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# Effect of seasonal variation on the prevalence and etiology of bloodstream infection and multiple antibiotic resistance index

**R.E. Eriamiatoe,[1]**
**E.E. Ibadin,[1]**
**I.S. Osayande,[1]**
**N.L. Idemudia,[1]**
**A.A. Eghiomon,[1]**
**O.D. Aguh,[1]**
**P.E. Onuoha,[1]**
**C.A. Egbe,[1]**
**J.A. Igunma,[2]**
**R. Omoregie[1,3]**

*[1]Medical Microbiology, Division of Medical Laboratory Services, University of Benin Teaching Hospital, Benin City*
*[2]Department of Medical Microbiology, University of Benin Teaching Hospital, Benin City*
*[3]Department of Medical Laboratory Science, School of Basic Medical Sciences, College of Medical Sciences, University of Benin, Benin City, Nigeria*

OBJECTIVE **To evaluate the effect of seasons on prevalence of bloodstream infections (BSI) and the multiple antibiotic resistance (MAR) index.** METHOD **A one-year retrospective review of laboratory records of 1,131 non-repetitive blood cultures was undertaken. The patients consisted of 624 males and 507 females with age range of one day to 100 years. The BACT/ALERT® 3D automated blood culture system was used to detect BSI. Identification and susceptibility tests of significant microbial isolates were performed using standard techniques.** RESULTS **Patients who were less than one year old (p<0.0001), from orthopedic ward (p<0.0001) and their BSI were detected in the month of June (p=0.0371) had higher prevalence of BSIs. Patients were 1.5 times more likely to have BSI in the rainy season compared with the dry season (odds ratio [OR]=1.533 95% confidence interval [CI]=1.179, 1.993; p=0.0017). *Klebsiella pneumoniae* was the most prevalent etiologic agent of BSI, and was more likely to be recovered in the rainy season (p=0.0003). Coagulase negative *Staphylococci, Staphylococcus aureus and Escherichia coli* were the predominant cause of BSI in the dry season. The MAR index of isolates recovered during the rainy season (0.61±0.21) was higher (p=0.0024) than that of isolates from the dry season (0.50±0.29). Isolates recovered during the rainy season were four times more likely to have MAR index >0.2 than their counterparts recovered during the dry season (OR=4.13, 95% CI=2.240, 8.326; p<0.0001).** CONCLUSIONS **An overall prevalence of BSI of 28.74% was observed. The BSI and MAR index were higher in the rainy season compared to the dry season. The data presented will be useful in the epidemiology and management of BSI.**

Επίδραση της εποχικής διακύμανσης στην επικράτηση και στην αιτιολογία της μικροβιαιμίας και στον δείκτη πολλαπλής αντοχής στα αντιβιοτικά

*Περίληψη στο τέλος του άρθρου*

**Key words**

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Bloodstream infections (BSI) are classified as infectious diseases characterized by the detection of viable bacterial or fungal microorganisms within the bloodstream, which is subsequently confirmed by the positive results of one or more blood cultures.[1] Sepsis and BSIs are two of the leading causes of death for hospitalized patients.[2] Sepsis, a life-threatening organ dysfunction caused by an exaggerated host response to infection, is one of the leading causes of death worldwide.[3] It has been described as any systemic bacterial infection documented by a positive blood culture.[4] Globally, there are approximately 48.9 million sepsis cases, leading to 11 million deaths annually.[5,6] The average hospital length of stay for sepsis is twice as long as any other fatal condition, and the in-hospital mortality remains as high as 20%.[7,8] Furthermore, sepsis survivors are at an increased risk of death or a reduced health-related quality of life even after discharge from the hospital.[9–11] Hence, sepsis is a significant contributor to the global health burden of diseases.

The development of resistance by bacteria to different antibiotics has resulted in the difficult treatment of infectious diseases. The infections caused by antibiotic resistant bacteria, most especially multi-resistance bacteria, can lead to serious health problems, such as long hospital stay, treatment failure, and death.[12] The major factors causing the development of bacterial resistance include the indiscriminate use of antimicrobial agents in human and animal medicine, agriculture, and aquatic farming.

Multiple antibiotic resistance (MAR) index is an effective, valid, and cost-effective method that is used in source tracking of antibiotic resistant organisms.[13] MAR index is calculated as the ratio between the number of antibiotics that an isolate is resistant to and the total number of antibiotics the organism is exposed to. An MAR index value >0.2 indicates that the isolate is from an environment where antibiotics are abused.[14]

Prevalence of etiologic agents of BSI as well as antibiotic consumption and antimicrobial resistance (AMR) has been reported to be influenced by season of the year.[15,16] Increase in environmental temperature has been reported to increase the prevalence of BSI and AMR.[17,18] Some countries experience four seasons while others experience two. This leads to differences in temperatures in the same month of the year between two countries. Against this background, this study aims to evaluate the effect of season on prevalence of blood stream infection and antibiotic resistance as measured by MAR index.

