



---

---

## **Readiness of Water Sanitation and Hygiene Facilities (WASH) as an Effort to Prevent COVID-19 Transmission in Elementary Schools at Ngaliyan Sub-District, Semarang City**

**Ega Friesa Yudhana<sup>1\*</sup>, Arum Siwiendrayanti<sup>1</sup>**

<sup>1</sup>Public Health Department, Faculty of Sports Science, Semarang State University, Semarang, Indonesia

\*Corresponding Author: Email : [egafriesayudhana@students.unnes.ac.id](mailto:egafriesayudhana@students.unnes.ac.id)

### **Abstract**

**Introduction:** Ngaliyan sub-district on Semarang city has the highest cases of Covid-19 (212 cases) in July 2021. High proportion of them occurred on elementary school-aged children aged 7-12 years. Among other levels of education, this group also has the lowest levels of sanitation. This study aimed to determine the readiness of WASH facilities as an effort to prevent the transmission of COVID-19 in elementary schools at Ngaliyan Sub-District, Semarang City.

**Methods :** This study was a descriptive observational study. Data collection techniques were carried out by observation, on 36 elementary schools in Ngaliyan District (total sampling method). Readiness of Water Sanitation and Hygiene Facilities (WASH) in each school were observed using checklist. Data were classified and compared to the requirements.

**Results:** The results of this study indicate that 100% of primary schools in Ngaliyan sub-district have the readiness of WASH facilities. Of the 36 primary schools, 97% of schools met the requirements for clean water, 64% for the toilet conditions, 14% for the waste disposal and 100% of the waste water disposal system and 67% for the hand washing facilities.

**Conclusion:** In general, WASH facilities in the elementary schools in Ngaliyan Sub district was ready for the transmission of COVID-19 prevention, but some improvements should be done, especially for the waste disposal, toilet conditions and hand washing facilities.

**Keyword:** water sanitation and hygiene facilities, COVID-19, elementary school, clean water, hand washing facilities

Article History: Received: 17<sup>th</sup> February 2022, revised: 30<sup>st</sup> March 2022, accepted: 16<sup>th</sup> April 2022

---

---

### **Introduction**

The outbreak of Coronavirus disease (COVID-19) is an outbreak that is currently the main focus of WHO. Coronaviruses disease (COVID-19) was first discovered in Hubei, China until it spread throughout the world on January 30, 2020. Then, in March 2020, WHO declared a pandemic status of COVID-19.<sup>1</sup> On 3 July 2021, the number of new global

COVID-19 cases increased by 6.32% with an average of 540,000 cases per day.<sup>2</sup> Indonesia was in the third highest position after the United States and Brazil, with 27,233 new cases as of July 3, 2021. There were 295,228 positive cases of COVID-19 recorded. Based on the map distribution of COVID-19 cases in Central Java, this province experienced an increase of 4,666 new cases. In Central Java as of July 3,

2021, there were 27,204 positive cases. The highest increase in the death rate of 93.1% was in Central Java Province. In addition, Semarang City has become a Red Zone or is referred to as a high-risk area in the spread of the COVID-19 virus<sup>3</sup>. Cases in Semarang City as of July 3, 2021, experienced an increase of 1404 cases to 24,051 positive cases of COVID-19 and became the area with the highest death rate nine times.<sup>4</sup> Ngaliyan sub-district was the highest sub-district with 212 cases as of 3 July 2021. Indonesian Ministry of health data on July 3, 2021, showed that there were 250,610 Indonesian children exposed to COVID-19, or 12.6% of the total confirmed child cases. Cases in elementary school-aged children aged 7-12 years dominate the children COVID-19 cases. In Central Java, the number of cases among children aged 7-12 years increased by 9.2% with 3,049 cases being in the third position after DKI Jakarta (5,001) and West Java (4,968).<sup>5</sup> Thus, schools are required to have proper sanitation facilities to stop the spread of COVID-19. Some clusters of cases occurred at schools from March to April 2021 in Bandung (16 students), in Padang Panjang City, West Sumatra (43 students), and in Tasikmalaya (20 students).<sup>6</sup>

