Academic Sciences International Journal of Pharmacy and Pharmaceutical Sciences

ISSN- 0975-1491 Vol 5, Issue 2, 2013

Research Article

STATISTICAL INVESTIGATION OF PATIENT FACTOR IN DEVELOPMENT OF ANTIBIOTC RESISTANCE - A STUDY IN EASTERN PROVINCE OF SAUDI ARABIA

ARSHIA SHARIFF*, BANDER E AL DHUBIAB, MARWAH AL NOWIS, FATHIMA AL HADDAD, NORAH AL OMRAN, HOWRAH AL KHULITEET

Department of Pharmaceutical Sciences, College of Clinical Pharmacy, King Faisal University, #400, Al-Hassa 31982, Kingdom of Saudi Arabia. Email: arshiashariff@yahoo.com

Received: 15 Dec 2012, Revised and Accepted: 03 Feb 2013

ABSTRACT

Objective: Our primary objective was to study the patient factors which contribute to development of antibiotic resistance in the treatment of upper respiratory tract infections in the population of eastern province of Saudi Arabia.

Methods: A methodical analysis of patient factors like patient compliance, patient knowledge about cause of cold/flu, antibiotic resistance etc was conducted. A questionnaire was designed reflecting questions meant to analyze the above factors and employed in 399 patients in the outpatient settings of large-sized hospitals. Statistical Analysis Software (SAS) was used for data analysis. The Kendall's tau correlation coefficient was calculated for association (if any) between variables. The Chi square statistic was calculated to study the dependence of the responses generated on the study variables (patient demographics) and percentage frequencies of the responses with respect to patient demographics were calculated using SAS.

Results: In result of the analysis, the variables were found to be independent (tau b approached zero), the responses were found to be independent of the variables (patient demographics) with $p > 0.05$.Since only a meager 18.8% of the patient population was found to have knowledge about drug resistance and only 24.3% of the patient population was compliant to their prescribed antibiotic therapy, these two factors were identified as primary factors of concern for future attention. However awareness of the fact that infections could be caused by either bacteria or virus was high (78.2%) and 83.7% of patients were found to be forthcoming towards being wise-users of antibiotics in the future.

Conclusion: It was concluded that patient education on compliance to antibiotic therapy and education on implications of antibiotic resistance can be effective tools in controlling the lurking threat of antibiotic resistance in the population of Saudi Arabia.

Keywords: Antibiotic Resistance; Patient Compliance; Patient awareness; Upper respiratory Tract Infections

INTRODUCTION

The history of antibiotic resistance dates back to 1943 with Staphylococcus aureus being the first bacteria to resist penicillin that caused pneumonia or toxic shock syndrome. It was followed by the occurrence of pneumococcus in Papua New Guinea in 1967, caused by *Streptococcus pneumoniae*. This event coincided with the American military personnel in Southeast Asia being afflicted with penicillin-resistant gonorrhea. The American soldiers eventually resulted in being carriers of gonorrhea on their return back home and the physicians had to find new drugs to treat gonorrhea. Sequentially, in 1983, a hospital-acquired intestinal infection caused by the bacterium *Enterococcus faecium* joined the list of penicillin resistant bacteria.

Antibiotic resistance spreads fast. The challenge is to be able to develop new replacement drugs at a pace faster than the bacteria could develop resistance to a new antibiotic. The resulting time lag between development on new drugs and establishment of resistance to the drug of concern will leave patients vulnerable with no available therapy for the disease, a situation similar to the pre-antibiotic era.

Nearly 90% of all Upper Respiratory Tract Infections are caused by viruses which do not respond to antibiotic treatment. It creates a selective pressure for the development of resistant strains of pathogens. Extensive over prescribing of the second generation drugs over the past decade, like in the case of Macrolide antibiotics (Azithromycin) has been a major concern amongst physicians. The resistance resulting from overprescribing has complicated the effective treatment of community-acquired respiratory tract infections.

