Research Report

A Comprehensive Assessment of Hand Washing: Knowledge, Attitudes and Practices (KAP) and Hand-Washing Behaviors among Primary School Students in Northeast China

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Abstract

Globally, the most common cause of death of children is infectious diseases, particularly in low- and middle-income countries. In China, infectious diseases, especially diarrhea, are still some of the most serious public health problems, simultaneously suggesting that effective hand washing may help prevent these diseases. However, its effectiveness has remained unclear in terms of the difficulty in measuring children's hand-washing behavior. The aim of the present study was to develop a hand washing checklist that is handy and suitable for children, to comprehensively evaluate their hand washing practice. In this study, 269 students aged 7–13 years and their mothers completed measures of knowledge, attitude and practices (KAP) level of sanitation and hygiene and demographics. In addition, this study tested participants' and washing skills following both the World Health Organization (WHO) checklist and new checklist (modified based on the WHO checklist). Two cameras were used to record the whole progress of hand washing test. The present study showed that knowledge and attitude had no correlations with hand washing test. None of the children perfectly completed all steps of the WHO checklist. Given this, after simplifying the WHO checklist, the completion rate has significantly improved. The findings of this study also demonstrated that social economic status plays a significant role in shaping students' hand washing behaviors along with the striking factor that children's age, and gender differences had a significant correlation with their hand washing behaviors.

Keywords: hand washing, KAP, sanitation, school students, China

Introduction

Globally, the most common cause of death yearly among more than two million people, particularly children, is infectious diseases (Scott et al. 2007). Disease burden due to inadequate and unsafe water, lack of sanitation and poor hygiene behaviors is a significant issue (Nath 2009). Schools have repeatedly been implicated in the spread of infectious diseases which is high among primary school children (Hoque 2003; Boyce et al. 2009; Blessing and January 2012; Tambekar and Shirsat 2012). In China, infectious diseases, especially diarrhea, are still some of the most serious public health problems (Hao et al. 2013). In this report, more than 10,000 children deaths are due to diarrhea annually (Hao et al. 2013). In the present society, hand washing is especially important for children, as they are the most prone to infections gained from unwashed hands (Dajaan et al. 2018). For example, simple hand washing with soap helps to protect children from diarrhea and lowers respiratory infection (Aiello et al. 2008).

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A previous study shows 48% of reduction in diarrhea risk with hand washing with soap (Cairncross et al. 2010). These findings emphasize the importance of proper hand washing behaviors for child health.

Although hand washing may be understood as a simple task, multiple factors exist to shape this behavior. Previous research has suggested that a wide range of factors, such as adult caregivers, gender, education levels, socio economic status, place of residence, and access to water and sanitation are associated with hand washing behaviors of children (Schmidt et al. 2009; Rabbi and Dey et al. 2013). Although it is important to evaluate children's hand washing behaviors, the difficulty of measuring hand washing behaviors is well-recognized. Two commonly used methods to evaluate hand washing are the self-answer questionnaires and actual observations. These methods have different validity and feasibility. Self-answer questionnaires are low-cost and widely effective. However, a previous study suggested that self-answer hand washing behaviors may overestimate actual behaviors (Hirai et al. 2016). Although observing hand washing practice can accurately evaluate the actual hand washing behaviors, a limited number of studies support its effectiveness. As the World Health Organization (WHO) checklist was aimed for use in healthcare facilities such as hospitals, its procedure is too detailed for them to fully achieve at children's level. In this regard, previous research suggests that primary school students cannot complete the hand-washing procedure recommended by WHO (Otsuka et al. 2019).

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. A comprehensive evaluation of hand washing behavior comprised questionnaires and observation at the same time. However, the WHO hand washing checklist is time consuming and might thus be difficult to apply to a large sample size. Therefore, this study amides to develop a hand washing checklist which is handy and suitable for children, to comprehensively evaluate their hand washing practice. Besides, we investigated its relationship with participants' demographics, the household social and economic status.

