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Can Flu-Like Absenteeism in Kindergartens Be Reduced Through Hand Hygiene Training for Both Parents and Their Kindergarteners?

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Abstract

Background: Hand hygiene has been found as an effective method to prevent the spread of infectious diseases. Parents, however, were found to have inadequate knowledge, reporting skills, and parenting practices related to seasonal influenza. The aim of our study was to investigate if there was any correlation between the flu infection among parents and their kindergarteners and ascertain the effectiveness of using hand hygiene interventions in kindergartens to lower kindergarteners' absenteeism attributable to seasonal flu. **Methods:** This study was a quasi-experimental study with a pretest-posttest design. Fifteen kindergartens were randomly selected from the kindergarten lists in different districts displayed on the Hong Kong government website. From these 15 kindergartens, parents and their kindergarteners were then randomly selected to participate in our hand hygiene program. To support the validity of the program, the WHO hand hygiene checklist was used to ensure sufficient coverage of the objectives. All kindergarteners attended 45-minute session for 4 weeks, while their parents attended a separate session lasting 1 hour. Parents monitored their kindergartners on a daily basis for any flu symptoms and kindergartens monitored their school attendance. **Results:** The study results showed that kindergarteners with strong parenting and proper hand hygiene compliance had fewer recorded signs and symptoms of flu-like illnesses. Our findings also showed that the kindergarteners' absence rates in all participating kindergartens owing to flu decreased from 21.5% to 12% of the study period in 3 months. **Conclusion:** It was found that the flu infection rates of the parents and their kindergarteners were significantly correlated with $P = .005$. The awareness and personal hygiene skills of the parents and kindergarteners were both raised after the program. The findings in this study supported that positive parenting on hand hygiene can help reduce kindergarteners' flu-like absenteeism.

Keywords

behavioral health, children, health promotion, prevention, community health

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Introduction

Infectious diseases account for millions of school-days lost each year among kindergarteners; for instance, kindergarteners with flu missed approximately 38 million school-days each year in the United States.[1] Many studies have been conducted to find ways to minimize the loss, and frequent hand hygiene has been found effective in preventing the spread of infectious organisms[2] and it remains the most important defense against diseases.[3] A recent study Or et al[4] on kindergarteners demonstrated an improvement in their hand hygiene routine markedly after receiving training. Before the program, the average percentage of colored (thoroughness of hand rubbing) areas before handwashing for all preschoolers were 73.7% on both hands. After the program, the

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average percentage of colored areas before handwashing were 87.7% on both hands and they paid more attention to wash those frequently missed areas of hand (such as backs of the hands) with the 7-step hand hygiene technique. However, the efficacy of this preventive measure requires active participation of kindergarteners and their parents in health-related activities. Leventhal et al[5] suggested that parents' own understanding of illnesses influenced the way they responded to the illnesses and thereby affected their children's behavior and development. As family members, parents and children influence one another through their daily interactions. Positive parenting interventions have potential beneficial effects on children leading to improve child behavioral outcomes and empower parents to develop better daily routines that encourage children to carry out health-related activities that might otherwise be resisted.[6]

Parenting plays a pivotal role in child development. Previous research showed a positive relationship between parents' health practices and their children's health behavior.[7,8] This highlights the importance of parental health education. Positive parenting is said to happen when parents create nurturing environments and guide their children to live more healthily.[9] Usually these are the parents who have better knowledge and skills to shape their children's healthy lifestyle. In the study by Lam et al,[10] parents were found to have inadequate knowledge, skills, and practices related to seasonal flu prevention. One reason was that few channels were available for parents to access health information.[10,11] They, therefore, did not use any specific method to guide their children's health practices.[8] Besides, they could not count on existing health promotion services and facilities because these were merely for specific groups of people such as the elderly and young children.[10,11] Thus, strengthening the health literacy of parents in seasonal flu prevention can facilitate positive parenting to improve their children's health outcomes in this regard.[12]

The study by Lam et al[10] showed that inadequate knowledge and skills in flu prevention resulted in parents not being actively involved in practices during seasonal flu outbreaks. This brings forth the need to train parents. Providing suitable training in flu prevention to parents will empower them to work with their kindergarteners to avoid falling ill when a flu pandemic breaks out. This parent-child partnership engages parents actively in health promotion and is clearly welcomed by parents, as it was found in some studies that parents did voice their willingness to be involved in their children's health promotion activities with health care promoters.[11] Since parents are the best promoter of health education to their children,[13] engaging parents will help develop strategically to elicit positive health behavioral changes in children.

