

Understanding parental self-medication with antibiotics for children in China: a multi-nationality analysis

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Abstract

Background: Bacterial resistance has become an important public health concern which mainly caused by irrational use and self-medication with antibiotics. This study aims to explore the association between parent's nationality and parental self-medication with antibiotics under the one Chinese health service system, and further compare differences in medical knowledge, attitudes and behaviors about antibiotics amongst nationalities. Methods: Based on a structured questionnaire survey, a cross-sectional study was designed to investigate a cluster of 310 parents in an International Department of an International School in Xi'an, Shaanxi, China, including Chinese, other Asians and Occidental. Binary Logistic Regression was used to examine the association between nationality and parental self-medication with antibiotics for children. The differences in medical knowledge, attitudes and behaviors about antibiotics were analyzed by Pearson Chi-square test. Results: The proportion of parental self-medication with antibiotics on children was 20.10%, 5.00% and 2.67% for Chinese, other Asians and Occidental, respectively ($P < 0.001$). Chinese parents were more likely to have self-medication with antibiotics for children compared to Occidental parents ($OR=8.221$, 95%CI: 1.646-41.054, $P < 0.01$ in Model1 and $OR=6.086$, 95%CI: 1.012-36.594, $P < 0.05$ in Model2). Occidental parents had higher rate of correct medical knowledge, attitudes and behaviors about antibiotics than Chinese and followed by other Asians in total ($P < 0.001$). Conclusions: Nationality is significantly associated with parental self-medication with antibiotics for children, showing that Chinese parents are more likely to self-medicate with antibiotics for children than Occidental parents. Occidental parents perform better in medical knowledge, attitudes and behaviors about antibiotics compared to Chinese and other Asians. This study highlights that the effectiveness of more efforts placed on health educations to parents on antibiotics use from demand side beyond the supervision and regulation on health service supplier in China. Key words: Parental self-medication with antibiotics; Nationalities; Medical knowledge; Attitudes; Behaviors

Background

Antibiotics are commonly used to treat disease caused by bacterial infections. Bacterial resistance, a main side effect of antibiotic use which is inevitable, has become an important public health concern[1]. Antimicrobial resistance is driven by appropriate and inappropriate use of antibiotic[2], especially the irrational and excessive use. It not only increases disease morbidity and mortality, reduces the efficiency of disease treatment, increases the economic burden of patients and society, but also makes it easy to cause the emergence of drug-resistance bacteria or multidrug-resistance bacteria, which does more enormous and serious harm to human health[3]. The World Health Organization have reported that respiratory diseases, infectious diarrhea, measles, Acquired Immune Deficiency Syndrome (AIDS) and tuberculosis account for more than 85% of global deaths caused by bacterial infection and its resistance[4]. Therefore, it's stated that "a post-antibiotic era—in which common infections and minor injuries can kill everything—far from being an apocalyptic fantasy, is instead a very real possibility for the 21st century"[5].

China is the largest producer and consumer of antibiotics, whose annual output of raw materials of antibiotics is about 210,000 tons and the annual consumption per capita is about 138g, up to 10 times higher than that in America, in addition to serious antibiotic abuse and faster growth rate compared to other countries in the world[6]. The irrational and excessive use of antibiotics is caused by either health service supplier or demander. The supply side factors mainly included the lack of supervision[7], corruption[8, 9], physicians' profit-seeking behavior[10]and unqualified physician due to insufficient in medical knowledge[11] and so on, which are various in different country or region's health service supplier. The demand side reasons were the lack of knowledge, attitudes and behaviors about antibiotics of the populations, mainly including patients[12], teachers[13], students[14], parents of children and adolescents[15-17] as well as residents[18-20] surveyed in hospital[21] or community[22].

There is an increasing trend on practicing self-medication with antibiotics in both developed and developing countries in recent years, which is usually regarded as the irrational use of antibiotic[23, 24]. Self-medication can be defined as the use of drugs with the aim to treat self-diagnosed disorders or symptoms, or the intermittent or continued use of a prescribed drug for chronic or recurrent disease and symptoms. In practice, it also includes medication for family members, especially the therapy for children or the old on one's own[25]. This behavior is normally done by the consumer rather than prescriber. Previous studies have presented that children and adolescents are the most widely users on antibiotics[26], whose medicines are usually purchased by parents themselves[27], naturally resulting in parental self-medication with antibiotics and making antibiotic abuse much more common[28]. Parental self-medication with antibiotics is prevalent around the world, with a rate of 59.4% in China[15], 43% in Nigeria[28], and 22.7% in Greece[29].

