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The Impact of the Lifting of COVID-19 Restrictions on College Students' Knowledge, Attitude, and Practice (KAP) in Self-Medication with Antibacterial Agents

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Abstract

Objective: This study aims to investigate the Knowledge, Attitude, and Practice (KAP) of college students regarding self-medication with antibacterial agents before and after the lifting of COVID-19 restrictions, as well as the impact of the lifting of COVID-19 restrictions on college students' KAP towards self-medication with antibacterial agents. We analyze the factors influencing college students' self-medication with antibacterial agents and provide relevant reference data for the rational use of antibacterial agents for self-medication among college students. ***Methods:*** Non-probability sampling methods, including convenience sampling and quota sampling, were employed to collect data samples. College students were invited to participate in an online questionnaire survey that they completed independently, and the data were entered into Excel software for statistical analysis using SPSS 26.0 software. ***Results:*** Independent samples t-test and analysis of variance revealed that, before the lifting of pandemic restrictions, female college students scored higher than male students in KAP towards self-medication with antibacterial agents, with all differences being statistically significant ($P<0.05$). However, after the lifting of pandemic restrictions, the gender differences in these aspects diminished; College students from rural areas scored significantly higher than their urban counterparts in the knowledge of antibacterial agents both before and after the lifting of COVID-19 restrictions ($P<0.05$); Moreover, medical students had significantly higher attitude scores compared to science and engineering students before the lifting of pandemic restrictions ($P<0.05$), while social science students scored significantly higher in practice compared to science and engineering students both before and after the lifting of pandemic restrictions ($P<0.05$). Paired samples t-test indicated a significant improvement in knowledge and practice towards self-medication with antibacterial agents after the lifting of pandemic restrictions, with attitude showing no significant change. Multiple linear regression analysis demonstrated that, before the pandemic, there were significant differences in KAP based on gender and grade. However, after experiencing the pandemic, there were no longer significant differences in KAP among different genders and different grades, and this could be attributed to the impact of health education and campaigns during the pandemic. ***Conclusion:*** The lifting of COVID-19 restrictions has had a positive impact on college students' knowledge and practice

towards self-medication with antibacterial agents. Before and after the lifting of COVID-19 restrictions, the KAP of college students regarding self-medication with antibacterial agents were influenced by multiple factors. One important measure to enhance the rational use of antibacterial agents for self-medication among college students is to conduct health education courses in universities. Public health should pay attention to online media channels.

Keywords: self-medication with antibacterial agents, Knowledge-Attitude-Practice, health education

1. Introduction

The COVID-19 pandemic that emerged in early 2020 has become one of the most serious issues in the field of global public health. The lifting of COVID-19 restrictions has had a certain impact on people's knowledge and practice of self-medication with drugs. College students, as a group with certain cultural literacy in society, have increasingly emphasized self-medication after the outbreak. Therefore, investigating the impact of the lifting of COVID-19 restrictions on college students' self-medication with antibacterial agents and promoting the rational use of drugs for self-medication among college students are of great significance.

For the theme of self-medication with antibacterial agents, we identified three keywords: "antibacterial agents," "KAP," and "self-medication." They were searched in databases such as CNKI, Wanfang, and PUBMED. The literature review indicated that foreign studies on this subject started earlier, with the first research paper titled "Self-treatment with antibiotics" published by Chretien J H et al. in 1976. Foreign research methods are more comprehensive, and the number of related papers is substantial. Currently, the foreign general public's KAP regarding self-medication with antibacterial agents are improving overseas, but there still exist some notable errors in practice. According to the U.S. CDC website, at least 28% of antibiotic treatments are unnecessary each year. A 2021 study conducted by Jordan University on the knowledge, usage, and indications of antibacterial agents indicated that college students have a relatively good overall knowledge of antibacterial agents. Their gender and age were found to be associated with their previous self-medication practice with antibiotics; Students' understanding of antibacterial agents use and resistance mainly comes from the internet, highlighting the need to strengthen the role of media, public policy, university courses, and pharmacists to eliminate inappropriate antibacterial agents use and correct misconceptions. In 2022, a study on self-medication with antibiotics during the COVID-19 pandemic in the Eastern Mediterranean region revealed that the rate of self-medication with antibiotics remained high during this period. It is necessary to impose more restrictions on the distribution of antibiotics in community pharmacies and enhance public awareness of self-medication with antibiotics.

Regarding domestic literature databases, research on self-medication with antibacterial agents among Chinese people began in 1995 with Zhao Chao's paper titled "Self-prevention and self-medication of traveler's diarrhea." The research in this area started relatively late, and the number of related studies is limited. Overall, the level of knowledge about antibacterial agents in China is generally low, and awareness of antibacterial agents' use is relatively limited. Research within China primarily focuses on surveys of parents' KAP regarding the self-medication of antibacterial agents in children, as well as factors influencing self-medication practice among the general public. For instance, the KAP study conducted by Chongqing Medical University in 2022 on parents in the Sichuan-Chongqing region regarding the self-medication of antibiotics in children revealed that parents with higher levels of education had higher knowledge scores. Parents with higher monthly incomes also had higher knowledge scores. The age of the child, kinship relationship, and the gender of the guardian significantly influenced the attitude scores of parents towards self-medication. Occupation and monthly income had a significant impact on parents' self-medication practice. The higher the knowledge level about antibacterial agents, the more positive the correct attitude and reasonable practice towards

antibacterial agents use. A study conducted by Changchun University of Chinese Medicine in 2023 analyzed the factors influencing rational drug use among residents in Jilin Province. The results indicated that age and education level were the main factors affecting residents' rational drug use, while physical health status and gender were significantly correlated with rational drug use. Marriage status and medical education were important factors affecting residents' rational drug use. The study suggested enhancing diverse and rational drug use knowledge dissemination and relevant departmental supervision.

