

# Antimicrobial Stewardship Program of Postgraduate Institute of Medical Education and Research, Chandigarh: Running Fast to catch the Missed Bus

<sup>1</sup>Nusrat Shafiq, <sup>2</sup>M Praveen Kumar, <sup>3</sup>Gautam Kumar, <sup>4</sup>Rachna Rohilla, <sup>5</sup>Shruti Saha, <sup>6</sup>Vikas Gautam  
<sup>7</sup>Ritesh Agarwal, <sup>8</sup>Pallab Ray, <sup>9</sup>Gurpreet Singh, <sup>10</sup>Jayashree Muralidharan, <sup>11</sup>Pankaj Arora

## ABSTRACT

Antimicrobial stewardship is a coordinated multidisciplinary effort directed at judicious use of antimicrobials. While antimicrobial stewardship is a routine activity in the developed world, the concept has evolved only of late in the developing countries including India. Started initially as a research project, a formal antimicrobial stewardship committee was constituted in the institute. The present article highlights the work done so far, problems faced, and the future of antimicrobial stewardship related activities in the institute.

**Keywords:** Antimicrobial stewardship, Rationale, Tertiary care hospital.

**How to cite this article:** Shafiq N, Kumar MP, Kumar G, Rohilla R, Saha S, Gautam V, Agarwal R, Ray P, Singh G, Muralidharan J, Arora P. Antimicrobial Stewardship Program of Postgraduate Institute of Medical Education and Research, Chandigarh: Running Fast to catch the Missed Bus. *J Postgrad Med Edu Res* 2017;51(3):123-127.

**Source of support:** Nil

**Conflict of interest:** None

## BACKGROUND

A shift in the burden of diseases from communicable to non-communicable diseases was accompanied by a change

in the focus of all and sundry from the former to the latter. While this shift did occur and non-communicable diseases rightly got their due, there was also a change in the patterns of communicable diseases. A report was presented in Annual ICAA/IDSA meeting at Washington regarding a novel subgroup of metallo-beta-lactamase (MBL), New Delhi Metallo- $\beta$ -lactamase (NDM-1).<sup>1</sup> This was followed by more publications on the issue.<sup>2,3</sup> The naming of the resistant gene aroused an apt remark, "a disease or gene by any other name would cause a stink."<sup>4</sup> While the appropriateness of the name assigned to MBL was being debated, it did act as a catalyst in creating awareness for the problems of antimicrobial resistance. Two landmark papers<sup>5,6</sup> appeared close on the heel of the above reports. An important tenet of both these papers was to delineate the need for curtailing indiscriminate and irrational use of antimicrobials to prevent the development of resistant microbial population. It is now well-established that there is a causal association between antimicrobial usage and antimicrobial resistance.<sup>7</sup> Being the highest users of antimicrobials,<sup>8</sup> we can understand the precarious situation that we imminently face. Our day-to-day encounters with infections and the changing antimicrobial susceptibility require no rocket science to conclude that we may already be too late. The burden of antimicrobial use which is amenable to intervention is the injudicious and irrational use of antimicrobials. Antimicrobial stewardship is one of the ways of cutting down unjustified use of the antimicrobials.

## What is Antimicrobial Stewardship about?

Simply speaking, antimicrobial stewardship refers to the coordinated interventions, which are directed at judicious use of antimicrobials. All antimicrobial stewardship activities are guided by the broader aim of achieving improved clinical outcomes while minimizing adverse outcomes of antimicrobial use including that of development of resistance.<sup>9</sup> The other important outcome of antimicrobial stewardship program has been reduction of health care costs.<sup>10</sup> Despite such programs being routinely conducted in health care settings in the developed world, paucity of such programs in the developing countries is a matter of grave concern. Some problems peculiar to health care settings in India would be large numbers of patients,

<sup>1</sup>Additional Professor, <sup>2-5</sup>Junior Resident, <sup>6-10</sup>Professor  
<sup>11</sup>Assistant Professor

<sup>1-5</sup>Department of Pharmacology, Postgraduate Institute of Medical Education and Research, Chandigarh, India

<sup>6,8</sup>Department of Medical Microbiology, Postgraduate Institute of Medical Education and Research, Chandigarh, India

<sup>7</sup>Department of Pulmonary Medicine, Postgraduate Institute of Medical Education and Research, Chandigarh, India

<sup>9</sup>Department of General Surgery, Postgraduate Institute of Medical Education and Research, Chandigarh, India

<sup>10</sup>Department of Paediatric Medicine, Postgraduate Institute of Medical Education and Research, Chandigarh, India

