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The Effect of Digital Health Education Using Video on Handwashing Behavior After Flooding Among Children

El efecto de la educación en salud digital mediante video sobre la conducta de lavado de manos después de inundaciones en niños

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SUMMARY

Introduction: *Handwashing is essential for preventing disease transmission after a flood disaster. Video-based health education can be an effective method to improve knowledge, attitudes, and handwashing practices among children. This study aims to investigate the impact of video-based digital health education on improving handwashing behavior among children following flooding.*
Methods: *A quasi-experimental study was conducted among fourth-, fifth-, and sixth-grade students from two public schools in Sidoarjo Regency, with one as the intervention group and the other as the control group. A total of 78 students participated in the study, 39 in each group. Data were collected via self-administered questionnaires at baseline and 3 days post-intervention. The intervention package consisted of 2 educational videos, with a 1-week gap between them. In contrast, the control group received no additional video education. The health education for the intervention group comprises two sessions, each using a 4-minute 23-second educational video. Data were entered and analyzed using the Wilcoxon signed-rank test and the Mann-Whitney U test.*
Results: *Before the intervention, the two groups were comparable with respect to the variables studied. However, three days after the intervention, significant improvements were observed in knowledge, attitude, and behavior scores in the intervention group compared with the control group.*
Conclusions: *Video-based health education is efficacious in improving handwashing behavior among elementary school students following a flood disaster. This intervention can be incorporated into nursing care to promote handwashing among school-aged children.*

Keywords: *Health education, video, handwashing behavior, children, flood.*

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RESUMEN

Introducción: *El comportamiento de lavado de manos es muy importante para prevenir la transmisión de enfermedades tras un desastre por inundación. La educación para la salud basada en videos puede ser un método eficaz para mejorar los conocimientos, las actitudes y las prácticas de lavado de manos en los niños. Este estudio tiene como objetivo investigar el impacto de la educación en salud digital mediante*

video en la mejora del comportamiento de lavado de manos en niños tras las inundaciones.
Métodos: *Se llevó a cabo un estudio cuasiexperimental con estudiantes de cuarto, quinto y sexto grado de dos escuelas públicas del distrito de Sidoarjo: una como grupo de intervención y la otra como grupo de control. En total participaron 78 estudiantes, 39 en cada grupo. Los datos se recopilaron mediante cuestionarios autoadministrados al inicio del estudio y tres días después de la intervención. El paquete de intervención consistió en la proyección de un video educativo dos veces, con una semana de intervalo entre proyecciones. En contraste, el grupo de control no recibió educación adicional en video. La educación para la salud en el grupo de intervención constó de dos sesiones, cada una con un video educativo de 4 minutos y 23 segundos. Los datos se introdujeron y se analizaron mediante la prueba de rangos con signo de Wilcoxon y la prueba U de Mann-Whitney.*
Resultados: *Antes de la intervención, los dos grupos eran comparables en las variables estudiadas. Sin embargo, tres días después de la intervención, se observó una mejora significativa en las puntuaciones de conocimiento, actitud y comportamiento en el grupo de intervención, en comparación con el grupo de control.*
Conclusiones: *La educación para la salud basada en videos ha demostrado ser eficaz para mejorar el comportamiento de lavado de manos entre estudiantes de primaria tras un desastre por inundación. Esta intervención puede implementarse como parte de las acciones de enfermería para promover el lavado de manos entre los niños en edad escolar.*

Palabras clave: *Educación para la salud, video, comportamiento de lavado de manos, niños, inundación.*

INTRODUCTION

Floods are natural disasters that substantially affect multiple dimensions of human life, particularly public health (1). Flood-prone regions are highly vulnerable to the transmission of infectious diseases, including diarrhea. Diarrhea symptoms can begin to appear within 1 to 3 days after exposure to contaminated floodwater and not washing hands after contact with water, soil, or objects that have been contaminated (2). Diarrhea is an endemic disease in Indonesia and a potentially fatal disease that is often accompanied by death (3).

According to data from Indonesia's Central Statistics Agency (Badan Pusat Statistik/BPS), flooding remains one of the most frequent natural disasters. East Java Province is one of Indonesia's provinces with a high incidence of flooding in 2024. Sidoarjo, located in East Java, had 57 villages or sub-districts affected by flooding in 2021. This figure increased compared to 2020, when 20 villages in Sidoarjo were affected by flooding. The area most affected by flooding in Sidoarjo was the Waru sub-district, where 11 villages were reported to have been flooded in 2024 (4).

