

# Emerging trend in antibiotic resistance: Global views by Health Care Professionals

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**Abstract** – To highlight the understanding, knowledge and perceptions of health care professional towards antibiotic use and antibiotic resistance Mechanism. A search was performed on using literature and different articles from June-October 2015 to identify the studies already published on the view of antibiotics usage and resistance worldwide. It involved students of Medicine and pharm-D, Doctors, Nursing professional, general population and their knowledge, attitude towards practicing antibiotics. Sixteen studies were identified that included three from India, two from Portugal and one each from China, Malaysia, Jordan, Nigeria, France, UK, Greece, Italy, Sweden, Boston and one in several Southeast Asian Countries. Majority of the individual's response varied widely. Most of them want quick cure rather than considering specifications. General public also showed less than average response to the use of antibiotics. The knowledge of Resistance on the part on all health care professionals was less than adequate. As per our search and studies it is concluded that anti-bacterial are the most widely used medicine across the world. Although our physicians, students of pharmacy, students of medicine, students of nursing and general public have adequate understanding regarding the use of antibiotic for bacterial diseases but it is found in most countries that due to less standard education in health care profession and unawareness in general population. The problem of antibiotic resistance has increased and it is the responsibility of Government, Educational institute and Pharmaceutical industry to take a more innovative step towards the development of newer and better anti-bacterial with safer results.

**Keywords** – Antibiotics resistance, infections, knowledge, Health care professionals

## 1. Introduction

The use of antimicrobial has increased worldwide in the last two decades. Antibiotics are the most blessing medication used across the world for almost all infection. For almost all infections throughout the world antibacterial are used. Now they have much knowledge of antimicrobial that it has become self-medication. People are using antibiotics which are in fact unnecessary [1]. The unsuitable use of antibiotics seen from various surveys has created the problem of antibiotics resistance [2]. On the other hand, over use of antibacterial is also seen that is leading towards the resistance caused by multiple of bacteria. The Antibiotics if not taken properly will definitely lead to the recurrence of disease in which the microbe will be resistant. The improper use of antibiotics also leads towards the failure of therapy. Most of the microbes have developed resistance to different antibiotics and their mechanism is difficult to understand. These microbes become more dangerous to the patients. This growing problem of bacterial resistance is a sign of threat to

the health care system worldwide. It is not only affecting the health but also the economy to the rate which is still unknown. Everyone in the field is trying to get some new information about the pathogenic diseases and their cure. Today most of the health experts are trying to reveal thoroughly the knowledge and practice of antibiotics in general population and they must also be well aware of the knowledge of antibiotics and resistance of microorganism at their education career [3]. Most of our general population is unaware of the actual use of antibiotics for that it is necessary to have standards procedure to guide our general population regarding the use of antibiotics. Up till now many achievements have been done in the nature of diseases and its causative agent. In the present century this has been a significant problem to the Doctor and other medical professional including students. For this the medical scientist and students are trying to have greater and better understanding of the infections that survive despite of anti-microbial therapy. They also required complicated diagnostic measures.

This article provides a review of different studies performed at different regions of the world to assess the knowledge and behavior of health care professionals/Students towards antibiotics use and resistance. It provides thorough view about the practice of prescribing antibiotics and health care professional/Students. This article also reveals the attitude of health care professional/students towards general population regarding the use antibiotics.

## 2. Methods

A search was performed using different articles from June-October 2015 to identify the studies already published on the view of antibiotics usage and resistance worldwide. It involved students of Medicine and pharm-D, Doctors, Nursing professional, general population and their knowledge, attitude towards practicing antibiotics. It is discussed one by one and country wise. In this review those studies were included that extracted the knowledge of health care professionals/students toward antibiotics both quantitatively and qualitatively. Most of the surveys were held through the use of questionnaire. In some studies, the knowledge was evaluated using formal lectures and also some of the studies involved statistical evaluation. The search got full understanding of the number of factors contributing mainly towards spread of antibiotic resistance. The review included evaluation of different research articles from various angles to know about antibiotic use and resistance worldwide.