Overall, there is a scarcity of literature research on college students' self-medication with antibacterial agents, with a lack of studies specifically focused on college students engaging in self-medication with antibacterial agents. There is also a dearth of studies examining the impact of the COVID-19 pandemic on the KAP of college students regarding self-medication with antibacterial agents. However, there is increasing public awareness and concern regarding self-medication with antibacterial agents. A review of the current research status both domestically and internationally provides valuable references and highlights the directions for further investigation.

2. Subjects and Methods

2.1 Survey Participants

The scope of this survey included 416 students from a comprehensive university in Guangdong Province. The basic situations of the participants are presented in Table 2.

2.2 Survey Methods and Contents

This survey targeted college students from a university in Guangdong Province and utilized an electronic questionnaire to understand their basic situations of KAP towards self-medication with antibacterial agents before and after the lifting of COVID-19 restrictions. We conducted searches of domestic and foreign literature databases to comprehensively investigate various factors that might influence college students' self-medication practice with antibacterial agents. We compared the differences in KAP towards self-medication with antibacterial agents among college students before and after the lifting of pandemic restrictions and studied the impact of the lifting of pandemic restrictions on college students' KAP towards self-medication with antibacterial agents. The main contents of the questionnaire included the participants' basic information, whether they had a medical background, their grade, major, knowledge level of self-medication with antibacterial agents, attitude towards self-medication with antibacterial agents, and their self-medication practice. The questionnaire was distributed and collected through online self-completion, and only qualified questionnaires were used for analysis after checking for completeness and logical consistency.

2.3 Quality Control

Before conducting the survey, the questionnaire distributors received professional training. Considering that the survey participants were college students and postgraduates with a relatively high level of education, we adopted an online self-completion method. After collecting the data, we used Excel to clean and check the data, identifying and removing data with missing information or numerous questionnaires from the same IP address, and then entered the data.

2.4 Statistical Analysis

We entered and organized the collected effective data using Excel and performed statistical analyses using SPSS 26.0 software. We calculated the assigned scores for KAP towards self-medication with antibacterial agents and conducted descriptive analysis of demographic variables. We used normality test for the influencing factors, for each demographic variable, then we used two-sample independent t-test or analysis of variance to compare the demographic variables with the assigned scores of college students' KAP towards self-medication with antibacterial agents before and after the lifting of pandemic restrictions; We used paired samples t-test to compare the assigned scores of college students' KAP towards self-medication with antibacterial agents before and after the lifting of pandemic restrictions; We conducted multifactor regression analysis to explore the factors influencing KAP. The assignment method is shown in Table 1.

Table 1. Assignment of variables for multifactor regression analysis

Variable	Assignment

Gender	Male = 1, Female = 2
Grade	Freshman = 1, Sophomore = 2, Junior = 3, Senior = 4, Fifth-year = 5, Postgraduate = 6
Major Type	Medical = 1, Science and Engineering = 2, Humanities = 3, Social Sciences = 4
Residence	Urban = 1, Rural = 2
Family Medical Background	Yes = 1, No = 2

3. Results and Analysis

Table 2. The basic situation of college students

	Demographic Characteristics Variables	Number (n)	Composition (%)
Gender	Male	215	51.7
	Female	201	48.3
Grade	Freshman	45	10.8
	Sophomore	90	21.6
	Junior	93	22.4
	Senior	104	25.0
	Fifth-year	48	11.5
	Postgraduate	36	8.7
Major	Medical	101	24.3
	Science & Engineering	138	33.2
	Humanities	106	25.5
	Social Science	71	17.1
Residence	Urban	249	59.9
	Rural	167	40.1
Family Medical Background	Yes	137	32.9
	No	279	67.1

3.1 Analysis of the Current Status of College Students' Self-Medication with Antibacterial Agents

3.1.1 College Students' Current Knowledge of Antibacterial Agents

Among the surveyed college students, 47.36% incorrectly believed that "antibacterial agents are anti-inflammatory drugs," 43.99% incorrectly thought that "antibacterial agents cannot treat Chlamydia infections," 40.63% incorrectly believed that "ibuprofen is an antibacterial agent," and 48.08% incorrectly thought that "aspirin is an antibacterial agent." Only 0.2% of surveyed college students had a clear understanding of which antibacterial agents are sensitive to erythromycin, and only 3.8% could distinguish between commonly used antibacterial agents and other drugs. Overall, college students' knowledge of antibacterial agents is relatively low, and their understanding of related knowledge is limited.

3.1.2 College Students' Current Attitude Towards Self-Medication with Antibacterial Agents

A survey was conducted using the Likert scale to assess the attitude of college students towards self-medication with antibacterial agents. After assigning values and calculating the total scores, it was found that the percentage of students with satisfactory attitudes reached 83.17%, indicating a positive attitude status.

Before the lifting of COVID-19 restrictions, only 51.44% of the surveyed college students believed that it was necessary to learn about

self-medication with antibacterial agents. However, after the lifting of COVID-19 restrictions, the percentage of students who considered it necessary to learn about self-medication with antibacterial agents increased to 74.04%.

3.1.3 College Students' Current Practice Towards Self-Medication with Antibacterial Agents

The practice survey towards self-medication with antibacterial agents among college students was conducted using the Likert scale. After assigning values and calculating the total scores, the results were analyzed. Before the lifting of COVID-19 restrictions, only 11.78% of the surveyed college students scored at a satisfactory level in terms of their self-medication practice with antibacterial agents. However, after the lifting of COVID-19 restrictions, the percentage of individuals with satisfactory scores increased significantly to 50.00%. Despite this notable improvement, the overall practice status remains average.