1. Subjects and Methods

1.1. Study area and participants

We selected one of three rural elementary school with more students in one district of Benxi City, Liaoning Province, Northeast China. Benxi is located about 75 km from Shenyang, the provincial capital city of Liaoning Province. The gross domestic product of Benxi is at the middle (20th) level among 36 cities in Northeast China, which reflects the average level in the region (China National Bureau of Statistics 2018). Before data collection, we obtained the school management's permission to approach study participants. We also explained the purpose and contents of the study to all the children (283 students) and their parents; consequently, 278 students and their parents agreed to participate. Children over 13 years old and/or who were absent were excluded during the investigation period. As a result, the participants comprising 269 students (142 boys and 127 girls, 7–13 years old) and their parents completed each questionnaire as shown below along with observation by the investigators.

1.2. Questionnaires

Questionnaires were made for two specific participant groups. The questionnaire for children included demographics (birth date, gender, grade, diarrhea symptom during the past two weeks) and KAP. The Social Economic Status (SES) questionnaire for parents comprised the following: ethnicity, religion, occupation, monthly income, disease history, educational background, age, sex, number of household members, and number of children.

The KAP questionnaires for this study were prepared and developed based on previous studies, which were

suitable to the local context and administered to participants. KAP questionnaires included basic knowledge, attitude and practice concerning hand washing with soap, important time of handwashing, waterborne disease and so on.

1.3. Students' hand washing test

We held a hand washing test to evaluate the detailed hand washing practice of children. To maintain students' privacy, the hand washing test was held in a detached room with water taps (Figures 1 and 2). Researchers provided bar soap and tissues for the hand washing test (Figures 1 and 2). Children's hand washing skills were examined based on the hand washing skill checklist.

The hand washing technique checklist was based on WHO hand washing procedures. The checklist comprises 10 steps and the duration of the entire hand washing practice. A length of more than 40 seconds is defined as eligible. One point is counted for every item, thus the total score is 11. To reduce mistakes and record more details, the whole hand washing test in this study was recorded by two cameras. According to the completion of children's hand washing test, we simplified the steps of WHO hand washing procedures to make it more suitable for children. The cameras were set in advance with the written consent of the participants. During the hand washing test, the camera was set in a location that did not affect the students. The video was also stored in accordance with ethical principles. Children who seemed to joke and play, and did not appear to take the procedure seriously, were excluded from the analysis.

1.4. Data analysis

The chi-squared test was performed to examine differences in hand washing skill test between boys and girls. Wilcoxon tests were performed to examine differences in the mean scores of the new hand washing checklist by parents' occupation. We used Pearson's correlation to assess the relationship between household SES and children's hand washing behaviors. Pearson's correlation coefficients were also used to assess the relationships between total score of knowledge and attitude, and hand washing score in students. A p-value of < 0.05 was considered statistically significant. JMP 14.1.0 software (SAS Institute Japan, Japan) was used for all statistical analyses.

1.5. Ethical consideration

This study was approved by the ethical review committee of the Faculty of Health Sciences, Hokkaido University (No.18–106). The researchers explained the purpose and contents of the study to all participants and obtained written consent.

Figure 1. The place where hand-washing test was conducted. (Photo by the author)

Figure 2. Hand-washing test. (Photo by the author)

2. Results and Discussion

2.1. Characteristic

The descriptive characteristics of the study participants were shown in Table 1. The socio-demographic characteristics of participants are shown in Table 1. A total of 269 primary school students (52.8% boys and 47.2% of girls) took part in this study. Children whose parents disapproved this research were excluded. Among the parents, 269 mothers and 266 fathers joined the parents' questionnaire survey. Nearly 80% of parents had completed secondary education. More than half of parents were unemployed. Parents' occupation was significantly associated with hand washing. In analyzing the relation with family income, students whose family had higher monthly income were found to have a higher level of hand washing behaviors (Figure 3).

Regarding KAP mean scores in hand washing behaviors among students as presented in Table 2. 53.2% of students had full scores of knowledge and attitude of hand washing behaviors. Only three students had the full mark in practice question. The results of this study revealed that more than half of students had the proper knowledge and attitude of hand washing. For example, more than 90% of students had the proper knowledge and attitude of the important time needed for hand washing, hand washing with soap, and disease prevention by hand washing (Table 2). In addition, almost all students (97%) reported that they always wash hands with soap. However, 51.7% of students reported the lack of soap as the main reason not washing their hands at school. Another reason was forgetting washing hands (31.2%), which may implicate the need for improving school facility as well as raising awareness of the importance of frequent hand washings.

