

Original Article

Knowledge Enrichment Would Enhance Hand Hygiene Practice in Early Childhood: An Observational Study in Hong Kong

HY CHAN, ASC LO, KHH MA, A LEE

Abstract

This study aimed to explore the current hygiene knowledge and handwashing practices among children, as well as to evaluate the changes in knowledge, attitude and behaviour towards personal hygiene after providing a hygiene thematic lecture. A pre- and post-observational study was conducted for case group and reference group. The participants were year-3 students around age 5 to 6 (N=251) from local kindergartens. McNemar test was conducted to analyse the changes in the post-test results within the groups. A test for analysing the proportion of positive change was conducted for cross-group comparison. Significant positive changes have demonstrated in the case group but not in the reference group. The percentage of fulfilling the recommended handwashing standard improved from 4.6% to 14.9% (P<0.001) among case group but dropped from 7.1% to 3.6% in the reference group. Children are capable to complete handwashing procedures as recommended but the proportion was still very low.

Key words

Handwashing; Infectious disease prevention; Observational study; Personal hygiene; Preschool

Introduction

Hand hygiene is an effective action against many communicable diseases, particularly respiratory infections and diarrhoea as shown by the WASH programme initiated by UNICEF.¹ The SARS experience in Hong Kong has also shown the importance of handwashing as an effective preventive measure, especially within the school setting.² Children in early childhood are at a high risk of suffering from communicable diseases, since some of them are too young to be aware of the importance of personal hygiene.

Kindergarten for early childhood education is a setting for children gathering to learn and play, and diseases can be transmitted through person-to-person contact. The contaminated hands with infectious agents directly and indirectly can cause disease outbreaks.³ Maintaining proper hand hygiene is actively promoted by Health Authority to prevent and control the spread of common infectious diseases where children are more often affected, including acute diarrhoeal diseases, mumps, scarlet fever and Hand, Foot and Mouth Disease (HFMD).⁴

Hand, Foot and Mouth Disease is now a common disease among 3-to 6-year-old kindergarten children in Hong Kong. The Centre for Health Protection of the Department of Health of Hong Kong SAR Government has established a surveillance system to monitor HFMD regularly at child care centres and kindergartens (CCC/KG). According to the findings from the sentinel surveillance points in 2015, there were 691 HFMD institutional outbreaks (346 in 2014), which affected a total of 4,194 people (2,087 in 2014) in 2015.⁵ The peak season for HFMD is from May to July in Hong Kong and over 20% of the CCC/KGs under the surveillance system have reported HFMD cases.

HFMD can develop several serious complications, including viral meningitis, encephalitis, poliomyelitis-like

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paralysis or death.⁶ Currently, there is no effective treatment or vaccine against HFMD. The main transmission route for HFMD is by contact with nose or throat discharge, and so children are easily infected without good hygiene practices in place. Kindergarten children are the most vulnerable population of HFMD in this part of world.^{7,8} There have been numerous studies that have indicated that the correct handwashing procedure with soap acts as a protective factor against HFMD and the correct handwashing practice should be promoted to prevent HFMD.⁹⁻¹¹

From the global perspective, the worldwide trend of handwashing after contact with excreta was only 19% among the different age groups in 2014.¹² The study concluded that more health promotion on handwashing practice is needed. To the best of our knowledge, there is no recent research study that has investigated the handwashing practices among Hong Kong kindergarten children. Information on the current practice of handwashing behaviour among this particular age group is needed to improve hygiene education. Previous studies have indicated that enriching the knowledge of the reason, method and time of handwashing is the most common method adopted by kindergarten children to enhance hand hygiene.^{13,14} However, the results from a cross-sectional descriptive study revealed that a high level of knowledge on personal hygiene did not necessarily reflect good practice of handwashing.¹⁵ The disparity between knowledge and practice related to hand hygiene has aroused the need to investigate how health education program can be implemented, in which the knowledge can be taught in parallel to the enrichment of practical handwashing skills.

