



Research Article

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Knowledge, attitudes and practices of hand hygiene among parents of preschool children

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Abstract

Background- Infections spread easily among children in nurseries due to overcrowding and their natural intimacy. Disease transmission via skin (particularly hand) contact is preventable through proper hand hygiene and good sanitation. Parental support and involvement in developing child's hygienic behavior are essential in promoting child's well being. This study aimed to determine knowledge, attitudes and practices of parents on hand hygiene, related to the care of their children. **Methods-** This cross-sectional study involved 240 parents of preschoolers in the Klang Valley, Malaysia. Participants were given self-administered questionnaires consisting statements related to personal hand hygiene, hand hygiene practices during childcare and infections related to poor hand hygiene. **Results-** The mean score for knowledge of hand hygiene was 2.72(SD 0.26) out of 3.00. Meanwhile, the mean score for attitude and practice of hand hygiene were 4.56(SD 0.58) out of 5.00 and 4.36 (SD 0.65) out of 5.00 respectively. Overall results showed that majority of parents had a good understanding of hand hygiene. However, about two thirds parents did not agree on washing hands before interacting with their children. Of concern, about 76% parents are unaware of correct hand washing techniques. **Conclusions-** This study highlighted the need for more comprehensive educational programs to create awareness regarding the importance of hand hygiene particularly among parents and children. This is very important for prevention of communicable diseases in the community.

Keywords: Hand hygiene, Parents, Preschoolers, Knowledge, Attitude, Practice.

INTRODUCTION

Children at daycare and kindergartens are at higher risk of getting infections. The overcrowded environment, children's natural intimacy where body contact is inevitable, lack of understanding on basic hygiene and lack of natural immunity to viruses and bacteria were among factors attributed to high rate of infections in the kindergartens [1]. Recurrent infections may have negative impact on children's psychological and psychosocial well-being as well as quality of life.

Microorganisms spread via contact (direct or indirect), air, food and vectors. Preventive strategies should be directed at interrupting the chain of transmission, which hand hygiene is the single most effective and cheapest measure. Hand hygiene has been shown to reduce the occurrence of acute gastroenteritis (AGE) and acute respiratory illness (ARI) in childcare setting [2]. Those infections could also be transmitted to parents and other family members. According to Sacri *et al*, the parental risk of AGE and ARI acquisition from their children was significant and the impact include parental work loss [3].

Educating children on basic knowledge of infection and hand hygiene is crucial to minimize the risk of infection and transmission. It should be started during their early learning environment at home where parents set good examples, followed by formal education in preschools, primary and secondary schools. Principles of hygiene should be made part of everyday life and the best way for parents to teach their children about good hygiene is to lead by example.

There is paucity of available literature regarding parental knowledge, attitude and practice regarding hand hygiene. Most studies targeted children and teachers and aimed at school-based interventions. Hence, we conducted this present study to evaluate parents' knowledge, attitude and practice on personal hygiene and hand hygiene, in relation to childcare. The study findings will help to improve the delivery of hand hygiene education to the community, which consequently results in improved society perception

and behavior on hand hygiene.

MATERIALS AND METHODS

Study population and Data Collection

This cross-sectional study involved randomly selected parents and guardians of preschoolers from 4 kindergartens in the Klang Valley. Written approval from related agencies (*Majlis Agama Islam Wilayah Persekutuan* and the Ministry of Rural and Regional Development) was obtained prior to commencement of this study. The parents were given a set of pre-tested, self-administered questionnaires pertaining to their knowledge, attitude and practice related to personal hand hygiene, hand hygiene practices during the care of children and infections related to poor hand hygiene.

Questionnaire Design

The questionnaire for this study was prepared based on Malaysia Guideline on Management of Children in Kindergartens and Preschools and literature reviews. It consisted of two parts; Part A contained demographic data that includes parental age, gender, race, level of education, number of children and employment. Part B comprised of 25 items (seven items on knowledge, eight items on attitude and ten items on practice) regarding hand hygiene. For knowledge section, respondents were asked to choose from three options- yes, no and not sure. Whereas, for attitude and practice sections, they have to choose from 5 options- strongly disagree, disagree, not sure, agree and strongly agree.