3.2 Analysis of Factors Influencing College Students' Self-Medication with Antibacterial Agents

3.2.1 Analysis of Differences in College Students' Knowledge of Antibacterial Agents Before and After the Lifting of Pandemic Restrictions

Based on the existing survey questionnaire data, the analysis revealed that before the lifting of COVID-19 restrictions, college students' knowledge of antibacterial agents showed differences in gender, residence, and grade, which were statistically significant ($P<0.05$). Specifically, female college students had significantly higher knowledge scores than male college students, students from rural areas had significantly higher knowledge scores than students from urban areas, and senior and fifth-year had significantly higher knowledge scores than freshmen. The family medical background, as well as the type of major, showed no significant differences in the knowledge of antibacterial agents among college students, which were statistically insignificant. ($P<0.05$). After the lifting of COVID-19 restrictions, college students' knowledge of antibacterial agents showed differences in residence, family members' medical backgrounds, and grades, which were statistically significant ($P<0.05$). Students from rural areas had significantly higher knowledge scores than students from urban areas, students without family members with medical backgrounds had significantly higher knowledge scores than those with family members with medical backgrounds, and seniors had significantly higher knowledge scores than juniors. There were no statistically significant differences in knowledge based on gender and major types ($P<0.05$). (Tables 3 and 4, Figures 1 and 2)

Table 3. Independent samples t-test on factors influencing college students' awareness of antibacterial agents

Variable			n	Mean	Standard Deviation	t	P
Before the lifting of COVID-19 restrictions	Gender	Male	215	4.27	1.53	-2.213	0.027
		Female	201	4.61	1.62		
	Residence	Urban	249	4.27	1.55	-2.695	0.007
		Rural	167	4.69	1.61		
	Family Medical Background	Yes	137	4.34	1.54	-0.896	0.371
		No	279	4.48	1.61		
After the lifting of COVID-19 restrictions	Gender	Male	215	6.79	2.00	-1.878	0.061
		Female	201	7.15	1.95		
	Residence	Urban	249	6.8	2.05	-2.163	0.031
		Rural	167	7.22	1.85		
	Family Medical Background	Yes	137	6.71	1.75	-1.982	0.048
		No	279	7.09	2.07		

Table 4. Analysis of variance in college students' knowledge of antibacterial agents

	Variable		n	Mean	Standard Deviation	F	p
Before the lifting of COVID-19 restrictions	Grade	Freshman	45	3.78	1.363	4.374	0.001
		Sophomore	90	4.24	1.567		
		Junior	93	4.23	1.505		
		Senior	104	4.79	1.623		
		Fifth-year	48	4.94	1.549		
		Postgraduate	36	4.58	1.645		
	Major	Medical	101	4.63	1.719	2.303	0.076
		Science & Engineering	138	4.19	1.365		
		Humanities	106	4.4	1.553		
		Social Sciences	71	4.69	1.77		
After the lifting of COVID-19 restrictions	Grade	Freshman	45	6.67	1.871	2.784	0.017
		Sophomore	90	6.88	1.798		
		Junior	93	6.6	1.94		
		Senior	104	7.51	2.09		
		Fifth-year	48	6.73	1.876		
	Major	Medical	101	7.26	1.988	1.426	0.235
		Science & Engineering	138	6.78	2.064		
		Humanities	106	6.83	1.9		
		Social Sciences	71	7.11	1.894		

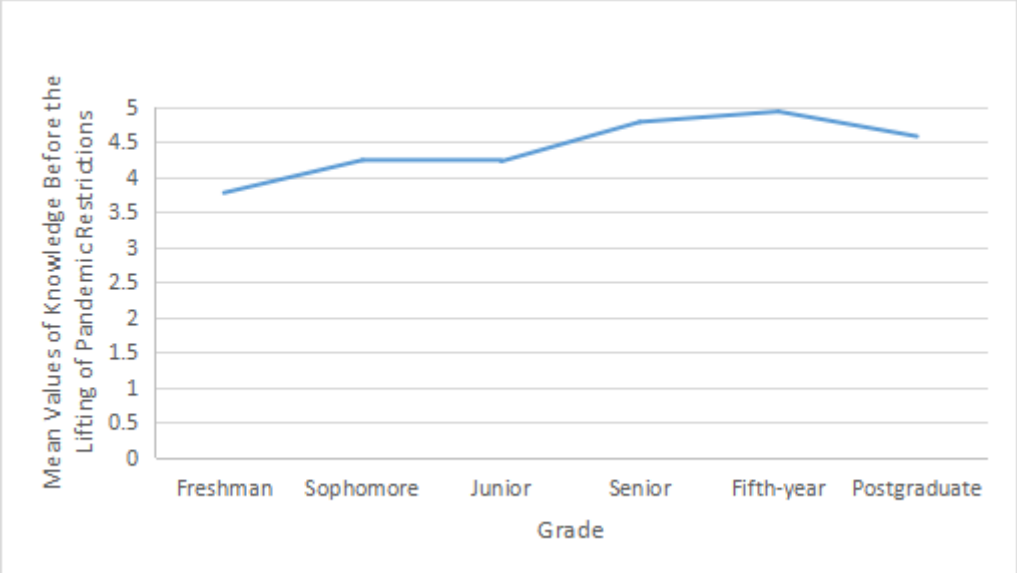

Figure 1. Mean values of knowledge about antibacterial agents among college students of different grades before the lifting of pandemic restrictions

