Investigation and Analysis of Sanitation-Related Knowledge and Hygiene Routines Among China's WASH Plus Program Students

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Abstract

Objective: This study was performed to determine the knowledge level of students in China's WASH Plus Program about sanitation and hygiene practices to provide a scientific basis for well-targeted health education.

Methods: The researchers randomly selected one fourth-grade class from each of the 12 schools in each of the five WASH Plus Program provinces (municipalities or autonomous regions). The students in the selected fourth-grade classes were then asked to complete a self-designed questionnaire. Chi-square testing and Bonferroni correction were used for paired and multiple comparisons of the enumeration data, respectively.

Results: The 2330 respondents (mean age, 9.9 ± 0.3 years) included 1151 male students (49.40%), 1489 students of minority (non-Han) ethnicity (63.91%), and 433 boarding students (18.58%). Overall, 81.09% of the students were found to have gained sanitation-related knowledge, and 79.64% had formed hygiene routines. Specifically, only 41.76% of students knew that "diarrhea can be transmitted through contaminated water," and 68.88% of students were aware that "diarrhea can be prevented by not drinking untreated water." In addition, only 67.94%, 62.83%, and 62.62% of students "wash hands with running water and soap/hand sanitizer at school," "never drink untreated water at school," and "never drink untreated water at home," respectively. Regionally, 88.54%, 87.13%, 79.13%, 77.23%, and 72.81% of students in Chongqing, Yunnan, Guangxi, Guizhou, and Xinjiang, respectively, had strong knowledge of sanitation, and 92.11%, 80.70%, 74.04%, 79.43%, and 69.86% of them practiced hygiene. In terms of gender, 80.53% of male students and 81.64% of female students had acquired sanitation-related knowledge, whereas 77.45% of male students and of 81.78% female students had adopted hygiene practices. The total awareness rates of sanitation-related knowledge for Han students and minority students were 83.10% and 79.96%, respectively. Approximately 85.53% of Han students and 76.32% of minority students had formed good hygiene routines. Some 81.32% of boarding students and 81.04% of non-boarding students had strong knowledge of sanitation, and 78.65% and 79.87%, respectively, had formed good hygiene habits.

Conclusions: Some of the students surveyed had insufficient hygiene knowledge, and a small number had poor hygiene habits. To provide students with well-targeted health education, improve their hygiene awareness, and change their bad habits, full consideration should be given to factors such as region, gender, ethnicity, boarding status, and the influence of the process via which students acquire hygiene knowledge and form effective hygiene routines.

Background

Water, sanitation, and hygiene (WASH) are major public health issues. According to the World Health Organization, 829,000 people worldwide die of diarrhea each year due to unsafe drinking water, inadequate sanitation, and poor hand hygiene(1). Since the outbreak of the COVID-19 epidemic, the virus has been detected in sewage(2), food packaging(3), patient feces(4), and other environmental samples(5), which has drawn attention to the safety of drinking water and personal hygiene, especially hand hygiene(6). The lack of hygiene knowledge and poor hygiene habits may harm people's health and allow life-threatening diseases to recur(7–9). Thus, it is important to heighten the awareness of sanitation and form good hygiene routines(10, 11) to effectively reduce the incidence of diarrhea and other sanitation-related diseases(12). Studies have shown that proper hand washing can reduce the risk of fecal-oral transmission of disease and that washing hands with soap can lower the incidence of diarrhea among children by 35%(13). Drinking water that has been boiled or treated can also reduce the incidence of various infectious diseases(14–16). Personal hygiene practices, such as washing hands with soap or hand sanitizer, washing fruits and vegetables before eating them raw, never drinking untreated water, and always washing hands before meals and after using the toilet(17, 18), have been widely encouraged to prevent COVID-19 infection. Schools are densely populated places with a great risk of infectious diseases. It is reported that more than 70% of public health emergencies occur in schools and that more than 80% of school emergencies are triggered by infectious diseases(19). The outbreak of infectious diseases in schools may be attributed to factors such as the school's environment and the students' habits. Adequate knowledge about sanitation and good hygiene practices by students play important roles in protecting their health and preventing diseases(13). From 2016 to 2020, the Ministry of Education of the People's Republic of China and the United Nations International Children's Emergency Fund (UNICEF) carried out the "WASH Plus" Program (hereinafter referred to as "the Program") at 300 rural primary schools in five provinces (municipalities or autonomous regions) in China to comprehensively improve the school environment, continuously enhance students' hygiene and health awareness, and help them to develop good hygiene practices(20, 21). Based on the Program, this study randomly selected students from 60 schools between September and December 2018 to investigate students' awareness of sanitation and formation of hygiene routines to provide a scientific basis for well-targeted health education.

