Research Report

Knowledge, Attitudes and Practices of Sanitation and Hygiene among Primary School Students in Rural Area of Northeast China

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Abstract

Disease burden due to unsafe water, lack of sanitation, and poor hygiene behavior requires attention. In developing countries, poor school hygiene behavior remains high-risk and causes infectious disease among students. Safe hygiene behavior such as hand washing with soap can protect children from infectious disease. However, a cross-sectional study found the correct rate of hand washing of Chinese people was only 4%. Our research evaluated the knowledge, attitudes, and practices (KAP) of sanitation and hygiene among school children in the rural area of Northeast China. Participants were 333 groups of students and their parents. A questionnaire was used in the participants who reported the score of KAP level of sanitation and hygiene. Hand washing skill was checked following a checklist. Observation of sanitation facilities at school was also conducted. The questionnaires included participant characteristic, household socioeconomic status, and KAP questionnaire. The results of the questionnaires survey showed more than 80% of students had adequate knowledge of proper hygiene. Although students have sufficient knowledge about hygiene, lack of facilities may negatively affect their practice. There was no soap available in 2 schools, 53% of students reported it affects their hand washing performance at school. The results indicated the impact of gender, facilities and knowledge level on behavior. Our findings underscore the need for more hygiene education and the improvement of sanitation and hygiene facilities in the area.

Keywords: sanitation, hygiene, KAP, child health, hand washing

Introduction

Disease burden due to inadequate and unsafe water, lack of sanitation and poor hygiene behavior is a significant issue (Nath 2009). According to the recent estimates, these 3 factors could prevent 58% of diarrheal deaths among children under 5 years of age worldwide per year (WHO et al. 2015). In developing countries, poor school hygiene behavior remains high-risk and causes infectious disease among primary school students (Assefa and Kumie 2014). Intervention studies have suggested that maintaining good hygiene behavior is vital for preventing the diffusion of infectious diseases and reducing the risk of child diarrhea and malnutrition (Aiello and Larson 2002). For example, simple hand washing with soap helps to protect children from diarrhea and lowers respiratory infection (Aiello et al. 2008).

Poor hygiene knowledge and attitudes caused the Chinese citizens' ineffective use of the sanitation facility. Hygiene environment was enhanced in the rural area of China. The coverage of sanitary toilets in the rural area has increased from 7.5% in 1993 to 78.5% in 2015 (NHFPC 2016). However, the proper hand washing rate of Chinese people was only 4% (Tao et al. 2013). According to the Chinese Center for Disease Control and Prevention, in Liaoning Province, 239 cases of infectious disease occurred from 2004 to 2013 were prevalent mostly in primary

school (Xu et al. 2016).

Knowledge and attitudes are some of the measures which are thought to be on the causal pathway to behavior. Inadequate knowledge, attitudes, and practices had negative consequences for a child's hygiene behavior (Scott et al. 2007). Thus, to ensure safe hygiene behavior to be implemented, the proper knowledge and attitudes of hygiene must be taken into account. However, very few studies have assessed the knowledge, attitudes and practices among students towards hygiene behavior in China.

This study examined the current situation of general sanitation and hygiene of children. We identified the knowledge, attitudes and practices (KAP) level of hygiene behavior of primary school students in the rural area of Benxi, Liaoning Province, Northeast China. This study also investigated students' demographics, nutritional status, household socioeconomic status and the status of sanitation environment at school.

1. Subjects and Methods

1.1. Research area and subjects

This study was carried out from September to October 2018, in the rural area of Benxi, Liaoning Province, Northeast China. Data was collected in 2 primary schools. There were 365 students in the 2 schools (211 boys, 154 girls). Children who were over 13 years old and absent during the investigation period were excluded. Children who disapprove this research by their parents were also excluded. The population included 333 healthy primary school students (grades 1–6, 6–13 years old) and their parents (25–57 years old, 331 mothers and 332 fathers). After explaining the purpose of the survey, all students went through the anthropometric measurements, hand washing test, and completed the questionnaires. The purpose of this study was explained to their parents with the parental consent letter. Questionnaires of students and parents were administered.

The data from the 2 schools as mentioned above were combined when summarizing the result and discussion. Considering the service level of water, sanitation and hygiene in each school are clarified at the same level, the same questionnaire and hand washing test were conducted in both schools.

