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Original Research

Self-medication practices with antibiotics among Chinese university students

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ABSTRACT

Objectives: Self-medication with antibiotics (SMA) is a serious global health problem. We sought to investigate SMA behaviors and risk factors among Chinese university students, and further explore the association between SMA practices and adverse drug events (ADEs).
Study design: Cross-sectional study.
Methods: An online survey was conducted at Jiangsu University (JSU) in eastern China in July 2011 using a pretested questionnaire.
Results: Out of 2608 website visitors, 1086 participated in the survey (response rate: 41.6%), 426 respondents were excluded for not being a JSU student or repeat participation, 660 (2.2% of JSU students) were included in analysis, and 316 students (47.9%) had a lifetime history of SMA. Among self-treated students, 43.5% believed that antibiotic was suitable for viral infections, 65.9% had more than one SMA episode in the previous year, 73.5% self-medicated with at least two different antibiotics, 57.1% and 64.4% changed antibiotic dosage and antibiotics during the course, respectively. Female gender, older age, and prior knowledge of antibiotics (PKA) were identified as independent risk factors of SMA. There was no difference between students with and without PKA regarding SMA frequency, use of polyantibiotics, and switching antibiotic dosage or antibiotics. ADEs happened to 13.3% of self-medicated students. Frequent change of dosage and simultaneous use of the same antibiotic with different names were independent risk practices associated with an ADE.
Conclusions: Our findings substantiate high SMA prevalence among Chinese university students. Older age and PKA are independent SMA risk factors common to Chinese

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university students and female gender is exclusive SMA risk factor for JSU students. Poor SMA practices are associated with ADEs. Strict regulations on antibiotic sales and public education reinforced by further health care reform are recommended.

Introduction

Self-medication with antibiotics (SMA), defined as antibiotic use by individuals to treat symptoms/diseases without professional advice or prescription, is a serious global health problem.[1,2] Studies on SMA in different countries involved mostly self-reported surveys; thus the true frequency of SMA practice is uncertain. The reported estimates of SMA frequencies in the general population are 3%–19% in developed countries and 9%–100% in developing countries, with consequences of masking symptoms, treatment failure, drug resistance, and adverse drug events (ADEs) including death.[1–3]

Many studies have reported SMA frequencies, poor SMA practices such as frequent change of dosage or antibiotics, and SMA risk factors mostly related to gender, age, education level, antibiotic knowledge, and income; however, these risk factors vary in different populations or countries and thus remain controversial, and SMA practices of risk populations are seldom evaluated.[1,2] ADE, defined as 'an injury resulting from the use of a drug, including harm caused by the drug (adverse drug reactions and overdoses) and harm from the use of the drug (including dose reductions and discontinuations of drug therapy)',[4] is a common consequence of SMA but rarely reported along with other consequences of SMA, due to difficulties in follow-up and critical evaluation.

Our previous study at Shantou University (STU) in southern China has demonstrated a high SMA rate and risky SMA behaviors of university students.[2] In this study, we aimed to confirm our previous findings, especially isolated risk factors (viz. prior knowledge of antibiotics [PKA], older age, and higher allowance) among university students in eastern China, and further explore the association between SMA practices and adverse drug event (ADE).

Methods

A university intranet-based online questionnaire survey was conducted over a month in July 2011 at Jiangsu University (JSU) hosting 30,535 students from 26 colleges/schools, with medical students constituting the largest proportion (10.6%). The questionnaire that we used in our previous study (available at http://www.sojump.com/jq/757672.aspx; also see Supplementary File 1),[2] included 24 questions about SMA practices and antibiotic knowledge. Students were invited to participate anonymously in the study via the JSU website, flyers, and posters with a chance to win a lucky draw as incentive for participation. Repeat participation by the same student was prevented by screening the IP address, submission time, and answering patterns. Only completed questionnaires submitted by JSU students were included in analysis.

