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Major article

# Comparative efficacy of a simplified handwashing program for improvement in hand hygiene and reduction of school absenteeism among children with intellectual disability

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*Key Word:*
Multidimensional strategies

***Background:*** Infectious diseases are common among schoolchildren as a result of their poor hand hygiene, especially in those who have developmental disabilities.
***Methods:*** A quasi-experimental study using a pre- to post-test design with a control group was used to test the feasibility and sustainability of simplified 5-step handwashing techniques to measure the hand hygiene outcome for students with mild intellectual disability. Sickness-related school absenteeism was compared.
***Results:*** The intervention group experienced a significant increase in the rating of their handwashing quality in both hands from pre- to post-test: left dorsum (+1.05, $P < .001$); right dorsum (+1.00, $P < .001$); left palm (+0.98, $P < .001$); and right palm (+1.09, $P < .001$). The pre- to post-test difference in the intervention group (+1.03, $P < .001$) was significantly greater than the difference in the control group (+0.34, $P = .001$). There were no differences between the post-test and the sustainability assessment in the intervention group. The intervention school experienced a significantly lower absenteeism rate (0.0167) than the control group in the same year (0.028, $P = .04$).Students in this study showed better performance in simplified handwashing techniques and experienced lower absenteeism than those using usual practice in special education school settings.
***Conclusion:*** The simplified 5-step hand hygiene technique has been proven effective in reducing the spread of infectious diseases.


The challenges of infectious diseases have caused tremendous public health concern in recent years, especially after the 2014 Ebola outbreak and the continued threat of a potential influenza A (H5N1) pandemic since the 1997 outbreak.[1,2] Schoolchildren are at a higher risk for infection because of their immature immune systems and more frequent social mixing.[3] Gastrointestinal and respiratory infections are the most commonly occurring illnesses among schoolchildren because of their poor hand hygiene.[4] Almost half of school-aged children (5-14 years old) were infected in the H1N1 influenza outbreak in Hong Kong, causing school absenteeism and school closures.[5] Handwashing has been proven effective in reducing the spread of infectious diseases.[6-8] Frequent hand-to-mouth and close contact activities without proper handwashing also place schoolchildren with mild intellectual disability (MID) at greater risk of acquiring infection. Studies have also shown that schoolchildren with MID are more vulnerable to infectious diseases because their developmental disabilities render them unable to follow complicated steps for life skills, such as proper handwashing procedures.[9,10] The school settings of this group render them particularly vulnerable because they have frequent social mixing[3] and poor hand hygiene techniques[5]; therefore, it is urged that targeted hand hygiene programs be implemented in

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these special education schools to prevent the spread of infection in the early stages of an outbreak.[11]

Effective handwashing training programs are a community alleviation measure to reduce influenza illness in the event of a severe pandemic because children in school settings are 18 times more likely to contract pathogens than those staying at home.[12] The impact of social behavior is based on Bandura's social learning theory and contributes to the transmission of influenza in the mixed contact human population.[13] According to Bandura's social learning theory, intensive training programs through enriched environments, such as observational learning and modeling, can provide rich mastery experiences that permanently raise the intellectual level and academic attainment of children.[13,14] Most human behavior is learned from observing others to form ideas of how new behaviors can be performed. Because a sense of capability is developed though these enriched environments, people strong in efficacy are able to endure in times of difficulty and stress.[14] Teaching strategies, such as video modeling of the simplified 5-step hand hygiene techniques with visual prompts and song lyrics, could help students to increase their concentration level, arouse their attention, and enhance their learning by facilitating their motor coordination as suggested by Bandura's social learning theory.[13] These social learning factors have been integrated into the simplified 5-step handwashing technique, contributing to improvement in handwashing quality among students with MID in the intervention group in this study.

This study aims to test the feasibility and sustainability of an intervention promoting the simplified 5-step handwashing techniques using multimedia visualization teaching strategies and compare it with the usual 7-step handwashing program to measure improvements in the quality of handwashing and reductions in school absenteeism for students in the school community.