In fact, roughly 30% of the pneumococcal strains common to all these infections are resistant to penicillin and/or macrolides. Since antibiotic resistance can pass from bacterium to bacterium and so can resistant bacterial infections pass from person to person resulting in an entire community developing antibiotic resistance. Scientists worldwide are trying to combat these resistant bacteria in novel ways. One approach is reported to open up MRSA (methicillin-resistant Staphylococcus aureus) to attack by penicillin and help create a library of designer antibiotics to use against a range of other dangerous bacteria [1]. To be able to out beat the resistant bacteria is almost improbable, as the bacteria develop resistance to antibiotics at a pace faster than we can produce new antibiotics. So, a more probable approach would be to prevent development of resistance to existing antibiotics. The contributive factors to this antibiotic resistance most certainly are the physician's over prescribing habits and the patient himself.

Most outpatient Respiratory Tract Infections (ie, acute bronchitis, common cold, and nonspecific upper Respiratory Tract Infections) are caused by respiratory viruses for which antibiotic use is not warranted[2] .Although Respiratory Tract Infections are caused primarily by viral pathogens, antibiotics are frequently prescribed and therefore show little or no response to the antibiotic treatment. Decreasing excess antibiotic use is an important strategy for fighting the increase in community-acquired antibiotic resistant infections. Although antibiotic treatment is effective for bacterial Respiratory tract Infections, such as Otitis Media, Sinusitis, Acute exacerbations of chronic bronchitis (AECBs), and Community Acquired Pneumonia, antibiotics do not kill viruses and do not shorten the course of viral illness. In fact, when antibiotics are given for viral infections, the result may be subsequent infection with resistant bacteria, since previous antibiotic exposure may provide a selective advantage for resistant bacteria. WHO Global Strategy for Containment of Antimicrobial Resistance recognizes that antimicrobial resistance is a global problem that must be addressed in all countries. When infections become resistant to first-line antimicrobials, treatment has to be switched to second- or third-line drugs, which are always much more expensive and sometimes more toxic. The drugs needed to treat multi drug-resistant forms of tuberculosis are said to be 100 times more expensive than the first-line drugs.

The prevalence of antibiotic resistance in typical respiratory pathogens, such as *S. pneumoniae, H. influenzae* and *M. catarrhalis* in Saudi Arabia [3] has already been reported. Over the counter availability of antibiotics is easy. Antibiotics are available at a fraction of their usual market price. Many of these drugs are within the means of the average Saudi national and costs in the Kingdom are some of the lowest in the region. In addition, majority of the population is covered for free medication at Government Hospitals. This easy availability and affordability of antibiotics are potential factors for antibiotic abuse by the patient. Hence, there arises a clear need to improve the understanding of the patient factors associated with antibiotic use, of them patient compliance being the most critical one [4].

So far, most of the efforts towards controlling the use of antibacterial agents have been directed towards the prescribers like guidelines for prescribing antibiotics, framing of national or international antibiotic policies, and educational programs for prescribers. Although patient has been identified as a major contributive factor, few studies have dealt with the patient demographics as a contributive factor. Studies on patient as a contributive factor are required from worldwide to be able to obtain conclusive evidence during development of global guidelines directed towards patient. Our study hopes to contribute by way of providing the patient scenario of population of Saudi Arabia in relation to antibiotic resistance.

Extensive literature is available on the high prevalence of antibiotics prescribed to treat Upper Respiratory Tract Infection's [5,6]. Although use of antibiotics in most Upper Respiratory Tract Infection's which are viral in nature is unwarranted, we see overprescribing of antibiotics in most outpatient settings. The most influencing factors for this type of prescribing habits are patient pressure and the doctors striving to achieve patient satisfaction. Clinicians and policy makers have time and again insisted on the strict adherence to guidelines in treatment of Upper Respiratory Tract Infections [7]. Barriers present amongst clinicians in adherence to guidelines have been enumerated as being the lack of awareness, lack of self efficacy, lack of motivation, patient related and environmental- related barriers etc. It has been noticed by clinicians that, with time and changing prescribing patterns, the bugs resistant to antibiotics are also emerging at an alarming rate [8]. This is cause for serious concern amongst clinicians as they run out of treatment options for certain critical conditions.