<sup>11</sup>Department of Hospital Administration, Postgraduate Institute of Medical Education and Research, Chandigarh, India

**Corresponding Author:** Nusrat Shafiq, Additional Professor Department of Pharmacology, Postgraduate Institute of Medical Education and Research, Chandigarh, India, Phone: +919478000822, e-mail: nusrat\_shafiq@hotmail.com

low doctor-to-patient ratio, lack of awareness about the problem of antimicrobial resistance, lack of guidance documents, inadequate microbiological facilities to guide choice of antimicrobials based on susceptibility patterns, over-the-counter availability of antimicrobials, and the near absence of a mechanism of the audit of prescriptions. A tertiary care center like ours has to face the additional problem of increased patient load, referrals who are already on broad-spectrum antimicrobials, no details of the patient's microbiological cultures and antibiotic sensitivity data when referred from other hospitals, no particulars of the antimicrobial treatments which were already received.

There are several techniques which have been used for antimicrobial stewardship. Broadly, these are classified as "front-end" and "back-end." These include formulary restriction, treatment algorithms, prospective audit and feedback, clinical guidelines, education, antibiotic cycling, dose optimization, computer-assisted decision support programs, and optimal timing of switch from IV to oral route.<sup>11</sup> Of these, prospective audit and feedback, formulary restriction and education are backed by good quality evidence to show that intervention using these techniques leads to positive outcomes.<sup>9</sup> Above all, prospective audit and feedback is an important component of all the guidelines for antimicrobial stewardship.

### **What have we done so far?**

As part of a small initiative, we set out to understand the patterns of antimicrobial usage across different areas of the institute. Further, we standardised our audit forms for evaluating antibiotic prescriptions and consumption. As this study was progressing, an antimicrobial stewardship committee was formed in the institute, which was assigned the task of looking into the use of antimicrobials in the hospital.

#### *Laying the Foundation for Prospective Audit and Feedback*

Since prospective audit and feedback has been recognized by nearly all authorities on the subject, we undertook the exercise of establishing a format for capturing the relevant data. After several trial runs and meetings with the stakeholders (pharmacologists, microbiologists, and clinicians), we drafted a generic form for capture of the required data. Most of the institutes worldwide depend on the data from hospital pharmacy. There were several roadblocks to achieve this purpose, the main being the fact that the hospital pharmacy caters to the need of only a minority of the patients. Further, this data would have provided only an indication of the antimicrobial consumption and the appropriateness of the antibiotic use could not have been

determined. Keeping these facts in mind, the format, we designed, had the components that could track the antimicrobial used, appropriateness (with regards to choice, dose, and duration) of the antimicrobial treatment given, microbiological data, and outcomes (clinical and microbiological). Simultaneously, with the help of information technology section of the department, we developed an electronic system for transcribing and analyzing the data. In the initial phase, only residents from the Department of Pharmacology were assigned the job of completing the record forms and presenting the reports. However, for the system to bring about meaningful changes, it has to have regular inflow of data and periodic feedbacks. Hence, as a pilot exercise, residents in three selected units were asked to fill out the form on a daily basis. These forms had to be retrieved from the patients' file at the time of shifting out of patients and were collected by the pharmacology residents for collating, analysing, and reporting the findings to the unit. An electronic format for transcription of information and analyzing the available information has also been developed.

We were assigned the job to streamline the use of antimicrobials in a recovery unit, which is akin to an intensive care unit (ICU).<sup>12</sup> Patients admitted in the unit are often critically ill, on ventilatory and/or vasopressor support. Having identified the key areas for intervention, we intervened by regularly helping residents make decisions about appropriate choice, dose, and duration of antibiotics. All these discussions were left as suggestions with final decision remaining with the consultant incharge for making any changes. We also made suggestions regarding optimal doses, discontinuation of redundant antibiotics, escalation or addition of an antibiotic on a case-by-case basis. While the residents were initially reluctant to join the discussions, this is now something that they look forward to. The outcome of this initial exercise is summarized in the form of publication.<sup>12</sup>

This system worked with watchful oversight by unit in charge. The purpose of this arrangement was that if unit head takes upon himself/herself to instruct the residents to have the system running, it would be a doable exercise in ICUs and wards. Efforts by the respiratory ICU team in this regard were exemplary. They have even piloted the exercise of concurrent filling and advise if any.

