International Multispeciality Journal of Health

ISSN: 2395-6291

www.imjhealth.org

Volume-7, Issue-12, December 2021

Preface

We would like to present, with great pleasure, the inaugural volume-7, Issue-12, December 2021, of a scholarly journal, *International Multispeciality Journal of Health*. This journal is part of the AD Publications series *in the field of Medical, Health and Pharmaceutical Research Development*, and is devoted to the gamut of Medical, Health and Pharmaceutical issues, from theoretical aspects to application-dependent studies and the validation of emerging technologies.

This journal was envisioned and founded to represent the growing needs of Medical, Health and Pharmaceutical as an emerging and increasingly vital field, now widely recognized as an integral part of scientific and technical statistics investigations. Its mission is to become a voice of the Medical, Health and Pharmaceutical community, addressing researchers and practitioners in below areas

Clinical Specialty and Super-specialty Medical Science:

It includes articles related to General Medicine, General Surgery, Gynecology & Obstetrics, Pediatrics, Anesthesia, Ophthalmology, Orthopedics, Otorhinolaryngology (ENT), Physical Medicine & Rehabilitation, Dermatology & Venereology, Psychiatry, Radio Diagnosis, Cardiology Medicine, Cardiothoracic Surgery, Neurology Medicine, Neurosurgery, Pediatric Surgery, Plastic Surgery, Gastroentrology, Gastrointestinal Surgery, Pulmonary Medicine, Immunology & Immunogenetics, Transfusion Medicine (Blood Bank), Hematology, Biomedical Engineering, Biophysics, Biostatistics, Biotechnology, Health Administration, Health Planning and Management, Hospital Management, Nephrology, Urology, Endocrinology, Reproductive Biology, Radiotherapy, Oncology and Geriatric Medicine.

Para-clinical Medical Science:

It includes articles related to Pathology, Microbiology, Forensic Medicine and Toxicology, Community Medicine and Pharmacology.

Basic Medical Science:

It includes articles related to Anatomy, Physiology and Biochemistry.

Spiritual Health Science:

It includes articles related to Yoga, Meditation, Pranayam and Chakra-healing.

Each article in this issue provides an example of a concrete industrial application or a case study of the presented methodology to amplify the impact of the contribution. We are very thankful to everybody within

that community who supported the idea of creating a new Research with *IMJ Health*. We are certain that this issue will be followed by many others, reporting new developments in the Medical, Health and Pharmaceutical Research Science field. This issue would not have been possible without the great support of the Reviewer, Editorial Board members and also with our Advisory Board Members, and we would like to express our sincere thanks to all of them. We would also like to express our gratitude to the editorial staff of AD Publications, who supported us at every stage of the project. It is our hope that this fine collection of articles will be a valuable resource for *IMJ Health* readers and will stimulate further research into the vibrant area of Medical, Health and Pharmaceutical Research.

Dr. Kusum Gaur
(Chief Editor)

Mr. Mukesh Arora
(Managing Editor)

Board Members

Dr. Kusum Gaur (Editor-in-chief)

Dr. Kusum Gaur working as professor Community Medicine and member of Research Review Board of Sawai Man Singh Medical College, Jaipur (Raj) India.

She has awarded with WHO Fellowship for IEC at Bangkok. She has done management course from NIHFW. She has published and present many research paper in India as well as abroad in the field of community medicine and medical education. She has developed Socio-economic Status Scale (Gaur's SES) and Spiritual Health Assessment Scale (SHAS). She is 1st author of a book entitled " Community Medicine: Practical Guide and Logbook.

Research Area: Community Medicine, Biostatics, Epidemiology, Health and Hospital Management and Spiritual Health.

Mukesh Arora (Managing Editor)

BE (Electronics & Communication), M.Tech (Digital Communication), currently serving as Assistant Professor in the Department of ECE.

Dr. AMER A. TAQA

Dr. AMER A. TAQA is Professor and Head in Dental Basic Science Mosul University, Mosul, IRAQ. He has been registrar of department of Dental Basic Science Mosul University, Mosul, IRAQ. He has published about 100 of research papers and out of that 50 were of international level. He has awarded many times for scientific researches by Government. He has been member of many examination committees and also is a Member in Iraqi Scientific Staff. He has been working as Editor - reviewer in many journals.

Research Area: Dental Science.

Dr. I.D. Gupta

Dr. I. D. Gupta is Professor Psychiatry and working as additional Principal and Dean of student welfare in SMS Medical College, Jaipur.

He is recipient of Prof. Shiv Gautam oration award by Indian Psychiatric Society. He has done training in YMRS at Monte Carlo and BPRS at Singapore. He has been President Indian Psychiatric Society, Rajasthan State Branch. He is author of "Psycho Somatic Disorder" chapter in 1st edition post graduate text book of Psychiatry by Vyas and Ahuja. He has also worked with National Mental Health Programme and has a lot of publication.

Research Area: Community Mental Health, Psycho somatic and liaison Psychiatry.

Dr. Lokendra Sharma

Dr. Lokendra Sharma is Associate Professor Pharmacology and working as Nodal officer of SMS Medical College, Jaipur.

He is recipient of WHO Fellowship award on Poison Patient Management at Vietnam. He is resource faculty for Experimental Toxicology and Basic Course for Medical Education. He is presented and published a lot of research articles at national and international level.

Research Area: PHARMACOLOGY

Dr. Anuradha Yadav

Dr. Anuradha Yadav is working as Professor Physiology, SMS Medical College, Jaipur (Rajsthan) India. She is a popular medical teacher and research scholar who had many publications in indexed journals. **Research Area:** CVS & CNS physiology, Medical Education and Spiritual Health.

Dr. Rajeev Yadav

Dr. Rajeev Yadav is working as Associate Professor Community Medicine, SMS Medical College, Jaipur (Rajsthan) India. He is member of Research Review Board of the Institute.

He has authored a book entitled "Community Medicine: Practcal Guide and Logbook".

Research Area: His area of Interest are Epidemiology, Biostatistics and Spiritual Health.

Prof. Dillip Kumar Parida

Professor and Head in the Department of Oncology, AIIMS, Bhubaneswar.

He has done the Professional Training in Japan (Oska University, NIBI, AHCC Research Association, Hyogo Ion Beam Center), ESTRO Fellowship in Denmark and India(AIIMS Delhi, BARC Mumbai, SCB Medical College-Cuttak, MKCG Medical College-Berhampur).

Research Area: Brachytherapy, Total Skin Electron Irradiation, Palliative Radiotherapy, Stereotactic & Conformal radiotherapy, Radiation Cell Biology, Cancer Genetics.

Dr. Praveen Mathur

Dr. Praveen Mathur is working as Professor- Pediatric Surgery and is recipient of Commonwealth Fellowship in Pediatric Laparoscopy from Uk and fellowship award in minimal access Surgery (FMAS). He has done Clinical observer ship in the Department of Pediatric Surgery, Johns Hopkins University, Baltimore, USA. (2008). He has presented and published a number of research articles at national and international level. He is reviewer of prestigious Journal of Pediatric Surgery (JPS) and World Journal of Gastroenterology, Journal of neonatal Surgery (JNS).

Research Area: Pediatric Surgery & Laparoscopy.

Dr. Lokendra Sharma

Dr. Lokendra Sharma is Associate Professor Pharmacology and working as Nodal officer of SMS Medical College, Jaipur.

He is recipient of WHO Fellowship award on Poison Patient Management at Vietnam. He is resource faculty for Experimental Toxicology and Basic Course for Medical Education. He is presented and published a lot of research articles at national and international level.

Research Area: PHARMACOLOGY.

Dr Rajeev Sharma (MS; FMAS; FIMSA;FCLS)

He is working as Professor, Department of Surgery, Government Medical College, Chandigarh, India. He has done FMAS, FIMSA and FCLS along with MS (Gen Surgery).

He has about 50 international and national publications to his credit. He has held various positions in the Association of Minimal Access Surgeons of India (AMASI) from time to time. He has also acted as instructor of various AMASI skill courses held at different places in India. He has established Surgical Technique learning centre at GMCH Chandigarh for imparting training to the budding surgeons in the field of minimal access surgery. He is also the reviewer in the subject in various journals.

Research Area: Minimal Access Surgery.

Dr Anshu Sharma (MS ANATOMY)

She is Presently working as assistant professor in the department of Anatomy, GMCH, Chandigarh. She has many publications in various national and international journals. She is executive member of Anatomical Society of India (ASI) and North Chapter of ASI. She is also a member of editorial board of Journal of Medical College Chandigarh.

Research Area: Congenital Malformation, Developmental Anatomy.

Dr. Rajeev Yadav

Dr. Rajeev Yadav is working as Associate Professor Community Medicine, SMS Medical College, Jaipur (Rajsthan) India. He is member of Research Review Board of the Institute.

