Vol. 14(11), pp. 608-616, November, 2020
DOI: 10.5897/AJMR2020.9392
Article Number: 0578AA265416
ISSN: 1996-0808

http://www.academicjournals.org/AJMR

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African Journal of Microbiology Research

Full Length Research Paper

Assessment of the hand hygiene status of internally displaced persons in Jos and environs, Nigeria

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Received 22 July, 2020; Accepted 25 August, 2020

Internally displaced persons (IDPs) are often predisposed to infectious diseases because of the temporary nature of their abode which usually does not have adequate water and hygiene facilities. A hundred (100) samples of hand-washed water taken under aseptic conditions from the hands of the IDPs prior to the emergence of COVID-19 were analyzed using standard bacteriological procedures to determine the total plate and coliform counts, identify the bacterial isolates, and to determine their sensitivity to an array of commonly used antibiotics. Structured questionnaires were also administered to IDPs in order to determine their knowledge, practice, and compliance to hand washing. The results of the study showed the mean total plate count and coliform count of the subjects to be 2.71 × 105 cfu/ml and 2.78 × 105 cfu/ml for House of Recabs and 2.90 × 105 cfu/ml and 2.54 ×105 for Stefanos Foundation respectively. The percentage frequency of Occurrence (in brackets) of the bacterial isolates were that *Streptococcus faecalis* (21%), *Staphylococcus aureus* (31%) *Escherichia coli* (32%), *Salmonella* spp (32%) *Pseudomonas aeruginosa* (40%), and *Proteus* sp (61.1%) was the most resistant organism to the antibiotics followed by *P. aeruginosa* (49.3%). The highly sensitive organisms were *S. aureus* (63.9%) and *S. faecalis* (56.7%) respectively. The results of the questionnaire survey showed that the hand washing compliance score of the IDPs was generally poor (34.00%) with House of Recabs having a slightly higher score (35.60%) than Stefanos Foundation (32.40%) respectively. Awareness drive and provision of hand washing facilities in the IDP camps should be provided to promote hand hygiene are hereby recommended.

Key words: Hand washing, antibiotic susceptibility, internally displaced person, hygiene, infectious diseases.

INTRODUCTION

Internally displaced persons (IDPs) are “persons or groups of people who have been compelled to flee or leave their homes or places of customary residence, in particular as a result of, or in order to avoid the effects of armed conflicts, situations of generalized violence, violations of human rights or natural or man-made disasters, and who have not crossed an internationally recognized state border” (UNHCR, 1998). Estimates from

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the Internal Displacement Monitoring Centre (IDMC) indicate that the number of people displaced annually by conflict and violence has increased globally since 2003 (IDMC, 2016). A massive 40.3 million of them were uprooted during 2016, equaling 15,000 people displaced every day in African countries alone (IDMC, 2015, 2016, 2017a,b,c).

The IDMC's Global Overview (IDMC, 2015) reported that the majority of the increase in new displacement during 2015 was the result of protracted crises in the Democratic Republic of the Congo, Iraq, Nigeria, South Sudan, and Syria. In total, these five countries accounted for 60% of new displacement worldwide. In Nigeria, the insurgent activities of Jamā'at Ahl as-Sunnah lid-Da'wah wa'l-Jihād (Islamic State's West Africa Province) commonly called Boko Haram (BH) in the past decade have forced more than 2,152,000 people to flee their homes with 1,434,142 of these coming from Borno State (Nigeria IDP Figures Analysis, 2018). This has resulted in an unprecedented humanitarian crisis in the Northeastern part of the country and the Lake Chad region (IDMC, 2016).

Intercommunal clashes resulting from ethno religious disputes, between Fulani herdsmen militia and farmers have also resulted in over 700,000 people being displaced from the Middle Belt region of Nigeria (IDMC, 2016). Internally displaced persons (IDPs) are often predisposed to infectious diseases because of the temporary nature of their abode which usually does not have adequate water and hygiene facilities (Olwedo et al*.,* 2008; Guerrier et al*.,* 2009; Lam et al*.,* 2015). According to Owoaje et al. (2016), there are several risk factors, working in synergy during displacement which promotes communicable diseases. These factors include the massive movement of populations and resettlement in temporary locations, overcrowding, economic, environmental degradation, poverty, inadequate availability of potable water, poor sanitation, and bad waste management. These conditions are further complicated by the absence of shelter, food shortages, and poor access to healthcare (Connolly et al*.,* 2004). In Sub-Saharan Africa, Diarrhoeal and Urinary tract diseases are major causes of morbidity and mortality among IDPs and mainly result from substandard or inadequate sanitation facilities, poor hygiene, and poor hand washing practices due to scarcity of soap, water, sanitizers, etc. (Connolly et al*.,* 2004; Kim et al*.,* 2007; Getanda et al*.,* 2015).