In improving the health status of the community, the implementation of basic sanitation is very important.<sup>7</sup> The implementation of health protocols in public places was one of the steps to prevent and control the spread of COVID-19, especially in schools.<sup>8</sup> The worst school sanitation conditions are at the Elementary School level, with a school sanitation index of 25% which means that the sanitation coverage in Indonesian Elementary Schools which includes toilets, physical quality of water, proper waste disposal and liquid waste is only accessed by less than half of the school population.<sup>9</sup> School sanitation is closely related to the occurrence of disease, so if the school environment is not properly sanitized it can cause the spread of disease.<sup>10</sup> Basic sanitation efforts that can be done are the availability of healthy latrines, waste water disposal facilities, clean water, and good waste water management. COVID-19 waste management based on WHO standards

should be applied in Indonesia and is urgently needed to break the chain of COVID-19 transmission in the community.<sup>11</sup> In addition to waste management, good quality water supply can prevent potential sources of contamination.<sup>12</sup> Based on a previous study, there was a correlation between water quality and risk of infectious disease in houses in the slum area.<sup>13</sup> Several risk factors for infectious diseases are originating from poor sanitation. The provision of hand washing facilities through running water and soap or alcohol-based hand sanitizer at several locations in schools had become the main efforts to stop the COVID-19 transmission.<sup>14</sup> In Semarang city, school sanitation readiness had not reached 100%. Only 85.1% of the elementary schools, 92% of the junior high and 91.2% of the high schools, which have met the standard.<sup>15</sup> Thus, elementary school levels had the lowest percentage of the school sanitation readiness.

Based on the theory of H.L. Blum, the environmental factor contributed to the health status of the community by 40%. Therefore, it was necessary to conduct a study to identify whether WASH facilities in all elementary schools in Ngaliyan Sub-District has been ready to prevent indirect COVID-19 transmission. In the previous studies, it has been shown that COVID-19 virus was found in water and human feces.<sup>16</sup> In addition, the COVID-19 virus also spread through the other surrounding objects such as iron, plastic, or aluminum.<sup>16</sup>

Therefore, this study entitled "Readiness of Sanitation and Water Hygiene Facilities (WASH) as an Effort to Prevent COVID-19 Transmission in Elementary Schools at Ngaliyan Sub-District, Semarang City" was conducted. The purpose of this study was to determine the readiness of WASH facilities in the elementary schools, at Ngaliyan Sub-District, Semarang City to prevent Covid-19 Transmission.

## Methods

This descriptive observational study was conducted on November to December 2021. The target population in this study was all of the elementary schools at Ngaliyan Sub-District, Semarang City.

Data collection techniques were carried out by observation using a checklist on WASH facilities on 36 elementary schools in Ngaliyan Sub-District. Total sampling technique was used in this study.

Data were processed using Microsoft Excel program. Then, data were analyzed descriptively. Comparison to the requirements of each facility were also conducted, which then presented in the tables. It is said to be qualified if all of the criteria for each facility were met, and it is said to be not qualified if one or more criteria for each facility were not met. The

WASH facility readiness was categorized into two categories, ready and not ready. Ready if > 50% of the requirements are met, and not ready if ≤50% are met.

## Results

Data collection was carried out through observations of the WASH facilities in the elementary schools. **Table 1** shows the results of the observations after comparing WASH facilities available in the schools to the requirements.

**Table 1. Schools' WASH facility qualification fulfillment**

No.	Facilities	Not qualified (n) / (%)	Qualified (n) / (%)
1.	Clean water	1 / 3%	35 / 97%
2.	Toilet	14 / 39%	22 / 61%
3.	Garbage disposal	31 / 86%	5 / 14%
4.	Waste water disposal	0 / 0%	36 / 100%
5.	Hand washing	12 / 33%	24 / 67%

Based on 50% fulfillment of the requirement, WASH facility readiness as an effort to COVID-19 prevention on the elementary schools in Ngaliyan Sub District

can be seen in **Table 2**. Data obtained from observations in 36 elementary schools, shows that all schools were ready to provide WASH facilities.