High rates of hand washing with soap were also found in our study (Table 2), compared to the results of the previous study with 300 children in Ghana (Dajaan et al. 2018). As education was a major factor influencing knowledge of hygiene, the present results may due to the different educational level on hand washing. In support of this argument, a previous study in China revealed that baseline scores on students' KAP questionnaire were slightly higher among students who took the health-education package (Ma et al. 2017). Moreover 88% of students in our research reported that they had been educated on hand washing (Table 2), which also shows that the finding is better than the study in Ghana where only 46.7% of students had been educated (Dajaan et al. 2018). Therefore, the discussion above suggests that health education is important to increase the rate of washing hands with soap in children.

2.2. Hand-washing test: completion rate and correlations between KAP and hand-wash test

The hand washing test checked by WHO checklist of students by gender is shown in Figure 4. In this research, none of the children perfectly completed all 10 steps. Focusing on each step, the completing rate was unbalanced. Most students were able to complete step 1, 2, 3 and 10. 94.6% of students used soap, and 70.6% of students dried hands thoroughly with tissue. The results showed that students tended to use tools for hand washing when available. Step 4 was completed by half of the participants, but more than 90% of students were unable to complete step 8. The completion rate was lower than 60% in 6 steps. The result was in line with a study in an urban slum of Indonesia among primary school students (Otsuka et al. 2019). There were significant positive correlation between WHO checklist total scores and new hand washing checklist ($r = 0.96$, $p < 0.01$).

Table 3 showed the complete rate of hand washing test by the new checklist. The checklist used in this study for measuring the hand washing skill was modified based on the WHO hand hygiene technique with soap. According to the video contents, the researchers deleted step 4 to step 8 from the WHO checklist. Instead of the 5 detailed steps from WHO, the researcher added "Wash back of the hand and all fingers" and "Rub each wrist with the thumb and forefinger using rotational movement". The new checklist had 8 steps. The average score of the hand washing test was 5.8 points. Meanwhile, it can also reduce the interference by the research during the hand washing test. More than 70% of students were able to complete the step 1, 2, 3, 9 and 10. According to the hand

washing video content, we found two special hand washing ("Wash back of the hand and all fingers" and "Rub each wrist with the thumb and forefinger using rotational movement") behaviors of the students, the completion rates were 43.8% and 22.8%, respectively.

Of our interest is that knowledge and attitude had no correlations with hand washing test. Despite that nearly all students are aware of the importance of hand washing and had sufficient KAP, they did not have proper hand washing performance. The result was in line with a study in an urban slum of Indonesia among primary school students (Otsuka et al. 2019). According to the study, as a detailed checklist, if students did not have a proper education about hand washing skill, it would be difficult for them to achieve the correct amount of hand washing.

Table 1. Characteristics of participants (n = 269).

Characteristics	n	%
Students characteristics		
Gender		
Boy	142	52.8
Girl	127	47.2
Age		
7–9 years old	89	33.1
10–11 years old	89	33.1
12–13 years old	91	33.8
Parents characteristics		
Mother		
Education background		
Completed primary education	55	20.4
Completed middle school	182	67.7
Completed senior high school	32	11.9
Occupation		
Employed	102	37.9
Unemployed	167	62.1
Father		
Education background		
Completed primary education	31	11.7
Completed middle school	195	73.3
Completed senior high school	40	15.0
Occupation		
Employed	127	47.7
Unemployed	139	52.3
Family monthly income (CNY)		
≤ 2,500	60	22.3
2,500–5,000	148	55.0
> 5,000	61	22.7

