Effectiveness Of A Structured Hand Hygiene Education Program In Relation To Preschool Children's Knowledge And Practice

Ding Chok Hao[1], Ghuganesvary Irrulappen[2], Keirthaana Palanisam[3], Nur Aizati Amirah Binti Anuar[4], Alana Shazmina Azelan[5], Alya Nasuha Mohamad Salleh[6], Ang An Qi[7], Sharmiza Samsuddin[8], Koh Kim Hua[9], Chye Wah Yu[10*]

[1,2,3,4,5,6,7,8,9]School of Nursing, Faculty of Allied Health Profession, AIMST University, Malaysia.
[10*]Faculty of Allied Health Professions, AIMST University, Malaysia.
[1]dingchokhao2002@gmail.com, [2]ghuganesvary94@gmail.com, [3]keirthaanap@gmail.com, [4]aizatiamirah36@gmail.com, [5]alanashazmina11@gmail.com, [6]alyaanasuha199@gmail.com, [7]angelang523@gmail.com, [8]sharmiza@aimst.edu.my, [9]kohkimhua@aimst.edu.my, [10]chyewah@aimst.edu.my
*Corresponding author: chyewah@aimst.edu.my

Abstract

Introduction: Handwashing can prevent diarrhea-related illness and respiratory infections, such as a cold or the flu. This study aims to evaluate the effectiveness of structured intervention program on knowledge and practice of hand washing among preschool children.

Method: A quasi-experimental study was conducted in three-time phases among 32 preschoolers aged between 3 to 6 years old in Kedah. The same questionnaire was delivered at each phase and they underwent the intervention program of hand washing. Their performance in hand washing was measured and evaluated using a questionnaire and checklist.

Results: The results of the study revealed a significant difference ($p<0.05$) in mean preschoolers' children score on knowledge and practice before and after participated in the intervention program.

Conclusion: Overall, preschoolers' knowledge and practice of handwashing were significantly ($p<0.05$) improved by the intervention program. However, as the participants were young children, it is important to emphasize the consistency of

reinforcement of knowledge and regular practices of hand hygiene.

Keywords: Hand washing, hand hygiene, knowledge, practice, education program, pre-school children.

Introduction

Preschools were created to offer young children (ages 4 to 6) an early education curriculum (Lily Muliana, & Azman, 2013). The resultant overcrowding of children in pre-schools will increase the risk of communicable disease transmission in the Malaysian community. According to the Malaysian Department of Statistics (2020), there were 6,152 young children registered in pre-schools in 2019 and 6,215 young children registered in 2020. Overcrowding in pre-schools as a result will eventually raise the danger of contagious disease transmission in Malaysian society. Children are prone to and a great source of infectious diseases due to behavioural factors like a predisposition to explore objects with their hands and mouth, as well as their immature immune systems (Alexandrino, Santos, Melo, Bastos, 2016). In pre-school environment, due to crowded surroundings, poor hygiene standards, and insufficient staffing, preschoolers are particularly vulnerable to the contracting communicable diseases which often transmitted via droplets, direct contact and faecal-oral route for instance, hand-foot-mouth disease, otitis media or diarrheal disease (Zomer et al., 2013). Pre-school children are at a higher risk of acquiring infectious diseases as their body immunity are low, a good method to develop a lifelong habit is to teach children the importance of hand hygiene and how to appropriately wash their hands at an early age (Tengku Zetty et al.,2020). When preschool children have knowledge about hand washing and can practice it, they can improve their hand hygiene perfectly through repetitive practice. The knowledge of proper hand hygiene needs to be maintained among preschool children as their practice to reduce infectious disease. It was evident that hand washing with soap is important in preventing infection among preschool children (Tengku Jamaludin, & Mohamed, Mohd Rani 2020). However, the rate of practice of hand washing with soap and water is unacceptably low among children (Tengku Jamaludin, 2020). The hand-hygiene routine practice among preschool children is the five (5) crucial times for hand washing, and it was found hand washing mostly performed before and after meals and after they visited toilet. Out of the total, less than half washed their hands after playing outdoors. Hand washing was least performed after playing with pets and after coughing and sneezing (Mohamed, Ramli, Amin, Sulaiman, Salleh, Jamaludin, & Isahak, 2014). This study aims to evaluate the

effectiveness of a special structured hand hygiene education program of preschool children(SHHEP-PC) in relation to preschool children's outcomes of hand washing performance. Specifically, to compare their knowledge and practice of hand washing before and after participation in SHHEP-PC at 3 time period at one pre-school located in Simpang Ampat, Penang, Malaysia.