**Table 2. WASH facility readiness to prevent Covid-19 transmission**

No.	Category	Total (n)	Percentage (%)
1.	Not Ready	0	0%
2.	Ready	36	100%
	<b>Total</b>	<b>36</b>	<b>100%</b>

## Discussion

The study results showed that for clean water facilities, only one school (3%) could not meet the requirements in terms of physical condition and water quality. During the COVID-19 pandemic, in addition to clean and healthy living behavior, clean water availability is an important thing to prevent the transmission of COVID-19 virus. Clean water is very important to support clean and healthy behavior of the school' community. Clean water is an important element and even considered as the basic need of the community during COVID-19 pandemic.<sup>17</sup> Clean water facilities are one of the WASH facilities needed to meet the daily needs of living things. In the households, clean water is used for drinking, cooking, and for latrines. In addition, clean water is also very

important for the elementary school environment for many activities in schools, such as toilet and hand washing facilities.

Based on the observation, the elementary school that did not meet the requirements was the elementary school that used dug well for their water source. This well had only 1 meter distance between the location of water and pollutant sources, while the requirement is 10 meters. Of the 36 elementary schools studied, 35 elementary schools used clean water sources, from drinking water company. In urban areas, especially in the Ngaliyan sub-district, most of them got clean water supplied from Jatibarang dam in Tegal District. For urban areas with limited land, clean water sources can be used from drinking water company.<sup>18</sup> Because the elementary school has very

limited land to use excavated water sources, the solution that can be done is to use other water sources, for example from drinking water company. By using water from drinking water company, there is no need to worry about the distance to the pollutant source or a long dry season. Drinking water company get their water from river water which is channeled to places that need clean water through technological processing.<sup>18</sup> Another way that can be done for the provision of clean water is by using rainwater sources through utilizing Rainwater Harvesting.<sup>19</sup> Of course, the use of rain water sources must also be controlled, including the tools to process and the place to store.<sup>20</sup> This method is considered quite effective because Ngaliyan Sub-District, Semarang City is an area which has high rainfall level.<sup>21</sup>

For the other water physical parameters such as tasteless, odorless, and colorless, the water available at all schools had met the requirements. Of the 36 elementary schools, 100% of clean water needs are met every day to support school operational activities. Most of the health protocols that have been set by the World Health Organization (WHO) contain recommendations for maintaining cleanliness and health, even during the new normal period. Health protocols recommended by WHO include washing hands with clean water and bathing when returning from traveling. Both activities require clean water in sufficient quantities.<sup>22</sup>

Regarding the toilet facilities, among 36 elementary schools (100%), there were 13 elementary schools (36%) that did not meet the requirements. These schools had dirty and smelly toilets. Dirty toilet schools can cause disease transmission for the school residents, including diarrhea, dengue fever, typhoid, dysentery, and urinary tract infections.<sup>23</sup> This disease is caused by bacteria and viruses that breed in dirty toilet conditions. The other health problems of the toilets were the lack of ventilation and lighting. As Indonesia is a tropical country, the toilets can be very humid if there is no air circulation/ ventilation. Bacteria and fungi will easily breed in toilets that have limited

lighting and ventilation.<sup>24</sup> The elementary schools have toilets that were very closed to the classrooms, teacher's room, library room, and other rooms. For hygienic reasons, the toilets should be in a distance from the other rooms.<sup>25</sup> At the time of observation, there were some elementary schools that have toilet in each classroom. This condition may also easily transmit the diseases to the students. As an effort to prevent the spread of diseases, water reservoir in the toilets must also be free from disease vectors such as mosquito larvae. Among the observed elementary schools, one of them had mosquito larvae on the water reservoir in the toilet. As the toilets were rarely used due to the COVID-19 pandemic, the water reservoirs were neglected and were not cleaned. This condition triggered the mosquito vectors to breed.<sup>26</sup> Toilets in schools are also one of the public toilets that have the potential to spread COVID-19. Transmission does not only come from viruses that stick to the doors and cubicles, but also through splashes of water from flushing toilets. In addition, COVID-19 has the potential to spread through the feces of an infected person. This statement is supported by previous research conducted which showed that the SARS-CoV-2 virus was found in human feces.<sup>16</sup>

All elementary schools in the Ngaliyan Sub-District, Semarang City have trash bins. However, there were 31 elementary schools (86%) that did not meet the requirements, such as the accumulation of garbage. This accumulation of garbage can result in air pollution. There were some schools that did not provide separate trash bins based on their type. The wet garbage placed in the room may results in air pollution.<sup>27</sup> It would interfere the health especially for people with breathing problems. Piling up wet and dry trash can also complicate the job of cleaners. The adequacy of trash bins in schools is judged by the number of rooms in the school. A school will meet the adequacy of trash requirements if each room has at least 1 trash can. From this current study, there were some elementary schools that did not provide at least one trash can in each room. The requirement of

at least one trash can in each room is based on the purpose of waste processing to prevent the environment pollution, as every activity can produce waste.

