

# Burden of Infections Caused by Multidrug Resistant Organisms and Antibiotics Stewardship Program in Poor Country

Burden of Infections Caused by Multidrug Resistant

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## ABSTRACT

**Objective:** To assess the burden of resistant infections and need for Antibiotic Stewardship Program at hospital of resource limited country.

**Study Design:** Prospective cross-sectional study

**Place and Duration of Study:** This study was conducted at the Department of Pulmonology, Fatima Jinnah Chest Institute affiliated with Bolan Medical College Quetta from January 2017 to December 2019.

**Materials and Methods:** Two hundred and two patients aged 14 years and above with pneumonia or sepsis, admitted to intensive care unit, high dependency unit and ward were enrolled. Demographics, physical examination findings, duration of illness and use of antimicrobials (along with group) during last three months were documented. Blood, respiratory secretions, pleural fluid/pus, and urine samples are sent for microbiological studies at time of admission.

**Results:** One hundred and sixty (79.2%) showed positive bacterial growth while 42 (20.8%) exhibited no growth. Out of 160 positive samples, 66 (41.2%) grew multi-drug resistant *Pseudomonas* 28 (17.5%) samples grew extended spectrum beta lactamases producing Gram negatives and 17 (10.7%) showed growth of Methicillin resistant *Staphylococcus aureus*. One hundred and thirteen (70.6%) of patients were required care in critical areas like intensive care unit and high dependency unit.

**Conclusion:** Infections caused by multi-drug resistant organisms are very high in our country. Patients infected with resistant organisms generally require admission to critical care areas that might have significant financial implications on patients and hospital budgets.

**Key Words:** Multi-drug resistant organism, Antibiotic Stewardship Program, Burden

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## INTRODUCTION

The MDRO is a microbe that resists three or more kinds of antimicrobial drugs. The MDROs are primarily bacteria.<sup>1</sup> These include *Staphylococcus aureus* (MRSA) resistant methicillin (SMR), *Enterococci* (VRE) species resistant to vancomycin, *Enterobacteriaceae* generating carbapenemase and

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Gram negatives that produces large spectrum beta-lactamases (ESBLs). These two last kinds of diseases produce compounds that resist the effect of some antimicrobials and this adaptability between various species is easily transferred.<sup>2</sup> Antimicrobial resistance is one of the largest challenges to human, animal and ecological health in the world at present.<sup>3-4</sup> The emergence and spreads of AMR continue to pose severe concerns by the abuse and misuse of antibiotics in human beings and animals, although this is a natural evolutionary phenomena.<sup>5</sup> Resistance to antimicrobials impacts on financial sustainability, global health, food and safety, environment and socioeconomic development.<sup>6</sup> Antimicrobial resistance has had a negative impact such as severe illnesses, longer hospital stays, increased healthcare expenses, a heavier public health system, higher second-line medicines costs, failure to treat and even greater levels of death.<sup>7</sup> Antimicrobial stewardship has been defined as the appropriate treatment selection, dosage and duration of antimicrobial therapy resulting in the best clinical outcome for infection treatment or prevention, with

minimum patient toxicity and low consequences for the resistance to infection.<sup>8</sup> Includes the unjustified use of broad spectrum antibiotics as well as poor prevention and management of infections and antibiotic stewardship policies, which are the key causes which increase Pakistan MDR rates.<sup>9-11</sup>

As a result, throughout the past years, an AMR spike has been seen, making drug therapy challenging for infectious conditions such as typhoid, tuberculosis, etc.<sup>12,13</sup> In 2016, the Pakistan Society for Medical Microbiology & Infectious Diseases approved the Guidelines for combating antibiotic (ASP) Resistance laid down by the World Health Organization (WHO) Global Plan of action (GAP).<sup>14,15</sup> We conducted present study that aimed to determine the burden of multi-drug resistant infections and need for Antibiotic Stewardship Program at hospital of resource limited country.

## MATERIALS AND METHODS

This prospective cross-sectional study was conducted at Department of Pulmonology, Fatima Jinnah Chest Institute affiliated with Bolan Medical College Quetta from January 2017 to 31st December 2019 and comprised of 202 patients. Patients below 14 years of age and those did not give any written consent were excluded. Patients aged 14 years and above with pneumonia or sepsis, admitted to intensive care unit (ICU), high dependency unit (HDU) and ward were enrolled. Demographics, physical examination findings, duration of illness and use of antimicrobials (along with group) during last three months were documented. Blood, respiratory secretions, pleural fluid/pus, and urine samples are sent for microbiological studies at time of admission. Complete data was analyzed by SPSS 22.

