

Public Health Center and Community, Two Important Elements in New Normal

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ABSTRACT

During the COVID-19 pandemic, stimulate education and awareness of the importance of a healthy lifestyle. Public health centers are at the front line of dealing with health problems, during the COVID-19 pandemic. The role, duties, and functions of the public health center are becoming increasingly important. All handling efforts to subscribe by the public health center require support from community components, one of which is public knowledge, especially regarding the transmission and methods of preventing Covid-19. The purpose of this community service activity is to directly educate the public about the new normal and support the health center in implementing healthy lifestyle. This service activity was designed by visiting the public health centers and counseling the community in Kabupaten Bandung, as well as distributing masks, hand soap, and hand sanitizers. The Public health center and the community appreciate this activity. The community gets knowledge and assistance regarding clean and healthy living habits. Support for these two aspects is expected to be one way to stop the spread of the COVID-19 infection in Bandung Regency.

Keywords : Community, new normal, public health centers

INTRODUCTION

In January 2020, an acute respiratory syndrome was discovered, named coronavirus 2 (SARSCov-2), and has infected seven residents of Wuhan, Hubei province, China.^{1,2} SARS-CoV-2, SARS-Cov, and MERS-Cov caused severe pneumonia with a mortality rate of 2.9% each; 9.6%, and 36%.^{3,4,5} In Indonesia, since March 2, 2020, it was reported that there were 2 confirmed cases of Covid-19. Until March 29, 2020, there was an increase in 1285 confirmed cases in 30 provinces. The five provinces with the highest number of Covid-19 cases are Jakarta (675 cases), West Java (149 cases), Banten (106 cases), East Java (90 cases), and Central Java (63).⁶ This case is increasing very quickly and has spread to many countries, WHO (World Health Organization) states that Covid-19 is a pandemic.⁷

The common characteristics of the Covid-19 infection are acute respiratory disorders such as fever, cough, and shortness of breath. The incubation period for the virus is on average 5-6 days, with a maximum of 14 days. In severe cases, COVID-19 can cause pneumonia, acute respiratory syndrome, kidney failure, and even death. If an X-ray examination is performed, there are spots/infiltrates in both

lungs.^{8,9} Severe and critical clinical symptoms in Covid-19 patients are almost similar to the clinical symptoms shown by SARS and MERS.¹⁰ The Covid-19 virus can spread easily because it is influenced by climatic factors (such as temperature and humidity) and population density.¹¹ Bacterial or fungal infections can be one of the causes of serious complications associated with viral infections, especially in older people who have been infected with the virus. These secondary infections can lead to clinical complications, thus requiring intensive care and may increase mortality.¹² A report related to Covid-19 coinfection showed a 15.2% mortality rate of patients with pneumonia caused by antibiotic-resistant *Staphylococcus aureus* and *Klebsiella pneumoniae*.¹³ The use of effective hand sanitizers can be an important alternative to hand washing and a health protocol to prevent the spread of viral infections and secondary infections, thereby helping to reduce the need for intensive care in hospitals and the use of antibiotics.

With the outbreak of Covid-19, hand sanitizers with alcohol raw materials have become a common alternative to conventional

hand washing in maintaining health and the environment, causing the increasing demand for alcohol-based hand sanitizers.¹⁴ WHO proposes two formulas for producing ABHS (Alcohol-Based Hand Sanitizers). The first formula contains 80% (v/v) ethanol; 0.125% (v/v) hydrogen peroxide; and 1.45% (v/v) glycerol, while the second formula contains 75% (v/v) isopropyl alcohol; 0.125% (v/v) hydrogen peroxide; and 1.45% (v/v) glycerin.¹⁵

West Java ranks second in the number of Covid-19 cases in Indonesia after the capital city of Jakarta, with 149 cases in March 2020. It is increasing over time. The description of the distribution of Covid-19 cases in West Java in terms of the level of alertness, in all districts and cities in West Java.¹⁶ Based on research that has been done previously, the factors that influence the increase in the number of Covid-19 cases that occur in West Java districts, one of which is Bandung district are influenced by poverty.¹⁷

At the beginning of November 2020, the number of Covid-19 cases in the district experienced a more than doubled jump, namely 101-377 cases/week, when compared to the previous month which was around 41-72 cases/week (<https://pikobar.jabarprov.go.id/data> accessed on December 14, 2021). By taking into account the data and facts above, the Community Health Center (Puskesmas) as a first-level health service facility must be ready to face current conditions. Puskesmas is the front line in dealing with health problems, especially during a pandemic. In addition, the public health center has regional areas that can reach all members of the community in its working area.¹⁸

