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Knowledge, attitudes and practices concerning self-medication with antibiotics among university students in western China

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Abstract

OBJECTIVES To evaluate the knowledge, attitude and behaviours of university students on the use of antibiotics.

METHODS A knowledge–attitude–practice questionnaire was developed and distributed to undergraduate students of Xi'an Jiaotong University, comprising 18 schools/colleges in Shaanxi Province, western China. Chi-square test and logistic regression analysis were applied to identify risk factors associated with self-medication with antibiotics.

RESULTS Of the 731 respondents (response rate = 73.1%), 294 (40.2%) had self-medicated with antibiotics in the past 6 months. Most of the antibiotics (59.2%) for self-medication were purchased without prescription in retail pharmacies. The median score of students' knowledge about antibiotics was 4 (IQR: 3–6) of a maximum possible score of 10. Students had moderately accurate beliefs towards antibiotics. More than half of the students (56.5%) were storing antibiotics frequently. During self-medication, 16.7% of students claimed to have experienced adverse reactions, and 30.6% had used antibiotics to prevent common colds. The majority preferred to use broad-spectrum antibiotics, and nearly half preferred intravenous antibiotics. Over 44% of students had changed antibiotic dosage, and 36.5% had switched to another antibiotic during the treatment course. Logistic regression analysis identified college and home town as independent risk factors for self-medication with antibiotics ($P < 0.01$).

CONCLUSIONS Undergraduate students had inadequate knowledge, moderately accurate beliefs and inappropriate practices concerning antibiotics, and a high rate of self-medication. This highlights the need for focused educational intervention and stricter governmental regulation concerning antibiotic use and sale in retail pharmacies.

keywords university students, antibiotic, self-medication, rational use of drugs, knowledge–attitude–practice method

Introduction

Antibiotic resistance is one of the world's most pressing public health problems. We are at the dawn of a post-antibiotic era (CDC 2013). The appearance of the super bacteria New Delhi metallo-beta-lactamase-1 (NDM-1)-positive Enterobacteriaceae in 2010, which are highly resistant to many antibiotic classes, has raised alarm about antibiotic resistance (Kumarasamy *et al.* 2010). This resistance may result in longer-lasting illnesses, more hospital stays, the need for more expensive and toxic medications, and even death (Holmberg *et al.* 1987; Davies 1994; Magee *et al.* 1999; Fischbach & Evans 2007).

Inappropriate use of antibiotics may contribute to the emergence of antibiotic resistance (Apisarnthanarak *et al.* 2008; Goossens 2009). Self-medication with antibiotics, in which antibiotics are used without medical consultation, can easily lead to their inappropriate use (Jose *et al.* 2013), yet this practice is highly prevalent in developing countries with lax regulatory systems (Borg & Scicluna 2002; Morgan *et al.* 2011; Laxminarayan & Heymann 2012).

Self-medication with antibiotics is also prevalent in China. Even higher rates of self-medication with antibiotics have been reported among Chinese university students

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(Bi *et al.* 2000; Pan *et al.* 2012). This requires particular attention for the reasons that higher education level and younger age are risk factors for self-medicating with antibiotics (Kuzujanakis *et al.* 2003), although the practice may be modifiable through education. At an individual level, knowledge and beliefs affect health-related behaviour, including behaviour concerning antibiotics use (Sawalha 2008; Widayati *et al.* 2011). Misconceptions about antibiotics among students potentially cause antibiotic abuse.

Given that abuse of antibiotics in undergraduates continues to be a significant problem in both developed and developing countries (Zafar *et al.* 2008), reducing misconceptions regarding antibiotic use among this population is imperative. Knowledge, attitudes and practices regarding self-medication with antibiotics in developed countries, among undergraduates in particular, have been widely reported (Buke *et al.* 2005; Grigoryan *et al.* 2007). A previous study found, at the national level, that a higher gross domestic product (GDP) was independently associated with a lower likelihood of self-medication (Grigoryan *et al.* 2008). The GDP in western China is lower than in other regions. One survey conducted in well-developed southern China (Pan *et al.* 2012) revealed a high prevalence of self-medication with antibiotics among university students. However, similar knowledge relating to China's under-developed western regions is scarce. Therefore, this study was aimed at examining common knowledge, attitudes and beliefs, and practices concerning self-medication with antibiotics among students in a university in western China. The findings may help initiate effective interventions to decrease misconceptions about antibiotic use.