The hand has been recognized as the major carrier of many germs of fecal origin and body flora through the mouth, nose, eyes, etc. into the human body resulting in infectious diseases such as the current pandemic Coronavirus, diarrhea, cholera, Ebola, Lassa fever, flu, hepatitis and the likes (Greger, 2007; Gould et al*.,* 2017; Jefferson et al*.,* 2011; Ngene et al*.,* 2020; Egbere et al*.,* 2008). Hand washing has an age-long recognition among religious and cultural practices of the world. A Nigerian proverb which states "that it is only the child that washes his or her hands that could eat with elders" bears credence to the cultural importance of hand washing.

The widespread occurrence of antibiotic resistance among thousands of people with suspected bacterial infections across 22 countries was revealed by W.H.O.'s new Global Antimicrobial Surveillance System (GLASS). The most commonly reported resistant bacteria have *Escherichia coli*, *Klebsiella pneumoniae*, *Staphylococcus aureus*, and *Streptococcus pneumoniae*, followed by *Salmonella* spp. (WHO, 2018). Improper or irregular Hand washing in areas starved with Hand washing facilities like internally displaced person camps can be a huge problem for antibiotic therapy (Todd, 2014). This research was therefore carried out to assess the compliance to hand washing and antibiotic susceptibility of hand-borne bacteria in the hands of internally displaced persons in Jos and environs, Plateau state, Nigeria.

MATERIALS AND METHODS

Study area

The sample area for this research work is two displaced camps situated within Jos which include House of Recaps (British American junction) and Stefanos Foundation IDP camp (Bukuru).

Sampling

Samples size and questionnaire type used

A total of 100 samples of hand-washed water from displaced persons (IDPs), 50 drawn from each camp were taken randomly. Randomization was done by tagging the IDPs with numbers 1-5 and the first 10 persons with numbers 5 were picked from each camp. A structured questionnaire comprising of various aspects meant to investigate the persons' knowledge, attitude, and practice (KAP), as well as compliance with proper hand washing procedures recommended by the world health organization were used.

Collection of samples

The collection of samples from the two camps was done ingeniously and aseptically using the Hand-dip technique modified from the method of Houshian et al*.* (2006). This involved the displaced person dipping his or her right or left hand (depending on which hand the person uses regularly) into a sterile surgical hand glove containing 50 ml of sterile water (held by the researcher) and left for 30 s. The hand of the Idp was twisted thrice in an attempt to rinse it with the water (with the researcher assisting in the process). Thereafter, the sample was carefully poured into a clean sterile bottle labeled appropriately. The collected samples were transported to the microbiological laboratory a few minutes after collection.

Bacteriological analyses

Cultivation and enumeration

A serial dilution of the hand-washed water was used. Each sample

Table 1. Mean bacterial counts of wash water from hands of internally displaced persons in Jos and Environs.

Location of IDPs	Total viable count (cfu/ml)		Coliform count (cfu/ml)	
	Range	Mean (n=50)	Range	Mean (n =50)
House of Recabs (British)	1.84×10^6 - 3.44×10^6	2.71×10^6	2.24×10^5 - 3.75×10^5	2.78×10^5
Stefanos Foundation (Bukuru)	1.84×10^6 - 3.74×10^6	2.90×10^6	1.93×10^5 - 3.19×10^5	2.54×10^5

was serially diluted to the power of 5 by pouring 9 ml of sterile water into test tubes arranged in fives for all samples following the Serial Dilution Technique as described by Cheesbrough (2000). The last dilution (10-5) was inoculated on plates containing different media (Nutrient Agar, MacConkey agar,) for each sample and then labeled accordingly After inoculation, plates were incubated upside down at 37°C for 24 h then were observed for growth and the colonies obtained were counted using Digital Colony Counter.

Identification of bacterial isolates

Macroscopic examination of the isolates

The isolates were examined macroscopically for morphological characteristics of the bacterial isolates to include size, shape, color, margin, elevation consistency, and hemolysis according to descriptions by Cheesbrough (2000).

Microscopic examination of the isolates

Standard bacteriological methods on microscopic examination of gram stained colonies as well as the determination of biochemical characteristics of the isolates as described by Cheesbrough (2005) were followed to identify the bacterial isolates obtained from the hands of the IDPs.