Factors influencing the misuse/overuse of antibiotics leading to antibiotic resistance have been categorized as psychosocial factors such as behaviors, beliefs, and attitudes (e.g., self-medication & over-the-counter medication), parents pressure, demographic characteristics (e.g., socio-economic status, education levels) and lack of health education [9,10,11]. It is worthy to note here that, all the above mentioned major factors affecting wise use of antibiotics are patient- related. This drives home a message that the policies and measures to be taken in future to control antibiotic resistance should concentrate on educating the patient on the wise use of antibiotics. The benefits of patient education will certainly percolate down to the clinicians who are constantly under parent/patient pressure [12]. Patient related factors commonly contributing to antibiotic resistance are overuse/abuse of antibiotics, self-medication, patient expectations, patient compliance and patient's belief that new and expensive medications are more efficacious than older agents [13]. So resistance develops to these newer classes of antibiotics as well as to older ones in their class. Many studies[14] are reported which reiterate the fact that patient compliance and patient awareness are the predominating patient factors contributing to the development of resistance to antibiotics. One of the greatest barriers to research on this issue has also been identified as the lack of standardized, validated survey instrument that can efficiently assess antibiotic-taking behavior on a large scale.

Patient Factor plays a major role in the control of antibiotic resistance. A myriad of patient characteristics like demographics, level of awareness, level of health education, compliance to therapy, self medication and affordability need to be addressed before sound policies are framed. One such issue was addressed in a Meta analysis which was conducted on hospital documented data. The prevalence of antibiotic abuse in terms of non-compliance with therapy and reuse of leftover antibiotics in the community was studied [14]. Mean patient compliance with antibiotics was found to be just 62.2% (95% confidence interval (CI), 56.4–68.0%) and the mean use of leftover antibiotics was found to be 28.6% (95% CI, 21.8–35.4%). Patient education and simpler antibiotic regimens were suggested to be encouraged to promote responsible use of antibiotic therapy. Better means of establishing rates of community compliance, along with efforts to address patient behavior and attitudes were suggested as approaches towards reducing the antibiotic misuse. Time and again, it has been noticed that antibiotic therapy in the community can be improved through patient and physician education of appropriate antibiotic use, and by the use of antibiotics with simpler dosing regimens [15, 16, 17]. The concept of "reserve drugs" is also a suitable method of preventing the misuse of the available antimicrobials [18]. Factors influencing compliance amongst patients treated with antibiotics for RTI mostly comprise of patient education, low price of antibiotics, short term therapy, infrequent doses, reminders, commitments etc. It has been observed from antibiotic surveillance studies that the reason for antibiotic resistance is mostly the inappropriate use of antibiotics due to lack of nation-wide uniform policies [19].

MATERIALS AND METHODS

Survey

A questionnaire was administered to the population of eastern province of Saudi Arabia visiting the outpatient settings of large–sized hospitals. These hospitals offered a mixed population, majorly comprising of Saudi nationals and a minority of expatriates. About 400 subjects were surveyed. However one patient was disqualified from the study due to non-conformance to exclusion criteria. The exclusion criteria was subject age not less than 18 yrs. Informed consent was included in the questionnaire along with introductory information on respiratory infections. A section on patient demographics was included to collect data on factors like age, sex, ethnicity and educational qualification to study their dependence (if any) on the responses generated from the study.

The questionnaire included questions which addressed three major issues, some sample questions for each issue presented in the questionnaire are enumerated in Table No. 4-6.

Issue 1: Level of awareness on use of antibiotics for cold/flu

Issue 2: Awareness about drug resistance

Issue 3: Level of patient compliance to the prescribed therapy

The study co-coordinators were available with the subjects, assisting the subjects with information and clarifications about the questions when requested. The study variables and the options were numerically coded in-order to assist analysis of data generated using Statistical Analysis Software (SAS version 9.1).

Instrument of Statistical Analysis

Chi-square is one of the most widely used statistical tests applied to a wide range of issues where frequency data is involved. One of the key pre-requisites of the chi square test is that the data categories are independent and mutually exclusive. So, the preliminary step was to first confirm that the variables did not have any relationship between themselves which may affect the responses generated from the survey. As the study population was mixed with respect to age, gender, qualification and ethnicity, the Kendall's tau correlation test was applied on the data to measure the strength of the relationship (if any) between any two variables. If tau b value approached zero, then variables were said to be independent of each other. If it approached 1, then they were supposed to have a relationship/co-relation.

