Comparison of knowledge and attitudes about antibiotics and resistance, and antibiotics self-practicing between Bachelor of Pharmacy and Doctor of Pharmacy students in Southern India

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ABSTRACT

Background: There is limited research on pharmacy specialization based differences with regards to usage of antibiotics.

Objective: To compare the knowledge, attitude and practice of Bachelor of Pharmacy (BPharm) and Doctor of Pharmacy (PharmD) students about usage and resistance of antibiotics in Southern India.

Methods: This was a cross sectional study involving final year BPharm and PharmD students studying in two private institutions located in Andra Pradesh, India. The study was conducted for the period of 3 months. The questionnaire was divided into 5 components: demographics, knowledge about antibiotic use, attitude towards antibiotic use and resistance, self-antibiotic usage, and possible causes of antibiotic resistance. The study questionnaire was assessed for reliability. Data were analysed by employing Mann Whitney and chi square tests using SPSS version 19.

Results: The sample size comprised of 137 students. The response rate was 76.11% for the study. There was a significant difference in the knowledge of antibiotic use in BPharm and PharmD students (Mean score: 5.09 vs 6.18, p<0.001). The overall attitude of PharmD students about antibiotic use and resistance was positive compared to BPharm students (Mean score: 3.05 vs 2.23, p<0.05). The self-antibiotic practices was higher in BPharm students than PharmD students (36.4% vs 20%, p<0.05). A significantly high number of PharmD students believed that empirical antibiotic therapy led to antibiotic resistance (19.5% versus 48%, P<0.05).

Conclusion: PharmD students were more knowledgeable about antibiotic usage and resistance compared to BPharm students who did not have accurate and the much needed information about the same. Future interventions should be targeted towards educating the BPharm students so that they can implement the acquired knowledge in their practice.

Keywords: Students, Pharmacy; Health Knowledge, Attitudes, Practice; Anti-Bacterial Agents; Drug Resistance, Bacterial; India

INTRODUCTION

WHO has reported high prevalence of drug resistance in healthcare facilities and in global community.1 The extent of damage by drug resistance could be realized by a report that suggested an increase of USD20 billion in direct healthcare cost in developed country like United States (US). The report also suggested of around 2 million reported cases of antibiotic resistance every year in US.2 However, in developing countries, many studies have been conducted in the past, but it is very difficult to quantify the burden imposed by antibiotic resistance on developing societies with precision. The situation is not so different in India as the identification of New Delhi metallo-beta-lactamase 1 (NDM-1) in recent past has raised many questions regarding antibiotic use. This gram negative Enterobacteriaceae is potentially resistant to all antibiotics except tigecycline and colistin.3 Earlier, Global Antibiotic Resistance Partnership (GARP) - India Working Group reported that between the span of 5 years from 2005 – 2009, the consumption of antibiotics was increased by 40%. The study also highlighted that many researchers in recent past have established significant rate of resistance to number of antibiotics in India.4 This statement was supported by another study which reported 24-67% of antibiotic prevalence in Maharashtra, India.5 Lack of knowledge of healthcare professionals, malpractice in community pharmacies and Pharmaceutical industry are the main contributors of this resistance saga.6-8 Several measures have been taken by the government in order to halt this surge of antibiotic resistance. The implementation of Schedule H-1 is one of the attempts to procrastinate the catastrophe of antibiotic self-medication practices in India.9