Respondents And Methods

1.1 Respondents

Stratified cluster sampling was used to randomly select 12 schools from each of the five provinces (municipalities or autonomous regions) in which the Program is implemented: Guangxi Zhuang Autonomous Region, Chongqing Municipality, Guizhou Province, Yunnan Province, and Xinjiang Uyghur Autonomous Region. Because fourth-grade students are able to understand and answer the questionnaire questions by themselves and have developed hygiene routines(22), the researchers randomly selected one fourth-grade class from each of the 60 schools for this study. If a selected class had fewer than 30 students, fifth-grade students were randomly selected to meet the quota requirement. Before the survey began, the students involved and their parents and teachers had all been informed of the investigation's purpose and had given their informed consent. The whole investigation process meets the ethical requirements.

1.2 Methods

The students were asked to complete a self-designed questionnaire by themselves, with the help of the researchers, who had received proper training. The questionnaire mainly included questions about the students' basic information, water-sanitation and disease-related knowledge, and hygiene practices. We surveyed 2330 primary school students for this study. All 2330 questionnaires distributed were returned, and all were valid. The awareness rate of a piece of

sanitation-related knowledge (%) was calculated as the number of respondents who correctly answered the question divided by the number of respondents who replied to the question multiplied by 100%, and the total awareness rate of sanitation-related knowledge (%) was calculated as the total number of respondents who correctly answered any relevant question(s) divided by the total number of respondents who replied to any relevant questions multiplied by 100%. The rate of formation of a hygiene routine (%) was calculated as the number of respondents whose answer indicated the formation of the hygiene routine divided by the number of respondents who replied to the corresponding question multiplied by 100%. The total hygiene routine formation rate was calculated as the total number of respondents whose answer indicated the formation of any good hygiene routine divided by the total number of respondents who replied to any relevant questions multiplied by 100%.

1.3 Quality Control

The researchers ensured the applicability and reliability of the questionnaire via expert consultation and pre-testing during the design of the questionnaire. As professionals who had received proper training, they explained to the primary school students how to complete the questionnaire and checked, one by one, the completeness of the answers to each question. Double data entry and real-time validation were used to ensure the accuracy of the data.

1.4 Statistical Analysis

The researchers used Excel for data entry and sorting and SPSS 24.0 for statistical analysis. Enumeration data were expressed as a percentage, and chi-square testing was used to compare the differences among the respondent groups (characterized by region, gender, ethnicity, boarding status, etc.) in their awareness of sanitation-related knowledge and formation of hygiene routines. A *P* value of less than 0.05 was considered to indicate that the differences were statistically significant. The method of Bonferroni correction(23) was used for multigroup comparisons, and a *P* value of less than 0.005 (0.05/10) was considered to indicate that the differences were statistically significant.

Results

2.1 Basic Information

The 2330 respondents comprised 461 students from Guangxi, 538 from Chongqing, 465 from Guizhou, 410 from Yunnan, and 456 from Xinjiang. Their mean age was 9.9 ± 0.3 years; 1151 students (49.40%) were male, 1489 were members of a minority group (63.91%), and 433 were boarding students (18.58%).