Methods

Study population

The study population consisted of undergraduates at Xi'an Jiaotong University (XJTU), a university comprising 18 colleges in Shaanxi Province, western China. XJTU, covering a broad range of disciplines, such as science, engineering, medicine, economics and management, and liberal arts, has typical representativeness for universities in western China. Of 29 863 students of XJTU, coming from almost all the parts of China, 1000 undergraduates were randomly selected using a stratified sampling method. The study population was randomly selected according to their student ID numbers and stratified according to academy and grade. The number recruits was estimated based on the following factors: expected proportion of the population self-medicating with antibiotics in developing countries (P) = 50%; tolerated error/margin of error (d) = 0.05; confidence interval (CI) = 95%; attrition rate = 1/10; design effect = 1.5 (Verma & Lê 1996). Ethical approval was obtained from the University's Research Ethics Committee.

Survey instruments

Data were collected using a self-administered, pre-tested questionnaire containing 40 closed questions. The questionnaire consisted of four parts: the first part, which contained ten questions, was designed to obtain demographic data such as gender, grade (college level), college and allowance (living costs). The second part investigated the students' knowledge of antibiotics, antibiotic resistance and the use of antibiotics. This part contained ten questions, assessed using 'right', 'wrong' and 'uncertain' responses. In the third and fourth parts, five-point Likert scales were used to determine the attitudes and practices, respectively, regarding students' self-medication with antibiotics. The attitudes and beliefs section focused on the students' attitudes regarding the selection and patterns of antibiotic use. The practices part evaluated the behaviour of students around the use of antibiotics, and their compliance to dose regimens and duration of treatment courses. Each part contained ten questions. Items in the questionnaire were structured based on published articles where people's knowledge, attitudes and practices regarding antibiotic use in various countries were assessed (Bi *et al.* 2000; Belongia *et al.* 2002; Aronson 2006; Céspedes & Larson 2006; Xu & Yu 2007; You *et al.* 2008; Pan *et al.* 2012; Sarahroodi *et al.* 2012). The questionnaire was pre-tested for content, design, readability and comprehension on 40 students (13 medical students and 27 non-medical students). Necessary modifications were made so that the questionnaire was easy to answer and gave accurate data. The pre-test data were discarded in the final analysis. Cronbach's alpha was used to assess the reliability of the questionnaire. The alpha coefficients of the knowledge, attitude and practice parts were 0.873, 0.842 and 0.821, respectively, and therefore confirming the adequacy of the internal consistencies of these questions.

Data collection

Information on the aims of our study was provided to the participants before verbal consent was obtained and participation. The final questionnaires were distributed and collected after completion in April and May 2013. To increase the response rate, questionnaires were sent to students and collected face-to-face by investigators.

Respondents were told in a covering letter that the information they provided would be anonymous and would be gathered for the purposes of research.

Data analysis

The data from the completed questionnaire were evaluated for various parameters. The responses from the knowledge, attitudes and beliefs, and practice sections were assessed by calculating the percentage of each response selected. Further, the questions relating to knowledge were estimated using a scoring scheme, with score of 1 for a correct response and 0 for an incorrect or uncertain response. The correct responses to the knowledge items were 'wrong' for Q11, and Q13–Q18, and 'right' for Q12, Q19 and Q20. The total correct responses were calculated to show the scores of overall knowledge (ranging from 0 to 10). Except for Q29, Q30 and Q40 (response frequencies and percentages for each question were calculated), questions relating to attitudes, beliefs and practices were assessed using the five-point Likert scales scoring scheme: scores of 1, 2, 3, 4 and 5 were assigned to each appropriate attitude item (Q23, Q27 and Q28). Response options were as follows: 'strongly disagree', 'disagree', 'uncertain', 'agree' and 'strongly agree'. Conversely, scores of 5, 4, 3, 2 and 1 were assigned to each inappropriate attitude item (Q21, Q22, Q24, Q25, Q26), with the same response options listed above. Regarding the practice items, scores of 1, 2, 3, 4 and 5 were assigned to each appropriate behaviour item (Q37). Response options were as follows: 'never', 'seldom', 'sometimes', 'often' and 'always'. Conversely, scores of 5, 4, 3, 2 and 1 were assigned to each inappropriate behaviour item (Q31–Q39, except Q37), with the same response options. Moreover, the median total scores based on responses to the three parts (knowledge, attitudes and beliefs, and practices) were estimated, with a maximum possible score of 95 and a minimum score of 17. For quantitative analysis, a score greater than 80% of the possible maximum score was considered good, between 60% and 80% was considered moderate and less than 60% was considered poor (Sawalha 2008). The median total score and the median score for the knowledge, attitudes and beliefs, and practices parts were compared based on the demographics of the students. The frequency of antibiotic use in the previous 6 months was also investigated.