Since prevalence of parental self-medication with antibiotics varied in different region due to the discrepancy of health service supplier (e.g., region, country) and demander (e.g., populations), we cannot directly compare it or explore internal association unless controlling the same supplier or same demander. However, the previous studies most only aimed at researching on parental self-medication with antibiotics of the same demander under the same supplier[15-17, 28, 29], instead of a design of different demanders but the same supplier, therefore, failed to clarify the pure difference amongst diverse populations and association with parental self-medication with antibiotics. This study selected parents of different nationalities as object and aimed to explore the difference in parental self-medication with antibiotics for children under the same context of Chinese health service policies, analyze the association between nationality and parental self-medication with antibiotics for children, as well as compare their differences in medical knowledge, attitudes and behaviors about antibiotics amongst nationalities.

Methods

Study design

This was a cross-sectional study conducted for a period of 2 months from September 2018 to October 2018. The study aimed to explore the difference in self-medication with antibiotics of parents of different

nationalities for children under the same health service supplier with unified health environment, health norms and doctors' behaviors, on behalf of different demanders and the same supplier, reveal the association between nationality and parental self-medication with antibiotics for children, as well as compare their differences in medical knowledge, attitudes and behaviors about antibiotics. Inclusion criteria for study included parents whose children were studying in International Department of International School, and willingness to participate in the study. Suffering obnubilation, insanity, or serious disease were exclusion of the participants from the study.

Data resource and collection

The overall survey was conducted in International Department of International School in Xi'an, Shaanxi Province, China. All parents of different nationalities (Chinese, other Asians and Occidental) whose children were studying in kindergartens, elementary schools, junior high schools and high schools were participated via questionnaire-based survey. Anonymous investigation was explained and completed between the respondents and trained investigators face to face, and the questionnaires were collected on the spot in order to ensure the quality of the survey. Overall, 296 of 310 questionnaires were returned completely. The response rate was 95.48%.

Data instrument and management

The questionnaire was designed based on the objectives of the study and literature review, and evaluated by experts for content validity as well, which consisted of two parts. The first part was the socio-demographic characteristics of the respondents and whether there was parental self-medication with antibiotics, including age, gender, nationality, education level, occupation, income. The second part was the three blocks of medical knowledge, attitudes and behaviors about antibiotics. The medical antibiotic knowledge block consisted of questions: "Antibiotics are anti-inflammatory drugs", "Antibiotics can kill or inhibit the virus", "Antibiotics are purchased by a prescription", "Most of the Upper Respiratory Tract Infections are viral infection", "Repeatedly using an antibiotic is prone to have bacterial resistance", "Deficiency use of antibiotics leads to bacterial resistance", with the correct answer of "Wrong" to the first two questions and "Right" to the other. The antibiotic attitudes block included questions such as "Do you agree that antibiotics should be used immediately when your children has Upper Respiratory Tract Infections", "Do you agree that expensive antibiotics work better with fewer side effects", "Do you agree that broad-spectrum antibiotics are better than narrow-spectrum antibiotics", "Do you agree that intravenous antibiotics (infusion) are better than oral antibiotics", "Do you agree that parents can self-medicate with antibiotics for their children based on children's condition when disease is mild", whose correct answer was "No". As for antibiotic behaviors block, there were "Is antibiotic available at home to mediate children timely when they are sick", "Will you give your children multiple antibiotics at the same time when they are sick", "Will you use leftover antibiotics if your children have similar symptoms", "Will

you ask for a doctor to prescribe antibiotics if the doctor does not prescribe an antibiotic", "Will you change the dosage of antibiotics according to the course of disease of children", "Will you change the type of antibiotics when you use antibiotics", where the more answer "No" showed the better behaviors. 50 volunteers were pre-investigated in order to ensure the design rationality and length of the questionnaire.