2.2 Sanitation-Related Knowledge

The awareness rates of three pieces of sanitation-related knowledge exceeded 90%. Some 96.18% of the respondents knew that open defecation may pollute water sources, damage environmental sanitation, and breed mosquitoes and flies; 94.29% knew the correct way to wash hands; and 93.18% knew that hand washing can prevent diarrhea, dysentery, hepatitis A, and parasitic diseases. The awareness rates of four pieces of sanitation-related knowledge fell between 80% and 90%. Some 89.31% of the respondents knew that dirty hands can transmit disease; 84.72% knew that feces can transmit diseases like roundworm disease; 80.99% knew that drinking untreated water is harmful to health; and 80.52% knew that diarrhea can be prevented by washing hands before meals and after using the toilet. Only 41.76% of the respondents knew that diarrhea can be transmitted by contaminated water, and 68.88% knew that diarrhea can be prevented by refraining from drinking untreated water (Table 1).

The differences in the awareness rates of sanitation-related knowledge were statistically significant among students from various regions. The difference between the male and female students was statistically significant with regard to the rates of (1) awareness that dirty hands can transmit diseases and (2) awareness of the correct way to wash hands. The differences among students of various ethnic groups were statistically significant with regard to the rates of (1) awareness that drinking untreated water is harmful to health, (2) awareness that diarrhea can be transmitted by contaminated water, (3) awareness of the correct way to wash hands, and (4) awareness that diarrhea can be prevented by washing hands before meals and after using the toilet. The differences between boarding students and non-boarding students were statistically significant ($P < 0.05$) with regard to the rates of (1) awareness that diarrhea can be transmitted through contaminated water, (2) awareness of the correct way to wash hands, (3) awareness that feces can transmit diseases like the roundworm disease, (4) awareness that diarrhea can be prevented by refraining from drinking untreated water, (5) awareness that diarrhea can be prevented by washing hands before meals and after using the toilet, and (6) awareness that open defecation may pollute the environment (Table 1).

The total awareness rate of sanitation-related knowledge was 81.09% (17,005 of 20,970). The differences in the total awareness rate among students of both genders and from various regions and ethnic groups were statistically significant ($P < 0.05$). The total awareness rates of students from Chongqing, Yunnan, Guangxi, Guizhou, and Xinjiang were (in descending order) 88.54% (4287 of 4842), 87.13% (3215 of 3690), 79.13% (3283 of 4149), 77.23% (3232 of 4185), and 72.81% (2988 of 4104), respectively. Through paired comparisons, the differences in the total awareness rates of students from Chongqing and Yunnan, Guangxi, and Guizhou were not statistically significant ($P > 0.005$), whereas the differences between any other two regions were statistically significant ($P < 0.005$). The female students showed a higher total awareness rate (81.64%; 8663 of 10,611) than their male counterparts. Han students had a higher total awareness rate (83.10%; 6290 of 7569) than minority students. No statistically significant difference in the total awareness rate was found between boarding students and non-boarding students (Table 3).

2.3 Sanitation-Related Hygiene Practices

The rate of formation of only one hygiene routine exceeded 90%. Approximately 94.85% of students brought drinking water from home or drank water provided by the school. The rates of formation of five hygiene routines fell between 80% and 90%. Approximately 89.18% of students washed hands after using the toilet at home, 89.06% washed fruits every time before eating them raw, 88.71% washed their hands after using the toilet at school, 86.70% washed their hands with running water and soap or hand sanitizer at home, and 84.64% washed their hands before meals. The rates of formation of three hygiene

routines fell between 60% and 80%. Approximately 76.65% of students washed their hands with soap or hand sanitizer at school, 62.83% never drank untreated water at school, and 62.02% never drank untreated water at home (Table 2).