The chi square test was applied to analyze whether the responses generated from the questionnaire, of the two primary issues of our interest (patient compliance and level of awareness) were affected by the demographics of the patient or not. If the calculated chi square statistic value was greater than the expected value and probability (P) > 0.05, it was concluded that the responses were independent of the demographic variables. Some sample questions representing the

patient related issues of concern (patient awareness and compliance level) were selected and grouped from the questionnaire as listed in table 4 and table 6 respectively, and chi square test was applied to the responses collected on these questions.

Descriptive statistics were applied to address the primary issue about their level of awareness, i.e. whether the patients were aware of the fact that upper respiratory tract infection could be caused by either bacteria or virus. Ethnicity was not considered for statistical analysis as a factor amongst the demographic factors since the study population majorly comprised of Saudi nationals.

RESULTS

The statistical analysis on the data of 399 patients from the eastern province of Saudi Arabia was analyzed using Statistical Analysis Software (SAS version 9.1).The demographic distribution of subjects of study from large-sized hospitals of eastern province of Saudi Arabia was obtained from the collected data (Table 1).

Table 1: It Shows Patient Demographics, N=399

Gender	Age Of Patients (years|)	Qualification	Origin
Male =188	18-25 =129	Under-graduate =124	Saudi =357
Female =211	25-35 =123	Graduate =275	Non-Saudi =42
	35-45 =84		
	45-55 =52		
	55 and above =11		

Prior to conduct of the statistical analysis, it was deemed necessary to check the independent nature of the study variables i.e. if any association existed between the variables. The Kendall's tau test results (Table 2) reflected that there was no relationship/association present between the variables. All the variables reflected a "tau b value" close to zero, signifying that the demographic variables were not associated with each other; hence they were independent in nature.

Table 2: It Shows Kendall's tau correlation statistics results.

Ethnic Group	Sex	Age Group	Qualification	
0.14209	-0.01547	-0.07193	1.00000	Qualification
(0.0046)	(0.7576)	(0.1165)		
0.14889	-0.29228	1.00000	-0.07193	Age Group
(0.0012)	(<.0001)		(0.1165)	
-0.00344	1.00000	-0.29228	-0.01547	Sex
(0.9452)		(<.0001)	(0.7576)	
1.00000	-0.00344	0.14889	0.14209	Ethnic Group
	(0.9452)	(0.0012)	(0.0046)	

Values are represented as Co -relation Co-efficient (tau b). N = 399, prob > |r| under H0: Rho=0

The chi square analysis of dependence of the categorical variables on responses generated (regarding patient compliance and level of awareness) demonstrated p-values for all the demographic variables greater than alpha=0.05 (Table 3). Therefore it was deduced that there is no relation between the demographic variables of the patient (qualification, age, sex or ethnicity) and the responses generated in the questionnaire. So the results/responses on patient compliance and awareness about appropriate use of antibiotics in cold/flu are true reflectance of patient population in general, and not dependant on any particular demographic character of patient.

Table 3: It Shows Chi Square Analysis Results.

Issue of interest	Patient Compliance to the Prescribed Therapy			Patient Awareness on Use of Antibiotics in Cold/Flu		
Patient Demographics	Q_C1	Q_C2	Q_C3	Q_A1	Q_A2	Q_A3
Qualification	(2)1.21	(1)1.62	(2)2.66	(2)2.23	(1)0.550.45	(1)0.21
	0.54	0.20	0.26	0.32		0.64
Age	(8)11.2	(4)8.34	(8)5.96	(8)6.67	(4)7.210.12	(4)7.0
	0.19	0.07	0.65	0.57		0.13
Ethnicity	(2)0.90	(1)0.81	(2)0.41	(2)0.61	(1)0.060.79	(1)1.04
	0.63	0.36	1.76	0.73		0.30
Sex	(2)2.41	(1)0.98	(2)0.12	(2)0.93	(1)0.630.42	(1)0.71
	0.29	0.32	0.93	0.62		0.39

Data is represented as (degrees of freedom) chi square value, probability. N=399 P=0.05. Q_A = Question related to awareness from questionnaire; Q_C=Question related to compliance from questionnaire

