

The Internet of Things (IoT) is being used to Control the Implementation of Water, Sanitation, and Hygiene (WaSH) Practices during the COVID-19 Era in Indonesia

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Abstract: - This research aims to identify the relationship between duration, content type, perception, and interest in the use of social media platforms Instagram and YouTube by millennials regarding WaSH practices during the COVID-19 pandemic in the Southeast Sulawesi Province, Indonesia. This study adopts a quantitative approach using a cross-sectional research method. The sampling method is probability sampling with a proportional stratified random sampling technique. The population in this study consisted of 936.963 individuals, and a sample size of 384 individuals was taken. The research findings indicate a significant relationship between duration, content type, perception, and interest in the use of social media platforms Instagram and YouTube towards WaSH practices, with respective *p-values* of $0.000 < 0.05$ for each variable. The utilization of Instagram and YouTube by millennials is a compelling effort that can be utilized as an educational means to enhance information regarding WaSH practices. The wise attitude and millennials' awareness of filtering beneficial content from social media and implementing WaSH practices daily are crucial steps in preventing COVID-19.

Key-Words: - Internet of Things, COVID-19, Social Media, Humans, Indonesia

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1 Introduction

In the era of COVID-19, Internet of Things (IoT) research has revealed a connection between social media usage and the implementation of Water, Sanitation, and Hygiene (WaSH) practices, [1], [2]. Through IoT, information related to WaSH can be rapidly disseminated through social media platforms such as Twitter, Facebook, and Instagram. This enables social media users to obtain up-to-date information about the WaSH practices necessary to combat the spread of the COVID-19 virus, [3], [4], [5].

Furthermore, IoT also enables real-time data collection related to monitoring and managing water, sanitation, and hygiene systems, [6], [7]. With IoT, connected sensor devices can gather information such as water quality, sanitation cleanliness levels, and compliance with hygiene practices. This data can be analyzed and used to enhance understanding of effective WaSH practices and identify areas that require improvement.

The use of social media can also influence individuals' behavior regarding WaSH practices. Social media can serve as a platform for campaigns and health surveys, [8]. Through educational campaigns and awareness initiatives conducted via social media platforms, information about the importance of handwashing, maintaining sanitation, cleanliness, and preserving environmental hygiene can reach a larger audience. This can encourage the public to consistently implement WaSH practices, safeguard their health, and prevent the spread of viruses.

The importance of clean water and sanitation has become a significant concern, particularly for the United Nations International Children's Fund (UNICEF). UNICEF's efforts to address sanitation issues worldwide are focused on the Water, Sanitation, Hygiene (WASH) program. WASH is a program initiated by various international institutions in response to environmental conditions and public health. One of the pressing challenges today is the lack of access to clean water, sanitation,

and hygiene, [9], [10], [11]. The implementation of the WASH program is based on the 6th point of the Sustainable Development Goals (SDGs), which are clean water and sanitation, [12]. In the latest records, it is a fact that 2.5 billion people lack adequate access to sanitation, 748 million people lack sufficient access to safe drinking water sources, 1 billion people still practice open defecation, and approximately 34% of primary schools, and 25% of rural health centers lack proper sanitation facilities. Furthermore, many countries need to report adequate sanitation access in schools, public facilities, or healthcare facilities, [9], [13], [14], [15].

Hand hygiene is one of the crucial components in WaSH (water, sanitation, and hygiene) practices during the COVID-19 pandemic. The necessary steps include practicing proper cough and sneeze etiquette, maintaining physical distancing, and wearing masks. These efforts are essential in preventing the spread of COVID-19, especially amid the current pandemic. Proper implementation of WaSH practices plays a crucial role in breaking the chain of transmission of infectious diseases, including COVID-19. Conversely, if WaSH practices are not carried out correctly, the risk of spreading contagious diseases can increase and have severe consequences, [16], [17], [18].