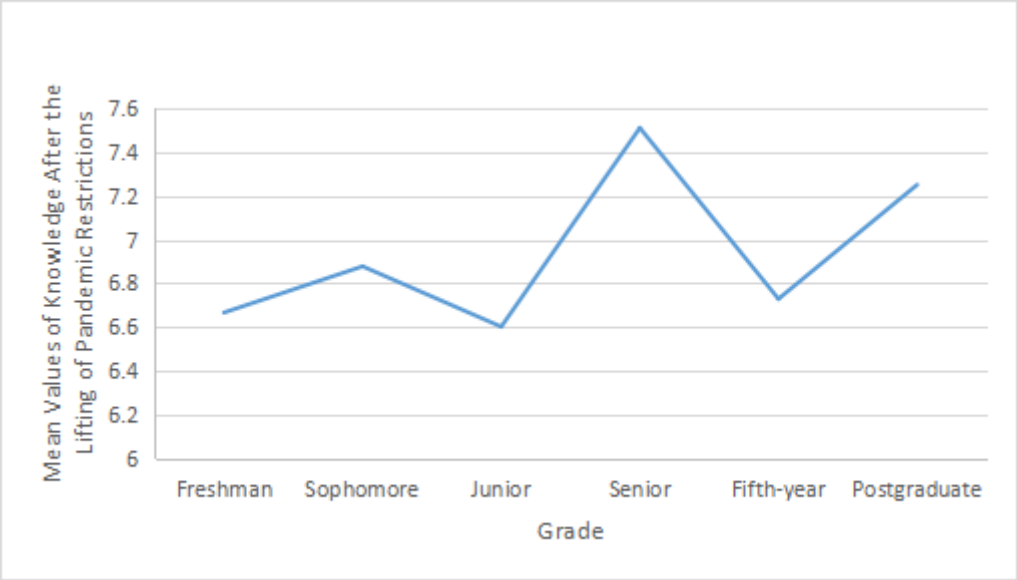

Figure 2. Mean values of knowledge about antibacterial agents among college students of different grades after the lifting of pandemic restriction

3.2.2 Analysis of Differences in College Students' Attitude Towards Self-Medication with Antibacterial Agents Before and After the Lifting of Pandemic Restrictions

Based on the existing survey questionnaire data, the analysis revealed that before the lifting of COVID-19 restrictions, there were statistically significant differences in attitudes towards self-medication with antibacterial agents among college students based on gender and major type ($P<0.05$). Specifically, female college students had significantly higher attitude scores than male college students, and students majoring in medicine had significantly higher attitude scores than those in science and engineering. However, there were no statistically significant differences in attitude based on residence, family medical background, and grade ($P<0.05$). After the lifting of COVID-19 restrictions, there were no statistically significant differences in attitude towards self-medication with antibacterial agents among college students based on gender, residence, family medical background, grade, and major type ($P<0.05$). See Table 5, Table 6, and Figure 3 for detailed information.

Table 5. Independent Sample t-test of factors influencing college students' attitude towards self-medication with antibacterial agents

Variable			n	Mean	Standard Deviation	t	P
Before the lifting of COVID-19 restrictions	Gender	Male	215	15.88	3.5	-2.268	0.024
		Female	201	16.65	3.4		
	Residence	Urban	249	16.35	3.274	0.685	0.494
		Rural	167	16.11	3.743		
	Family Medical Background	Yes	137	16.35	3.364	0.413	0.68
		No	279	16.2	3.522		
After the lifting of COVID-19 restrictions	Gender	Male	215	16	3.66	-0.044	0.965
		Female	201	16.02	3.34		
	Residence	Urban	249	16.01	3.558	-0.028	0.977

	Rural	167	16.02	3.428		
Family Medical Background	Yes	137	16.08	3.4	0.278	0.781
	No	279	15.98	3.557		

Table 6. Analysis of variance in college students' attitude towards self-medication with antibacterial agents

	Variable		n	Mean	Standard Deviation	F	p
Before the lifting of COVID-19 restrictions	Grade	Freshman	45	15.71	3.653	2.124	0.062
		Sophomore	90	16.24	3.306		
		Junior	93	15.77	3.294		
		Senior	104	16.14	3.537		
		Fifth-year	48	17.56	3.747		
		Postgraduate	36	16.72	3.195		
	Major	Medical	101	17.07	3.845	5.089	0.002
		Science & Engineering	138	15.39	3.425		
		Humanities	106	16.53	3.22		
		Social Sciences	71	16.34	3.019		
After the lifting of COVID-19 restrictions	Grade	Freshman	45	16.13	3.958	0.59	0.708
		Sophomore	90	15.94	3.864		
		Junior	93	16	3.11		
		Senior	104	15.72	3.565		
		Fifth-year	48	16.75	2.756		
	Major	Medical	101	16.12	3.345	1.48	0.219
		Science & Engineering	138	15.54	3.779		
		Humanities	106	16.16	3.389		
		Social Sciences	71	16.55	3.285		