DISCUSSION

The survey demonstrated that majority of the study population believed that they required antibiotics for common colds (Table 3).When questioned directly about need for antibiotics in viral infections, a similar quantum of response was generated (72%).This shows that there is a dire need to educate the population about the common cause of common colds and flu and direct the patient education towards differentiating between a viral and bacterial infection. This issue needs to be addressed by the prescriber during patient visit to the clinic. Presently, this is seen happening vey rarely as only 25% of the patients agreed to having been told about antibiotic resistance by their physicians. However an overwhelming response of 83% was obtained (Table 4) in the affirmative when asked about their willingness to know more about antibiotic resistance. It is encouraging to know that majority of the population accepts that antibiotics don't work as well these days. Since about 36% of them have requested for a specific antibiotic (Table 4) and a similar 32% stop taking medicines when they start feeling better (Table 5) show that this is the representative population (36%) which is a major contributor to the problem of antibiotic resistance in Saudi Arabia. These figures are certainly lower when compared to a 50% European population found noncompliant in a pan-European study [20]. Amongst the patient related factors, the one on patient awareness towards cause of common cold and flu needs to be addressed at a war footing, followed by patient education on implications of non-compliance to antibiotic therapy and their contribution to development of antibiotic resistance. A similar need has been identified by an analytical study on patient perceptions from four European countries [21].

Amongst the patients classified based on their attitudes, the involved category of patients demonstrated accuracy in use of antibiotics, and in understanding dosing intervals and course length thereby emphasizing patient involvement in disease management as a crucial factor in appropriate use of antibiotics.

Table 4: It Shows Results of Patient Analysis on the Level of Patient Awareness to the Use of Antibiotics in Cold and Flu

Question Number	Questions	Patient Response (Yes)
Q_A1	Do viral infections require antibiotics?	72.43%
Q_A2	Is antibiotic necessary for treatment of common colds?	63.15%
Q_A3	Is antibiotic necessary for yellowish nasal mucous discharge?	66.4%
Q_A4	Is antibiotic necessary for productive cough of yellow mucous?	59.9%

Q_A= Questions on awareness

Table 5: It Shows Results of Patient Analysis on Issue of Antibiotic Resistance.

Question Number	Questions	Patient response(yes)
Qr1	Do you think many antibiotics do not work well as they did in the past?	66.91%
Qr2	Has your doctor ever discussed antibiotic resistance with you?	25.00%
Qr3	Do you prefer certain antibiotics thinking they work better for you?	66.41%
Qr4	Have you ever requested for a specific antibiotic for common cold and flu?	36.60%
Qr5	Should antibiotic resistance be discussed with you?	83.70%

Qr=Questions related to Resistance

Table 6: It Shows Results of Patient Analysis on Issues of Patient Compliance to Antibiotic Therapy.

Question Number	Questions	Patient Response (yes)
Q_C1	Do you complete the antibiotic therapy for the given number of days?	63%
Q_C2	Do you complete the antibiotic therapy when given for more than 5 days?	63%
Q_C3	Do you stop taking antibiotics when you start feeling better.	32%

Qc=Questions related to Compliance

Further, the representative population which was aware of the cause of common cold and flu (66%) was characterized to visualize the spread of awareness based on their demographics. It was found that awareness was present majorly in the adult age group between18-45 yrs (Fig1) when calculated on a cumulative basis and in graduates (Fig 2).This signifies that methods of patient education employed should be preferably oriented towards the geriatrics and the non-graduates. Gender wise, the male as well as the female population showed almost similar levels of awareness with 56% and 43.9% respectively (Fig 3).These findings are in agreement with a sole study wherein demographics of survey population was considered and there was no significant difference in responses found based on gender, education, ethnic groups or prescription plan[22]. The demographic factor on ethnicity was not considered for statistical analysis as the participation of expatriate population in the study was a minority as compared to the Saudi nationals. So irrespective of patient demographics, patient education on compliance to therapy and their contribution to antibiotic resistance should be addressed primarily at the prescriber's level.