## 3. Results

Thirty research articles were included in the search which were thoroughly studied by two people. Out of thirty, twenty were considered fit for the reevaluation. After reevaluation the contents of sixteen review articles were most suitable for narration. These were purely related to the understanding of antibiotics in health care professionals and general public. Sixteen studies identified included three from India, two from Portugal and one each from China, Malaysia, Jordan, Nigeria, France, UK, Greece, Italy, Sweden, Boston and one in several Southeast Asian Countries. Here we provide a narrative review of the studies conducted for the purpose of knowledge and perception found in healthcare professional and general public regarding antibiotics worldwide.

### 3.1. India

In GGS Medical College Faridkot Punjab a study was conducted regarding antimicrobial use in medical and nursing students [4] According to their view many of them take antibiotics on their own for most of the common infections due to which chances of resistance increased. This survey showed many faults regarding the use of antibiotics which has usually a bad impact, For Example using improper drug with improper dose make the outcomes of therapy difficult and most of the bacteria become resistant to it. Most of the high level students answered correctly while others were of the view that they use antibiotics without prescription to save time and get quick cure. The view of these students were similar to the WHO[5]. Statement which define cure of small illness by using medicine without prescription. Out of total

students 74% responded that antibiotics were used by them as self-medication. They mostly used it for upper respiratory tract infection. Gaps were also found in the knowledge of senior and junior students. This practice seems to be harmful so it is suggested that this should be prevented in proper way to protect the students/individual.

Another survey was conducted in Southern Indian Teaching Hospital involving second year Medical students [6]. They were asked different questions regarding the practice and use of antibiotics, bacteria diseases and resistance. 100% response was seen in almost all the students more than 70% of the students knew about antibacterial agents and the specific bacterial diseases. They were also aware of the resistance problem as a worldwide issue.

Next search was from Southern India that enrolled 137 Pharmacy students [7]. The main objective of the study was to compare the knowledge of pharm-D and B-Pharm students regarding the knowledge of antibiotics. It was found that 76% of the students have adequate knowledge with more percentage of Pharm-D students. Pharm-D students also had more knowledge about resistance and practice of antibiotic than B-Pharm students. Most of the B-Pharm students use antibiotic without consultation. Thus Pharm-D degree holder knew more about the proper use of antibiotics as compared to Bachelor of pharmacy students.

### 3.2. China

Another study was done that included about 2500 Chinese students both medical and non-medical [8]. This study evaluated the knowledge and behavior towards antibiotics use through different types of Questions about 83% of the students answered correctly. At the end the response from medical and non-medical students was compared. Both the answers were quietly different their knowledge increase as they step in their higher grades. It was observed that medical student have much serious approach towards the safe use of antibiotics than the non-medial and general population. The observations were much more similar to that occurred in Jordan [9].

### 3.3. Malaysia

This study enrolled nursing students at Master skill university Malaysia[10] . In this research the views of nursing students on the use of antibiotics, antibiotic resistance, its unwanted effects and contraindication were noted down. The students showed a low level knowledge about antibiotics but still 43% knew about the categories of antibiotics. 75% of the students were well aware the fact that antibiotics can be used to treat pathogenic diseases. Over all knowledge about antibiotics was poor.

### 3.4. Jordan

A survey was performed in Jordan University that incorporated medical and non-medical students [9]. The level of knowledge and behavior towards antibiotics use/resistance was accessed. Overall from the data it was found that the usual practice of antibiotics is very low in Jordan. The nature of prescribing varied widely among the clinicians. Some of them use antibiotics for viral infections. 61% of the students were unaware of the proper duration of antibiotic consumption. 70% of medical and 29% of non-medical were

aware of the fact that antibiotics are effective against bacteria. Both of the students have also good knowledge about the effect of unnecessary use of antibiotic and resistance.