Some elementary schools had their trash bins without lids. For health reasons, a good trash can must be closed. The lid functions as a barrier to odors from the unpleasant smell of rotting garbage. The unpleasant smell of garbage has the potential to interfere the breathing and can invite disease-causing animals such as flies.<sup>28</sup> The existence of temporary waste collection sites is also required in the school environment. In this study, it was found that most of the elementary schools did not have temporary garbage collection sites. Garbage that is disposed of to the temporary garbage collection sites were placed based on the waste sorting that has been done. This should be done because organic waste decomposes faster than non-organic waste which takes a longer time to decompose.<sup>29</sup> Therefore, schools should provide temporary waste shelters to minimize the accumulation of garbage in every room in the school environment. For temporary waste shelter that is provided in the school environment, they should be equipped with a cover system. This cover is used to prevent disease vectors such as rats, insects, and certain animals to enter and to avoid unpleasant odors from garbage that can disturb the surrounding environment.<sup>30</sup> The available garbage collections should be separated into organic and inorganic waste bins, and when they are full, they are immediately taken and transported by the cleaning staff to be disposed to the temporary waste shelters. Garbage collection aimed to minimize the risk of pollution and the breeding ground for disease vectors such as flies, cockroaches, and rats.<sup>28</sup>

The waste water disposal facilities in all elementary schools studied had met the requirements according to the school sanitation requirements as in the letter of Indonesian Ministry of Health No. 1429/SK/XII/2006. Elementary schools in essence only produce domestic waste that comes from latrine sewers that have been separated between feces and urine, so the waste water is only used washing water.<sup>31</sup>

All of the elementary schools in the Ngaliyan Sub District, Semarang City, have waste water disposal facilities with impervious conditions. The sewerage channel in elementary schools in Ngaliyan Sub-District, Semarang City has been made permanently. At the time of the research, there were no puddles of water found in the school environment even in the rainy season. This means that rainwater flows into the sewerage. Waste water disposal system that meet the requirements can minimize the breeding ground for disease vectors. Waste water disposal system that do not meet the requirements can trigger the occurrence of diseases such as worms in school students.<sup>32</sup>

One of the WASH practices is the practice of washing hands with soap. Hand washing is one of the health protocols required by WHO as a preventive effort in transmitting COVID-19 in every education unit. This study found that there were 12 elementary schools (33%) that did not meet the requirements for hand washing facilities. Hand washing is one of the hygiene behaviors that has a major impact on health. Especially when there is a pandemic condition or the emergence of outbreaks of infectious diseases such as diarrhea, bird flu, intestinal worms, even COVID-19 as is happening nowadays. In accordance with Indonesian Ministry of Health Letter No. 1429/SK/XII/2006, in the school environment, it is mandatory to have hand washing facilities.<sup>33</sup> Among the 12 elementary schools that did not meet the requirements, the problem was the unavailability of hand washing facilities in each class. If the school cannot provide hand washing facilities in front of each class, a solution that can be used is to provide hand washing facilities with a larger size. The other requirement is the hand washing facilities in the canteen must be adequate,<sup>34</sup> because most of the students, visit the canteen for snacks. As an effort to prevent the transmission of COVID-19 cases, the school canteen requires hand washing facilities accompanied by soap and running water so that students can wash their hands before and after eating. It was found in this study that some

elementary schools did not have hand washing facilities in the school canteen. The schools that did not meet the requirements for hand washing facilities, had no disposable tissues/napkins to dry hands. The disposable tissue/napkins to dry hands needs to be provided near the sink or hand washing faucet, because wet hands are easier to transmit pathogens or bacteria.<sup>35</sup> While drying wet hands, pathogens will continue to spread in the air and fill the room. This condition can increase the contamination possibility five to tenfold times than the contamination of clothing. In the previous study, it has been shown that drying hands using disposable tissues/napkins was less likely to spread the source of infection than drying hands using a hand dryer.<sup>36</sup> This is due to the fact that air dryer can create aerosols that are scattered throughout the toilet, including the floor, sink, doorknob, as well as the dryer itself. On the other hand, disposable tissue/napkins limit the movement of the virus.<sup>37</sup>