In another study, Song et al[14] found that parent-child bonding and shared time were significantly correlated with children's thoroughness of hand hygiene practice, which is an important measure to prevent the spread of infectious diseases among kindergarteners from minimizing school days lost (school absenteeism). Based on this finding, the first step in achieving good hand hygiene practice was to assist parents to learn the required 7-step handwashing procedure so that they could instruct their children with clarity and quality information[8] at home if needed. Positive parent-child communication was identified as a contributory factor to an effective health practice learning.[8] Hence, parental influence on children's hand hygiene practice is worth exploring to see whether both parents and kindergarteners with good hand hygiene skills can help reduce the spread of infectious diseases among kindergarteners, and thus eventually reduce the school absenteeism. To this end, our study aimed to investigate if there was any correlation between the flu infection among parents and their kindergarteners and ascertain the effectiveness of using hand hygiene interventions in kindergartens to lower kindergarteners' absenteeism attributable to seasonal flu.

Methods

Participants

This study adopted a quasi-experimental study with a pretest-posttest design. Fifteen kindergartens were randomly selected from the kindergarten lists in different districts on the Hong Kong government website. The target participants were kindergarteners aged 5 to 6 years and their parents. Letters were sent to the principals of 15 kindergartens in Hong Kong to invite their kindergarteners (K3) and their parents to participate. Ethics approval was obtained from the Human Research Ethics Committee of the university (2014-2015-0357). At the start of the study, the study objectives and procedures were clearly explained to all participants. The parents were informed that they had every right to withdraw from the study at any time without any negative consequences. The principals of the kindergartens, parents, and their kindergarteners enrolled to participate in this study after providing their informed consent.

Intervention

The structured hand hygiene program used in this study was designed by our research team in our prior study[4] based on the guidelines of the World Health Organization (WHO) and the Centers for Disease Control and Prevention. We adopted the same training program for kindergarteners and add one session for parents. For the kindergarteners, there were 4 sessions, 1 session per week for 4 consecutive weeks, with each session lasting 45 minutes. Parents attended a separate session lasting for an hour. In the sessions the instructor was an infection control nurse who explained common infectious diseases in kindergarteners (eg, flu, and hand, foot, and mouth disease), personal hygiene (proper mask wearing and removed, 7-step hand hygiene technique), and hygiene in kindergarten and household

scenarios. To evaluate the effect of the program, both the participating kindergarteners and parents were required to answer 10 true-or-false questions in a questionnaire on hand hygiene knowledge (eg, "There are 7 steps for proper hand hygiene." True or false?) before and after the hand hygiene program. For the completion of the questionnaire, the research assistant explained the answers clearly to the kindergarteners. The questionnaire was used to assess the hand hygiene knowledge of the participants. Its content validity was affirmed by a panel of 3 experts, its test-retest reliability was obtained by inviting 5 kindergarten teachers and 5 kindergarteners who were not involved in this study to complete the questionnaire. The scale-level content validity index was 0.86, and hence content validity was established. For the test-retest reliability, the Pearson correlation coefficient was 0.75, indicating a good correlation between the 2 measurements.