The collected data were processed using the Statistical Packages for Social Sciences (SPSS), version 18.0. Data about demographic and socioeconomic characteristics of the students were presented as a percentage, along with the responses for each item. Because the score is not normally distributed, Wilcoxon rank test and Kruskal–Wallis test were used to evaluate associations between the median score and the characteristics of respondents. Chi-square test and logistic regression analysis were applied to identify risk factors associated with self-medication with antibiotics. The logistic regression model included only the variables significantly and independently associated with self-medication with antibiotics, as shown by the chi-square test. A P value of < 0.05 was considered to be statistically significant.

Results

Of 1000 questionnaires sent out, there were 750 usable returns (75.0% response rate). Nineteen questionnaires were subsequently excluded because of incomplete data, and the final response rate was 73.1% (731/1000). Of the 731 respondents, 294 (40.2%) had self-medicated with antibiotics in the previous 6 months. Most of the respondents (70.0%) characterised their allowance as 500–1000 Yuan (in RMB/month, 82–163 USD). 8% of students mentioned that they were uninsured. The relationships between the median total scores and demographic parameters of respondents are demonstrated in Table 1. The median total score of all respondents was 67 (Interquartile range, IQR: 62–73) of a possible maximum score of 95, meaning that the overall score for respondents was at a moderate level.

Knowledge

Of 731 respondents, 334 (45.7%) obtained information on judicious antibiotic use from instructions, 283 (38.7%) from physicians and 265 (36.3%) from relatives or friends. Only 68 (9.3%) students declared that they obtained information from class teachings. For 307 (42.0%) students, knowledge was based on their previous experience with antibiotics. 489 (66.9%) obtained information from media, including newspapers, magazines, the internet and TV advertisements.

In the knowledge part of the questionnaire, a median score of 4 (IQR: 3–6) was obtained from a maximum of 10. This demonstrated poor knowledge on aspects of antibiotics. The evaluation of the difference in the median score based on demographics of the respondents revealed significant differences in terms of grades ($P < 0.001$; Kruskal–Wallis test) and colleges (medical students *vs.* non-medical students, $P < 0.001$; Wilcoxon rank test), as illustrated in Table 1. Intern students, all of whom worked in hospitals, had significantly better knowledge about antibiotics than other students.

Figure 1 illustrates the responses to questions 11–20. A majority of students (54.8%, 400/731) held misconceptions that antibiotics can prevent skin infections when

Table 1 Median knowledge, belief, behaviour and total score based on demographics

Demographic parameters	Total score Median (IQR)	*P* value	Knowledge score Median (IQR)	*P* value	Belief score Median (IQR)	*P* value	Practice score Median (IQR)	*P* value
Gender								
Female	68 (63–73)	0.062	4 (3–6)	0.507	29 (26–31)	0.027	34 (31–38)	0.093
Male	66 (60–73)		5 (3–6)		28 (25–31)		34 (30–38)	
College								
Non-medical	66 (60–71)	0.001	4 (3–5)	<0.001	28 (25–30)	0.001	34 (30–38)	0.445
Medical	70 (64–74)		5 (4–7)		30 (27–32)		34 (31–38)	
Grade (college level)								
Freshman	68 (63–72)	0.001	4 (3–5)	0.001	29 (26–30)	0.005	35 (32–38)	0.001
Sophomore	67 (62–72)		4 (3–6)		29 (26–31)		34 (31–37)	
Junior	67 (60–73)		4 (3–6)		28 (25–30)		34 (29–38)	
Senior	65 (60–72)		5 (3–6)		28 (25–31)		33 (30–36)	
Intern	74 (70–78)		7 (6–8)		30 (29–32)		37 (34–39)	
Home town								
Rural	68 (61–73)	0.820	4 (3–6)	0.091	29 (26–31)	0.527	34 (30–38)	0.162
Urban	67 (62–73)		5 (3–6)		29 (26–31)		34 (31–37)	
Allowance (living costs, in RMB/month)								
≤500	68 (62–74)	0.550	5 (3–6)	0.180	29 (26–31)	0.282	34 (31–38)	0.915
500–1000	68 (61–63)		5 (3–6)		29 (26–31)		34 (30–38)	
1000–2000	66 (62–71)		4 (3–5)		28 (25–31)		34 (31–38)	
>2000	70 (62–75)		5 (3–6)		29 (26–31)		33 (31–39)	
Whether attend school's Health insurance								
No	68 (61–73)	0.897	4 (3–6)	0.490	28 (25–31)	0.431	35 (30–38)	0.776
Yes	67 (62–73)		4 (3–6)		29 (26–31)		34 (31–38)	

IQR, Interquartile range.

they are poured onto wounds and that they can be effective for viral infections (43.8%, 320/731). Almost 28.0% (203/731) of students incorrectly believed that antibiotics are the same as anti-inflammatories. In terms of knowledge regarding antibiotic resistance, most students knew that antibiotic overuse can result in antibiotic resistance (89.5%, 654/731), but fewer than half of the students (42.1%, 308/731) knew that repeated non-compliance with the treatment course would increase bacterial resistance. Meanwhile, fewer than half of the students knew that antibiotics should be purchased with a doctor's prescription (45.1%, 330/731). 77 (10.5%) students incorrectly believed that broad-spectrum antibiotics are more effective than those with a narrow spectrum, and 311 (42.6%) students believed that intravenous administration is preferable to oral administration under any circumstance.