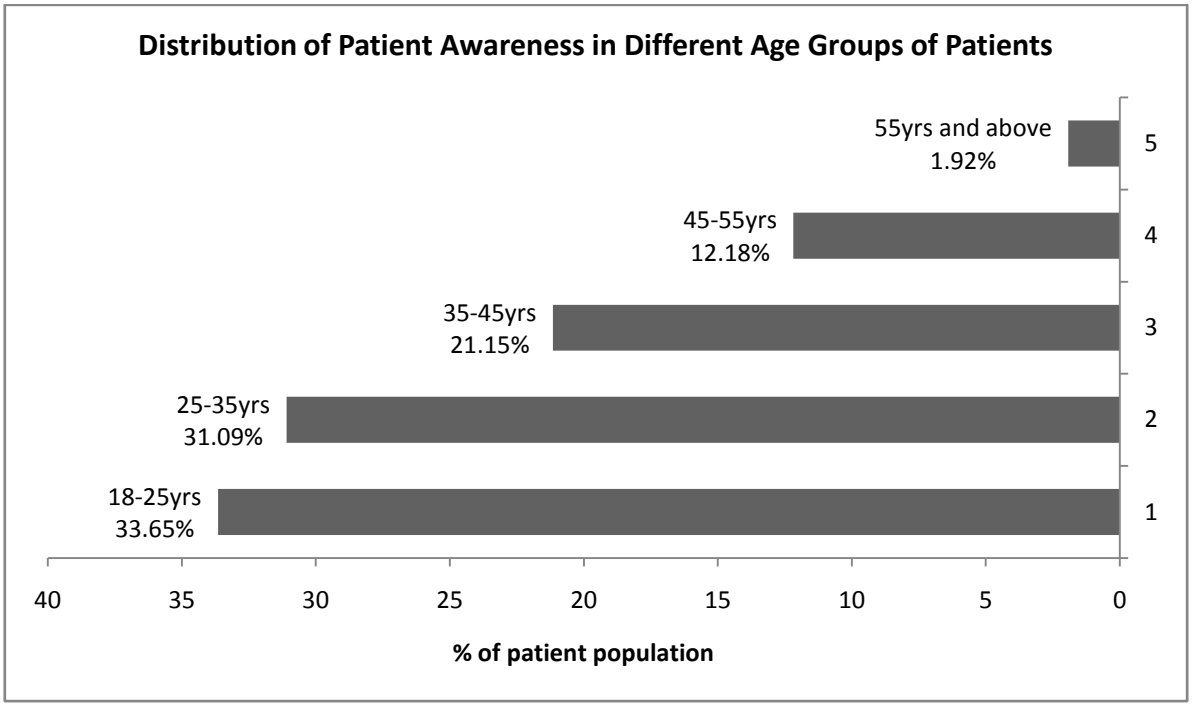

Fig. 1: It Shows Distribution of Awareness About the Cause of Common Cold and Flu among Patient Population Characterized on the Basis of their Age.