Statistically significant differences were found in hygiene routine formation rates among students from various regions. Statistically significant differences were also found between male and female students in the rates of formation of hygiene routines such as (1) washing fruits and vegetables every time before eating them raw, (2) washing their hands every time before meals, and (3) washing their hands every time after using the toilet at school and home. Statistically significant differences were seen among students of Han vs. minority ethnicity in the rates of formation of hygiene routines such as (1) never drinking untreated water at school or home, (2) washing vegetables and fruits every time before eating them raw, and (3) washing their hands with running water and soap or hand sanitizer at school and at home. Statistically significant ($P < 0.05$) differences were also seen between boarding students and non-boarding students in the rate of formation of hygiene routines such as (1) never drinking untreated water at school, (2) washing their hands every time after using the toilet at school, and (3) washing their hands with running water and soap or hand sanitizer at school (Table 2).

The total rate of hygiene routine formation was 79.64% (16,701/20,970). The differences in the total hygiene routine formation rate among students from various regions and ethnic groups and of different genders were statistically significant ($P < 0.05$). The total hygiene routine formation rates of students from Chongqing, Yunnan, Guizhou, Guangxi, and Xinjiang were (in descending order) 92.11% (4460/4842), 80.70% (2978 of 3690), 79.43% (3324 of 4185), 74.04% (3072 of 4149), and 69.86% (2867 of 4104), respectively. Through paired comparisons, the difference in the total hygiene routine formation rate of students between Yunnan and Guizhou was not statistically significant ($P > 0.005$), whereas the differences between any other two regions were statistically significant ($P < 0.005$). Female students had a higher total hygiene routine formation rate (81.78%; 8678 of 10,611) than their male counterparts, and Han students presented a higher rate (85.53%; 6474 of 7569) than minority students. No statistically significant difference in the total hygiene routine formation rate was found between boarding students and non-boarding students (Table 3).

Discussion

The WASH target for schools—to increase the proportion of schools with hand-washing facilities and soap and water—was included in the United Nations 2030 Agenda for Sustainable Development.(24) The WASH Plus Program promotes the sound development of education in target regions by improving water supply and sanitation facilities and by providing WASH training at schools in these regions. Since the outbreak of the COVID-19 epidemic, countries around the world have paid increasing attention to and realized the importance of hygiene and health education at schools(25). Hygiene practices such as never drinking untreated water and washing one's hands with soap before meals and after using the toilet play an important role in preventing COVID-19 and other infectious diseases(17).

The results of this study show that the students' total awareness rate of sanitation-related knowledge was 81.09%, which exceeds their total hygiene routine formation rate (79.64%). This finding conforms with the knowledge-attitude-practice health behavior change model(26). The inclusion of the WASH Plus Program in schools could help train a large number of teachers to provide WASH education and hold regular health education activities to improve students' hygiene awareness and change their bad hygienic practices. Today's students are society's future. Fostering students' health education can improve the health awareness and self-care capabilities of not only the students, but their families and society as a whole.

The results of this study show that region, gender, ethnic group, and boarding status have a certain impact on students' hygiene knowledge and practices. As for region, Chongqing had the highest total awareness rate of sanitation-related knowledge and the highest total hygiene routine formation rate, whereas Xinjiang ranked lowest in both. In general, students of Chongqing Municipality and Yunnan Province had high scores in the awareness rate of sanitation-related knowledge and hygiene routine formation rate. Schools in Chongqing were found to have proper water and sanitation facilities, and this improvement is the most effective way to protect students' health. Although the schools in Yunnan lagged behind those in Chongqing on water supply facilities and toilets, they were fully equipped with drinking water facilities and hand-washing facilities (including soap). They also provided students with necessary health education and allowed the students to play the leading role in such education. With its focus on the water supply, toilet improvement, and health education, the Program has effectively helped students improve their hygiene awareness and adopt good hygienic practices.