## MATERIAL AND METHOD

### Study location

The study was a retrospective review of laboratory records. The study was carried out in the University of Benin Teaching Hospital (UBTH), Benin City, Nigeria, from 1st of December 2021 to 30th November 2022. The hospital is a tertiary health institution with referral status and is located on latitude 6.3903° N and longitude 5.6118° E. It has over 900 beds and 30 wards, and is situated in Nigeria's South-South geopolitical zone. It provides services to roughly six to ten states both within and outside of the zone.

### Study population

The study population consisted of a total of 1,131 patients of 624 males and 507 females with age range of one day to 100 years (mean±standard error of the mean: 27.38±2.47 years) with signs and symptoms of BSI. Information on the age and gender of patients and wards/clinics blood culture specimens were recovered from, amongst other information, were obtained from laboratory records.

### Ethical consideration

The study was conducted in line with the Helsinki Declaration and the Nigeria National Health Act.[19] With particular reference to section 28, subsection 1 and 2, use of patient's records for research does not require ethical authorization or approval if the identities of the patients are not disclosed. There's nothing within the data presented that identifies any patient whose record was used in this study.

### Specimen collection and processing

Each patient's blood was collected and dispensed into a BACT/ALERT® blood culture container (bioMérieux, Inc, France). A set of blood cultures was collected from each patient. For adults, one aerobic and one anaerobic blood culture bottles were employed, while for pediatric patients, two aerobic bottles were used. These bottles were incubated immediately in BACT/ALERT® 3D automated blood culture equipment (bioMérieux, Inc, France). All BACT/ALERT-positive broths were subcultured onto chocolate, blood and McConkey agar plates. The chocolate agar plates were incubated in candle jars and the blood and McConkey agar plates were incubated aerobically. True infection was indicated by the growth of the same organism in both bottles.

Vitek 2 compact system (bioMérieux, Inc, France) was used for identification and susceptibility tests. Conventional methods of identification and manual disc susceptibility tests were used when there were logistic challenges with the Vitek system.[20,21] In such cases, identification was done to the genus level.

The MAR index was determined as previously described.[22] Briefly, MAR index was calculated by dividing the number of antibiotics an organism was resistant to by the total number of antibiotics tested.

### Statistical analysis

The data obtained were presented in figures and tables using Microsoft Excel (2010 version) and Graph Pad Prism (version 5). Parametric data were analyzed with Student's t-test and ANOVA while non-parametric data were analyzed with Chi-square ($x^2$) test and Odds ratio (OR) analysis using the statistical software INSTAT® (Graph Pad Inc, La Jolla, CA, USA).

## RESULTS

The overall prevalence of BSI was 28.74% (325/1,131). The prevalence of BSI was significantly higher ($p<0.0001$) among those with <1 year of age compared to other age groups (fig. 1). Gender (fig. 2) did not significantly affect the prevalence of BSI (male versus female: 28.04% versus 29.59%; $p=0.6147$). The prevalence of BSI was highest among patients from orthopedic wards (fig. 3), followed by those from neonatal intensive care units. There was no laboratory confirmed case of BSI among patients from renal unit, gynecological and eye wards. The wards/clinics that the patients were from significantly affected the prevalence of BSI ($p<0.0001$). The highest prevalence of BSI was observed in the month of June ($p=0.0371$; fig. 4), and indeed, patients were 1.5 times more likely to have BSI in the rainy season compared with the dry season (rainy season versus dry season: OR=1.533; 95% confidence interval [CI]=1.179, 1.993; $p=0.0017$).

Of the 325 isolates, 199 and 126 were recovered from rainy and dry seasons respectively (tab. 1). *Klebsiella pneumoniae* ($p=0.0003$) was more prevalent in the rainy season while *Escherichia coli* ($p=0.0441$), coagulase negative *Staphylococci* ($p=0.0127$) and *Staphylococcus aureus* ($p=0.0325$) were most prevalent in the dry season.

The effect of age, gender, ward and season on MAR index is shown in figure 5. Age (fig. 5a), gender (fig. 5b) and location (ward: data not shown) had no significant effect on multiple antibiotic resistance (MAR index ($p>0.05$). The MAR index of isolates recovered during the rainy season ($0.61\pm0.21$) was higher ($p=0.0024$) than that of isolates from dry season ($0.50\pm0.29$), and the isolates recovered in the month of September had the highest MAR index (fig. 5c and 5d, respectively). The MAR index obtained in September was higher than those obtained in the months of January ($p<0.01$), March ($p<0.001$), June ($p<0.001$) and November ($p<0.05$). Similarly, the MAR index of isolates from the month of May was higher than those from the months of March and June ($p<0.05$ each) (fig. 5d).