Territory wide health promotion programme on personal hygiene has been implemented among kindergartens in Hong Kong over the years. The aim of this study is to explore the current practice of handwashing and the level of personal hygiene knowledge among kindergarten students (early childhood education from age 3 to 6). An observational study was conducted in 15 local kindergartens to investigate knowledge enrichment and the compliance to the recommended handwashing behaviour among the students after joining the programme in the academic year of 2015/16. The results from this study can evaluate the effectiveness of the programme and help to improve or further develop the related educational materials with the ultimate goal to reduce the disease outbreaks in kindergartens by enhancing health literacy on personal hygiene.

Methods

Study Design

A pre- and post-observational study was conducted to evaluate the changes in knowledge, attitude and behaviour towards personal hygiene after providing a hygiene thematic lecture. There were two groups of participants; the case group and reference group. Both groups were recruited and completed the study in the same academic year. The post-test was conducted within a month after the pre-test for both groups. Intervention was provided for the case group in between pre- and post-tests. The same set of assessment tools for pre- and post-test was used in both groups. The assessment tool included a questionnaire and handwashing observation checklist. The completed assessment refers to having carried through with both the questionnaire and handwashing observation.

Intervention

The intervention was a standardised hygiene thematic lecture, which was provided by trained tutors from the Health Academy. The main content of the lecture included: 1) what are infectious agents and infectious diseases; 2) introducing the concept of infectious agents that can cause disease; 3) how infectious agents attack the human body (the common transmission means of infectious agents); 4) highlighting the importance of handwashing that can prevent getting sick by infection; 5) demonstrating the recommended handwashing steps with a pictorial guide; 6) when we should wash our hands and 7) introducing the appropriate hygiene manner (e.g. covering the mouth and nose when sneezing). The handwashing demonstration was conducted with an in-class practice and all the students were required to follow the steps accordingly.

Setting and Study Population

The study was conducted in the kindergarten setting. Kindergarten students in year 3 (K3) around age 5 to 6 were the study population.

Sampling and Recruitment Method

The list of kindergartens retrieved from the Education Bureau was the sampling frame in our study and all kindergartens in Hong Kong were invited to join the hygiene thematic lecture. The participating kindergartens were classified into the case group recruitment list and non-participating kindergartens were classified into the reference group recruitment list. The kindergartens were then categorised into High, Middle or Low Socioeconomic

Status (SES) group for each list. The classification was based on the average household income of the district from the Population Census 2011.¹⁶ Equal numbers of kindergartens were recruited randomly from each SES group to maintain similar numbers of participants under each SES group. Random samples were selected within the kindergartens. Both the case group and reference group followed the similar sampling and recruitment method. In order to ensure that the participants in the reference group were not exposed to the hygiene thematic lecture, the researcher confirmed that the recruited kindergartens had not joined the programme in the past three years. Figure 1 outlines the flow of the study.

A sample size of 197 for each group was required to detect a 10% difference (10% versus 20%) at a 95% significant level with 80% power.¹⁷ An average class size is around 20 to 30 students in local kindergartens. One class was selected from each recruited kindergarten, and therefore around 10 kindergartens were required to recruit enough participants.

Eligibility of the Participant

An eligible participant should be a K3 student who is a native Chinese (Cantonese) speaker and who has obtained their parents' consent to join the study for both the case and reference groups.

Data Collection

A completed assessment is that the participant has gone

through all parts of our research study in the sequence of pre-test, hygiene thematic lecture for the case group, and post-test. Any participant who were absent at any point of the research study were considered to have withdrawn from the study. The assessment was conducted on a one-on-one basis, and each respondent was required to complete a questionnaire immediately followed by a handwashing observation. Each student took around 5 to 10 minutes to complete one assessment.