## RESULTS

There were 110 (54.45%) male patients and 92 (45.54%) were female patients. Mean age of the patients was 32.54±8.36 years. One hundred and twenty (59.40%) were from urban area, 115 (56.9%) were literate and 108 (53.46%) were from high socioeconomic status (Table 1). One hundred and sixty (79.2%) showed positive bacterial growth while 42 (20.8%) exhibited no growth. Out of 160 positive samples, 66 (41.2%) grew multi-drug resistant (MDR). Pseudomonas 28 (17.5%) samples grew extended spectrum beta lactamases producing Gram negative and 17 (10.7%) showed growth of Methicillin Resistant Staphylococcus aureus (Table 2). One hundred and thirteen (70.6%) of patients were required care in critical areas like ICU and HDU among 160 cases of positive growth (Table 3).

**Table No.1: Baseline details demographics of enrolled cases (202)**

Variable	No.	%
Mean age (years)	32.54±8.36	
<b>Gender</b>		
Male	110	54.45
Female	92	45.54
<b>Educational status</b>		
Illiterate	115	56.9
Literate	87	43.06
<b>Locality</b>		
Rural	120	59.40
Urban	82	40.6
<b>Socioeconomic status</b>		
High	108	53.46
Low	94	46.54

**Table No.2: Outcomes after culture and sensitivity reports (n=202)**

Variable	No.	%
<b>Bacterial growth</b>		
No	42	20.8
Yes	160	79.2
<b>Positive bacterial growth (n=160)</b>		
MDR Pseudomonas	66	41.2
ESBL	28	17.5
MRSA	17	10.7
Others	49	30.6

**Table No.3: Treatment and admission of affected cases in ICU and HDU (n=160)**

ICU/HDU Admission	No.	%
No	113	70.6
Yes	47	29.3

## DISCUSSION

There is little or no such monitoring in most developed countries to ensure appropriate monitoring of antibiotic resistance development. In 2014, the WHO released its first antimicrobial resistance report, in which the World Health Organization collected country data on nine bacterial infections/antimicrobial combinations that are the most serious health concerns.<sup>16</sup> In this prospective cross-sectional study 202 patients with ages >14 years were presented. Mean age of the patients was 32.54±8.36 years. Majority 110 (54.45%) cases were males and the rest were 92 (45.54%) female patients. Our findings were comparable to the previous study.<sup>17</sup> In the current study mostly infected patients were non-educated 56.9% and from rural areas 59.40%. Majority of the patients 53.46% had high socioeconomic status.

There are a shortage of qualified doctors and health workers certified for diagnosing and treating illnesses in many developing countries and particularly rural areas. As a consequence, many unqualified, low-training medical workers as well as traditional healers treat and prescribe antibiotics.<sup>18</sup> A study of pediatric diarrhea and pneumonia carried out in rural India indicated that out of 340 doctors, 80 of them did not have formal schooling.<sup>19,20</sup> The study also found that unskilled professionals are more likely to prescribe dangerous treatments.<sup>20</sup> The repercussions of unrestricted antibiotic usage are often little or nothing understood by unqualified health personnel and healers.<sup>21</sup>

We found in our study that, one hundred and sixty (78.4%) showed positive bacterial growth while 44 (21.6%) exhibited no growth. Out of 160 positive samples, 66 (41.2%) grew multi-drug resistant (MDR). *Pseudomonas* 28 (17.5%) samples grew extended spectrum beta lactamases producing gram negatives, and 17 (10.7%) showed growth of Methicillin Resistant *Staphylococcus aureus*. These results were comparable to the previous findings in which use of medications without prescriptions had adverse effects.<sup>21,22</sup> While antibiotics have been prohibited in Europe since 2006 as growth boosters, this practice remains standard in numerous nations, including the United States.<sup>23</sup>

In the current study 70.6% patients were required care in critical areas like ICU and HDU among 160 cases of positive growth. Previous study presented same results.<sup>24</sup> The hospitals have an important role in preventing the appearance and transmission of antimicrobial resistant micro-organisms and ensuring that the available antimicrobials are effective. Infection and antimicrobial stewardship programs are run by multi-disciplinary expert teams such as infectious diseases doctors, clinical pharmacists, clinical microbiologists.<sup>25,26</sup>

## CONCLUSION

Infections caused by multi-drug resistant organisms are very high in our resource limited, developing country settings. Patients infected with resistant organisms generally require admission to critical care areas that might have significant financial implications on patients and hospital budgets. This might also be a contributing factor to global threat of antibiotics resistance. Implementation of Antibiotic Stewardship Program could be the only evidence based solution to this problem.

### Author's Contribution:

Concept & Design of Study: Muhammad Farooq  
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**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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