A total of 87.08% of the recovered isolates had MAR index >0.2 (tab. 2). This value was not affected by the gender of the patients ($p=0.4717$). However, the age groups 71–81 years and 81–91 years had significantly ($p=0.0021$)

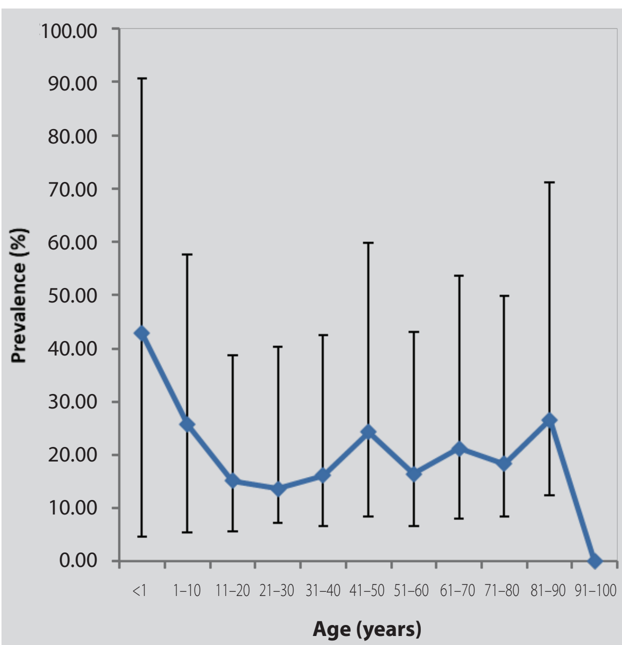


**Figure 1.** Effect of age on prevalence of positive blood culture ($p<0.0001$).

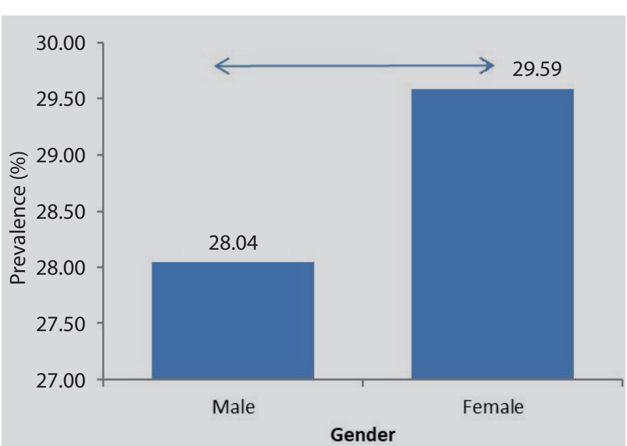


**Figure 2.** Effect of gender on prevalence of bloodstream infections (BSI).

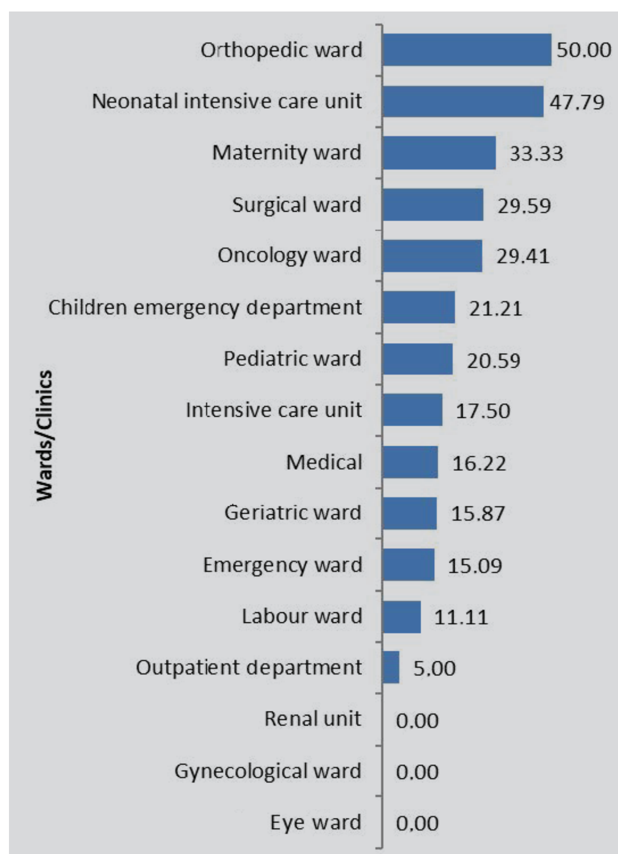


**Figure 3.** Prevalence of bloodstream infections (BSI) in various wards and clinics ($p<0.0001$).

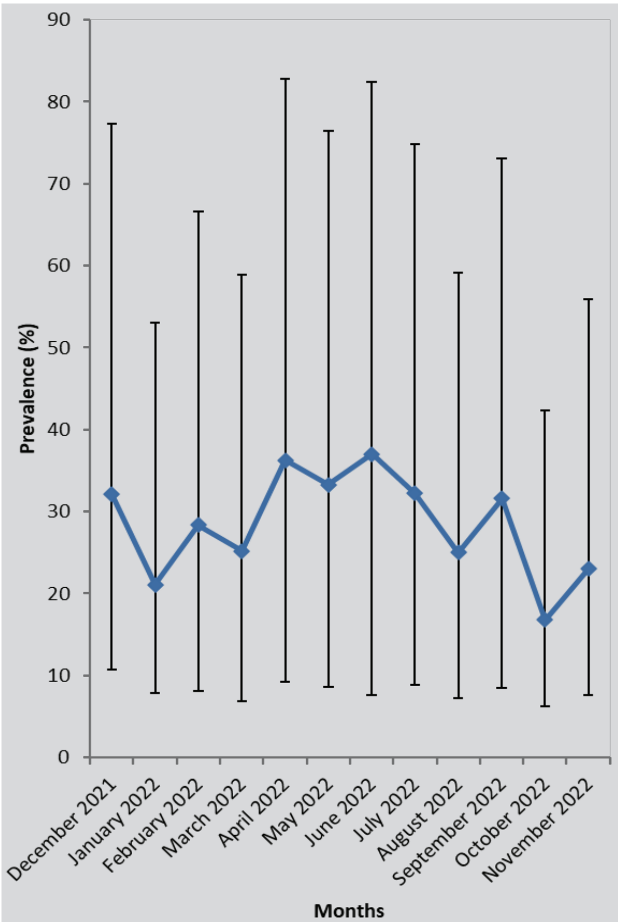


**Figure 4.** Prevalence (±95% confidence interval [CI]) of bloodstream infections (BSI) in relation to various months of the year (p=0.0371).

higher prevalence (100% each) compared with other age groups. All isolates from emergency, geriatric and orthopedic wards had MAR index >0.2. Also, all isolates recovered from the month of August had MAR index >0.2. Wards and months of the year (p=0.0011 and p<0.0001, respectively) significantly affected the prevalence of isolates with MAR index >0.2. Isolates recovered during the rainy season were four times more likely to have MAR index >0.2 than their counterparts recovered during the dry season (OR=4.13; 95% CI=2.240, 8.326; p<0.0001).

## DISCUSSION

The overall prevalence of BSI in this study (28.74%) is comparable to 28.09% reported from Calabar, Nigeria,[23] but higher than the 19.2% and 17.2% reported from Ido-Ekiti, Nigeria and four health institutions in Ibadan, Nigeria, respectively.[24,25] The prevalence of BSI observed in this study was lower than the 42.2% reported in Gombe, Nigeria,[26] but higher than that reported from Bangladesh and Belgium.[27,28] Among children with diarrhea, prevalence of the infection varied with geographical locations, regions within the same country, and even over time in the same location and population.[29] This may explain the finding in this study.