1.2. Observation

Observations were conducted in 2 primary schools. The service level of water, sanitation, and hygiene (WASH) of each school was specified, following the original JMP service ladders for WASH in schools (WHO and UNICEF 2017).

1.3. Anthropometric measurements

The measurement of each item was conducted by the principal author to avoid inter-observer biases. Height was measured to the nearest 0.1cm using a stadiometer (Seca 213; Seca, Germany) and body weight to the nearest 0.1 kg using a digital weight scale (BC-754-WH; Tanita, Japan). Body mass index (BMI; in kg/m²) was calculated based on the height and weight measurements. Height-for-age Z-score (HAZ) and body mass index-for-age Z-score (BMIAZ) were calculated based on the WHO AnthroPlus (version 1.0.4) (WHO 2009a). According to recommendations by WHO, children with HAZ < -2 were categorized as stunted, BMIAZ < -2 as thin and BMIAZ > 2 as obese.

1.4. Questionnaire survey

All the questionnaires were made for 2 specific participant groups.

Questionnaire for parents included birth date, educational background, occupation, monthly household income, and the number of family members.

Questionnaire for children included demographics (birth date, gender, grade, the diarrhea symptom during the past 2 weeks) and KAP questionnaire of sanitation and hygiene. Self-reported questionnaires in Chinese were suitable for local contexts. The questionnaire was developed for this study based on various previous studies. Questions were in the quest for following information: drinking water, hand washing habits, waste disposal, and waterborne disease. The scores were calculated based on the correct answers for each question. Question 14, 15 and 16 were excluded. Question 1, 3, 8, 9, 10, 11, and 12 were multiple-choice questions. Higher scores indicate better knowledge, attitudes, and practices level of hygiene behavior.

1.5. Hand washing skill test

Hand washing facilities in both schools were in the school toilet (Figure 1). To provide student's privacy, the hand washing skill test was held in a laboratory and a detached room with water taps (Figure 2).

Researchers provided bar soap and tissues for the hand washing test. Children's hand washing skill was examined following a hand washing skill checklist. The checklist for measuring the hand washing skill was modified based on the WHO hand hygiene technique with soap.

The checklist comprises 11 steps, 1) wet hands with water; 2) apply enough soap to cover all hand surfaces; 3) rub hands palm to palm; 4) right palm over left dorsum with interlaced fingers and vice versa; 5) palm to palm with fingers interlaced; 6) backs of fingers to opposing palms with fingers interlocked; 7) rotational rubbing of left thumb clasped in right palm and vice versa; 8) rotational rubbing, backward and forwards with clasped fingers of right hand in left palm and vice versa; 9) rinse hands with water; 10) dry hands thoroughly with a single-use towel; 11) length duration of hand washing. Considering that 40–60 seconds as the duration of the entire hand washing procedure recommends by WHO (2009b). The period more than 40 seconds is defined as eligible. One point for every step, thus the total score is 11. To reduce mistakes and record more details except the checklist, the whole hand washing steps was recorded by a camera and scored based on the recorded video.

Figure 1. Sanitation facilities of each school. (a) (b) School A toilet, (c) (d) School B toilet.
(Taken by the author)

Figure 2. The place of hand wash skill test. (a) School A, (b) School B.
(Taken by the author)

1.6. Statistical analyses

Wilcoxon tests were performed to examine differences in the KAP level among gender and grades. The chi-squared test was performed to examine differences in hand washing skill test between boys and girls. Stepwise variable selection using the increase-and-decrease method was used with a threshold p-value of 0.20, and calculated using a likelihood ratio test. Stepwise regression was performed to examine the factors associated with students' KAP scores. A p-value of < 0.05 was considered statistically significant. JMP 14.1.0 software (SAS Institute Japan, Tokyo, Japan) was used for all statistical analyses.

2. Results and Discussion

2.1. General status of WASH in research area

Drinking water source and sanitation facilities at 2 schools are safely managed. For the drinking water, there was a hot water supply room at every floor of the teaching building at school A, where students could get boiled water. In school B, students could get water from the drinking water machine with water in tanks at every classroom. Both schools' drinking water was from an improved source, and free from fecal contamination and chemical contamination.

The toilet type was a flush toilet in school A and school B (Figure 1). School A had independent flush toilet. However, school B had only timed water flushing system with tanks. Students cannot flush the toilet immediately after defecation. Toilet at school B did not have doors and provide the privacy.