Attitudes and beliefs

In the attitudes and beliefs section, the median score was 29 (IQR: 26–31) from a maximum of 40. The results of the difference in the median attitude score based on demographics of the respondents revealed that there were significant differences in terms of grades ($P = 0.005$; Kruskal–Wallis test), colleges ($P < 0.001$; Wilcoxon rank test) and gender ($P = 0.027$; Wilcoxon rank test), as illustrated in Table 1.

Figure 2 illustrates the responses to questions 21–30. More than 10% (87/731) of students incorrectly believed that antibiotics should be used for common colds. Sixty percentage (440/731) of the respondents agreed that the effectiveness of treatment would be reduced if the full course of antibiotic treatment was not completed. The number of students who declared that they could cease treatment 1 or 2 days after recovery was 356 (48.7%). 578 (79.1%) students believed that limiting inappropriate use of antibiotics played an important role in preventing the emergence of antibiotic resistance. However, 119 (16.3%) students incorrectly believed that patients could ask physicians to prescribe antibiotics during the visit. The need to obtain further information regarding judicious antibiotic use was reported by 697 (95.4%) students.

Practice

The median practice score of 34 (IQR: 31–38) was obtained from a potential maximum of 45. Evaluating

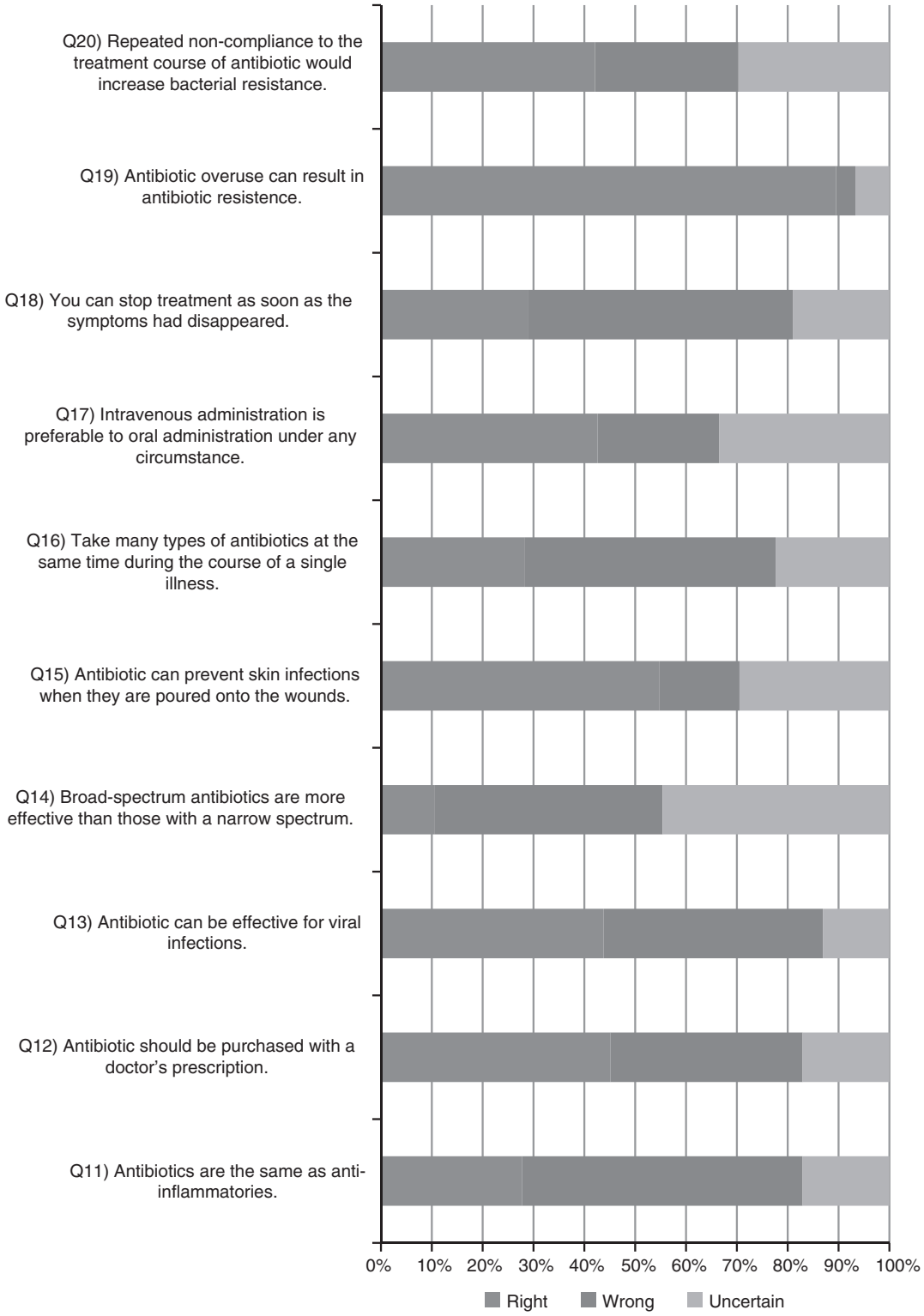

Figure 1 Students' responses (%) to questions related to knowledge (Q11–Q20).

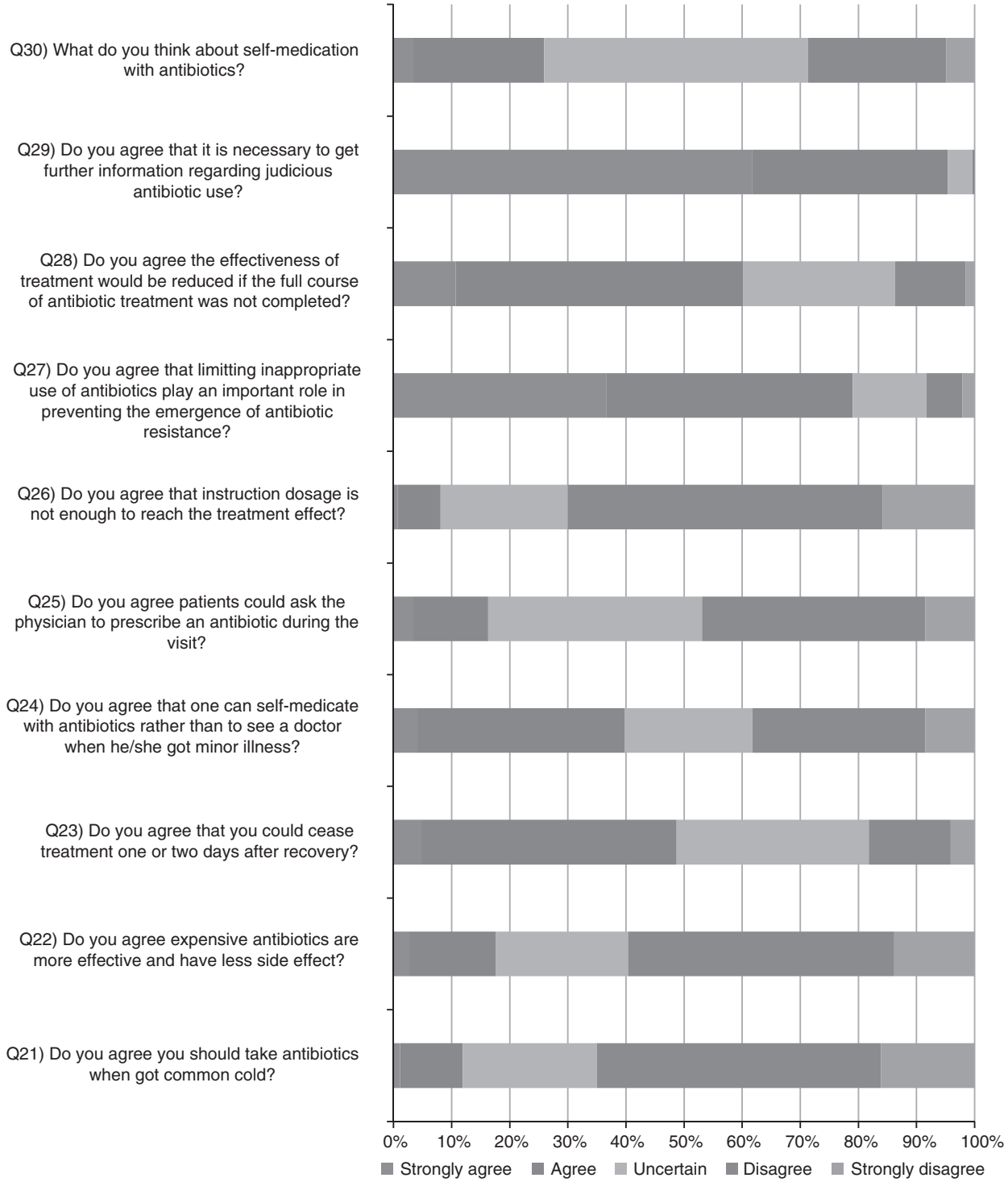

Figure 2 Students' responses (%) to questions related to attitudes and beliefs (Q21–Q30).

the difference in the median practice score based on demographics of the respondents showed that there was a significant difference in grade only ($P = 0.001$; Kruskal–Wallis test) (Table 1).