SMA was defined as taking over-the-counter antibiotics (without prescription) for self-treatment. PKA was defined as knowledge acquired through formal lectures about antibiotics in the medical school.

Chi-square test was used to examine the association between demographic variables (gender, age, major, education level, monthly allowance, insurance, and hometown) and SMA. The variables with significant differences were included in bivariate correlation and unconditional logistic regression analyses to identify SMA risk factors. For subgroup analysis, the participants were divided into PKA ($n = 247$) and non-PKA ($n = 337$) or ADE ($n = 42$) and non-ADE ($n = 274$) groups, based on the previously recognized risk factor PKA[2] or their experiences of ADE, respectively. The associations between PKA or ADE and antibiotic knowledge or SMA practices/attitude of self-medicated students were evaluated by Chi-square test and unconditional logistic regression as well. In logistic models, we used a propensity score as a covariate to control potential confounding factors (viz., gender, age, education level, monthly allowance, insurance, and hometown) as described previously.[5,6] In brief, propensity score for each participant was calculated through logistic models, where PKA was used as dependent variable with the confounding factors mentioned above as independent variables, generating a score which represented the possibility of having PKA for each participant. Antibiotic knowledge/SMA practices were further used as dependent variables respectively with PKA and the generated score as independent variables to investigate the influence of PKA on antibiotic knowledge/SMA practices. All the analyses were conducted in SPSS 17.0.

Results

Out of 2608 website visitors, 1086 participated in the survey (response rate 41.6%; 1086/2608). Among the respondents, 426 were excluded for not being a JSU student or repeat participation, and 660 (2.2% of JSU students) were included in analysis. The demographic characteristics of respondents and their SMA practices are shown in Table 1. Students were aged 18–45 years (median: 21, interquartile range: 21–22). Nearly half of the students (47.9%, 316/660) had a lifetime history of SMA.

Those being female, older than 23 years, majoring in medicine, or having a masters degree had higher odds of self-medication, and those receiving a monthly allowance of 501 to 1000 RMB (approximately US$ 80 to US$ 160) had lower odds of

Table 1 – Demographic characteristics of JSU students and their self-medication practices with antibiotics (n = 660).

Variable	Total (n = 660) n (%)	Non-self-medicated (n = 344) n (%)	Self-medicated (n = 316) n (%)	OR (95% CI)	P-value
Gender					
Male	369 (55.9)	205 (55.6)	164 (44.4)	1	–
Female	291 (44.1)	139 (47.8)	152 (52.2)	1.37 (1.00–1.86)	0.05
Age range (years)					
18–19	53 (8.0)	30 (56.6)	23 (43.4)	1	–
20–21	294 (44.5)	171 (58.2)	123 (41.8)	0.94 (0.52–1.69)	0.84
22–23	238 (36.1)	122 (51.3)	116 (48.7)	1.24 (0.68–2.26)	0.48
24–25	51 (7.7)	19 (37.3)	32 (62.7)	2.20 (1.00–4.82)	0.05
26–45	24 (3.6)	2 (8.3)	22 (91.7)	14.35 (3.06–67.34)	<0.0001
Major (n = 584)[a]					
Non-medicine	305 (46.2)	190 (62.3)	115 (37.7)	1	–
Medicine	279 (42.3)	110 (39.4)	169 (60.6)	2.54 (1.82–3.54)	<0.01
Education level (n = 645)[b]					
Undergraduate	581 (90.1)	319 (54.9)	262 (45.1)	1	–
Masters	59 (9.1)	17 (28.8)	42 (71.2)	3.01 (1.67–5.41)	<0.01
Ph.D.	5 (0.8)	1 (20.0)	4 (80.0)	4.87 (0.54–43.84)	0.18
Monthly allowance (in RMB)					
≤500	45 (6.8)	17 (37.8)	28 (62.2)	1	–
501 to 1000	423 (64.1)	231 (54.6)	192 (45.4)	0.50 (0.27–0.95)	<0.05
1001 to 2000	173 (26.2)	90 (52.0)	83 (48.0)	0.56 (0.29–1.10)	0.09
>2000	19 (2.9)	6 (31.6)	13 (68.4)	1.32 (0.42–4.11)	0.64