Like previous studies, this study found that female students scored higher than male students in the total awareness rate of sanitation-related knowledge and in the total formation rate of hygiene routines(27). In particular, female students performed significantly better in hand-washing than their male counterparts, and this phenomenon will likely continue. Women and men differ in their acceptance of information on hand-washing promotion, and women are more likely to seek knowledge-based information(28). The frequency of hand-washing and the use of hand-hygiene products by women are greater than those by men, and women wash their hands longer than men do(29). A study from Michigan State University published in the *Journal of Environmental Health* found that 15% of men and 7% of women do not wash their hands at all, and that among those who do wash their hands, only 50% of men, compared with 78% of women(30), use hand sanitizer. The gap between men and women in hand-washing is a social issue, as women engage more in personal care, family care, and child care(31) than men.

This study found that the total awareness rate of sanitation-related knowledge and the total hygiene routine formation rate were higher in Han students than in minority students (mostly Dong people in Guangxi, Chuanqing people in Guizhou, Bai people in Yunnan, and Uyghurs in Xinjiang). Duan et al.(32) showed that minority students did a poorer job than Han students in acquiring sanitation-related knowledge and developing good hygiene habits. Yang et al.(33) found that minority students' poor performance in sanitation-related knowledge and hygiene practices was a result of their remote geographical locations (often far from schools), poverty, and inadequate school sanitation infrastructure.

This study also found no statistically significant differences between boarding students and non-boarding students in the total awareness rate of sanitation-related knowledge or in the total hygiene routine formation rate. Specifically, boarding students outperformed non-boarding students in some respects but

performed more poorly in others. For example, boarding students were more likely to drink untreated water than non-boarding students, and they had a lower awareness rate of sanitation-related knowledge such as “never drinking untreated water” and “diarrhea can be prevented by washing hands before meals and after using the toilet.” Because boarding students live in schools for long periods, it is important to provide them with basic amenities, especially safe drinking water, safe and convenient toilets, and bathing and washing facilities.

The survey results indicate that some students lacked adequate and sound sanitation-related knowledge, especially that related to water-borne diseases. Some students had bad habits, such as drinking untreated water, not washing their hands before meals and after using the toilet, and eating fruits raw without washing them first. The survey showed that it is common for students to drink untreated water. If the water quality fails to meet the standards for safe drinking water, their health will be in great danger. Moreover, the proportion of students who drank untreated water at school was approximately the same as that of those who drank untreated water at home, which indicates that the students lacked awareness of drinking water safety and that much needs to be done in health education. The rate of formation of a hand-washing routine with soap or hand sanitizer at school was lower than that at home, which suggests that schools should provide soap or hand sanitizer at hand-washing facilities.

Insufficient sanitation-related knowledge and bad hygienic practices are harmful to health and cause the recurrence of life-threatening diseases. To effectively avoid this, people must improve their health awareness and form good hygiene routines. Good hygienic practices, such as washing hands with soap or hand sanitizer, washing fruits and vegetables before eating them raw, never drinking untreated water, and washing hands before meals and after using the toilet, are important for limiting the spread of COVID-19(17). To sum up, factors such as region, gender, ethnicity, and boarding status, as well as the influence of the process via which students acquire sanitation-related knowledge and form hygiene habits, must be fully considered in a bid to provide students with more comprehensive and well-targeted health education programs to improve their hygiene awareness and change their bad practices.

Declarations

Ethics approval and consent to participate

Before the survey, both parents' informed consent and students' consent were obtained. The whole survey process met the ethical requirements. The relevant research and investigation meet the ethical requirements and have passed the unit ethical certification

Consent for publication

Not applicable

Availability of data and material

Please contact author for data requests.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

CYE wrote plans, conducted on-site investigation, collected and inputted data, made statistics and drafted the manuscript. FYZ made statistics, revised manuscripts. CGL collected and inputted data. YW is responsible for the whole project, revised the plans, on-site investigation, revised the manuscript

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Tables

Table 1
Comparison of the Awareness Rates of Sanitation-Related Knowledge among Student Groups [n (%)]