During the pandemic, the role of the public health center becomes increasingly important, by following its duties, functions, and roles. All of these efforts cannot be carried out independently by the public health center but must be supported by the community component. The function of the public health center in preventive and promotive efforts in the case of the rapid spread of covid-19 is experiencing problems because it is influenced by the number of human resources and the service time is very short. Medical personnel devotes a lot of time to their duties at the public health center in the context of handling COVID-19 patients. This causes the performance of the public health center to not reach the target by following the minimum service standards. Based on data on the 2019 Bandung city health profile, states that all health centers in districts/cities in West Java regarding human resources in the health sector have not met the target until 2019.

Based on that background, we as representatives of the community, who are at the university level, have a role in supporting these efforts, one of which is in the community service program, which is an obligation in the tridharma. This service program aims to support the role of the public health center and provide education for community members regarding awareness of clean and healthy living behavior in the context of Adapting to New Habits (IMR).

METHOD

This activity uses a qualitative design, based on case studies, with stages of coordination and discussion, socialization and documentation of healthy lifestyles in the community. The method used is coordination and discussion regarding community compliance related to 3M (wearing masks, washing hands and keeping distance) to the puskesmas, as well as the development of the Covid-19 case and direct socialization to the community and distribution of masks, hand washing soap and hand sanitizers. Data analysis method used is descriptive analysis with problem identification and analysis. The main data to know the description of the community was obtained through coordination and discussion with the puskesmas. coordination and discussion were carried out at several health centers, namely the Sukajadi, Sugih Mukti, Rancabali, Ciwidey, and Pasir Jambu Health Centers. Socialization activities are carried out while still using the health protocol set by the government. At the end of the event, free medical treatment was carried out for the community. This service activity is in collaboration with various parties, namely the Dharma Husada Bandung College of Health Sciences (DHB), Jamaatus Sholihin, and the Social Community (LEGEND)

Service activities are carried out in 2 stages, namely the preparation stage (1) and implementation (2). The preparation stage (December 14-26, 2020) was carried out by analyzing data on the increase in COVID-19 cases through the Pikobar page, to determine service targets and service materials. The targeting is based on the increasing number of COVID-19 infections and the environmental conditions of the community. After determining the location, preparation of service materials was carried out, namely making visual graphic media (posters), presentation materials, procurement of masks, hazmat, hand soap, hand sanitizer, and vitamins. The implementation is carried out in 2 stages, the first stage is carried out on December 29, 2020, by making direct visits by the community

service team to the targeted health centers, having a short conversation with the head of the public health center / who represents him about the real conditions of the community and health workers at the public health center. these, the posting of posters in strategic places, and the delivery of health support equipment and vitamins. The second stage was carried out on March 8 and 9, 2021, in the form of socializing activities for clean and healthy living behavior and free medical treatment for the community, accompanied by the distribution of masks, hand soap, and hand sanitizer.

RESULT AND DISCUSSION

The service team received a good response from the puskesmas when they visited all puskesmas (Figure 1). The results of the brief discussion obtained information that public awareness of the application of 3 M (washing hands, wearing masks, maintaining distance) in the puskesmas environment can be carried out well because every citizen who visits the puskesmas will always be reminded of health workers to carry out health protocols. But outside of the puskesmas environment, many people are not disciplined in carrying out health protocols, especially in the use of masks. For this reason, continuous education for the community is needed. It is hoped that education through posters (Figure 2) and socialization of clean and healthy living behavior can build awareness in the community about the importance of maintaining health.

Universities have a role in the social life of the community, namely, applying scientific theories to answer problems that exist in society, one of which is community service activities. This community service activity targets changes and awareness of new habits in the era of the COVID-19 pandemic, where awareness of healthy lifestyles and self-protection can significantly reduce the transmission rate of the COVID-19 virus. Awareness of a healthy lifestyle in the community cannot be separated from the participation of health workers on duty at the puskesmas, where the puskesmas is the spearhead of health services that have functions, duties, and roles in preventing and controlling the spread of COVID-19.¹⁸

Reducing the transmission rate is one of the goals of the puskesmas, with one of the efforts being the implementation of the New Habit Adaptation (IMR) policy. During the implementation of the IMR, all health workers became an example for the community in implementing the IMR, such as using masks properly and correctly (covering the mouth and nose), getting used to washing hands with

soap, and keeping a distance/avoiding crowds.¹⁶ IMR socialization is a promotive and preventive effort, which must be optimized so that it can help deal with the COVID-19 national disaster by slowing down the incidence of human-to-human transmission.¹⁹

Herdiana (2020)²⁰ stated that there will be efforts from the West Java Provincial Government in synergizing IMR policies at the provincial level with IMR policies at the City and Regency levels. In supporting and supporting this, the service team took a small step in disseminating the IMR to the community in the form of counseling, distributing masks, hand soap, and hand sanitizers, providing support for health workers at the puskesmas in the form of distributing health support equipment and vitamins and submitting media posters for assisting the socialization of IMR in the puskesmas area.

