

ORIGINAL

Knowledge, attitude and practice towards antibiotic use and resistance among non-medical university students: A cross sectional survey in the United Kingdom

Conocimiento, actitud y práctica hacia el uso de antibióticos y la resistencia entre los estudiantes universitarios no médicos: Una encuesta transversal en el Reino Unido

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Abstract

Objective: Student surveys conducted in Higher Educational Institutes globally have indicated a dearth of knowledge regarding antibiotics and their appropriate usage. The knowledge, attitude, and practices (KAP) of non-medical students towards antibiotics is under-researched in the United Kingdom so in this study, we aimed to assess the antibiotic KAP of non-medical students at the University of the West of England.

Methods: A cross-sectional survey was conducted among a diverse group of 602 university students using self-administered written questionnaires. Descriptive and inferential statistics were carried out using SPSS 24.

Results: The survey response rate was 99.7%. Knowledge of antibiotics was significantly higher among home (UK) students and those enrolled in Faculty of Health and Applied Sciences ($P < 0.001$). Respondents displayed a good understanding of personal use of antibiotics affecting their own health however the relationship between individual consumption of antibiotics contributing to antibiotic resistance in the community was not clear. 71% of the respondents thought antibiotic resistance was a property of human body, rather than bacteria. Over half of the respondents failed to acknowledge it as a serious global and national problem.

Conclusions: This study highlighted the cultural differences in knowledge, attitudes and practices regarding antibiotics among students. Misconceptions about biological mechanisms of antibiotic resistance and lack of personal responsibility for the issue were clearly demonstrated among respondents. Identification of these misunderstandings could inform targeted interventions aimed at improving the understanding of causes and consequences of antibiotic resistance along with emphasis on potential social benefit made by rational personal use of antibiotics.

Keywords: antibiotic resistance, cross sectional survey, university, students, non-medical.

Resumen

Objetivo: Las encuestas realizadas a estudiantes de centros de enseñanza superior de todo el mundo han puesto de manifiesto la escasez de conocimientos sobre los antibióticos y su uso adecuado. El conocimiento, la actitud y las prácticas (CAP) de los estudiantes no médicos con respecto a los antibióticos está poco investigado en el Reino Unido, por lo que en este estudio nos propusimos evaluar el CAP sobre antibióticos de los estudiantes no médicos de la Universidad del Oeste de Inglaterra.

Métodos: Se realizó una encuesta transversal entre un grupo diverso de 602 estudiantes universitarios utilizando cuestionarios escritos autoadministrados. Se realizaron estadísticas descriptivas e inferenciales con el programa SPSS 24.

Resultados: La tasa de respuesta a la encuesta fue del 99,7%. El conocimiento de los antibióticos fue significativamente mayor entre los estudiantes de origen (Reino Unido) y los matriculados en la Facultad de Salud y Ciencias Aplicadas ($P < 0,001$). Los encuestados mostraron una buena comprensión del uso personal de los antibióticos que afecta a su propia salud, sin embargo, la relación entre el consumo individual de antibióticos que contribuye a la resistencia a los antibióticos en la comunidad no estaba clara. El 71% de los encuestados pensaba que la resistencia a los antibióticos era una propiedad del cuerpo humano, más que de las bacterias. Más de la mitad de los encuestados no reconocen que se trata de un grave problema mundial y nacional.

Conclusiones: Este estudio puso de manifiesto las diferencias culturales en cuanto a conocimientos, actitudes y prácticas en relación con los antibióticos entre los estudiantes. Los encuestados demostraron claramente sus ideas erróneas sobre los mecanismos biológicos de la resistencia a los antibióticos y su falta de responsabilidad personal en el tema. La identificación de estos malentendidos podría servir de base para las intervenciones dirigidas a mejorar la comprensión de las causas y las consecuencias de la resistencia a los antibióticos, junto con el énfasis en el potencial beneficio social que supone el uso personal racional de los antibióticos.

Palabras clave: resistencia a los antibióticos, encuesta transversal, universidad, estudiantes, no médicos.

Introduction

Antimicrobial resistance (AMR) is a major public health issue presenting a significant threat globally in the 21st century. The World Health Organization has declared AMR as one of the top ten global public health threats facing humanity which requires urgent multisectoral action in order to achieve the Sustainable Development Goals¹.