A noteworthy area was highlighted by many researchers regarding the inadequate training of healthcare professionals in their undergraduate education in an area of antibiotic use and resistance.10 Competence in understanding resistance patterns is a valuable guide to devise antibiotic guidelines and directing the antibiotic
The role of pharmacist is unequivocal in this war against antibiotic resistance. They are viewed as a more knowledgeable and resourceful healthcare professional to assist in infection control campaign. More importantly, community pharmacists are blessed to be called as a ‘gateway practitioner’. They have the significant opportunity to portray a prestigious role of promoting public health by their active participation in antibiotic stewardship program.1 In this consideration, Doctor of Pharmacy (PharmD) program was started in India with the aim of providing pharmaceutical care and to meet the pressing needs of healthcare in society.12 Before the introduction of this course, Diploma in Pharmacy (DPharm) and Bachelor of Pharmacy (BPharm) were the main degree programs in pharmacy offered in India. The entry point for BPharm and PharmD programs is 12 years of formal education in the sciences. The BPharm involves 4 years of study with no standardized curriculum. The focus of this degree is mainly towards industrial orientation, and there is no compulsory training in hospital/community practice site. The PharmD program constitutes 6 years of full-time study, while the PharmD (post-baccalaureate) program is a 3-year program. The final year of the study consist of practical training and/or residency at practice sites. The curriculum of PharmD program emphasizes majorly on clinical and patient-oriented aspects of the profession. At present, all three programs are running concurrently in different institutes of India. The curriculum of BPharm is mainly industry and product oriented unlike PharmD. However, the degree holders of both these programs are presenting their services in healthcare settings of India.13

To the best of our knowledge, no study has been conducted till date comparing the knowledge of BPharm and PharmD students. The objective of this study was to compare the knowledge, attitude and practice of BPharm and PharmD students towards antibiotic use and resistance. Our goal was to identify the knowledge gaps among students to form a basis of effective interventions regarding their understanding of pharmacist directed antibiotic stewardship program.

METHODS
A cross sectional study was conducted between final year Bachelor of Pharmacy (BPharm) and Doctor of Pharmacy (PharmD) students in two private institutes approved by pharmacy council of India (PCI) in South Indian state of Andhra Pradesh. PCI has granted an approval of 30 seats for PharmD and 60 seats for BPharm in the studied pharmacy colleges. The study was conducted for the period of 3 months from July to September, 2014 in which all the final year students of both the colleges were invited to participate in this study. All the students are briefed about the nature and the objectives of the research before requesting them to their voluntary participation in this study. Students were also informed via questionnaire about the operational definition of self-medication given by World Health Organization which is ‘the selection and use of medicines by individuals to treat self-recognised illnesses or symptoms’.

A self-administered questionnaire was designed and used as an instrument to collect data from the participants. A thorough literature review was done initially by one of the authors and research papers were shortlisted for further discussions among authors.6,9,11,17 After all the selected papers were comprehensively reviewed by the authors, an initial draft of the questionnaire was designed. The questionnaire was then subjected to content validity and face validity. The draft was then subjected to Statistical Package for the Social Sciences (SPSS) for reliability coefficient. A Cronbach's alpha of 0.76 was computed. Necessary changes were incorporated and after a series of discussions among the authors and between authors and selected pharmacy academicians. A final version of the questionnaire was then distributed to students for data collection.

The study instrument consisted of 5 sections. First section highlighted the demographic information like gender, living status and residence. Second section, comprised of 10 questions, evaluated the knowledge of participants about the use of antibiotics. Third section assessed the attitudes of respondents regarding antibiotic use and resistance. This section included 5 questions. The fourth part explored the self-antibiotic practices between BPharm and PharmD students. The last part of the questionnaire appraised the students regarding their knowledge of possible causes of antibiotic resistance.

Knowledge of antibiotics use was assessed by asking question about the effectiveness, side effects, resistance, cost, policy matters and implication of antibiotic use on public health. Each response was scored as ‘True’, ‘False’ or ‘Don’t Know’. A score of 1 was given to the correct answer and 0 to incorrect answer. Respondent who marked ‘Don’t know’ was considered as a wrong answer. The maximum possible marks of knowledge section were 10 and the minimum mark was 0. A cut-off value of 6 or higher was taken as good knowledge while score of <6 was considered as poor knowledge. The same criteria were also used when assessing the knowledge of respondents about the possible causes of antibiotic resistance. The attitude of students was measured on 4 point Likert scale. A score of 1 was given to strongly agree, 2 to agree, 3...
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A mean score of 3 or higher was considered as positive attitude while score of <3 was taken as negative attitude. Self-antibiotic practices among students were examined by asking closed ended questions regarding their self-antibiotic practices, frequency of self-medication, reason of self-medication, source of information about antibiotics, and the disease condition in which they practice self-medication. Participants were asked to respond to this part of questionnaire based on their practices since their enrolment at pharmacy schools.

