.41%) from secondary school samples. The isolates showed variability in susceptibility pattern to antibiotics. The resistance to penicillin and chloramphenicol were found to be 100% and 63% respectively.

Conclusion: *S. aureus* isolates frequency was high in both hospitals and schools. The majority of the toilets both in hospitals and selected secondary schools lack proper sanitation systems. Relatively high resistance to antimicrobial drugs was observed in hospital isolates in comparison to school isolates. Vancomycin, Amikacin, gentamicin and Ofloxaicin were among the drugs showed efficient activity against the isolates.

Keywords: *Staphylococcus aureus, Hospitals, Schools, Antimicrobials, Drugs, Wolaita, Toilet*

1. Background

Microorganisms are ubiquitous and constitute a chief part of every ecosystem living either freely or as parasites which can cause various diseases (Brook *et al.,* 2009). The transmission of diseases through hand contact has been an area of major concern. Daily interaction of people contributes to spreading of microbial diseases but a major source for spreading of community as well as hospital acquired microbial infections are fomites (Li *et al.,* 2009).

The unhygienic use of the toilet facilities, which results in the gross contamination of the place including door-handle, which individuals are less likely to see as contaminated (Francesco, 2010). A toilet is a plumbing fixture primarily intended for the disposal of human excreta, urine and fecal matter. Additionally, vomit and menstrual waste are sometimes disposed in the toilets in some societies. If toilet handles are contaminated then organisms that are not resident in the hand can be easily picked up by contact with surfaces (Maori *et al.,* 2013). The ability of the pathogen to deposit and survive on the different surfaces in the toilets poses a great risk of infection to the toilet users (Boon and Gerba, 2007).

Staphylococcus aureus has been regarded as a serious threat to human health, capable of causing a multitude of infections among the microorganisms (Drago *et al.*, 2007). The staphylococci most frequently associated with human infection are *S. aureus*, *S. epidermidis* and *S. saprophyticus*. Among the *Staphylococcus* spp. *S.aureus* is the most virulent species of the genus causing both nosocomial and community acquired infections worldwide (Francois *et al.*, 2003). Its essentiality is not only due to its incidence and pathogenecity but especially due to its tendency to resist antimicrobial effects (Souza *et al.*, 2012).

In Ethiopia there were no studies done in this kind and most available data regarding *S.aureus* was hospital based, and most samples were taken from human. This study was carried out on the environment to determine the prevalence of *S.aureus* isolates and their antimicrobial susceptibility pattern from toilet door handles of hospitals and selected secondary schools.

2. Materials And Methods

2.1. Description of the Study Area

This study was conducted in Wolaita Sodo town which is located in southern part of Ethiopia. The area lies between 1600m and 2100 m above sea level, and located between 7^0 24'15"N and 37^0 54"E longitude and 350 km away from Addis Ababa, the capital of Ethiopia and 156 km away from Hawassa, southern nation's nationalities and peoples regions capital (SNNPRS). According CSA projection by 2012 the total population of the town was estimated at 102,922 of which 54,315 were male and 48,607 were female with annual growth rate of 5.3%. The total area of administration is 1,527 hectare it has three sub town administrations. The rainfall of the area was bimodal and characterized by medium rainy season which extends from October to January;

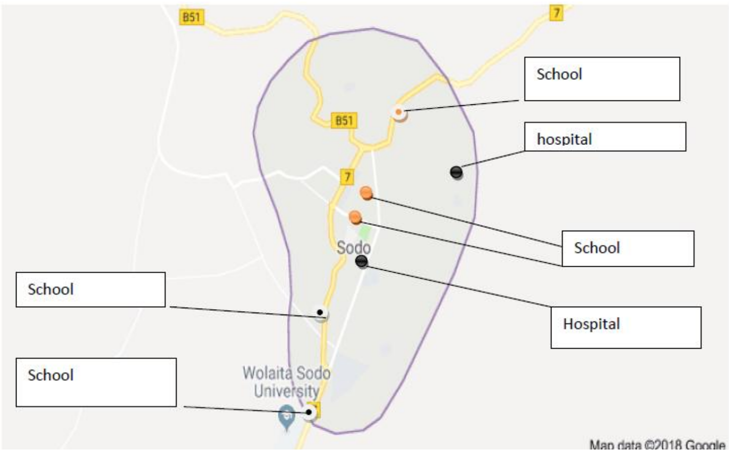

Figure3.1. *Map of Wolaita Sodo Town*

Source: *GIS data*

2.2. Study Design and Period

A cross sectional prospective study was conducted from December 2017 to May 2018 to determine *S. aureus* isolates and their antimicrobial susceptibility pattern from toilet door handles of hospitals and selected secondary schools in Sodo town, southern Ethiopia.