The Global action plan on antimicrobial resistance identifies AMR as a complex problem calling for whole-of-society engagement². University students, being an accessible antibiotic user group and influential advisors to friends and family, are a potential target to engage with for addressing the problem of AMR. Recent research, however, has been majorly confined to students with medical backgrounds since they will be future antibiotic providers and trained for appropriate anti-microbial prescribing and responsible antibiotic use³⁻⁷.

In the United Kingdom, knowledge, attitude and practice (KAP) relating to antibiotic use and resistance amongst students in higher educational institutes has not received much research attention. A literature search revealed three studies exploring antibiotic KAP among health care students⁸⁻¹⁰ with no published reports on university students affiliated to non-medical backgrounds in the country.

Furthermore, no study so far has attempted to assess these patterns across a wide spectrum of courses in an ethnically diverse population of students at the same time using the same survey instrument. The current study aimed to present a contemporary picture of the antibiotic KAP of a varied group of students from non-medical backgrounds in a large UK university. The information obtained may provide guidance for the improvement of health services on the university campus and in initiating targeted health promotion interventions for individuals identified at higher risk.

Methods

Study population

The study population consisted of students at the University of the West of England (UWE). UWE is the largest provider of higher education in the Southwest of England. The student community at UWE is quite diverse in terms of their age groups, ethnic backgrounds and study programmes¹¹.

Raosoft sample size calculator was used to determine the minimum required sample size¹². Based on the calculation with a 5% margin of error, a 95% confidence level and a 50% response distribution, the effective sample size estimated was 380. However, a larger

sample size of 600 students was eventually included in the study, yielding approximately 1.5 times the initial sample size projection.

Students were approached in public spaces including post rooms and cafeterias and questionnaires were distributed to all the participants along with the participant information sheet. Ethical approval was obtained from the University's Research Ethics Committee. Anonymised questionnaires were used to ensure confidentiality.

Survey instruments

Data were collected using a self-administered, pre-tested questionnaire containing 26 questions. The questionnaire was developed after undertaking a literature review of comparable studies and was tailored to suit the local population¹³⁻¹⁶. It consisted of three sections: the first section recorded the respondent's socio-demographic characteristics.

The second section investigated respondent's knowledge and attitudes relating to antibiotics and their use. It had 12 knowledge statements and 4 attitude statements. A five-point Likert scale was employed to evaluate the respondent's responses. Section three consisted of four questions providing information about the practice of antibiotic use.

The questionnaire was pre-tested for content, design, readability, and comprehension on twenty students. Necessary modifications were done to make the questionnaire easy to answer and improve the acceptability. The pre-test data were discarded in the final analysis. Cronbach's alpha was used to assess the reliability of the statements determining knowledge and attitude and were calculated to be 0.71 and 0.83, respectively, therefore confirming the adequacy of the internal consistencies of the statements.

Data collection and analysis

A total of 602 students were approached for the study, of which 600 agreed to participate. The study had students belonging to 74 different countries who were grouped into continents (except the home students) for ease of analysis. The responses for knowledge, attitudes, and practice sections were assessed by calculating the percentage of each response selected. Further, the questions relating to knowledge were scored using five-point Likert scales (1= Strongly disagree, 2= Disagree, 3= Don't Know, 4= Agree and 5= Strongly agree). The total knowledge score for each of the respondents was calculated by adding up scores for each of these 12 statements yielding a maximum obtainable score of 60.

Data were analysed using the Statistical Packages for Social Sciences (SPSS), version 24.0. Frequency tables were used to summarise the data on the socio-

demographic variables. To examine the relationship between knowledge of antibiotics and socio-demographic variables, Mann –Whitney U test and Kruskal– Wallis test were employed depending upon the levels of the demographic variables owing to the

skewed distribution of data. Groups with number of cases <10, were amalgamated with the next category wherever appropriate (as in the case of age, level of education, and student's normal residence). In demographic variables for which a significant overall association with KAP was established, further post hoc analysis was performed to determine the differences between groups employing Mann-Whitney U tests. Bonferroni correction was applied to control for inflation in Type I error rates. Association between knowledge score and prudent antibiotic use was explored using Mann-Whitney U test. For all analyses, a p value of < 0.05 was considered to be statistically significant.

Table I: Demographic characteristics of the study participants.