Of the 731 respondents, 294 (40.2%) had self-medicated with antibiotics over the study period. Figure 3 illustrates the responses to questions 31–40. To have immediate access to antibiotics, 56.5% (413/731) of students stored antibiotics frequently, while 16.7% (122/731) of students had ever experienced adverse reactions during self-medication. Using antibiotics to prevent the common cold was reported in 30.6% (244/731) of students. Broad-spectrum antibiotics were chosen by 66.8% (488/731) of students, and nearly 50% (365/731) chose intravenous antibiotics, which they believed could hasten recovery. To recover more quickly, 19.5% (143/731) of the students reported that they might take multiple antibiotics during the course of a single infectious disease. We found that 81.3% (594/731) of students read the package insert carefully before taking antibiotics, while 44.5% (325/731) of students changed antibiotic dosage, and 36.5% (267/731) switched to another antibiotic during the treatment course.

Factors associated with self-medication of antibiotics

Table 2 shows the rate of self-medication with antibiotics, taking into account the demographic parameters of the participants, as well as the odds ratio and 95% confidence intervals. The rate of self-medication was significantly affected by college ($P < 0.01$; chi-square test) and home town ($P < 0.05$; chi-square test). Further logistic regression analysis showed that medical students self-medicated with antibiotics 1.612 times more frequently than non-medical students (95% CI 1.147–2.080, $P = 0.004$). Those from urban areas were 1.495 times more likely to self-medicate than those from rural areas (95% CI 1.052–1.916, $P = 0.013$), as shown in Table 3.

Discussion

This descriptive, quantitative study believed to be the first of its kind conducted in western China, focused on the knowledge, attitudes and practices of undergraduate students and identified the main source of antibiotics and factors for self-medication.

Knowledge

The results indicated that most of the participants based the use of antibiotics on their previous experience. An study of adults (Al-Azzam *et al.* 2007) found that the strongest predictor of patients' belief in the effectiveness of antibiotics was having previously received antibiotics for a similar illness. A systematic review (Yin *et al.* 2013) found that the percentage of outpatient encounters in which one antibiotic and two antibiotics were prescribed was 69.4% and 26.9%, respectively, in western China. It is probable that physicians' inappropriate antibiotic prescribing behaviours contribute to the misconceptions of patients around antibiotic use (Cho *et al.* 2004).

This study revealed that over 40% of students incorrectly believed that antibiotics could be helpful for viral illnesses, similar to findings from the study conducted in Karachi (Zafar *et al.* 2008). It is noted that antibiotics certainly do not have any effects against viruses; however, they may indeed be useful to cure bacterial superinfections of underlying viral diseases (McCullers 2011). Nearly half of the students incorrectly thought that they could stop treatment as soon as their symptoms had disappeared. Using antibiotics for a short period of time, or ceasing antibiotic treatment as soon as the symptoms subside, exposes the infecting or even commensal bacteria to subtherapeutic levels of the drug (Austin *et al.* 1999). This may lead to bacterial resistance.

The study showed that antibiotic knowledge of medical students is significantly better than that of non-medical students, and interns also have significantly better knowledge than students of other grades. This may because medical students receive a series of didactic lectures on antibiotics and interns practice at hospitals, where they observe doctors' antibiotic prescribing practices.

Attitude and beliefs

More than 10% of students incorrectly believed that antibiotics can cure the common cold, which is in line with the practice of 30% of the students who frequently used antibiotics for that purpose. With minor infectious disease, nearly 40% of students strongly believed in self-medication instead of going to hospital. This is also a common reason for self-medication with antibiotics by participants in previous studies (Mainous *et al.* 2008).

In the current study, 16.3% of students agreed that patients could ask the physician to prescribe an antibiotic during the visit. A previous study showed that doctors prescribed antibiotics 62% of the time if they thought patients wanted them, and 7% of the time if they thought they did not (Mangione-Smith *et al.* 1999). This proved that patients' expectations may contribute to inappropriate antibiotic prescription.