The finding that the highest prevalence of BSI was among <1 year old agrees with a previous report,[23] where they suggested that infants may have a higher incidence of BSIs than other age groups because of their underdeveloped immune systems, poor skin integrity, and frequent engagement in activities that could make them more susceptible to infections. Additionally, intravascular devices are typically used to provide medications to infants, which make it easy for infectious agents to enter their bloodstream. Similarly, the finding that the prevalence of BSI did not differ significantly between males and females agrees with a previous report.[24]

There are conflicting reports on the effect of wards/clinics on the prevalence of BSIs. Some authors report higher prevalence from trauma and emergency wards, special care baby unit (SCBU or neonatal intensive care unit [ICU]) and ICU.[30–32] In this study ward/clinic had a significant effect (p<0.0001) on the prevalence of BSI with patients from orthopedic ward having highest prevalence followed by those from neonatal ICU. Orthopedic practices may be responsible for this. We recently reported a BSI prevalence among neonates of 44.2% which is comparable to the 47.79% observed in this study.[33]

The highest prevalence of BSI observed in this study occurred in the month of June (part of the rainy season), and the prevalence of BSI was significantly higher in rainy season compared to the dry season (rainy versus dry: 32.73% versus 240.9%: OR=1.533; 95% CI=1.179, 1.993; p=0.0017). This finding is at variance with our 2009 report among children five years and younger, where no significant difference in prevalence of septicemia between rainy and dry seasons was observed.[34] In Nigeria, recorded environmental temperatures are lower in the rainy season than in the dry season. Thus, the finding of higher prevalence of BSI in the rainy season does not agree with reports of higher BSI being associated with higher environmental temperatures.[17,35,36] Malaria infection is reported to be higher in the rainy season.[37] Malaria parasites can affect immune cells, including T cells and antigen-presenting cells, making it more difficult for the host to develop a successful immune response.[38] Lower immunity due to malaria may occur in the rainy season and give rise to secondary infections such as BSI. This may explain the higher prevalence in the rainy season observed in this study.