#### *Surgical Prophylaxis Guidelines and Audit*

The second area which required attention was that of surgical prophylaxis. Based on our initial audit, we understood the pattern of surgical prophylaxis practices across the hospital. We observed that there was a wide variation in surgical prophylaxis practices not only between different departments but also within the department. Further, the antimicrobials were being continued for a duration

which did not commensurate with available guidelines and reasoning. During our extensive discussions on the use of inappropriate antibiotics, we understood that it arose out of fear of inadequate sterilization techniques, environmental contamination, and nonavailability of data regarding antimicrobial sensitivity patterns to back the practices. The susceptibility data, although, being circulated periodically was underutilized in policy formulation. With this background, we decided to start the stewardship with a single surgical unit, where it was proposed that suggested modifications of the prophylaxis regimen will be followed. The patients were followed for the development of surgical site infections and the hospital acquired infections. Though surgical prophylaxis is not directed against hospital acquired infections, we included it as a part of confidence building measure. The data so obtained was discussed with the faculty members of the unit. It was then suggested that they develop a consensus guideline with all the faculty members participating in the process. Barring a few departments, most of the departments have participated in the initial phase. It was a welcome sign, considering the fact that it was reflective of receptiveness for the idea of developing surgical prophylaxis guideline.

Wherever these were developed, we also maintained a system for conducting regular audits. These audits will not only help in exploring the extent of adherence but also analyzing and addressing the reasons for deviation. The real challenge lies in making the system of audit work in an effective manner. Interestingly, two departments within the institute (Obstetrics and Gynecology and Urology) have initiated the process of auditing the adherence to surgical prophylaxis guidelines and outcomes related to infection. Both the departments are facing hurdles in maintaining the audit system and are currently exploring the ways to overcome the same.

### *Education regarding Rational Use of Antimicrobials*

Early, during the course of our activities, we learnt that there was a dire need for educating the stakeholders. As ours is a tertiary care teaching center, the residents and fellows not only learn the art of practising medicine, but also take the learnt lessons to the outside world on the completion of their course. This is of great relevance to antimicrobial use.

### *Dose Optimization*

Inappropriate dosing includes a range of problems that includes under dosing (e.g., colistin) which leads to selection of resistant subpopulation due to selective pressure and thus antibiotic resistance,<sup>13</sup> overdosing and too frequent dosing (e.g., aminoglycosides) leading to increased

risk of side effects, infrequent dosing (e.g., piperacillin-tazobactam) increasing risk of therapeutic failure. Other problems which add up to this list include failure to administer loading dose (e.g., colistin, fluconazole), shorter duration of infusion (meropenem, imipenem), and failure to adjust dose in special population (pediatric, obese, renally or hepatically compromised). To address this issue, during our interaction in the multidisciplinary rounds and telephonic conversation, we emphasized the need for correct dosing and also provided patient tailored doses on need basis. The process of establishing the optimal doses for patients in a particular setting for a few antimicrobials has been started. We are currently developing an android app that aims to serve as quick reference for dose-related queries.

### *Training for Judicious Use of Antimicrobials*

It was realised that there was a need of providing up-to-date information about changing guidelines and antibiotic associated queries to help clinicians taking important decisions in certain cases. So, at the behest of certain unit, multidisciplinary rounds were initiated. The queries regarding the cases were sent to us for weekly discussions. Our team then provided unbiased up-to-date information about the appropriate treatment or antibiotic and thus guide the clinician in further management of the case. This has been instrumental in reducing inappropriate use of antibiotics, tailoring the antibiotics when required and improving patient outcome while simultaneously providing the residents training for making decisions about the judicious antimicrobial use.

A one-day program for priming medical professionals regarding antimicrobial stewardship and its relevance was undertaken by us in the Department of Pharmacology. It was sponsored by National Academy of Medical Sciences. The participants were shown possible ways of forming teams and initiating antimicrobial stewardship program in their respective health care settings.

Further to this, similar program was also undertaken by the Department of Pediatrics for rational use of antibiotics in ICUs.

### *Tackling the Problem of “Referrals on Antimicrobials”*

The fourth important aspect that we have understood is that the majority of patients being referred to PGIMER, Chandigarh have already been started on antimicrobials. Quite often, these could be categorized as irrational. Compounding this problem is the fact that the details of microbiological workup done in the referring centers are either nonexistent or are unavailable. This not only makes further decision-making tricky, but also perpetuates

resistant bugs. We have often seen cases wherein a particular carbapenem to which the infective organism showed sensitivity was not given to the patient and instead another carbapenem to which it was resistant was administered. It was thus felt that while we improve our systems, there was a need to improve the practices in the other health care settings. With this background, we conducted a public forum with a group of panelists to address queries raised by lay persons. This was a first in the series of dialogues that we wish to start with all stakeholders. It is not uncommon that we find patients being prescribed antibiotics for common cold or dengue, even injectable. Several important questions were raised by participants, such as “How does a common person know whether the use of antibiotic is justified or not”; “What role do teachers have in dealing with this issue?”, “What are the consequences of growing antimicrobial resistance”, “What do we have to say about over-the-counter sale of antibiotics.” All these queries were addressed by panelists from various medical specialities and also experts who have worked in the community. Currently, we are undertaking a study to help us understand the kind of antimicrobial prescriptions various patients report to us within the emergency department. This exercise will help us guide our policies for deciding actions to be taken in emergency for such cases.