Methods:

This is a quasi-experimental study implemented in three-time phases of data collection at pre-intervention(T_0); post-intervention (T_1) one day after intervention and post-intervention (T_2) 7 days post intervnetion. The study is to measure and evaluate the differences between knowledge and practice of hand hygiene among preschool students. The study was conducted at Tadika Maju Intelek a private Montessori-based preschool that provides basic education to children aged 3 to 6 before their journey to primary school. The researcher has chosen this study setting because the institution is interested and consented to this research. The school has a total of 35 students consists of 18 students at 6 years old, 9 students at 5 years old and 8 students at 4 years old. There are 1 principal, 2 teachers, and 1 helper at the institution. This study targeted at all preschool students aged between 3 to 6 years old. Thus all 35 students were selected, however 3 students were used as pilot study before the initiation of main study. The instrument consists of a questionnaire and a checklist of hand-washing steps. The questionnaires consist of 3 sections: Section A was to collect baseline demographic data. Section B was a modified questionnaire adapted from Mohamed et al., (2018) to measure the levels of knowledge and practice on hand hygiene and the respondent are required to complete 8 items of knowledge and practice on hand hygiene based on their understanding. Section C was the checklist of hand washing procedure steps to evaluate preschool students' performance of hand washing in pre and post-intervention programs (T_0, T_1 and T_2), a total of 20 marks will be given to participants that able to perform steps correctly. The response of number 1 is the response to 'Yes' (perform correct technique) and number 0 is response to 'No' (perform slightly incorrect or wrong technique). The checklist was to measure the correct technique of hand washing practiced by the respondents three times to make sure all the respondents were able to perform the proper hand washing technique in their school and at home. The questionnaire was delivered in English version only. The same questionnaire was used at T_0, T_1, and T_2.

The Structured Hand Hygiene Education Program of Preschool Children (SHHEP-PC) was developed based on Mohamed et al. (2018). In this intervention program, the researchers divided into three sub-scales, hand hygiene techniques, personal hygiene, and proper

sanitizer among preschool children. In the hands-on session, the researchers demonstrated hand washing techniques based on WHO (2022) guidelines. Additionally, the researchers provide hand sanitizer to each participant for them to practice proper hand washing skills by using the hand rub. This intervention program was delivered in 30 minutes sessions for theory and practical parts. In the theory part, the researchers emphasized the importance of hand hygiene, the 7-step of hand washing technique, and the benefits for preschool children. While in the practical part, we included the show and tell of how to perform the proper 7-step hand washing techniques with demonstration and return demonstration with the checklist provided at T_0, T_1 and T_2. The SHHEP-PC, is an intervention program that focuses on elevating the level of hand hygiene in the aspect of knowledge and practice among preschool children. The program intended to improve the self-hygiene skills of preschool children purposely to reduce the risks of infection in their early stage of life. By enhancing the knowledge and practice of hand hygiene, the participants would be able to benefit from the reduction of risk of infectious disease.

In the SHHEP-PC intervention program, pre and post-questionnaires were distributed to evaluate the knowledge, attitude and hand washing technique of the participants. After a week the same group of participants was re-interviewed on knowledge, attitude and technique of hand washing using the same questionnaires. The post-intervention was immediately after the respondents completed the theory and hands-on session and one week after the post-intervention program delivered to the respondents. The data was collected from 29 August 2022 until 29 September 2022. Permission to conduct this research was also obtained from Maju Intelek Tadika preschool management. Written informed consent obtained from parents and they were assured the identity remain anonymous and confidentiality assured against unauthorized access to the data.The researchers divided the respondents into seven groups based on the numbers of researchers, namely group 1 (G1) until group 7 (G7). Each group consisted of four to five preschoolers. Only two groups have had teachers acting as observers because they are responsible to reinforce the inputs given to the respondent when the researchers were not present. In the first phase, after obtaining written informed consent, participants were seated for the pre-test questionnaire at T_0 within 15 to 20 minutes and assisted to respond. All of the pre-test questionnaires were collected by the researchers. The researchers then observed each respondent's hand washing and hand rub techniques and recorded it on the provided pre-test checklist. In the second phase, the researchers delivered and conducted the SHHEP-PC for roughly about 20 to 30 minutes for theory and 20 to 30 minutes for practical session of proper hand washing and hand rub techniques

with soap, water, and hand sanitizer after completing the hand washing on each respondent and noting it in the pre-checklist. The researchers then carried out a practical section on how to wash hands properly using water, soap, and sanitizer, and the post-checklist was recorded appropriately a second time (T_1). Within 15-20 minutes of the session ending, the researchers distributed the same post-test questionnaire and collected it for T_1 data analysis. Then, each researcher observed each participant in their group performed the hand-washing and hand rub procedures, and they recorded it on the post-intervention checklist (T_1). In the third phase, after a week the researchers, delivered the third same questionnaire within 15 to 20 minutes to the participants. At T_2, no intervention was given to the respondents. Then the researchers observed on handwashing and hand rub techniques based on the provided checklist at T_2 (the seventh day post-intervention program). The data was gathered and returned to the researchers for data analysis after the session is over (Figure 1) This study had obtained ethical clearance from AIMST University Human Ethical Committee with registered number AUHEC/FOAHP/2022/07. The items of the questionnaire were validated by experts in infection control from clinical and academic field. Some items were amended accordingly based on the suggestions. After conducting a pilot study, the researcher analyzed the finding using Kuder Richardson 21 and Cronbach's alpha. If Kuder Richardson 21 is within 0.7 to 1.0 and Cronbach's alpha is more than 0.7, the questionnaire is acceptable and reliable.

Results:

A total of 32 of participants completed the interventional program which included questionnaires. The socio-demographic data consisted of four items: the age, gender, race, religion (Table 1). The mean age of respondents was M=4.50 (SD =0.51) years old. The participant age 5 to 6 years old (n=16; 50.0%) and 3-4 years old (n=16; 50.0%). The participants between male (n=16;50.0%) and female (n=16;50.0%) are the same. Majority of the participants races is India (n=24;75%), Malay and Chinese have the same number (n=4; 12.5%). More than half of the participants (n=20; 62.5%) were Hindu while (n=7; 2.19%) of the participants were Christian, (n=4; 12.5%) were Islam while (n=1; 3.1%) were Buddha.

