Open Access
Original Article
Antimicrobial Drug Resistance
Pak Armed Forces Med J 2018; 68 (4): 986-91

ANTIMICROBIAL DRUG RESISTANCE - SIMULATION BASED METHODICAL ASSESSMENT

Khadija Qamar, Hira Irfan, Nigar Johar

Army Medical College/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To find the efficiency of student moderated sessions and ability of undergraduate students to assess methodically problem at hand and propose globally applicable solutions regarding the antimicrobial drug resistance.

Study Design: A descriptive cross sectional study.

Place and duration of study: Army Medical College, a two day Model United Nations (MUN) simulation from 16 to 17 Feb 2018.

Material and Methods: A total of 57 students were part of World Health Organization (WHO) committee out of which 23 responded to a self-constructed questionnaire. Chi square test of significance was applied to find improvement in scores before and after simulation. A *p*-value of <0.05 was considered significant.

Results: Out of 57 students of preclinical years who took part in cross sectional study 23 were those who responded to the questionnaire both before and after simulations. Ten students (43.5%) out of 23 that responded to questionnaire were male and 13 (56.5%) were female. The association between total test scores before and after simulation by paired sample t-test came out to be <0.001 which was highly significant. Although there was no significant association between each question found by chi-square test yet marked improvement in terms of percentage of positive response was observed.

Conclusion: Our study concludes that student moderated sessions with role assignment significantly increase both knowledge content and interest in students. The draft resolution i.e. comprehensive report of problem at hand identified short comings and proposed solutions which are in line with global reports clearly showing the capability of students to methodically assess and evaluate problem.

Keywords: Antimicrobial resistance, Economic case, Nano particles, Simulation, Student moderated session, Surveillance.

INTRODUCTION

Antimicrobial resistance (AMR) is the ability of a microorganism (like bacteria, viruses, and some parasites) to stop an antimicrobial (such as antibiotics, antivirals and antimalarial) from working against it[1]. As a result, standard treatments become ineffective, infections persist and may spread to others.

World Health Organization (WHO) first release of surveillance data on antibiotic resistance reveals high levels of resistance to a number of serious bacterial infections in both high and lowincome countries, inability to take urgent and effective steps would result in major breakdown in curative healthcare facilities provision against infectious diseases[2].

Resistant microorganisms render treatment of infectious diseases ineffective increasing both mortality and morbidity as well as increasing the burden on the healthcare setup. The incidence of AMR is on rise making it a global concern. Five hundred thousand people in over 22 countries are reportedly affected from AMR and even a larger proportion is susceptible and at risk of being affected[2]. The highest resistance was found in *Escherichia coli*, *Staphylococcus, Streptococcus* closely followed by *Salmonella SP*. Mycobacterium tuberculosis has been under WHO's surveillance since 1994 and statistics are communicated through an annual report[3]. Forty countries provided national healthcare system data while 22 additionally provided data on

Correspondence: Dr Khadija Qamar, HOD Anatomy Department, Army Medical College Rawalpindi Pakistan
Email: colkhadijaqamar@gmail.com
Received: 23 May 2018; revised received: 30 Jul 2018; accepted: 30 Jul 2018

antimicrobial resistance to WHO's surveillance system i.e. Global Antimicrobial Resistance Surveillance System (GLASS)[3]. To ensure effectivity of available treatment and to provide effective, safe and quality approved drugs to all in need global action plan stresses to minimize the causative factors of AMR. All member states are encouraged to add these points in their national health policies as the multidimensional cause of AMR makes global integrated initiative the only plausible solution.

Student moderated session is relatively newer learning technique that employs the use of focused discussion groups in learning and problem solving and is being employed in many extracurricular activities such as MUN. This student moderated sessions alongwith enhancing knowledge nurture leadership and writing skills, teamwork, ability to negotiate, public speaking and the art of scientifically analysing problems. The topic of discussion was chosen to be AMR considering its global importance, the study course of the participants and taking into account the fact that medical professionals are both the direct cause of developing and perpetuators of other causes of development of AMR. Healthcare professionals alone can be the largest party to curb this global crisis by judicial use and promoting public awareness in this regard.