Tools

To reveal their hand hygiene skills, the participants were required to perform hand hygiene techniques with the help of a fluorescent stain gel (Brevis Corporation, South Salt Lake City, UT) as the germ tracker. A small amount (3 mL) of fluorescent stain gel was applied to the parents or kindergarteners' palms, which were subsequently rubbed together until both hands were covered with the gel. Then they were asked to wash their hands with soap and water. In the process, pictures of the participants' hands were taken, before and after handwashing. The colored stain on their hands was only visible through the use of an ultraviolet lamp. The percentage of their hands (backs and palms) with color were computed by ImageJ software (http://imagej.nih.gov/ij/docs/index.html) to assess their handwashing skills in 2 steps: (1) before handwashing and (2) after handwashing. Before handwashing, the higher the percentage of colored areas on the parent and their kindergarteners' hands, the more thoroughly they had rubbed their hands with the gel. After handwashing, the colored (dirty) areas on their hands represented the parts they missed in washing. The lower the percentage of the hands with colored (dirty) areas, the better was their hand hygiene performance. The handwashing process was done twice for each participant, once before the program and the other after the program.

Outcomes

A self-reporting instrument was adopted from the Parent-Child Relationship Schema Scale (PCRSS),[15] composed of items like what parents should do for kindergarteners; what kindergarteners should do for parents; and what parents and kindergarteners should do together. PCRSS score have a minimum score of 25 and a maximum score of 125. Higher total scores indicate strong parenting. To ensure simplicity and clarity to the kindergarteners, the research team went through the instructions and questions with them in great detail so that they could complete the self-report. The parents were asked to complete the PCRSS on their own. They were also requested to record any flu signs and symptoms in their kindergarteners' health logbooks for 3 consecutive months (ie, 1 month before to a month after the program), which were considered here as evidences of hand hygiene compliance and behavioral change of the kindergarteners. During the same period, absences by the kindergarteners were recorded in a standardized absentee form with the help of the administrative staff of the kindergartens. Data to be recorded in the form included name of the kindergartener, date of absence, and the reason for their absence (eg, with flu symptoms like fever, cough, sore throat, runny nose, muscle pain, fatigue, headache, diarrhea, and vomiting). These symptoms were those stipulated in the guidelines issued by the Centre for Health Protection. From the collected data, the absentee rates for the participating preschoolers were ascertained. For these 3 months, the parents were asked to submit weekly reports on any flu symptoms of their participating kindergarteners, which would be used for the compilation of an index of hand hygiene compliance and behavioral change. These flu symptoms were then collated with their sick leave records for further analysis by the research team. Besides, supplementary information was also provided by vigilant teachers on the hand hygiene of these kindergarteners after toileting within this period. One outcome measure of the study was the change in the participants' hand hygiene skills.

Statistical Analysis

Student's t test for continuous variables was used to examine the change in their hand hygiene skills before and after the intervention. In addition, McNemar test was performed to examine the performance of hand hygiene knowledge before and after the intervention. Also, Pearson correlation analysis was used to investigate the relationship between the seasonal flu infection of the parents and their kindergarteners in the period. For all tests in this study, the statistical significance was set at $P < .05$.

Results

A total of 58 parents joined the study and 2 grandparents were treated as parents for simplicity. Of these, 2 parents who have 2 kindergarteners participated in the study. The sample had a sex distribution of 4 (6.9%) males and 54 (93.1%) females. The demographic information of the participants is shown in Table 1.

For the hand hygiene knowledge test, the percentage of parents who answered correctly the question on the 7-step hand hygiene technique increased by 6.8% before the program to 79.5% (McNemar test, $P < .001$). For the hand hygiene skills test, the parts of the hands that were not

Table 1. Demographic Data of Study Participants.

	Parent (N = 58), n (%)	Kindergartener (N = 60), n (%)
Gender		
Male	4 (6.9)	36 (60)
Female	54 (93.1)	24 (40)
Age, years		
5-6	—	60 (100)
20-30	13 (22.4)	
31-40	32 (55.2)	
41-50	9 (15.5)	
51-65	4 (6.9)	

properly washed before the intervention were back of hands, back of fingers, thumbs, and wrists. After the program, the percentages of the properly washed areas on both hands increased significantly, in particular the wrists from 0.5% to 82% (paired-sample t test with $P < .001$). The level of significance level was set at $P < .05$.