Table 1: Socio-Demographic Data of Respondents (n=32)

Demographic Variables	**n(%)**
Age (M= 4.50,SD= 0.51)	
3 - 4	16 (50.0)

5 - 6	16 (50.0)
Gender	
Male	16 (50.0)
Female	16 (50.0)
Race	
Malay	4 (12.5)
Chinese	4 (12.5)
India	24 (75.0)
Religion	
Islam	4 (12.5)
Buddha	1 (3.1)
Hindu	20 (62.5)
Christian	7 (21.9)

Note: n= number of participants; %=percentage; M=Mean; SD= Standard Deviation**.**

A 3-point Likert scale was used to measure the level of knowledge on hand hygiene among preschool children. Mean scores was used to classify into two categories; yes, not sure, no and frequently, sometimes, never. Mean scores of 3.00 and 4.00 (mean scores on correct answers) indicate a high level of knowledge. While the mean score of 1.00 to 2.99 indicates a low level of knowledge, the higher the mean score, the better the level of knowledge about hand hygiene among the preschool children. Mean score for item 1 M=1.50 (SD=0.568), p <0.05 (Table 2).

Table 2: Mean Comparison Scores on Level of Knowledge of Hand Hygiene among Preschool Children at T_0, $T_1$and T_2 (n=32).

Items	**T0**			**T1**		**T2**	
	n	M(SD)	p-value	M(SD)	p-value	M(SD)	p-value
1.Do you know what hand hygiene is?	32	1.56(0.91)	0.127	2.62(0.79)	0.021	3.59(0.80)	0.011
2.Do you think	32	1.56(0.91)	0.127	2.25(0.98)	0.044	3.71(0.68)	0.022

hand hygiene is important ?							
3.Do you know how to practice it correctly and effectively ?	32	1.18(0.59)	0.237	2.28(0.85)	0.046	3.03(0.10)	0.050
4.Do you know about 7 steps of hand hygiene practicing ?	32	1.40(0.50)	0.128	1.50(0.71)	0.069	2.00(0.76)	0.058
5.Do you use soap to wash your hands ?	32	1.56(0.80)	0.100	2.87(0.49)	0.029	3.31(0.97)	0.031
6.Do you know 5 crucial moments of hand hygiene? After toileting, before and after meals, after playing outdoors, after sneezing or coughing, after contact with pets.	32	1.46(0.51)	0.629	2.50(0.88)	0.047	3.78(0.87)	0.024
7.Do you know the consequences of improper hand hygiene ?	32	1.31(0.74)	0.346	2.62(0.79)	0.048	3.40(0.91)	0.036
8.Do you know hand washing is part of personal hygiene ?	32	1.63(0.95)	0.154	2.59(0.76)	0.048	3.71(0.63)	0.039

Note: n=number of respondents, M= Mean; SD= Standard Deviation, T0=pre test; T1=post test 1; T2=post test 2

* Significant at level $p<0.05$

The above Table 2 shows the mean comparison of the pre test knowledge, post test T1 and post test T2 on hand hygiene among preschool children in Tadika Maju Intelek. The findings revealed that there were eight statements related to knowledge on hand hygiene. The highest mean score of knowledge of hand hygiene at T0 was M=1.63; (SD=0.95) with p=0.154 where the statement was " Do you know hand washing is part of personal hygiene ?". Next, there were two statements that have the same mean score of M=1.56; (SD=0.91) with p=0.127. The statement were "Do you know what hand hygiene is?" and "Do you think hand hygiene is important ?". Then followed

by “Do you use soap to wash your hands ?” with the mean score M=1.56; (SD=0.80) with p=0.100. Moreover, the mean score was rated M=1.46; (SD=0.51) with p=0.629 for the statement “Do you know 5 crucial moments of hand hygiene? After toileting, before and after meals, after playing outdoors, after sneezing or coughing, after contact with pets.”. Next, the statement “Do you know about 7 steps of hand hygiene practicing ?” the mean score was rated M=1.40; (SD=0.50) and p=0.128. Furthermore, the following statement “Do you know the consequences of improper hand hygiene ?” the mean score was M=1.31; (SD=0.74) with p=0.346. Lastly, the lowest mean score was M=1.18; (SD=0.58) with p=0.128 where the statement was “Do you know how to practice it correctly and effectively ?”. Overall, this indicates that the majority of the preschool children does not have a significant high level of knowledge with a mean score range between M=1.13; (SD=0.74) to M=1.63; (SD=0.95) with p>0.05 in relation to hand hygiene in Tadika Maju Intelek. There was no significant because the test was done before the interventions programme where the preschool children have poor knowledge on hand hygiene. From post-test (T1) was done immediate after the interventions programme. In table 4.2, shows highest mean score of knowledge of hand hygiene was M=2.87; (SD=0.49) with p=0.029 where the statement was “ Do you use soap to wash your hands ?”. Next, there were two statements that have the same mean score of M=2.62; (SD=0.79). The statement were “.Do you know what hand hygiene is?” with p=0.021 and “Do you know the consequences of improper hand hygiene ?” with p=0.048. Then followed by “Do you know hand washing is part of personal hygiene ?” with the mean score rated M=2.59; (SD=076) and p=0.048. Next, the mean score M=2.50; (SD=0.88) with p=0.047. The statement was “Do you know 5 crucial moments of hand hygiene? After toileting, before and after meals, after playing outdoors, after sneezing or coughing, after contact with pets.”. Moreover, the mean score was rated M=2.28; (SD=0.85) with p=0.046 and the statement was “Do you know how to practice it correctly and effectively ?”. The statement “Do you think hand hygiene is important ?” have the mean score of M=2.25; (SD=0.98) and p=0.044. Lastly, the lowest mean score was M=1.50; (SD=0.71) with p=0.069 with the statement “Do you know about 7 steps of hand hygiene practicing?”. Overall, this indicates that the majority of the preschool children have a significant high level of knowledge with a mean score range between M=2.25; (SD=0.98) to M=2.87; (SD=0.49) p>0.05 in relation to hand hygiene in Tadika Maju Intelek. Except for one statement there were no significant of p=0.069, because the preschool children were unable to remember all the 7 steps of hand hygiene. The post-test (T2) was done after 7th days of the intervention programme. The highest mean score of knowledge of hand hygiene