Floods in an area have a significant impact on various post-flood health problems, especially diarrhea, which can be linked to a lack of knowledge about hand washing (5). After flooding, handwashing itself becomes a concern due to the low handwashing behavior among children (6). Poor handwashing during and after flooding can become a disease outbreak that will be a serious challenge and increase the risk of infectious diseases after a disaster (7). Floodwaters are frequently contaminated with pathogens, including bacteria, viruses, and parasites, all of which are capable of causing diarrheal diseases (2). Lack of knowledge and awareness, especially among school-aged children, regarding the importance of proper handwashing, contributes significantly to the transmission of these infections (8). Post-flood disease prevention efforts should be reinforced by promoting knowledge and good hygiene practices, particularly handwashing with soap (9).

Based on preliminary studies conducted at Sekolah Dasar (SD) Muhammadiyah 2 Waru and SD Muhammadiyah 1 Waru, approximately 15 of 160 students were absent from school due to diarrhea following the February 2024 flood. Data from interviews and observations at the school revealed that both schools reported providing health education on handwashing only through lectures, reminding students to wash their hands. In addition, interviews and observations of several students indicated that some had not washed their hands properly and had missed important moments during and after the flood. Facilities for handwashing, such as the number of sinks and soap availability in the school environment, consisted of only three sinks and two stickers indicating the correct handwashing steps.

Sanitation and hygiene-related illnesses pose a significant challenge, particularly among

children in developing countries, yet they can be prevented. Washing hands at critical times can reduce the incidence of diarrheal diseases by 42 %-48 %. Proper hygiene practices are crucial in curbing infectious diseases. According to the World Health Organization (WHO), essential hygiene practices such as handwashing with soap and water and the use of clean water contribute to improved health outcomes. These efforts are more successful when supported by coordinated educational initiatives from parents, teachers, and the media (10). Health education using audiovisual media, such as instructional videos, represents an effective strategy for enhancing children's understanding of proper handwashing behaviors (11) more engaging and memorable (12). Evidence indicates that animated video media serves as an effective pedagogical tool for improving handwashing knowledge and practices among early childhood students (13).

There is a need for an innovative health education approach specifically designed to align with the developmental characteristics of school-age children to improve handwashing behavior, particularly during the post-flood period. This study aims to investigate the effect of video-based health education on improving handwashing behavior among children following flooding.

METHODS

A *quasi-experimental* study was conducted among public primary school students in fourth, fifth, and sixth grades in Sidoarjo Regency from November to December 2024. The study population comprised students from SD Muhammadiyah 2 Waru, Sidoarjo, and SD Muhammadiyah 1 Waru, Sidoarjo, in the 2024-2025 academic year. The intervention group was based at SD Muhammadiyah 2 Waru, Sidoarjo, and the control group was conducted at SD Muhammadiyah 1 Waru, Sidoarjo. Both schools have two handwashing stations and handwashing step stickers are provided. Until this study, health education on handwashing in these two schools had been delivered solely through classroom teacher lectures. Therefore, this study represents the first video-based health education activity on handwashing behavior conducted by external staff at these two schools.

The sample was determined using purposive sampling. The two schools together have 90 respondents. The sample was determined using the Isaac and Michael formula, and 39 respondents were selected for each intervention and control group, assuming a 10 % dropout rate, for a total of 78 participants from two schools. The Inclusion criteria were: 1) Students in grades 4, 5, and 6 in the 2024-2025 academic year; 2) Students who have been affected by flooding in the last year, from November 2023 to November 2024. Exclusion criteria: uncooperative students.

The instruments used in this study included researcher-developed instructional videos and a 20-item questionnaire adapted from the WHO Guideline for Handwashing with Soap, which was further modified to incorporate a handwashing-after-flooding component. The 4-minute and 23-second educational video covers definitions, purpose, benefits, principles, duration, key moments, and steps for handwashing after flooding. This video features visual animations, audio dubbing, and music that appeal to children. The questionnaire underwent validity and reliability tests. The validity test indicated that the questionnaire was valid, and the reliability test showed it was highly reliable, with Cronbach's alpha values of 0.909 for knowledge and 0.928 for attitude.

In the intervention group, the intervention was delivered over one month, comprising three separate visits. At the first visit, after explaining the study methodology, stating the objectives, and assuring them of the confidentiality of their information, the questionnaires were distributed to the students for completion. The data collection instrument used in this study comprised three parts. The first part was a questionnaire that collected demographic information, including students' age, gender, and grade level. The second part contained 10 questions assessing knowledge and 10 questions assessing attitudes. The scoring range for the knowledge questionnaire is as follows: if the answer matches the answer key, it receives a score of 1; if it is incorrect, it receives a score of 0. The assessment criteria are as follows: good = 76 %-100 %, fair = 56 %-75 %, and poor = <55 %. Responses were

measured on a 5-point Likert scale: "always" scored 4, "very often" 3, "rarely" 2, and "never" 1, with a positive attitude if the score ≥ the mean and a negative attitude if the score < the mean. After completing the pretest, health education uses a digital video lasting approximately 40 minutes, beginning with a verbal explanation of handwashing after flooding, followed by a 4-minute video. One week later, the students were given the same intervention. Three days after the video was shown, the students were given a post-test to assess the effect of the handwashing education video following the flood. The third part, a questionnaire on handwashing practice, contained 6 questions. According to the proper steps, it will receive a score of 1; if it is incorrect, it will receive a score of 0. The assessment criteria are as follows: good = 76 %-100 %, fair = 56 %-75 %, and poor = <55 %.