The rationale of this study was to identify the problem awareness among the under-graduate medical students as how to manage and prevent infectious diseases with effective medicines those are safe to use, dispensed in accordance to global recommendations, evidence based use and prescription available to all assessing their ability to methodically assess problem at hand gauging effectivity of student moderated sessions with role assignment.

MATERIAL AND METHODS

This descriptive cross sectional research was conducted at Army Medical College from 16 to 17 February 2018. The duration of study was a two day MUN Simulation. Through non-purposive convenient sampling 57 students who were part of the WHO committee of simulation were included in the study. This research was approved by ethical review committee, informed voluntary consent was taken by participants before starting interview and no risk or harm was anticipated to best of our knowledge. Data were collected by self-constructed questionnaire (verified by medical educationalist) and from the working paper and draft resolution passed by the committee. The tool employed was a closed ended questionnaire. It was composed of two parts; first part was related to general knowledge about AMR and second part to steps taken worldwide. Data were entered and analyzed in SPSS 22. Qualitative data were presented as frequencies and percentages.

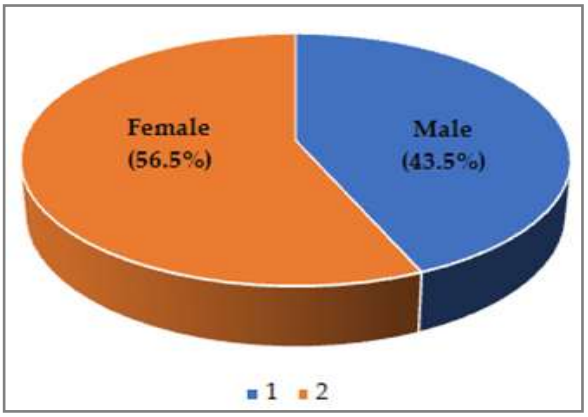

Figure-1: Gender distribution.

We used a thematic framework analysis specifically designed for applied qualitative research to identify emergent themes from respondents' antibiotic resistance definitions entered as free-text. Quantitative data were presented as mean and standard deviation. McNemar's test of significance was applied to find improvement and scores before and after simulation and paired sample t-test was applied to find association between total scores. A *p*-value of <0.05 was considered statistically significant.

RESULTS

Out of 57 students that took part in proceedings of the session, 23 were part of the cross-sectional study which included a 10 items self-constructed questionnaire. Out of 23

undergraduate students of pre-clinical years, 10 (43.5%) were male while 13 (56.5%) were female with a mean age of 20.78 ± 0.6 years. Details are in fig-1.

The first 5 questions were related to the topic of discussion i.e. AMR. For the first question of statement "AMR is consequence of" only 4 (17.4%) answer correctly however 14 (60.9%) responded positively after the two day simulation. Table-I summarizes responses in terms of absolute and relative frequencies from Q1-Q5.

Q6-Q10 were regarding the global initiatives taken to cater for the problem under discussion and table-II summarizes responses before and after simulation in terms of absolute and relative frequencies. Fig-2 is graphical presentation of positive responses before and after simulation.

Table-I: Associations of questions regarding awareness of AMR.

	Absolute Frequency (*f*)		Percentage Frequency (%*f*)		*p*-value
	Before	After	Before	After	
AMR is consequence of.	4	14	17.4	60.9	0.49
First drug against which R developed.	15	22	26.1	95.7	0.016
Nanoparticles are used in diagnosis.	6	13	26.1	56.5	0.29
Antibiotics should be used.	6	16	26.1	69.6	0.5
WHO region having highest percentage of AMR.	6	17	26.1	73.9	1

Though association for every question independently was not significant however a large difference in terms of percentage of positive response is evident. When total score for the ten questions was assessed before and after the simulation a significant *p*-value of <0.001 was found.