was rated as M=3.78; (SD=0.87) with p=0.024, with the statement "Do you know 5 crucial moments of hand hygiene? After toileting, before and after meals, after playing outdoors, after sneezing or coughing, after contact with pets?". Then, followed by "Do you know hand washing is part of personal hygiene ?" with the mean score was M=3.71; (SD=0.63) and p=0.039. Next, "Do you think hand hygiene is important ?" with M=3.71; (SD=0.68) and p=0.022. Moreover, the mean score value was M=3.59; (SD=0.80) with p=0.011 and the statement was "Do you know what hand hygiene is?". The statement "Do you know the consequences of improper hand hygiene ?" have the mean score of M=3.40; (SD=0.91) with p=0.036. Then, the statement "Do you use soap to wash your hands ?" have the mean score of M=3.31; (SD=0.97) with p=0.031. Furthermore, the mean score rated M=3.03; (SD=0.10) and p=0.050. The statement was "Do you know how to practice it correctly and effectively ?". Lastly, the lowest mean score was M=2.00; (SD=0.76) with p=0.058 and the statement was "Do you know about 7 steps of hand hygiene practicing ?". Overall, this indicates that the majority of the preschool children have a significant high level of knowledge with a mean score range between M=3.03; (SD=0.10) to M=3.78 (SD=0.87) p>0.05 in relation to hand hygiene in Tadika Maju Intelek after the one week one intervention programme. Except for one statement there were no significant of p=0.058, because the preschool children were unable to remember all the 7 steps of hand hygiene. The Table 3 shows the mean comparison score practice at T0 (M=1.76; SD=0.43), T1 (M=2.50; SD=0.74) and T2 (M=3.68; SD=0.75) on hand hygiene among preschool children. The findings revealed that there were five statements related to practice on hand hygiene.

Table 3: Mean Comparison Scores on Level of Practice of Hand Hygiene among Preschool Children at T_0,$T_1$and T_2 (n=32).

Items	T0			T1		T2	
	n	M(SD)	p-value	M(SD)	p-value	M(SD)	p-value
1.How many times do you wash your hands in a day ?	32	1.37(0.71)	0.212	2.56(0.84)	0.030	3.62(0.79)	0.026
2.How long do you wash your hands each time ?	32	2.00(0.25)	0.154	2.00(0.98)	0.048	3.68(0.86)	0.031
3.How do you perform hand	32	1.21(0.42)	0.410	2.21(0.97)	0.032	3.84(0.92)	0.028

washing? (Follow WHO 6 steps of hand washing)							
4.Do you wash your hands until your wrist ?	32	2.59(0.62)	0.903	2.81(0.59)	0.047	3.46(0.72)	0.027
5.Do you dry your hands after washing ?	32	1.62(0.94)	0.154	2.93(0.35)	0.040	3.81(0.47)	0.023

Note: n=number of respondents, M= Mean; SD= Standard Deviation, T0=pre test; T1=post test 1; T2=post test 2

* Significant at level $p<0.05$

A 3 points Likert scale was used to measure the level of practice on hand hygiene among preschool children. Mean scores of practice toward hand hygiene were used to classify into three categories; yes, not sure and no. Mean scores of 3.00 and 4.00 (mean scores on correct answers) indicate a high level of practice. While the mean score of 1.00 to 2.99 indicates a low level of practice. The higher the mean score, the better the level of practice about hand hygiene among the preschool children. In Table 3, the mean on pretest on level of practice on hand hygiene among preschool children. The statement on "Do you wash your hands until your wrist?" had the highest mean scores M=2.59; (SD=0.62) p=0.903. This was followed by "How long do you wash your hands each time?" with mean score was rated M=2.00; (SD=0.254), p=0.154 and "Do you dry your hands after washing?" with the mean was rated M=1.62; (SD=0.941) and p=0.154. Other than that, the mean was rated M=1.37; (SD=0.71) and p=0.212 score in "How many times do you wash your hands in a day?". The last statement was "How do you perform hand washing? (WHO 6 steps of hand washing)" with the mean was rated M=1.21 (SD=0.42) p=0.410. Overall, this indicates that the majority of the preschool children does not have a significant high level of practice on pretest with a mean score range between M=1.28 (SD=0.683) to M=2.41; (SD=0.615) $p>0.05$ in relation to hand hygiene as the test was done before the intervention programme. In Table 3, the comparison of practice hand hygiene means score at post-test (T1). The statement on "Do you dry your hands after washing?" had the highest mean scores M=2.93; (SD=0.35) p=0.040. This was followed by "Do you wash your hands until your wrist " with mean score was rated M=2.81; (SD=0.59), p=0.047 and "How many times do you wash your hands in a day?" with the mean was rated M=2.56; (SD=0.84) and p=0.030. Other than that, the mean was rated M=2.21; (SD=0.97) and p=0.032 score in "How do you perform hand washing? (Follow WHO 6 steps of hand washing)?". The last statement was "How long do you wash your hands each time?"