**Table 1.** Seasonal variation of microbial isolates.

| Isolates | Rainy season (n=199) | Dry season (n=126) | p value |
|---|---|---|---|
| *Acinetobacter baumanii complex* | 4 (2.01) | 3 (2.38) | 0.8224 |
| *Alkaligenes* species | 2 (1.01) | 2 (1.59) | 0.6422 |
| *Bacillus* species | 5 (2.51) | 6 (4.76) | 0.4367 |
| *Burkholderia cepacia complex* | 26 (13.07) | 15 (11.90) | 0.8922 |
| *Citrobacter* species | 4 (2.01) | 1 (0.79) | 0.6850 |
| *Coagulase negative Staphylococci* | 6 (3.02) | 13 (10.32) | 0.0127 |
| *Enterobacter cloacae complex* | 3 (1.51) | 2 (1.59) | 0.9546 |
| *Enterobacter* species | 2 (1.01) | 1 (0.79) | 0.8461 |
| *Enterococcus faecium* | 4 (2.01) | 1 (0.79) | 0.6850 |
| *Klebsiella oxytoca* | 0 (0.00) | 2 (1.59) | 0.2915 |
| *Klebsiella pneumoniae* | 53 (26.63) | 12 (9.52) | 0.0003 |
| *Klebsiella* species | 7 (3.52) | 3 (2.38) | 0.8038 |
| *Pseudomonas aeruginosa* | 7 (3.52) | 3 (2.38) | 0.8038 |
| *Staphylococcus aureus* | 24 (12.06) | 27 (21.43) | 0.0325 |
| *Staphylococcus colinii* ssp *urealyticus* | 1 (0.50) | 1 (0.79) | 0.7437 |
| *Staphylococcus epidermidis* | 4 (2.01) | 7 (5.56) | 0.1593 |
| *Staphylococcus hemolyticus* | 23 (11.56) | 7 (5.56) | 0.1042 |
| *Staphylococcus hominis* | 2 (1.01) | 6 (4.76) | 0.0780 |
| *Staphylococcus saprophyticus* | 4 (2.01) | 1 (0.79) | 0.6850 |
| *Escherichia coli* | 0 (0.00) | 4 (3.17) | 0.0441 |
| *Candida albicans* | 1 (0.50) | 2 (1.59) | 0.6883 |
| *Alloiococcus otitis* | 1 (0.50) | 0 (0.00) | 0.4255 |
| *Kocuria kristinae* | 2 (1.01) | 0 (0.00) | 0.6885 |
| *Leuconostac mesenteroides* spp *cremoris* | 4 (2.01) | 0 (0.00) | 0.2779 |
| *Micrococcus luteus* | 3 (1.51) | 0 (0.00) | 0.4299 |
| *Staphylococcus capitis* | 1 (0.50) | 0 (0.00) | 0.4255 |
| *Staphylococcus artettae* | 1 (0.50) | 0 (0.00) | 0.4255 |
| *Klebsiella oxytoca* | 2 (1.01) | 0 (0.00) | 0.6885 |
| *Candida auris* | 1 (0.50) | 0 (0.00) | 0.4255 |
| *Candida tropicalis* | 1 (0.50) | 0 (0.00) | 0.4255 |
| *Candida species* | 1 (0.50) | 0 (0.00) | 0.4255 |
| *Acinetobacter hemolyticus* | 0 (0.00) | 1 (0.79) | 0.8174 |
| *Proteus vulgaris* | 0 (0.00) | 1 (0.79) | 0.8174 |
| *Pseudomonas* species | 0 (0.00) | 1 (0.79) | 0.8174 |
| *Sphingomonas paucimobilis* | 0 (0.00) | 2 (1.59) | 0.2915 |
| *Staphylococcus caprae* | 0 (0.00) | 1 (0.79) | 0.8174 |
| *Staphylococcus kloosii* | 0 (0.00) | 1 (0.79) | 0.8174 |
| *Staphylococcus pseudointermedius* | 0 (0.00) | 1 (0.79) | 0.8174 |
| *Streptococcus* species | 0 (0.00) | 1 (0.79) | 0.8174 |