1. Questionnaire Interview

The questionnaire includes 9 close-ended questions about hygiene knowledge and 1 question asking their attitude towards hand hygiene. For the knowledge questions, the researcher read out the questions with all of the answer choices in a pictorial guide. The pictorial guide was a set of cue cards demonstrating the answers and it was tested by two kindergartens who did not participate in the research before data collection. All of the cue cards were displayed on the desk, allowing the students to pick the correct answer(s). A card for not knowing the answer was displayed in every question for students to skip the questions that they did not know. As for the attitude question, there were 5 identical star pictures allowing the respondent to indicate their degree of agreement to the statement that handwashing is a very important preventive measure to protect themselves from getting sick. The participants were told 'The more stars the more important' and they were required to circle the star(s).

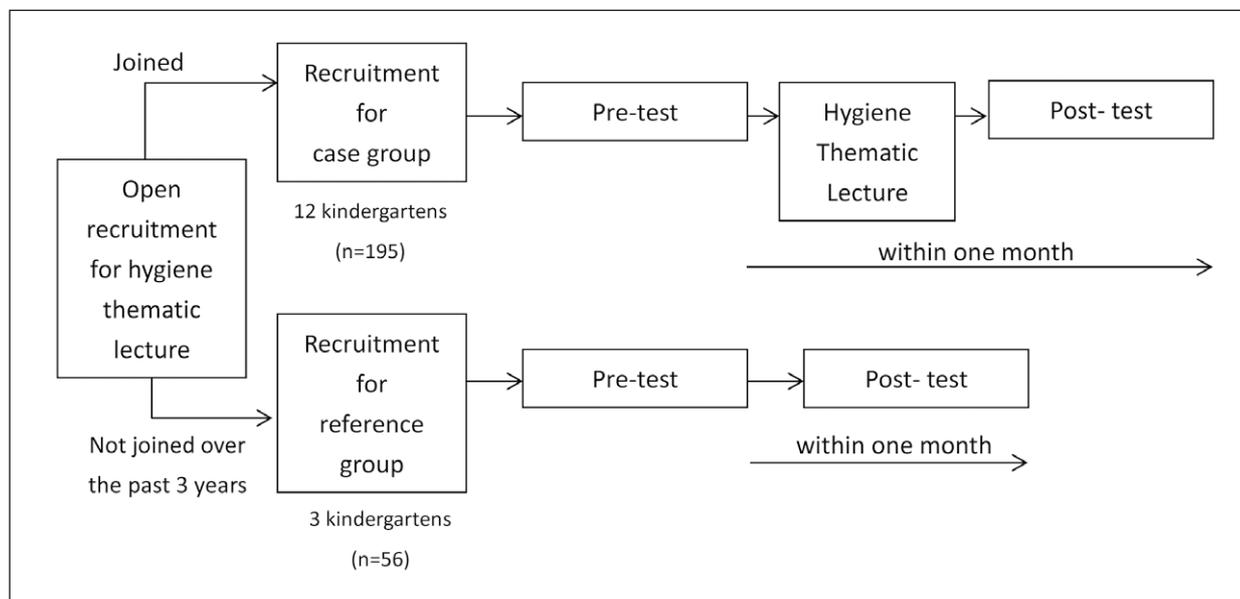


Figure 1 The flow of the study.

2. Handwashing Observation

There are different methods of measuring handwashing behaviour as discussed by Ram et al.¹⁸ We have taken reference from the method of structured observation, which capture the details on handwashing behaviour. During the observation, the researcher observed the student's handwashing behaviour without giving any instructions. The students were expected to wash their hands as usual. The handwashing observation checklist included 10 marking items based on the hand hygiene guideline recommended by the Department of Health (Table 1).¹⁹ The steps in the correct sequence and the marking criteria are as below.