### 3.5. Nigeria

In Nigeria the proper regulation and use of antibiotic is lagging behind which has bad impact on the health system. A study was therefore conducted that determined and

recognized the behavior and knowledge of antibiotics in non-medical and medical students in Nigeria University [11]. Here the disposal of antibiotics was also check in addition to the use of antibiotics. More than 50% of the students use antibiotics with due prescription of the physician. More than 70 % of the students had no idea about the proper use and duration of the therapy. Several reasons were identified that were creating problems in the proper treatment as shown in figure 1.

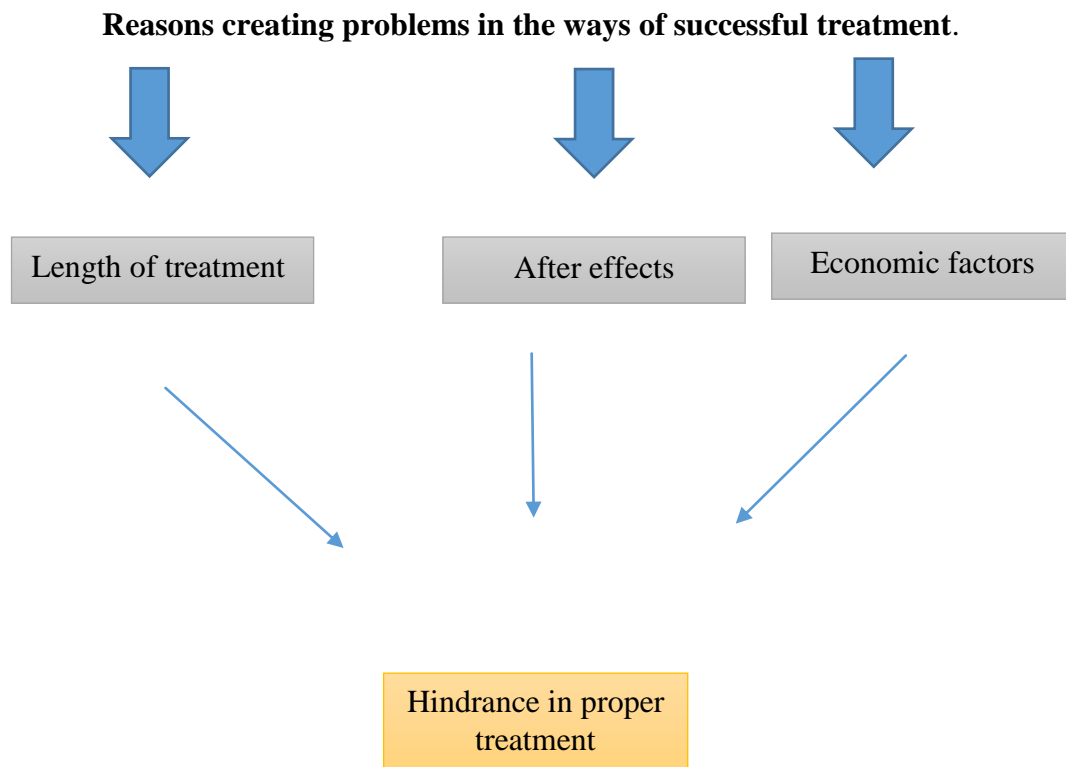


Figure 1. Reasons creating problems in the ways of successful treatment

### 3.6. Portugal

Another important survey that explains a clear idea about the antibiotic use and the extent to which high school students in university of Porto, Portugal know about antibiotic resistance. A high participation rate was noted, who had more detailed knowledge of antibiotic use and resistance [12]. They showed keen interest and performed practically in the assigned project. A part from the medical students and other professional least knowledge was found in common people who knew little about antibacterial and its resistance [13]

Another survey was held in Braga, Portugal[3]. About 349 students of school and university level were enrolled. The result showed a wide variability in the knowledge of antibiotics. A slight increase in the awareness about antibiotics was seen from 9th to 12th grade students. They were totally unaware of the treatment strategy. A bit knowledge about resistance was seen.