with the mean was rated M=2.00; (SD=0.98) p=0.048. Overall, this indicates that the majority of the preschool children have a significant high level of practice on pretest with a mean score range between M=2.00; (SD=0.98) to M=2.93; (SD=0.35) p<0.05 in relation to hand hygiene after the immediate intervention programme. In Table 3, the comparison of practice hand hygiene at post-test (T2). The statement on "How do you perform hand washing? (Follow WHO 6 steps of hand washing)" had the highest mean scores M=3.84; (SD=0.92) p=0.028. This was followed by "Do you dry your hands after washing?" with mean score was rated M=3.81; (SD=0.47), p=0.023 and "How long do you wash your hands each time " with the mean was rated M=3.68; (SD=0.86) and p=0.031. Other than that, the mean was rated M=3.62; (SD=0.79) and p=0.026 score in "How many times do you wash your hands in a day?". The last statement was "Do you wash your hands until your wrist?" with the mean was rated M=3.46; (SD=0.072) p=0.027. Overall, this indicates that the majority of the preschool children have a significant high level of practice at T2 with a mean score range between M=3.46; (SD=0.0.72) to M=3.81; (SD=0.47) p<0.05 in relation to hand hygiene after the immediate intervention programme. A 3 -point Likert scale was used to monitor the steps on hand washing practice among preschool children. Mean scores was used to classify into one category; low, moderate, good. Mean scores of 6.00 and 8.00 (mean scores on good marks) indicate a high practice on steps of hand washing. While the mean score of 1.00 to 3.00 indicates a low practice on steps of hand washing, the higher the mean score, the better the practice on steps on hand washing among the preschool children.

Table 4: Mean Comparison of Scores on Checklist on Hand Washing Among Preschool Children T_0, T_1 and T_2 (n=32)

Hand Washing Practice		**T0**	**T1**	**T2**	p-value
Age (Year)	n	M(SD)	M(SD)	M(SD)	
3-4	16	4.69(0.24)	5.63(0.24)	7.69(0.14)	0.000
5-6	16	4.44(0.24)	5.88(0.24)	7.69(0.14)	0.000

Note: n=number of respondents, M= Mean; SD= Standard Deviation, T0=pre test; T1=post test 1; T2=post test 2

* Significant at level p<0.05

The above Table 4 shows the mean comparison of checklist on hand washing practice at T0, T1 and T2 among preschool children. In Table 4 shows the highest mean score of practice on steps of hand washing was M=4.69; (SD=0.24) with p=0.000 for the children age 3-4 years old.

While the lowest mean score was M=4.44; (SD=0.24)with p=0.000 for the children age 5-6 years old. Overall, this indicates that majority of the preschool children on age 3-4 years old does not have a good practice on steps of hand washing with a mean score range between M=4.44; (SD=0.24) to M=4.69; (SD=024) p<0.05 in relation to hand washing. There was significant difference p<0.05 of practice on the steps of hand washing among preschool children.

From post-test (T1) was done immediate after the interventions programme. According to the table 4, the highest mean score was M=5.88; (SD=0.24) with p=0.000 for the children age 5-6 years old. While the lowest mean score was M=5.63; (SD=0.24) with p=0.000 for the children age 3-4 years old. Overall, this indicates that majority of the preschool children on age 5-6 years old have moderate practice on steps of hand washing with a mean score range between M=5.63; (SD=0.24) to M=5.88; (SD=024) p<0.05 in relation to hand washing. There was significant shown because the test was done immediate after the interventions programme where the preschool children have moderate practice on the steps of hand washing. The post-test (T2) was done after one week of the interventions programme. In Table 4, there were same mean score for the children group age 3-4 years old and children group 5-6 years old which was M=7.69; (SD=0.14) with p=0.000. Overall, this indicates that both of the preschool children on age 3-4 years old and 3-4 years old have good practice on steps of hand washing with the mean score M=7.69; (SD=0.14) with p=0.000 in relation to hand washing. There was significant shown because the test was done after one week of the interventions programme where the preschool children have good practice on the steps of hand washing.

