

Original Article**APPLICATION OF WHONET FOR THE SURVEILLANCE OF ANTIMICROBIAL RESISTANCE IN TEACHING HOSPITAL****Sanath P Patil¹, Shreya M Nagamoti², M B Nagamoti³**¹Second MBBS Student, J.N. Medical College, KLE University Belagavi, Karnataka²- First MBBS student, JJM Medical College. Davanagere. Karnataka³- Professor of Microbiology, J.N. Medical College, KLE University Belagavi, Karnataka

Received: 20/07/2018 Revised: 04/08/2018 Accepted: 19/08/2018

ABSTRACT:**Background:** Manual monitoring and surveillance of the antibiotic resistance in the hospital laboratory is a difficult procedure.**Objectives:**

To identify the pattern of the organisms and their drug resistance pattern to prepare the antibiotic policy of the hospital.

Material and Methods: We used WHO NET program, for analysis and reporting surveillance data of our isolates. In this study we analyzed our bacterial isolates and antibiotic sensitivity (Kirby-Bauer's method) using this software.**Results:** The drug resistance rate was high in our case. Detection of ESBL, MRSA and other important isolates were easily analysed.**Conclusion:** WHONET software has in-built analysis program which helps in preparation and identification of hospital outbreaks as well as in preparation of drug policy and recognition of quality control monitor measures in the hospital laboratory.**Keywords:** Antimicrobial susceptibility; Surveillance; WHONET.**INTRODUCTION**

The emergence and dissemination of resistant bacteria is a natural process in which bacteria get adapted to a hostile environment rich in antibacterial agents.¹ The organisms are adopting newer characteristics including drug resistance in the present scenario. This has led to tremendous differences in the patterns of drug resistance in hospitals and communities throughout the world.

This problem began initially as resistance to a single drug, followed by multiple drugs and now progressed to different members of each family of agents with the varying levels of resistance. Terms like MDR, XDR and TDR (multiple, extra and total drug resistance) were unknown two - three decades ago, are now commonly used in hospital practice. This is due to adoption of resistance genes by bacteria, through their frequency of emergence, vectors, linkages and pathways have thus emerged, re-emerged, converged and disseminated irregularly throughout bacterial ecosystems over the last 60 years to ultimately reach infectious strains and inhibit treatment of infection.^{1,2}

Address of Correspondence:

Dr M B Nagamoti

Professor, Department of Microbiology

J.N. Medical College, KLE University

Belagavi, Karnataka, INDIA

Email: drmbnagamoti@gmail.com

Mobile: 9448141342

The problem of increasing antimicrobial resistance is even more concerning, especially considering the limited number of new antimicrobial agents that are in development.³

This problem is largely attributed to the extensive and often unregulated use of antibiotics. There is a strong need to maintain surveillance and monitor the use of antibiotics in hospitals to control bacterial drug resistance.⁴ There are many laboratories in the world, which are investigating clinical samples to identify organisms and their antibiotic susceptibility / resistance patterns. Such results and records of microbiology laboratories are usually stored in registers, paper files or in computer files, which makes the task of data analysis and comparison difficult.⁵ In order to prepare the antibiogram for a concerned organism, or a particular in-patient ward for the development of empirical therapy regimen for patients who are admitted using such a record system, makes the job at hand difficult. Therefore it is very difficult to identify resistograms and identify the trends of drug resistance of infectious organisms.

Since many years, the Department of Microbiology at KLE University's J.N. Medical College Belagavi, is maintaining investigation data in the hard copies. Analyzing the data stored in these registers and identifying resistance patterns manually is extremely cumbersome and time consuming. With this in mind, hereby we used the WHO NET program to analyze our bacterial spectrum and their resistance pattern.

OBJECTIVES

To identify the pattern of the organisms and their drug resistance pattern to prepare the antibiotic policy of the hospital.

MATERIAL AND METHODS

The present study was carried out at Department of Microbiology, J.N. Medical College KLE University Belagavi (Karnataka) India from 1st January to 31st December 2016. We used WHONET software, which is a Windows based

database software package for the management of Microbiology laboratory data and the analysis of antimicrobial susceptibility test results. We have downloaded WHONET 5.5 from the internet free of charge from URL: www.who.int/drugresistance/whonet software.

After the routine reporting of the bacterial culture, all the positive data was entered in the software on a daily basis. We used Kirby-Bauer disk diffusion technique for the detection of antibiotic sensitivity. The results are recorded as interpreted values i.e. "R" (Resistant), "I" (Intermediate) and "S" (Sensitive). The special tests like Methicillin resistance / ESBL, were also entered in the data. Interpretation guidelines for most standardized testing methodologies were built into the system. At the end of every three months, we analyzed the data and prepared a quarterly report and circulated to all the clinicians and nursing faculty for their information.