All of the elementary schools studied in the Ngaliyan Sub-District of Semarang City had ready to provide WASH facilities as an effort to prevent COVID-19 transmission. The WASH facilities studied included clean water facilities, toilets, waste disposal facilities, waste water disposal channels and hand washing facilities. The readiness of safely managed WASH facilities is an important part of preventing and protecting human health during outbreaks of infectious diseases, including the current COVID-19 pandemic.<sup>38</sup> One of the most cost-effective strategies for improving pandemic preparedness, particularly in resource-limited settings, is to invest in core public health infrastructure, including eligible WASH facilities. WASH practice can be achieved if WASH facilities are also fulfilled or supported. In WASH practice, good waste management, which is applied consistently, becomes a barrier to the transmission of the COVID-19 virus from human to human in homes, communities, health care facilities, and other public spaces, especially in the school environment.<sup>39</sup> In addition, frequent and proper hand hygiene is one of the most

important measures that can be used to prevent COVID-19 infection. Therefore, the provision of hand washing facilities and clean water facilities that meet the requirements must be available in the school environment. WASH services should enable more frequent and regular hand hygiene by improving facilities and using proven behavior change techniques.<sup>40</sup>

## Conclusion

Based on this observational study, all of the 36 elementary schools in the Ngaliyan Sub-District of Semarang City were ready to provide WASH facilities as an effort to prevent the transmission of COVID-19. However, some schools still need to improve their toilets, garbage disposal, and hand washing facilities to fulfill the requirements to prevent the spread of COVID-19 disease.

## Acknowledgment

Not applicable

## Funding

None

## Author Contribution

By contributor role an author's statement: EFY is responsible for drafting, as well as wrote the original draft. AS helps in reviewing, and edit of this writing.

## References

1. World Health Organization. Coronaviruses disease. 2020. Available from: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports>
2. World Health Organization. Data Sebaran COVID-19. 2021. Available from: <https://covid19.go.id/>
3. Central Java Province District Level Health Office (Dinas Kesehatan Provinsi Jawa Tengah). Tanggap COVID-19. 2021. Available from: <https://corona.jatengprov.go.id/data>
4. Semarang City District Level Health Office (Dinas Kesehatan Kota Semarang). Informasi Coronavirus (COVID-19) Semarang. 2021.