Pre-test

The reliability of the questionnaire designed was determined by a pre-test on 30 administrative staff with preschool children. This group of parents was not included in the actual study. By using *Cronbach Alfa* test, the reliability coefficient test was 0.65. Following the item analysis, two questions were removed and three other questions were modified to improve clarity.

Scoring system

The scoring mechanism for each section was developed by the researchers. For knowledge, each correct answer was given a score of 3, 'not sure' answer was given a score of 2, while each wrong answer was given a score of 1. One out of seven questions was a negatively-framed statement. A respondent could score a maximum of 21 marks and a minimum of 7 marks in the knowledge section. For attitude and practice sections, a score of 1 was given to 'strongly disagree', a score of 2 was given to 'disagree', a score of 3 was given to 'not sure', a score of 4 was given to 'agree', and a score of 5 was given to 'strongly agree'. There were two negatively-frame statements in the attitude section and one such statement in the practice section. Overall, the score was reversed for all the negative items. A respondent could score a maximum of 40 and a minimum of 8 in the attitude section and a maximum of 50 and a minimum of 10 in the practice section. The final KAP score was calculated by adding up the scores of the knowledge, attitude and practices sections correspondingly. The scores were classified into good or poor based on 70% cut-off point out of the total expected score ^[4].

Data Analysis

Data were analyzed using SPSS software (version 21). Frequency distribution and percentages were used to analyze categorical variables.

Continuous variables were evaluated by means and standard deviations. Correlation was determined by Pearson's correlation coefficient.

RESULTS

A total of 300 questionnaires were distributed, with 80% (240) returned rate. Almost all respondents were parents; 45.8% mothers and 52.9% fathers. Majority of them were 30 to 40 years old with mean age of 35.9 (SD 6.27). More than 90% of respondents received at least secondary education. Almost 90% of respondents had 4 children or less. Only 13.3% of the respondents were not working at the time of this study. Table 1 summarized the demographic data of the respondents.

Table 1: Demographic data of respondents

Item	Demographic characteristics	Number (%)
Category	Mother	110 (45.8)
	Father	127 (52.9)
	Guardian	2 (0.8)
	Others	1 (0.4)
Age	21-30	46 (19.6)
	31-40	135 (56.3)
	41-50	53 (22.1)
	>50	5 (2.1)
Race	Malay	234 (97.5)
	Others	6 (2.5)
Level of Education	Primary education	0
	Secondary Education	155 (64.6)
	Tertiary Education	69 (28.7)
	Others	16 (6.7)
No of children	1	47 (19.6)
	2	54 (22.5)
	3	70 (29.2)
	4	43 (17.9)
	5	16 (6.7)
	≥6	10 (4.1)
Employment	Government sector	136 (56.7)
	Private sector	67 (27.9)
	Not working	37 (15.4)

The total mean score of knowledge, attitude and practice were 2.73 (SD 0.13), 4.56 (SD 0.58), 4.36 (SD 0.65) respectively. The total KAP score ranged from 13 to 50 (refer Table 2). The scores were considered good if it was more than 15 for knowledge, more than 28 for attitude and more than 35 for practice. Scores lower than the above said figures were considered poor ^[4]. All respondents (100%) had good knowledge in hand hygiene. Only 0.8% respondents had poor attitude and practice related to hand hygiene.

Table 2: Total score of KAP

	Knowledge	Attitude	Practice
Minimum	15	17	30
Average	19	36	43
Maximum	21	40	50

Table 3 shows the mean knowledge, attitude and practice on hand hygiene in male and female respondents. The mean differences were not significant.

Table 3: Mean score of KAP based on gender (n=240)

Gender	Male (n=128) Mean (SD)	Female (n=112) Mean (SD)	p
Knowledge	2.72 (0.12)	2.73 (0.14)	0.491
Attitude	4.54 (0.67)	4.56 (0.47)	0.592
Practice	4.32 (0.62)	4.36 (0.69)	0.161

The descriptive analysis of mean score knowledge, attitude and practice on hand hygiene with respondents' number of children. Mean score for knowledge, attitude and practice were between 2.70 to 2.74, 4.36 to 4.64, and 4.07 to 4.44 respectively.