RESULTS

During one year period (2016), 4,471 clinical samples were received for bacterial culture division. Of them, 1,447 samples showed growth in culture. All these isolates were studied for sensitivity pattern against various antibiotics and beta lactamase production. Pus (33.65%), Urine (23.22%), Blood (5.25%), Sputum (14.65%) and Ear (5.66%) samples were the major clinical samples received in this period. *E. coli* (24%), *Staph aureus* (20%), *Psed aeruginosa* & *Kleb pneumoniae* (14% each) and CONS (0.2%) are the major pathogens isolated from these samples. Among the Staphylococci isolates, 35.43% were MRSA and MR CONS were 30%. ESBL producers (6.09%) were also detected among Gram negative bacilli.

Most common organism isolated from the Medical wards was *E.coli* (33.56%), from Surgery was *E. coli* (27.17%), from OBG was *E. coli* (30.84%), Pediatrics was *E.coli* (45.33%), Chest & TB was *Kleb. pneumoniae* (20.94%), ENT was *Staph. aureus* (34.07%) & *Psed. aeruginosa* was (34.07%). Monthly wise assessment of organisms

was as follows; Staph. aureus is more in the month of July (Fig No 8), E. coli in September 2017, Enterococcus species in the month of Jan 2016 , Psed aeruginosa in the months of July- Aug 2016. Rare isolates in this year were S. typhi one isolate from Blood (in June), Sh. flexneri (02) (June 2016), Vib. cholera in July (one isolate) and Corynebacterium diphtheriae two isolates (in August and September 2016).

Table: Specimen wise isolation of the organisms

Sample	Organisms	Percentage
Blood	<i>S.aureus</i>	30%
	<i>Ps.aeruginosa</i>	25%
	<i>E.coli</i>	13%
Pus	<i>E.coli</i>	24%
	<i>Staph aureus</i>	20%
	<i>Ps.aeruginosa</i>	14%
Urine	<i>E.coli</i>	48%
	<i>K.pneumoniae</i>	14%
	<i>Enterococcus sps.</i>	14%
Ear	<i>Ps aeruginosa</i>	43%
	<i>S.aureus</i>	40%
	<i>Proteus mirabilis</i>	04%
Sputum	<i>K.pneumoniae</i>	22%
	<i>Ps aeruginosa</i>	20%
	<i>St.pneumoniae</i>	18%
Wound swab	<i>S. aureus</i>	42%
	<i>E.coli</i>	12%
	<i>K.pneumoniae</i>	09%

DISCUSSION:

Emergence of antimicrobial resistance in gram negative organisms has been seen against cephalosporin group and presence of MRSA among all the wards of our hospitals. Khyder^{et.al.}³ and Sharma ^{et.al.}⁴ have reported increased drug resistance of gram negative and gram positive bacteria to commonly used drugs. We also agree with the opinion of Kyder^{et.al.}³ that, it may be due to the misuse, free access to antibiotics and unnecessary prophylactic administration of antibiotics. In such alarming situation, along with administrators, microbiologists need to be very

active to minimize the use of all antibiotics in all the cases of our hospital.

WHONET has proved its use in identification of clustering of cases and outbreaks. Park R ^{et. al.}⁶ found that clustering of *E.coli*, Huang ^{et.al.}⁷ detected MRSA and VRE clusters and local and regional outbreaks of *Shigella* species in Argentina.^{8,9} We have not found any such outbreaks in our study. This may be due to our study period being only one year with less number of samples.

Our study reveals, there is increase number of *Ps. aeruginosa* in July- Sept 2016, which is rainy season at Belagavi. Due to humid conditions these organisms must have reached from outpatients' department and to wards.

However, as this is the first time analysis of our institutional data using WHONET, we found the following advantages of this software.

a. Data entry:

1. The details of patients and test results is a single door entry into the computer. As Ghosh ^{et.al.} mentioned the data obtained from this analysis can be easily circulated among the concerned in an easy format.¹⁰

2. A trained data operator can enter the data easily, which takes 5-6 minutes for each patient's information.

b. Analysis:

1. The program has a modular configuration that allows customization of software for clinical, epidemiological, and infection control applications.

2. We could analyze the data smoothly for each individual organism, ward/ area, and for a wide range of antibiotics.

3. We could analyze data for every month and compare the trends of each month of the year, along with the area and ward getting more of such infections.