Table 5: Mean Comparison of Scores on Checklist on Hand Rub Among Preschool Children T_0, T_1 and T_2 (n=32)

Variable		**T0**		**T1**		**T2**		p-value
Age (Year)	n	Mean	SD	Mean	SD	Mean	SD	
3-4	16	4.69	0.24	5.63	0.24	7.69	0.14	0.000
5-6	16	4.44	0.24	5.88	0.24	7.69	0.14	0.000

Note: n=number of respondents, M= Mean; SD= Standard Deviation, T0=pre test; T1=post test 1; T2=post test 2

* Significant at level p<0.05

A 3 -point Likert scale was used to monitor the practice on steps of hand rub among preschool children. Mean scores was used to classify into one category; low, moderate, good. Mean scores of 6.00 and 8.00 (mean scores on good marks) indicate a high practice on steps of hand

rub . While the mean score of 1.00 to 3.00 indicates a low practice on steps of hand washing, the higher the mean score, the better the practice on steps on hand rub among the preschool children. In Table 5, the highest mean score was M=4.69; (SD=0.24) with p=0.000 for the children age 3-4 years old. While the lowest mean score was M=4.44; (SD=0.24)with p=0.000 for the children age 5-6 years old. Overall, this indicates that majority of the preschool children on age 3-4 years old does not have a good practice on steps of hand rub with a mean score range between M=4.44; (SD=0.24) to M=4.69; (SD=024) p<0.05 in relation to hand rub. There was significant shown because the test was done before the interventions programme where the preschool children have poor practice on the steps of hand rub. The post-test (T1) was done immediate after the interventions programme. In Table 5, the highest mean score was M=5.88; (SD=0.24) with p=0.000 for the children age 5-6 years old. While the lowest mean score was M=5.63; (SD=0.24) with p=0.000 for the children age 3-4 years old. Overall, this indicates that majority of the preschool children on age 5-6 years old have moderate practice on steps of hand rub with a mean score range between M=5.63; (SD=0.24) to M=5.88; (SD=024) p<0.05 in relation to hand rub. There was significant shown because the test was done immediate after the interventions programme where the preschool children have moderate practice on the steps of hand rub. The post-test (T2) was done after one week of the interventions programme. In Table 5, there were same mean score for the children group age 3-4 years old and children group 5-6 years old which was M=7.69; (SD=0.14) with p=0.000. Overall, this indicates that both of the preschool children on age 3-4 years old and 3-4 years old have good practice on steps of hand rub with the mean score M=7.69; (SD=0.14) with p=0.000 in relation to hand rub. There was significant because the test was done after one week of the interventions programme where the preschool children have good practice on the steps of hand rub.

Table.6: Effect of SHHEP-PC on Related to Hand Washing Between T_0, T_1 and T_2 Group Across Time

Hand Washing Steps	df	MS	F-value	p-value	η_p^2
Time	2	0.118	108.75	0.000	0.882
Time*Group	2	7.500	108.75	0.000	0.882
Group	2	7.500	108.75	0.000	0.882

Note: df= Degrees of freedom; MS= Measured Squared; η_p^2= Partial Eta Squared; *Significance at level p<0.05

General linear model (GLM) and estimated effect size were used to measure the effect of the SHHEP-PC related to hand washing steps at T0, T1 and T2 between time, across time, and group After controlling for selected age categories, the partial Eta- squared across time (η_p^2

=0.882; p=0.000) between time and group (η_p^2 =0.882; p=0.000) and between group (η_p^2 =0.882; p=0.000) was large (Table 6). Overall, there was a significant effect p=0.000 on preschool children related to hand washing procedure after participation in the SHHEP-PC across time and group at T0 ,T1 and T2.

Table 7: Effect of SHHEP-PC on Related to Hand Rub Between T_0, T_1 and T_2 Group Across Time

Hand Rub Steps	df	MS	F-value	p-value	η_p^2
Time	2	0.118	108.75	0.000	0.882
Time*Group	2	7.500	108.75	0.000	0.882
Group	2	7.500	108.75	0.000	0.882

Note: df= Degrees of freedom; MS= Measured Squared; η_p^2= Partial Eta Squared; *Significance at level p<0.05

General linear model (GLM) and estimated effect size were used to measure the effect of the SHHEP-PC on hand rub steps at T0, T1 and T2 across time. After controlling for selected age categories, the partial Eta- squared across time (η_p^2 =0.882; p=0.000); across time and group (η_p^2 =0.882; p=0.000) and across group (η_p^2 =0.882; p=0.000) was large (Table 7). Overall, there was a significant effect p=0.000on preschool children related to hand rub procedure after participation in the SHHEP-PC across time at T0, T1 and T2.

Discussions

This study was carried out to determine the level of knowledge and practice of hand hygiene before and after giving Structured Hand Hygiene Educational Program at a local preschool. Overall, the findings demonstrated a positive outlook towards this intervention program. There were 32 participants involved in this research study, consisting of 30 preschoolers and 2 teachers. Majority of them were Indian, followed by Malay and Chinese. The participants came from a local preschool. All parents and guardians of participants agreed to let their child participate in this research study without any coercion. Majority 100 % benefited from this intervention program and demonstrated significant improvement in knowledge and practice of hand hygiene during preschool setting. Good number of participants were 100% able to gain knowledge through this education program and around 100% of participants were able to demonstrate most of the steps using WHO hand washing technique after Structured Hand Hygiene Education Program of Preschool Children (SHHEP-PC) was carried out. This study found that the respondents, with age between 3-4 (50%) and for ages between 5-6 (50%). For gender, the respondents were equally distributed, female which were 50%. Male respondents about 50%. In this study, majority races among the