Demographic characteristics	Number of respondents	Percentage
Gender		
Male	289	(48.3%)
Female	308	(51.2 %)
Prefer not to say	3	(0.5%)
Age		
Under 18	11	(1.8%)
18-22	504	(84.0%)
23-29	75	(12.5%)
30 or above	10	(1.7%)
Faculty		
Health and Applied Sciences	108	(18.0%)
Business and Law	275	(45.9%)
Environment and Technology	155	(25.8%)
Arts, Creative Industries and Education	62	(10.3%)
Level of education		
Foundation	86	(14.3%)
Undergraduate	426	(71.1%)
Postgraduate	86	(14.3%)
Doctoral	2	(0.3%)
Country of residence		
UK (Home)	315	(52.5%)
Europe	44	(7.3%)
Asia	186	(31.0%)
Africa	43	(7.2%)
North America	8	(1.3%)
South America	4	(0.7%)

Results

A total of 600 UWE students participated and completed the questionnaire survey, generating a response rate of 99.7%. The mean age of the participants was 20.4 years. The median antibiotic knowledge score for the respondents was 36 with 55.6% scoring ≤ median and remaining 44.4% scoring > median. **Table I** summarises the demographic characteristics of the study population.

Knowledge and perceptions about antibiotics and antibiotic resistance

Response distributions to knowledge-probing statements are shown in **table II**.

Table II: Overall responses to knowledge assessments statements.

Statements	Strongly disagree N (%)	Disagree N (%)	Don't know N(%)	Agree N(%)	Strongly agree N (%)	Total N (%)
1 Antibiotics are effective against bacteria	01 (0.2%)	17 (2.8%)	71 (11.8%)	390 (65.0%)	121 (20.2%)	600 -100%
2 Antibiotics are effective against viruses	43 (7.2%)	116 (19.3%)	114 (19.0%)	294 (49.0%)	33 (5.5%)	600 -100%
3 Antibiotics work on most colds & coughs	13 (2.2%)	153 (25.5%)	126 (21.0%)	280 (46.7%)	28 (4.7%)	600 -100%
4 A course of antibiotics should be stopped when a person starts feeling better	92 (15.3%)	228 (38.0%)	73 (12.2%)	160 (26.7%)	47 (7.8%)	600 -100%
5 Humans can become resistant to antibiotics	7 (1.2%)	50 (8.3%)	116 (19.3%)	297 (49.5%)	130 (21.7%)	600 -100%
6 Viruses can become resistant to antibiotics	21 (3.5%)	50 (8.3%)	153 (25.5%)	307 (51.2%)	69 (11.5%)	600 -100%
7 Bacteria can become resistant to antibiotics	4 (0.7%)	20 (3.3%)	159 (26.5%)	299 (49.8%)	118 (19.7%)	600 -100%
8 Antibiotic resistance is an issue that could affect me and my family	6 (1.0%)	53 (8.8%)	181 (30.2%)	294 (49.0%)	66 (11.0%)	600 -100%
9 Resistance to antibiotics is a problem in my country	15 (2.5%)	104 (17.3%)	295 (49.2%)	160 (26.7%)	26 (4.3%)	600 -100%
10 Antibiotic resistance is a significant global problem	6 (1.0%)	30 (5.0%)	261 (43.5%)	255 (42.5%)	48 (8.0%)	600 -100%
11 Inappropriate personal use of antibiotics can contribute to the problem of antibiotic resistance for myself	9 (1.5%)	21 (3.5%)	128 (21.3%)	345 (57.5%)	97 (16.2%)	600 -100%
12 Inappropriate personal use of antibiotics can contribute to the problem of antibiotic resistance for the whole community	3 (0.5%)	64 (10.7%)	187 (30.2%)	288 (48.0%)	64 (10.7%)	600 -100%

Confusion regarding the understanding of the basic biological mechanism behind antibiotic resistance was demonstrated in the study. Almost seven in ten respondents incorrectly agreed that “Humans can become resistant to antibiotics”. Faculty of Health and Applied Sciences (HAAS) had the highest proportion of respondents (81.5%) affirming to the statement. Also, 77% of the home students agreed with the statement. Antibiotic resistance was not perceived as an important national or global challenge by a sizeable proportion of students.

Almost two-thirds of the respondents (75%) recognised that inappropriate personal use of antibiotics can contribute to the problem of antibiotic resistance for themselves. Whereas the number of respondents agreeing to inapt personal antibiotic use contributing to the problem of antibiotic resistance for the whole community was relatively lower at 59%.