5. Semarang City District Level Health Office (Dinas Kesehatan kota Semarang). Informasi Corona Viruses (COVID-19) Semarang 2021. Available from: <https://siagacorona.semarangkota.go.id/halaman/covid19>
6. COVID-19 Response Acceleration Task Force (Satuan Tugas Penanganan COVID-19). COVID-19 Dissemination (Sebaran COVID-19). 2021. Available from: <https://covid19.go.id/peta-risiko>
7. World Health Organization, UNICEF. Air, Sanitasi, Higiene, dan Pengelolaan Limbah yang Tepat Dalam Penanganan Wabah COVID-19. World Health Organization. 2020;1–10. Available from: [https://www.who.int/docs/default-source/searo/indonesia/covid19/who-unicef---air-sanitasi-higiene-dan-pengelolaan-limbah-yang-tepat-dalam-penanganan-wabah-covid-19.pdf?sfvrsn=bf12a730\\_2](https://www.who.int/docs/default-source/searo/indonesia/covid19/who-unicef---air-sanitasi-higiene-dan-pengelolaan-limbah-yang-tepat-dalam-penanganan-wabah-covid-19.pdf?sfvrsn=bf12a730_2)
8. Velavan TP, Meyer CG. The COVID-19 epidemic. *Trop Med Int Heal.* 2020;25(3):278–80.
9. Siti S, Sudarwati. Profil Sanitasi Sekolah Tahun 2017. 2017. 76 p. Available from: <http://ditpsd.kemdikbud.go.id/upload/filemanager/2020/04/Profil-Sanitasi-Sekolah-Tahun-2017.pdf>
10. Chadijah S, Sumolang PPF, Veridiana NN. Hubungan Pengetahuan, Perilaku, Dan Sanitasi Lingkungan Dengan Angka Kecacangan Pada Anak Sekolah Dasar Di Kota Palu. *Media Penelit dan Pengemb Kesehat.* 2014;24(1):50–6.
11. Hadi MI, Widiyanti M, Kumalasari MLF, Alamudi MY, Suprayogi D. Management of Sars-Cov-2 Medical Waste Against a Covid19 Pandemic in Indonesia: A Literature Review. *J Kesehat Lingkung.* 2020;12(4):244.
12. Mullane MJ, Thomas HM, Epstein M, Mandzufas J, Mullan N, Whelan A, et al. DETECT Schools Study Protocol: A Prospective Observational Cohort Surveillance Study Investigating the Impact of COVID-19 in Western Australian Schools. *Front Public Heal.* 2021;9:1–10.
13. Ardillah Y, Sari IP, Windusari Y. Association of Environmental Residential Sanitation Factors to Communicable Disease Risk Among Musi Side-River Household in Palembang, Indonesia: A Study of Slum Area. 2020;25(Sicph 2019):159–63.
14. Burhan, Erlina et al. Pedoman tatalaksana COVID-19 Edisi 3 Desember 2020. Pedoman Tatalaksana COVID-19. PDPI, PERKI, PAPDI, PERDATIN, IDAI. 2020. 36–37 p. Available from: <https://www.papdi.or.id/download/983-pedoman-tatalaksana-covid-19-edisi-3-desember-2020>
15. Semarang City District Level Health Office (Dinas Kesehatan kota Semarang). Semarang City Health Profile 2019 (Profil Kesehatan Kota Semarang 2019). *Dinkes Semarang Gold.* 2020;1–104.
16. Frank Esper, Zhen Ou and YTH. Human coronaviruses are uncommon in patients with gastrointestinal illness. 2017;48(2):131–133. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2864800/>
17. Suryani AS. Pembangunan Air Bersih dan Sanitasi saat Pandemi Covid-19 (Clean Water and Sanitation Development during the Covid-19 Pandemic). *J Masal Sos |.* 2020;11(2):2614–5863.
18. Widayat W. Teknologi Pengolahan Air Siap Minum Untuk Daerah Padat Penduduk. *J Air Indones.* 2018;1(2).
19. Fairuz Nadia MAM. Perencanaan Sistem Penampung Air Hujan Sebagai Salah Satu Alternatif Sumber Air Bersih di Rusunawa Penjaringan Sari Surabaya. *Tek ITS.* 2016;5(2). Available from: <http://ejurnal.its.ac.id/index.php/teknik/article/view/19035>
20. Bismo IS. Strategi Perolehan Air Bersih dari Beberapa Kegiatan dan Aktivitas. 2014;(September).
21. Astri Purnama Dewi dan Broto Sunaryo. Analisis Kesesuaian