Definition of variables and measurement

In the regression model, the dependent variable was parental self-medication with antibiotics measured by question "Did you self-medicate with antibiotics for children in the past 6 months", with an answer of "Yes or No". Parents' nationality was independent variable measured by "What's your nationality", with an answer of "Chinese, Other Asians or Occidental". Covariate consisted of two parts. The first part was socio-demographic characteristics of the respondents, including age, gender, education level, occupation and income. The other part was medical knowledge, attitudes and behaviors about antibiotic use of the respondents. Medical knowledge was measured by "Antibiotics are purchased by a prescription". Attitudes were measured by "Do you agree that antibiotics should be used immediately when your children has Upper Respiratory Tract Infections", "Do you agree that parents can self-medicate with antibiotics for their children based on children's condition when disease is mild". What's more, "Is antibiotic available at home to medicate children timely when they are sick", "Will you use leftover antibiotics if children have similar symptoms", "Will you ask for a doctor to prescribe antibiotics if the doctor does not prescribe an antibiotic" were used to measure behaviors.

Statistical analysis

The data was entered into a database using the Epidata 3.1, and transferred to Predictive Analytics Software (PASW statistics, IBM Corporation, Armonk, NY, USA, version 18.0) for all analysis. Descriptive analysis was used to describe the socio-demographic characteristics and medical knowledge, attitudes and behaviors about antibiotics of the respondents. Whether self-medication with antibiotics of parents of different nationalities for children in the past six months had a difference was examined using Pearson Chi-square test, so did knowledge, attitudes and behaviors about antibiotics. What's more, the association between nationality and parental self-medication with antibiotics was tested using two binary logistic regressions models. Model 1 was adjusted for potential confounders of socio-demographic characteristics of the respondents. The confounders of both socio-demographic characteristics and medical knowledge, attitudes and behaviors about antibiotics of the respondents were controlled in Model 2. P value was at the significance level $\alpha= 0.05$.

Results

General socio-demographic characteristics of the respondents

As shown in Table 1, out of all respondents, 121(40.88%) were Chinese parents, 100(33.78%) were other Asian parents and 75(25.34%) were Occidental parents. The proportion of female was 84.30%, 73.00% and 37.33% among three nationalities, respectively, and the average age of the respondents were 37.96(5.447) years, 40.76(3.610) years and 39.44(4.630) years.

Self-medication with antibiotics of parents of different nationalities

We found that there were 13.85% of the respondents self-medicating with antibiotics for children in the past 6 months. The rate of self-medication with antibiotics of Chinese parents was higher than that of other Asian parents and Occidental parents (20.10%, 5.00% and 2.67% in Chinese, other Asians and Occidental parents, respectively, $P<0.001$).

Logistic regression analysis on parental self-medication with antibiotics

The result of Model1 and Model2 of Logistic regression analysis examining the association between nationality and parental self-medication with antibiotics is conducted and presented in Table 2. We identified that parents' nationality was associated with parental self-medication with antibiotics for children, Chinese parents were more likely to have self-medication with antibiotics compared to Occidental parents ($OR=8.221$, 95%CI: 1.646-41.054, $P<0.01$ in Model1 and $OR=6.086$, 95%CI: 1.012-36.594, $P<0.05$ in Model2). In addition, the rate of self-medication with antibiotics of parents aged 25-34 years was higher than that of parents aged 40-55 years ($OR=6.130$, 95%CI: 1.685-22.302, $P<0.01$ in Model2), parents considering that antibiotics should be purchased by a prescription were less likely to self-medication with antibiotics than those who didn't think so ($OR=0.011$, 95%CI: 0.001-0.144, $P<0.01$ in Model2), and parents asking for a doctor to prescribe antibiotics were easily to self-medicate with antibiotics than those who didn't have such behavior ($OR=15.288$, 95%CI: 2.746-85.111, $P<0.01$ in Model2).

Medical knowledge, attitudes and behaviors about antibiotics of parents of different nationalities

Medical knowledge about antibiotics results are presented in Table 3. Totally, the rate of correct medical knowledge about antibiotics of Occidental parents were higher than those of Chinese and followed by other Asians ($P<0.001$), so did items such as "Antibiotics aren't anti-inflammatory drugs ($P<0.001$)", "Antibiotics can't kill or inhibit the virus ($P<0.001$)", "Antibiotics are purchased by a prescription ($P<0.001$)", "Repeatedly using an antibiotic is prone to have bacterial resistance ($P=0.034$)". Besides,

there was a best awareness in the item “Repeatedly using an antibiotic is prone to have bacterial resistance” (84.30%, 76.00%, and 90.67% in Chinese, other Asians and Occidental parents, respectively).