Data Analysis

Chi-Square test was conducted to detect any significant difference in the demographic characteristics between the case and reference groups. To compare the results of the pre-test and post-test, two tests were applied for within group comparison and cross-group comparison. The McNemar test was conducted for the former, to analyse any differences in the responses between the pre-test and post-test for both groups. For the latter, the proportion of positive change was calculated (defined as the proportion of participants who answered/behaved incorrectly during the pre-test but correctly during post-test), and the z-test comparing the two proportions was used to test the difference between the proportions of positive change in the case group and in the reference group.²⁰

Results

Background Information of the Recruited Kindergartens and the Demographic Characteristics of the Participants (Table 2)

A total of 251 children aged 5-7 years old were recruited from 15 local kindergartens. There were 195 children from 12 kindergartens in the case group and 56 children from 3 kindergartens in the reference group. The characteristics of the participants in the two groups were compared; all of the variables had no significant difference. All of the kindergartens were non-profit making and 14 kindergartens were subsidised by the government. All of the kindergartens were co-educational schools and the majority of the students were native Cantonese speakers. The majority of the participants (88.8%) were born in 2010 and the male to female ratio was 1:1.11 among the two groups. They came from different socioeconomic status (SES) groups and the distribution was similar.

The Current Situation of Hygiene Knowledge and the Perceived Value of Handwashing (Table 3)

The students have demonstrated a good understanding of the basic concept of bacteria, and around 90% of the students understand that bacteria are tiny living things that cannot be seen without a microscope. However, they do not realise some frequently used items containing bacteria. Less than 40% of the students can tell towels containing bacteria and situation for their school bag would be even worse (less than 30%). The students do not have adequate

Table 1 Handwashing steps and marking criteria

Steps	Marking criteria
1 Wet the hands under running water	If the student applies liquid soap without rinsing their hands first, no mark will be given in this step.
2 Apply liquid soap onto the hands	If yes, 1 mark will be given.
3 Rub the hands thoroughly including the palms, fingers web, nails, and the back of the hands	A total of 4 separate marks will be given for rubbing palms, finger web, nails, and the back of the hands.
4 Rub the hands for more than 20 seconds	Researcher uses timer to count the exact time, 1 mark will be given if the student rubs their hands for at least 20 seconds.
5 Rub hands away from the running water	If the student rubs his/her hands under running water, no mark will be given in this step but the marks for rubbing will be given.
6 Rinse hands thoroughly under running water	If there is no visible dirt or soap, 1 mark will be given.
7 Drying hands thoroughly with a clean cotton towel, a paper towel or hand dryer	If the student dries his/her hands with public towel, no mark will be given.

A total of 10 marks will be given if the student has fulfilled all of the steps in the correct sequence (described as correct handwashing).

understanding of the transmission modes of bacteria. Around 70% of the students do not realise that bacteria can be transmitted with direct wound contact; more than 60% of the students do not know that towel sharing can spread bacteria. Regarding to personal hygiene, the majority of students know that they should not go to school (over 80%) and should wear a mask (over 70%) during sickness. The performance of sneezing is unsatisfactory with 40% of the students not knowing that they should cover their nose and mouth when sneezing. Most of the students know that they should wash their hands after using the toilet (over 80%), before eating (over 70%) and after sneezing (around 70%). However, around half of the students do not know that they should wash their hands after playing with toys. Despite the students being able to tell when they should wash their hands, only half of the participants with the knowledge rubbing their hands for at least 20 seconds. Most of the students have positive attitude on handwashing, and over 70% of the students rank the importance of handwashing as 5 stars (very important).

The Current Situation of Handwashing Behaviour (Table 4)

Kindergarten students are able to wash their hands as per the recommended guideline, but less than 10% of the

students can fulfil all the handwashing steps in the correct sequence (described as correct handwashing) at baseline. The intervention has improved the students' performance of correct handwashing (10% statistically significant increase). There is a need to improve handwashing particularly the steps of rubbing the nails (less than 20% students can perform this) and rubbing the finger web (around 30% students can perform this), and adequate time on rubbing their hands (less than 30% of the students rub their hands for at least 20 seconds).