He has authored a book entitled "Community Medicine: Practical Guide and Logbook".

Research Area: His areas of Interest are Epidemiology, Biostatistics and Spiritual Health.

Dr. Dilip Ramlakhyani

Dr. Dilip Ramlakhyani working as Associate professor Pathology and member of IT Committee of Sawai Man Singh Medical College, Jaipur (Raj) India. He has published many articles in indexed journals.

Dr. Virendra Singh

Dr. Virendra Singh worked as Supernatant and head of department of Pulmonary Medicine, SMS Medical College, Jaipur (Rajsthan) India.

He has gone abroad for many training courses and to present research papers. He had been chairman of Research Review Board of SMS Medical College, Jaipur. He is a great research scholar and had published book related to his faculty and had many publications in indexed journals.

Dr. Mahesh Sharma

Dr. Mahesh Sharma is a Principle specialist General Surgery in Rajasthan State Government, India. He has been PMO of district hospitals for more than 15 years. He has gone abroad as observer of many of training related to his speciality. He has published and present many research paper in India as well as abroad.
He has developed Spiritual Health Assessment Scale (SHAS) with Dr. Kusum Gaur.

Research Area: General Surgery, Health and Hospital management and Spiritual Health.

Dr. Ravindra Manohar

Professor Community Medicine, working as head of department of PSM,SMS Medical College, Jaipur (Rajsthan) India.

Previously he has worked in BP Kiorala Institute of Medical Sciences, Nepal. He has visited CDC Atlántica for a Statistical workshop. He has been convener of MBBS and PG exams. He is a research scholar and had many publications in indexed journals.

Dr. Praveen Mathur

Dr. Praveen Mathur is working as Professor- Pediatric Surgery and is recipient of Commonwealth Fellowship in Pediatric Laparoscopy from Uk and fellowship award in minimal access Surgery (FMAS). He has done Clinical observer ship in the Department of Pediatric Surgery, Johns Hopkins University, Baltimore, USA. (2008). He has presented and published a number of research articles at national and international level. He is reviewer of prestigious Journal of Pediatric Surgery (JPS) and World Journal of Gastroenterology, Journal of neonatal Surgery (JNS).

Research Area: Pediatric Surgery & Laparoscopy.

Table of Contents

Volume-7, Issue-12, December 2021

Antibiogram Profile of Bacteria Isolated from different Clinical Specimens in Chukwuemeka Odumegwu Ojukwu University Teaching Hospital, Awka

Okoye, Ebele L and Kemakolam, Christian C

Department of Applied Microbiology and Brewing, Nnamdi Azikiwe University, P.M.B 5025, Awka, Anambra State, Nigeria

Received:- 12 November 2021/ Revised:- 28 November 2021/ Accepted: 07 December 2021/ Published: 31-12-2021

Abstract— *The danger posed by pathogenic bacteria that are resistant to antibiotics has become a global issue and developing strategies for restoring treatment options against them is inevitable. This research aimed at determining the "Antibiogram profile of bacteria isolated from different clinical specimens in Chukwuemeka Odumegwu Ojukwu University Teaching Hospital Awka" was carried out in the microbiology laboratory of the Hospital between December 2018 and May 2019. A total of 707 clinical samples from 500 patients attending the Hospital were examined by streaking method of microbial culture and susceptibility tests by Agar diffusion method. A total of 491 clinical specimens had positive growth and 860 bacteria were isolated. 280 male patients and 220 female patients were tested with the P-value at .08. The frequency of the isolates from different samples showed that urine had the highest number of isolates 139 (16.16%), followed by wound with 123 (14.30%) and Nasal swab recorded the number of least isolates; 38 (4.41%). The susceptibility pattern of the isolates to various antibiotics used varied as Staphylococcus aureus exhibited highest sensitivity against Ofloxacin and least sensitivity range against Erythromycin. Pseudomonas aeruginosa was sensitive to most of the antibiotics used with greatest sensitivity against Azithromycin while Proteus Spp. had the least sensitivity to most of the antibiotics. However, all the isolates had the greatest resistance against Piperacillin-tozabactam and Clindamycin. The high level of resistance observed in Piperacillin-Tozabactam, Cefixime, Erythromycin, Gentamicin and Clindamycin can be attributed to the irrational use of antibiotics in the study area and a possible high level of drug abuse. There should be continuous monitoring and periodical research on antibiogram profile of these bacteria isolated from different clinical specimens before definitive treatment of bacterial infections to reduce the burden posed by multidrug resistant bacteria.*

Keywords— Antibiotic Susceptibility, Bacteria, Clinical specimens, Resistance, Awka.

I. INTRODUCTION

Antibiotics are substances produced by microorganisms that inhibit the growth or kill other microorganisms (1). Though they are critical in modern medicine, but their widespread use or misuse has led to the evolution of microbial strains resistant to most of the commonly used antibiotics (2). Brooks (3) noted that antibiotics revolutionized medicine in the 20th Century, however, their effectiveness and easy access have also led to their overuse, prompting bacteria to develop resistance thereby putting the global health at high risk with multidrug-resistant bacteria observed globally. Presently, antimicrobial resistance poses a major threat to patient's treatment as it leads to increased morbidity and mortality, increased hospital stay, and severe economic loss to the patient and nation (4); (5). Due to the pacing advent of different resistance mechanisms and decrease in efficacy of antibiotics used in treating common infectious diseases, patients now endure prolonged illness, higher expenditures for health care, and an immense risk of death. Infections caused by resistant bacteria adversely affect treatment outcomes, costs, disease spread and duration of illnesses, posing a serious challenge to the future chemotherapies (6); (7).

According to Hussain (8), multidrug resistance in bacteria may be caused by any of the two mechanisms. Firstly, these bacteria may accumulate multiple genes, each coding for resistance to a single drug, within a single cell. This accumulation occurs typically on resistance (R) plasmids. Secondly, multidrug resistance may also occur by the increased expression of genes that code for multidrug efflux pumps, extruding a wide range of drugs. Antibiotic resistant bacteria are able to transfer

copies of DNA that code for a mechanism of resistance to other bacteria even distantly related species, which then are also able to pass on the resistant genes and so generations of antibiotic resistant bacteria are produced. This process is called horizontal gene transfer (8). When strains have multiple antibiotic resistance, the choice of therapy is limited, thus the tremendous therapeutic advantages afforded by the introduction of new antimicrobial agents will always be threatened by the emergence of increasingly resistant bacteria pathogen (9); (10). To overcome these difficulties, monitoring of resistance profiles in the health institutions is needed (11); (12); (13).

David and Nanette (14) described plasmids as extra pieces of genetic material found in many cells (Bacteria) that usually confer a specific property to the cell. These properties include antibiotic resistance, toxin production, and many other features. The role of plasmids in the dissemination of antibiotic resistance is increasingly worrisome to human health; allowing pathogenic bacteria to obtain multiple resistance genes in a single transfer event (15). The present study was performed to determine the antibiogram profile of bacteria isolated from different clinical specimens in Chukwuemeka Odumegwu Ojukwu University Teaching Hospital Awka in order to inform the Clinicians on possible treatment options due to multidrug resistance experienced in the healthcare delivery.

II. MATERIALS AND METHODS

2.1 Study Area

Clinical specimens were collected from Chukwuemeka Odumegwu Ojukwu University Teaching Hospital (COOUTH) Awka (formerly called Amaku General Hospital) which is the only tertiary hospital in Awka the capital of Anambra State between December 2018 and May 2019. Their analyses were carried out in the Microbiology laboratory of same hospital during the study period.

2.2 Study Design

The study population includes 500 patients who attended Chukwuemeka Odumegwu Ojukwu University Teaching Hospital Awka between December 2018 and May 2019. However, only subjects sent to the bacteriology laboratory for microscopy culture and sensitivity formed the test population. A total of 707 different clinical specimens; Ear discharge, Sputum, Urethral swab, Wound swab, Urine from Catheter, Urine, Nasal swab, High vaginal swab, Stool, Eye swab and Blood were collected from patients. These samples were collected from Monday to Friday in the morning hours of 8.00 a.m-12:00 noon except on public holidays and weekends. However, ethical clearance for this study was obtained from the ethical committee of the Hospital management board.

2.3 Determination of Sample Size

The sample size was determined according to Araoye (16) using the formula;

$N= {}_{3}{}^{2}Pq/d^{2}$.

$N= 1.96^{2}$ X 0.5 X 1/0.0025 =500 (approximately)

Where N is the sample size @ 500

3 is the standard deviation @ 95% confidence interval (1.96),

P is the is the proportion to be used on estimation 0.5%, d is the degree of accuracy/precission expected (0.05),

q =1-p.