JSU, Jiangsu University.
[a] Seventy-six missing data.
[b] Fifteen missing data.

self-medication (all $P \leq 0.05$ by Chi-square test, Table 1). Bivariate correlation and multivariate logistic regression analyses identified female gender (OR: 1.44, 95% CI: 1.01–2.05, $P < 0.05$), older age (OR: 1.25, 95% CI: 1.12–1.38, $P < 0.0001$), and PKA (OR: 2.26, 95% CI: 1.59–3.22, $P < 0.0001$) as independent risk factors of SMA.

A total of 44% and 90% of self-medicated students believed that antibiotic was suitable for viral infections and bacterial infections, respectively, and most of them knew common adverse reactions of antibiotics as nausea (75.4%), vomiting (63.3%), diarrhea (58.9%), rash (59.3%), and drug resistance (76.2%), except vaginal thrush (20.6%, Table 2). The PKA group had significantly better knowledge of antibiotics than did the non-PKA group (Table 2).

Among 316 self-treated students, 65.9% (201/305, 11 missing data) had more than one SMA episode in the previous year and 73.5% (227/309, seven missing data) self-medicated with more than one kind of antibiotics for a single episode of illness; there was no difference between the PKA and non-PKA groups (all $P > 0.05$). Other SMA practices and attitudes of the non-PKA and PKA groups are shown in Table 3. We noted convenience (85.6%) as the main reason of SMA, community

Table 2 – Antibiotic knowledge of self-medicated JSU students (n = 248).[a]

Question	n (%) of YES answer			aOR (95% CI)	aP-value[c]
	Total (n = 248)	Non-PKA[b] (n = 100)	PKA[b] (n = 148)		
1. Antibiotic is suitable for:					
· Viral infections	108 (43.5)	53 (53.0)	55 (37.2)	0.62 (0.42–0.90)	<0.05
· Bacterial infections	222 (89.5)	80 (80.0)	142 (95.9)	4.83 (2.64–8.84)	<0.001
2. Knowing common adverse reaction of antibiotic as:					
· Nausea	187 (75.4)	70 (70.0)	117 (79.1)	1.56 (1.03–2.36)	<0.05
· Vomiting	157 (63.3)	57 (57.0)	100 (67.6)	1.60 (1.09–2.36)	<0.05
· Diarrhea	146 (58.9)	51 (51.0)	95 (64.2)	1.58 (1.09–2.30)	<0.05
· Rash	147 (59.3)	38 (38.0)	109 (73.6)	3.44 (2.31–5.11)	<0.001
· Vaginal thrush	51 (20.6)	10 (10.0)	41 (27.7)	2.52 (1.58–4.01)	<0.001
· Drug resistance	189 (76.2)	63 (63.0)	126 (85.1)	4.40 (2.89–6.70)	<0.001

JSU, Jiangsu University; aOR/aP value, adjusted Odds ratio/P-value, adjusted for the propensity scores calculated with potential confounders including gender, age, education level, monthly allowance, insurance, and hometown.
[a] Seventy-six students with non-classified major were excluded with 36 missing data.
[b] non-PKA, without prior knowledge of antibiotics; PKA, with prior knowledge of antibiotics.
[c] non-PKA group vs PKA group.