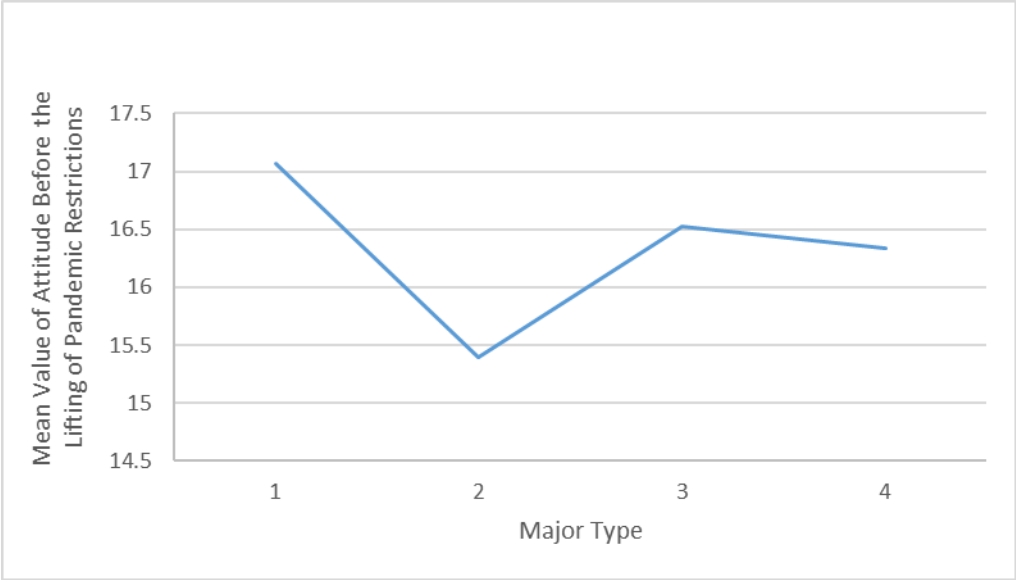

Figure 3. Mean values of college students' attitude towards self-medication with antibacterial agents by different majors before the lifting of pandemic restrictions

Note: 1 = Medical, 2 = Science and Engineering, 3 = Humanities, 4 = Social Science

3.2.3 Analysis of Variations in College Students' Self-Medication Practice with Antibacterial Agents Before and After the Lifting of Pandemic Restrictions

Based on the analysis of the existing survey questionnaire data, the results indicate that there are significant differences in the self-medication practice with antibacterial agents among college students before the lifting of COVID-19 restrictions. These differences are observed based on gender, family medical background, grade, and major type, which are statistically significant ($P<0.05$). Notably, female college students obtained significantly higher scores than their male counterparts in terms of self-medication practice. Moreover, students without medical backgrounds in their primary family members achieved significantly higher scores compared to those with family members having medical backgrounds. Furthermore, Fifth-year students demonstrated significantly higher scores than freshmen, sophomores, and juniors, and seniors scored significantly higher than sophomores. Students majoring in social sciences outperformed those in science and engineering. However, no statistically significant differences in practice were observed based on the residence. ($P<0.05$). After the lifting of COVID-19 restrictions, there were significant differences in the self-medication practice with antibacterial agents among college students based on their majors. These differences had statistical significance ($p<0.05$), with social sciences students exhibiting significantly higher self-medication practice scores compared to science and engineering students. Nevertheless, no statistically significant differences in practice were found concerning gender, residence, family medical background and grade ($P<0.05$). See Table 7, Table 8, Table 9, Figure 4, Figure 5, and Figure 6.

Table 7. Independent sample t-test of factors influencing college students' self-medication practice with antibacterial agents before the lifting of COVID-19 restrictions

Variable			n	Mean	Standard Deviation	t	P
Before the lifting of COVID-19 restrictions	Gender	Male	215	12.2	2.77	-3.481	0.001
		Female	201	13.2	3.06		
	Residence	Urban	249	12.61	2.973	-0.642	0.521
		Rural	167	12.8	2.932		

	Family Medical Background	Yes	137	12.09	2.954	-2.905	0.004
		No	279	12.97	2.915		

Table 8. Independent sample t-test of factors influencing college students' self-medication practice with antibacterial agents after the lifting of COVID-19 restrictions

Variable			n	Mean	Standard Deviation	t	P
After the lifting of COVID-19 restrictions	Gender	Male	215	14.83	3.29	-1.944	0.053
		Female	201	15.43	2.98		
	Residence	Urban	249	14.9	3.209	-1.796	0.073
		Rural	167	15.46	3.057		
	Family Medical Background	Yes	137	14.68	3.481	-1.91	0.057
		No	279	15.34	2.968		

Table 9. Analysis of variance (ANOVA) for factors influencing college students' self-medication practice with antibacterial agents

	Variable		n	Mean	Standard Deviation	F	p
Before the lifting of COVID-19 restrictions	Grade	Freshman	45	12.13	3.382	4.997	0
		Sophomore	90	11.79	2.612		
		Junior	93	12.45	2.581		
		Senior	104	13.1	3.051		
		Fifth-year	48	14.06	3.124		
		Postgraduate	36	13.17	2.793		
	Major	Medical	101	12.96	3.349	4.388	0.005
		Science & Engineering	138	12.01	2.823		
		Humanities	106	12.77	2.641		
		Social Sciences	71	13.45	2.837		
After the lifting of COVID-19 restrictions	Grade	Freshman	45	15.56	3.571	1.919	0.09
		Sophomore	90	14.5	3.073		
		Junior	93	14.95	2.99		
		Senior	104	15.1	3.275		
		Fifth-year	48	16.1	3.04		
		Postgraduate	36	15.36	2.82		
	Major	Medical	101	15.33	3.092	2.653	0.048
		Science & Engineering	138	14.59	3.324		
		Humanities	106	15.14	3.202		
		Social Sciences	71	15.83	2.704		