Knowledge of antibiotics was found to vary significantly with the faculty of enrolment ($p < 0.001$) and country of residence ($p < 0.001$). The respondents from Faculty of HAAS and home students had the highest mean ranks translating into higher antibiotic knowledge when

compared to their counterparts (Table III). Further, the post hoc analysis performed for the variables of Faculty revealed statistically significant differences between the mean ranks of respondents from HAAS & FBL ($p < 0.001$), HAAS & FET, ($p < 0.001$), HAAS & ACE ($p < 0.001$) respectively. For the country of normal residence, a significant difference was found between the mean ranks of respondents from UK and Asia ($p < 0.001$).

Attitudes and beliefs towards antibiotic use

Almost one-third of the considered it appropriate to bring antibiotics from home to avoid hassles of booking an appointment and seeing a doctor at university, of which 60% were international students (Table IV).

Practices on antibiotics use among participants

Almost three quarters of the students had taken oral antibiotics in the past 12 months, with the majority (73%) having completed their last antibiotic course. Approximately 16% didn't finish the last antibiotic course, maximum rates reported among respondents from Africa and South America (27.7%) followed by Asia (20.0%). The majority of these attributed it to getting better (65%) and being forgetful (19%).

Table III: Association between knowledge of antibiotics & socio-demographic characteristics of respondents.

Demographic characteristics	N (%)	Median knowledge score	Interquartile range (P value)*	Z score (P value)**	χ^2
Gender					
Male	289 (48.3)	35.0	32.0 - 39.0	-1.52	
Female	308 (51.2)	36.0	33.0 - 40.0		
Age					
Under 18	11 (1.8)	34.0	33.0 - 38.0		0.30 (0.86)
18-22	504 (84.0)	36.0	33.0 - 40.0		
23 and above	85 (12.5)	36.0	33.0 - 40.0		
Faculty					
Health and Applied Sciences (HAAS)	108 (18.0)	39.0	35.0 - 44.0		46.45 (< 0.001)
Business and Law (FBL)	275 (45.9)	35.0	32.0 - 38.0		
Environment and Technology (FET)	155 (25.8)	36.0	33.0 - 40.0		
Arts, Creative Industries and Education (ACE)	62 (10.3)	35.0	33.0 - 40.0		
Level of education					
Foundation	86 (14.3)	35.5	33.0 - 40.0		1.23 (0.54)
Undergraduate	426 (71.1)	36.0	33.0 - 40.0		
Postgrad & Doctoral	88 (14.6)	35.0	32.5 - 38.5		
Student's normal residence					
UK (Home)	315 (52.5)	37.0	34.0 - 41.0		32.26 (< 0.001)
Europe+ North America	52 (8.6)	37.0	33.0 - 40.0		
Asia	186 (31.0)	34.0	32.0 - 37.0		
Africa + South America	47 (7.9)	37.0	32.0 - 41.5		

* Mann-Whitney U test ** Kruskal-Wallis test

Table IV: Overall responses to attitudes assessments statements.

Statements	Strongly disagree N (%)	Disagree N (%)	Don't know N (%)	Agree N (%)	Strongly agree N (%)	Total N (%)
1 When I get a cold, I should take antibiotics to get better quickly	53 (8.8%)	289 (48.1%)	73 (12.2%)	169 (28.2%)	16 (2.7%)	600 -100%
2 When I have a cold, I should take antibiotics to prevent getting worse	26 (4.3%)	266 (44.3%)	101 (12.2%)	185 (30.8%)	21 (3.5%)	600 -100%
3 It is fine to bring antibiotics from home to avoid hassles of booking an appointment and seeing a doctor at university	37 (6.2%)	214 (35.7%)	144 (24.0%)	168 (28.0%)	37 (6.2%)	600 -100%
4 It is okay to keep unused antibiotics and use them later when needed without the advice of doctor	123 (20.5%)	293 (48.8%)	79 (13.2%)	95 (15.8%)	10 (1.7%)	600 -100%

Most of the respondents (87%) declared using prescribed antibiotics. Of those using unprescribed antibiotics, majority either (51%) purchased them from a pharmacy or obtained them from family and friends (25%). The rates of self-medication were highest among African and South American students (29.8%) followed by Asian respondents (21.5%). Home students reported lowest rates of self-medication at 4.4%. Respondents who had finished their last antibiotic course were found to be significantly more knowledgeable about antibiotics than those who failed to finish the prescription ($p=0.01$).

Discussion

To the best of our knowledge, this is the first study to survey antibiotic KAP of a diverse population of students from a range of courses in the UK, all affiliated to non-medical backgrounds.

Knowledge and perceptions

The findings indicate confusion among students regarding whether antibiotics are effective against bacteria or viruses and their role in treating coughs and colds as observed in previous student surveys¹⁷⁻²⁰.