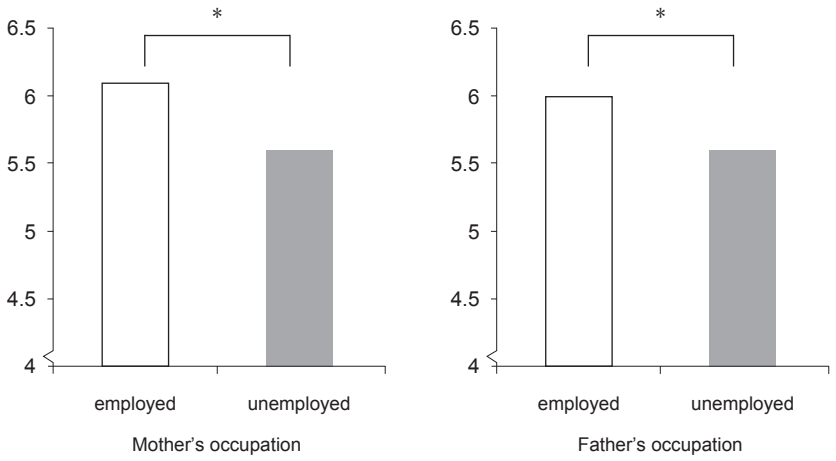

Figure 3. Students' mean scores of new hand-wash checklist by parents' occupation (n = 269).

*Wilcoxon test, $p < 0.05$.

Table 2. Students' KAP level of hand-wash behaviors (n = 269).

Questions	n	%
Always handwash with soap		
Yes	261	97.0
Important time of handwash		
After using the toilet	225	83.6
Before eating	199	74.0
After handling the garbage	122	45.4
After blowing nose or coughing	84	31.2
Reason of do not wash hands at school		
No soap	139	51.7
No time	90	33.5
No water available	71	26.4
Always forget	84	31.2
Laziness	32	11.9
Have you ever been educated on how to wash hands?		
Yes	238	88.5
No	31	11.5
Who educated you on hand washing?		
School	173	64.3
Home	84	31.2
Community durbar	5	1.9
How do you wash your hands?		
Under running water	131	48.7
KAP questionnaire total score (mean ± SD)		
Girls' score		6.69 ± 1.3
Boys' score		6.67 ± 1.3

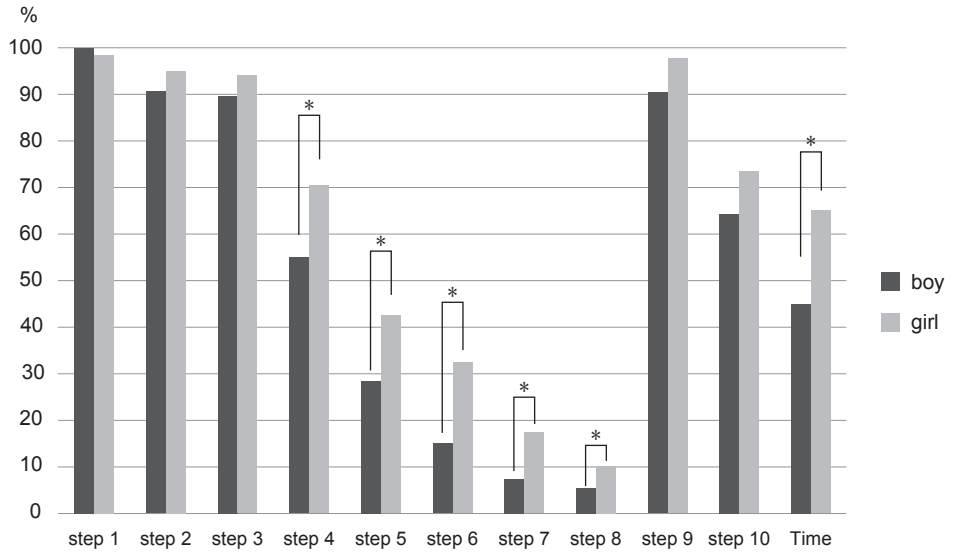

Figure 4. The completion rate of WHO hand-wash checklist by gender (n = 269).

*Wilcoxon test, $p < 0.05$.

WHO checklist: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, and time.

Table 3. Students' hand-washing total scores by gender† (n = 269).