According to Table 1, majority of respondents (64.6%) received secondary education and 28.7% received tertiary education. A one-way

analysis of variance (ANOVA) was calculated for mean score knowledge, attitude and practice (KAP) of the level of education. The result revealed that there were no significant differences on KAP between these three groups (secondary, tertiary, others) on level of education (refer table 4).

Table 4: Analysis of variance (ANOVA) comparison three groups of KAP

		Sum of Squares	df	Mean Square	F	Sig.
Mean knowledge	Between Groups	0.010	2	0.005	0.306	0.737
	Within Groups	3.973	237	0.017		
	Total	3.983	239			
Mean attitude	Between Groups	0.869	2	0.435	1.282	0.279
	Within Groups	80.341	237	0.339		
	Total	81.211	239			
Mean practice	Between Groups	1.139	2	0.569	1.351	0.261
	Within Groups	99.918	237	0.422		
	Total	101.057	239			

ANOVA was also calculated for mean score knowledge, attitude and practice (KAP) according to the number of children and the type of employment. The result revealed that there were no significant differences on KAP between parents with different number of children. Similarly, type of employment did also not show differences on KAP significantly.

Table 5 showed correlation between means knowledge, attitude and practice. There was a significant correlation between knowledge and attitude. It also showed that correlation between attitude and practice was also significant.

Table 5: Correlations between mean knowledge, attitude and practice

		Mean knowledge	Mean attitude	Mean practice
Mean knowledge	Pearson correlation	1	0.169**	0.057
	Sig. (2-tailed)		0.009	0.382
	N	240	240	240
Mean attitude	Pearson correlation	0.169**	1	0.296**
	Sig. (2-tailed)	0.09		0.000
	N	240	240	240
Mean practice	Pearson correlation	0.057	0.296**	1
	Sig. (2-tailed)	0.382	0.000	
	N	240	240	240

Table 6 and 7 show list of questionnaires and the response rate.

Table 6: Knowledge-related Questions and Answers

Questions	Yes N (%)	Not Sure N (%)	No N (%)
1 Bacteria may spread from hands to the nose and mouth	233 (97.1)	4 (1.7)	3 (1.3)
2 The correct techniques hand washing have 5 steps	184 (76.7)	22 (9.2)	34 (14.2)
3 Unwashed hands can cause diarrhea	228 (95)	3 (1.3)	9 (3.8)
4 Clean hands may reduce food contamination	237 (98.8)	0	3 (1.3)
5 Proper hand washing can prevent infectious diseases	229 (95.4)	3 (1.3)	8 (3.3)
6 It is our responsibility to ensure the children to wash hands properly	240 (100)	0	0
7 The bacteria can spread easily if we keep long nails	235 (97.9)	4 (1.7)	1 (0.4)