Occidental parents’ antibiotic attitudes were also better than those of Chinese and followed by other Asians in total as Table 4 shows ($P<0.001$). Items such as “Disagree that antibiotics should be used immediately when your children has Upper Respiratory Tract Infections”, “Disagree that expensive antibiotics will work better with fewer side effects”, “Disagree that intravenous antibiotics (infusion) are better than oral antibiotics”, “Disagree that parents can self-medicate with antibiotics for their children based on their children’s condition when disease is mild” presented the same results ($P<0.001$, $P<0.001$, $P<0.013$, $P<0.001$, respectively).

In terms of behaviors about antibiotics, a significant difference was still identified amongst parents of three nationalities in total that Occidental parents performed better than Chinese parents and then other Asian parents, which is shown in Table 5 ($P<0.001$). In addition, the consistent results could be seen in the following items including “Antibiotic is available at home to medicate children timely when they are sick” ($P<0.001$), “Will give children multiple antibiotics at the same time when they are sick” ($P<0.001$), “Will use leftover antibiotics if children have similar symptoms” ($P<0.001$), “Will change the dosage of antibiotics according to the course of disease of children” ($P<0.001$), “Will change the type of antibiotics when you use antibiotics” ($P<0.001$).

Discussion

The study explored the association between nationality and parental self-medication with antibiotics for children under the same health service supplier in China, and compared parental differences in medical knowledge, attitudes and behaviors about antibiotics. It was found that: 1) parent’s nationality was significantly associated with self-medication with antibiotics, and that Chinese parents were more likely to have self-medication with antibiotics for children compared to Occidental parents; 2) Occidental parents performed better in medical knowledge, attitudes and behaviors about antibiotics than Chinese parents and followed by other Asian parents in total.

Unnecessary and irrational use of antibiotics is a major cause of bacterial resistance[30], which is accelerated by the prevalent fact that children and adolescents self-medicated with antibiotics by parents around the world. Previous studies have reported that there was a high proportion of parental self-medicating with antibiotics among Chinese. For instance, it was reported 62% in Jiangxi[31] and 59.4% in Hefei[15]. However, the rate was 4.0% in urban US, 12.1% in suburban US[32], and 22.7% in the Greece[29]. As for Asians, the rate was 43.9% in Saudi Arabia[33] and 29.8% in Vietnam[34]. In our study, the rates of parental self-medication with antibiotics of three nationalities were all lower than previous findings. The reason is probably that China issued a “Restricted Sales” that antibiotics should be purchased with physician prescriptions[35] as early as 2004, which have restricted parental self-medication with antibiotics for children in China to some extent.

This study revealed the essential difference of different nationalities in parental self-medication with antibiotics by controlling health service supplier the same, which was more convincing than analyzing and comparing parental self-medication with antibiotics amongst various countries or regions. It was worth noting that nationality was associated with parental self-medication with antibiotics and that Chinese parents were still more likely to self-medicate with antibiotics for children than Occidental parents, the same as studies separately showed before [31, 32]. It may be explained by insufficient knowledge and inappropriate attitudes about antibiotics and different traditional concepts of Chinese parents. The growth of children is paid much more attention by parents[27] and even indulged in Chinese society. Usually, even mild ailments can cause excessive sensitivity and tension in family. Parents prefer to self-medicate with antibiotics or misuse antibiotics when children suffer from the Upper Respiratory Tract Infection for symptoms such as fever, cold and cough [36-38], or for some other reasons, including same ailments with no need to see doctors[39], expensive consultation fees and the long waiting time in the clinics[40], storing antibiotics at home[31] and enough previous experience to cure[41]. There is still a long way for Chinese government to make efforts on strengthening public education about the correct and appropriate use of antibiotics.