Handwashing steps	Total (n = 269) %	Boy (n = 142) %	Girl (n = 127) %	P-value††
1. Wet hands with water	99.1	99.8	98.4	NS
2. Use soap	94.8	94.3	95.2	NS
3. Rub hands palm to palm	92.6	91.5	93.7	NS
4. Wash dorsum and all fingers	43.8	31.7	55.2	< 0.05
5. Rub each wrist with thumb and purlicue in opposite hand using rotational movement	22.0	14.1	30.0	< 0.05
6. Rinse hands with water	95.5	93.7	97.6	NS
7. Dry hands with tissue or towel	70.6	65.5	76.4	< 0.05
8. Length duration of hand wash	58.7	47.9	70.1	< 0.05
Total scores (mean ± SD)	5.75 ± 0.09	5.38 ± 0.12	6.17 ± 0.13	< 0.05

NS, not significant.

† The hand wash test scoring with the new hand washing checklist.

†† Chi-square test, $p < 0.05$.

2.3. Gender differences and education levels in hand-washing behaviors

Regarding gender differences, girls demonstrated how to wash hands more correctly than boys (Table 3). Girls scored more highly and had better completion than boys in step 2 to 8. It is in agreement with a previous study among primary school students in South Africa that girls had more positive attitudes toward hand hygiene than boys (Sibiya and Gumbo 2013). In this regard, the impact of gender differences on hand washing behaviors may be due to the environmental factors. In a previous research, the hand washing facilities' cleanliness was strongly associated with hand washing for both genders (Curtis 2003). Based on the video content of the hand washing test, the present study found that the girls kept hygiene facilities cleaner than boys (data not shown). In the previous study, 87% of students do not wash their hands after defecation when the washbasins are unclean, compared with 36% of those in moderately clean facilities (Curtis 2003). This finding highlighted the impact of gender difference on hand washing behaviors, emphasizing that the girls generally keep hygiene facilities clean, which may cause them to practice better hand washing behaviors (Ebong 1994).

The study found the hand washing scores increased as students' age increased ($r = 0.24$, $p < 0.05$). According to a previous study among primary school students in China, it would seem that students in higher grades had more education on hygiene at school than those of lower grades (Ma et al. 2017). Broadly speaking, older students were more aware of hygiene than the younger ones since knowledge increases as children grow (Chittleborough et al. 2012). As education is an important factor that influences knowledge and awareness of hand washing (Chittleborough et al. 2012), it is important to emphasize education in hand washing behaviors from an earlier age.

2.4. Household influence: parents' income levels and occupations in children's hand-washing

Children whose parents were employed and from higher monthly-income families had better hand washing behaviors ($r = 0.14$, $p < 0.01$). A previous study found that children from poorer income households had worse overall health behaviors, including hand washing (Case et al. 2002). In the study, higher income households had enough and better-quality hand washing facilities, which may have improved their children's hand washing behaviors (Case et al. 2002). Although income is one of the important factors associated with children's hand washing behaviors, parents' occupation was also a contributor (Figure 3). A study in three provinces of China (Beijing, Shanghai and Guangdong) also reported the employed parents, for example, civil servants and office workers, had a significant positive correlation with children's hand washing behaviors (Feng et al. 2015). Broadly speaking, employed parents have higher education levels and better social economic status than unemployed parents, which suggests that they are more likely to encourage their children to learn better hygiene behaviors. The interpretations above may help explain that socioeconomic status of parents are an important factor for shaping children's better hand washing behaviors.

Conclusions

The present study aimed to identify the factors for hand washing among primary school students, estimated by the use of a composite measure for each household enrolled. In general, this study revealed that the basic knowledge, attitude and practices levels on hand washing behavior among participants were good. However, the proper hand washing practice was not reported. In this regard, the present study revealed that the WHO hand washing checklist was found to be not suitable for primary school students. Given the findings above, the authors developed a hand washing checklist based on the WHO checklist based on the results of video contents. This study demonstrated that social economic status (SES) plays a significant role in shaping students' hand washing

behaviors along with the striking factor that children's age and gender also had a significant correlation with their hand washing behaviors.

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