### 3.7. France

Two university Hospitals were enrolled in Paris, France for a survey conducted in 2008 [14]. And the

perception and attitude regarding antibiotics use of Physician from the stated hospitals were noted down. The answers of different questions through statistical measures at the end of the study showed that most of them are well aware of the knowledge of antibiotics and serve good practice. The questions which were correctly answered are given in table 1. All of the senior and junior Physicians had mostly similar views regarding infectious ailments and their cure.

### 3.8. United Kingdom

A survey under the supervision of British society for Anti-microbial chemotherapy was conducted in UK [15]. This survey highlighted the following contents given in the table 2.

The result was collected at the end. It was concluded that most of the teaching methodology is organized towards medicines and no evaluation towards diseases. It was also noted down that the practice is being done mostly in hospitals and little in community. The data from the Drug Information Centers and articles also showed more preference for drug and less towards treatment strategies.

Table 1: Physician assessment questions about antibiotic use

S. No.	Questions
1	Does there any risk associated with improper antibiotic uses?
2	Knowledge about recommendations during antibiotic prescribing?
3	Do the recommendations are followed?
4	Is there any advantage of prescribing proper antibiotics?
5	Do you observe that recommendation are followed by your fellow physicians?
6	Do your attitude towards prescribing antibiotics server as role model for others?
7	Any difficulties in following recommendations?
8	Any desire for improving compliance through recommendations?

Table 2: Factors considered for the survey

S. No	Contents Analyzed
1	Teaching methods about antibiotic knowledge in schools of pharmacology and microbiology in UK.
2	Knowledge of post grade students and doctors regarding antibiotic chemotherapy
3	Assessment of review articles, journals and drug information centers

### 3.9. Greece

Owing to the practice towards antibiotics use in parents which is more towards self-treatment and expect better outcomes, a study was conducted that included about 200 school in Greece with 8000 parents as participants[16]. They were from different geographical regions. The parents participated well in that study and contributed to the provision of safe use of antibiotics. 95% of the answers were correct. As most of them were teachers so the knowledge was higher than expected.

### 3.10. Italy

A study in University of Torino, Italy was performed that incorporated Medical, Nursing and Pharmacy students[17]. More than 1000 students took part. Almost all of them fulfilled the task and their views were collected at the end. The level of knowledge on the basic use of antibiotics was average. Interestingly it was noted that female students take more antibiotics than male. Less percentage of students knew that antibiotics cannot be used for viral infections. Students have also average knowledge about the classes of antibiotics. More than 90% knew that antibiotics are effective against bacteria and can cause side effects and resistance. Most of them from their behavior showed that they do not know about the proper duration of antibiotic use.

### 3.11. Sweden

A survey in Sweden was performed on general population by distributing Questionnaire about thousand individual took part in it[3]. Their ages were 21 to 80. The data was collected at the end. A higher response rate was noted that was about 74.7%. It was found that number of people who trust the Doctors prescribing antibiotics was almost similar to those who do not trust them. Small population group knew that antibiotics can cure common cold quickly. About 77% of the population had knowledge that antibiotics are used against bacteria. A very little knowledge about resistance was found. Most of the

general population trusted in Pharmacy professional that they provide better information than medical professional.

### 3.12. Others

#### 3.12.1. Parents and Physicians view

A study involving parents and physicians from Boston, Massachusetts was performed that evaluated the knowledge of parents and views of physicians[18]. The results showed that almost 85% of the parents think that too many antibiotics can be risky to their children health. About 55% of the parents knew about resistance towards these medicine and 18% use antibiotics without consultation. On the other hand, highlighting the views of Physicians it was revealed that most of the parent's request antibiotics for their children when the Doctor thinks that it is not necessary.