A brief summary of our activities is outlined in Flow Chart 1.

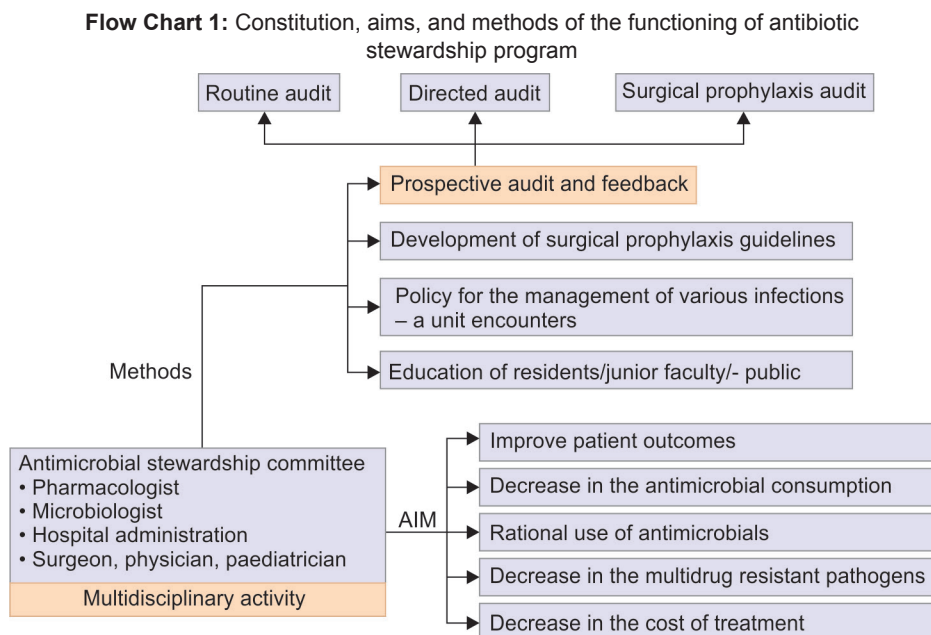
**Hurdles that need to be overcome**

Despite a very good practice of interdepartmental cooperation in our institute, most of the discussions amongst the experts for administering the most suitable treatment to patients were not without hurdles. The entire exercise

is being carried out without any monetary or personnel support. The administration is providing support in terms of passing orders for compliance and making audit forms available in files. However, much more is needed. Every head of the unit and department should emphasize upon the residents the need for improving antimicrobial use and filling out the forms meant for audit correctly. Further to this, any audit report should be taken constructively with an open mind to improve practices. We are not far away from a point when the success stories in the field of surgery, transplants, and cancer management would come tumbling down, if we do not contribute to this exercise.

The second important hurdle we have faced is regarding the argument of contaminated environment. No doubt, it is a concern and we have to get infection control practices in order. Infection control committee is working actively in training health care workers with good infection prevention and control practices. One needs to understand that infection control is as much of an individual responsibility as of the infection control committee. A message of zero tolerance to violation of infection control practices has to become a norm. A key person in this endeavor would be the unit in charge as it has been observed that good practices percolate from top-down. In addition, a very important role is played by the nursing staff. More involvement of this body of staff is much needed.

The third hurdle was perception of audit process as an intrusion to the decision-making powers of the treating consultant. This is a myth since we have just been leaving suggestions regarding appropriate antibiotic, its duration and dose. The final decision is at the discretion of the treating consultant.



The fourth significant hurdle is ICUs in particular. In ICUs, clinicians deal with critically ill patients requiring timely selection and administration of antibiotics to improve outcomes. The problem often starts with distinguishing “systemic inflammatory response system” from “sepsis.” Patients in ICU often have had a protracted stay in other units, often are harbouring multidrug-resistant organisms and may have end-organ failure. To top this, there is considerable variation in epidemiology of cases with infection in different ICUs of the hospital. Every ICU should have its own microbial audit, regular education, and multidisciplinary rounds to tackle the problem of antimicrobial resistance.