Health workers at the puskesmas are the first to come into contact with COVID-19 patients, both during diagnosis and initial treatment. Body resistance is the main key to being able to continue to perform optimally. Therefore, the body's resistance to health workers must be maintained, one of which is by giving vitamins. Vitamins can be obtained through the intake of nutritious food and drinks, but in a pandemic situation like today, an additional intake of vitamins is needed to survive viral infections. Vitamins containing micronutrients and omega-3 fatty acids are one way to overcome nutritional gaps and support the function of the immune system, to reduce the risk of infection,^{22,23} especially for health workers. Micronutrient mechanisms have a fundamental role in immune function and complement inadequate dietary intake.²³ Additional vitamin intake can be obtained from multivitamin tablets. One of the vitamins needed by the body to maintain the body's resistance to viral attacks is vitamin C.

Vitamin C can significantly reduce the level of infection, which can reduce infection and metabolic needs. Vitamin C plays a role in the body's defenses and supports the cellular function of the innate and adaptive immune systems. Vitamin C supports the epithelial function to block pathogens and enhance preventive activity against oxidative stress. Vitamin C will accumulate in phagocytic cells, such as neutrophils.²²

Vitamins C and E play an important role in antioxidant activity to protect the body from free radicals. Vitamin C can also regenerate antioxidants such as vitamin E and guttation to remain active²⁴ and in apoptotic pathways and the clearance of neutrophils that are destroyed by macrophages at the site of infection.²² The

decline in T cell function can be caused by the production of prostaglandin E2 from macrophages, thereby suppressing T cells. The results of animal testing show that the role of vitamin E can restore this condition, by inhibiting prostaglandins produced by macrophages, so that T cell function can be protected.²⁵ The anti-inflammatory effect can be provided by vitamin C with the mechanism of action of modulating the production of cytokinins so that it can reduce histamine levels, one of the causes of inflammation.²⁶

Regulatory T cells (Tregs) are a subset of T cells that play an important role in inducing and maintaining peripheral tolerance, and therefore have an important role in preventing an exaggerated immune response.²⁷ Vitamin D is a compound that has immunosuppressant

activity²⁸; The inhibition of T and B cell differentiation may be induced by calcitriol²⁵, but the production of calcitriol by DCs "programs" T cells in the epidermis is essential for maintaining long-term immunity. This is in contrast to vitamins C and B12, both of which facilitate the production of T cells, particularly cytotoxic T cells.²⁹ In one case the use of vitamin C 40-110 mg were included in the category of general dietary recommendations.³⁰

Poster media is one way to increase knowledge and remind people of a healthy lifestyle for all people. A study conducted by Lina (2020) stated that efforts to improve people's healthy living behavior can be increased through knowledge about healthy and clean living, especially the habit of washing hands and using masks properly.²¹



Figure 1. Visit to Bandung Regency Health Centers



Figure 2. Socialization Poster

The second phase of service activity is the socialization of healthy living behavior during the COVID-19 pandemic. The socialization activity was carried out in a school building located in Banjarsari Village (Figure 3). The socialization activity was attended by more than 100 people. In the implementation of the socialization, the service team carried out strict health protocols, including maintaining distance, using masks, and washing hands with soap when entering the school area. When washing hands, community members are accompanied by a service team to guide them on how to wash their hands. In this way indirectly, the community is guided to wash their hands properly and correctly. This second phase of activity aims to practice and re-educate the community about healthy lifestyles and strengthen the first phase of activities which are only limited to information through poster media for the community. This second phase of activity also assesses the extent to which the effectiveness of disseminating health information through poster media can be applied by the public. It can be seen that the participants who attended this activity adhered to health protocols, starting with wearing masks

and keeping their distance. It's just that, when washing hands, some participants still don't fully understand how to wash their hands properly, and some don't use soap and just wet their hands, therefore, the service team provides direct guidance to each participant when washing their hands.