Antibiotic susceptibility test

Kirby-Bauer Disk Diffusion technique of antibiotic susceptibility testing (AST) was carried out to determine according to specifications of the National Committee for Clinical Laboratory Standards (NCCLS), 2013 (Kassim et al*.,* 2016) using standard antibiotic discs on Muller-Hinton agar. A clear zone or ring of inhibition around the antibiotic disc was measured as the Zone diameter of Inhibition by the respective bacterial isolates tested.

Statistical analysis

Data were subjected to statistical analysis using the software SPSS version 13.0 (SPSS Inc, Chicago, USA).

RESULTS

The results of the mean of Bacterial Loads on Hands of Internally Displaced Person in two camps situated in Jos which include Stefanos Foundation, (Bukuru) and House of Recabs, (British America Junction) Plateau State are shown in Table 1. The results indicate that the mean of the total plate and coliform count were 2.71×10^5 cfu/ml and 2.78×10^5 cfu/ml respectively for House of Recabs while the values for Stefanos Foundation were higher being 2.90×10^5 cfu/ml and 2.54×10^5 cfu/ml for total plate count and coliform counts respectively.

The results of the morphological, microscopic and biochemical characteristics of bacterial isolates associated with the hands of Internally Displaced Persons in Jos and Environ are shown in Table 2. Six organisms were identified and they include *S. faecalis* (21.00%), *S. aureus* (31.00%), *E. coli* (32.00%), *Salmonella* sp (32.00%), *P. aeruginosa* (40.00%) and *Proteus* sp (54.00%). The results of the percentage frequency of occurrence of bacterial isolates associated with the hands of the Internally Displaced Persons in Jos and Environs are shown in Table 3. The results indicated that while *Proteus* sp (54.00%) had the highest occurence, the least frequently occurring organism is *S. faecalis* (21.00%).

The result of the antibiogram of bacterial pathogen isolated from the hands of Internally Displaced Persons in Jos and Environs are displayed in Tables 4 and 5. The result showed that while *Proteus* sp was the most resistant (61.1%) organism to the 10 commonly used antibiotics, *S. aureus* was found to be the most sensitive organism (63.9%). The results obtained from the questionnaire which were filled by the IDP's about their knowledge of pathogenic bacteria and hygienic practices and precautions taken to prevent infections such as hand washing after defecating and before eating and also use of gloves during domestic work and washing hands afterwards as well as the nature of the finger nails as to whether it is trimmed, semi trimmed, or untrimmed is represented Figures 1 to 5.

DISCUSSION

The results in Table 1 having an average mean total plate count of 2.81× 105 tallies with reports of (Okareh and Erhahon, 2015) who equally enumerated bacterial loads on the hands of food handlers in Benin city, their mean total plate count was gotten to be 3.07×105. It should be noted however that the mean bacterial count of IDPs in the Stefanos Foundation (2.90×105) was slightly higher than those in House of Recabs (2.71×105). This could be due to inadequate water supply, both in quantity and quality, poor sanitation, and overcrowded condition of the Stefanos Foundation camp. In converse, the population in House of Recabs is less than and more manageable, they also have more access to the water supply. The

Table 2. Biochemical characteristics of bacterial isolates associated with hands of internally displaced persons in Jos and environs.

Gram reaction	Motilty	Catalase	Coagulase	Oxidase	Spore	Lactose fermentation	Glucose fermentation	Sucrose fermentation	Suspected organisms
-	+	-	-	-	-	+	+	+	*Escherichia coli*
-	+	-	-	-	-	-	+	-	*Salmonella* species
+	-	+	-	-	-	-	-	-	*Streptococcus faecalis*
+	-	+	+	-	-	-	-	-	*Staphylococcus aureus*
-	+	-	-	+	-	-	+	-	*Pseudomonas aeruginosa*
-	+	-	-	-	-	-	+	-	*Proteus* pecies

- = negative, += positive.

Table 3. Occurrence of bacterial isolates from hands of internally displaced persons in Jos and environs.

Location	*Staphylococcus aureus* (%)	*Streptococcus feacalis* (%)	*Escherichia coli* (%)	*Proteus* sp (%)	*Pseudomonas aeruginosa* (%)	*Salmonella* sp (%)
House of Recabs (British)	18 (36.00)	11 (22.00)	15 (30.00)	31 (62.00)	27 (54.00)	20 (40.00)
Stefanos foundation (Bukuru)	13 (26.00)	10 (20.00)	17 (34.00)	23 (46.00)	13 (26.00)	12 (24.00)
Total	31 (31.00)	21 (21.00)	32 (32.00)	54 (54.00)	40 (40.00)	32 (32.00)

Table 4. Antibiogram of bacteria pathogen isolated from the hands of internally displaced persons in Jos and Environs.