Furthermore, this study outlined significant gap in medical knowledge, attitudes and behaviors amongst parents of different nationalities: Occidental parents performed better than Chinese, followed by other Asians, which is less confounded by supplier side because they lived in the same city under the same health service supplier in China in this study. Several studies stated that the control of irrational use of antibiotics is mainly dominated by the regulation of physician prescription and improving populations' correct knowledge, attitudes and behaviors about antibiotics [42-44]. There are already many campaigns successfully held at a national or regional level in many high-income countries to educate the public the appropriate use of antibiotics from 1990 to 2007, including Australia, Canada, France, the UK, New Zealand and so on[45]. China also issued a "Restricted Sales" that antibiotics should be purchased with prescriptions in 2004[35], and demonstrated a series of educational activities on the rational use of antibiotics since 2010[46]. Considering educational campaigns of antibiotic use in Occident carried out earlier and have already got excellent achievements than China [45], Occidental parents' knowledge, attitudes and behaviors about antibiotics are likely to be better. Nevertheless, there is still some achievements attained by educational activities in China. It could be seen that "Repeatedly using an antibiotic is prone to have bacterial resistance" was the best acknowledge of antibiotic knowledge among parents of three nationalities, higher than some studies in other regions [21, 47]. In order to further improve residents' rational antibiotic use, there is still a great necessity for Chinese government to issue more regulations and carry out more educations on antibiotics.

In addition, we also found that young parents had a higher rate of self-medication with antibiotics, the same as related studies[48, 49]. The possible reason is that the younger parents are, the less knowledge and more impulsivity have.

To the best of our knowledge, this study contributes to the literature on self-medication with antibiotics of parents of different nationalities for children under the same health service provider in China, on behalf of

different demanders and the same supplier, revealing the pure difference in parental self-medication with antibiotics and medical knowledge, attitudes, behaviors about antibiotics amongst different nationalities from demand side, as well as association between nationality and parental self-medication with antibiotics, which is different from the previous studies analyzing parental self-medication with antibiotics designed by the same demanders under the same supplier.

The study highlights the phenomenon that Chinese parents are more likely to have self-medication with antibiotics for children and their less mastery of medical knowledge, attitudes and behaviors about antibiotics compared to Occidental parents, which make it necessary for health sector to pay much attention to provide more practical and effective health educations to parents on antibiotic knowledge, attitudes and behaviors from the perspective of the demand side.

There are several limitations of this study that need to be further addressed in future studies. The study is cross-sectional and retrospective, so recall bias on whether there was parental self-medication with antibiotics for children in the past 6 months in the survey is possible. In addition, the targeted observations of this study is limited in an International Department of an International School in Xi'an, Shaanxi Province due to time, manpower and other conditions, resulting in inadequate sample size and finite category of nationality. Considering the concentration on parents of different nationalities in study scene at level of Xi'an City, China, the results of our findings can basically reflect the fact that parents of different nationalities do vary in self-medication with antibiotics for children, as well as medical knowledge, attitudes and behaviors about antibiotics.

Conclusions

In this study among parents of different nationalities in the one healthcare supplier in China, nationality is associated with parental self-medication with antibiotics for children, showing that Chinese parents are more likely to self-medicate with antibiotics for children than Occidental parents. What's more, Occidental parents perform better than Chinese and other Asian parents in medical knowledge, attitudes and behaviors about antibiotics. These findings highlight the need for health sector and government not only to strengthen the supervision and regulation on health institutions and healthcare workers from the perspective of the supply side, but also provide more initiative and effective health educations to parents on antibiotic knowledge, attitudes and behaviors, by various means of brochures, poster, lectures and Internet.

Abbreviations

AIDS: Acquired Immune Deficiency Syndrome

PASW statistics: Predictive Analytics Software

Declarations

Acknowledgments:

Not applicable.

Authors' contributions:

ZZ, DZ, HZ and LZ designed and conceptualized the study. DZ interpreted the statistical results and drafted the manuscript. ZZ contributed to the editing and polishing of the manuscript. HZ was responsible for the quality control of investigation and coordination of study spot. YZ, DC and YR investigated and collected the data. DZ analysed the data and CS provided statistical analysis guidance and results' interpretation. YS and SM offered suggestions on study and critically revised the manuscript. All of the authors have read and approved the final manuscript as submitted.

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Availability of data and materials:

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate:

Ethical approval for this project was granted by the department of science, technology and discipline construction at Xi'an Jiaotong University (No: 2019-1169). In case participants weren't able to write and consideration of convenience and efficiency, verbal informed consent approved by the ethics committee was obtained from all participants before we investigators told them the survey purpose and privacy safety printed at the top of the questionnaire.

Consent for publication:

Not applicable.

Competing interests:

The authors declare that they have no competing interests.