2.4 Specimen Collection

During the study period, about 707 clinical specimens were collected aseptically from 500 patients with the help of licensed Medical laboratory science personnel in the following wards: Male medical ward (MMW), Female medical ward (FMW), Male surgical ward (MSW), Female surgical ward (FSW), Antenatal ward (AW), Postnatal ward (PNW), children's ward (CW), Emergency ward (EW) and Outpatients Department (OPD) of Chukwuemeka Odumegwu Ojukwu Teaching Hospital, Awka and taken to Bacteriology laboratory within 1hr for bacteriological examination by standard bacteriological methods of culture, microscopy and sensitivity. For the identification of isolates, morphological characteristics, biochemical and sugar tests were used.

2.5 Standardization of Inoculum

McFarland 0.5 turbidity standard was prepared by mixing 99.5ml of 1% dilute Sulfuric acid solution and 0.5ml of 1% Barium chloride to give a standard turbidity (17).

2.6 Agar Disc Diffusion Method Antibiotic Susceptibility Test

The antibiotics susceptibility of identified isolates was tested using Single disc diffusion method according to the Kirby-Bauer. Mueller Hinton agar plates were prepared according to the manufacture's instruction, the standardized organisms were introduced on to the agar by streaking method and the antibiotic discs were placed firmly on the surface of the agar using sterile dispenser. The plates were allowed to stand for an hour to enable the antibiotics to diffuse into the agar. The plates were then incubated at 37^{o}C for 24 h, after which the plates were observed for development of inhibition zones (18). The diameters of zones of inhibition were measured and interpreted as susceptible, intermediate or resistant using the standardized method of National Committee for Clinical Laboratory Standards (19). A total of 12 antibiotic discs (Oxoid, England.) were used; Piperacillin-Tozabactam (P 110 µg), Erythromycin (ERY 15 µg), Ciprofloxacin (CIP 5µg), Cefixine (ZEM 5µg), Cefotaxime (GX 30µg), Ceftriaxone (CRO 45µg), Levofloxacin (LBC 5µg), Augumentin (AUG, 30µg), Azithromycin (AZN 15µg), Clindamycin (CD 2µg), Ofloxacin (OFX 5µg) and Gentamicin (CN10µg).

2.7 Statistical Analysis

All statistical analyses were carried out using the SPSS 21.0 window based program for the Analysis of Variance (ANOVA). A value of $P < .05$ was considered significant.

III. RESULTS AND DISCUSSION

TABLE 1
SOCIO-DEMOGRAPHIC CHARACTERISTICS OF STUDY PARTICIPANTS

Characteristics	Total No of Patients tested N0 (%)	Total no of specimen N0 (%)	Culture +ve specimen N0 (%)	Culture -ve specimen N0 (%)	P-value
Gender					
Male	280 (56.00)	403 (57.00)	278 (39.32)	125 (17.68)	.08
Female	220 (44.00)	304 (43.00)	213 (30.13)	91 (12.87)	
Total	**500 (100)**	**707 (100)**	**491 (69.45)**	**216 (30.55)**	
Age in Years					
0-15	45 (9.00)	100 (14.14)	53 (7.50)	47 (6.65)	.21
16-30	131 (26.20)	163 (23.05)	137 (19.38)	26 (3.68)	
31-45	155 (31.00)	182 (25.74)	149 (21.07)	33 (4.67)	
46-60	100 (20.00)	141 (19.94)	91 (12.87)	50 (7.07)	
>60	69 (13.80)	121 (17.11)	61 (8.63)	60 (8.49)	
Total	**500 (100)**	**707 (100)**	**491 (69.45)**	**216 (30.55)**	
Occupation					
Schooling	76 (15.20)	83 (11.74)	77 (10.89)	6 (0.85)	.06
Farming	140 (28.00)	181 (25.60)	130 (18.39)	51 (7.21)	
Civil Servants	105 (21.00)	166 (23.48)	98 (13.58)	68 (9.62)	
Trading	120 (24.00)	179 (25.31)	118 (16.69)	61 (8.63)	
Artisan	35 (7.00)	60 (8.49)	37 (5.23)	23 (3.25)	
Others	24 (4.80)	38 (5.38)	31 (4.38)	7 (1.00)	
Total	**500 (100)**	**707 (100)**	**491 (69.45)**	**216 (30.55)**	
Educational Status					
Tertiary	144 (28.80)	236 (33.38)	142 (20.08)	94 (13.30)	.15
Secondary	180 (36.00)	276 (39.03)	173 (24.47)	103 (14.57)	
Primary	106 (21.20)	116 (16.40)	100 (14.14)	16 (2.26)	
Uneducated	70 (14.00)	79 (11.17)	76 (10.54)	3 (0.42)	
Total	**500 (100)**	**707 (100)**	**491 (69.45)**	**216 (30.55)**	

KEY: +ve= positive, -ve=negative

TABLE 2
FREQUENCY OF BACTERIA ISOLATES

Bacteria Isolates	Total No (%)
Staphylococcus aureus	134 (15.58)
Coagulase Negative Staphylococcus	71 (8.26)
Streptococcus pyogenes **GRAM POSITIVE TOTAL**	53 (6.16) **258 (30.00)**
Pseudomonas aeruginosa	197 (22.91)
Escherichia coli *Klebsiella Pneumoniae*	179 (20.81) 106 (12.32)
Salmonella typhi	79 (9.19)
Proteus Spp. **GRAM NEGATIVE TOTAL**	41 (4.77) **602 (70.00)**
GRAND TOTAL	**860 (100)**

Key: spp= species

TABLE 3
FREQUENCY OF BACTERIA ISOLATES FROM CLINICAL SPECIMENS

Specimen type	Total no of specimen N0 (%)	Total no of Culture +ve Specimen N0 (%)	Total no of bacteria isolated (%)	P.value
Ear discharge	42 (5.94)	33 (4.66)	70 (8.14)	
Sputum	37 (5.23)	30 (4.24)	69 (8.02)	
U/S	30 (4.24)	23 (3.25)	43 (5.00)	
Wound	123 (17.40)	76 (10.74)	123 (14.30)	
Urine from Catheter	47 (6.64)	44 (6.22)	75 (8.72)	
Urine	151 (21.31)	81 (11.45)	139 (16.16)	.32
Nasal swab	21 (2.97)	11 (1.55)	38 (4.41)	Not significant
HVS	90 (12.72)	65 (9.11)	89 (10.35)	
Stool	59 (8.34)	55 (7.77)	86 (10.00)	
Eye Swab	29 (4.10)	12 (1.69)	42 (4.88)	
Blood	81 (11.45)	61 (8.62)	86 (10.00)	
TOTAL	**707 (100)**	**491 (69.44)**	**860 (100)**	

KEY: Hvs= High vaginal swab, u/s= Urethral swab, +ve= positive, -ve= negative

TABLE 4
DISTRIBUTION OF BACTERIA IN DIFFERENT CLINICAL SPECIMENS

Specimen type	*S.aureus* 134	*CoNS* 71	*E.coli* 179	*P.aeruginosa* 197	*S.pyogenes* 53	K.*pneumoniae* 106	*S.typhi* 79	*Proteus spp* 41	Total 860 (%)
Urine	28 (3.26)	19 (2.21)	22 (2.56)	27 (3.14)	15 (1.74)	22 (2.56)	0 (0)	6 (0.70)	139 (16.16)
Nasal Swab	10 (1.60)	10 (1.60)	12 (1.40)	2 (0.23)	1 (0.12)	3 (0.35)	0 (0)	0 (0)	38 (4.44)
U/S	4 (0.47)	1 (0.12)	16 (1.86)	5 (0.58)	2 (0.23)	11 (1.28)	0 (0)	4 (0.47)	43 (5.00)
HVS	19 (2.21)	7 (0.81)	17 (1.98)	17 (1.98)	6 (0.70)	17 (1.98)	0 (0)	6 (0.70)	89 (10.35)
Catheter (urine)	9 (1.04)	8 (0.93)	6 (0.70)	42 (4.88)	3 (0.35)	6 (0.70)	0 (0)	1 (0.12)	75 (8.72)
Blood	20 (2.33)	2 (0.23)	7 (0.81)	7 (0.81)	10 (1.60)	15 (1.74)	20 (2.33)	5 (0.58)	86 (10.00)
Eye Swab	12 (1.40)	6 (0.70)	7 (0.81)	7 (0.81)	5 (0.58)	5 (0.58)	0 (0)	0 (0)	42 (4.88)
Stool	0 (0)	0 (0)	27 (3.14)	0 (0)	0 (0)	0 (0)	59 (6.86)	0 (0)	86 (10.00)
Sputum	14 (1.63)	3 (0.35)	19 (2.21)	10 (1.60)	3 (0.35)	10 (1.60)	0 (0)	10 (1.60)	69 (8.02)
Ear swab	6 (0.70)	3 (0.35)	5 (0.58)	29 (3.37)	4 (0.47)	15 (1.74)	0 (0)	8 (0.93)	70 (8.14)
Wound	12 (1.40)	12 (1.40)	14 (1.63)	51 (5.93)	4 (0.47)	2 (0.23)	0 (0)	1 (0.12)	123 (14.30
Total	134 (15.58)	71 (8.26)	179 (20.12)	197 (22.91)	53 (6.16)	106 (12.33)	79 (9.18)	41 (4.77)	860 (100)