Comparison Between the Case Group and Reference Group

The case group and the reference group indicated similar results at baseline. From the results of within group comparison (Table 3), nearly all of the variables of the case group have revealed a positive change with statistical significance. For the reference group, all the variables related to knowledge except one have shown no or little positive change. From the results of the cross-group comparison (Tables 5 & 6), higher proportion among the case group has shown positive change than the reference group in most of the variables related to knowledge (Table 5). Higher proportion among the case group has shown improvement in most

Table 2 Demographic characteristic of the participants

Variable	Case (n=195)	Reference (n=56)	Total (n=251)	Chi-Square tests P-value
Gender				
Male	92 (47.2%)	27 (48.2%)	119 (47.4%)	0.891
Female	103 (52.8%)	29 (51.8%)	132 (52.6%)	
Male to female ratio	1 : 1.12	1 : 1.07	1 : 1.11	
Socioeconomic status ^a				
Low	65 (33.3%)	16 (28.6%)	81 (32.3%)	0.771
Middle	62 (31.8%)	20 (35.7%)	82 (32.7%)	
High	68 (34.9%)	20 (35.7%)	88 (35.1%)	
Year of birth				
2008	1 (0.513%)	1 (1.79%)	2 (0.797%)	0.111 ^b
2009	16 (8.21%)	8 (14.3%)	24 (9.56%)	
2010	176 (90.3%)	47 (83.9%)	223 (88.8%)	
2011	2 (1.03%)	0 (0%)	2 (0.797%)	

^aAccording to the average household income of the district from Population Census 2011:

Low: Median monthly domestic household income <= HKD18,000

Middle: Median monthly domestic household incomes between HKD18,001-23,000

High: Median monthly domestic household income >= HKD23,000

^bCompare the year of 2008-2009 and the year of 2010-2011

of the handwashing steps than the reference group with statistical significant (Table 6).

Discussion

The participants in the case group have shown an improvement in most items reflecting the basic knowledge of hand hygiene and attitude towards handwashing with statistical significance. Knowledge improvement was not found to be statistically significant with a worsening of

the attitude towards handwashing in the reference group. Most of our assessments on handwashing procedures have shown positive changes in the case group but not in the reference group with a worsening of some techniques. This study has suggested that the improvement of knowledge and attitude would have some impact on behavioural changes, highlighting the importance of education programmes in the format of a lecture and demonstration.

Action learning in the format of a lecture and demonstration has an impact on belief and personality for

Table 3 Within group comparison of hygiene knowledge and the perceived value on handwashing

Variable	Case (n=195)				Reference (n=56)			
	Pre-test (%) [*]	Post-test (%) [*]	Difference	p value	Pre-test (%) [*]	Post-test (%) [*]	Difference	p value
The understanding on the nature of bacteria								
tiny living things	86.7	93.8	7.1**	0.009	85.7	92.9	7.2	0.289
The method for observing bacteria								
too small to be seen without a microscope	87.7	97.9	10.2**	<0.001	91.1	92.9	1.8	1.0
The item which contains bacteria								
School bag	28.2	51.3	23.1**	<0.001	28.6	41.1	12.5	0.092
Toy	73.3	94.4	21.1**	<0.001	82.1	85.7	3.6	0.774
Stationery	49.7	69.7	20.0**	<0.001	60.7	64.3	3.6	0.815
Towel	29.7	35.4	5.7	0.207	37.5	32.1	-5.4	0.607
Food	27.7	25.6	-2.1	0.672	42.9	39.3	-3.6	0.804
The transmission means of bacteria								
Direct contacting the wound	31.8	55.9	24.1**	<0.001	32.1	48.2	16.1	0.078
Not cover mouth and nose when sneezing	59.5	80.0	20.5**	<0.001	73.2	76.8	3.6	0.804
Eating the contaminated food	42.1	61.0	18.9**	<0.001	67.9	69.6	1.7	1.0
Towel sharing	39.5	47.2	7.7	0.110	35.7	42.9	7.2	0.503
The appropriate action when getting sick								
Cover mouth and nose when sneezing	54.9	67.2	12.3**	0.004	64.3	78.6	14.3	0.096
Not going to school	84.1	94.9	10.8**	0.001	89.3	91.1	1.8	1.0
Wearing a mask	77.9	80.5	2.6	0.542	76.8	94.6	17.8**	0.013
The scenario required handwashing								
After playing toy	38.5	59.5	21.0**	<0.001	55.4	53.6	-1.8	1.0
Before eating	72.3	86.7	14.4**	<0.001	83.9	91.1	7.2	0.344
After sneezing	69.2	81.0	11.8**	0.001	78.6	85.7	7.1	0.481
After using toilet	85.1	85.6	0.5	1.0	83.9	89.3	5.4	0.453
The required time for rubbing hands								
20 seconds	42.6	59.5	16.9**	<0.001	51.8	55.4	3.6	0.754
The perceived value on handwashing								
5 stars	72.8	80.5	7.7**	0.020	78.6	76.8	-1.8	1.0