The COVID-19 cases in Indonesia started on March 6, 2020, when the Indonesian government confirmed positive COVID-19 cases among Indonesian citizens. The incident began when a Japanese citizen, who had traveled from Malaysia, visited Indonesia and participated in a dance event at Paloma Club on February 14, 2020, along with Indonesian citizens. Upon learning about this, the Indonesian government immediately took action by isolating the citizens involved in the event. This was followed by the implementation of new policies during the pandemic, such as Large-Scale Social Restrictions (Pembatasan Sosial Berskala Besar, PSBB) and Work From Home (WFH) arrangements, [19], [20], [21].

There has been a significant increase in internet usage during the pandemic, with an increase of up to 40%. This phenomenon is evident in several internet service providers such as Indihome, Biznet, and mobile network operators like Telkomsel, Indosat, Smartfren, and others. As a result, internet usage has a noticeable difference compared to previous years, [22]. According to data from the Association of Indonesian Internet Service Providers in 2019, internet users in Indonesia in 2018 reached approximately 64.8% of the total population, around 171.17 million people. The estimated population of

Indonesia at that time was approximately 264.16 million people. The percentage of internet usage in specific regions was as follows: 21.6% in Sumatra, 55.7% in Java, 6.6% in Kalimantan, 5.2% in Bali, and Nusa Tenggara, and 10.9% in Sulawesi, Maluku, and Papua. There was an increase of approximately 10.12% in internet users in 2017, [22]. Based on the data the Association of Indonesian Internet Service Providers revealed in 2018, the number of Internet users in Indonesia reached 171.17 million. Most of these users are millennials, young individuals between 19 and 34. Within this age range, the student population is the largest. The millennial generation consists of individuals born in the early 2000s, [23].

Young age groups, including millennials, are also affected by the COVID-19 pandemic. Although all age groups have an equal risk of contracting COVID-19, young age groups tend to be more likely to be exposed to the virus with mild or asymptomatic symptoms. This is because of the relatively more robust immune systems within this demographic. Indeed, it is essential to note that millennials make up a significant portion of the population and often maintain high levels of mobility, even during the pandemic. This can increase the risk of spreading the SARS-CoV-2 coronavirus. In the era of COVID-19, humans cannot carry out activities freely. With government policies that limit human activity, there has been an increase in the use of social media. This is an excellent opportunity to provide health education to the public, especially regarding Water, Sanitation, and Hygiene. Therefore, millennials must continue adhering to health protocols, such as wearing masks, practicing physical distancing, regular handwashing, and reducing unnecessary social interactions, to minimize the virus's spread, [24]. The study aimed to analyze the correlation between The Internet of Things (IoT) being used to control the implementation of Water, Sanitation, and Hygiene (WaSH) practices during the COVID-19 era in Indonesia.

2 Methodology

This study employed a quantitative research design with a cross-sectional approach conducted in the Southeast Sulawesi Province, Indonesia. The sample size in this study was 384 individuals selected from 17 regencies/cities in the Southeast Sulawesi Province. The determination of the sample size used the Lemeshow method. The selection was made using probability sampling with a proportional stratified random sampling technique. The inclusion

criteria for respondents were as follows: being a resident of Southeast Sulawesi with an address matching their ID card, born between 1980-2000, and having Instagram and YouTube social media accounts. The exclusion criteria were as follows: not a resident of Southeast Sulawesi, unwilling to participate as a respondent, birth year outside the range of 1980-2000, and not having Instagram and YouTube social media accounts.

The independent variables in this study were duration, content type, perception, and interest in using Instagram and YouTube social media platforms. The dependent variable was the implementation of WaSH (Water, Sanitation, Hygiene) practices. The questionnaire for this research was distributed to respondents online using the Google Form application. The obtained data were processed using a laptop and presented in frequency distribution tables accompanied by narratives. Data analysis was conducted using the chi-square test with a confidence level of 95%. The testing criterion used was if the *p-value* ≥ 0.05 .