As for handwashing compliance, the parents and kindergarteners were asked whether they cleaned their hands according to the "Five Moments for Hand Hygiene" developed by the WHO. Before the program intervention, more than 85% of the kindergarteners reported that they washed their hands in all moments of hand hygiene opportunities. Quite surprisingly, their parents had lower percentages of handwashing compliance in all the moments except for handwashing after toilet use. Table 2 shows the 6 questions on the handwashing moments. After the program, 27% more kindergarteners showed concern about the hand hygiene behavior of the people around them, especially their parents.

Our findings showed that the kindergarteners' absence rates owing to flu had decreased in each of the 3 months, from 21.5% (before intervention) to 15.5% (during intervention) and then to 12% (after intervention), showing a decreasing trend over the 3 months in all participating kindergartens. It was found that in one kindergarten, there was almost a 30% decline even though there was an increase in local flu activity from October 2016 to February 2017 in Hong Kong[16] covering the study period. A repeated-measures analysis of variance was performed to compare the kindergarteners' absence rates over the 3-month period. There was a significant difference over the 3 months with $F(2, 58) = 34.65$, $P < .001$.

Regarding the performance of their posttest hand hygiene skill, the kindergarteners were classified into 3 groups. The lowest group were those who obtained 0 to 83.82 marks in the posttest, while the middle group got 83.83 to 96.99 marks, and the highest group scored 97.00 to 100.00 marks.

The total PCRSS score of 95 or higher was classified as strong parenting. In the month following the program, the kindergarteners who had better hand hygiene compliance with positive parenting at home showed fewer recorded flu-like signs and symptoms than before the intervention, fewer cases of recorded flu-like signs and symptoms in the same month than their parents as shown in Table 3. Also, in that month, the kindergarteners with positive parenting were comparatively less infected by their family members than those with negative parenting. On the whole, both the kindergarteners and their parents showed fewer flu-like signs and symptoms after the intervention. With Pearson correlation analysis, it was found that parenting and kindergarteners hand hygiene compliance was significant with $P = .005$.

Discussion

Most previous studies[17-20] have focused on parenting outcomes relating to kindergarteners' mental health or risk behaviors. Limited studies were done on physical health. There was one study which reported that low parental literacy could adversely influence hygiene practice among school children[21] because parents, in most cases, were primary caretakers at home and taught their kindergarteners proper hygiene practices.[22] In this study, it was found that significant relationships existed between parenting, hand hygiene compliance, and absenteeism. After the intervention, the kindergarteners with positive parenting were found to have fewer recorded flu-like signs and symptoms.

Regarding the kindergarteners' handwashing habits, there was a discrepancy between the parents' reported observation and the kindergarteners' self-reporting. The parents, in general, underestimated their kindergarteners' awareness of handwashing before the program. Our findings are similar to those of Song et al[14] and Pesu et al.[23] A possible explanation for this discrepancy is that the parents' attention on handwashing practices was relatively low and therefore, they neither use nor teach these practices to their kindergarteners. Another possible explanation may be due to reporting biases, with kindergarteners tending to report socially desirable answers more frequently than their parents.[24,25] With regard to the kindergarteners' performance, the divergence in views between the parents and their kindergartener is similar to some of the studies done on kindergarteners with chronic illnesses like cancer but not on healthy kindergarteners.[26-28] After the program, the kindergarteners shared what they had learnt with their parents. The parents then started to pay more attention to proper handwashing. It was found that there were more common topics for conversations between them following the program, which bonded their relationship even more. Coincidentally, there was a substantial decline in illness-related absenteeism in the participating kindergartens after the program. It was plausible that increased communication between parents and kindergarteners did foster the kindergarteners' physical health.

Table 2. Questions on Handwashing Moments as Reported by Kindergarteners and Their Parents.

Questions on Handwashing Moments	Kindergarteners (%True)	Parents (%True)
1. (True/False) ____ I always wash my hands after going to the toilet.	91.7	93.3
2. (True/False) ____ I always wash my hands after touching garbage.	91.7	80.0
3. (True/False) ____ I always wash my hands before having meals.	90.0	91.1
4. (True/False) ____ I always wash my hands before and after touching eyes, nose, or mouth.	85.0	28.9
5. (True/False) ____ I always wash my hands after nose-wiping, coughing, or sneezing.	88.3	44.4
6. (True/False) ____ I always wash my hands after arts or physical activities.	88.3	77.8

Table 3. Parents and Kindergarteners Who Recorded Flu-Like Signs and Symptoms 1 Month After the Program.