*% of giving the correct answers

**P-value <0.05

young children as well as establishing a system of norms and motivation in line with Tone's Health Action Model.²¹ The knowledge and skills as well as the school environment would further facilitate the transition from behavioural intention into health action. The proper implementation of an education programme would change the behaviour of school children including improved handwashing.²² The ability to detect learning events is related to the level of motivation and interest that children have in school activities, and younger children engaging in activities results in clearly observable changes of behaviour whereas older children tend to learn facts rather than new skills.²³

In this study, the children in the case group were shown to identify and apply what an adult had demonstrated while children in the reference group did not demonstrate improvement in handwashing. A study has revealed that pre-school children learnt something more fundamental from watching the model's demonstration.²⁴ Gesturing during the instructions encourages the children to produce gestures of their own which leads to learning.²⁵ Gestures uses the body to do as embodied representations which would promote learning as embodied forms of representations are involved in cognitive processes such as working memory,²⁶ action memory²⁷ and imagery.²⁸

Handwashing demonstration has not embodied representation of those perspectives such as items containing bacteria. Children are given towels to clean their hands and food to eat so they would assume safety to consume. Children would rush to play after toileting so they might not wash their hands thoroughly with soap. This would explain why we would not observe improvement of certain aspects of hygiene knowledge among the children in case group.

Study has shown that preschool children could form a mindset looking for analogous solutions to problems differing in surface features but sharing deeper relational commonalities.²⁹ Therefore exposing children to a variety of transfer experiences would teach them to search for underlying commonalities and education programme with lecture and practical demonstration would help children to develop this kind of mindset. This would explain why children in the case group showed more positive attitude towards handwashing but not in the reference group. Educational intervention should emphasise more on training students to search for underlying commonalities so they would learn how to avoid infecting others when getting sick and also protecting themselves from getting infected. Hopefully, more students would cover their nose

Table 4 Within group comparison of the assessment on handwashing procedures

Variable	Case (n=195)				Reference (n=56)			
	Pre-test (%) [*]	Post-test (%) [*]	Difference	p value	Pre-test (%) [*]	Post-test (%) [*]	Difference	p value
Steps for handwashing								
Wetting hands under running water	93.3	94.4	1.1	0.791	89.3	89.3	0	1.0
Applying liquid soap	57.9	70.3	12.4**	<0.001	76.8	82.1	5.3	0.375
Rubbing								
Palms	72.3	85.1	12.8**	0.001	89.3	87.5	-1.8	1.0
Fingers web	35.4	46.2	10.8**	0.015	30.4	21.4	-9.0	0.359
Nails	17.4	26.2	8.8**	0.009	10.7	7.1	-3.6	0.625
Back of hands	59.0	68.7	9.7**	0.023	64.3	58.9	-5.4	0.549
Rubbing more than 20 seconds	27.2	36.4	9.2**	0.025	23.2	26.8	3.6	0.727
Rubbing hands away from running water	51.3	65.6	14.3**	<0.001	64.3	71.4	7.1	0.289
Rinsing hands thoroughly under running water	56.4	72.3	15.9**	<0.001	73.2	76.8	3.6	0.727
Drying hands thoroughly with a clean cotton towel, a paper towel or hand dryer	59.0	75.4	16.4**	0.001	85.7	85.7	0	1.0
Percentage of fulfilling all handwashing criteria in correct sequence	4.6	14.9	10.3**	<0.001	7.1	3.6	-3.5	0.625

^{*}% of fulfilling the steps

^{**}P-value <0.05

and mouth when sneezing and similarly, understanding the importance of not sharing personal items to avoid transmission of infectious disease, such as HFMD.

