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Research Note

# Master of Pharmacy students' knowledge and awareness of antibiotic use, resistance and stewardship

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ABSTRACT

*Introduction:* Antibiotic resistance has become a global public health concern. In this study, we investigated the knowledge and awareness of antibiotic use, resistance and stewardship, held by the pharmacy students currently studying at the University of Brighton.

*Methods:* This was a cross-sectional, online survey, and email invitations to participate were sent to all students attending our Master of Pharmacy (MPharm) course (n = 583). Students' knowledge was assessed with 29 items; responses for these were totaled before comparison among students. Comparison of scores between groups of students was performed using the Kruskal-Wallis or the MannWhitney *U* test, as appropriate.

*Results:* The response rate was 32%. The overall median knowledge score was 7.9. There was a statistically significant difference in knowledge scores between years of study ($p = 0.02$), particularly between year of study 1 (7.6) and 4 (8.3). A statistically significant difference was found between the knowledge scores of male (8.4) and female (7.9) students ($p = 0.03$). Most students believed a strong knowledge of antibiotics, and microbiology and infection control is important for their pharmacy careers and more than 90% agreed that antibiotic resistance will be a greater clinical problem in the future.

*Discussion and conclusions:* Although the MPharm students studied achieved good overall knowledge scores, a significant proportion showed a lack of understanding with regards to some important aspects of antibiotic resistance mechanisms, factors promoting the emergence and spread of antibiotic resistance, and antibiotic stewardship policies.

## Introduction

Antibiotic resistance has become a global public health concern, causing the deaths of more than 25,000 people every year in Europe and creating a significant and growing economic burden worldwide.[1] As a consequence, and in an attempt to try to contain and mitigate the development of antibiotic resistance, antimicrobial stewardship programs have been developed worldwide.[2] The concept of antimicrobial stewardship encompasses a wide range of interventions intended to achieve the optimization of antimicrobial therapies for individual patients and the prevention of overuse and misuse of these drugs. Key areas for action include

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the optimization of antibiotic prescribing, the improvement of infection prevention procedures, diagnostics and control practices, the search for new antimicrobial drugs and therapies, and the improvement of professional education and training. It is particularly relevant that the World Health Organization (WHO) emphasizes the relevance of health-related undergraduate training courses in nurturing prudent prescribing and use of antibiotics.[1]

Educational inquiry studies relating to students' knowledge base regarding antibiotic use and the development of resistance have been popular in the literature and have, to date, mostly been carried out among medical students in Europe,[3–6] the United States (US),[7,8] and developing countries.[9,10] A significant proportion of the medical students surveyed in these studies demonstrated significant gaps in their understanding of appropriate antibiotic usage and the processes involved in the development of antibiotic resistance, and in general, wanted more instruction in these subject areas. Educational deficiencies with respect to an appreciation of the antibiotic drug class in general, and their safe use, also seem to be widespread among students in scientific fields such as biology, nursing and other health-related fields.[10–13]

Given their vital role in healthcare systems in terms of the information and access to medicines they provide, pharmacists are essential in the battle against antibiotic resistance, and in promoting the implementation of effective antibiotic stewardship programs in order to support the more rational use and control of antimicrobial drugs.[14–18] However, and somewhat surprisingly, almost no information is available about the knowledge-base and perceptions regarding antibiotics among this professional group. Educational gaps in pharmacy education on antibiotics and their use have been identified in studies from India,[19] Trinidad and Tobago,[20] Malaysia,[21,22] and the US,[23] However, to our knowledge, no similar study has been carried out in Europe to-date. In these studies, one common misconception found was the belief that antibiotics are an effective way to treat the common cold and other viruses. Nevertheless, most pharmacy students believed a strong knowledge of antibiotics was important for their careers and requested more education in this area.[23]

In this study, we aimed to learn about our master of pharmacy (MPharm) students' knowledge and awareness of antibiotic use, drug resistance and stewardship, and their perceptions about the education they receive on the course relating to these topics.

## Methods

### *Study design, population, and ethics*

This study was a cross-sectional, online survey designed to evaluate MPharm students' knowledge and awareness of antibiotic use, resistance and stewardship. Survey invitations were sent to all MPharm students in the first (n = 172), second (n = 137), third (n = 136) and fourth (n = 138) years. Ethical approval was granted by the Centre for Learning and Teaching Research Ethics Committee of the University of Brighton. The purpose of the study was explained to students in the invitation email, together with a participant information sheet. Students were discouraged from using any additional resources such as guidelines or electronic applications when answering the survey. The survey was anonymous, and the students were informed that it was non-compulsory and would have no impact on their grades. There was no monetary incentive to participate. Online submission of the completed survey by student participants was accepted as consent.

### Survey instrument and administration

A 51-item questionnaire was developed after a literature review of comparable studies,[4–6,19–21,23] composed of five sections and validated by a pilot study on 15 MPharm students for readability, relevance of questions and length (see questionnaire in Supplementary Material). The first part of the questionnaire investigated the demographic characteristics of the participants. The second and third parts assessed the general level of knowledge about antibiotics among the participants, and specific knowledge and awareness regarding antibiotic resistance and antibiotic stewardship, respectively. The fourth part of the study addressed students' perceptions about the education they received on antibiotics. Finally, the last part of the questionnaire provided the students with an option to give additional suggestions or opinions about the different topics covered in the study. Both a three points scale ("disagree," "not sure, and "agree"), and yes/no responses were used. The final survey was self-administered using the Bristol Online Services tool (www.onlinesurveys.ac.uk) in February 2016, after most teaching and learning activities regarding antibiotics had taken place for the first and second years of study. Students received an email inviting them to participate in the survey and reminders were sent out after both one and two weeks.

### *Statistics*

A descriptive analysis of the sample was performed, considering the distribution of gender and year of study, age range, United Kingdom (UK) residency status, intended practice area, and association with relatives or close friends working in health-related fields. The results regarding knowledge were dichotomized as "correct" or "incorrect" by grouping the three points scale as appropriate.[5,6,23] For example, for question 9 (aspirin is an antibiotic), the option "disagree" was considered "correct," and the options "agree" and "not sure" were merged as "incorrect." The percentages of correct answers were calculated for each question for all student cohorts and subgroups, as appropriate. Additionally, an overall knowledge score was estimated for each respondent by calculating the proportion of correct answers for the 29 knowledge-based questions (questions 8–19 and 24–40) and representing this on a scale 0–10 ("0" shows poor knowledge and "10" shows good knowledge).[8,19,20,23] Knowledge scores, reported as median with interquartile range (IQR) were computed for each year of study, male and female students, and other groups of students as