Table 3 – SMA practices/attitude of self-medicated JSU students (n = 284).[a]

Question	n (%) of YES answer			aOR (95% CI)	aP-value[c]
	Total (n = 284)	Non-PKA[b] (n = 131)	PKA[b] (n = 153)		
1. Reasons of SMA (MC[d])					
Convenience	243 (85.6)	110 (84.0)	133 (86.9)	1.06 (0.53–2.13)	0.88
Cost saving	74 (26.1)	27 (20.6)	47 (30.7)	2.02 (1.12–3.64)	<0.05
Lack of trust in prescribing doctor	17 (6.0)	14 (10.7)	3 (2.0)	0.14 (0.04–0.53)	<0.01
2. Antibiotics obtained mainly from (MC[d])					
Community pharmacy	254 (89.4)	121 (92.4)	133 (86.9)	0.64 (0.28–1.46)	0.28
Surplus	133 (46.8)	54 (41.2)	79 (51.6)	1.62 (0.98–2.67)	0.06
3. Main symptom for SMA (MC[d])					
Sore throat	188 (66.2)	89 (67.9)	99 (64.7)	0.91 (0.54–1.55)	0.73
Fever	121 (42.6)	48 (36.6)	73 (47.7)	1.66 (1.00–2.78)	0.05
Cough	115 (40.5)	47 (35.9)	68 (44.4)	1.53 (0.92–2.55)	0.10
Runny nose	91 (32.0)	37 (28.2)	54 (35.3)	1.53 (0.89–2.62)	0.12
4. SMA based on (MC[d])					
Own experience	184 (64.8)	74 (56.5)	110 (71.9)	1.82 (1.08–3.08)	<0.05
Opinion of family member	101 (35.6)	54 (41.2)	47 (30.7)	0.77 (0.46–1.29)	0.32
Advice of community pharmacist	89 (31.3)	46 (35.1)	43 (28.1)	0.82 (0.48–1.40)	0.46
5. Review of package insert for instruction					
Always	205 (72.2)	93 (71.0)	112 (73.2)	1.32 (0.75–2.30)	0.34
Sometimes	78 (27.5)	37 (28.2)	41 (26.8)	0.79 (0.45–1.38)	0.41
Never	1 (0.4)	1 (0.8)	0 (0)	0 (0)	1.00
6. Understanding the instruction (non-PKA: n = 130; PKA: n = 148[e])					
Partly understood	160 (57.6)	85 (65.4)	75 (50.7)	0.53 (0.32–0.87)	<0.05
Fully understood	100 (36.0)	34 (26.2)	66 (44.6)	2.25 (1.32–3.82)	<0.01
Did not understand at all	18 (6.5)	11 (8.5)	7 (4.7)	0.65 (0.23–1.81)	0.41
7. Change of dosage during the course					
Sometimes	138 (48.6)	68 (51.9)	70 (45.8)	0.92 (0.56–1.51)	0.73
Never	122 (43.0)	50 (38.2)	72 (47.1)	1.11 (0.67–1.84)	0.69
Always	24 (8.5)	13 (9.9)	11 (7.2)	1.01 (0.41–2.48)	0.98
8. Change of antibiotic during the course					
Sometimes	165 (58.1)	70 (53.4)	95 (62.1)	1.50 (0.91–2.49)	0.11
Never	101 (35.6)	54 (41.2)	47 (30.7)	0.55 (0.32–0.92)	<0.05
Always	18 (6.3)	7 (5.3)	11 (7.2)	1.98 (0.69–5.62)	0.20
9. Discontinuation of antibiotic use (MC[d])					
After symptoms disappeared	201 (70.8)	98 (74.8)	103 (67.3)	0.66 (0.38–1.14)	0.13
A few days after recovery	63 (22.2)	22 (16.8)	41 (26.8)	2.20 (1.18–4.09)	<0.05
At the completion of course	53 (18.7)	17 (13.0)	36 (23.5)	2.53 (1.30–4.95)	<0.01
10. Attitude towards self-medication					
Good/acceptable practice	266 (93.7)	126 (96.2)	140 (91.5)	2.65 (0.86–8.18)	0.09
11. Confidence to treat common infectious diseases by SMA					
Successfully treatable	124 (43.7)	55 (42.0)	69 (45.1)	1.12 (0.68–1.84)	0.67

SMA, self-medication with antibiotics; JSU, Jiangsu University; aOR/aP value, adjusted Odds ratio/P-value, adjusted for the propensity scores calculated with potential confounders including gender, age, education level, monthly allowance, insurance, and hometown.