TABLE 5
PREVALENCE OF ISOLATED BACTERIA ACCORDING TO PATIENTS IN DIFFERENT HOSPITAL WARDS

Bacterial Isolated	Total No (%)	MMW No (%)	FMW No (%)	AW No (%)	FSW No (%)	MSW No (%)	OPD No (%)	CW No (%)	EW No (%)	PNW No (%)
S. aureus	134 (15.58)	31 (3.60)	28 (3.26)	7 (0.81)	4 (0.47)	11 (1.28)	16 (1.86)	19 (2.21)	13 (1.51)	5 (0.58)
CoNS	71 (8.26)	14 (1.62)	12 (1.40)	14 (1.62)	12 (1.40)	4 (0.47)	4 (0.47)	1 (0.12)	8 (0.93)	2 (0.23)
E. coli	179 (20.81)	29 (3.37)	28 (3.26)	11 (1.28)	19 (2.21)	18 (2.09)	19 (2.21)	27 (3.14)	20 (2.33)	8 (0.93)
P. aeruginosa	197 (20.91)	37 (4.30)	37 (4.30)	7 (0.81)	8 (0.93)	27 (3.14)	32 (3.72)	9 (1.05)	20 (2.33)	20 (2.33)
S. Pyogenes	53 (6.16)	15 (1.74)	11 (1.28)	1 (0.12)	0 (0.00)	10 (1.16)	10 (1.16)	1 (0.12)	3 (0.35)	2 (0.23)
S. typhi	79 (9.19)	17 (1.98)	15 (1.74)	1 (0.12)	0 (0.00)	14 (1.63)	14 (1.63)	2 (0.23)	9 (1.05)	7 (0.81)
Proteus spp	41 (4.76)	7 (0.81)	8 (0.93)	2 (0.23)	2 (0.23)	4 (0.47)	7 (0.81)	0 (0.00)	4 (0.47)	7 (0.81)
K. pneumonia	106 (12.33)	30 (3.49)	23 (2.67)	0 (0.00)	0 (0.00)	17 (1.98)	22 (2.56)	1 (0.12)	11 (1.28)	2 (0.23)
Total	860 (100)	180 (20.99)	162 (18.84)	43 (5.00)	45 (5.23)	105 (12.21)	124 (14.42)	60 (6.98)	88 (10.22)	53 (6.16)

KEY: Male medical ward (MMW), Female medical ward (FMW), Male surgical ward (MSW), Female surgical ward (FSW), Antenatal ward (AW), Postnatal ward (PNW), children's ward (CW), Emergency ward (EW), Outpatient department (OPD), cons= coagulase negative staphylococci, spp= species, no=number, %=percentage.

TABLE 6
ANTIBIOTICS ZONES OF INHIBITION

ANTIBIOTICS	ERY	AZN	CRO	GX	CN	P	CIP	OFX	LBC	CD	AUG	ZEM
(POTENCY)	(15 µg)	(15 µg)	(30 µg)	(30 µg)	(10µg)	(110 µg)	(5µg)	(5 µg)	(5µg)	(2µg)	(30µg)	(5µg)
Standard	S ≤ 13	S ≤ 13	ENT.	ENT.	S ≤ 12	ENT.	S ≤ 15	ENT.	ENT.	ENT.	S ≤ 19	S ≤ 15
	R ≥ 23	R ≥ 18	S ≤ 13	S ≤ 22	R = ≥ 15	S ≤ 17	R ≥ 21	S ≤ 12	S ≤ 13	S ≤ 14	R ≥ 20	R ≥ 19
	I = 14-22	I = 14-17	R ≥ 23	R ≥ 26	I = 13-14	R ≥ 21		R ≥ 16	R ≥ 17	R ≥ 21		I = 16-18
			I = 20-22	I = 23—25		I = 18-20		I = 13-15	I = 14-16	I = 15-20		
			PA/Staph.	PA /Staph.		PA		Staph.	Staph.			
			S ≤ 13	S ≤ 14		S ≤ 14		S ≤ 14	S ≤ 15			
			R ≥ 21	R ≥ 23		R ≥ 21		R ≥ 18	R ≥ 19			
			I = 14-20	I = 15-22		I = 15-20		I = 15-17	I = 16-18			
						Staph						
						S ≤ 17						
						R ≥ 18						
Result	S=505	5=768	S=820	S=680	S=572	S=466	S=796	S=787	S=687	S=442	S=684	S=516
(860 isolates)	R=355	R=92	R=40	R=180	R=288	R=414	R=64	R=64	R=73	R=418	R=176	R=314

Key: S = sensitive, R = Resistant, I = Intermediate, ENT = Enterobacteriaceae, PA = P. aerugnosa, Staph = Staphylococus, Piperacillin-Tazobactam=P, Cefixime = ZEM, Erythromycin = ERY, Augumentin = AUG, Cefotaxine = GX Levofloxacin = LBC, Azithromycin = AZN, Gentamicin=CN, Ceftriaxone = CRO, Ciprofloxacin = CIP, Clindamycn = CD,
Ofloxacin = OFX, Standard zones of inhibition (CLSI, 2014)

TABLE 7
SUSCEPTIBILITY PATTERN OF ISOLATED BACTERIA

Number of Bacteria Isolates sensitive to Antibiotics													
ISOLATE	**TOTAL (%)**	**ERY**	**AZN**	CRO	**GX**	**CN**	**P**	**CIP**	**OFX**	**LBC**	**CD**	**AUG**	**ZEM**
S. aureus	134 (15.58)	22 (2.56)	128 (14.77)	12 7 (14.77)	100 (11.62)	31 (3.60)	32 (3.72)	124 (14.42)	130 (15.12)	120 (13.95)	54 (6.28)	122 (14.19)	64 (7.44)
CoNS	71 (8.26)	69 (8.02)	70 (8.14)	70 (8.14)	66 (7.67)	61 (7.09)	54 (6.28)	69 (8.02)	68 (7.91)	70 (8.14)	67 (7.79)	70 (8.14)	60 (6.98)
S. Pyogenes	53 (6.16)	41 (4.77)	50 (5.70)	49 (5.70)	44 (5.12)	46 (5.35)	40 (4.65)	48 (5.58)	46 (5.35)	42 (4.88)	33 (3.84)	42 (4.88)	40 (4.65)
TOTAL G +VE	258 (30)	132 (15.34)	248 (28.83)	246 (28.60)	210 (24.42)	138 (16.05)	126 (14.65)	241 (28.2)	244 (28.37)	232 (26.98)	154 (17.91)	234 (27.21)	164 (19.07)
GRAM –VE *E. coli*	179 (20.12)	141 (16.40)	161 (18.72)	170 (19.77)	121 (14.07)	108 (12.56)	67 (7.79)	162 (18.84)	166 (19.23)	88 (10.23)	72 (8.37)	121 (14.07)	111 (12.91)
P. aeruginosa	197 (22.91)	135 (15.70)	184 (21.40)	188 (21.86)	157 (18.26)	132 (15.35)	86 (10)	185 (21.74)	187 (21.74)	166 (19.30)	113 (13.14)	124 (14.42)	108 (12.56)
K. pneumoniae	106 (12.33)	35 (4.70)	96 (11.16)	100 (0.00)	82 (9.53)	94 (10.93)	92 (10.70)	97 (11.28)	91 (10.53)	92 (10.70)	31 (3.60)	88 (10.23)	66 (7.67)
S. typhi	79 (9.18)	21 (2.44)	39 (4.53)	77 (8.95)	71 (8.26)	61 (7.09)	34 (3.95)	70 (8.14)	58 (6.74)	68 (7.91)	32 (3.72)	76 (8.84)	27 (3.14)
Proteus spp	41 (4.77)	41 (4.77)	40 (4.65)	39 (4.77)	39 (4.53)	39 (4.77)	41 (4.77)	41 (4.77)	41 (4.77)	41 (4.77)	40 (4.65)	41 (4.77)	40 (4.65)
Total GRAND TOTAL RESISTANCE (%)	602 (70) 860 (100)	373 (43.37) 505 (58.72) 355 (41.28)	520 (60.47) 768 (89.30) 92 (10.70)	574 (66.65) 820 (95.35) 40 (4.65)	470 (54.47) 680 (79.06) 180 (20.93)	434 (50.47) 572 (66.51) 288 (33.49)	320 (37.21) 446 (51.86) 414 (48.14)	555 (64.14) 796 (92.55) 64 (7.44)	543 (63.14) 787 (91.51) 73 (8.49)	455 (52.91) 687 (79.88) 173 (20.12)	288 (33.49) 442 (51.39) 418 (48.60)	450 (51.36) 684 (79.53) 176 (20.47)	352 (40.93) 516 (60.00) 344 (40.00)