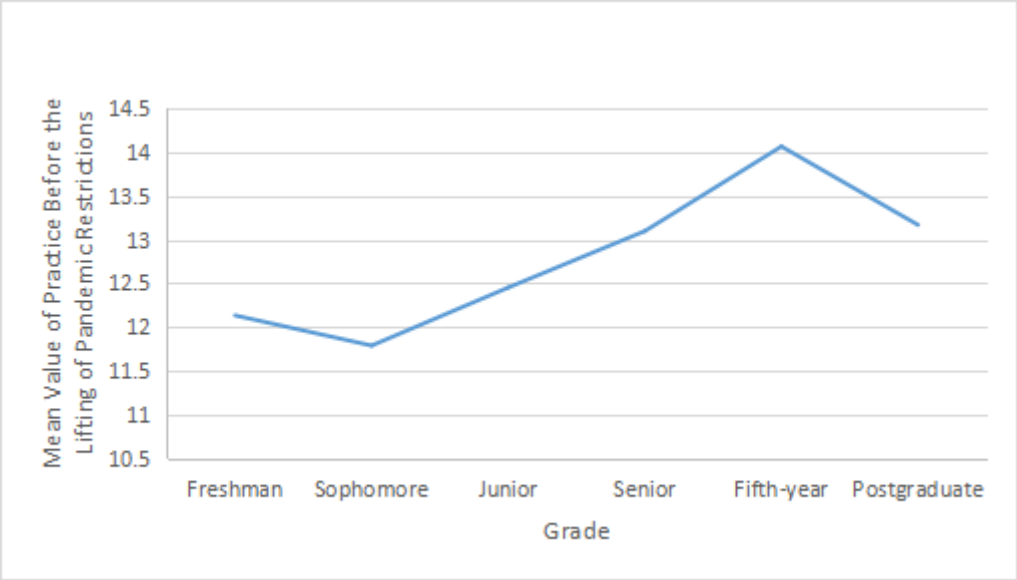

Figure 4. Mean values of practice towards self-medication with antibacterial agents among college students of different grades before the lifting of pandemic restrictions

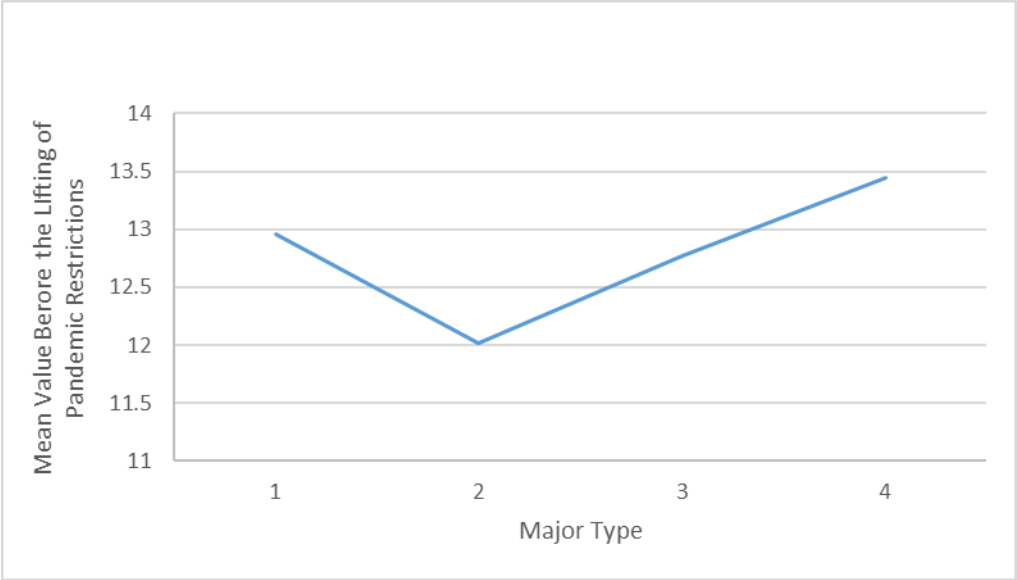

Figure 5. Mean value of practice for college students of different majors on self-medication with antibacterial agents before the lifting of pandemic restrictions

Note: 1 = Medical, 2 = Science and Engineering, 3 = Humanities, 4 = Social Science

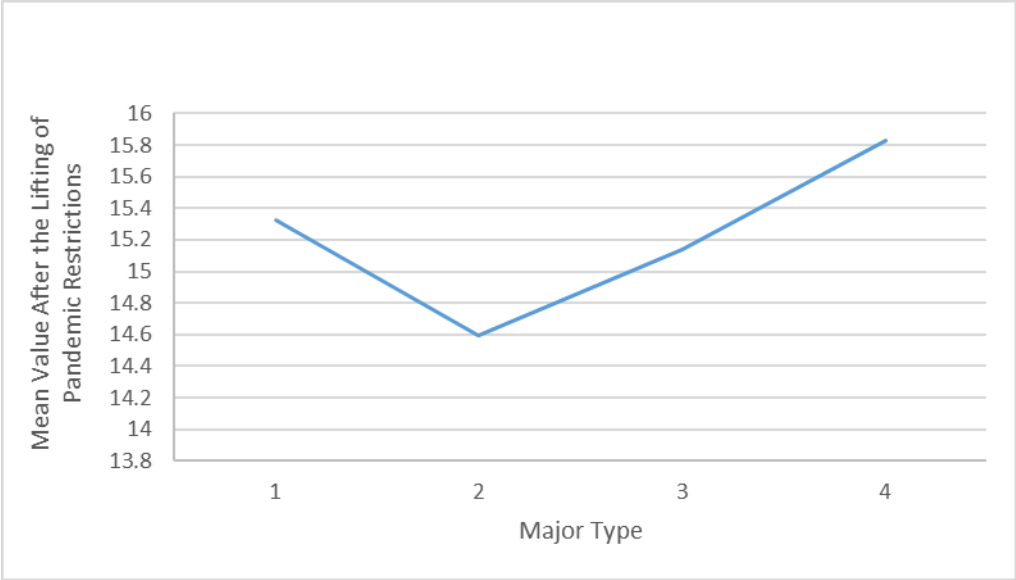

Figure 6. Mean value of practice for college students of different majors on self-medication with antibacterial agents after the lifting of pandemic restrictions