Table 7: Attitude and Practice-related Questions and Answers

	Questions	1 N (%)	2 N (%)	3 N (%)	4 N (%)	5 N (%)
	<i>Attitude</i>					
1	<i>Always keep the children's hands clean</i>	1 (0.4)	1 (0.4)	1 (0.4)	59 (24.6)	178 (74.2)
2	<i>We need to wash hands with soap after going to the toilet</i>	1 (0.4)	0	0	64 (26.7)	175 (72.9)
3	<i>We need to wash hands before eating</i>	1 (0.4)	1 (0.4)	0	50 (20.8)	188 (78.3)
4	<i>We need to wash hands after eating</i>	2 (0.8)	0	0	42 (17.5)	196 (81.7)
5	<i>Before handling food such as raw materials, we do not have to wash hands</i>	94 (39.2)	82 (34.2)	15 (6.3)	25 (10.4)	24 (10)
6	<i>I have to keep nails short and clean</i>	2 (0.8)	0	1 (0.4)	57 (23.8)	180 (75)
7	<i>Hand towels should not be shared</i>	3 (1.3)	10 (4.2)	31 (12.9)	91 (37.9)	105 (43.8)
8	<i>I do not have to teach children how to wash hands properly</i>	154 (64.2)	72 (30)	3 (1.3)	9 (3.8)	2 (0.8)
	<i>Practice</i>					
1	<i>I wash my hands with soap after going to the toilet</i>	0	0	3 (1.3)	89 (37.1)	148 (61.7)
2	<i>I always remind the children to wash hands before and after eating</i>	0	0	0	56 (23.3)	184 (76.7)
3	<i>I wash hands after bathing children</i>	1 (0.4)	37 (15.4)	31 (12.9)	103 (42.9)	68 (28.3)
4	<i>I always wash my hands before handling raw material such as chicken and beef</i>	1 (0.4)	3 (1.3)	88 (36.7)	148 (61.7)	0
5	<i>I always wash my hands after handling raw material such as chicken and beef</i>	1 (0.4)	1 (0.4)	2 (0.8)	74 (30.8)	162 (67.5)
6	<i>I wipe my wet hands until dry</i>	0	1 (0.4)	7 (2.9)	100 (41.7)	132 (55)
7	<i>I wash my hands after changing diapers</i>	0	2 (0.8)	10 (4.2)	84 (35)	144 (60)
8	<i>I do not wash hands before touching children</i>	84 (35)	77 (32.1)	31 (12.9)	34 (14.2)	14 (5.8)
9	<i>I wash my hands after touching children</i>	17 (7.1)	48 (20)	54 (22.5)	81 (33.8)	14 (5.8)
10	<i>Washing hands with soap is my practice</i>	0	0	6 (2.5)	77 (32.1)	157 (65.4)

1= strongly disagree, 2= disagree, 3= not sure, 4= agree, 5= strongly agree

DISCUSSIONS

Knowledge on Hand Hygiene

The overall knowledge of hand hygiene was good. Based on Table 6, respondents have good knowledge on basic hand hygiene where more than 95% answered 6 out of seven questions correctly. This was perhaps due to their usual understanding on personal and hand hygiene, obtained from formal and informal learning processes. In contrast, only 14.2% respondents answered question regarding techniques of proper hand washing, correctly.

This finding showed that most parents did not know the correct technique of hand washing that involves the following steps: rubbing both palms with fingers interlaced, rubbing right palm onto left dorsum with finger interlaced and vice versa, rubbing knuckles and fingers, rotational rubbing of thumbs, rubbing tips of right fingers on left palm and vice versa and rotational rubbing of wrist. This question was rather tough and tricky for non-healthcare workers. Questions on the techniques should be more layman-friendly, for example by using pictogram on correct and incorrect steps or by giving open-ended question on how to do proper hand washing.

Nevertheless, this result should trigger us to be more aggressive in teaching public on proper hand hygiene. Washing hands with correct technique have been shown to reduce spread of infectious diseases, such

as diarrhea and respiratory infections. Clean hands are the single most important factor in preventing the spread of pathogens and antibiotic resistance in healthcare settings. In 2009, the World Health Organization (WHO) has issued an evidence-based *Guidelines on Hand Hygiene in Health Care* to provide health-care workers (HCWs), hospital administrators and health authorities on hand hygiene in health care and specific recommendations to improve practices and reduce transmission of pathogenic microorganisms to patients and HCWs [5].

Of late, there were numerous reports on community-acquired infections that caused by multidrug resistance organisms namely methicillin-resistant *Staphylococcus aureus* (MRSA) and extended spectrum beta-lactamase (ESBL) *Escherichia coli* [6,7]. Resistant organisms, which spread via close contacts, cause infections that are associated with increased mortality, morbidity, health care costs, and the need for broad-spectrum antibiotics [8]. Thus, embarking public education on hand hygiene is one of the simplest and cost-effective ways to lessen the disease burden.