There were limited numbers of hand washing facilities in both schools. There were 3 sinks with tap water shared by both boys and girls at school A (Figure 3). Toilets for both boys and girls had 1 sink with tap water at school B (Figure 3). Neither school had bar soap or liquid soap. No towels, tissues, nor air driers were provided at school. Only cold water is available all year round.

2.2. Characteristics of study participants

Children's characteristics are shown in Table 1. The overwhelming majority of students had correct cognition of hygiene behavior (Figure 4). Despite the fact that there was no significant difference in KAP score by gender. Results of hand washing test showed a significant difference by gender ($p < 0.05$). Boys performed worse than girls in hand washing test. The boys' average score of the hand washing test met only half of the total score.

Table 2 shows the results of child nutritional status. The HAZ of all students ranged from -3.25 to 3.66, and BMIZA ranged from -2.61 to 5.10. The prevalence of stunting, thinness and obesity was 1.5%, 2.7% and 18.9%, respectively. The average BMIAZ was between 0 and 1. It showed that the nutritional status of primary students was generally good. However, the percentage of stunting, thinness, obesity had gender differences, especially obesity in boys may need attention (Figure 2). The obesity prevalence is higher than the nationwide average level. Previous studies reported that the obesity prevalence in China was 14.8% in 2010 (Wang 2009). The averaged BMIAZ of boys was close to 1. Boys also had a higher prevalence of obesity than girls.

The characteristics of parents are shown in Table 3. Almost all the parents participated in the research. There were 20% more fathers engaging in agriculture than mothers (Table 3). Approximately 15% of the mothers had finished senior high school. Compare to the previous study in 85 districts of 10 provinces in China, less mothers finished senior high school in this study (Ji et al. 2018).

Figure 3. Hygiene facilities of each school. (Taken by the author)
(a) School A hand washing facility were out of the toilet, 3 sinks were between men's and women's toilet.
(b) School B hand washing facility were in the toilet and one sink for each toilet.

Table 1. Characteristics of primary school students (n = 333).

Characteristics	n	%
Gender		
Boy	194	58.3
Girl	139	41.7
Diarrhea symptoms[†]		
Reported	53	15.9
Not reported	280	84.1
Age		
6	18	5.4
7	37	11.1
8	54	16.2
9	51	15.3
10	64	19.2
11	62	18.6
12	45	13.5
13	2	0.6
		(mean ± SD)
KAP[‡] questionnaire total score (range) (7–26)		16.61 ± 4.05
Boy		16.44 ± 4.24
Girl		16.83 ± 3.78
Hand wash skill test total score[#] (range) (1–11)		6.38 ± 1.85
Boy		5.93 ± 1.67
Girl		7.03 ± 1.91

[†]Two-week period prevalence.
[‡]Knowledge, Attitudes and Practices (KAP).
[#]Wilcoxon test, $p < 0.001$.

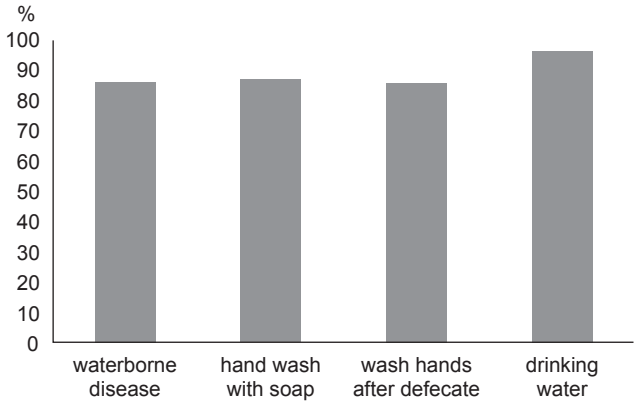

Figure 4. The correct responding rate of knowledge on hygiene (n = 333).

Table 2. Child nutritional status by gender (n = 333).

	Boy	Girl
BMIAZ† (mean ± SD)	0.76 ± 1.57	0.17 ± 1.27
HAZ‡ (mean ± SD)	0.43 ± 1.06	0.27 ± 1.18
Stunting (%)	1.03	2.16
Thinness (%)	3.09	2.16
Obesity (%)	25.26	10.07

†Body mass index-for-age Z-scores (BMIAZ).
‡Height-for-age Z-scores (HAZ).

Table 3. Characteristics of household and parents (n = 333).