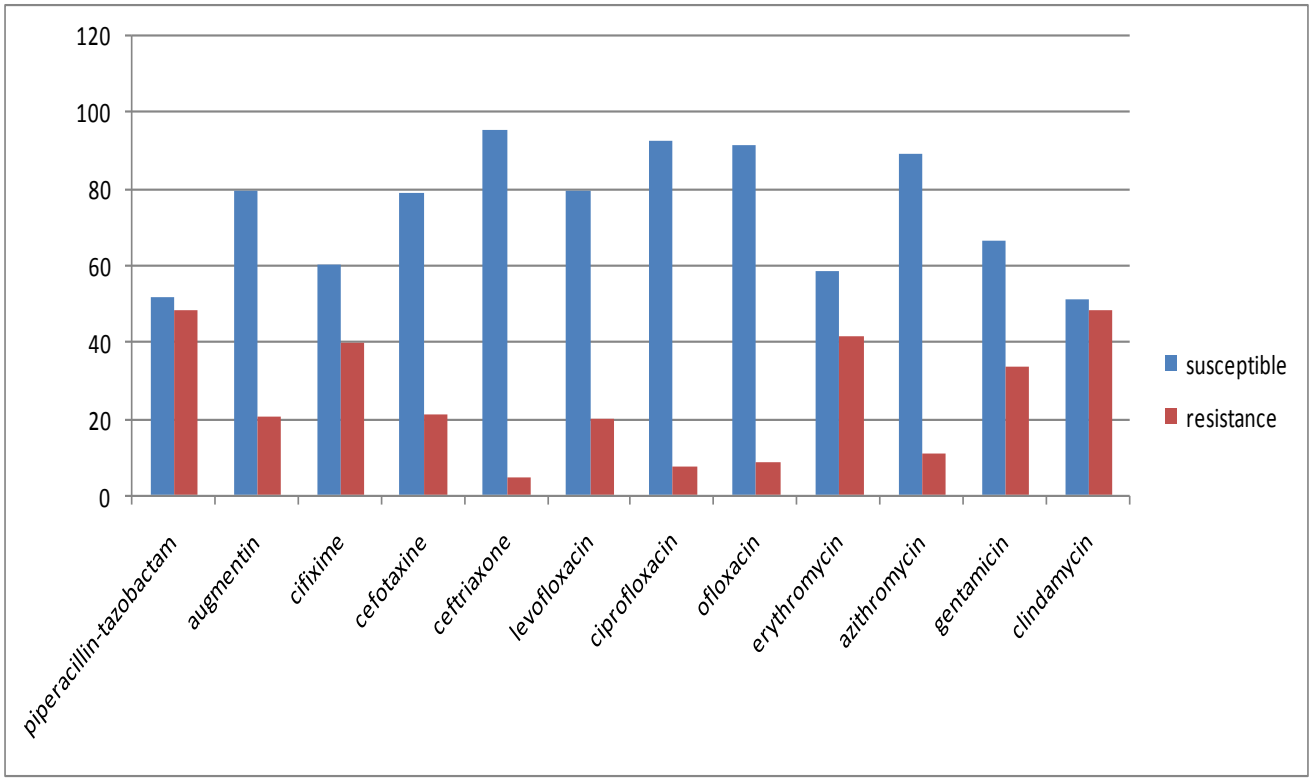

FIGURE 1: Bar chart showing percentage of the antibiotics sensitivity and resistance

TABLE 8
SUSCEPTIBILITY FREQUENCY OF THE ISOLATES TO THE ANTIBIOTICS

Isolates	Number of Isolates	Total Number of Antibiotics	Total Number of Sensitivity	Total Number of Resistance
S. aureus	134	1608 (15.58%)	1054 (10.21%)	554 (5.36%)
CoNS	71	852 (8.25%)	794 (7.69%)	58 (0.56%)
S. pyogenes	53	636 (6.16%)	521 (5.04%)	115 (1.11%)
E. coli	179	2148 (20.81%)	1488 (14.41%)	660 (6.39%)
P.	197	2364 (22.90%)	1765 (17.10%)	599 (5.80%)
K. pneumoniae	106	1272 (12.32%)	964 (9.34%)	308 (2.98%)
S. typhi	79	948 (9.18%)	634 (6.14%)	314 (3.04%)
Proteus spp	41	492 (4.76%)	444 (4.30%)	48 (0.47%)
TOTAL	806	10,320 (100%)	7664 (74.26%)	2656 (25.74%)

Key: CoNS= coagulase negative Staphyloccoccus, spp= species

Multidrug resistance by infectious agents poses a great danger and setback in a search for a suitable chemotherapy, therefore understanding the resistance pattern has become imperative in winning this war against antibiotics resistance by bacteria.

Table 1 shows that male participants were higher in number than female participants with 280 (56.00%) and 220 (44.00%) respectively. Majority of the samples were collected from the male 403 (57.00%) while the female had 304 (43.00%) samples, the male had more positive growth than the female of 278 (39.32%) and 213 (30.13%) respectively though not statistically significant with P-value at .08. The age bracket of 31-45 years had the greatest isolates of 155 (31.00%) with the P-value at .21. The groups that contributed the greatest number of samples are farmers, civil servants and traders, age group of 31-45years and participants with educational levels of secondary and tertiary. This could be attributed to the reason of being the workforce, full of energy and have families that depend on them. They are exposed to all manner of hazards on the course of their jobs, livelihood and endeavours. This is contrary to the findings of Amsalu (19) who reported that majority of their samples 288 (56.5%) were collected from females, their highest isolation rates were obtained from 10-19 years and the isolated bacteria was relatively higher in females 81 (28.1%) than males 62 (27.9%) with P value = .96.

A total of 258 (30%) Gram positive bacteria were isolated; *S. aureus*, CoNS and *Streptococcus pyogenes* while the Gram negative has a total of 602 (70%); *Escherichia coli, Pseudomonas aeriginosa, Klebsiella pneumoniae, Salmonella typhi* and *Proteus* spp as shown in Table 2. Amsalu (19) reported similar result/percentage that Gram negative bacteria accounted for 67.8% and the rest 32.2% were Gram positive bacteria. The most common bacteria isolated were *Escherichia coli* 35 (24.5%), *Staphylococcus. aureus* 31 (21.7%) and *Klebsiella species* 21 (14.7%). A study in South Western Nigeria by Taiwo (20) agrees with the result as it revealed that Gram positive bacteria constituted 47.3% while Gram negative constituted 52.7%. The most common organisms were *Staphylococcus aureus* (37.3%), *Klebsiella* (30%), *Pseudomonas* (8.2%), *Proteus* (6.4%), *Escherichia coli* (5.5%) and coagulase negative staphylococci (4.6%).

This is also in agreement with Makanjuola (21) who reported that more than half of the infections occurring in their study were noted to be caused by Gram-negative bacteria. Although there is a wide variation in the distribution of these Gram-negative organisms, *Pseudomonas aeruginosa* appears to predominate globally which is consistent with these findings. However, Erbay (22) noted a preponderance of *Klebsiella* spp, especially *Klebsiella pneumoniae,* which accounted for close to half of the isolated organisms in their study is a common nosocomial pathogen whose rates of colonization is very high therefore likelihood of infection rises dramatically with hospitalization. Jroundi (23) revealed that the organisms most frequently isolated were *Staphylococcus spp, Escherichia coli* and *Kliebsiella* but *Staphylococcus* remains the frequent germ found in most studies.

In this study, *Staphylococcus aureus, Klebsiella pneumoniae, Escherichia coli*, CoNS, *Pseudomonas aeruginosa, Salmonella typhi* and *Proteus Spp* were isolated from different clinical specimens. However, the frequency of different bacteria isolates revealed that *Pseudomonas aeruginosa* had the greatest frequency of 22.91%, this is followed by *Escherichia coli* and *Staphylococcus aureus* with 20.81% and 15.58% respectively as shown in Table 2. This is in agreement with the study by Akindele and Afolayan, (24) and Church (25) who isolated *Staphylococcus aureus, Klebsiella pneumoniae, Escherichia coli, Pseudomonas aeruginosa*, and *Proteus Spp.* On the contrary, Demilie (26) reported that the most prevailing bacteria isolated from the various specimens in all the laboratories in their study were *E. coli* and *Staphylococcus aureus.* This could be attributed to the fact that most times *Staphylococcus aureus* and *Escherichia coli* can exist as normal flora of the skin but can become infectious when there is a break in the skin from a wound or surgery, or if there is a compromised or suppressed immune system.