4. Identification of epidemic/ nosocomial strains (MRSA/ CONS/ESBL / VRSA) in the ward could be traced.[11]

5. Empirical treatment and antibiotics could be planned for the each ward by analyzing the data.

6. Antibiotic policy could be prepared easily using this analysis.

7. Alert for microbiologists; the system has a number of “expert rules” for modifying the interpretation of susceptibility test results. For example in the case of MRSA, software can change the interpretation for all beta-lactam antibiotics to resistant,

8 Alert for clinicians and hospital infection control (HIC) team; these rules automatically arise as soon as the data completion over and will help the HIC team to look for the emerging problem every day and to prevent the complications at that site.

9. The analysis could be recorded and used for presentations in the form of histograms, scatter-plots and regression curves besides comparing measurements.

10. Type of analysis included percentage of data categorized as resistant, intermediate, or susceptible by standard distributions of test measurements (zone diameter, minimal inhibitory concentration) for different agents or methods for the same isolates.

11. In addition the program also permits retrieval and correction of clinical records.

These observations will help the Health Administrators of the Hospital, to take preventive actions depending on the season, ward and units. Further it will help the administration categorically, scrutinize the adoption of preventive measures as effective or not. Special areas are easily identified and can help the infection control nurse to take necessary action urgently when required. The data can be easily presented during hospital infection control meetings and directly advise the individual nurse or clinician to take corrective actions.

Limitations of our study: Present study was only one year analysis of the organisms and their antibiotic study. Therefore it was not possible for us to generalize the antibiotic policy of our hospital.

CONCLUSION

WHONET software is user friendly, has an easy procedure of data analysis, provides a wide variety of analysis options for local problems, useful for comparing national data and gives guidance for

drug-policy decisions coupled with preventive measures.

REFERENCES:

- O'Brien TF, Stelling JM. WHONET: An Information System for Monitoring Antimicrobial Resistance. *Emerging Infectious Diseases* 1995;1;2:66.
- O'Brien TM. The global epidemic nature of antimicrobial resistance and the need to monitor and manage it locally. *CID* 1997;24 :S1; 2-8.
- Kheder SI. Application of WHONET 5 Software for the Surveillance and Analysis of Antimicrobial Resistance in A Sudanese Hospital. *JPBMS*, 2012, 16 (18);1-10.
- Sharma A, Grover PS. Application of WHONET for the surveillance of antimicrobial resistance. *Indian J Med Micro*. 2002; 22 (2):115-118.
- Agarwal A, Kapila K, Kumar S. WHONET Software for the Surveillance of Antimicrobial Susceptibility. *MJAFI*. 2009;65; 3:264-66.
- Park R, O'Brien TF, Huang SS, Baker MA, Yokoe DS, Kulldorff M. Statistical detection of geographic clusters of resistant *Escherichia coli* in a regional network with WHONET and SaTScan. *Expert Rev Anti Infect Ther*. 2016 Nov;14(11):1097-1107.
- Huang SS, Yokoe DS, Stelling J, Placzek H, Kulldorff M, Kleinman K. Automated Detection of Infectious Disease Outbreaks in Hospitals: A Retrospective Cohort Study. *PLoS Med* 7(2):e1-e10.
- Stelling J, Yih WK, Galas M, et al. Automated use of WHONET and SaT Scan to detect outbreaks of *Shigella* spp. using antimicrobial resistance phenotypes. *Epidemiol Infect*. 2010; 138(6): 873–883.
- Vinas MR, Tuduri E, Galar A, Yih K, Pichel M, Stelling J. Laboratory-Based Prospective Surveillance for Community Outbreaks of *Shigella* spp. in Argentina. *PLoS Negl Trop Dis* 7(12): e2521;1-13
- Ghosh AN, Bhatta DR, Ansari, MT, et al. Application of WHONET in the Antimicrobial Resistance Surveillance of Uropathogens: A First User Experience from Nepal. *Journal of Clinical and Diagnostic Research*. 2013;7(5): 845-848.
- Vatopoulos AC, Kalapothaki V, Legakis NJ & the Greek Network for the Surveillance of Antimicrobial Resistance. An electronic network for the surveillance of antimicrobial resistance in bacterial nosocomial isolates in Greece. *Bulletin of the World Health Organization*, 1999, 77;70: 595-60587

How to Cite this article :

Sanath P.P, Shreya M.N, Nagamoti M.B. Application Of WHONet For The Surveillance Of Antimicrobial Resistance In Teaching Hospital J Pub Health Med Res 2018;6(2):11-14

Funding: Declared none

Conflict of interest: Declared