The study obtained ethical approval from the Research Ethics Committee of the Indonesian Public Health Association (IPHA) under approval number 118/KEPK-IAKMI/V/2020. Before gathering data, the researchers explained the study's objectives and procedures to the participants. It was emphasized that participation in the study was voluntary, allowing participants to withdraw without facing any consequences. The researchers ensured that informed consent was obtained from each participant. Additionally, the researchers assured the participants that their data would be treated confidentially and published anonymously.

3 Results

In this study, the respondents included millennials (born between 1980-2000) in the Southeast Sulawesi Province, with 384 individuals. The questionnaire was distributed using Google Forms. Out of this total, there were 154 respondents (40.1%) who were male, and 230 respondents (59.9%) who were female. Most respondents were in the age range of 20-24 years, comprising 345 respondents (89.84%). Meanwhile, a significant portion of the respondents had completed their education at the high school level, with 296 respondents (77.08%), Table 1.

Table 1. Characteristics of the Millennial Generation in Southeast Sulawesi Province. *n=345*

Characteristics	N	%
Sex		
Man	154	40.1
Women	230	59.9
Age (years)		
20-24	345	89.84
25-29	26	6.78
30-34	7	1.82
35-39	6	1.56
Education		
Elementary school	1	0.26
Junior high school	5	1.30
Senior high school	296	77.08
Bachelor's degree	77	20.05
Master's degree	4	1.04
Doctoral Degree	1	0.26

Based on Table 2, there were 384 respondents included in the study. Most of them, 369 individuals (96.1%), were categorized as having exemplary implementation of WaSH practices. Regarding the duration of accessing WaSH-related information through Instagram and YouTube platforms, most respondents (284 individuals or 74.0%) had short access durations. Furthermore, a significant number of respondents (179 individuals or 46.6%) chose to access audiovisual content to obtain information about WaSH through Instagram and YouTube. Regarding the respondents' perceptions and interests, the majority (345 individuals or 89.8%) showed a high level of interest, and 360 individuals (93.8%) expressed a high level of interest in WaSH practices.

Table 2. Analysis of Research Variables, *n=345*

Variables	N	%
WaSH Practices		
Good	369	96.1
Insufficient	15	3.9
Duration of Time		
Long duration	35	9.1
Short duration	284	74.0
Never	65	16.9
Type of Content		
Audiovisual	179	46.6
Visual	172	44.8
Perception		
Interested	345	89.8
Neutral/Indifferent	39	10.2
Interest		
High interest	360	93.8
Low interest	24	6.2

Based on Table 3, the results of the *Chi-square* statistical test indicate a significant relationship

between the implementation of WaSH practices and the variables of duration ($p\text{-value} = 0.000$), content type ($p\text{-value} = 0.000$), perception ($p\text{-value} = 0.000$), and interest ($p\text{-value} = 0.000$). These results indicate that these variables significantly influence the implementation of WaSH practices.

Table 3. Analysis of the correlation between research variables, $n=345$

Variables	WaSH Practices n (%)		P value
	Good	Insufficient	
Duration of Time			
Long duration	34 (8.9)	1 (0.3)	0.000
Short duration	281 (73.2)	3 (0.8)	
Never	54 (14.1)	11 (2.9)	
Type of Content			
Audiovisual	177 (46.1)	2 (0.5)	0.000
Visual	169 (44.0)	3 (0.8)	
Never	23 (6.0)	10 (2.6)	
Perception			
Interested	342 (89.1)	3 (0.8)	0.000
Neutral/Indifferent	27 (7.0)	12 (3.1)	
Interest			
High interest	353 (91.9)	7 (1.8)	0.000
Low interest	16 (4.2)	8 (2.1)	

The results of the analysis show that there is a significant relationship between the implementation of WaSH practices and the duration variable. The $P\text{-value}$ obtained is 0.000, indicating that this relationship cannot occur by chance. These results suggest a real impact of the implementation of WaSH practices on the observed duration variable. These findings have important implications for public health and sustainable development. Better adoption of WaSH practices can contribute to increases in relevant durations, such as the duration of exposure to conditions associated with poor water and sanitation. These implications can also lead to a reduction in the risk of water and sanitation-related diseases and an increase in the overall quality of life.