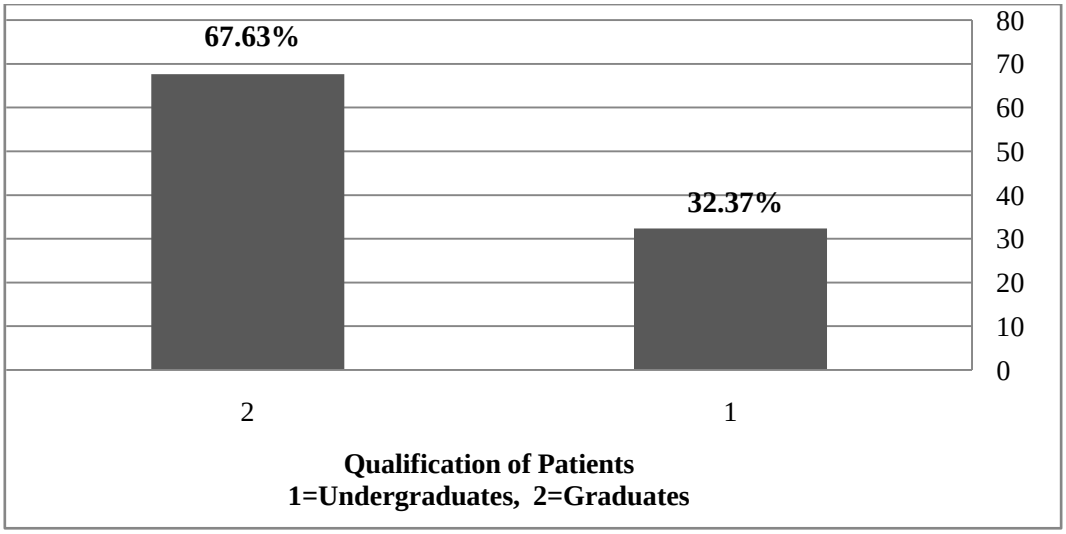

Fig. 2: It Shows Distribution of Awareness on the Cause of Common Cold and Flu among Patient Population Characterized on the Basis of their Qualification

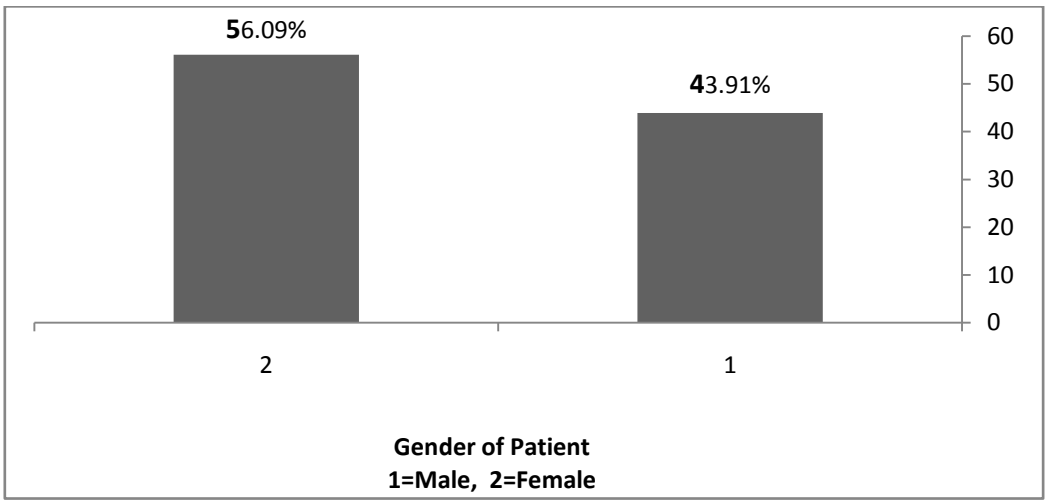

Fig. 3: It Shows Distribution of Awareness About the Cause of Common Cold and Flu Among Patient Population Characterized on the Basis of their Gender.

CONCLUSION

Primary care patients were unaware of the implications of drug resistance caused by misuse of antibiotics. They were also found unaware of what antibiotic resistance is and how it arises. One third of the study population exhibited non compliance towards their antibiotic therapy thereby contributing to development of antibiotic resistance in the community. So health education about antibiotic resistance and importance of compliance to their antibiotic therapy should be addressed primarily in patients to control antibiotic resistance. Patient Education on the wise use of antibiotics in treatment of Upper Respiratory Tract Infections should be included on priority in Government health policies and also while framing antibiotic related health guidelines.

ACKNOWLEDGEMENT

The authors wish to thank College of Clinical Pharmacy, King Faisal University for the financial support for the project and Analytics Training Institute, Bangalore, India for their invaluable help in the statistical analysis of data.