Attitude and Practice on Hand Hygiene

Majority of respondents reported good attitudes and practices related to hand hygiene. More than 90% agreed that hands should be washed before and after eating and soap should be used to wash hands after coming out from toilets. Almost all stated that children's hands should always be kept clean and 94.2% disagreed with 'I do not have to teach

my children how to wash hands properly' statement. Contrary, majority parents did not wash their hands before and after contact with their child. These may be due to several reasons. First, parents are unaware that children are more vulnerable than adults, due to their lack of immunity towards bacteria and viruses. Diarrheal and respiratory infections spread readily in the household. Asymptomatic parents or adults may also become healthy carriers and transmit diseases to children. Second, they also were unaware that hand hygiene was able to reduce disease transmission. Pang *et al* had similar findings, where half of adult respondents from their study did not wash hands before and after attending to a child or sick person [9].

The behavior of washing hands before and after interacting with children and sick people had a large protective effect against diarrhea and respiratory illness [10, 11]. Good hand hygiene practice is very essential to break transmission of infectious diseases as recommended by the World Health Organization (WHO) "Five moments of hand hygiene". In the hospital setting, hand hygiene should be practiced in this '5 moments'; before touching patients, after touching patients, after doing procedure, after touching patient's environment and before doing aseptic technique. This simple practice of hand hygiene should be adapted at home, where adults or older children wash their hands before and after touching children and babies.

This study showed that there were significant correlation between knowledge and attitude, as well as attitude and practice. This result indicated that attitude can be influenced by knowledge, and good attitude may result in good practices. Therefore, we propose that a comprehensive community and school-based program should be implemented. This is to ensure that everyone get hold of the essence of hand hygiene; where, when and how to practice hand hygiene. To reach the community, flexible and creative approaches such as interactive talk, hands-on program, quizzes and posters should be initiated. Imparting knowledge to parents would result in better understanding on hand hygiene, which information would be conveyed to their children, either directly or indirectly.

Our findings showed that the knowledge, attitude and practice of hand hygiene according to parents' level of education, number of children and type of employment were not significantly different. However, educated parents were associated with better children education. This is evidenced by a report by Nematian *et al* where they found that parents with higher educational level were related to decreased infection rate in their children. The reduction of infection rate in their children might also be associated with several other contributing factors; environment, lifestyles and access to medicine [12].

Naturally, mothers are more concern of cleanliness, child's appointment, vaccination and health. Maternal education has been suggested to be a powerful and significant determinant of child health status [13]. Therefore, community-based public education specifically for mothers should be encouraged in order to improve children's hygienic behavior and their health status. The best time to reach out to young mothers would be during prenatal and postnatal classes.

Hand hygiene intervention in the community is also important for several other reasons: recent explosion in the options and use of hand-hygiene products in the community and the risk of acquiring antibiotic-resistant bacteria, associated with use of some hand-hygiene products such as antibacterial soaps [14]. This study identified a few areas that need to be emphasized in the program; the importance of hand hygiene before and after childcare and hand washing steps.

Community-based program should also include activities targeting school pupils. Schools should not merely focus on academics attainment, but personal development, wellbeing and health ought to be balanced. Nurturing preschool children in their early learning environment might subsequently change their behavior towards practicing good hand hygiene. In Europe, hand hygiene topic is extremely covered, where many countries teach pre-primary school children how to wash their hands. This message is repeated at both the junior and senior school level, and school children are thought that hand washing can help prevent the spread of infection [15]. This curriculum should be emulated and conducted properly in all schools. Theoretical and practical teaching and learning should be supported by adequate facilities and strong courage. This is to exert a long-lasting, positive influence on the performance of hygiene routines.

Several limitations have been observed from this study due to time constraint and limitation of the funding. This study only involved parents but not their child. Thus, correlation of parents' and their child's knowledge, attitude and practice on hand hygiene could not be determined. Preschool teachers and caretakers should also be involved to ensure continuity of child education from home to preschool environment. Questions should also be improved and expanded to cover wider aspect of hand hygiene and childcare. However result of this study had shed a glimpse of information about knowledge, attitudes and practices of hand hygiene among parents of preschool children as a baseline parameter for a bigger study in the near future.