#### 3.12.2. Southeast Asian Universities

Southeast Asia has been found to the core of many factors contributing towards the emergence of anti-bacterial resistance. Based on these observations a study was held in that area which shows the educational career held in medical and Pharmacy school. (Education on antibiotic resistance in medical and pharmacy schools: findings from curriculum survey in selected Southeast Asian universities, 2011 University Sains Malaysia USM, 2011). How they cope with the problem of Antibacterial resistance is also a key of this survey. The study included Malaysia, Thailand, Singapore, Indonesia and Philippines. The heads of medical and pharmacy schools from the stated countries took part in that study. In the result 20% of the response was correct that included 65% from Pharmacy schools and 35% from medical schools. The survey highlighted the education on the antibacterial resistance and in their curriculum and also the problem associated with the teaching methodology.

## 4. Discussion

The study got through complete sixteen research articles that were exclusively related to the Attitude, behavior and knowledge of antibiotics in Physicians, Pharmacy students, nursing students, medical students and general population. Majority of the individual's response of the stated professionals varied widely.

We started with search on Southeast Asian countries including India as our first preference. In India students of nursing, students of medical, students of B-Pharm and Pharm-D were evaluated for the information of antibiotics usage and resistance. The senior medical and nursing students were more competitive in the knowledge of antibiotic usage than the junior students that may be due to curriculum gaps. Most of the students unintentionally use antibiotics for viral infection like upper respiratory tract infection and common flu/cough. This usually has bad impact.

The behavior of the Medical students of the Southern Indian Teaching hospital was reported to be very formal and their educational career mainly emphasize on the new approaches towards better use of antibiotics and new methods for the prevention of antibiotics resistance. The

factors that required more consideration before prescribing antibiotics included adverse effects, nature of pathogenic organism and nature of immune system of patient.

In the evaluation of the knowledge, behavior and attitude towards the use of antibiotics in Pharm-D and B-Pharm students in Southern India revealed that Pharm-D students know more about antibiotics than the B-Pharm students. Pharm-D students also have better understanding of the resistance towards antibiotics than B-Pharm students. The B-Pharm students required a little case based studies in their educational curriculum. The level of knowledge of Pharm-D student in India shows that many projects are included in their curriculum related to the clinical practice of drugs and treatments.

In China the comparison of knowledge of medical and non-medical students revealed some gaps. The higher grade students acquired more knowledge than the lower grade students. The misuse of antibiotics was also a part of the prescribing practice in clinicians. A positive relation was found in the actual knowledge and practice of antibiotics in medical professional with the awareness in public towards safe usage of antibiotic. It was a good point of the Chinese medical curriculum that antibiotic is taught at earlier stages in the subjects of microbiology, pharmacology, internal medicine and Epidemiology. The survey included a large number of participant that reflects the overall perception of those students towards antibiotics.

In Malaysia the knowledge of antibiotics in nursing students is less than average. They were asked various questions which included, usage, side effects, resistance and contraindications about antibiotics. Their understanding level was not as good as medical students. However almost all of them consider antibiotic for infectious diseases.

In Jordan the antibiotic overuse and irrational prescription is contributing towards the emergence of resistance. Most of the resistance was due to use of antibiotics without consultation. Students were of the view that they want quick cure of the disease so they seek antibiotics by their own. Another factor that is considered to be the cause of resistance was financial problems. The views of medical and non-medical students regarding self-medication were not different.

The use of antibiotics in Nigerian medical and non-medical students indicated various factors that are contributing towards resistance of antibiotics. It included self-prescription, wrong indication, non-compliance, overuse and use of antibiotics for viral infection. However adequate number of participants used antibiotics with due prescription of Doctors.

The studies on Portugal were based on school level students of 9th and 12th grades and a project involving 15-17 years old students. The knowledge spectrum of those students was analyzed. The project was more elaborative towards antibiotic and antibiotic resistance. Many new technologies were used in the project to have a clearer picture of antibiotic resistance. On the other hand, 9th and 12th grade students had limited knowledge about antibiotic use. But still that was enough to get admission in universities. Many misunderstandings were found in these

students regarding correct usage.