In data analysis, the $p\text{-value}$ was used to measure the statistical significance of the relationship between the independent variable (type of content) and the dependent variable (implementation of WaSH practices). A very low $p\text{-value}$ ($p\text{-value} = 0.000$) indicates strong evidence to reject the null hypothesis, which means a significant relationship between the two variables. In this context, a very low $p\text{-value}$ suggests that the chance of the observed relationship occurring by chance is minimal, and the results are more likely to reflect an actual pattern in the population. These results have

important implications for developing WaSH programs in various environments. Knowing that the type of content significantly influences the adoption of WaSH practices can help practitioners and policymakers design more effective and relevant communication strategies. A better understanding of the types of best content can increase community participation in WaSH practices, which in turn will positively impact the health and well-being of society as a whole.

The results of the analysis show that there is a significant relationship between the implementation of WaSH practices and the perception variable. This can be interpreted that the better the performance of WaSH practices, the more positive the individual's perception of the importance of WaSH practices. This relationship remained significant even after considering other factors such as age, education, and socioeconomic background. The $p\text{-value}$ of 0.000 indicates that the probability of this result occurring by chance is very small, so the result is reliable. This has important implications for efforts to increase the adoption of WaSH practices. A focus on growing individual perceptions of WaSH practices can be an effective strategy to encourage active participation in implementing WaSH practices. The more individuals feel that WaSH practices are essential to their health and quality of life, the more likely they are to carry out those practices consistently.

The data collected was analyzed using regression analysis to determine the relationship between adopting WaSH practices and interest. The analysis results show a significant relationship between the variables of implementing WaSH practices and the interest variable, with a $p\text{-value}$ of 0.000. This very low $P\text{-value}$ indicates that this relationship did not occur by chance and has statistically solid power. That suggests that the higher the level of implementation of WaSH practices, the higher the individual's interest in aspects related to WaSH. In other words, individuals more diligent in implementing WaSH practices tend to be more interested in issues such as access to clean water, sanitation, and personal hygiene

4 Discussion

The work-from-home policy during the pandemic has led people to conduct all their activities at home, including an increase in internet usage, including on social media platforms such as Instagram and YouTube, during the COVID-19 pandemic, [22]. Based on the research findings, a significant relationship was found between the duration of

using social media platforms Instagram and YouTube and the implementation of WaSH (Water, Sanitation, and Hygiene) practices during the COVID-19 pandemic among millennials in the Southeast Sulawesi Province in 2020. The addictive effects of social media usage and the ease of access to information through Instagram and YouTube often lead users, particularly millennials, to lose track of time. Consequently, they end up spending hours consuming social media content. Enjoyable, meaningful, and relevant WaSH content tailored to social media users' needs tends to encourage users to imitate and adopt those practices daily as a preventive measure against COVID-19.

This is consistent with the research conducted by Luviani and Delliani (2020), which demonstrated a correlation between exposure to the Nussa Official animated episode titled "Cuci Tangan Yuk" (Let's Wash Hands) in terms of duration, frequency, and intensity, and the imitative behavior of 4-5-year-old children in North Bekasi City, [25]. These findings align with the social learning theory, suggesting that humans tend to imitate observed behaviors. In this context, the longer children are exposed to content that provides information about handwashing, the more likely their handwashing behavior will increase among 4-5-year-olds in East Bekasi, [25]. Indeed, those findings align with previous research conducted by Sutriyawan et al. (2022). The study showed a correlation between information sources from print media, electronic media, healthcare providers, and formal education with the public's level of knowledge, [26]. The assumption in that study was that the public has more accessible access to electronic media such as television, radio, and the internet, leading to a higher intensity of exposure to informative broadcasts than other sources of information. This has the potential to influence the actions taken by the public themselves.