*Staphylococcus aureus* has been reported as the most prevalent cause of BSI in many studies from Nigeria.[23–26,34,39] as well as some non-Nigerian studies.[30] In contrast, *K. pneumoniae* was the most prevalent in this study, a finding that agrees with an earlier report among neonates.[41] The finding that the prevalence of *S. aureus* was significantly higher in

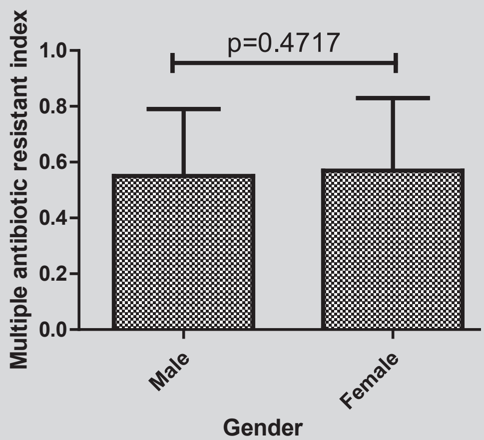


**Figure 5a.** Effect of gender on multiple antibiotic resistance (MAR) index.

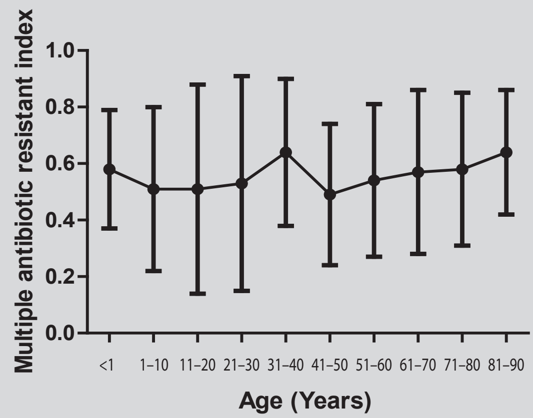


**Figure 5b.** Effect of age on multiple antibiotic resistance (MAR) index.

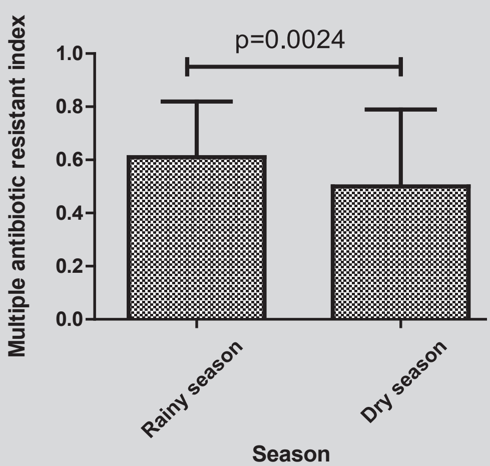


**Figure 5c.** Effect of seasons on multiple antibiotic resistance (MAR) index.

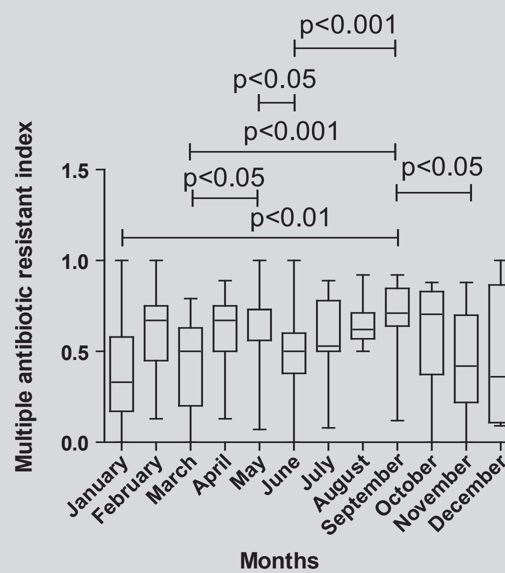


**Figure 5d.** Effects of months of the year on multiple antibiotic resistance (MAR) index.

**Figure 5.** Effect of age, gender, ward and season on multiple antibiotic resistance (MAR) index.

dry season than rainy season agrees with a previous report.[42]

The primary cause of AMR is antibiotic usage, and this correlation suggests a dynamic process wherein there may be a temporal lag between antibiotic use and AMR.[43–45] AMR is a public health issue globally. Unregulated use of antimicrobials is rife in our setting, and multiple antibiotic (MAR) index is an inexpensive surveillance tool to monitor AMR in an environment.[46] The MAR index in this study was not significantly affected by age and gender which may be due to unregulated use of antibiotics in Nigeria and over-the-counter (OTC) sales of antibiotics without prescriptions are common.[47–49] The MAR index of BSI isolates recovered in the rainy season was higher than those of isolates recovered in the dry season. Heavy rainfall is reported to facilitate the spread of antibiotic-resistant bacteria.[50] The peak prevalence of BSI was observed in June while September had the highest MAR index. In the United States of America, a one-month time lag was observed between antibiotic prescription and appearance of resistance,[44] while a three to six month delay was observed for a Dutch study.[15] This may explain the finding in this study.