In the two day committee session, a total of 57 delegates took part in proceeding of the house. They identified problems proposed to the house for discussion and pertinent implementable solutions were proposed keeping in view the current work and associations of WHO. Through framework analysis we distinguished 3 major themes based upon the entity that develops resistance to antibiotics. These were lack of new drug development - WHO promotes research with various projects being started under its umbrella and Global Antibiotic Research & Development Partnership (GARDP). The house taking into account the shortcomings proposed to develop a monetary programme which outlines guideline for sustainable investment, that takes account of needs of all countries, increasing investment in new medicines, diagnostic tools and vaccination and environmental factors like sanitation and pharmaceutical company waste- Currently this issue is being handled by each country's individual national policies while WHO stresses on public health services. House proposed implementation and support programs for public health service in lieu of current launched region based WHO programmes with a globally implementable legalization on inap-propriate industrial (in regard of discussion pharmaceutical) waste disposal (table-III).

Minor themes, cataloged as subsets of the major themes, conveyed reasons for or causes of antibiotic resistance. The first minor theme addressed antibiotic overexposure, overpre-scription, overuse and misuse, often conjointly with idea that failure to complete antibiotic courses promotes antibiotic resistance. The second minor theme, about evolution, mutation, and adaptation, appeared primarily among the responses correctly relating antibiotic resistance to bacteria. A third minor theme indicated that an

immune response, developed by bacteria, the body, or the illness, resists antibiotics. This was the most common minor theme among responses within the major theme that one's physical body is what becomes resistant to antibiotics.

Over the counter availability of antibiotics-WHO considers it to be an important factor however till yet to tangible steps have been taken. The house proposed authorized health professionals and veterinary doctors to be given the right to prescribe and distribute drugs under a supervisory body or other suitably trained person authorized in accordance with national legislation. To cater for poor drug quality no current global program is currently in progress. The house proposed marketing authorization resistance in them with public awareness campaigns to be started utilizing mass media. For public awareness WHO promotes AMR week and house proposed to strengthen it with programs at national and international level targeting different audiences in human health, animal health and agriculture practice and strengthening community communication. Surveillance program launched by WHO is Global antimicrobial resistance Surveillance System (GLASS) which lacks proper input from national health departments. The house proposed to manage it at national and provincial level for effective working of GLASS. The recommendations included development of a national antimicrobial advisory council to oversee proper

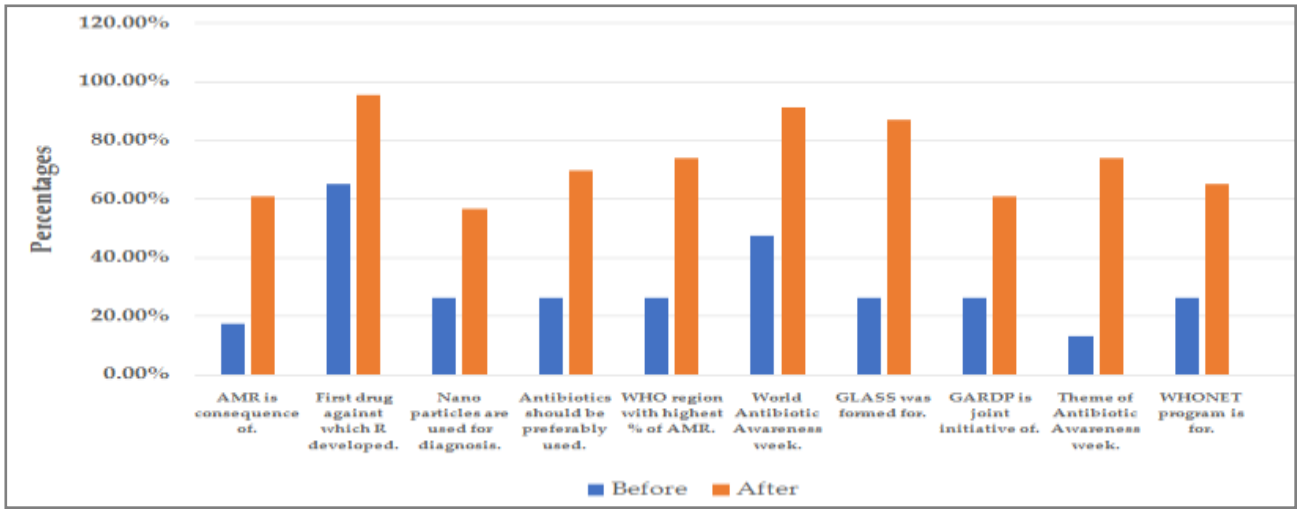

Figure-2: Positive responses before and after simulation.