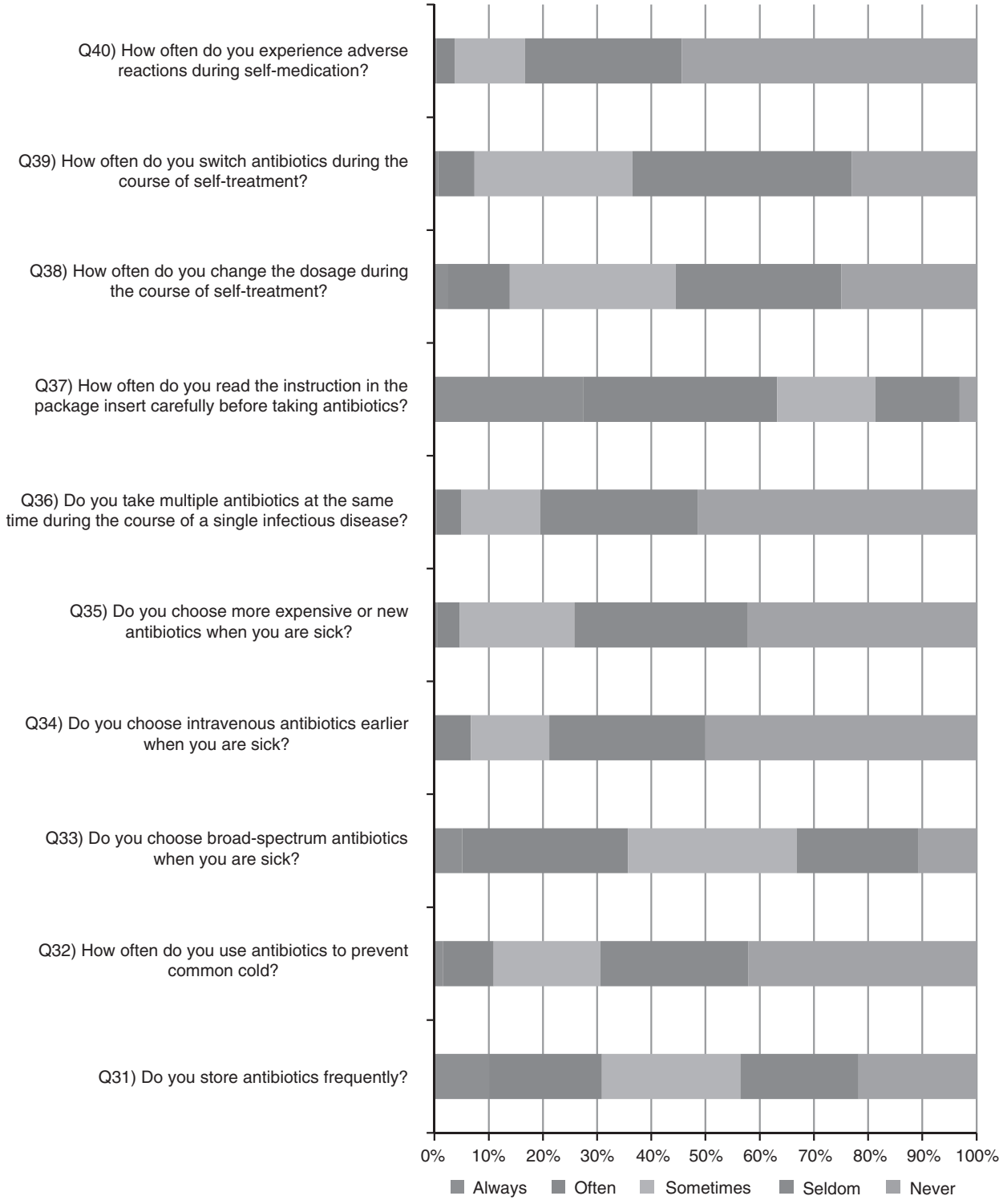

Figure 3 Students' responses (%) to questions related to practices (Q31–Q40).

Table 2 Demographic parameters and self-medication with antibiotics among students (n = 731)

Demographic parameters	Total students (n = 731) n (%)	Self-medicated students (n = 294) n (%)	OR	95% CI	P value
Gender					
Female	390 (53.4)	155 (52.7)	1	–	–
Male	341 (46.6)	139 (47.3)	1.204	0.891–1.627	0.249
College					
Non-medical	378 (51.7)	133 (45.2)	1	–	–
Medical	353 (48.3)	161 (54.8)	1.545	1.147–2.080	0.004
Grade (college level)					
Freshman	148 (20.2)	61 (20.7)	1	–	–
Sophomore	238 (32.6)	98 (33.3)	0.981	0.640–1.503	0.930
Junior	197 (26.9)	70 (23.8)	1.240	0.791–1.942	0.348
Senior	111 (15.2)	53 (18.0)	0.788	0.468–1.327	0.371
Intern	37 (5.1)	12 (4.2)	1.696	0.775–3.711	0.522
Home town					
Rural	326 (44.6)	116 (39.5)	1	–	–
Urban	405 (55.4)	178 (60.5)	1.420	1.052–1.916	0.013
Allowance (living costs, in RMB/month)					
≤500	139 (19.0)	58 (19.7)	1	–	–
500–1000	447 (61.1)	175 (59.5)	1.141	0.761–1.711	0.522
1000–2000	131 (17.9)	56 (19.0)	0.995	0.592–1.672	0.986
>2000	14 (2.0)	5 (1.8)	1.261	0.385–4.129	0.701
Whether attend school's health insurance					
No	52 (7.2)	15 (5.1)	1	–	–
Yes	679 (92.9)	279 (94.9)	1.721	0.926–3.195	0.106