Antibiotics	*Staphylococcus aureus* n= 31 (%)		*Streptococcus faecallis* n= 21 (%)		*Escherichia coli* n= 32 (%)		*Proteus* sp n= 54 (%)		*Pseudomonas aerugnosa* n= 40 (%)		*Salmonella* sp n= 32 (%)	
	S	R	S	R	S	R	S	R	S	R	S	R
Cpx	20(64.5)	11(35.5)	17(81.0)	4(19.0)	27(84.4)	5(15.6)	21(38.9)	33(61.1)	24(60.0)	16(40.0)	10(31.3)	22(68.8)
Gen	15(48.4)	16(51.6)	15(71.4)	6(28.6)	20(62.5)	12(37.5)	20(37.0)	34(63.0)	21(52.5)	19(47.5)	27(84.4)	5(15.6)
Ofx	23(74.2)	8(25.8)	9(42.9)	12(57.1)	19(59.4)	13(40.6)	16(29.0)	38(70.4)	12(30.0)	28(70.0)	8(25.0)	24(75.0)
Pef	17(54.8)	14(45.2)	12(57.1)	11(52.4)	15(46.8)	17(53.1)	23(42.6)	31(42.6)	26(65.6)	14(35.0)	18(56.3)	14(43.8)
Stre	25(80.6)	6(19.4)	18(85.7)	3(14.3)	11(34.4)	21(65.6)	26(48.1)	28(51.9)	27(67.5)	13(32.5)	23(71.9)	9(28.1)
Aug	19(61.3)	12(38.7)	10(47.6)	11(52.4)	28(87.5)	4(12.5)	14(25.9)	40(71.4)	17(42.5)	23(57.5)	15(46.9)	17(53.1)
Cot	22(71.0)	9(29.0)	16(76.2)	5(23.8)	23(71.9)	9(28.1)	19(35.2)	35(64.8)	22(55.0)	18(45.0)	19(59.4)	13(40.6)
Tet	18(58.1)	13(41.9)	13(61.9)	8(38.1)	18(56.3)	14(43.8)	18(33.3)	36(66.7)	15(37.5)	25(62.5)	11(34.4)	21(65.6)
Amx	10(32.3)	21(67.7)	7(33.3)	14(66.7)	10(31.3)	22(68.8)	30(55.6)	24(44.4)	27(57.5)	17(42.5)	29(90.6)	3(9.38)
Amp	29(93.5)	2(6.45)	2(90.5)	2(9.5)	8(25.0)	24(75.0)	23(42.6)	31(57.4)	16(50.0)	24(60.0)	7(21.9)	25(78.1)
Mean	63.9	36.1	56.7	36. 2	55.9	44.1	38.9	61.1	51.8	49.3	52.2	47.8

CPX=Ciprofloxacin, Amx=Amoxicillin, Aug=Augmentin, Tet=Tetracycline, Ofx=Ofloxacin, Pef=Pefloxacin, Cot=Cotrimoxazole, Amp= Ampicillin, Stre= Streptomycin, Gen=Gentamycin. S=Sensitive, R=Resistance.

Table 5. Compliance to hand hygiene by the IDPs in Stefanos Foundation and House of Recabs.

Parameter	Stefanos foundation	House of recabs
Washing hands after toilet usage		
With water and soap	33	37
	20	18
After contact with dirt	26	29
With water and soap	17	18
Before eating	32	42
With water and soap	30	23
Finger nail status (trimmed)	1	10
Use of Hand gloves during sanitation	3	1
Total plate count below 10^5	0	0
Mean compliance	32.4	35.6