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Tables

Table 1 Sample description

Variable	Chinese (N=121)		Other Asians (N=100)		Occidental (N=75)	
	n	%	n	%	n	%
Gender						
Male	19	15.70	27	27.00	47	62.67
Female	102	84.30	73	73.00	28	37.33
Age, years						
Mean (SD)	37.96 (5.447)		40.76 (3.610)		39.44 (4.630)	
25-34	48	39.67	6	6.00	18	24.00
35-39	34	28.10	45	45.00	27	36.00
40-55	39	32.23	49	49.00	30	40.00
Education level						
Postgraduate and above	44	36.36	19	19.00	45	60.00
Undergraduate	55	45.45	53	53.00	26	34.67
Junior college and below	22	18.19	28	28.00	4	5.33
Occupation						
Staff	12	9.92	18	18.00	4	5.33
Official cadre	3	2.48	9	9.00	8	10.67
Doctor	3	2.48	4	4.00	4	5.33
Teacher	25	20.66	6	6.00	30	40.00
Business manger	35	28.93	23	23.00	25	33.33
Self-employed	18	14.88	1	1.00	0	0.00
Others	25	20.65	39	39.00	4	5.34
Income						
Up to 0.5 million	62	51.24	37	37.00	67	89.33
0.5-10 million	30	24.79	46	46.00	5	6.67
Above 10 million	29	23.97	17	17.00	3	4.00

Shown as mean (standard deviation), number or percent, as assessed from a cross-sectional whole sample of 296 parents of different nationalities participated in an International Department of an International School in Xi'an, Shaanxi, China.

Table 2 Association between parents' nationality and parental self-medication with antibiotics

Variable	Model 1				Model 2			
	OR	S.E	95%CI		OR	S.E	95%CI	
			Lower	Upper			Lower	Upper
Nationality								
Chinese	8.221**	0.821	1.646	41.054	6.086*	0.915	1.012	36.594
Other Asians	0.845	0.998	0.119	5.977	0.453	1.255	0.039	5.310
Occidental	Ref				Ref			
Gender								
Male	1.005	0.575	0.326	3.105	0.737	0.815	0.149	3.645
Female	Ref				Ref			
Age								
25-34	2.601	0. 527	0.925	7.312	6.130**	0.659	1.685	22.302
35-39	0.783	0.530	0.277	2.214	0.722	0.613	0.217	2.397
40-55	Ref				Ref			
Education level								
Postgraduate and above	0.433	0.625	0.127	1.472	1.434	0.854	0.269	7.646
Undergraduate	0.633	0.560	0.211	1.896	0.859	0.690	0.222	3.323
Junior college and below	Ref				Ref			
Occupation								
Staff	0.376	0.852	0.071	1.998	0.562	1.011	0.078	4.075
Official cadre	0.385	1.202	0.036	4.054	0.060	1.771	0.002	1.945
Doctor	1.330	0.981	0.194	9.108	4.909	1.339	0.356	67.745
Teacher	1.446	0.644	0.409	5.109	4.610	0.876	0.828	25.680
Business manger	0.382	0.655	0.106	1.378	0.315	0.817	0.064	1.563
Self-employed	0.843	0.713	0.208	3.411	1.234	0.826	0.201	7.568
Others	Ref				Ref			
Income								
Up to 0.5 million	0.619	0.648	0.174	2.204	0.315	0.831	0.062	1.606
0.5-10 million	3.588	0.633	1.037	12.417	3.292	0.756	0.748	14.483
Above 10 million	Ref				Ref			
Antibiotics are purchased by a prescription								
Right					0.011**	1.327	0.001	0.144
Wrong					Ref			
Agree that antibiotics should be used immediately when your children has Upper Respiratory Tract Infections								
Yes					1.104	0.550	0.376	3.242
No					Ref			
Agree that parents can self-medicate with antibiotics for their children based on their children's condition when disease is mild								
Yes					1.788	0.547	0.612	5.219
No					Ref			
Antibiotic is available at home to mediate children timely when they are sick								
Yes					0.671	0.854	0.126	3.581
No					Ref			
Will use leftover antibiotics if your children have similar symptoms								
Yes					3.202	0.618	0.953	10.754
No					Ref			
Will ask for a doctor to prescribe antibiotics if the doctor does not prescribe an antibiotic								
Yes					15.288**	0.876	2.746	85.111
No					Ref			

1. Shown as odds ratio, standard error and 95% confidence interval obtained from two binary logistic regression models adjusted for socio-demographic characteristics of the respondents in Model 1, and both

socio-demographic characteristics and medical knowledge, attitudes and behaviors about antibiotics of the respondents in Model 2, as assessed from a cross-sectional whole sample of 296 parents of different nationalities participated in an International Department of an International School in Xi'an, Shaanxi, China.