The two University Hospitals in Paris, France showed higher response from physicians. They acquired better practice in prescribing antibiotics. Their learning behavior contributed towards safe outcomes in patients.

The survey in United Kingdom recognized the basic drawbacks at undergraduate and postgraduate medical education and medicine practice regarding antibiotic usage. Their educational system emphasizes more on formal system rather than case based and problem based situation. Most of the clinical physicians prescribe antibiotics for infectious diseases so the education on antibiotics should be included in the basic curriculum of medicine. The study also did not reflect every day practice on most common cases.

The practice of antibiotics in parents of Greece were more oriented towards their children behavior and quick relief. The parents had more knowledge and awareness. They filled the Questionnaire more logically as they were mostly teachers. This method of collecting data is usually helpful rather than getting interviews. As it was cleared from the correct results. It also helps the parents in seeking their importance and research.

Looking at the survey in Italy where least work is done in publications on health care professionals [19], it holds a great importance for medical students. Average knowledge exist there regarding the use of antibiotics and their side effects. However most of them answered correctly. Some of them were not aware of the fact that antibiotics are not effective against viral infections. More interventions in their educational curriculum will improve antibiotics practice.

The survey in Sweden has given the views that the proper indication of antibiotics, resistance and proper usage is more satisfactory in general public. Only few consider antibiotics for viral infection. The limitation in failure of therapy included usage of leftover medications and self-prescribing. The pharmacy professionals are playing important role in awareness of proper antibiotic use in general public. Most of the people get concern with pharmacy personnel rather than Doctors.

Antibiotic resistance is considered to be the main risk worldwide. It is mainly related to overuse and misuse. The education on the part of general public is limited and they required more awareness. However, many infectious diseases are now better cured that increase the life span of human.

## 5. Conclusions

As per our search and studies it is concluded that anti-bacterial are the most widely used medicine across the world. These are the most blessing medicine that is fighting many of the infectious diseases for decades. Although our physicians, students of pharmacy, students of medicine, students of nursing and general public have adequate understanding regarding the use of antibiotic for bacterial diseases but it is found in most countries that due to less standard education in health care profession and unawareness in general population, viral infections are also treated with anti-bacterial. The study identified that overuse and misuse has created a rooted problem of anti-

bacterial resistance worldwide. The problem of antibiotic resistance has increased to that level there many efforts of medical science are in vain. Due to these factors it is affecting the health as well as the economy. This practice seems to be harmful so it is suggested that it should be prevented in proper way to protect humans. In order to cease this problem, it is the responsibility of Government, Educational institute and Pharmaceutical industry to take a more innovative step towards the development of newer and better anti-bacterial with safer results. The general public should be aware of the proper use of the antibiotics. There should be proper measures to access the severity of diseases in each patient and also the causative agent should be identified earlier. This required more functional approach that can be only done if the educational curriculum for medical and pharmacy students promote the methodology associated with anti-bacterial use, and modern diagnostic tools thus seek a better therapy. The educational system should include better opportunity regarding antibiotics for the nursing professionals as they are the front line individuals in administering medicine. Useful educational programs can also help the students and health care professionals to a significant level. The educational system should include the contents on the proper use and disposal methods for anti-microbial agents for the development and provision of safe regulation of antibiotics. Physicians are also of the view that changes in formal education system of health care professional can provide a better way to prevent antibiotic resistance to a greater extent.

It is also find that both parents and physician are struggling towards better use of antibiotics yet it is the need of time to educate and counsel parents more on better attitude towards good therapy. If the medication is used correctly by consulting Doctors so it will probably increase the chances of better cure.

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### Declaration of Conflicting Interests

All the authors declare that there is no conflict of interest.

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