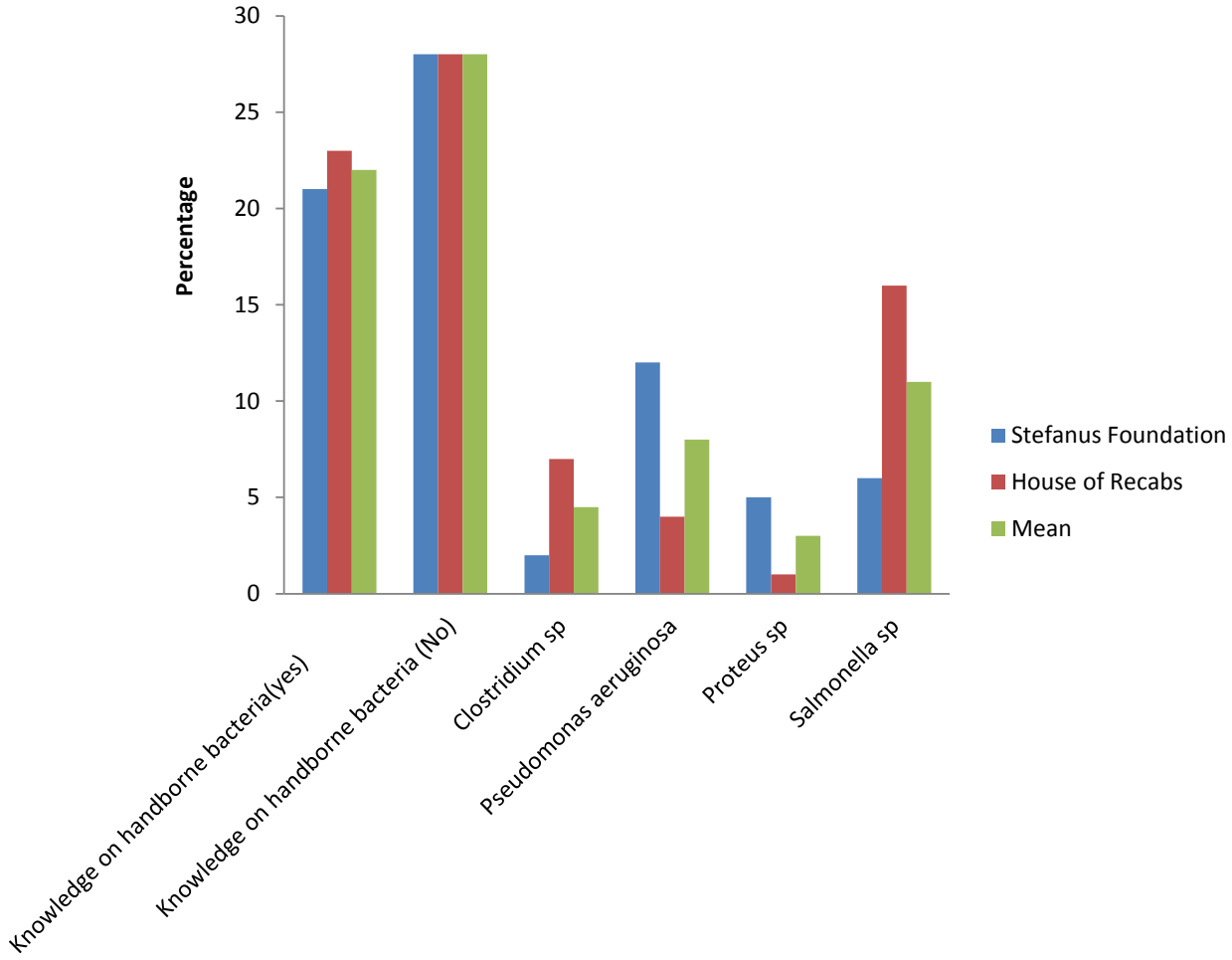

Figure 1. Knowledge of some pathogenic bacteria by internally displaced persons.

difference in mean count between the two camps could also be reflective of the different personal hygiene status of the IDPs in two camps as well.

The results in Table 2 show that *S. faecalis* (21.00%), *S. aureus* (31.00%), *E. coli* (32.00%). *Salmonella sp* (32.00%), *P. aeruginosa* (40.00%) and *Proteus spp*