In the control group, the pre-test questions were administered 4 days after the pre-test, and in the intervention group, the same questionnaire was used. The control group did not receive the intervention but obtained information from other media sources. Students filled out the post-test questionnaire 8 days later. After the research was completed, the control group received digital health education via videos produced by the researchers.

The data analysis involved processing and testing the data using the Statistical Package for the Social Sciences (SPSS) to assess changes in knowledge, attitudes, and behaviors between the intervention and control groups. For descriptive analysis of quantitative data, the mean, standard deviation (SD), median, and interquartile range (IQR) were used; for qualitative data, frequency (N) and percentage (%) were used. The Wilcoxon Signed-Rank test was used to assess differences between pre-test and post-test scores for the intervention and control groups for each dependent variable, with $p < 0.05$. Then, the Mann-Whitney U Test was used on the post-test data for both groups to compare two samples from different populations.

This study has obtained ethical approval from the Health Research Ethics Committee of the Faculty of Nursing, Airlangga University, under No. 3528-KEPK.

RESULTS

This research involved 78 elementary school students: 39 in the intervention group and 39 in the control group. The gender distribution shows that most participants in the intervention group were female (51.3 %), whereas most participants in the control group were male (59 %). Most of the children were 11 years old in the intervention group (41 %) and the control group (46.2 %). The class distribution was the same in both the control and intervention groups, with 13 children in each of grades 4, 5, and 6 (Table 1).

A homogeneity test of demographic characteristics between the intervention and control groups was conducted using the Kruskal-Wallis's test. Table 1 showed a gender difference (p-value = 0.0001) but no difference in age (p-value = 0.653) or grade (p-value = 1.000). This means the two groups did not differ in age or grade characteristics.

Table 2 show significant differences in hand-washing knowledge (p-value = 0.0001), attitude (p-value = 0.0001), and practice (p-value = 0.0001) after flooding between the intervention and control groups. The difference is evident in the results of statistical tests comparing pre-test and post-test abilities within each group.

At the pre-test, children in the intervention group demonstrated poor knowledge (66 %), negative attitudes (56 %), and poor hand-washing skills (87 %) following flooding. After the intervention, 62 % demonstrated good knowledge, 62 % had a positive attitude, and 59 % had good hand-washing skills. In the control group, there were no differences between pre-test and post-test scores for knowledge ($p = 0.681$), attitudes ($p = 0.097$), or practices ($p = 0.791$). This indicates that digital health education delivered via video improved knowledge, attitudes, and handwashing practices among school-aged children following flooding.

DISCUSSION

The analysis demonstrated a statistically significant improvement in participants'

Table 1. Demographic Characteristics of Study Participants.

Respondent Characteristics	Intervention Group		Control Group		P-Value
	n	%	n	%	
Gender					
Male	19	48.7	23	59.0	0.0001
Female	20	51.3	16	41.0	
Age					
10 Year	12	30.8	11	28.2	0.653
11 Year	16	41.0	18	46.2	
12 Year	11	28.2	10	25.6	
Grade					
Grade 4	13	33.3	13	33.3	1.000
Grade 5	13	33.3	13	33.3	
Grade 6	13	33.3	13	33.3	

Table 2. Comparison of Knowledge, Attitude, and Practice Hand Washing Between Groups.

Variables	Intervention Group				Control Group				P-value[1]
	Pre test		Post test		Pre test		Post test		
	n	%	n	%	n	%	n	%	
Knowledge									
Good	3	8	24	62	1	3	1	3	0.0001
Fair	10	26	15	38	9	23	11	28	
Poor	26	66	-	-	29	74	27	69	
P-value[2]		0.0001				0.681			
Attitude									
Positive	17	44	24	62	13	33	18	46	0.0001
Negative	22	56	15	38	26	67	21	54	
P-value[2]		0.0001				0.097			
Practice									
Good	2	5	23	59	-	-	-	-	0.0001
Fair	3	3	15	39	3	8	3	8	
Poor	34	87	1	2	36	92	36	92	
P-value[2]		0.0001				0.791			

[1] Wilcoxon Signed Rank test, [2] Mann-Whitney Post-test.

knowledge and attitudes in the intervention group following the implementation of the digital video–based educational intervention. This finding suggests that the intervention was effective in enhancing students' understanding and fostering more positive attitudes toward handwashing behaviors. In contrast, the control group showed no significant difference in knowledge scores between the pretest and posttest, indicating no improvement in knowledge despite not receiving the intervention. These results collectively highlight the efficacy of digital video education in

improving health-related knowledge and attitudes among primary school students.