respondents were India, which were 75%, for Malay were 12.5% and Chinese were 12.5%. Majority of the respondents believe in Hinduism, 62.5%, the remaining respondents believe in Christianity, 21.9%, 12.5% were practices Islam and 3.1% of the respondents believe in Buddhism. Research reveals the benefits of hand hygiene intervention programs in facilitating smooth transition for preschool children as well as the positive impacts of intervention programs in the transitional stage, Mohamed, Ridzuwan, Ungah, and Jamaluddin (2018). The results of this study demonstrated similar results as most of the respondents responded positively to the impacts of the intervention program. Majority of the preschool children perceived that the hand hygiene intervention program had significantly assisted them to increase self-awareness and achieve better self-hygiene. This finding is supported by Rani, Mohamed, Jamaluddin, Ismail, Ramli, Faroque, Samad, Ariffien Farid, & Isahak (2020) results that found hand hygiene intervention programs allow students to develop hand washing awareness during crucial times. The finding also revealed that the majority of preschool children perceived hand hygiene intervention programs to enhance their level of knowledge on hand hygiene M=3.31 (SD=0.97) as well as improve their practice on hand hygiene M=3.46 (SD=0.72). Comparable findings were reported by Rani, Mohamed, Jamaluddin, Ismail, Ramli, Faroque, Samad, Ariffien, Farid, Isahak, (2020), a study conducted to exam the effectiveness of comprehensive hand hygiene modules on preschool children in Klang Valley. The overall results showed that the test group acquired higher knowledge and implemented better practice of hand hygiene. The knowledge on hand hygiene can be attributed to numerous factors. Whereas, the most advantageous knowledge on hand hygiene among preschool students showed that parents are the greatest influence in teaching the children hand washing. This result supports a previous study by Mohamed (2020) who found that most parents agreed that they should teach their children how to wash hands properly and that children's hands should always be kept clean. The result of this study shows that most preschool children react positively to the knowledge of hand hygiene. The findings reveal that the preschool children have better knowledge on five crucial moments of hand hygiene after the post-test M=3.78 (SD=0.87), such as after toileting, before and after meals, after playing outdoors, after sneezing or coughing, and after contact with pets. A comprehensive hand hygiene education program should include parents and teachers in the preschools' education syllabus to inculcate positive hand hygiene (Tengku Zetty et al., 2020). The study also reported after the post test, preschool children have a clearer idea that they need to use soap to wash hands M=3.31 (SD=0.97), where effective hand washing was able to reduce the transmission of microorganisms. Effective hand washing with soap has

been shown to remove bacteria more effectively compared to hand washing with water alone. This is because soap contains surfactants that dislodge microorganisms from the skin, Nurul Asmawati (2020).The findings in this study reveal that most of the preschool children acknowledge the consequences of improper hand hygiene M=3.40 (SD=0.91). This finding was supported by Nurul, Amin and Nooriah (2016) that due to overcrowding and the natural closeness of children, infections were frequently spread among them in nurseries. Through appropriate sanitation and hand hygiene, it is possible to avoid the spread of disease when skin and hands come into contact.The study shows that after the hand washing teaching by researchers, the preschool children were able to acknowledge the duration of hand washing each time M=3.68 (SD=0.86). The World Health Organization guidelines, 2020 reported that the most effective hand washing duration was 10 seconds to 30 seconds. Proper hand washing with soap and water is considered highly effective at removing microbial contamination and against enveloped viruses. Besides, the findings in this study reveal that the preschool children were able to understand how frequently they should perform hand washing in a day after the education programme M=3.62 (SD=0.79). Based on Tengku Jamaluddin theory (2020) according to the findings of his study, hand washing was mostly done before and after meals, as well as after using the restroom. This reflected their fundamental behaviors as they were taught to do so by most of their parents and teachers.The study report also shows positive results that preschool children have a better understanding of the correct ways to perform hand washing M=3.84 (SD=0.92) according to WHO 6 steps of hand washing. These findings correspond with World Health Organization (WHO), 2022 where it was critical to stop the spread of infectious diseases by performing hand washing using the 6 steps hand wash. This easy hand hygiene technique should be encouraged at home to protect the community against transmission of microorganisms. After Structured Hand Hygiene Education Program Among Preschool Children (SHHEP-PC) program, the preschool children able to achieve an average mean of 7.69 during T2. In comparison with T0, which preschool children only able to obtain an average mean of 4.57. Meanwhile, preschool children hand rub practice were enhanced with an average mean score of 7.69 in T2, while during T0 were only 4.57. This reflect the effectiveness of SHHEP-PC is good.

Conclusions

Results indicate that with SHHEP-PC, examined preschool children gain knowledge and better hand washing practice. They received better knowledge regarding the purpose of hand washing, indication for hand washing and understood the consequence of not practicing

hand wash. In addition, their hand washing techniques have been improved significantly with new understanding on duration and frequency that can contribute to the effectiveness of hand washing. The effect of SHHEP-PC is large and significant outcome in Knowledge and Practice of Hand Hygiene (Hand Washing and Hand Rub). Their positive findings indicate that the community should focus and direct this education program into part of the childhood education to reduce the prevalence of infectious disease in the community.