The distribution of bacteria isolates according to different specimens indicated that Urine sample had the highest number of isolates with a total of 139 (16.16%) followed by wound with 123 (14.30) as shown in table 3. This is in agreement with Amsalu (19) who reported that the most frequently processed specimen in hospital laboratories was urine with 44.3%. This could be attributed to the fact that Urine is the most frequently demanded sample during the investigation of urinary tract infections therefore, there is high possibility of more isolates coming from urine when there is growth during culture.

The individual isolates from urine sample indicated that *Staphyloccocus aureus* has the highest number of isolates 28 (3.26%). This was closely followed by *P. aeruginosa* with 27 (3.14%) isolates. However, *Escherichia coli* and *Klebsiella pneumoniae* had the same number of isolates 22 (2.56%) as indicated in table 4. This is in agreement with the report by Ekwealor (27) that *Staphyloccocus aureus* was found to be the predominant and most frequently isolated urinary pathogen, followed by *Escherichia coli* in Awka. They further explained that studies had previously linked the increasing cause of urinary tract infections (UTIs) by *Staphylococcus* to increased use of instrumentation such as bladder catheterization. However, the observed high proportion of *Staphylococcus* varied with some previously published studies where *E. coli* was found to be the predominant urinary tract pathogen (27).

This is contrary with findings of Amsalu (19) who reported that predominant isolate from urine was *Escherichia coli* (42.9%) followed by *Klebsiella pneumoniae* (12.7%) and *Staphylococcus aureus* (12.7%). However, this difference might be explained by difference in geographic area and time of study; while Amsalu (19) conducted theirs between January 2012 and December 2014 in Southern Ethiopia, our research was conducted between December 2018 and May 2019 in Awka, Nigeria.

Other urinary tract samples had the following figures as shown in table 5; High vaginal swab had *Staphylococcus aureus* 19 (2.21%) while *Pseudomonas aeruginosa* and *Escherichia coli* had 17 (1.98%) isolates each. For Urethral swab, *Escherichia coli* had 16 (1.86%) while *Klebsiella. pneumoniae* had 11 (1.28%) and *Staphylococcus aureus* 4 (0.47%). Urine from catheter; *Pseudomonas aeruginosa* had 42 (4.88%), *Staphylococcus aureus* 9 (1.04%) and *Escherichia coli* had 6 (0.70%) as shown in table 5. This is in line with the findings of Kolawole (28) who reported that the most common pathogenic

organisms of urinary tract infection (UTI) are *Escherichia coli, Staphylococcus aureus, Proteus spp., Klebsiella pneumonia* and *Pseudomonas aeruginosa.*

The pattern of organisms isolated from urinary tract samples had *Pseudomonas aeruginosa* as the highest isolate. This is followed by *Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae, Coagulase Negative Staphyloccocus (CoNS)* and *Proteus Spp.* as the least isolates. This is similar to the findings of Muhammed (29) who reported that *Escherichia coli* and *Staphylococcus aureus* were the main isolates from all the laboratories in their research. Amin (30) also reported that the most predominantly isolated bacteria were *Staphylococcus aureus* and *Escherichia coli* however *Escherichia coli* has been the most frequently reported isolate causing urinary tract infections in similar studies. This is also in line with the confirmation by Demilie (26) who reported that *Escherichia coli* is the primary etiologic agent causing urinary tract infection, accounting for 90% of the cases in their study. Rachid (31) identified that the predominant organisms were *Staphylococcus* (18.7%) followed by *Escherichia coli* (14.7%) and *Klebsiella pneumoiae* (14.7%). The site of infection most frequently affected by *Staphylococcus* was urinary tract (42.9%). However, the urinary tract samples (Urine 16.16, HVS 10.35%, U/S 5.00% and urine from catheter 8.72%) when combined had the highest frequency of 30.23% isolates. This is closely related to the work of Unegbu (32) who reported that urinary tract infection has the highest prevalence of 36.33%. The reason for the high frequency of urinary tract infection could be attributed to poor hygiene in the hospital environment especially for the admitted patients who had no choice but to share the rest rooms with other patients who might take issues of hygiene for granted.

Wound sample had a total of 123 (14.30%) isolates with *Pseudomonas aeruginosa* at 51 (5.93%) as the highest isolate as indicated in table 5. This is followed by *Escherichia coli* with 14 (4.7%), *Staphylococcus. aureus* had 12 (1.40%) and CoNS 12 (1.40%). This is in line with the findings of Motayo (33) who reported that high prevalence of *Pseudomonas aeruginosa* and *Staphyloccocus aureus* infections maybe because of an endogenous source of the infection. Infection with these organisms may also be due to contaminations from the environment. With the disruption of the natural skin barrier, *Staphyloccocus aureus* may easily find their way into wounds. Basu (34), suggested that the relatively high number of *Pseudomonas aeruginosa* isolates is suggestive of the high level of nosocomial infections particularly in hospitalized patients, again, bringing up the need for strict infection control practices and good hygiene such as frequent hand washing and sterilization of wounds cleaning instruments by wound care givers. The study by Ehiaghe (35) revealed that wound swab had the highest number of clinical isolates of *Pseudomonas aeruginosa,* this may be due to surgical wounds are exposed to many ubiquitous environmental pathogens which include unsterile surfaces, water and soil.

On the contrary, Shittu (36) reported that their microbiological analysis of wound samples revealed that *S. aureus* was the leading etiologic agent of wound infection in many health institutions in their study area.

A total of 86 (10.00%) bacteria were isolated from blood samples. These include *Staphyloccocus aureus, Escherichia coli, Pseudomonas aeruginosa, Salmonella typhi,* CoNS, *Streptoccocus pyogenes* and *Klebsiella pneunomiae*. In the study, we found out that *staphyloccocus aureus* and *Salmonella typhi* had the highest number of isolates 20 (2.33%), *Klebsiella pneumoniae* had 15 (1.74%) and *Streptoccocus. pyogenes* had 10 (1.60%). This is closely related to the report by Mehta (37) that *Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, Salmonella typhi,* CoNS and *Klebsiella pneunomiae* as the commonest pathogens implicated in septicemia. On the contrary, Alam (38) reported that Gram-positive pathogens; Coagulase-negative staphylococci, *Staphylococcus aureus* and Gram negative *Salmonella typhi* were the major causative organisms of septicemia.

A study by Falagas (39) agrees with this as they reported coagulase-negative staphylococci the commonest cause of septicemia. However, Onile (40) reported *Salmonella typhi* as the predominant pathogen. This difference could be attributed to the changing etiology of blood stream infection with the selection of drug resistant bacteria isolates that were better adapted for survival according to Taiwo (20).

We found out that Stool samples had 86 (10.00%) isolates as indicated on table 5, however, only two organisms were isolated *Salmonella typhi* 59 (6.86%) and *E. coli* 27 (3.14%). Amsalu (19) slightly agree with this as they isolated only *Salmonella typhi* 41.70% and *Shigella spp* 58.39%. On Nasal swab, we had 38 (4.44%) isolates which included the following organisms were; *E. coli* 12 (1.40%), *Klebsiella pneumoniae* 3 (0.35%), *S. aureus* 10 (1.60%), *P. aeruginosa* 2 (0.23%). This is in agreement with Amsalu (19) isolated*; E. coli 16.7%, Klebsiella pneumonia* 58.3%, *P. aeruginosa* 8.3% and *Proteus Spp* 8.3%.

Our findings on isolates in relation to different hospital wards as indicated in Table 5 revealed that the male medical ward (MMW) had the highest number of isolates 180 (20.99%) followed by female medical ward (FMW) with a total of 162 (18.84%) isolates and Outpatients Department (OPD) with 124 (14.42%) isolates. The Antenatal ward (AW) with 43 (5.00%) has the least number of isolates. In general, the medical wards (MMW and FMW) had the highest number of isolates 342 (39.77%), this is followed by the surgical wards (FSW and MSW) which has a total of 150 (17.44%) isolates. This is in line with Rachid (31) who reported that medical and surgical wards had the highest number of infections 392 (32.8%) and 379 (31.7%) respectively. However, Lizioli (41) reported the Surgical site infections appear higher compared to what is reported in several regions of the world.

The susceptibility test conducted on all the 860 isolates as compared to the standard, their antibiotics zones of inhibition as shown in Table 6 indicate Erythromycin exhibited susceptibility against 505 isolates and resistance against 355 against isolates. Ofloxacin had susceptibility against 787 isolates and resistance against 64 isolates. Augumentin was susceptible against 684 isolates while resistant against 178 isolates.

The following were the percentage of resistance exhibited by Piperacillin-Tozabactam (P) (48.14%), Clindamycin (CD) (48.60%), Erythromycin (ERY) (41.28%), Cefixime (ZEM) (40.00%) and Gentamicin (CN) (33.49%) as shown in figure 7.