Characteristics	n†	%
Mother Education background	331	
Completed primary education	74	22.4
Completed middle education	210	63.4
Completed senior education	47	14.2
Mother Occupation		
Agriculture	241	72.9
Non-agriculture‡	90	27.1
Father Education background	332	
Completed primary education	62	18.7
Completed middle education	217	65.4
Completed senior education	53	15.9
Father Occupation		
Agriculture	175	52.6
Non-agriculture‡	158	47.4
Family monthly income (CNY)		
≤ 1500	59	17.7
1501–3500	147	44.2
> 3500	127	38.1

†Missing data excluded.
‡Government officials, employee and self-employed.

2.3. Knowledge, attitudes and practices level of hygiene behavior among students

Water borne disease, waste disposal and drinking water

The results indicated that knowledge about the waterborne disease was uneven in the research area. More than half of the students knew that diarrhea is a waterborne disease, only less than 15% of the students had knowledge about fever (Figure 5). The results was in line with a study in Vietnam, the waterborne diseases that was recount by children were: diarrhea (62%), parasitic diseases (18.6%), skin diseases (17.6%), eye diseases (11%) and gynecological and obstetrical diseases (3.8%) (Sibiya and Gumbo 2013).

Regardless of the fact that the students did not have comprehensive knowledge of waterborne disease, they did better in practices. Most students knew how to prevent water diseases (Figure 4). The students mentioned must be boiled before drinking to avoid waterborne diseases. When asked what respondents could do to prevent diarrhea, “drinking safe water” was the most popular response, and “eating safe food” was the second most prevalent. 88% of students reported that they drink boiled water at school (data not shown).

The study revealed that most of the students obtained information about hygiene from school, television, and internet (Figure 6). This result is due to that students may spend most of their time at school. When they

reach home, they may spend most of their time watching television. The results in line with the study of the urban area in South Africa, school and television are proven to be the most popular sources of information. There were disparities between China and South Africa, with rural schools in South Africa obtaining most of their information from newspapers (Sibiya and Gumbo 2013). The penetration rates of internet and mobile phone in both countries had obvious difference between China and South Africa. According to the report from China Internet Network Information Center (CINIC), the internet penetration rate was high in China. The number of mobile internet users in China reached 871 million, and the proportion of internet users accessing the internet through mobile phones was 98.6% (CINIC 2019). Based on Stats SA's estimate, South Africa reached 40% internet penetration mark in 2017 (WWW 2017). The difference in sources information between the rural area of China and South Africa may relate to the economic development of both countries. South Africa's economy has entered recession and the downturn was driven by contractions in agriculture and manufacturing industries (Anonymous 2018). However, China's GDP increased by 6.6% year-on-year in 2018 to about 90.03 trillion yuan (NBS 2018).

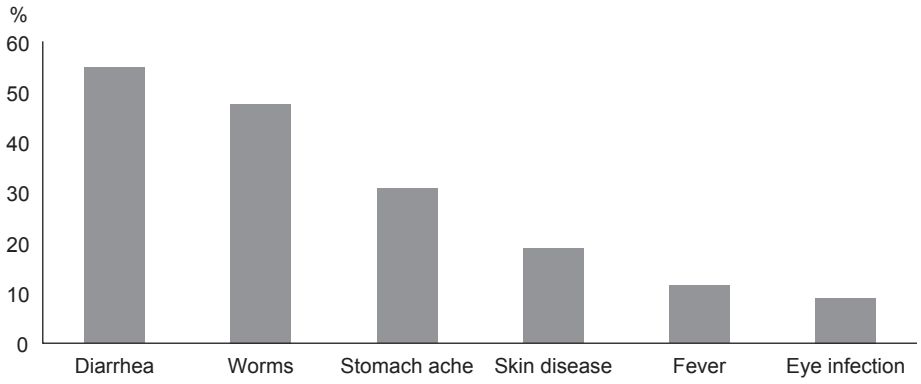

Figure 5. The correct responding rate of each waterborne disease (n = 333).