2. * $P\leq 0.05$, ** $P\leq 0.01$

Table 3 Medical knowledge about antibiotics of parents of different nationalities

Item	Chinese[N=121]		Other Asians [N=100]		Occidental[N=75]		χ^2	P value
	n	%	n	%	n	%		
Antibiotics aren't anti-inflammatory drugs	55	45.45	26	26.00	45	60.00	20.963	<0.001
Antibiotics can't kill or inhibit the virus	58	47.93	15	15.00	39	52.00	33.814	<0.001
Antibiotics are purchased by a prescription	97	80.17	64	64.00	67	89.33	16.683	<0.001
Most of the Upper Respiratory Tract Infections are viral infection	67	55.37	49	49.00	38	50.67	0.965	0.617
Repeatedly using an antibiotic is prone to have bacterial resistance	102	84.30	76	76.00	68	90.67	6.773	0.034
Deficiency use of antibiotics leads to bacterial resistance	64	52.89	70	70.00	48	64.00	7.035	0.030
Total	443	61.02	300	50.00	305	67.78	36.650	<0.001

1. Shown as number, percent and χ^2 obtained from Pearson Chi-square test, as assessed from a cross-sectional whole sample of 296 parents of different nationalities participated in an International Department of an International School in Xi'an, Shaanxi, China.

2. Higher percent indicated better medical knowledge about antibiotics.

Table 4 Attitudes about antibiotics of parents of different nationalities

Item	Chinese[N=121]		Other Asians [N=100]		Occidental[N=75]		χ^2	P value
	n	%	n	%	n	%		
Disagree that antibiotics should be used immediately when your children has Upper Respiratory Tract Infections	84	69.42	40	40.00	56	74.67	27.980	<0.001
Disagree that expensive antibiotics will work better with fewer side effects	84	69.42	42	42.00	63	84.00	35.505	<0.001
Disagree that broad-spectrum antibiotics are better than narrow-spectrum antibiotics	70	57.85	48	48.00	46	61.33	3.579	0.167
Disagree that intravenous antibiotics (infusion) are better than oral antibiotics	74	61.16	50	50.00	54	72.00	8.742	0.013
Disagree that parents can self-medicate with antibiotics for their children based on their children's condition when disease is mild	80	66.12	47	47.00	71	94.67	44.025	<0.001
Total	392	64.79	227	45.40	290	77.33	97.133	<0.001

1. Shown as number, percent and χ^2 obtained from Pearson Chi-square test, as assessed from a cross-sectional whole sample of 296 parents of different nationalities participated in an International Department of an International School in Xi'an, Shaanxi, China.

2. Higher percent indicated better attitudes about antibiotics.

Table 5 Behaviors about antibiotics of parents of different nationalities

Items	Chinese[N=121]		Other Asians [N=100]		Occidental[N=75]		χ^2	P value
	n	%	n	%	n	%		
Antibiotic is available at home to medicate children timely when they are sick	85	70.25	73	73.00	25	33.33	34.724	<0.001
Will you give children multiple antibiotics at the same time when they are sick	24	19.83	40	40.00	7	9.33	24.040	<0.001
Will you use leftover antibiotics if children have similar symptoms	71	58.68	71	71.00	18	24.00	39.881	<0.001
Will you ask for a doctor to prescribe antibiotics if the doctor does not prescribe an antibiotic	23	19.01	73	73.00	29	38.67	65.945	<0.001
Will you change the dosage of antibiotics according to the course of disease of children	39	32.23	71	71.00	0	0.00	94.647	<0.001
Will you change the type of antibiotics when you use antibiotics	45	37.19	68	68.00	7	9.33	62.145	<0.001
Total	287	39.53	396	66.00	86	19.11	237.375	<0.001

1. Shown as number, percent and χ^2 obtained from Pearson Chi-square test, as assessed from a cross-sectional whole sample of 296 parents of different nationalities participated in an International Department of an International School in Xi'an, Shaanxi, China.

2. Lower percent indicated better behaviors about antibiotics.