Note: 1 = Medical, 2 = Science and Engineering, 3 = Humanities, 4 = Social Science

3.2.4 Analysis of Differences in College Students' KAP Towards Antibacterial Agents' Self-Medication Before and After the Lifting of Pandemic Restrictions

Based on the results of paired t-test, it is evident that there are statistically significant differences (P<0.05) in the knowledge and practice of college students regarding antibacterial agents' self-medication before and after the lifting of COVID-19 restrictions, the knowledge and practice have significantly increased after the lifting of COVID-19 restrictions. However, there were no statistically significant differences in attitude towards antibacterial agents' self-medication (P>0.05). See Table 10 for detailed information.

Table 10. Paired samples t-test of college students' KAP towards self-medication with antibacterial agents before and after the lifting of COVID-19 restrictions

	Difference 95% Confidence Interval	t	Degrees of Freedom	P
Knowledge Before lifting - Knowledge After lifting	(-2.724, -2.339)	-25.864	415	0
Attitude Before lifting - Attitude After lifting	(-0.142, 0.618)	1.23	415	0.219
Practice Before lifting - Practice After lifting	(-2.794, -2.086)	-13.561	415	0

3.2.5 Multiple Linear Regression Analysis of Factors Influencing College Students' KAP Before and After the Lifting of Pandemic Restrictions

The Multiple linear regression analysis revealed that there were significant differences in KAP among college students of different genders and grades before the lifting of pandemic restrictions, and the difference was statistically significant (P<0.05). However, after the lifting of pandemic restrictions, there were no significant differences in KAP among students of different genders and grades, and the difference was not statistically significant (P>0.05). College students showed improvement in all three aspects of KAP towards antibacterial agents' self-medication, and this could be attributed to the impact of health education and campaigns during the pandemic.

Table 11. Multiple linear regression analysis of demographic characteristics

		Unstandardized Coefficient	Standardized Coefficient	t	Significance
Knowledge level before the lifting of pandemic restrictions	Gender	0.228	0.072	1.45	0.148
	Grade	0.19	0.171	3.499	0.001
	Major	-0.02	-0.013	-0.255	0.799
	Residence	0.357	0.111	2.263	0.024
	Family Medical Background	-0.011	-0.003	-0.065	0.948
Knowledge level after the lifting of pandemic restrictions	Gender	0.288	0.073	1.451	0.148
	Grade	0.084	0.061	1.229	0.22
	Major	-0.126	-0.066	-1.302	0.194
	Residence	0.348	0.086	1.742	0.082
	Family Medical Background	0.315	0.075	1.476	0.141
Attitude toward medication before the lifting of pandemic restrictions	Gender	0.796	0.115	2.281	0.023
	Grade	0.241	0.1	2.003	0.046
	Major	-0.143	-0.043	-0.844	0.399
	Residence	-0.341	-0.048	-0.973	0.331
	Family Medical Background	-0.258	-0.035	-0.688	0.492
Attitude toward medication After the lifting of pandemic restrictions	Gender	-0.043	-0.006	-0.122	0.903
	Grade	0.032	0.013	0.263	0.793
	Major	0.205	0.06	1.183	0.238
	Residence	0.005	0.001	0.013	0.99
	Family Medical Background	-0.205	-0.028	-0.537	0.591
Medication practice before the lifting of pandemic restrictions	Gender	0.77	0.13	2.651	0.008
	Grade	0.352	0.171	3.518	0
	Major	0.056	0.019	0.394	0.694
	Residence	-0.076	-0.013	-0.259	0.795
	Family Medical Background	0.604	0.096	1.939	0.053
Medication practice after the lifting of pandemic restrictions	Gender	0.419	0.066	1.316	0.189
	Grade	0.1	0.046	0.915	0.361
	Major	0.085	0.028	0.547	0.584
	Residence	0.416	0.065	1.302	0.194
	Family Medical Background	0.459	0.068	1.343	0.18

4. Discussion and Recommendations

4.1 Analysis of College Students' KAP Towards Antibacterial Agents' Self-Medication Before and After the Lifting of COVID-19 Restrictions

Before and after the lifting of COVID-19 restrictions, college students displayed a positive attitude towards antibacterial agents' self-medication, but their knowledge and practice were inadequate. Before the lifting of COVID-19 restrictions, female college students scored significantly higher than male college students in terms of KAP related to antibacterial agents' self-medication ($P<0.05$). However, after the lifting of COVID-19 restrictions, no significant differences were observed between male and female college students ($P>0.05$). Before the lifting of pandemic restrictions, female college students were more concerned about health issues, actively sought knowledge about antibacterial agents' self-medication, and were more inclined to seek professional help when falling ill, such as visiting a hospital. After the lifting of pandemic restrictions, male college students also exhibited increased interest in antibacterial agents' self-medication, with no significant differences compared to female college students.

College students from rural areas scored significantly higher in antibacterial agents' knowledge both before and after the lifting of COVID-19 restrictions compared to urban areas ($P<0.05$). However, no significant differences were found in attitude and practice between college students from rural and urban areas ($P>0.05$). College students from rural areas have a better understanding of antibacterial agents' self-medication-related knowledge compared to urban areas.