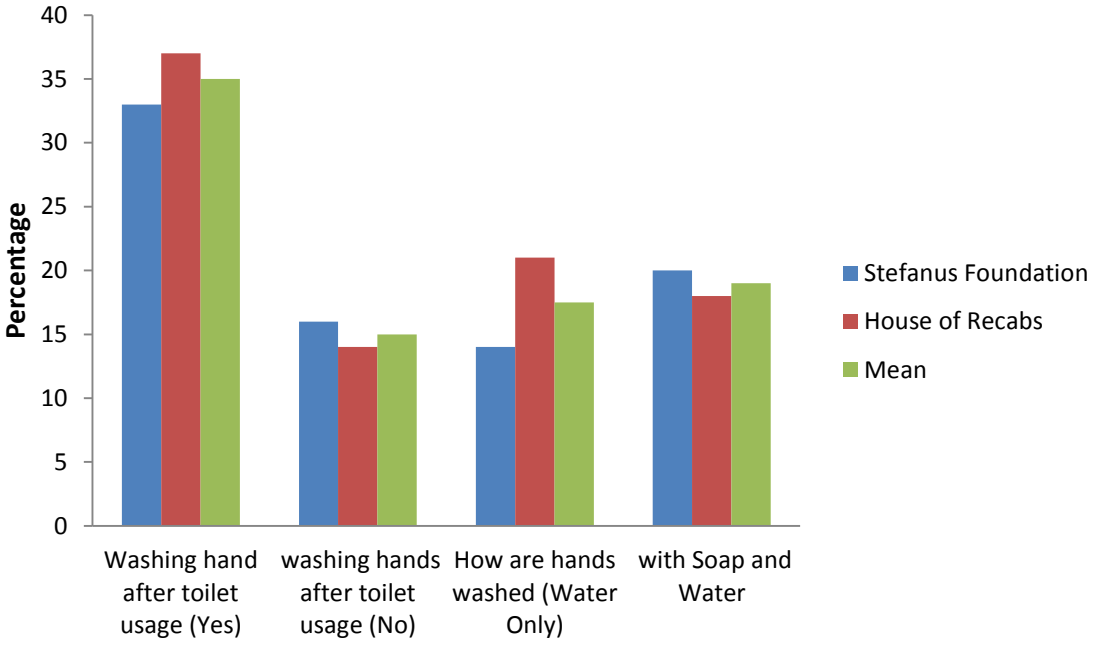

Figure 2. Compliance to hand washing after toilet usage.

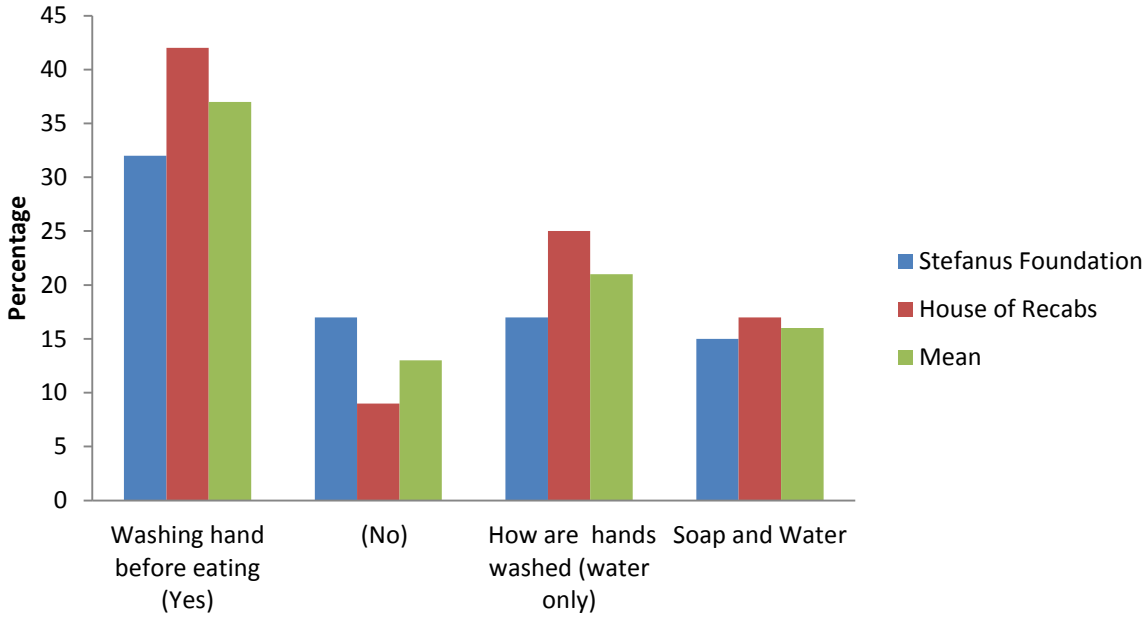

Figure 3. Compliance to hand washing before eating.