	Flu-Like Signs and Symptoms					
Parenting	Kindergartener[a]	Parents	Kindergartener[b]	Parents	Kindergartener[c]	Parents
Strong parenting	18%	18%	7%	19%	0%	20%
Weak parenting	33%	0%	25%	17%	7%	17%

[a]The lowest hand hygiene compliance group of kindergarteners (0 to 83.82 marks).
[b]The middle hand hygiene compliance group of kindergarteners (83.83 to 96.99 marks).
[c]The highest hand hygiene compliance group of kindergarteners (97.00 to 100 marks).

Conclusion

The findings in this study supported that strong parent-child bonding, improved knowledge and skills of both parents and kindergarteners on hand hygiene helped reduce kindergarteners' absenteeism due to flu-like signs. When parents were actively involved in their kindergarteners' behavioral change, their kindergarteners performed better hand hygiene and had fewer flu-like signs and symptoms. If kindergarteners can learn personal hygiene skills in kindergartens, they can practice them at home under the guidance of their parents. In this regard, the findings of this study do provide important implications for future studies to explore further the impacts of strong and positive parenting on kindergarteners' health-related behaviors.

Declaration of Conflicting Interests

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References

1. Scott L. Families fighting flu guide for communities. https://www.familiesfightingflu.org/wp-content/uploads/FFF-Community-Toolkit_PDF.pdf. Published 2011. Accessed July 2, 2017.
2. Thomas RE. Do we have enough evidence how seasonal influenza is transmitted and can be prevented in hospitals to implement a comprehensive policy? *Vaccine*. 2016;34:3014-3021. doi:10.1016/j.vaccine.2016.04.096
3. Saito H, Kilpatrick C, Pittet D. The 2018 World Health Organization SAVE LIVES: clean your hands campaign targets sepsis in health care. *Intensive Care Med*. 2018;44:499-501. doi:10.1007/s00134-018-5097-9
4. Or PL, Ching PTY, Chung JWY. A program to improve the hand hygiene compliance of Hong Kong preschoolers with an insight into their absenteeism. *Am J Infect Control*. 2019;47:498-503.
5. Leventhal H, Weinman J, Leventhal EA, Phillips LA. Health psychology: the search for pathways between behavior and health. *Annu Rev Psychol*. 2008;59:477-505.
6. Morawska A, Calam R, Fraser J. Parenting interventions for childhood chronic illness: a review and recommendations for intervention design and delivery. *J Child Health Care*. 2015;19:5-17.
7. Wu CS, Fowler C, Lam WY, Wong HT, Wong CH, Loke AY. Parenting approaches and digital technology use of preschool age children in a Chinese community. *Ital J Pediatr*. 2014;40:44. doi:10.1186/1824-7288-40-44
8. Lam WY, Fowler C, Dawson A. The approaches Hong Kong Chinese mothers adopt to teach their preschool children to prevent influenza: a multiple case study at household level. *BMC Nurs*. 2016;15:51. doi:10.1186/s12912-016-0172-4
9. Biglan A, Flay BR, Embry DD, Sandler IN. The critical role of nurturing environments for promoting human wellbeing. *Am Psychol*. 2012;67:257-271. doi:10.1037/a0026796
10. Lam WY, Dawson A, Fowler C. The health literacy of Hong Kong Chinese parents with preschool children in seasonal

influenza prevention: a multiple case study at household level. *PLoS One*. 2015;10:e0143844. doi:10.1371/journal.pone.0143844