Before the lifting of pandemic restrictions, there were no significant differences in knowledge scores of antibacterial agents' self-medication between college students with family members having medical backgrounds and those without medical backgrounds ($P>0.05$). However, after the lifting of pandemic restrictions, college students without medical backgrounds in their families scored significantly higher in knowledge compared to those with medical backgrounds ($P<0.05$). Before the lifting of COVID-19 restrictions, the practice scores of college students without medical backgrounds in their families were significantly higher than those with medical backgrounds ($P<0.05$). After the lifting of COVID-19 restrictions, there were no significant differences in practice scores ($P>0.05$). After the lifting of COVID-19 restrictions, college students without medical backgrounds in their families are more active in learning the knowledge of antibacterial agents, while college students without medical backgrounds in their families are less motivated to learn the knowledge of antibacterial agents because they can rely on medical professionals at home, but both are more cautious in their practice.

Medical college students had significantly higher attitude scores than science and engineering college students before the lifting of pandemic restrictions ($P<0.05$). Social science college students scored significantly higher in practice both before and after the lifting of pandemic restrictions compared to science and engineering college students ($P<0.05$). Before the lifting of pandemic restrictions, medical college students showed greater awareness of the dangers of antibacterial agents' misuse and had more conservative attitude towards antibacterial agents' usage compared to college students in other majors. After the lifting of pandemic restrictions, all majors showed more conservative attitude. Medical college students, due to their exposure to a wealth of antibacterial agents' knowledge, might tend to self-medicate, and their practice may not be as cautious, social science college students were the most cautious in their practice, while science and engineering college students displayed the least cautious practice.

The differences in knowledge and practice regarding antibacterial agents' self-medication among college students before and after the lifting of COVID-19 restrictions were statistically significant ($P<0.05$), with higher scores observed after the lifting pandemic restrictions. However, no statistically significant differences were found in attitude towards antibacterial agents' self-medication before and after the lifting of COVID-19 restrictions ($P>0.05$). College students, as a group with a certain level of cultural literacy, have consistently maintained a high level of attitude towards antibacterial agents' self-medication. However, the lifting of COVID-19 restrictions made them more aware of the importance of learning about antibacterial agents' knowledge. During the pandemic, health education played a significant role, leading students to actively seek knowledge about antibacterial agents' self-medication and be more willing to seek help from medical professionals, resulting in more cautious use of medication.

4.2 Measures and Recommendations to Improve

College Students' KAP Towards Antibacterial Agents' Self-Medication

According to the survey, 78.85% of college students obtained antibacterial agents-related knowledge through online new media such as Sina Weibo, Xiaohongshu, and WeChat official accounts, over half of the college students acquired this knowledge through school education and traditional media. This provides avenues to enhance college students' KAP towards antibacterial agents' self-medication, and the following measures and recommendations are proposed:

(1) Supervise and manage new media, monitor the content shared on new media platforms to limit the dissemination of erroneous medical knowledge. After the lifting of COVID-19 restrictions, a large number of individuals have spontaneously summarized the output of medication content on the Internet. To take holistic, it is quite helpful for the public to get through the peak period of COVID-19 infection, but a small number of the contents have obvious medical errors, such as listing certain antibacterial agents as symptomatic drugs for the treatment of COVID-19. It is suggested that relevant authorities should regulate the dissemination of medical information on new media and provide alerts for posts with obvious medical inaccuracies.

(2) Strengthen health education in colleges and enhance students' awareness of medication. Among the college students surveyed, 40% mistakenly thought that ibuprofen and aspirin were antibacterial agents, and 30% mistakenly thought that oseltamivir was an antibacterial agent. College students were not familiar with common drugs, did not use them cautiously, and could not well realize that the abuse of antibacterial agents was harmful to the health of all mankind. It is suggested that colleges should set up related activities, carry out courses to guide college students to use antibacterial agents correctly and enhance their awareness of medication.

(3) Collaboration between traditional media and medical professionals, disseminate accurate and reliable information about medications. It is suggested that relevant authorities should carry out special actions, set up an encouragement mechanism, deepen the cooperation between traditional media and medical professionals, and strengthen publicity, so as to improve the KAP of college students using antibacterial agents for self-medication.

5. Conclusion

This study investigates the impact of the lifting of COVID-19 restrictions on college students' KAP towards self-medication with antibacterial agents, fully understands the college students' KAP concerning antibacterial agents' self-medication before and after the pandemic. The study analyzes various factors influencing college students' KAP towards antibacterial agents' self-medication and proposes comprehensive measures and recommendations to enhance their KAP regarding self-medication with antibacterial agents. The aim is to guide college students in developing a proper understanding of antibacterial agents, using them responsibly for self-medication, and significantly improving their awareness of safe medication practice. Through this investigation, the following conclusions have been drawn:

College students have relatively poor knowledge about self-medication with antibacterial agents, but they display positive attitude and relatively average practice. Many of them rely on past experiences rather than seeking professional guidance when self-medicating.

After the lifting of pandemic restrictions, college students show improved knowledge about self-medication with antibacterial agents, and their practices have become more cautious. However, the overall situation remains not ideal. To address this issue, society, educational institutions, and individuals must collectively take action, through the regulation and monitor new media platforms by relevant authorities, encouraging traditional media to enhance mediation education, and colleges to set up courses on proper medication use, etc., to comprehensively improve college students' KAP of self-medication with antibacterial agents.

The significant output of medication safety information on new media after the lifting of COVID-19 restrictions highlights the need for public health education. It also emphasizes the importance of regulating and restricting the dissemination of obvious medical misinformation on the internet.

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