It was rather surprising that knowledge of wearing mask only improved slightly (77.9% to 80.5%) among the case group and greater improvement among reference group (76.8% to 94.6% $P=0.013$). Wearing mask has become the propaganda in the media for prevention of droplet infection. Students in the case group might have better understanding of usefulness of mask in preventing droplet infection so the improvement was only slight. Children in the reference group might just learn by observation through the media

rather than developing the mindset for analogical reasoning as described earlier. Therefore no significant improvements were observed on other variables of knowledge improvement, attitudinal change as well as better handwashing technique among the reference group.

One would expect that all students should wash their hands after using toilet but not so in the both case and reference groups deserving our attention. The performance handwashing after contact with excreta worldwide as mentioned before, only a few percent of participants would perform the desired behaviours.¹² As discussed earlier on, convenience would account for low level of handwashing

Table 5 Cross-group comparison of hygiene knowledge and the perceived value on handwashing

Variable	Case (n=195)	Reference (n=56)	Difference (%)	95% Confidence Intervals	
	Positive change (%)*	Positive change (%)*		(Upper %)	(Lower %)
The understanding on the nature of bacteria					
tiny living things	10.26	10.71	-0.46	-9.61	8.69
The method for observing bacteria					
too small to be seen without a microscope	10.77	5.36	5.41	-1.92	12.74
The item which contains bacteria					
School bag	27.69	17.86	9.84	-2.00	21.67
Toy	22.05	12.50	9.55	-0.88	19.99
Stationery	27.69	17.86	9.84	-2.00	21.67
Towel	18.97	10.71	8.26	-1.53	18.05
Food	11.79	12.50	-0.71	-10.48	9.07
The transmission means of bacteria					
Direct contacting the wound	31.28	26.79	4.50	-8.80	17.80
Not cover mouth and nose when sneezing	24.62	16.07	8.54	-2.82	19.91
Eating the contaminated food	30.26	16.07	14.18**	2.60	25.77
Towel sharing	23.59	21.43	2.16	-10.13	14.45
The appropriate action when getting sick					
Cover mouth and nose when sneezing	22.56	23.21	-0.65	-13.17	11.87
Not going to school	14.36	5.36	9.00**	1.32	16.68
Wearing a mask	12.31	21.43	-9.12	-20.82	2.57
The scenario required handwashing					
After playing toy	29.23	14.29	14.95**	3.78	26.11
Before eating	18.46	12.50	5.96	-4.27	16.19
After sneezing	17.95	19.64	-1.69	-13.41	10.02
After using toilet	8.72	8.93	-0.21	-8.66	8.24
The required time for rubbing hands					
20 seconds	25.64	10.71	14.93**	4.77	25.08
The perceived value on handwashing					
5 stars	13.33	8.93	4.40	-4.46	13.27

*% of giving the incorrect answers in the pre-test and correct answers in the post-test

**Statistically different from zero at 95% significant level

after toileting. One should explore the feasibility of similar education programme for the family members to enrich their knowledge and cultivating positive attitudes as well as training session on handwashing skills. Although statistical significant improvement was observed in the case of fulfilling all criteria of handwashing, the proportion was still very low (4.6% to 14.9%, Table 4). Family members should provide a good modelling for children to learn effectively.²³

Addressing the perceived value on handwashing would be the fundamental issue for promoting hand hygiene. Findings of this study have indicated that the perceived importance on handwashing can be changed positively by a planned education. Although most kindergartens had adequate toilet facilities and sessions for washing hands, not many kindergartens had regular practical demonstrations. This would facilitate development a norm culture of hand hygiene with a supportive school environment for positive behavioural change. The hygiene thematic lecture provided in this study was intended to improve the knowledge level hence changing their beliefs positively and increasing the value of the desired behavioural outcome. Enhancing the perceived behavioural control would facilitate the desired behaviour as explained by Theory of Planned Behavior,³⁰ and the practical demonstration of the hygiene-themed lecture can assist

participants to gain control over the behaviour. This should be coupled with good physical facilities and also school culture emphasising importance of hygiene to achieve higher compliance rate of correct handwashing techniques.