2.3. Study Variables

The variables in the study were the category of hospitals and schools, samples from either the inside or the outside of the toilet door handles and the result was positive or negative.

2.4. Sample Size Determination

The sample size was determined using the formula given by (Thrusfield, 2007) at 95% confidence limit, 5% sampling error and reported prevalence of 29.5%.

$$n = Z^2[P(1-P)]/d^2$$

Where; n = number of samples (sample size) P = prevalence of *S. aureus*, which is 29.5 %(0.295) d = marginal error between the samples and the population (0.05) Z = critical value at 95% certainty (1.96).

n= $[(1.96)^2 \times 0.295\ (1-0.295)]/\ (0.05)^2 = 316.16$.

Therefore, the total sample sizes of all school and hospitals toilet door handles were 316.16 (With 10% contingency the total sample size was 348).

2.5. Sampling Technique

Two hospitals and five secondary schools were recruited for this study and two stages sampling techniques were employed. The hospitals were selected by purposive method as well as the secondary schools were selected by systematic random sampling technique accordingly by their serial list. A total of 348 samples were collected from two hospitals and five secondary schools, 174 from hospitals and 174 selected secondary schools.

2.6. Sample Collection

The swab samples were taken by using sterile cotton tipped swabs moistened using normal saline solution by swabbing the toilet door handles. The swabs were taken by gently rubbing the moistened swab on the door handles surface and rotating the swab round to 360^0. A total of 348 swab samples were collected. The swabbed samples were dipped in to sterile screw caped test tubes containing one milliliter (1ml) of peptone water to avoid drying and transported in a cool box to the Wolaita Sodo university microbiology laboratory. The swab samples were properly labeled using reference numbers. Student's toilets (male and female), school workers toilets, the hospitals staff and the patient's toilets in each school and hospitals were swabbed.

2.7. Laboratory Isolation and Identification of Staphylococcus Aureus

In the laboratory the samples were thoroughly mixed to suspend the microorganisms in to peptone water. The suspension were inoculated in to 5% sheep blood supplemented blood agar base (oxoid Cambridge, UK) and incubated aerobically 37^0C for 24 hours. Depending on the colony morphology and character of the colony which showed beta hemolysis was sub cultured on manitol salt agar (MSA) and incubated aerobically at 37^0C for 24-48 hours. The reaction on MSA agar was interpreted and recorded as positive or negative based on criteria described by (Quinn *et al.,* 2002). The isolates that grew and ferment manitol and as a result produced yellow zones on MSA after 24-48 hours incubation at 37^0C were considered as *S.aureus*. The suspected colony from MSA subjected to further Grams staining reaction test and biochemical tests.

2.8. Antimicrobial Susceptibility Tests

The susceptibility testing of antimicrobial agent was done by using Kirby Bauer disk diffusion method under Clinical Laboratory Standards Institute guide lines (CLSI, 2014). The antibiotic discs were selected based on their availability in the study area; literature information and CLSI guide lines. The following antibiotic discs were placed to the MHA plate aseptically by using sterile forceps. Amikacin (AK)(30μg), Chloramphenicol (C)(10μg), Clindamycin (CD)(2μg), Cotri-mexozale (COT)(25μg), Erythromycin (E)(5μg), Gentamicin (GEN)(10μg), Ofloxaicin (OF)(2μg), penicillin G (10U), Tetracycline (TE)(30μg) and Vancomycin (VA)(30μg) were placed and incubated at 37^0C for 24 hours. After overnight growth zone of inhibitions were determined by measuring the size of clear zones with a graduated ruler (caliper). The measurements were done in millimeters and the zones were compared and confirmed with the CLSI standards for interpretation (CLSI, 2014). The reporting was done by indicating Resistant, Intermediate or Sensitive (CLSI, 2014).