to be given only to antimicrobial agents that fulfil strict quality criterion as per WHO recommendations. For misuse and abuse of antimicrobials, WHO has various awareness campaigns the house proposed to reinforce them by making preparing and instruction on contamination aversion measures as compulsory necessity in proficient improvement, accreditation and enlistment to maintain a strategic distance professional negligence. Self-medication is a serious problem and WHO promotes no specific targeted program. House's propositions were that school curricula should inculcate antimicrobial proper use and consequences of use of antimicrobial drugs, a directorate addressing AMR at the ministry of health and also managing budgets allotted by WHO through decision of advisory council and set targets and outcomes to be achieved at provincial and district level. Utilizing hospital management systems for effective district level surveillance and reporting with National Health Advisory council to report to regional WHO Headquarters. Each national reference center should have the ability to systematically collect and analyze data in conjunction with GLASS. Animal health and agriculture sector over the course of time have become an evident contributor to AMR to contain which

WHO advisory group on integrated surveillance of AMR was established, the house favored strengthening surveillance by implementing recommendations of WHO advisory group for antimicrobial susceptibility testing of foodborne pathogens and making it compulsory for each member state with regional headquarters providing technical and adminis-trative support. Publications and sharing of data is the only way to stay abreast with current situation and to quantify the effects of steps taken. WHO has launched GLASS program while house proposed working with United Nation (UN) bodies in collaboration to collect, consolidate and publish information also considering legal and ethical requirements. Global response by WHO is establishment of GLASS and GARDP and house proposed to elaborate it with collaborative research to bolster improvement of new medicines, working with different associations to encourage the advancement and clinical assessment of particular need antibodies for anticipation of hard to-treat or untreatable contaminations. To counter for the viable administration of money related requirements the house proposed to work with World Bank and other improvement banks to create and execute a layout to assess the venture expected to actualize national and global action plans on AMR and to group and condense these necessities.

DISCUSSION

Our results showed that student moderated sessions increase both knowledge and interest in studies as well as polish students' ability to methodically assess problem at hand.

A metanalysis[4] and a research conducted in texas[5] in accordance to our research demonstrated that small group learning sessions which are student moderated are effective in promoting greater academic achievement and more positive attitude towards learning. A Belgian study[6] stated that role assignment in asynchronous discussion groups resulted in significantly higher level of knowledge construc-tion in students which is in accordance to our study where a significant association was found in before and after total test scores with mean of 2.96 and 7.35 respectively.

A research conducted in Atlanta[7] like our committee recommended careful and rational use of antimicrobial agents, development of new agents and vaccines for control of AMR. However, it did not lay out any plan for implementation of these ideas like our committee.

A research conducted in Italy[8] also supported the fact that vaccines decrease development of AMR. An English research[9] statistically proved decreased resistance development in

Table-II: Associations of questions regarding world response awareness.

	Absolute frequency (*f*)		Percentage frequency (%*f*)		*p*-value
	Before	After	Before	After	
World antibiotic awareness week.	11	2	47.6	91.3	0.01
GLASS was formed for.	6	20	26.1	87.0	0.74
GARDP is joint initiative of.	6	14	26.1	60.9	0.72
Theme of antibiotic awareness week.	3	17	13.0	73.9	0.74
WHONET is computer program for.	6	15	26.1	65.2	0.86

Table-III: Association before and after scores.

	Mean		S.D		Minimum		Maximum		*p*-value
	Before	After	Before	After	Before	After	Before	After	
Total Score	2.96	7.35	1.107	1.641	1	4	5	10	<0.001*

*$p \leq 0.05$=significant.

strains with known vaccines; this too was in line with the solutions provided by our committee.

Our committee recognized lack of environmental sanitation practices as one of the main factors in development and transmission of AMR. A study conducted in England[10] also supported this fact, however, in addition to our committee's suggestion it also provided a detailed protocol; especially for hospital sanitation.