References

1,.AL,Bashtawy, M. (2015). Personal hygiene in school children aged 6–12 years in Jordan. British Journal of School Nursing, 10(8)

2.Alexandrino, A. S., Santos, R., Melo, C., & Bastos, J. M. (2016). Risk factors for respiratory infections among children attending day care centres. Family practice, 33(2)

3.Al-Maani, A., Al Wahaibi, A., Al-Zadjali, N., Al-Sooti, J., AlHinai, M., Al Badawi, A., Al Saidi, A., AlZadjali, N., Elshoubary, W.,Al-Harthi, K., & Al-Abri, S. (2022). The impact of the hand hygiene role model project on improving healthcare workers' compliance: A quasi-experimental observational study. Journal of Infection and Public Health, 15(3), 324-330.

4.Alsan, M., Bloom, D. E., & Canning, D. (2006). The effect of population health on foreign direct investment inflows to low- and middle-income countries. World Development, 34(4), 613–630. Austin, A., Langer, A., Salam, R. A., Lassi, Z. S., Das, J. K., & Bhutta, Z. A. (2014).

5.Approaches to improve the quality of maternal and newborn health care: an overview of the evidence. Reproductive health, 11(2), 1-9.

6.Lange, S. L., Barnard, T. G., & Naicker, N. (2019). Effect of a simple intervention on hand hygiene related diseases in preschools in South Africa: research protocol for an intervention study. BMJ Open, 9(12), e030656.

7.Mathew, S. M., & Sujatha, R. (2018). Effectiveness of Child To Child Approach on Practice of Hand Washing Among School Children in a Selected School at Mangalore.

8.Mohamed, N. A., Ridzuwan, M. H. M., Ungah, N. A. E., & Jamaluddin, T. Z. M. T. (2018). Effects of "Bacterfree Hand Intervention" on the knowledge, attitude of handwashing and its technique, among pre-schoolers in Wilayah Persekutuan, Malaysia. Bangladesh Journal of Medical Science, 17(1), 67-70.

9.Mohamed, N. A., Ramli, S., Amin, N. N. Z., Sulaiman, W. S. W., Salleh, N. M., Jamaludin, T. Z. M. T., & Isahak, C. I. C. (2014). Knowledge, attitudes and practice of hand hygiene among parents of nursery children in Ampang, Selangor: a pilot study. Journal of Infection Prevention.

10.Mustafa, L. M., & Azman, M. N. A. (2013). Preschool education in Malaysia: Emerging trends and implications for the future. American Journal of Economics, 3(6), 347-351.

11.Rani, M. D. M., Mohamed, N. A., Jamaluddin, T. Z. M. T., Ismail, Z., Ramli, S., Faroque, H., Samad, F. N. A., Ariffien, A. R., Farid, A. A. R. C. A., & Isahak, I. (2020). Effectiveness of comprehensive hand hygiene module on preschool children in Klang Valley, Malaysia. Clinical and Experimental Pediatrics, 63(3), 115.

12.Rosen, L., Zucker, D., Brody, D., Engelhard, D., & Manor, O. (2009). The effect of a handwashing intervention on preschool educator beliefs, attitudes, knowledge and self- efficacy. Health education research, 24(4), 686-698.
13.Tellier, R, Li, Y, Cowling, BJ, Tang, JW. Recognition of aerosol transmission of infectious agents: A commentary. BMC Infect Dis. 2019;19
14.Tengku Jamaluddin, T. Z. M., Mohamed, N. A., Mohd Rani, M. D., Ismail, Z., Ramli, S., Faroque, H., Samad, F. N. A., Affiffien, A. R., Farid, A. A. R. C. A., & Isahak, I. (2020). Assessment on Hand Hygiene Knowledge and Practices Among Pre-school Children in Klang Valley. Global Pediatric Health, 7,2333794X20976369.
15.Zomer, T. P., Erasmus, V., van Beeck, E. F., Tjon-A-Tsien, A., Richardus, J. H., & Voeten, H. A. (2013). Hand hygiene compliance and environmental determinants in child day care centers: an observational study. American journal of infection control, 41(6), 497-502.
16.Wang, Y., Xu, C., Zhang, S., Yang, L., Wang, Z., Zhu, Y., & Yuan, J. (2019). Development and evaluation of a deep learning approach for modeling seasonality and trends in hand-foot-mouth disease incidence in mainland China. Scientific reports, 9(1), 1-15.
17.White, K. M., Jimmieson, N. L., Obst, P. L., Graves, N., Barnett, A., Cockshaw, W., Gee, P., Hanemen, L., Page, K., Campbell, M., Martin, E., & Paterson, D. (2015). Using a theory of planned behaviour framework to explore hand hygienebeliefs at the '5 critical moments' among Australian hospital-based nurses. BMC health services research, 15(1), 1-9.
18.Why Wash Your Hands? Read the Science Behind the Recommendations.(n.d.).,from https://www.cdc.gov/handwashing/why-handwashing.html
19.Younie, S., Mitchell, C., Bisson, M. J., Crosby, S., Kukona, A., & Laird, K. (2020). Improving young children's handwashing behaviour and understanding of germs: The impact of A Germ's Journey educational resources in schools and public spaces. Plos One, 15(11), e0242134.
20.Zomer, T.P, Erasmus, V, Van Beeck, E.F, Tjon-A-Tsien, A, Richardus, J.H, & Voeten H,A.(2013). Hand hygiene compliance and environmental determinants in child day care centers: An observational study. Am J Infect Control. 41(6):497-502.