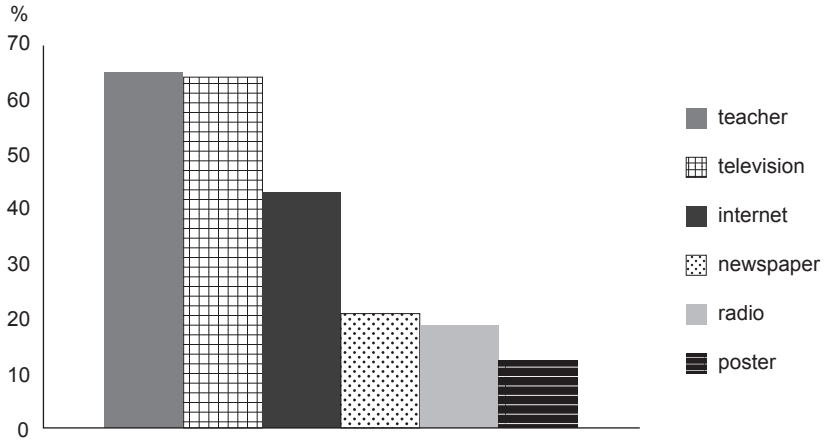

Figure 6. The different sources of information on sanitation and hygiene (n = 333).

Hand washing habits

Hand washing test in the study also revealed that wash hands with soap is a common behavior of students in the research area if the soap was available. Step 2 of hand washing test examined using enough soap to cover all hand surfaces. The rate of completing the hand washing step 2 was more than 90% (Figure 8). However, neither 2 schools provided bar soap or liquid soap in toilet. Limited hygiene facility is a common situation in the rural areas of developing countries. Research among Colombian school children reported that only 7% of students answered that there is soap regularly available at school (Lopez-Quintero et al. 2009). A UNICEF study in Ethiopia found that only 5% of schools had hand washing facilities. Although students had proper knowledge of hand washing, lack of the facilities may negatively affect proper hand washing knowledge. In our research, most students mentioned the importance of hand washing, indicating a high level of knowledge. The questionnaire survey indicated that 86% of students thought that washing hands with soap is one of the most effective ways to prevent waterborne disease (Figure 4). Question 16 asked students "If you have any difficulty on hand washing at school, what is the reason?", 53% of students that reported no soap affected their hand washing performance at school (Figure 7). Therefore, they could not practice the hand washing knowledge they had acquired.

Figure 8 indicates the rate of completing the hand washing step of students. Focusing on each step, 92.5% of students used soap, and more than half students dried hands thoroughly with tissue. The result showed that students tend to use tools for hand washing when available. Most children were relatively able to do step 1, 2, 3, 9, and 10. However, each step was no equally performance. In this regard, none of the children perfectly did all 10 steps. Half of the students did step 4, 11.4% did step 7, and few students did step 8. Primary school children were unable to complete all steps based on following 2 reasons. As the WHO checklist procedure is aimed for use in healthcare facilities, it is too detailed for primary school children to achieve at their level fully. This may also imply that students had not received proper hand washing education.

Table 4 presents the results of the stepwise regression. Being a male child and a younger child was associated with a decrease in the KAP scores. In analyzing the parents' background, a child with higher educated mother or whose father's occupation was non-agriculture were more likely to had higher KAP scores. The results indicated that there were significant relationships between the KAP of students with the parents' educational level and occupation.

The results indicated that gender differences could influence washing hands. The rate of completing the hand wash step was lower in boys than girls, which indicated a significant association between gender and hand wash behavior (Figure 8). The results are in line previous studies, one study reported that females have better hygiene than males in general population (Cruz et al. 2015). It is in agreement with the previous report that female had more positive attitudes toward hand hygiene than male (Sibiya and Gumbo 2013). In our research, we divided students by gender during the hand washing test. Based on the video content of the hand wash test, we found that the girls kept hygiene facilities cleaner than boys. Some boys did not have proper hand washing behavior. They forgot to turn off the tap, wiped hands on their clothes, and threw away tissues. The researcher had to interrupt the hand washing test because some boys throw away tissues which blocked the drain. The impact of gender differences on the hand washing behavior may be due to physical environment. In previous research, the hand washing facilities' cleanliness was strongly associated with hand washing for both genders. In the previous study, 87% students do not wash their hands after defecation when the washbasins are "dirty", compared with 36% of those in moderately clean facilities and more 69% in sanitary facilities (Curtis 2003). This study content showed that the girls always kept the physical environment clean, which coursed them to keep a better hygiene behavior.