CONCLUSIONS

Overall knowledge, attitude and practice of hand hygiene amongst parents of preschoolers were good. However, the proper hygiene practice was not as anticipated. Future interventions should target community and school children and focus more on the important aspects of hand hygiene; *how, when and where*.

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REFERENCES

1. Brady, M.T. Infectious disease in pediatric out-of-home child care. *Am J Infect Control*. 2005;33(5):276-85.
2. Warren-Gash C.I., Fragaszy E., Hayward A.C. Hand hygiene to reduce community transmission of influenza and acute respiratory tract infection: a systematic review. *Influenza Other Respir Viruses*. 2013; 7(5):738-49.
3. Sacri A.S., De Serres G., Quach C., Boulianne N., Valiquette L., Skowronski D. Transmission of Acute Gastroenteritis and Respiratory Illness From Children to Parents. *Paediatric Infectious Disease Journal*. 2014;33 (6): 583-588.
4. Doshi D., Reddy B.S., Kulkarni S., Karunakar P. Breast Self-examination: Knowledge, Attitude, and Practice among Female dental Students in Hyderabad City, India. *Indian J Palliat Care*. 2012;18 (1): 68-73.
5. WHO. Guidelines on Hand Hygiene in Health Care. 2009 <http://www.who.int/gpsc/5may/tools/9789241597906/en/>
6. Zainol Rashid Z., Bahari N., Othman A., Jaafar R., Mohamed N.A., Jabbari I., *et al*. Community-Acquired Methicillin-Resistant *Staphylococcus aureus* in a Malaysian Tertiary Centre. *Southeast Asian J Trop Med Public Health* 2013; 44 (1): 104-108.
7. Leistner R., Meyer E., Gastmeier P., Pfeifer Y., Eller C., *et al*. Risk Factors Associated with the Community-Acquired Colonization of Extended-Spectrum Beta-Lactamase (ESBL) Positive *Escherichia Coli*. *An Exploratory Case-Control Study*. *PLoS ONE*. 2013;8(9): e74323.
8. Rottier W.C., Ammerlaan H.S., Bonten M.J. Effects of confounders and intermediates on the association of bacteraemia caused by extended-

- spectrum beta-lactamase-producing Enterobacteriaceae and patient outcome: a meta-analysis. *J Antimicrob Chemother* 2012; 67:1311–1320.
9. Pang J., Chua S.W.J.L., Hsu L. Current knowledge, attitude, and behavior of hand and food hygiene in a developed residential community of Singapore: a cross-sectional survey. *BMC Public Health*. 2015; 15:577.
 10. Ejemott R.I., Ehiri J.E., Meremikwu M.M., Critchley J.A. Hand washing from preventing diarrhoea. *The Cochrane Database of Systematic Reviews*. 2008; 1,CD004265.
 11. Jefferson T., Del Mar C.B., Dooley L., Ferroni E., Al-Ansary L.A., Bawazeer G.A., et al. Physical Interventions To Interrupt Or Reduce The Spread Of Respiratory Viruses. *The Cochrane Database of Systematic Reviews*. 2011; 7, CD006207.
 12. Nematian J., Nematian E., Gholamrezanezhad A., Asgari A.A. Prevalence of intestinal parasitic infections and their relation with socio-economic factors and hygienic habits in Tehran primary school students. *Acta Trop*. 2004; 92(30): 179-186.
 13. Huq M.N., Tasnim T. Maternal Education and Child Healthcare in Bangladesh. *Matern Child Health J*. 2008;12 (1): 43-51.
 14. Aiello, A.E., Coulborn, R.M., Perez, V., & Larson, E.L. Effect of Hand Hygiene on Infectious Disease Risk in the Community Setting: A Meta-Analysis. *Am J Public Health*. 2008; 98(8): 1372–1381.
 15. Lecky D.M., McNulty C.A.M., Adriaenssens N., Herotova T.K., Holt J., Touboul P., *et al*. What are school children in Europe being taught about hygiene and antibiotic use? *J Antimicrob Chemother*. 2011;66 Suppl 5: v13-v21.