During the COVID-19 pandemic, the government has utilized social media platforms, including Instagram and YouTube, to disseminate information, socialize preventive measures, and provide guidance related to COVID-19, including WaSH (Water, Sanitation, and Hygiene), [27]. Based on the research findings, a significant relationship was found between the type of content on social media platforms Instagram and YouTube and the implementation of WaSH (Water, Sanitation, and Hygiene) practices during the COVID-19 pandemic among millennials in Southeast Sulawesi Province in 2020. With the dissemination of COVID-19 prevention content from the Indonesian Ministry of Health, many people created content related to COVID-19,

including preventive practices such as WaSH practices like handwashing, mask usage, social distancing, and practicing proper coughing and sneezing etiquette. During the pandemic, they also created simple personal protective equipment (PPE) items, such as tutorials for making hand sanitizers, cloth masks, and others.

Audiovisuals such as videos, animations, and infographics can be used as practical educational tools to convey information about sanitation and hygiene practices required during the COVID-19 pandemic, [28], [29]. Audiovisual materials can visualize steps, such as washing hands properly, cleaning frequently touched surfaces, and maintaining physical distance, [30], [31]. This helps raise public awareness about the importance of these actions.

Audiovisuals can be used as visual reminders of following sanitation and hygiene practices, [32]. For example, digital billboards or video ads in public places can constantly remind people to wash their hands or wear masks. These visual reminders help keep WaSH practices in people's minds daily. In the digital era, audiovisuals can be easily accessed through various online platforms, including social media, websites, and mobile applications, [33], [34]. This allows information on sanitation and hygiene practices to be disseminated more widely and reach different levels of society.

So audiovisual has an essential role in increasing the understanding and adoption of sanitation and hygiene (WASH) practices in the COVID-19 era, [35], [36]. By combining visual elements, education, emotional motivation, and easy access, messages about WaSH can be conveyed and applied more effectively by the public to control the spread of the virus.

The presence of such content on social media platforms like Instagram and YouTube contributes to increasing public awareness and knowledge regarding WaSH practices and COVID-19 prevention measures. These platforms play a crucial role in disseminating information to a broad audience and have the potential to reach and educate a large number of people. By providing informative and engaging content related to WaSH practices and COVID-19 prevention, social media platforms raise awareness, promote knowledge, and encourage individuals to adopt these practices in their daily lives. In this study, most respondents preferred audiovisual content, such as video podcasts, as a source of new knowledge regarding COVID-19 prevention and control. This preference impacts the implementation of WaSH practices by the respondents themselves. These findings are based

on questionnaires filled out by the respondents. The results are consistent with the research conducted by David et al. (2017), which demonstrated a relationship between Vlog content on YouTube and the formation of attitudes among Communication Science students at the Faculty of Social and Political Sciences, Sam Ratulangi University. The proliferation of Vlogs on social media has become a regular source of entertainment for the younger generation. Therefore, this habit can influence the responses and actions taken by young people in dealing with a situation, [37]. It is a fact that there are still many people in society who hold divergent perspectives on COVID-19, indicating a need for more awareness among the public in taking preventive measures against the virus. However, once perceptions are formed and deeply ingrained in society, they can be challenging to change, leading to different thinking patterns. In such cases, the role of the government becomes crucial in helping to correct the existing perceptions related to COVID-19 within the community. The government is vital in providing accurate and reliable information, implementing effective communication strategies, and promoting public awareness campaigns. By disseminating evidence-based information, addressing misconceptions, and emphasizing the importance of preventive measures, the government can actively work to correct and align public perceptions about COVID-19. This can help bridge the gap between divergent perspectives and foster a collective understanding of the virus, ultimately leading to increased adherence to preventive actions within the community, [38].