- Lahan Kawasan Permukiman Bagi Masyarakat Golongan Menengah Ke Atas Di Kecamatan Ngaliyan, Semarang. Tek Perenc Wil Kota. 2013;2(3):434–43.
22. Panirman L, Merisca DW, Candrayadi, Nugroho PB, Samsudin, Nainggolan JS. Manajemen Enam Langkah Cuci Tangan Menurut Ketentuan WHO Sebagai Upaya Pencegahan Covid-19. *Abdi Masy*. 2021;2(2):105–13.
  23. Farisah RA. Hubungan Angka Kejadian Infeksi Saluran Kemih dengan Keadaan Toilet Sekolah pada Anak Usia Sekolah di SD Negeri Cempaka Putih Barat 17 Pagi Jakarta Pusat dan SD Negeri Cikentang Kecamatan Taktakan Kota Serang Ditinjau Menurut Kedokteran Dan Islam. Universitas YARSI. 2017.
  24. Santi Deliani Rahmawati HS. Identifikasi Jamur *Candida albicans* Pada Bak Penampungan Air di Toilet Umum. 2020;3(2017):54–67.
  25. Putri Wijayanti Ika. Studi Kondisi Fisik Dan Sanitasi Sekolah Dasar Negeri Di Wilayah Surabaya Utara Dan Surabaya Barat. *Swara Bhumi*. 2015;2(2):42–7. Available from: <https://jurnalmahasiswa.unesa.ac.id/index.php/swara-bhumi/article/view/11434>
  26. Kinansi RR, Pujiyanti A. Pengaruh Karakteristik Tempat Penampungan Air Terhadap Densitas Larva *Aedes* dan Risiko Penyebaran Demam Berdarah Dengue di Daerah Endemis di Indonesia. *Balaba J Litbang Pengendali Penyakit Bersumber Binatang Banjarnegara*. 2020;1–20.
  27. Kurniaty Y, Nararaya, Bani Haji Wahyu, Turawan, Nabila Ranatasya. Nurmuhamad F. Mengefektifkan Pemisahan Jenis Sampah sebagai Upaya Pengelolaan Sampah Terpadu di Kota Magelang. *Varia Justicia*. 2016;12(1):140.
  28. Nurfitri I. Hubungan Pengelolaan Sampah Rumah Tangga terhadap Daya Tarik Vektor *Musca domestica* (Lalat Rumah) dengan Risiko Diare pada Baduta di Kelurahan Ciputat. *J Kesehat Mandiri I Aktif Stikes Puter Banjar*. 2018;2(1):102–8.
  29. Wahyono S. Pengolahan Sampah Organik dan Aspek Sanitasi. *J Teknol Lingkung*. 2001;2(2):113–8.
  30. Majdi M, Siswandi E, Solehah H, Kukuh L, Diyatna A. Jarak Tempat Pembuangan Sementara (TPS) Sampah dan Tingkat Kepadatan Lalat Di Desa Montong Betok, Kecamatan Montong Gading , Kabupaten Lombok Timur (Distance Of A Temporary Disposal Site Of Waste And Flies Density Level In Montong Betok Village, Monton). *J Sanitasi dan Lingkung*. 2021;2(1):111–20.
  31. Sunarsih, LE. Penanggulangan Limbah. Yogyakarta: Deepublish; 2018. p. 42.
  32. Nur MI, Ane R La, Selomo M. Faktor Risiko Sanitasi Lingkungan Rumah terhadap Kejadian Kecacingan pada Murid Sekolah Dasar pada Pulau Barrang Lompo Kota Makassar (Risk Factors Enviromental Sanitation Of House On Helminthiasis Of Elementary School Students In The Barrang Lompo). Universitas Hasanuddin; 2013.
  33. Dajaan DS, Addo HO, Ojo L, Amegah KE, Loveland F, Bechala BD, et al. Hand washing knowledge and practices among public primary schools in the Kintampo Municipality of Ghana. *Int J Community Med Public Heal*. 2018;5(6):2205.
  34. Supriyatno et al. Gizi Seimbang Dan Kantin / Jajanan Sehat di Sekolah Dasar. Jakarta: Direktorat Jenderal Pendidikan Anak Usia Dini, Pendidikan Dasar dan Pendidikan Menengah Kementerian Pendidikan, Kebudayaan, Riset dan Teknologi; 2021.
  35. Puspita I, Palandeng H, Sinolungan J. The relationship of food handlers' sanitary hygiene practices to the contamination of *Escherichia coli* on traditional gado-gado along the streets of Manado City. Universitas Sam Ratulangi; 2013.
  36. Best E, Parnell P, Couturier J, Barbut F, Le Bozec A, Arnoldo L, et



- al. Environmental contamination by bacteria in hospital washrooms according to hand-drying method: a multi-centre study. *J Hosp Infect.* 2018;100(4):469–75. <https://doi.org/10.1016/j.jhin.2018.07.002>
37. Primadita DS, Kumara INS, Ariastina WG. A Review on Biomass for Electricity Generation in Indonesia. *J Electr Electron Informatics.* 2020;4(1):1.
38. Meilinda, Gustini F. Analisis Fasilitas Sanitasi Dalam Mencegah Penularan Covid-19 di Rumah Sakit X. *J Educ Dev.* 2021;9(4):81–5.
39. Baharuddin NH, Gusnawati G. Penerapan WASH sebagai Langkah Awal Pencegahan Penyakit di Desa Borisallo Kabupaten Gowa. *Idea Pengabdian Masyarakat.* 2021;1(01):9–12. <https://doi.org/10.53690/ipm.v1i1.4>
40. World Health Organization (WHO). WASH (Water, Sanitation & Hygiene) and COVID-19. Brief. 2020. Available from: <https://www.worldbank.org/en/topic/water/brief/wash-water-sanitation-hygiene-and-covid-19>. Accessed 6 Apr 2021.