Item	Number of students	Drinking untreated water is harmful to health.	Diarrhea can be transmitted through contaminated water.	Dirty hands can transmit diseases.	Know the right way to wash hands.	Hand-washing can prevent diseases like diarrhea, dysentery, hepatitis A, and roundworm disease.	Feces can transmit diseases like roundworm disease, hookworm disease, diarrhea, and dysentery.	Diarrhea can be prevented by not drinking untreated water or washing raw fruits before eating them.	Diarrhea can be prevented by washing hands before meals and after using the toilet.	Open defecation may pollute water sources, damage the environmental sanitation, and breed mosquitoes and flies.
Guangxi	461	80.48	38.18	84.60	89.59	92.41	77.44	72.02	82.86	94.58
Chongqing	538	91.82	52.23	97.03	99.26	97.58	93.87	76.95	89.22	98.88
Guizhou	465	78.71	35.48	82.80	90.11	89.46	78.49	65.38	80.00	94.62
Yunnan	410	90.00	57.32	95.61	96.59	98.05	91.95	71.95	83.41	99.27
Xinjiang	456	62.94	25.44	85.96	95.39	88.16	81.14	57.02	65.79	93.42
χ^2 value		160.756***	257.449***	90.049***	63.753***	60.321***	88.639***	52.875***	92.906***	37.095***
P value		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Male	1151	80.80	41.27	87.49	93.31	93.66	84.88	68.46	79.32	95.57
Female	1179	81.17	42.24	91.09	95.25	92.71	84.56	69.30	81.68	96.78
χ^2 value		0.052	1.432	8.036*	4.073*	0.830	0.046	0.189	2.063	2.313
P value		0.819	0.698	0.018	0.044	0.362	0.830	0.664	0.151	0.128
Han people	841	84.66	45.78	90.73	95.96	93.82	86.21	71.11	83.00	96.67
Ethnic minority	1489	78.91	39.49	88.52	93.35	92.81	83.88	67.63	79.10	95.90
χ^2 value		11.536***	23.728***	2.820	6.781**	0.850	2.245	3.031	5.165*	0.861
P value		0.001	0.000	0.244	0.009	0.356	0.134	0.082	0.023	0.353
Boarding	433	78.98	47.11	90.07	96.30	92.84	88.91	63.97	75.06	98.61
Non-boarding	1897	81.44	40.54	89.14	93.83	93.25	83.76	70.01	81.76	95.62
χ^2 value		1.386	8.860*	0.720	4.004*	0.094	7.225**	5.986*	10.096***	8.577**
P value		0.239	0.031	0.698	0.045	0.759	0.007	0.014	0.001	0.003
Total	2330	80.99	41.76	89.31	94.29	93.18	84.72	68.88	80.52	96.18
***, **, and * indicate $P < 0.001$, $P < 0.01$, and $P < 0.05$ respectively.										

Table 2
Comparison of the Hygiene Routine Formation Rates among Student Groups [n (%)]