The elderly consume about 50% more antibiotics per capita than younger adults, making them a particularly significant demographic in terms of antibiotic overuse.[5,52] Due to a number of age-related physiological changes, including immunological senescence, altered skin and

**Table 2.** Effect of demography and seasons on the prevalence of antimicrobial resistance.

| Characteristics | No tested | No with MAR index >0.2 | | OR | 95% CI | p value |
|---|---|---|---|---|---|---|
| *Gender* | | | | | | |
| Male | 175 | 154 | (88.00) | 1.194 | 0.624, 2.284 | 0.7114 |
| Female | 150 | 129 | (86.00) | | | |
| *Age (years)* | | | | | | 0.0021 |
| <1 | 178 | 165 | (92.70) | | | |
| 1–10 | 54 | 40 | (74.07) | | | |
| 11–20 | 15 | 10 | (66.67) | | | |
| 21–30 | 6 | 4 | (66.67) | | | |
| 31–40 | 12 | 11 | (91.67) | | | |
| 41–50 | 17 | 13 | (76.47) | | | |
| 51–60 | 12 | 10 | (83.33) | | | |
| 61–70 | 14 | 13 | (92.86) | | | |
| 71–80 | 9 | 9 | (100.00) | | | |
| 81–90 | 8 | 8 | (100.00) | | | |
| *Wards* | | | | | | 0.0011 |
| Cancer ward | 10 | 9 | (90.00) | | | |
| Children emergency ward | 49 | 37 | (75.51) | | | |
| Emergency ward | 8 | 8 | (100.00) | | | |
| Geriatric ward | 10 | 10 | (100.00) | | | |
| ICU | 7 | 6 | (85.71) | | | |
| Labour ward | 1 | 1 | (100.00) | | | |
| Maternity ward | 5 | 3 | (60.00) | | | |
| Medical ward | 18 | 14 | (77.78) | | | |
| Orthopedic ward | 4 | 4 | (100.00) | | | |
| Outpatient department | 1 | 1 | (100.00) | | | |
| Pediatric ward | 21 | 14 | (66.67) | | | |
| Neonatal ICU | 162 | 153 | (94.44) | | | |
| Surgical ward | 29 | 23 | (79.31) | | | |
| *Seasons* | | | | | | |
| Rainy | 199 | 181 | (90.95) | 4.319 | 2.240, 8.326 | <0.0001 |
| Dry | 126 | 95 | (75.40) | | | |
| *Months* | | | | | | <0.0001 |
| January | 15 | 11 | (73.33) | | | |
| February | 27 | 24 | (88.89) | | | |
| March | 30 | 21 | (70.00) | | | |
| April | 33 | 30 | (90.91) | | | |
| May | 32 | 31 | (96.88) | | | |
| June | 50 | 45 | (90.00) | | | |
| July | 28 | 27 | (96.43) | | | |
| August | 26 | 26 | (100.00) | | | |
| September | 30 | 28 | (93.33) | | | |
| October | 16 | 14 | (87.50) | | | |
| November | 20 | 16 | (80.00) | | | |
| December | 18 | 10 | (55.56) | | | |

MAR index: Multiple antibiotic resistance, OR: Odds ratio, CI: Confidence interval, ICU: Intensive care unit mucosal barrier function, degenerative changes in bone and cartilage, and a decrease in respiratory capacity, elderly people are more susceptible to infectious illnesses.[53–55] Thus, elderly people may harbour more resistant isolates. This may explain the higher prevalence of MAR index >0.2 among BSI isolates recovered from the elderly (>60 years) in this study. In terms of wards, the prevalence of BSI isolates with MAR index >0.2 was significantly (p<0.0001) lower among BSI isolates recovered from patients in the maternity ward. The cautionary use of antibiotics on pregnant and lactating women may explain this finding.

In conclusion, BSI was predominant in the rainy season and *K. pneumoniae* was the most prevalent isolate generally as well as in the rainy season. MAR index was higher in the rainy season, and showed that BSI isolates from the elderly, emergency, geriatric, labour, orthopedic and outpatient department (OPD) wards as well as BSI isolates recovered from the rainy season, particularly in the months of August and September, have previously been exposed to antibiotics. The data presented will be useful in the management of BSIs.