At baseline, most participants in the intervention group exhibited negative attitudes toward handwashing. Following the video-based health education intervention, students reported a significant increase in positive attitudes, with the majority responding favorably. In contrast, the control group largely maintained negative attitudes throughout the study period. Furthermore, the number of positive attitudes in the post-test for the intervention group was significantly higher than that for the control group, indicating a statistically significant improvement. These results provide evidence that video-based health education effectively enhances positive attitudes among elementary school students toward handwashing practices following flooding, highlighting the potential of digital media to promote handwashing behavior change in post-disaster contexts.

A significant improvement in students' handwashing practices was observed in the intervention group following the video-based health education. The difference was reflected in the increase in students' adherence to proper handwashing steps before and after the intervention. Before the intervention, nearly all participants in the intervention group exhibited poor handwashing performance. However, post-test results indicated substantial improvement, with most respondents achieving scores in the good range. In contrast, the control group, showed no notable change in performance between the pretest and post-test. The results of this study are consistent with those of Robert et al. (14), who found that the experimental group had a higher behavioral intention to wash their hands properly than participants in the control group. These findings suggest that video-based health education can effectively enhance practical hand hygiene behaviors among elementary school students.

In line with a study about the effect of video-supported handwashing training on handwashing knowledge and skills in children aged 7-14, the present study found significant improvements in both knowledge and practical skills after video intervention (15). In the context of public health, proper handwashing is recognized as one of the most effective strategies for preventing infectious disease outbreaks globally and for mitigating the risk of post-flood infections. Hand hygiene practices, including thorough handwashing with soap, significantly prevent microbial cross-contamination, thereby decreasing the incidence of diseases such as diarrhea and respiratory infections (16).

The observed increase in positive attitudes within the intervention group may be attributed to the delivery of health education through video-based media. This finding aligns with a study conducted in Ghana involving female participants aged 13-16 years, which reported that video interventions exerted a transformative influence on knowledge, attitudes, and behavior (17). The use of visual and auditory components—such as imagery, color, and sound—likely enhanced students' engagement and strengthened their retention of handwashing-related information. This multimodal presentation is believed to facilitate improved comprehension and memory, thereby supporting the effective adoption of health-related behaviors. Post-intervention data revealed a significant change in attitudes compared to the pretest, indicating that exposure to video-based health education contributed to this improvement. The enhancement in students' knowledge appears to have played a key role in shaping more positive attitudes among respondents. This result is consistent with a study that found a significant effect of video use in health education (18).

Our current results indicate that video-based media is an effective approach for delivering health education and improving knowledge acquisition. Such media possess distinctive characteristics, including the ability to convey messages through visual cues such as facial expressions, motor movements, and contextual cues. Educational music videos can increase children's attention more effectively than standard educational videos due to their interactive content (19). The cognitive development of middle-aged children enables them to focus their attention for longer periods and to store information in their short- and long-term memory more effectively, especially when the information is presented in engaging ways, such as through play, visualization, or group discussion (20).

The combination of video and educational interventions enhances children's attention. It facilitates greater retention of learning material, as visual and color elements tend to sustain engagement more effectively than text-based methods. Consequently, learners' comprehension and memory performance are likely to improve, thereby reinforcing the overall process of information assimilation. Furthermore, repeated exposure to video interventions has been shown to strengthen learning outcomes and increase the effectiveness of educational media in promoting health-related knowledge.

Collectively, these findings suggest that health education delivered via video has a significant positive impact on school-aged children's knowledge, attitudes, and practices regarding proper handwashing behaviour following flood events.

A limitation of this study is changes in knowledge, attitudes, and behaviors within each health education session were not assessed. Further studies could be conducted by providing more frequent health education and ongoing assessment during each session.

CONCLUSION

Health education using video had a significant effect on improving knowledge, attitudes, and handwashing behavior among elementary school children in Sidoarjo, Indonesia. Therefore, the health education-based digital video can be considered for health promotion and use this model in school educational programs to improve hand hygiene, promote, and anticipate the occurrence of post-flood diseases. It is recommended that schools integrate video-based learning materials into health education activities and that teachers actively supervise and guide students in proper handwashing, particularly in areas prone to flooding.

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