Item	Number of students	Drink water brought from home or boiled water/purified water/bottled water provided at school.	Never drink untreated water at school.	Never drink untreated water at home.	Wash vegetables and fruits every time before eating them raw.	Wash hands every time before meals.	Wash hands every time after using the toilet at school.	Wash hands every time after using the toilet at home.	Wash hands with running water and soap or hand sanitizer at school.	Wash hands with running water and soap or hand sanitizer at home.
Guangxi	461	90.24	57.92	71.37	84.82	72.23	81.56	82.00	56.18	70.07
Chongqing	538	98.33	87.55	86.43	94.24	92.75	93.87	95.35	89.59	90.89
Guizhou	465	94.19	71.18	65.38	90.11	83.44	86.02	88.39	58.49	77.63
Yunnan	410	97.32	56.59	48.05	89.51	82.93	90.98	87.32	88.05	85.61
Xinjiang	456	93.86	35.75	35.96	85.75	90.35	90.57	91.67	45.83	58.99
χ^2 value		39.818***	314.680***	346.297***	47.587***	105.708***	63.003***	52.091***	400.187***	214.593***
P value		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Male	1151	93.40	61.08	62.38	85.06	81.32	85.32	86.53	76.19	85.84
Female	1179	96.27	64.55	62.85	92.96	87.87	92.03	91.77	77.10	87.53
χ^2 value		9.827**	6.750*	2.084	39.933***	21.599***	26.266***	19.546***	4.629	2.413
P value		0.002	0.034	0.353	0.000	0.000	0.000	0.000	0.201	0.491
Han people	841	96.79	79.43	77.76	90.96	86.21	89.06	90.73	74.67	84.19
Ethnic minority	1489	93.75	53.46	54.06	87.98	83.75	88.52	88.31	64.14	72.87
χ^2 value		10.136***	160.544***	129.232***	13.528**	5.044	0.199	3.393	34.133***	43.179***
P value		0.001	0.000	0.000	0.004	0.080	0.905	0.183	0.000	0.000
Boarding	433	96.07	54.97	61.66	87.53	84.53	91.69	88.45	70.44	72.52
Non-boarding	1897	94.57	64.63	62.84	89.40	84.66	88.03	89.35	67.37	77.97
χ^2 value		1.631	15.372***	0.525	4.226	0.729	7.096*	1.686	13.396**	9.196**
P value		0.202	0.000	0.769	0.238	0.695	0.029	0.430	0.004	0.027
Total	2330	94.85	62.83	62.62	89.06	84.64	88.71	89.18	67.94	76.95
***, **, and * indicate significance level of $P < 0.001$, $P < 0.01$, and $P < 0.05$ respectively.										

Table 3

Comparison of the Total Awareness Rates of Sanitation-Related Knowledge and the Total Hygiene Routine Formation Rates among Student Groups [n (%)]

Item	Number of responses (Number of students × 9)	Total awareness rate of sanitation-related knowledge	Total hygiene routine formation rate
Guangxi	4149	3283 (79.13) ^a	3072 (74.04) ^d
Chongqing	4842	4287 (88.54) ^b	4460 (92.11) ^e
Guizhou	4185	3232 (77.23) ^a	3324 (79.43) ^f
Yunnan	3690	3215 (87.13) ^b	2978 (80.70) ^f
Xinjiang	4104	2988 (72.81) ^c	2867 (69.86) ^g
χ^2 value		497.652	789.513
P value		0.000	0.000
Male	10,359	8342 (80.53)	8023 (77.45)
Female	10,611	8663 (81.64)	8678 (81.78)
χ^2 value		4.232	60.713
P value		0.040	0.000
Han nationality	7569	6290 (83.10)	6474 (85.53)
Ethnic minority	13,401	10,715 (79.96)	10,227 (76.32)
χ^2 value		31.211	253.495
P value		0.000	0.000
Boarding	3897	3169 (81.32)	3065 (78.65)
Non-boarding	17,073	13,836 (81.04)	13,636 (79.87)
χ^2 value		0.161	2.906
P value		0.688	0.088
Total	20,970	17,005 (81.09)	16,701 (79.64)
Note: Based on the comparison of the total awareness rates and the total hygiene routine formation rates of each pair of regions using the Bonferroni correction method, the <i>P</i> values with different superscript letters are significantly different ($P < 0.005$), whereas the <i>P</i> values with the same superscript are not significantly different ($P > 0.005$). Comparing the total awareness rates between Guangxi and Guizhou, it can be concluded that $\chi^2 = 4.405$, $P = 0.036$; comparing those between Chongqing and Yunnan, $\chi^2 = 3.925$, $P = 0.048$; comparing the total hygiene routine formation rates between Guizhou and Yunnan, $\chi^2 = 2.004$, $P = 0.157$.			