## METHODS

Ethical approval was obtained from the Hong Kong Polytechnic University Ethical Committee. Parental consent was obtained via the school communication system in each school. The study was conducted in 2 special education schools with a student capacity of around 200-250 in the Kowloon district of Hong Kong. There were sinks and soap dispensers in each classroom, in the school playground, and in the school toilets. The study was conducted as a pilot study over a 12-week period from February 26-May 23, 2014. A quasi-experimental study was used, with a pretest (T0) and posttest (T1) design and sustainability assessment (T2), with a fluorescent stain test and photos taken before and after program implementation as a measure of handwashing quality at a 12-week interval with a control group. The pilot study tested the feasibility and sustainability of the study and evaluated the quality of handwashing before and after a simplified 5-step multimedia visualization hand hygiene improvement program by schoolchildren with MID. The sustainability assessment (T2) was also conducted 4 weeks after completion of the hand hygiene program to assess the sustainability effect in the intervention group. The calculation of sickness-related school absenteeism for 12 months was compared to identify the impact of the intervention. We compared hand hygiene improvement measurements between the intervention and control groups after the implementation of the simplified program using 3 different methods: an 8-week direct observation of handwashing practice with a validated checklist pretest (T0) and posttest (T1) using a fluorescent stain rating test ranging from 0-3 and a 12-month calculation of sick-related absenteeism rate between the 2 participating special education schools as an intervention group (simplified 5-step handwashing program) and a control group (usual handwashing practice) using the fluorescent stain rating test with scores 0-3 based on a previous study.[15] Scale scores are as follows: 0 (fluorescent gel is totally visible under ultraviolet light after handwashing), 1 (fluorescent gel is partially invisible under ultraviolet light after handwashing), 2 (fluorescent gel is almost invisible under ultraviolet light after handwashing), and 3 (fluorescent gel is totally invisible under ultraviolet light after handwashing).

### *Setting*

In Hong Kong, children with special educational needs are admitted into special schools to receive education services to help them develop their potential to the full, achieve as much independence as they are capable of, and become well-adjusted individuals in the community.

### *Intervention*

The intervention, named the multimedia visualization handwashing intervention to promote the simplified 5-step technique, consists of the following: (1) the simplified 5-step handwashing technique, including demonstrations and return demonstrations; (2) a handwashing song; (3) a video for behavior modeling; (4) a poster giving visual cues for the 5 steps of the handwashing procedure; (5) a reward card system for behavioral reinforcement; and (6) a validated handwashing checklist for concordance observations.[16] The simplified 5-step handwashing technique was validated in our preliminary study targeting students with intellectual disability in a special education school in Hong Kong.[16]

### *Intervention school setting*

This simplified 5-step handwashing technique was modified from the World Health Organization's (WHO's) 7-step handwashing technique.[17] The simplified 5-step technique combines steps 1 and 3, rubbing palms and fingers together (palm-to-palm and palm-to-palm with fingers interlaced steps), and omits the wrist-rubbing procedure. The simplified 5-step technique is as follows: (1) between fingers, (2) backs of hands, (3) backs of fingers, (4) finger tips, and (5) thumbs. This reduces the spread of microorganisms because water can wet children's clothes, especially when they are wearing long-sleeved shirts in winter. Wet sleeves serve as a reservoir for microbes that can be transferred to the hands by direct contact, therefore providing a habitat for infectious disease transmission. This is unlike in the clinical setting, in which health care workers are at higher risk of contaminating all parts of their hands, including the wrists, because their wrists are potentially much more easily contaminated with infectious pathogens when taking care of patients or engaging in clinical procedures. By contrast, pathogen transmission via the wrists is less likely in the school community setting. Because most of the pathogen transmission is via hand-to-mouth or hand-to-eye action and seldom via the wrists (eg, serving food with hands, rubbing eyes), the palm-to-palm and palm-to-palm with fingers interlaced steps are combined as 1 step to simplify the procedure of handwashing for retention. There are several advantages of the simplified version of handwashing when compared with the usual WHO's 7-step handwashing technique for students. The multimedia visualization simplified 5-step handwashing technique can be memorized more easily by students with intellectual disability and poor motor coordination according to Bandura's social learning theory.[13,17]

The school nurse from the intervention school was trained by the research team on the simplified 5-step handwashing technique. This school nurse and one of the researchers were responsible for teaching the simplified 5-step technique to the students in that