2.9. Quality Control

In the laboratory to minimize the cross contamination a standard microbiological procedures were strictly followed. During sample collection each sample was properly labeled, recorded and transported aseptically to the laboratory for microbiological assessment. All the culture plates were stored at recommended refrigeration temperature after preparation and sterilized by autoclaving at 121^0c for 15 minutes. *S. aureus* ATCC 25923 was used as positive control organism by subjecting the bacteria under the same conditions as the test organism. The positive control was used to verify that the drugs used for the susceptibility is working correctly. All laboratory procedures were conducted based on recommended standard laboratory procedure.

2.10. Data Analysis

After checking for completeness and consistency the collected data were entered into computer subsequently analyzed by using statistical package for social science (SPSS) version 20 and MS

EXCEL package windows software. Descriptive statistics, frequencies and cross tabulation were used. P-value of less than 0.05 was considered as statistically significant.

2.11. Ethical Consideration

Ethical clearance approves and obtained from Wolaita sodo university college of Natural and computational science research and review committee. Official permission was gained from the hospitals authorities of Wolaita sodo teaching referral hospital and Wolaita sodo christian hospital and sodo town educational administrative unity.

3. RESULT

3.1. The General Characteristics of Sampled Hospitals and the Selected Secondary Schools

In this study two hospitals and five secondary schools were included. In hospitals the workers number ranged from 681 to 723 with the mean of 702, and 5685 patients visited the hospitals per month with daily mean of 189.5. In secondary schools the number of student ranged from 1846 to 2459 with a mean of 2148.8 and number of school workers ranged from 115 to 143 with a mean of 125.8 were found in the school. In both hospitals the numbers of toilets ranged from 18 to 22, each have a minimum 3 doors to a maximum of 8. In selected secondary schools, the numbers of toilets range from 4 to 6 and each toilet have 4 to 16 doors.

3.2. Isolation Rate of Staphylococcus Aureus from both Hospitals and Secondary Schools

In this study a total of 348 swab samples were collected from both hospitals and selected secondary schools in Wolaita sodo town, southern Ethiopia. Among these 192(55.17%) of the swab samples showed *Staphylococcus* spp. growth positive. Out of 192 *Staphylococcus* spp positive isolates, 104(29.88%) identified to be *S.aureus.*

Table3.1. *Frequency and percentage of S.aureus isolates from two hospitals and five selected secondary schools in Wolaita Sodo town, southern Ethiopia*

	Sample sites	Total sample	Frequency	%	% of average	p- value
Hospitals	OTRH	87	37	42.52	37.35	0.01
	SCH	87	28	32.18		
Schools	SSS	34	10	29.41	22.41	
	SPS	36	9	25		
	BWSS	34	5	14.7		
	WSS	36	7	19.44		
	LSPS	34	8	23.52		
Total		348	104		29.88	

$\chi^2 = 6.5$ Key:-OTRH=Otona teaching referral hospital SCH=Sodo christen hospital SSS=Sodo secondary school SPS=Sodo preparatory school BWSS=Bogale Walelu secondary school

WSS=Wadu secondary school LSPS=Lika secondary and preparatory school

3.3. Distribution of Staphylococcus Aureus in Schools and Hospitals

Distribution of *S.aureus* was found in different toilet door handles in two hospitals as seen in (Table 3.2) the samples were collected. In the OTRH toilet door handles sampled, 37(42.5%) samples were positive for S.aureus isolates, while in Sodo christen hospital 28(32.2%) swab samples were positive.

Table3.2. *Percentages of S.aureus isolated from the two hospitals in sodo town, southern Ethiopia*

	HOSPITALS					
	SCH			OTRH		
No Types of Toilets handle	n	Frequency	%	n	Frequency	%
1 Medical ward toilet	18	7	38.9	23	7	30.4
2 Outpatient toilet	14	6	42.9	12	9	75
3 Kitchen ward toilet	17	4	23.5	---	---	---
4 Staff toilet	16	5	27.8	10	3	30
5 Surgical toilet	22	6	27.3	26	13	50
6 Obestric ward toilet	---	---	---	16	5	31.3
7 Total	**87**	**28**	**32.2**	**87**	**37**	**42.5**

n =number of samples

3.4. The Isolation Rate of Staphylococcus Aureus in Schools

During the study period *S.aureus* were isolated from selected secondary schools. The schools showed varied prevalence of the isolates. Different isolation rates were observed in school toilets accordingly high prevalence rates were observed in male student toilets as in Table 4.3.