(54.00%) were isolated from hand washed samples of IDPs. All the six bacterial isolates are known to be pathogenic to man. *E. coli* the commonest coliform organism was isolated may be due to fecal contamination. *S. aureus* and *S. faecalis* being normal floras of the skin were isolated probably due to the use of hand to scratch wounds, pick specks of dirt from the nose, and so on. *Salmonella spp* which is mostly found in contaminated water indicates health hazards (Cheesbrough, 2000). *P. aeruginosa* which is mostly found in soil was probably isolated due to contact with soil. Microorganisms such as *S. aureus*, *E. coli* found in hand washed samples if ingested could lead to acute or chronic food poisoning or food-borne related illness such

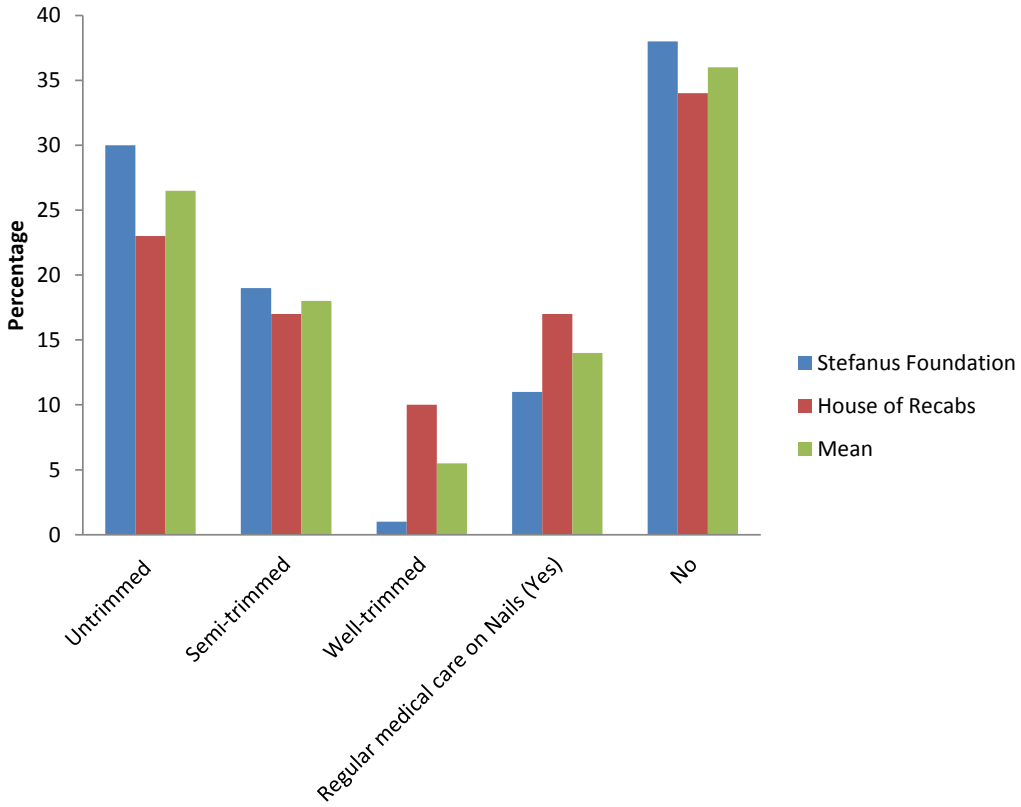

Figure 4. Fingernail status of internally displaced persons.