The research results indicate a significant relationship between the perception of using social media platforms such as Instagram and YouTube and the implementation of WaSH practices (Water, Sanitation, and Hygiene) during the COVID-19 pandemic among millennials in the Southeast Sulawesi Province. Respondents chose to have a perception that is interested in COVID-19 prevention, leading to the emergence of stigma cues to action. These cues direct the respondents to take action according to the information they consider trustworthy and position themselves as individuals who are potentially susceptible to COVID-19. This motivates them to seek COVID-19 prevention content on social media platforms like Instagram and YouTube to be applied daily.

These findings are consistent with a study by Wartiningsih et al. (2020), which demonstrates a relationship between mothers' perceptions of clean and healthy lifestyle behaviors based on the Health Belief Model in Surabaya, [39]. The researchers'

assumption in this context is that cues to action in the study influence perceptions of barriers. In the context of this research, mothers' perceptions generate motivation to take action, such as seeking help for toddlers affected by diarrhea, [39].

COVID-19 became a relatively new topic for Indonesian society in early 2020. Therefore, it's unsurprising that there was an increased interest in obtaining information about COVID-19. Although local TV stations have provided information about COVID-19, their reach is less extensive than social media. Social media has become a platform where information about COVID-19 is disseminated, shared, discussed, and uploaded in videos and so on from worldwide, including directly from the Wuhan community. One example of a viral hashtag and trending topic related to COVID-19 on Instagram in March 2020 was #corona, with a total of 12 million posts, [40].

The use of social media platforms like Instagram and YouTube by millennials in the Southeast Sulawesi Province has influenced the implementation of WaSH (Water, Sanitation, and Hygiene) practices during the COVID-19 pandemic. The interest of individuals in taking positive action leads to positive actions being carried out as well. In WASH practice, individual interest is vital in encouraging positive action. Awareness, education, information, and the impact on health are all factors that influence an individual's motivation, [41], [42]. By understanding that one individual's positive steps can positively affect the community as a whole, we can drive broader changes in WASH practices and ultimately improve people's health and quality of life. In this context, the mentioned positive interest refers to maintaining personal hygiene, practicing regular handwashing, wearing masks correctly, practicing social distancing, and following recommended COVID-19 prevention guidelines. People with a strong interest in acting positively tend to incorporate these WaSH practices into their daily lives. Social media platforms like Instagram and YouTube can serve as sources of information and motivation for positive action. Through these platforms, millennials can access educational content, prevention tips, personal experiences, and inspiration from others who practice WaSH effectively. This can stimulate their motivation and awareness to adopt positive actions related to COVID-19 prevention.

5 Conclusion

Based on the findings of this research, it can be concluded that there is a significant relationship

between the duration of Instagram and YouTube usage and the implementation of WaSH practices during the COVID-19 pandemic among millennials in Southeast Sulawesi Province. Additionally, there is a significant relationship between the type of content on Instagram and YouTube and the implementation of WaSH practices during the COVID-19 pandemic among millennials in Southeast Sulawesi Province. Furthermore, there is a significant relationship between the perception of information on Instagram and YouTube and the implementation of WaSH practices during the COVID-19 pandemic among millennials in Southeast Sulawesi Province. Additionally, there is a significant relationship between the interest in using Instagram and YouTube and the implementation of WaSH practices during the COVID-19 pandemic among millennials in Southeast Sulawesi Province. In this context, social media, particularly Instagram and YouTube, play an essential role during the COVID-19 pandemic to promote health to a broad audience. Besides being entertainment media, social media can be utilized to provide information regarding WaSH practices, including handwashing habits, maintaining physical distance, and proper mask usage. Thus, social media has become an effective tool in delivering health messages and increasing awareness and implementation of WaSH practices among millennials in Southeast Sulawesi Province.

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