Table3.3. *Isolation rate and percentage of S.aureus isolated from toilet door handles of secondary schools.*

	types of toilets							
	FST		MST		SWT			
Schools	Positive/n	(%)	Positive/n	(%)	Positive/n	(%)	Total	(%)
SSS	3/10	(30)	4/12	(33.3)	3/12	(25)	10/34	(29.4)
SPS	3/12	(25)	4/12	(33.3)	2/12	(16.7)	9/36	(25)
BWSS	2/12	(16.7)	3/10	(30)	0/12	(0)	5/34	(14.7)
WSS	2/12	(16.7)	4/12	(33.3)	1/12	(8.3)	7/36	(19.4)
LSPS	3/12	(25)	4/12	(33)	1/10	(10)	8/34	(23.5)
Total	**13/58**	**(22.5)**	**19/58**	**(32.8)**	**7/58**	**(12.1)**	**39/174**	**22.4**

Key:-SSS =Sodo Secondary Schools SPS=Sodo Preparatory School BWSS=Bogale Walelu Secondary School WSS=Wadu Secondary School LSPS=Lika Secondary and Preparatory FST=Female student toilet MST=Male Student toilet SWT=School workers toilet

3.5. Antimicrobial Susceptibility Pattern of S. Aureus Isolated From Hospitals and Selected Secondary Schools.

In this study a total of 348 swab samples were collected. Out of this one hundred four (29.88%) isolates were positive for *S.aureus*. All the isolates were tested for susceptibility of drugs. The antimicrobial susceptibility pattern of *S.aureus* isolates against the selected antimicrobial agents was given in the following table. The resistance and susceptibility pattern of *S.aureus* isolated from hospitals and schools were found to be variable. All the isolates sampled from both hospitals and selected secondary schools showed high resistance to penicillin G (100%). both hospitals and selected secondary schools. Susceptibility of isolates to vancomycin was (100%) in secondary schools and (98.5%) in hospitals (Table 3.4).

Table3.4. *Antimicrobial susceptibility of Staphylococcus aureus isolates isolated from selected secondary schools (n=39) and Hospitals (n= 65).*

		Schools		Hospitals		
Anti	S (%)	I (%)	R (%)	S (%)	I (%)	R (%)
AK	37(94.5)	2(5.13)	0(0)	56(86.2)	5(7.7)	4(6.2)
C	3(7.7)	20(51.3)	16(41.0)	3(4.6)	21(32.3)	41(63.1)
CD	25(64.1)	9(23.1)	5(12.8)	47(72.3)	9(13.9)	9(13.9)
COT	18(46.2)	5(12.8)	11(41.0)	28(43.1)	12(18.5)	25(38.5)
E	12(30.8)	11(28.2)	15(38.4)	22(33.8)	5(7.7)	28(43.1)
GEN	32(82.1)	1(2.7)	6(15.4)	51(78.5)	3(4.0)	11(16.9)
OF	28(71.8)	7(17.9)	4(10.3)	0(0)	0(0)	4(6.2)
P	0(0)	0(0)	39(100)	39(60)	1(1.5)	65(100)
TE	31(79.5)	2(5.1)	6(7.6)	39(60)	1(1.5)	25(38.5)
VA	0(0)	0(0)	0(0)	64(98.5)		0(0)

Key:-Anti=Antimicrobial AK=Amikacin C=Chloramphenicol CD=Clindamycin COT=Cotri-Mexozale E=Erythromycin GEN=Gentamicin OF=Ofloxaicin P=PenicillinG TE=Tetracycline VA=Vancomycin S=Susceptible I=Intermediate R=Resistant

4. Discussion

Staphylococcus aureus is gram positive cocci and both catalase and coagulase positive. They often found in the human nasal cavity (and on other mucous membranes) as well as on the skin and environmental surfaces (Dubourg *et al.*, 2017). The size of their colonies are 2-3mm in diameter and occur singly, in pairs, and most commonly, in irregular grape-like clusters and generally tolerate relatively high concentrations of sodium chloride (7.5-10%). The organism is an important pathogen of human being and responsible to cause myriad types of diseases including both nosocomial and community acquired infections.