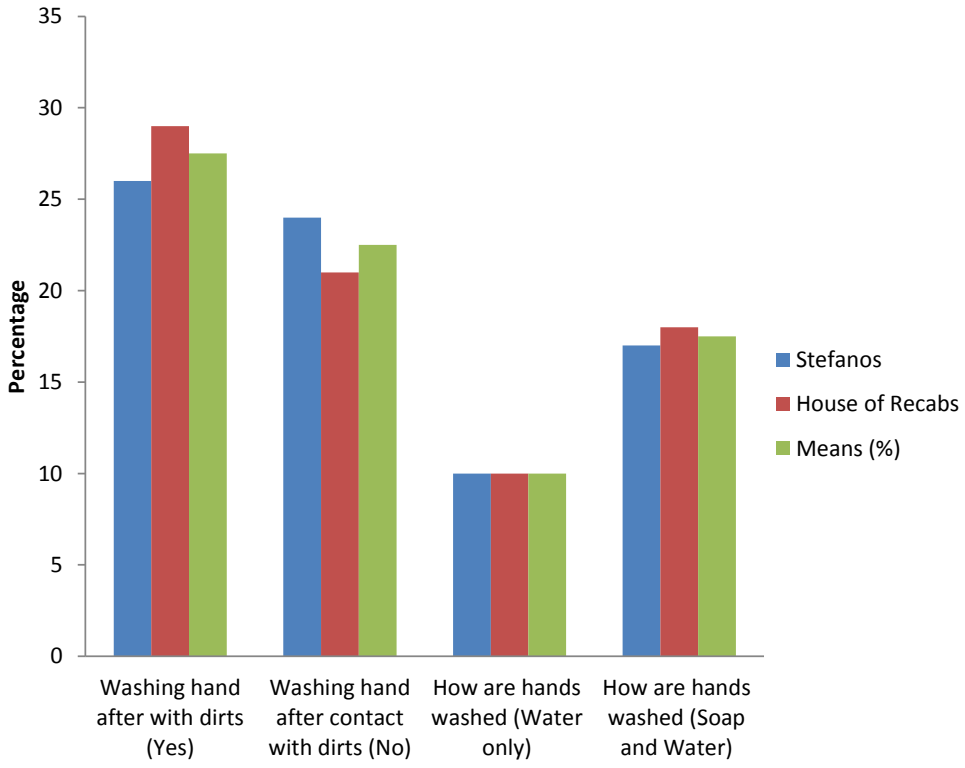

Figure 5. Compliance to Hand washing after contact with dirt.

as gastroenteritis, etc.

They can cause other infections as well. The result agrees with (Tambekar and Shirsat, 2009) who isolated similar microorganisms from hand swab samples from students. (Clarence et al*.,* 2009) isolated almost similar organisms from meat pie while (Ajao and Atere, 2009) who isolated microbes from cooked rice. (Wogu et al*.,* 2011) also reported similar organisms from ready to eat rice sold in Benin City. The presence of indicator organisms on Hand provides a direct and relevant measure of cleaning efficiency and hygiene (Moyo and Baudi, 2004).

The result of the percentage frequency of occurrence of bacterial isolates associated with the hands of IDPs in Jos and Environs indicated that while *Proteus spp* has the highest frequency of occurrence (54%), the least frequently occurring organism was *S. faecalis* (21%). *Proteus species* known to be a normal microflora of the gastrointestinal tract is recorded the highest, possibly been that they probably do not wash their hands often. This is in contrast with the research carried out by Tambekar et al. (2009) having a lower percentage of the organisms, the low results of the authors could be due to the fact that the samples were collected from the hands of students who might tend to have a general knowledge on hand hygiene.

The result showed that while *Proteus* spp was the most resistant (61.1%) organisms to the 10 antibiotics used, *S. aureus* was found to be the most sensitive (63.9%) organism. The high antibiotic resistance of *Proteus* spp may be an indication of resistance level among the *Enterobacteriaceae*. *Salmonella* having relatively high prevalence could be due to indiscriminate in-take of antibiotics which provides selective pressure, leading to the higher prevalence of resistant bacteria (Barrow and Feltham, 2003). Not only are these species potential causes of infections but also potential reservoirs of resistance genes that could be transferred to other bacterial pathogens. The increase in levels of Beta-lactamase production and multi-drug resistance of the isolates indicates an increase in the resistance menace reported by many studies (Feglo et al*.,* 2010). The resistance of 77.85% of *Proteus* spp against ampicillin, cotrimoxazole, tetracycline, and chloramphenicol was reported by Feglo et al*.* (2010). Similar results were reported by Newman et al*.* (2006). These organisms are entirely preventable by practicing good sanitation and proper hand hygiene practices.

The results of the questionnaire survey showed that hand washing compliance score of the IDPs was generally poor (34.00%) with House of Recabs having a slightly higher score (35.60%) than Stefanos Foundation (32.40%) respectively. The compliance score of House of Recabs is higher than that of Stefanos Foundation possibly because the former has a lower population of children and youth with teachers who teach them hygiene and other manners. The result of the hand hygiene compliance score recorded here is slightly lower than that recorded by Odidi (2014) for students of the University of Jos (46.70%) who are obviously informed. There is a need for improvement in basic hand hygiene practices.

The following are the conclusions derived from this study; the bacterial burden of the hands of the IDPs is high, all the six organisms isolated are implicated for pathogenicity, most of the bacteria isolated have high resistance to common antibiotics used, knowledge of and compliance to hand washing by IDPs are generally low. It is recommended that effective washing agents should be provided by those in charge of the displaced camps and these agents include clean water (Tap), Antiseptic liquid, soaps, drying agents (disposable) followed by teachings about proper hand washing procedure to displaced persons.

Finally effective hand washing according to the Centre for Disease Control and Prevention (CDC) 2013 (Center for Disease Control and Prevention, 2013) should be done by wetting the hands, lather by rubbing together (back of hands, between the fingers and under the nails), scrub for at least twenty 20 s, rinse under clean running water and dry using a clean towel or air dry.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

ACKNOWLEDGEMENT

The authors appreciate the role of Local Government officials, particularly the Directors of Primary Health Care and PLACA Programme Officers and Volunteers and are indebted to all the Field Assistants for their spirit of hard work and patriotism.

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