Descriptive analysis was used to illustrate demographic characteristics. Results were reported as percentage and frequency. The Kolmogorov-Smirnov test was carried out to observe the nature of data distribution. Mann-Whitney U test was applied to integrate the mean score of knowledge with the demographic information. Chi square test was used to assess the association between dependent and independent variables. However, if the expected frequency is lower than 5, in contingency table, fisher exact test was used instead. Monte Carlo test was utilized at 99% confidence level to estimate the fisher exact p value, which was considered as significant at p<0.05.

The study was conducted with the approval of the dean of the faculty and the permission of the concerned lectures was also taken. Students were thoroughly explained about the objectives of this study. It was also clarified to the students that the completion and submission of the questionnaire would be taken as their consent to participate voluntarily in this study. High level of confidentiality and anonymity was maintained throughout the study.

RESULTS

A total of 137 students participated in this study. PharmD students demonstrated greater overall knowledge of antibiotic use than BPharm students (Mean score: 5.09 vs 6.18, p<0.01). It was explored that the students with urban family background had greater knowledge as compared to students from rural background (Mean score: 5.65 vs 5.13, p<0.05). The results were not significantly different when the current living status of the participants was integrated with the knowledge. The interrelation of demographic characteristics and the knowledge is presented in Table 1.

The superiority of PharmD students was apparent as majority of them correctly answered all the knowledge related questions. However, it is noteworthy to mention that the concept of superbugs and NDM-1 was low in both the groups, as only 2.3% of BPharm students and 28% of PharmD students correctly answered the question about the concept mentioned above. Similarly, it was also noticed that BPharm students incorrectly identified the use of antibiotics in common cold and flu (24.1%) as compared to PharmD student (64%). The knowledge gap was also exposed by this study as only one third of BPharm students and one half of PharmD students were aware of the National Antibiotic Policy of India. The responses of all knowledge questions is mentioned in Table 2.

Table 1. Interrelation of Knowledge of antibiotic use and score with demographic information of participants (N=137)

| Demographic Characteristics (n) | Knowledge Score Mean (SD) | Mean Rank | P value* |
|--------------------------------|--------------------------|-----------|----------|
| Gender                         |                          |           |          |
| Male (93)                      | 5.56 (1.43)              | 70.78     | 0.433    |
| Female (44)                    | 5.31 (1.39)              | 65.23     |          |
| Degree                         |                          |           |          |
| B. Pharm (87)                  | 5.09 (1.24)              | 58.63     | <0.001   |
| Pharm D (50)                   | 6.18 (1.46)              | 87.05     |          |
| Living Status                  |                          |           |          |
| Hostler/Outsider (34)          | 5.41 (1.41)              | 61.06     | 0.168    |
| Family home (103)              | 5.60 (1.41)              | 71.62     |          |
| Family Residence               |                          |           |          |
| Rural (44)                     | 5.13 (1.09)              | 57.90     | 0.021    |
| Urban (93)                     | 5.65 (1.53)              | 74.25     |          |

* derived from Mann-Whitney U test
Note: Knowledge was assessed by giving 1 point to correct answer and 0 to incorrect answer. The scale measured knowledge from maximum 10 to minimum 0. A score of ≥6 was taken as good knowledge while score of <6 termed as poor knowledge.

Table 2. Students who answered correctly to knowledge questions regarding antibiotic use (N=137)

| Knowledge Questions                  | Correctly Answered (%) | P value* |
|--------------------------------------|------------------------|----------|
| Indication of antibiotic use         | 24.1                   | 0.01     |
| Effectiveness of antibiotics         | 68                     | 72.4     | 0.035    |
| Complication of antibiotics          | 74                     | 88.5     | 0.01     |
| Resistance due to antibiotics        | 55.2                   | 78       | 0.001    |
| Cost of antibiotics                  | 63.2                   | 90       | 0.046    |
| Future of antibiotics use            | 58.6                   | 88       | <0.001   |
| Effects of superbugs                 | 2.3                    | 28       | <0.001   |
| Knowledge of Schedule H1             | 46.4                   | 53.6     | <0.001   |
| National antibiotic policy           | 32                     | 48.3     | <0.001   |
| Implications on public health        | 70                     | 79.3     | 0.074    |