## ΠΕΡΙΛΗΨΗ

### Επίδραση της εποχικής διακύμανσης στην επικράτηση και στην αιτιολογία της μικροβιαιμίας και στον δείκτη πολλαπλής αντοχής στα αντιβιοτικά

R.E. ERIAMIATOE,[1] E.E. IBADIN,[1] I.S. OSAYANDE,[1] N.L. IDEMUDIA,[1] A.A. EGHIOMON,[1] O.D. AGUH,[1] P.E. ONUOHA,[1] C.A. EGBE,[1] J.A. IGUNMA,[2] R. OMOREGIE[1,3]

*[1]Division of Medical Microbiology, Medical Laboratory Services, University of Benin Teaching Hospital, Benin City, [2]Department of Medical Microbiology, University of Benin Teaching Hospital, Benin City, [3]Department of Medical Laboratory Science, School of Basic Medical Sciences, College of Medical Sciences, University of Benin, Benin City, Νιγηρία*

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**ΣΚΟΠΟΣ** Αξιολόγηση της επίδρασης των εποχών του έτους στη συχνότητα εμφάνισης μικροβιαιμίας (BSI) και στον δείκτη πολλαπλής αντοχής στα αντιβιοτικά (MAR). **ΥΛΙΚΟ-ΜΕΘΟΔΟΣ** Διεξήχθη αναδρομική ανασκόπηση ενός έτους των εργαστηριακών αρχείων 1.131 μη επαναλαμβανόμενων καλλιεργειών αίματος. Οι ασθενείς περιλάμβαναν 624 άνδρες και 507 γυναίκες, με ηλικιακό εύρος από μία ημέρα έως 100 έτη. Το αυτοματοποιημένο σύστημα καλλιέργειας αίματος BACT/ALERT® 3D χρησιμοποιήθηκε για την ανίχνευση BSI. Η ταυτοποίηση και η δοκιμή ευαισθησίας σημαντικών μικροβιακών απομονωμένων στελεχών πραγματοποιήθηκε με την εφαρμογή τυπικών τεχνικών. **ΑΠΟΤΕΛΕΣΜΑΤΑ** Ασθενείς ηλικίας <1 έτους (p<0,0001), από το ορθοπαιδικό τμήμα (p<0,0001) και των οποίων οι BSI ανιχνεύτηκαν τον μήνα Ιούνιο (p=0,0371) είχαν υψηλότερη συχνότητα εμφάνισης BSI. Οι ασθενείς είχαν 1,5 φορά μεγαλύτερη πιθανότητα να εμφανίσουν BSI κατά την περίοδο των βροχών σε σύγκριση με την περίοδο της ξηρασίας (σχετικός λόγος [ΣΛ]=1,533, 95% διάστημα εμπιστοσύνης [ΔΕ]=1,179, 1,993, p=0,0017). Η *Klebsiella pneumoniae* ήταν ο πλέον διαδεδομένος αιτιολογικός παράγοντας της BSI και ήταν πιο πιθανό να ανακτηθεί κατά την περίοδο των βροχών (p=0,0003). Οι αρνητικοί στην κοαγκουλάση σταφυλόκοκκοι, ο *Staphylococcus aureus* και η *Escherichia coli* αποτελούσαν την κυρίαρχη αιτία της BSI κατά την περίοδο της ξηρασίας. Ο δείκτης MAR των απομονωμένων στελεχών που ανακτήθηκαν κατά την περίοδο των βροχών (0,61±0,21) ήταν υψηλότερος (p=0,0024) από εκείνον των απομονωμένων στελεχών από την περίοδο της ξηρασίας (0,50±0,29). Τα απομονωμένα στελέχη που ανακτήθηκαν κατά την περίοδο των βροχών είχαν τετραπλάσιες πιθανότητες να εμφανίζουν δείκτη MAR >0,2 από τα αντίστοιχα στελέχη τα οποία ανακτήθηκαν κατά την περίοδο της ξηρασίας (ΣΛ=4,13, 95% ΔΕ=2,240, 8,326, p<0,0001). **ΣΥΜΠΕΡΑΣΜΑΤΑ** Παρατηρήθηκε συνολική επικράτηση της BSI σε ποσοστό 28,74%. Η BSI και ο δείκτης MAR ήταν υψηλότεροι κατά την περίοδο των βροχών σε σύγκριση με την περίοδο της ξηρασίας. Τα δεδομένα που παρουσιάζονται θα είναι χρήσιμα στην επιδημιολογία και στη διαχείριση της BSI.

**Λέξεις ευρετηρίου:** Δείκτης πολλαπλής ανοχής στα αντιβιοτικά, Εποχική διακύμανση, Μικροβιαιμία, Πρόληψη

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*Corresponding author:*

R. Omoregie, Medical Microbiology, Division of Medical Laboratory Services, University of Benin Teaching Hospital, Benin City, Nigeria
e-mail: richard.omoregie@ubth.org