11. Lam W, Wu ST, Fowler C. Understanding parental participation in health promotion services for their children. *Issues Compr Pediatr Nurs*. 2014;37:250-264. doi:10.3109/01460862.2014.951132
12. Lam W, Dawson A, Fowler C. Approaches to better engage parent-child in health home-visiting programs: a content analysis. *J Child Health Care*. 2017;21:94-102. doi:10.1177/1367493516653260
13. Andrews KR, Silk KS, Eneli IU. Parents as health promoters: a theory of planned behavior perspective on the prevention of childhood obesity. *J Health Commun*. 2010;15:95-107.
14. Song IH, Kim SA, Park WS. Family factors associated with children's handwashing hygiene behavior. *J Child Health Care*. 2013;17:164-173. doi:10.1177/1367493512456106
15. Dixson M, Bermes E, Fair S. An instrument to investigate expectations about and experiences of the parent-child relationship: the parent-child relationship schema scale. *Soc Sci*. 2014;3:84-114. doi:10.3390/socsci3010084
16. Centre for Health Protection. Local situation of influenza activity (as of April 12, 2017). *Flu Express*. http://www.chp.gov.hk/files/pdf/fluexpress_web_week13_13_4_2017_eng.pdf. Published April 13, 2017. Accessed February 10, 2018.
17. de Looze M, van den Eijnden R, Verdurmen J, et al. Parenting practices and adolescent risk behavior: rules on smoking and drinking also predict cannabis use and early sexual debut. *Prev Sci*. 2012;13:594-604. doi:10.1007/s11121-012-0286-1
18. Beiser M, Hou F, Hyman I, Tousignant M. Poverty, family process, and the mental health of immigrant children in Canada. *Am J Public Health*. 2002;92:220-227. doi:10.2105/AJPH.92.2.220
19. Mirghafourvand M, Ouladsahebmadarek E, Hosseine MB, Heidarabadi S, Asghari-Jafarabadi M, Hasanpour S. The effect of creating opportunities for parent empowerment program on parent's mental health: a systematic review. *Iran J Pediatr*. 2016;27:e5704. doi:10.5812/ijp.5704
20. O'Connell LK, Davis MM, Bauer NS. Assessing parenting behaviors to improve child outcomes. *Pediatrics*. 2015;135:e286-e288. doi:10.1542/peds.2014-2497
21. Vivas A, Gelaye B, Aboset N, Kumie A, Berhane Y, Williams MA. Knowledge, attitudes and practices (KAP) of hygiene among school children in Angolela, Ethiopia. *J Prev Med Hyg*. 2010;51:73-79.
22. Family Health Service, Department of Health. The parenting practices in Hong Kong: a community survey on parents of 4-year-old children (2014). https://www.fhs.gov.hk/english/archive/files/reports/report-pp-2014_full.pdf. Published 2018. Accessed July 2, 2019.
23. Pesu L, Viljaranta J, Aunola K. The role of parents' and teachers' beliefs in children's self-concept development. *J Appl Dev Psychol*. 2016;44:63-71. doi:10.1016/j.appdev.2016.03.001
24. Rebholz CE, Chinapaw JM, van Stralen MM, et al. Agreement between parent and child report on parental practices regarding dietary, physical activity and sedentary behaviours: the energy cross-sectional survey. *BMC Public Health*. 2014;14:918. doi:10.1186/1471-2458-14-918
25. Ansem W, Schrijvers C, Rodenburg G, van de Mheen D. Children's snack consumption: role of parents, peers and child snack-purchasing behavior. Results from the INPACT study. *Eur J Public Health*. 2015;25:1006-1011. doi:10.1093/eurpub/ckv098
26. Bornstein MH. Cultural approaches to parenting. *Parent Sci Pract*. 2012;12:212-221. doi:10.1080/15295192.2012.683359
27. Vetter TR, Bridgewater CL, McGwin G Jr. An observational study of patient versus parental perceptions of health-related quality of life in children and adolescents with a chronic pain condition: who should the clinician believe? *Health Qual Life Outcomes*. 2012;10:85. doi:10.1186/1477-7525-10-85
28. Phipps S, Dunavant M, Jayawardene D, Srivastiva DK. Assessment of health-related quality of life in acute in-patient settings: use of the BASES scales in children undergoing bone marrow transplantation. *Int J Cancer*. 1999;12:18-24. doi:10.1002/(SICI)1097-0215