[a] Seventy-six students with non-classified major were excluded.

[b] non-PKA, without prior knowledge of antibiotics; PKA, with prior knowledge of antibiotics.

[c] non-PKA group vs PKA group.

[d] MC, multiple choice.

[e] Five incomplete data in PKA group (5/153).

pharmacies (89.4%) as the main source of antibiotics for self-medication, and flu-like symptoms as the major complaints for SMA. While most students (64.8%) self-medicated basing on their own experiences, only 36% of them fully understood the package insert. Change of dosage or antibiotics and discontinuation after disappearance of symptoms during self-treatment were common. Most self-medicated students (93.7%) regarded SMA as a good/acceptable practice. There was no difference between the non-PKA and PKA groups for most SMA practices, such as main source of antibiotics, main symptoms, review of instructions, change of dosage/antibiotics, and attitudes towards and confidence in SMA (all $P > 0.05$).

ADEs, including nausea, vomiting, stomach ache, diarrhea, head ache, anorexia, tinnitus, dizziness, fatigue, hypersomnia, and rash, happened in 13.3% (42/316) of self-medicated students, of which 32 students stopped taking antibiotics and 13 switched to other antibiotics because of the ADEs. Multivariate logistic regression analysis showed that frequent change of dosage (OR: 10.15, 95% CI: 3.03–33.94, $P < 0.001$, 'never' as reference) and simultaneous use of the same antibiotic with different names (OR: 2.92, 95% CI:

1.14–7.49, $P < 0.05$) were independent risk practices leading to ADE.

Discussion

Compared to our previous study site in southern China,[2] Zhenjiang, JSU is located in eastern China with lower population density (0.26 vs 0.08 million/km^2), more developed economy (US$ 3666 vs 10,191 GDP per capita/year; US$ 2446 vs 3717 disposable income per capita/year), and better health care access (22.9 vs 33.1 hospital beds per 10,000 persons; 13.1 vs18.8 doctors per 10,000 persons) but fewer community pharmacies (5.2 vs 3.8 pharmacies per 10,000 persons). Despite these differences, we found that high SMA prevalence, independent SMA risk factors (older age and PKA), and poor SMA practices among students in two universities are common. Under our study approaches, geographic, socio-economic, and health care factors play no significant role in SMA prevalence and practices among university students.

SMA rates have been reported as 24%–90% in university students from different regions and countries.[2,7–9] The rates of 47.9% at JSU and 47.8% at STU[2] in China are considerably high. Some likely reasons for these high SMA rates in China are misconception about antibiotic use for flu-like symptoms, false confidence in antibiotic use, high medical costs at health care centers (generally US$ 32 for receiving care for a common cold, which is nearly 10% of the monthly income per capita for the citizens of Shantou and Zhenjiang where our studies were conducted),[2,10,11] long waiting hours (up to half a day) for outpatient services in hospitals and clinics, lack of trust in prescribing physicians, easy access to antibiotics, and profit-driven persuasion by community pharmacists.[2,12] In China, antibiotics can be easily obtained without prescription, although it is illegal. Ineffective penalties for contravention, difficulty in surveillance, and poor enforcement of regulations can be explained as main reasons.[13,14]

There are known independent risk factors of SMA among university students such as older age and/or PKA/pharmacological knowledge in India,[7] Nigeria,[15] Sudan,[9] and China;[2] non-science major in Nigeria[16] or non-medicine major in Ghana;[17] female gender in Mozambique;[18] and higher monthly allowance in southern China.[2]

Accumulated episodes of illnesses in the older age group and false confidence due to PKA could be the reasons for older age and PKA being independent risk factors in our studies (STU[2] and this study). Higher allowance and female gender are independent risk factors unique to STU and JSU, respectively. While the allowance might have predisposed economically disadvantaged STU students to opt for SMA, the role of gender is not clear here. As described previously, female being more cautious about self-care and prone to self-medicate with antibiotics for menstrual symptoms, or variance in utilization of health care facilities and health knowledge may explain this gender factor.[16,18]