Finally, we have to understand that the antimicrobial stewardship is different from individualized consultation for cases. Stewardship usually occurs in the form of a single or set of exercises carried out collectively at the level of a unit or the institute. Improved decision-making for an individual case could also be considered a part of antimicrobial stewardship.

### What PGIMER needs to do?

We need to gradually move towards a state wherein we can set benchmarks and direct our activities toward achieving the same. This process is highly dependent on the system of prospective audit. Second, we have to commit ourselves to train all the resident doctors, nursing students, and other affiliated staff in the importance of rational use of antimicrobials and ultimately making this practice a compulsory part in their teaching/residency program. Third, we have to develop ourselves as a model for antimicrobial stewardship program in a resource compromised setting. Last but not the least, with an active community medicine department and a telemedicine center with links across the region, we intend to initiate an intervention program for health care settings at the primary and secondary care level.

### CONCLUSION

Authors would simply like to tweak the famous Billy Joel’s number— “(Although), we do not start the fire, it was always burning, since the world was turning, we shall hopefully douse the fire.”

### REFERENCES

1. Yong D, Toleman MA, Giske CG, Cho HS, Sundman K, Lee K, Walsh TR. A novel subgroup metallo-beta-lactamase (MBL), NDM-1 emerges in *Klebsiella pneumoniae* (KPN) from India. 48th Annual ICAA/IDSA 46th Annual Meeting, Washington DC. 2009 Oct;53(12):C1-105-87.
2. Kumarasamy KK, Toleman MA, Walsh TR, Bagaria J, Butt F, Balakrishnan R, Chaudhary U, Doumith M, Giske CG, Irfan S et al. Emergence of a new antibiotic resistance mechanism in India, Pakistan, and the UK: a molecular, biological, and epidemiological study. *Lancet Infect Dis* 2010 Sep;10(9):597-602.
3. Rolain JM, Parola P, Cornaglia G. New Delhi metallo-beta-lactamase (NDM-1): towards a new pandemic? *Clin Microbiol Infect* 2010 Dec;16(12):1699-1701.
4. Palmer R. A disease—or gene—by any another name would cause a stink. *Nat Med* 2010 Oct;16(10):1059.
5. Ghafur A, Mathai D, Muruganathan A, Jayalal JA, Kant R, Chaudhary D, Prabhaskar K, Abraham OC, Gopalakrishnan R, Ramasubramanian V et al. The Chennai declaration: a roadmap to tackle the challenge of antimicrobial resistance. *Indian J Cancer* 2013 Jan-Mar;50(1):71-73.
6. Ganguly NK, Arora NK, Chandy SJ, Fairuze MN, Gill JP, Gupta U, Hossain S, Joglekar S, Joshi PC, Kakkar M, et al. Global Antibiotic Resistance Partnership (GARP) - India Working Group. Rationalizing antibiotic use to limit antibiotic resistance in India. *Indian J Med Res* 2011 Sep;134:281-294.
7. McGowan JE Jr. Antimicrobial resistance in hospital organisms and its relation to antibiotic use. *Rev Infect Dis* 1983 Nov-Dec;5(6):1033-1048.
8. Van Boeckel TP, Gandra S, Ashok A, Caudron Q, Grenfell BT, Levin SA, Laxminarayan R. Global antibiotic consumption 2000 to 2010: an analysis of national pharmaceutical sales data. *Lancet Infect Dis* 2014 Aug;14(8):742-750.
9. Dellit TH, Owens RC, McGowan JE Jr, Gerding DN, Weinstein RA, Burke JP, Burke JP, Huskins WC, Paterson DL, Fishman NO, Carpenter CF et al. Infectious diseases society of America and the society for healthcare epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. *Clin Infect Dis* 2007 Jan;44(2):159-177.
10. MacDougall C, Polk RE. Antimicrobial stewardship programs in health care systems. *Clin Microbiology Rev* 2005 Oct;18(4):638-656.
11. Doron S, Davidson LE. Antimicrobial stewardship. *Mayo Clin Proc* 2011 Nov;86(14): 1113-1123.
12. Shafiq N, Praveen Kumar M, Gautam V, Negi H, Roat R, Malhotra S, Ray P, Agarwal R, Bhalla A, Sharma N et al. Antibiotic stewardship in a tertiary care hospital of a developing country: establishment of a system and its application in a unit-GASP Initiative. *Infection* 2016 Oct;44(5):651-659.
13. Roberts JA, Kruger P, Paterson DL, Lipman J. Antibiotic resistance—what’s dosing got to do with it? *Crit Care Med* 2008 Aug;36(8):2433-2440.