* derived from chi-square test
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The data suggested that overall attitude of PharmD students was positive in contrast to BPharm students (Mean score: 3.05 vs 2.23). This difference in attitude was statistically significant in all the attitude related questions, except for one question concerning skipping of doses and its effect on resistance. The responses of BPharm and PharmD students towards attitude statements in summarized in Table 3.

Furthermore, the study also revealed the self-antibiotic practices of participants as expressed in Table 4. Significant difference was observed between the two groups when asked whether they consult physician before taking antibiotics (p<0.05). Practices of the contrasting groups varied in terms of disease in which antibiotics were self-practiced (p<0.05). However, the practices were similar with regards to the frequency, reason and sources of antibiotic use (p>0.05). No significant differences were observed between BPharm students and PharmD students in terms of different classes of antibiotics used (p>0.05). Penicillins were amongst the common antibiotic frequently used by the participants. Antibiotics which were self-practiced by the respondents are illustrated in Table 5.

Another aspect of this study was to understand the perception of students regarding the possible causes of antibiotic resistance. It is worth reporting that only 19.5% of BPharm students believed that empirical therapy is a possible cause of antibiotic resistance. The figure rose to 48% when the same question was asked to PharmD students (p<0.01). Similarly PharmD students were also more of the opinion that use of broader antibiotics and lack of restrictions do contribute to the development of resistance (p<0.05). The participants’ response towards the possible causes of resistance is tabularized in Table 6.

**DISCUSSION**

This study aimed to assess the knowledge, attitude and practice related to antibiotic usage and antibiotic resistance in BPharm and PharmD students. The results of the study showed that PharmD students had better knowledge about antibiotic usage compared to BPharm students. BPharm students, as opposed to their PharmD peers, fared poorly on questions pertaining to costs of antibiotics, effects of superbugs, indications of antibiotic use and resistance.

| Table 3. Students’ attitude towards antibiotic use (N=137) |
|---------------------------------------------------------|
| **Attitude Questions (%disagreed)**                        | BPharm students | PharmD students | P-value** |
| When I have a cold, I should take antibiotics to prevent getting a more serious illness | 24.1            | 66              | <0.001    |
| When I get fever, antibiotics help me to get better more quickly | 27.5            | 52              | 0.021     |
| Antibiotic intake should be stopped as soon as possible patient feel better | 24.1            | 76              | <0.001    |
| Skipping one or two doses does not contribute to the development of antibiotic resistance | 59.7            | 58              | 0.10      |
| Antibiotics are safe, hence they can be commonly used | 47.1            | 76              | 0.001     |

*Percentages of Disagreed and Strongly disagreed responses were combined
**P value derived from Chi-square test

Note: Attitude was assessed by giving 1 to SA, 2 to A, 3 to D and 4 to SD. Score of 3 or higher were taken as positive attitude while <3 as negative attitude. Mean attitude of BPharm students was 2.23 ± 0.29, and PharmD students were 3.05±0.14.

Mean Attitude Score (SD): *2.19 (1.06), **2.03 (0.96), **2.18 (1.06), **2.42 (0.93), **2.55 (0.95)