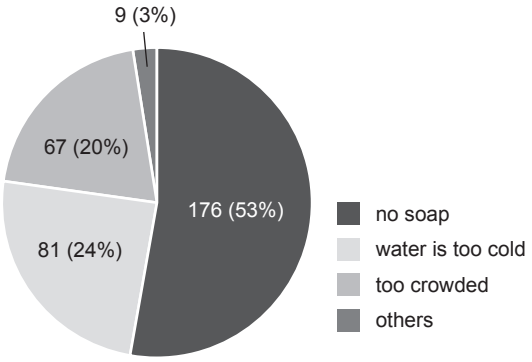

Figure 7. The most important difficulty on hand washing at school among students (n = 333).

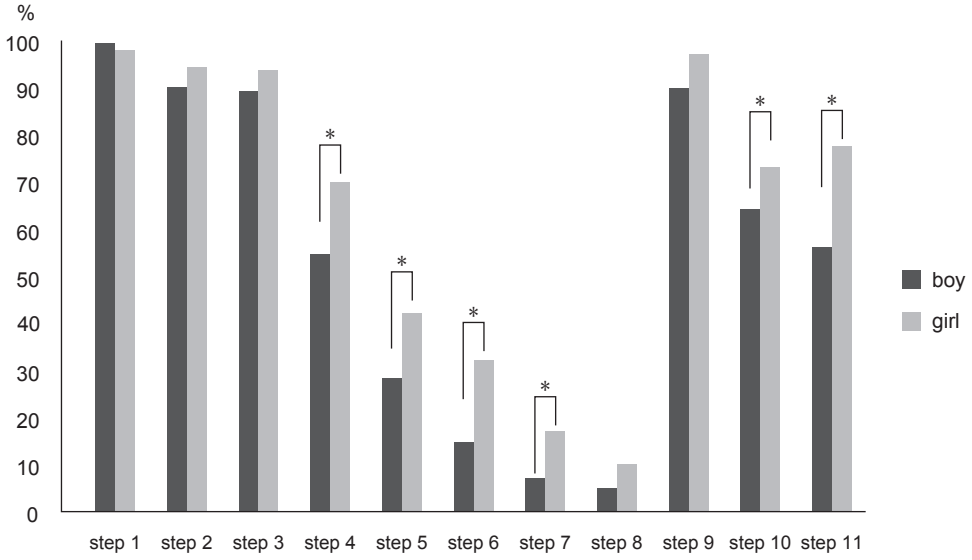

Figure 8. Rate of complete the hand washing step (n = 333).
*Chi-squared Test, $p < 0.05$.

Table 4. Factor associated with students' KAP scores in stepwise regression analysis (n = 333).

	β	t	VIF	*p*
Student's gender†	0.32	6.36	1.02	< 0.01
Student's age	0.29	5.64	1.06	< 0.01
Mother education level	0.17	3.27	1.03	< 0.01
Father occupation‡	0.15	2.6	1.41	< 0.05
Mother occupation‡				NS

$R^2 = 0.23$; Root meansquare error = 1.64.
†Boy = 0, Girl = 1.
‡Parents' occupation was divided in to Agriculture and Nonagriculture. Agriculture = 0, Nonagriculture = 1. Nonagriculture included government officials, employee and self-employed.

Summary

This study revealed the general status of water, sanitation, and hygiene in this area, drinking water source and sanitation facilities of primary school in this research area were safely managed, but hand washing facilities like taps, sinks and soap were inadequate.

In general, the nutritional status of children was found to be acceptable because the average BMIAZ of all students was between 0 and 1. However, the obesity issue in boys needs more attention continuously. The obesity prevalence was higher in boys than girls. Overall, boys were more likely to have a high BMI than girls.

For the knowledge, attitudes, and practices of hygiene research, most of the participants were found to have a correct understanding of those questions. However, only the knowledge of the waterborne disease found to be inadequate. Although students knew little on specific waterborne disease, they had high scores in the practices of this part. Several limitations are considered in the questionnaire survey. Students' self-reported questionnaire may have resulted in over-reporting of proper hygiene practices. In future studies, researchers should attempt to mitigate this limitation by including objective methods examined students' hygiene behavior.

This study also detected the impact of gender, sanitation facilities and knowledge level on hygiene behavior. Although participants had sufficient knowledge of hygiene, a lack of hand washing facilities may negatively affect proper hygiene practices. Students had excellent completion rate in hand washing step1–3. However, we found a gradual decline in the completion rate of the following step. It was caused by the students had not received the proper education of hygiene and hand washing skill. Cleanliness of the physical environment was associated with hand washing practices for both boys and girls. Overall, girls have a better sense of hygiene behavior and keep cleaner environment than boys.

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