This study was designed to determine the prevalence of *S.aureus* isolates from the surface of toilet door handles of hospitals and selected secondary schools in Sodo town. Contamination of door handles with the organism was observed more at the hospitals than the secondary schools sampled. The result showed that high prevalence rate of isolates was seen on hospitals toilet door handles than school toilet door handles. The reason could be the toilets in schools were used by a person who was a healthy, while in hospitals the toilet users were mostly patients. This study showed that among the schools highest prevalence rate were seen Sodo secondary 29.4% and the lowest were seen in Bogale Walelu secondary school (14.7%) (Table4.1). Toilet door knobs were serve as reservoir of infection when contaminated since the toilet user must have to touch the site both at entrance and exit from the toilet (Maori *et al.,* 2013). Bright *et al.,* (2013) stated as have an increase in population growth and mobility enhances pathogen transmission and this intensifies the difficulty of interrupting disease spread.

From the current study the prevalence of *S.aureus* isolated from hospital toilet door handle surface were (37.4%) which is higher than the pooled prevalence of the selected secondary schools (22.42%). This difference among the hospitals and the schools might be the hospitals toilets were routinely used by patients and visited by the user's usual time interval in comparison to school toilets. Due to this intervals the rate of contamination would reduced in the schools and those peoples use school toilets were look like health personnel's. So the high prevalence of the *S.aureus* isolates from the hospitals show that contamination and responsible to cause nosocomial infections. Because environmental contact surfaces became an issue of health concern particularly it serves as potential carriers and transmitters of disease causing microorganisms (Rogo, 2008).

The current study finding was similar with previous finding (26.3%) reported by Solomon *et al.,* (2017). The finding of current study was higher than the former findings (39%) reported by Saba *et al.,* (2016) and lower than the study report conducted in Kenya (19.9%) by Mbogori *et al.,* (2013). The variability of the findings may be due to the sites were samples collected, the size of the swab and the swabbing technique. The present study result was strongly disagree with the previous finding (60%) conducted by Kawo *et al.,* (2012) in sokkoto secondary school, Nigeria. The high difference between the two reports may be the sample size; the time interval of study conducted and due to this previous study result was higher than the current study findings. The present study result was in line with the previous study result 30.1% conducted in door handles /knobs in selected public connivance in Abuja Metropolis, Nigeria (Nworie *et al.,* 2012). The present study was agree with the study entitled as antimicrobial resistance profile of *S.aureus* isolates isolated from ear discharge of patients at university of Hawassa conducted by Deyano *et al.,* (2017). The current study result was disagreeing to the previous study result 44.1% reported by Shibabaw *et al.,* (2013). The rate of prevalence in previous result is higher the reason could be the sample source in the previous study were taken from human beings

In current study two hospitals and five schools were recruited, high isolation rate were observed in otona teaching referral hospital which showed higher prevalence 42.52% than Sodo christen hospital 32.18%. This result indicates that the organism was more common in OTRH than Sodo christen hospital this due to the improved facility managements of the hospitals may be a factor. From finding of this study the prevalence *S.aureus* in selected secondary schools ranges from 14.70% to 29.41%. The pooled prevalence of all the schools was 22.41%. This study result was lower than the previous finding reported by 40.6% Ngonda, (2017), in line with 30.6% reported by Sabra, (2013). In current study zero percent (0%) of the isolates was resistant to vancomycin in hospitals and the same resistance was observed in selected secondary schools. The result of the present study was similar to the previous study result reported by Al-zaubi *et al.,* (2015). Another study analyzed the antimicrobial susceptibility pattern of *S. aureus* on hospital sample noted that 0.4% of the isolates were resistance to vancomycin reported by Gizachew *et al.,* (2015). This is similar to present study report. All the isolates both in hospitals and selected secondary schools showed (100%) resistance to penicillin. The isolates did not show any change because *S.aureus* has the ability to produce β-lactamase or penicillinase enzyme which breakdown the β-lactam ring present in penem heteronucleus (Milazzo *et al.,* 2003) According to the study result as indicated the bacterial isolates were adapted the drug. The highest resistance of isolates next to penicillin in the current study was observed to chloramphenicol which was (63.08%) in hospitals isolates and (41.08%) of the isolates in selected secondary schools were resistant to chloramphenicol. In our finding 38.48% of isolates were resistant to erythromycin in selected secondary schools and 43.07% of the isolates were resistant in hospitals. The resistance between the two sampling sites in relation to erythromycin was slightly similar. The resistance in the present study was too much higher than the previous study report (0%) by Mbogori *et al.*, (2013). The difference in the results might be the sample site and study period. No isolates of *S.aureus* were resistant to Amikacin in selected secondary schools where as a little (6.15%) resistance was observed in hospitals to the drug Amikacin. According to the current study finding the antibiotics like Amikacin, vancomycin, gentamicin, tetracycline, Ofloxaicin and clindamycin showed a good antimicrobial activity against *S.aureus* isolates. Out of 39 isolates 37(94.48%) were susceptible to Amikacin in selected secondary schools and from 65 isolates 56 (86.15%) were susceptible in hospitals, where as all the 39 (100%) isolates of the selected secondary schools were susceptible for vancomycin and from 65 isolates in hospitals 64(98.46%) of them were susceptible to vancomycin, the present study result was similar to the report in Nepal 100% by Bhatt *et al.,* (2014), out of 39 isolates in selected secondary schools 32 (82.05%) were susceptible to gentamicin and from 65 isolates 51(78.46%) were susceptible in hospitals, from 39 isolates (71.79%) were susceptible to Ofloxaicin in selected secondary schools and out of 65 isolates 50(76.92%)were susceptible to Ofloxaicin in hospitals, from 39 isolates in selected secondary schools 25(64.10%) were susceptible to clindamycin and out of 65 isolates 47(72.30%) were susceptible to clindamycin in hospitals and out of 39 isolates in selected secondary schools 31(79.48%) were susceptible to tetracycline and 60% in hospitals.