Since a greater percentage of the isolates in this study were sensitive to Ceftriaxone, ciprofloxacin and Azithromycin as shown in Figure 1, they would be a good choice for empiric therapy of most bacterial infections within the study area while waiting for the result of culture and sensitivity tests. It is worthy of note that, majority of the isolates were resistant to Clindamycin, Erythromycin and Piperacillin-tozabactam. This high level of resistance observed against the drugs may be attributed to the irrational use of drug in this locality. The increasing level of abuse of drugs by the public, where patients indulge in antibiotic self-medication to treat all kinds of infections, has been recorded as one significant way of promoting antibiotic resistance according to Ugwu (42).

Madigan (43) reported that Clindamycin was most commonly used within the clinic due to its higher bioavailability, higher oral absorption and efficacy within the target organism spectrum. It is also the first-choice use antibiotic in veterinary microbiology, this indiscriminate use of Clindamycin both for human and veterinary purposes may as well be the reason for high resistant development. Schlünzen (44) suggested that the high resistance could be attributed to the inability of some of the antibiotics to pass through the porins of Gram-negative isolate therefore may not get to their target site. Inappropriate use of antibiotics, use of substandard brands of antibiotics may also be a factor in antibiotic resistance.

Pseudomonas aeruginosa is the most sensitive isolate in this study, having good sensitivity to most of the antibiotics tested as indicated in table 8. It was also found that some of the organisms were susceptible at varying degrees to the antibiotics used. Ceftriaxone (CRO) which is a cephalosporin has the highest sensitivity of 95.35%. This is followed by a fluoroquinolone ciprofloxacin (CIP) with sensitivity of 92.55%, a macrolide; Azithromycin (AZN) has sensitivity of 89.30%. This slightly agrees with the report of Orhue (45) which observed the Ciprofloxacin has the greatest sensitivity of 80%. The predominant isolates in this study showed different degrees of resistance to most drugs used including *Pseudomonas aeruginosa* (5.80%), *Escherichia coli* (6.39%), *Staphylococcus aureus* (5.36%) and *Klebsiella pneumoniae* (2.98%) as shown in table 8.

Augmentin also exhibited resistance to an extent and it is worthy of note that Augmentin (AUG) (amoxicillin-clavulanic acid) (20.47%) and piperacillin-tozabactam (P) (48.14%) belong to penicillin family. According to Hitchings (46), some penicillins are naturally resistant to certain beta-lactamases and are called penicillinase-resistant penicillins. Others, such as amoxicillin, ampicillin, and piperacillin can have their activity extended by combining them with a beta-lactamase inhibitor like clavulanate, sulbactam, and tozabactam. However, Brooks (1) pointed out that resistance exhibited by penicillins may be because of the absence of some penicillin binding proteins which occurs as a result of chromosomal mutation or failure of the B-lactam drug to activate autolytic enzymes in the cell wall which inhibits the organisms such as in *staphylococci* and *streptococci*.

Ekwealor (27) explained that Clavulanic Acid present in the Amoxicillin-Clavulanic Acid complex is meant to afford protection to the -lactam chemical ring nucleus present in the Amoxicillin, and this protection should be expected to enhance the activity of Amoxicillin. Hence, the Amoxicillin-Clavulanic Acid complex should demonstrate clearly significant susceptibility rates over the isolates. Ugwu (42) further explained that observed resistance against Amoxicillin-Clavulanic and piperacillin-tozabactam could be related to permeability and absorption factors influencing antibiotic transfer across the

microbial cells. Thus, the Amoxicillin-Clavulanic Acid complex (Augmentin) being a large molecule possibly would experience great difficulty in permeability and overall transport across the microbial cell wall. As a result, high resistance may be due to the relatively limited quantity available to exert an antimicrobial effect.

IV. CONCLUSION

This work on antibiogram profile of bacteria from different clinical specimens revealed that an increase in antibiotics resistance has made it necessary for the updating of information on antibiotics susceptibility pattern of bacterial isolates in order to determine appropriate empirical and definitive therapy. *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Escherichia coli* and *Klebsiella pneumoniae* were the predominant bacteria isolates from different clinical specimens in this study.

The relatively high number of *P. aeruginosa, S. aureus* and *E. coli* isolates is suggestive of the high level of nosocomial infections particularly in hospitalized patients making the spread of infectious agents very easy among them. This again brings up the need for strict infection control practices and good hygiene.

The high level of resistance observed with piperacillin-Tozabactam, Cefixime, Erythromycin, Gentamicin and clindamycin can be attributed to the irrational use of drug in the study area. This is also a pointer to a situation where patients indulge in antibiotic self-medication to treat all kinds of infections. Reducing the length of stay in the hospital and duration of invasive devices like catheter can equally reduce the rate of the infection since most of them can be nosocomial.

There should be continuous monitoring, periodical research on antibiotics susceptibility pattern of these bacteria implicated and isolated from different clinical samples and conducting of microscopy, culture and sensitivity (MCS) before definitive treatment of bacteria related infections.

COMPETING INTERESTS

The authors have declared that no competing interests exists regarding the publication of this paper.

ACKNOWLEDGMENTS

The authors are grateful to the administrative staff of Chukwuemeka Odumegwu Ojukwu Teaching hospital, Awka hospital for granting them permission to collect different clinical specimens from patients. They appreciate the guidance and assistance of doctors and laboratory scientists during this research.

AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among the authors. Author OEL designed the study and managed the analyses while Author KCC wrote the protocol, the first draft of the manuscript, managed the literature searches and also performed the statistical analysis. All authors read and approved the final manuscript.

REFERENCES

[1] Brooks, G. F., Carroll, K. C., Butel, J. S., Morse, S. A. and Mietzner, T.A. Jawetz, Melnick and Adelberg's medical microbiology. 26th edition. New York: McGraw Hill Companies: 2013. Pp 371-403

[2] Watson, J. D., Witkowski, J., Witte, W., Wright, G., Yeh, P. and Zgurskaya, H.I. Tackling antibiotic resistance. *National Review Microbiology*. 2011: 9 **(**15**):**894–896.

[3] Brooks, M. "Public Confused About Antibiotic Resistance, WHO Says". *Medscape Multispeciality*. Retrieved 21 November 2015.

[4] Morales, E., Cots, F. and Sala, M. Hospital costs of nosocomial multi-drug resistant Pseudomonas aeruginosa acquisition, *Health Services Research*, 2012: 12 (1):122.

[5] Rosenberger, L. H., Hranjec, T. and Politano, A. D. Effective cohorting and 'superisolation' in a single intensive care unit in response to an outbreak of diverse multi-drug-resistant organisms, *Surgical Infections*. 2011: 12 (5):345–350.

[6] Mulu W, Kibru G, Beyene G, and Damtie M. Postoperative nosocomial infections and antimicrobial resistance pattern of bacteria isolates among patients admitted at Felege Hiwot Referral Hospital, Bahir Dar, Ethiopia. *Ethiopian Journal of Health Science.* 2012: 11 (22):7–17.

[7] Javeed, I., Hafeez, R. and Anwar, A. S. Antibiotics susceptibility pattern of Patients admitted to a tertiary care hospital in Lahore. Journal of *Biomedical*. 2011: **27**:19–23.

[8] Hussain, T. Pakistan at the verge of potential epidemics by multi-drug resistant pathogenic Bacteria. *Advanced. Life Science.* 2015: **2** (2) Pp: 46-47.

[9] File, F.M. Overview of resistance in the 1990s. *Chest.* 1999: 115 (3):35-85

[10] Sexton, D..J. The impact of antimicrobial resistance on empiric selection and antimicrobial use in clinical practice. *Journal of Medicine.* 2000: 48 (4):215-220.

[11] Kibret, M. and Abera, B. Antimicrobial resistance trend of bacteria from clinical isolates: an 8-year retrospective study at Dessie Regional Laboratory, Northeast Ethiopia. *Ethiopian Pharmaceutical Journal*. 2010: 28:39–46.

[12] Abreu, A. C., McBain, A. J. and Simões, M. "Plants as sources of new antimicrobials and resistance-modifying agents". *Natural Product Reports.* 2012: 29 (9): 1007–21.

[13] Tenover, F. C. Mechanisms of antimicrobial resistance in bacteria. *American Journal of Med*icine. 2006: 119 (1):3–10.

[14] David, P. C. and Nanette, J. P. Molecular Biology: International union of Biochemistry and molecular Biology. (2nd Edition) Academic Press Cell. 2013: Pp 928

[15] Carattoli, A. Plasmids and the spread of resistance. *International Journal of Medical Microbiology*. 2013: 30 (8):298–304.

[16] Araoye, M. O. Research methodology with statistics for Health and social sciences. 1st Ed. NATHADER. Ilorin, Nigeria. 2004: Pp. 115-120.