OR, odds ratio; CI, confidence interval.

Table 3 Logistic regression analysis of factors influencing self-medication with antibiotics among students (n = 731)

Demographic parameters	Coefficient (β)	OR	95% CI	P value
College				
Non-medical	1	1	–	–
Medical	0.478	1.612	1.193–2.178	0.002
Home town				
Rural	1	1	–	–
Urban	0.402	1.495	1.103–2.026	0.010

Prevalence of and risk factors for self-medication with antibiotics

In our study, 40.2% of respondents reported self-medicating with antibiotics in the previous 6 months. This finding is similar to that of a study (Pan *et al.* 2012) conducted on university students in southern China (47.8%), but less than findings of a study (Xing & Kang 2007) conducted in Beijing (90.4%). The GDP is lower in western China than in southern China and Beijing. Seeing a doctor is more expensive and requires longer waiting in more developed regions, especially in Beijing. As a result, the rate of self-medication with antibiotics in Shaanxi is lower than the other two regions. We found that the risk factors for self-medication with antibiotics were the students' college and home town. Students from medical college have a false sense of confidence in self-diagnosis and self-management. Previous studies indicated that the common reasons for self-medication with antibiotics were convenience and cost-savings and that non-prescribed antibiotics can be purchased conveniently and affordably in community pharmacies (Belongia *et al.* 2002; Aronson 2006; Céspedes & Larson 2006; Xu & Yu 2007; You *et al.* 2008). Compared with rural areas, access to pharmacies and information is more adequate in urban areas. With the loose regulation regarding the sale of antibiotics in retail pharmacies, students from urban areas may be accustomed to buying antibiotics in retail pharmacies. This may help to explain why students from urban areas prefer to self-medicate.

Regarding the source of antibiotics, most of the students in our study obtained their medication from retail pharmacies without prescription (59.2%). In retail pharmacy settings, sales people often recommend medicines that will gain them more profit. This, coupled with patients' lack of knowledge about their medications, may

lead to the inappropriate use of antibiotics. It is almost 10 years as China's drug watchdog, the China Food and Drug Administration, announced that the sale of antibiotics without a doctor's prescription would be prohibited. However, people can still buy almost all types of antibiotics without prescription in retail pharmacies.

Nearly half of the students use previously prescribed antibiotics stored in the household (48.0%). The surplus medicine prescribed the last time reflected the doctor's over-prescription and/or the patient's non-compliance with the prescription (Reynolds & McKee 2009), both of which are quite common in China. This study also found that 56.5% of students were storing antibiotics frequently. This behaviour may contribute to antibiotic misuse in the community (Kuzujanakis *et al.* 2003; McNulty *et al.* 2007).

Liberal self-medication with antibiotics among students in China should be considered an alarming problem. Immediate action should be taken to alter this trend and to avoid serious health consequences. Firstly, there is an urgent need to improve education on antibiotic treatment and antibiotic resistance in medical curricula and to make use of health centres of universities to provide information on judicious antibiotic use. Secondly, there need to be stricter and more practical regulations enforcing supervision of the sale of antibiotics in retail pharmacies. Finally, the government should deepen the healthcare reform to ensure easy and affordable access to doctors, and eliminate economic incentives for drug sales, thus reduce unnecessary prescribing and overuse of antibiotics.

Limitations of this study included a recall bias in terms of the self-reporting of antibiotic experience and use. It is possible that the study population was not representative of all university students in China, thus limiting the generalisability of our results. This study may have overestimated the prevalence of non-prescription antibiotic use because it was carried out in the capital city, where access to pharmacies and information is more adequate than in rural settings.

Conclusions

The undergraduates' liberal practice of self-medication with antibiotics in China should be considered an alarming problem. Students' knowledge about antibiotics seems to be inadequate, and their practices were inappropriate. There is a need for harsher legal regulations and supervision on the sale of antibiotics without prescription in retail pharmacies. Deepening healthcare reform is highly necessary to ensure easy and affordable access to doctors. Health education is also important for students to decrease the inappropriate use of antibiotics and self-medication.

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