The sensitivity pattern of *S.aureus* to penicillin in the present study was 0% this were lower than the reports in Gondar university, North West of Ethiopia 37.8% the variability may be the sample source and in line with reports in Nepal 0% (Bhatt *et al.*, 2014). The sensitivity profile the organism to gentamicin in present study was 82.05% in selected secondary schools and 78.46% in hospitals. This is in line with the report 80% by Gizachew *et al.*, (2015) and lowers than the reports in Nigeria 99.4% by Emmanuelle and Magoj, (2011). The resistance patterns *S.aureus* isolates to cotri-moxazole in current study was 41.02% in selected secondary schools and 38.46% in hospitals. This is lower than the report in St. Mary hospital lacor, 50% and Gondar university hospital North West of Ethiopia, 60.3% (Kitara *et al.*, 2011 and Gizachew *et al.*, 2015). This difference could be due to indiscriminate use of the antimicrobials agents in the area. The resistance pattern of *S.aureus* isolates to tetracycline in the present study was 7.69% in selected secondary schools and 38.46% in hospitals. These results were lower than the report in Gondar university hospital 60.9% and slightly similar to the report in Kenya 28% reported by Mbogori *et al.,* (2013). This difference may be due to miss- consumption of drugs in the area (Gizachew *et al.*, 2015). The sensitivity pattern of *S.aureus* to Amikacin in current finding was 94.48% in selected secondary schools and 86.15% in hospitals. This result is agreeing with study report 90% in Nepal by Bhatt *et al.*, (2014). The resistance pattern of *S.aureus* to erythromycin in our finding was 38.46% in selected secondary schools and 43.07% in hospitals. The current study report regarding erythromycin was higher than the previous study report in Kenya 13% (Mbogori *et al.,* 2013). The difference could be due to overdose of antibiotics and the current study period.

5. CONCLUSION

The majority of toilets both in hospitals and selected secondary schools lack proper sanitation. Therefore the prevalence rate of *S.aureus* 39(22.41%) in selected secondary schools and 65(37.35%) in hospitals with the cumulative prevalence rate of 29.88% in both sites were represents the way of acquiring both nosocomial and community acquired infection by the pathogen. The isolates of both hospitals and schools were tested for antimicrobial susceptibility pattern and relatively high resistances were displayed by hospital isolates in comparison with selected secondary schools isolates. The reduced sensitivity of the isolates of *S.aureus* to the tested antimicrobial agents indicates that the isolates were adapting to the antimicrobial agents. All the isolates both in selected secondary schools and hospitals were highly resistant to penicillin and highly sensitive to vancomycin. The antimicrobial agents like vancomycin, Amikacin, gentamicin and Ofloxaicin are drugs showed efficient activity against the *S.aureus* isolates in this study.

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COMPETING INTEREST

The author declares that there is no competing interest.

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