| Table 4. Self-Antibiotics practice among student (N=137) |
|---------------------------------------------------------|
| **Self-Antibiotic data**                                   | BPharm students* (%) | PharmD students* (%) | P-value** |
| Self-medication use                                        | Do you consult physician before taking antibiotics | 63.6* | 80* | 0.039 |
|                                                       | Occasionally | 36.8 | 22 |          |
|                                                       | Weekly | 4.6 | 2 | 0.052 |
|                                                       | Rarely | 54 | 60 | |
|                                                       | Never | 4.6 | 16 | |
| Reason                                                     | Disease is simple | 18.4 | 36 | 0.144 |
|                                                       | Treatment cost is high in clinics | 11.5 | 10 | |
|                                                       | There was a previous experience with the disease | 34.5 | 26 | |
|                                                       | Lack of hospitals in the nearest place | 4.6 | 4 | |
|                                                       | Lack of trust in medical service | 6.9 | 0 | |
|                                                       | Self-decision | 24.1 | 24 | 0.227 |
| Source                                                     | Drugs directory | 5.7 | 18 | |
|                                                       | Family, friends or neighbours | 5.7 | 4 | |
|                                                       | Pharmacist (retail pharmacy shops) | 44.8 | 36 | |
|                                                       | Previous prescription | 31.2 | 32 | |
|                                                       | Others | 12.6 | 10 | |
| Disease conditions                                         | Cough/cold/flu and other respiratory problems | 46 | 32 | 0.011 |
|                                                       | Fever and other milder illness | 23 | 40 | |
|                                                       | Wound infection | 13.8 | 8 | |
|                                                       | Diarrhea and other G/I/T related problems | 11.5 | 4 | |
|                                                       | Eye/ ear infection | 1.1 | 12 | |
|                                                       | Others | 4.6 | 4 | |

* Students answered in yes
**P value derived from Chi-square test
Table 5. Use of antibiotics by BPharm and PharmD students

| Antibiotic                        | BPharm students (%) | PharmD students (%) |
|-----------------------------------|---------------------|---------------------|
| Penicillins                       | 26%                 | 34%                 |
| Cephalosporins                    | 15%                 | 16%                 |
| Macrolides                        | 21%                 | 10%                 |
| Aminoglycosides                   | 5%                  | 4%                  |
| Quinolones                        | 14%                 | 4%                  |
| Others                            | 20%                 | 30%                 |

Table 6. Students perception of possible causes of antibiotic resistance

| Following are the possible causes of resistance                                      | Respondents answered Yes (%) | P value* |
|-------------------------------------------------------------------------------------|------------------------------|----------|
|                                                                                     | BPharm students | PharmD students |         |
| Use of antibiotics for self-limited non bacterial infections                        | 56.63            | 62              | 0.516   |
| Use of antibiotics with a broader than necessary spectrum                           | 44.8             | 64              | 0.034   |
| Use of antibiotics for shorter than standard duration                               | 42.5             | 38              | 0.604   |
| Poor infection control measures                                                    | 54               | 52              | 0.819   |
| Use of antibiotics for self-limited bacterial infections                            | 56.3             | 60              | 0.675   |
| Empirical antibiotic therapy (best guess therapy)                                   | 19.5             | 48              | 0.001   |
| Mutational and evolutionary changes in the micro organism                           | 55.2             | 72              | 0.052   |
| Lack of restrictions on antibiotic usage                                            | 56.3             | 74              | 0.039   |
| Excessive antibiotic use in livestock (Animals reared for food)                     | 35.8             | 34              | 0.744   |
| Use of antibiotics for longer than standard duration                                | 62.1             | 68              | 0.486   |

* P value derived from Chi-square test
PharmD students were more informed about the restrictions on antibiotic usage than their BPharm counterparts, indicating more awareness about the recently adopted Schedule H15 and related regulatory policies.

This study is not without limitations. The conclusions were drawn from a convenience sample representing two institutions in South India. These findings might not be generalizable for BPharm students all over India. However, this study provides a valuable insight about knowledge, attitude and practice about antibiotic usage and resistance among pharmacy students.

CONCLUSIONS

The study highlighted significant difference between the knowledge and attitude of PharmD and BPharm students regarding antibiotic use and resistance. However, no significant difference was observed in the self-antibiotic practices among the students. The study also identified the areas where marked deficiencies were observed in the knowledge of BPharm and PharmD students regarding the possible causes of antibiotic resistance. This research can become a basis for nationwide study comparing the knowledge of BPharm and PharmD students and the possible inclusion of advanced antibiotic education in BPharm curriculum subsequently.

CONFLICT OF INTEREST

Nill.

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