Confusion persists regarding the biological mechanism underlying antibiotic resistance, it seems to be conceptualized as some change caused in the human body rendering antibiotics ineffective rather than interpreting it as an intrinsic property of the bacteria. This fits with findings published in public surveys²¹⁻²⁴.

Misconception about human body building resistance to antibiotics was significantly more prevalent among the home students and those enrolled in Faculty of Health and Applied Sciences, both of which were predictors of higher knowledge of antibiotics in the study. This is a unique finding, and no historical studies exist to make direct comparisons. It indicates that although the term antibiotic resistance and its severity is firmly instilled among students with higher antibiotic knowledge, the understanding of the biological mechanism and events behind the phenomenon remains largely obscure.

Students in our survey didn't perceive antibiotic resistance as a serious global and/or national challenge discordant with the findings reported in student surveys conducted on medical students^{3,5,7,18}.

When queried about perceptions of relationship between inappropriate use of antibiotics and the phenomenon of antibiotic resistance, respondents seemed to have demonstrated a good understanding of their personal use of antibiotics affecting their own health. However, understanding of the relationship between the individual consumption of antibiotics and development of antibiotic resistance in the community was limited. The findings are

congruent with published reports²⁵⁻²⁶ and clearly suggests a lack of understanding of the individual ownership of the cause and calls for development of interventions explaining how antibiotic resistance develops and spreads in the first place including a dimension that assigns individual responsibility.

Students from Faculty of Health and Applied Sciences seemed to be more knowledgeable about antibiotic use and resistance than their peers from other faculties. The study also revealed a significant relationship between knowledge of antibiotics and country of residence with the home students scoring notably better than their counterparts. This difference might be accounted for by the influence of the high-level efforts in the UK, including several antibiotic awareness campaigns undertaken since 2004, to educate the public about the appropriate use of antibiotics and increase awareness of the issue of antibiotic resistance²⁷⁻³⁰.

Attitudes and beliefs

Misbeliefs regarding antibiotics speeding up recovery from colds and preventing more serious illness were found to be prevalent and were indicative of a lack of understanding of the efficacy of antibiotics and their role in treating viral infections.

Majority of the international students perceived it appropriate to bring antibiotics from home to avoid hassles of consulting a doctor at the university. This perception is likely to have been influenced by the apprehensiveness accompanying transition and acclimatization in a setting very different from their country of normal residence.

Practices

When enquired about the practices of antibiotic usage, low level of self-medication and high level of adherence to antibiotic prescription was observed. Self-medication rates and noncompliance with the course of antibiotics were found to be lowest among the home students which can in part be associated with the effectiveness of antibiotic stewardship programs in UK. Apart from the multiple antibiotic awareness campaigns targeting the general public, several regulatory measures including surveillance and legislative actions have been strictly in place to ensure the appropriate use of antibiotics³¹⁻³³. High rates of self-medication and non-adherence were reported for respondents from Africa and South America along with their Asian peers, suggestive of a lack of regulation on antibiotic prescription and sales in these countries. Furthermore, differences in implementation of drug regulations affecting the availability of antibiotics over counter in different countries has been found to play an important role in promoting higher rates of self-medication and inappropriate use³⁴.

The more knowledgeable respondents were more likely to have completed their last course of prescribed

antibiotics and was found to be consistent with findings reported in previous surveys³⁵⁻³⁷.

Strengths and Limitations

The strengths of the study include a high response rate of 99.7% and a large sample size. Our study has some limitations, it was not possible to carry out a random sampling procedure owing to the blanket policy of security measures in place which might have compromised the generalizability of the findings, though sincere efforts were made to maintain the representativeness of the sample.

Conclusions

Clear cultural differences in knowledge, attitudes and practices regarding antibiotic use were identified among respondents. Misconceptions about the biological mechanisms of antibiotic resistance and lack of personal responsibility for the issue was clearly demonstrated among the respondents. Antibiotic resistance was not perceived as a serious global or national problem among the study subjects. This highlights the need

for developing targeted health promotion interventions within the university strategizing methods to engage with the less knowledgeable groups to improve topic-specific knowledge. Also, campaigns and educational efforts applying behavioral insights methodology and emphasising on potential social benefit made by rational personal use of antibiotics can help facilitate the desired behavioural change and foster responsible use of antibiotics.

Conflict of interest

The author has no conflict of interest to declare

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