In previous studies on SMA, knowledge/attitudes/practices (KAP) of risk populations were rarely investigated and the influence of confounders was seldom ruled out to prevent biased estimation of the observed effects.[5] Different to our previous study in STU,[2] bias reduction in this study was achieved using both multivariate logistic regression and propensity score adjustment[5] approaches, which resulted in very similar results (data from the former not shown). Of note, although JSU students had rather good antibiotic knowledge, they had poor SMA practices; even medical education did not improve SMA practices (SMA frequency, switching antibiotic dosage or antibiotics, and use of polyantibiotics). Such deficient translation of knowledge into practices and behaviors has been also reported among Indian and Turkish university students.[7,8]

To the best of our knowledge, this is the first report that confirms the positive associations between self-reported ADE and poor SMA practices, such as using antibiotics for fever, using the same antibiotic with different names simultaneously, and switching antibiotics and the dosage. Unlike adverse drug reactions, which are well-known and reported frequently, ADEs that include adverse drug reactions and injuries caused by inappropriate dosage of antibiotics and substandard/counterfeit drugs are often underestimated or even ignored.[1,4,19] Self-claimed ADEs herein could be under-reported as non-PKA students with poor antibiotic knowledge might not be aware of them even if they had some. With the observed prevalence around 48% and lack of due recognition by the authorities concerned, approximately 14 million out of the 30 million Chinese university students are at risk of SMA and its consequences if no effective interventions are offered.

Interventions are usually aimed at specific populations and risk factors;[1] however, reported SMA risk factors are varied and inconsistent across the studies.[2,7,9,15–18] Public education and implementation of law and regulations on antibiotic sales/use are the most effective ways to fight against SMA.[1] For example, Chile has witnessed a significant decrease in antibiotic use after strict restriction on over-the-counter sales of antibiotics and public education campaign,[1,20] while a national policy in South Korea prohibiting physicians from dispensing drugs noticeably decreased overall antibiotic use and improved quality of antibiotic prescriptions, especially for viral infections.[21] Practical solutions for the current situations in China could be stricter enforcement of surveillance and regulations on antibiotic sales, severe punishment for infringement, and targeted public education on antibiotics and its misuse in treating self-limiting viral infections, importance of compliance, and consequences of SMA.

There are several limitations in this self-reported study. Students who self-medicated or were more concerned about self-care could have been attracted to this study. Besides, the number of participants represented only ca. 3.5% (1086/30,535) of all JSU students, which could therefore have introduced bias in SMA frequency estimates and interpretation or generalizability of our findings. Our results might also have been influenced by other unmeasured confounders (for example, behavior influences) that could lead people to self-medication. The role of PKA in ADE in self-medication or prescription, which was seldom investigated in the related studies, should be explored further for a better understanding. As cross-sectional study design has limited ability to confirm the causality of different variables, the findings from our survey require further investigation through well-designed longitudinal observational studies.

In summation, our findings substantiate that SMA is prevalent among Chinese university students. Older age and prior knowledge of antibiotics are independent SMA risk factors common to Chinese university students and female gender is exclusive SMA risk factor for JSU students. Poor SMA practices are associated with ADEs. Strict regulations on antibiotic sales, and public education reinforced by further reform in health care systems would be successful approaches to meaningful interventions.

Author statements

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Ethical approval

This study was approved by the ethics committee of JSU.

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Completing interests

None declared.

Author contributions

Conceived and designed the survey: XZ HP WB-T. Performed the survey: XZ HP. Conducted data analysis: XZ HP ZRY WB-T. Wrote the paper: XZ HP WB-T. Translated the questionnaire: HP BC DZ. Validated questionnaire and analysis: BC DZ. All authors have approved the final article.

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.puhe.2015.04.005.

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