[17] Cheesbrough, M. District Laboratory Practice in Tropical Countries Part II. NewYork . Cambridge University Press.2006: Pp 35-143

[18] National Committee for Clinical Laboratory Standards (NCCLS). Performance standards for antimicrobial disk susceptibility testing, 10 Information Supplement approved Standard. 2000: Pp.100-110

[19] (19) Amsalu Anteneh., Zeleke Geto., Demissie Assegu and Setegn Eshetie. Antimicrobial resistance pattern of bacterial isolates from different clinical specimens in Southern Ethiopia: A three year retrospective study. *African Journal of Bacteriology Research.* 2017: 9 (1): 1-8

[20] Taiwo, S. Samuel., Solomon, O. Fadiora. and Samuel, A. Fayemiwo. High antimicrobial resistance among bacterial isolates of blood stream infections (BSI) in a Nigerian University Teaching Hospital. *World journal of Microbiology and Biotechnology.* 2008: 24:231–236

[21] Makanjuola, O.B., Fayemiwo, S. A., Okesola1, A. O. Gbaja, A., Ogunleye, V, A., Kehinde, A. O, and Bakare R. A. Pattern of multidrug resistant bacteria associated with intensive care unit infections in Ibadan, Nigeria. *Annals of Ibadan Postgraduate Medicine.* 2018: 16 (2) 162-169.

[22] Erbay, H., Yalcin, A. and Serin, S. Nosocomial infections in intensive care unit in a Turkish university hospital: a 2-year survey. *Intensive Care Medical*. 2003: 29 (9):1482-1488.

[23] Jroundi, I., Khoudri, I., Azzouzi, A. A., Benbrahim, N.F., Hassouni, F., Oualine, M and Abouqal, R. Prevalence of hospital acquired infection in a Morrocan University Hospital. *American journal of infection control.* 2007: 35:412-416.

[24] Akindele, P. O. and Afolayan, C. O. (2017).Plasmid Profile of Multidrug Resistant Bacteria Isolated from Wound Swabs from Hospital Patients in Akure, Nigeria. *Asian Journal of Medicine and Health.* **2** (3): 1-13.

[25] Church, D., Elsayed, S., Reid, O., Winston, B. and Lindsay, R. Burn wound infections. *Clinical Microbiology Reviews*. 2006: 19 (2):403-434.

[26] Demilie, T., Beyene, G., Melaku, S. and Tsegaye, W. Urinary bacterial profle and antibiotic susceptibility pattern among pregnant women in North West Ethiopia. *Ethiopian Journal of Health Sciences*. 2012: 22 (2):121.

[27] Ekwealor, A. Perpetua, Malachy C. Ugwu, Ifeanyi Ezeobi, George Amalukwe, Belinda C. Ugwu, Ugochukwu Okezie, Catherine Stanley and Charles Esimone. Antimicrobial Evaluation of Bacterial Isolates from Urine Specimen of Patients with Complaints of Urinary Tract Infections in Awka, Nigeria. *International Journal of Microbiology*. 2016: (9740273) 6

[28] Kolawole, A. S., Kolawole, O. M., Kandaki-Olukemi, Y. T., Babatunde, S. K., Durowade, K. A. and Kolawole, C. F. "Prevalence of urinary tract infections (UTI) among patients attending Dalhatu Araf Specialist Hospital, Lafia, Nasarawa State, Nigeria," *International Journal of Medical Sciences*. 2009: 1 (5) 163–167.

[29] Mohammed, Jibril, Hounmanou, Yaovi Mahuton Gildas. and Thomsen, Line Elnif. Antimicrobial resistance among clinically relevant bacterial isolates in Accra. Antimicrobial resistance among clinically relevant bacterial isolates in Accra: a retrospective study. *BMC Research Notes*. 2018: 11 (1): 254.

[30] Amin, Elvis Tajoache., Charles, Njumkeng., Belmond, T. Kika., Akemfua, Fualefac and Patrick, Njukeng. Pattern of Antimicrobial Resistance among Bacterial Isolates from Urogenital Clinical Specimens: A Descriptive Study from the Buea Health District, Cameroon. *Drugs - Real World Outcomes*. 2018: 5:101–108

[31] Rachid, R., Abderrahim, A., Amina, B., Ibtissam, K., Fadil, H., Almontacer, C. and Redouane, A. prevalence of hospital acquired infections in the university medical centre, Rabat, Morocco. *International Archives of Medicine*. 2012: 5: 26

[32] Unegbu Nnachetam Valetine., Ezennia Obioma Jennifer., Nkwoemeka Ndidi Ethel., Emmanuel Nnabuike Ugbo., Ezebialu Chinenye Uzoamaka and Eze Ebere Mary. Prevalence of nosocomial infections and plasmid profile of bacteria isolated from hospital environment. *Europian Journal of Pharmaceutical and medical research.* 2017:4 (9):75-85

[33] Motayo, B. O., Akinbo, J. A., Ogiogwa, I., Idowu, A. A., Nwanze J. C., Onoh, C. C., Okerentugba, P. O., Innocent-Adiele, H. C., Okonko, I. O. Bacteria Colonisation and Antibiotic Susceptibility Pattern of Wound Infections in a Hospital in Abeokuta. *Frontiers in Science,* 2013: **3** (1): 43-48

[34] Basu, S., Ramchuran, P. T., Bali, S. T., Gulati, A. and Shukla, V. A prospective, descriptive study to identify the microbiological profile of chronic wounds in outpatients. *Ostomy Wound Manage.*2009: 13 (1):14–20.

[35] Ehiaghe, F. A., Ehiaghe, I. J., Agbonlahor, D. E., Oviasogie, F. E., Etikerentse, S. M. O., Nwobu, R. A. U., Akinshipe, B. O., Ikusemore, A. I., Aladenika, S. T. and Enwa, F. O. Plasmid Profiling and Curing Analysis of Fluoroquinolone Multidrug Resistant *Pseudomonas aeruginosa* in Benin City, Nigeria. *Open Journal of Medical Microbiology*. 2013: 3: 201-205.

[36] Shittu, A.O., Kolawole, D.O. and Oyedepo E.A.R. A study of wound infections in two health Institutions in Ile-Ife, Nigeria. *African journal of biomedical research.* 2002: 5: 97 – 102

[37] Mehta, M., Dutta, P., and Gupta, V. Antimicrobial susceptibility pattern of blood isolates from a teaching hospital in north India. Japan Journal of Infectious Disease. 2005:.58:174–6.

[38] Alam, M. S., Pillai, P. K., Kapur, P. and Pillia, k. k. Resistance patterns of bacteria isolated from bloodstream infections at a university hospital in Delhi. Journal of Pharmacy and Bioallied Science. 2011: 3 (4): 525–530.

[39] Falagas, M. E, Kasiakou, S. K., Nikita, D., Morfou, P., Georgoulias, G. and Rafailidis, P. I. Secular trends of antimicrobial resistance of blood isolates in a newly founded Greek hospital. Infectious Diseases. 2006: 6:99.

[40] Onile, B. A., Odugbemi, T., Nwofor, C. Antibiotics susceptibility of bacterial agents of septicaemia in Ilorin, Nigeria. *Nigerian Medical Practice*. 1985: 9 (4):93–96

[41] Lizioli, A., Privitera, G., Alliata, E., Antonietta, E.M., Boselli, L., Panceri, M.L., Perna, M.C., Porretta, A.D., Santini, M.G and Carreri, V. Prevalence of nosocomial infections in Italy: result from the Lombardy survey in 2000. *Journal of Hospital infections*. 2003: 54:141-148.

[42] Ugwu, M. C., Ikegbunam, M. N, Nduka, S. O., Attama, A. A, Ibezim, E. C., and Esimone, C. O. Molecular characterization and efficacy of antibiotic combinations on multiple antibiotic resistant *Staphylococcus aureus* isolated from nostrils of healthy human volunteers. *Journal of Pharmaceutical Sciences and Research.* 2013: **5** (1) 26–32.

[43] Madigan, M., Martinko. J., Stahl, D. and Clark, D. Brock Biology of Microorganisms (13th ed.), Pearson Education. 2012: P. 797

[44] Schlünzen, Frank., Zarivach, Raz., Harms, Jörg., Bashan, Anat., Tocilj, Ante., Albrecht, Renate., Yonath, Ada. and Franceschi, François.. "Structural basis for the interaction of antibiotics with the peptidyl transferase centre in eubacteria". Nature. 2001: 413 (6858): 814–821.

[45] Orhue, P. O., Okoebor, F.O, and Momoh, M.A. Pre and Post Plasmid Curing Effect on *Pseudomonas aeruginosa* Susceptibility to Antibiotics. *American Journal of Current Microbiology*. 2017: **5** (1)33-41

[46] Hitchings, A., Lonsdale, D., Burrage, D. and Baker, E. Top 100 drugs: clinical pharmacology and practical prescribing. 2015:. Pp. 174–181.

AD Publications

Sector-3, MP Colony, Bikaner, Rajasthan, INDIA

www.adpublications.org, www.imjhealth.org, info@imjhealth.org