Limitation

The time limitation was the biggest challenge faced in this study. The researchers planned to recruit 200 students for each group. There were difficulties recruiting the reference group due to various reasons. In order to ensure that the participants were not exposed to the hygiene thematic lecture, the recruited kindergartens in the reference group should be kindergartens which had not joined the programme in the last three years. This has limited the numbers of kindergartens that could be recruited for the reference group. Moreover the reference group also had a higher rejection rate than the case group. Eligible kindergartens for the reference group had not joined the related health promotion programme, they might have a lower awareness of hygiene and lower motivation to join the study. It was very time consuming to collect the data on a one-on-one basis as the participants were too young to conduct a self-administered questionnaire so there was less incentive to join.

Table 6 Cross-group comparison of the assessment on handwashing procedures

Variable	Case (n=195)	Reference (n=56)	Difference (%)	95% Confidence Intervals	
	Positive change (%)*	Positive change (%)*		(Upper %)	(Lower %)
Steps for handwashing					
Wetting hands under running water	4.10	3.57	0.53	-5.07	6.13
Applying liquid soap	16.92	7.14	9.78**	1.22	18.34
Rubbing					
Palms	19.49	3.57	15.92**	8.53	23.30
Fingers web	23.08	12.50	10.58**	0.09	21.07
Nails	14.36	1.79	12.57**	6.55	18.59
Back of hands	21.03	7.14	13.88**	5.04	22.73
Rubbing more than 20s	19.49	8.93	10.56**	1.25	19.87
Rubbing hands away from running water	17.44	10.71	6.72	-2.97	16.42
Rinsing hands thoroughly under running water	20.00	8.93	11.07**	1.73	20.41
Drying hands thoroughly with a clean cotton towel, a paper towel or hand dryer	29.23	8.93	20.30**	10.48	30.13
Percentage of fulfilling all handwashing criteria in correct sequence	11.28	1.79	9.50**	3.86	15.13

*% of not fulfilling the steps in the pre-test and fulfilling the steps in the post-test

**Statistically different from zero at 95% significant level

For those variables with statistical significant results in McNemar test (Table 3), only some variables have shown statistical significant positive changes for positive change in cross-group comparison (Table 5). The differences in proportion of those variables with positive change with no statistical significance range from 9.55% to 9.84% with the corresponding power of the z-test ranging from 56.48% to 62.89%. Those variables are expected to have statistical significance in cross-group comparison with larger sample size.

Conclusions

Performance of kindergarten students on handwashing can be improved after providing a specialised intervention programme. Health education should be implemented in early childhood and the young children are capable to perform desirable health behaviour with knowledge enrichment and demonstration. A programme with well-structured theme would enhance the effectiveness of health education leading to improvement of health behaviours such as handwashing.

Declarations

Ethics Approval and Consent to Participate

Ethical approval was granted by the Survey and Behavioural Research Committee of The Chinese University of Hong Kong. Written parental consent was sought with informed purpose and procedures of the study for all of the participants prior to study commencement. Written consent was also obtained from each participating kindergarten with the study information and verbal informed consent was gained before collecting feedback from the educators. All identifiable information was kept confidential and will not be disclosed to any party other than the research team.

Declaration of Interest

The Health Academy was initiated by Reckitt Benckiser, which provided the hygiene-themed lecture to the participants. Our centre provided professional advice on the educational materials. The research was designed and conducted by our centre without the involvement of the Health Academy and Reckitt Benckiser.

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