REFERENCES

1. Fuda C, Suvorov M, Sergei B, Vakulenko , Mobashery SA. The Basis for Resistance to β-Lactam Antibiotics by Penicillin-binding Protein 2a of Methicillin-resistant *Staphylococcus aureus.* J Biol Chem 2004; 279: 40802-06.
2. Gjelstad S, Fetveit A, Straand J, Dalen I, Rognstad S, Lindbaek M. Can antibiotic prescriptions in respiratory tract infections be improved? A cluster-randomized educational intervention in general practice – The Prescription Peer Academic Detailing (Rx-PAD) Study [NCT00272155]. BMC Health Services Research 2006; 6(75): 1-12.
3. Fouda SI, Kadry A A, Shibl A.M. ß-lactam and macrolide resistance and serotype distribution among Streptococcus pneumoniae isolates from Saudi Arabia. J Chemother 2004; 16(6): 517-23.
4. Abdalla NM. Study on Antimicrobial Resistance in Saudi Arabia. Res J Med Sci 2011; 5: 94-8.
5. Teng CL, Leong KC, Aljunid SM, Cheah M. Antibiotic prescription in upper respiratory tract infections. Asia Pacific Family Medicine 2004; 3(1-2):38-45.
6. Irshaid Y, Al-Homrany M, Hamdi A, Adjepon-Yamoah K and Mahfouz A. A pharmacoepidemiological study of prescription pattern in outpatient clinics in Southwestern Saudi Arabia. Saudi Med J 2004; 25(12): 1864-70.
7. Wong DM, Blumberg DA, Lowe LG. Guidelines for the Use of Antibiotics in Acute Upper Respiratory Tract Infections. Am Fam Physician 2006; 74(6): 956-66.
8. Conly J. Antimicrobial resistance: revisiting the tragedy of the commons. Bull World Health Organ 2010; 88:805–06.
9. Alumran A, Hurst C, Xiang-Yu Hou. Antibiotics Overuse in Children with Upper Respiratory Tract Infections in Saudi

Arabia: Risk Factors and Potential Interventions. Clinical Medicine and Diagnostics 2011; 1(1): 8-16.

10. Zoutman DE, Ford DB, Bassili AR, Cosby JL, Nakatsu K. Factors affecting antibiotic decisions for upper respiratory tract infections I: A survey of family physicians. Int J Infect Contr 2008; 4:1-7.
11. Chan C. What do patients expect from consultations for upper respiratory tract infections? Family Practice 1996; 13(3): 229-35.
12. Britten N, Ukoumunne O. The influence of patients' hopes of receiving a prescription on doctors' perceptions and the decision to prescribe: a questionnaire survey. BMJ1997 ; 315:1506–10.
13. Braun B and Fowles, J. Characteristics and Experiences of Parents and Adults Who Want Antibiotics for Cold Symptoms. Arch Fam Med 2000; 9(7):589-95.
14. Kardas P, Devine S, Golembesky A, Roberts C. A systematic review and meta-analysis of misuse of antibiotic therapies in the community. Int J Antimicrob Agents 2005; 26(2): 106-13.
15. Gonzales R, Bartlett JG, Besser RE, et al. Principles of appropriate antibiotic use for treatment of acute respiratory tract infections in adults: background, specific aims, and methods. Ann Intern Med 2001; 134:479–86.
16. Zoutman DE, Ford BD, Bassili AR. Antibiotic prescribing by family physicians for upper respiratory tract infections: Impacts of feedback, non-anibiotic recommendations and patient factors. Int J Infect Contr 2002; 2:65-71.
17. Kardas P. Patient compliance with antibiotic treatment for Respiratory Tract Infections. J Antimicrob Chemother.2002; 49: 897-03.
18. Arora D, Jindal N, Kumar R, Romit. Emerging antibiotic resistance in pseudomonasa Challenge. Int J Pharm Pharm Sci. 2011; 3(2): 82-84.
19. Kumar A , Rajiah K, Chandrasekhar. Antibiotics surveillance: a survey on the susceptibility of microorganisms to Antibiotics in respiratory tract infections. Int J Pharm Pharm Sci, 2012; 4(4):181-85.
20. Branthwaite A, Pechère JC. Pan-European survey of patients' attitudes to antibiotics and antibiotic use. J Int Med Res 1996; 24(3):229-38.
21. Pechère JC, Cenedese C, Müller O, Perez-Gorricho B, Ripoll M, Rossi A, et al. Attitudinal classification of patients receiving antibiotic treatment for mild respiratory tract infections. Int J Antimicrob Agents. 2002; 20(6):399-406.
22. Filipetto FA, Modi DS, Weiss LB, Ciervo CA. Patient knowledge and perception of upper respiratory infections, antibiotic indications and resistance. Patient Prefer Adherence. 2008: 2(2):35-9.