Our committee outlined drawbacks in current surveillance systems and a study conducted in Europe[11] did agree that non-coverage of population was a factor affecting surveillance with average coverage of population in countries participating in EARSS being 52%. However, it didn't provide any framework for global exchange of data with the ability to be utilized in research, health policies and publications. However, an English study[12] encompassed both drawbacks and plausible solutions to surveillance systems.

Our committee laid stress on controlled use of antimicrobials in agriculture and livestock, studies conducted in USA[13] and Europe[14] supported the fact that increasing use of antimicrobials in agriculture and livestock is increasing resistance.

An American[15] study did take into account the monetary implications of AMR, however, it didn't provide any elaborate global economic case like our committee.

CONCLUSION

Our study concludes that student moderated sessions with role assignment significantly increase both knowledge content and interest in students.

The committee's careful analysis on AMR in general and steps to counter it concluded that policies that exist require implementation framework while initiating global response for research and development of vaccines along with accurate and early data sharing requires a lot of work. Appropriate budgeting and accountability is also a neglected area that needs to be worked upon. Identification of these shortcomings as well as proposed solutions are in line with global reports which shows that students are fully capable of methodically assessing problem at hand and presenting their ideas in implementable format.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

1. Antimicrobial resistance [Internet]. World Health Organization. 2018 [cited 2018]. Available from: http://www.who.int/ mediacentre/ factsheets/fs194/en/
2. High levels of antibiotic resistance found worldwide, new data shows [Internet]. World Health Organization. 2018 [cited 2018]. Available from: http://www.who.int/ mediacentre/ news/releases/2018/antibiotic-resistance-found/en/
3. UN health agency finds high levels of antibiotic resistance to world's most common infections [Internet]. UN News. 2018 [cited 2018]. Available from: http://www.un.org/ apps/ news/ story.asp?NewsID=58499#.WuKJPOqgfIX
4. Springer L, Stanne ME, Donovan SS. Effects of Small-Group Learning on Undergraduates in Science, Mathematics, Enginee-ring, and Technology: A Meta-Analysis. Educ Res Rev 1999; 69(1): 20-51.
5. Lyon DC, Lagowski JJ. Effectiveness of facilitating small-group learning in large lecture classes. J Chem Educ 2008; 85(11): 1571.
6. Wever BD, Keer HV, Schellens T, Valcke M. Applying multilevel modelling to content analysis data: Methodological issues in the study of role assignment in asynchronous discussion groups. Learning and Instruction 2007; 17(4): 436-47.
7. Cohen ML. Epidemiology of drug resistance: Implications for a post-antimicrobial era. Science 1992; 257(5073): 1050-55.
8. Mishra RPN, Oviedo-Orta E, Prachi P, Rappuoli R, Bagnoli F. Vaccines and antibiotic resistance. Curr Opin Microbiol 2012; 15(5): 596-602.
9. David FJ, Keith KP, Michael P. Increased Antimicrobial resistance among nonvaccine serotypes of streptococcus pneumoniae in the pediatric population after the introduction of 7-valent pneumococcal vaccine in the United States. Pediatr Infect Dis J 2007; 2(2): 123-28.
10. Dancer SJ. The role of environmental cleaning in the control of hospital-acquired infection J Hosp Infect 2009; 73(3): 378-85.
11. Bronzwaer SLAM, Cars O, Buchholz U, Mölstad S, Goettsch W, Veldhuijzen IK, et al. The relationship between antimicrobial use and antimicrobial resistance in europe. Emerg Infect Dis 2002; 8(3): 278-82.
12. Johnson AP. Surveillance of antibiotic resistance. Phil Trans R Soc B 2015; 370(1670): 20140080.
13. Mathew AG, Cissell R, Liamthong S. Antibiotic resistance in bacteria associated with food animals: A United States Perspective of Livestock Production. Foodborne Pathog Dis 2007; 4(2): 115-33.
14. Wise R, Hart T, Streulens M, Huovinen P, Sprenger M. Antimicrobial resistance. BMJ 1998; 317: 609.
15. McGowan JE. Economic impact of antimicrobial resistance. Emerg Infect Dis 2001; 7(2): 286-92.