The socialization was delivered through lecture and discussion methods. The socialization material begins with providing insight into the pandemic condition in Indonesia, which is increasing every day. In the socialization, the service team explained the causal factors and the role of the community that could be done to prevent transmission, to reduce the infection rate. The core material of socialization is to invite and provide public understanding regarding the application of clean and healthy living behaviors, such as the consumption of a balanced diet, exercise, adequate rest, and the application of the 3 M in daily activities. Socialization and public knowledge increase, especially regarding the current pandemic conditions and provides an understanding of why the government issued the New Habit Adaptation (IMR) program, in the context of handling COVID-19.



Figure 3. Socialization of New Habit Adaptation

In addition to socialization activities, the service team added free consultation health events for the community (Figure 4). Free consultation health is carried out at the same location, implementing health protocols, involving

4 doctors from Jamaatus Sholihin, 8 pharmacists from the Indonesian Pharmacy College (STFI), and nursing students from Sekolah Tinggi Ilmu Kesehatan Dharma Husada Bandung (DHB).



Figure 4. Free consultation health events
infections.^{34,35}

Prevention of transmission and spread in the community can be done by maintaining personal hygiene, one of which is by getting used to washing hands using hand soap or hand sanitizer. Hand soap will damage the viral membrane, where the viral membrane, which is similar to a double-layered micelle, with a hydrophobic tail flanked by a hydrophilic head, which will be dissolved by the presence of soap. The membrane plays an important role in viral defense, with dissolution or destruction of the viral membrane no longer having defense and eventually death.³¹ In a study conducted by Burton et al, it was stated that the use of antiseptic liquid soap had an effectiveness of 82% in reducing the number of germs.

Hand sanitizer is a product with antiseptic content that is intended as a hand sanitizer without the need to rinse with water. This product can be used on the go. This product generally contains 60-90% alcohol. Based on research by Kampf et al, the corona virus can be inactivated by using 62-71% ethanol (alcohol), 0.5% hydrogen peroxide, or 0.1% sodium hypochlorite within one minute.³² One of the working mechanisms of the material that can inactivate the corona virus, namely hydrogen peroxide, is to form H-O bonds from hydrogen peroxide, with thiol groups in proteins, lipids, and nucleic acids. This mechanism prevents the function of proteins and nucleic acids in the virus, thereby inhibiting the viral replication process. The results showed that the alcohol content in the hand sanitizer could inhibit the growth of *Pseudomonas aeruginosa* bacteria with an inhibition zone value of 16 mm.³³ The active ingredient of hand sanitizer other than alcohol, namely benzalkonium chloride based on research, has better antibacterial activity, especially in hospital use, because it can prevent nosocomial

Hand sanitizer is enough used as much as 3 ml is enough to clean and evenly distributed on the surface of the skin of the hands³⁶ then rubbed evenly on the entire surface of the skin.³⁷ Alcohol-based hand sanitizer with a scrubbing time of 30 seconds can reduce various microorganisms on the surface³⁸ Keep in mind that dirt or organic substances cannot be removed by hand sanitizer, so soap and running water are needed to remove dirt from the surface of the skin.

Getting used to maintaining health, one of which is a simple thing, namely routine hand washing, not only can you protect yourself from the dangers of COVID-19 virus infection, but also avoid various diseases that come from microorganisms on your hands. The use of hand soap or hand sanitizer can be used wisely according to the conditions because both have advantages and disadvantages of each.

CONCLUSION

The public health center is the front line in dealing with health problems, especially during a pandemic, where its implementation requires support from various groups in achieving goals. Protection against the risk of infection and health problems is a special concern and at the same time the key to providing excellent service to the community. In addition, to support for health workers, socialization, and providing an understanding of the Adaptation of New Habits (IMR) during the pandemic for the community has a very important role, to provide awareness of the importance of maintaining the health of themselves and other members of the community. Support for these two aspects is expected to be one way to reduce and break

the spread of COVID-19 virus infection in the Bandung Regency area and can increase public awareness about the importance of maintaining personal and environmental sanitation.

REFERENCES

1. Wu F, Zhao S, Yu B, Chen YM, Wang W, Song ZG, et al. A new coronavirus associated with human respiratory disease in China. *Nature*. 2020;579(7798): 265–9.
2. Zhou P, Yang X Lou, Wang XG, Hu B, Zhang L, Zhang W, et al. A pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature* [Internet]. 2020;579(7798):270–3. Available from: <http://dx.doi.org/10.1038/s41586-020-2012-7>
3. Wang C, Horby PW, Hayden FG, Gao GF. A novel coronavirus outbreak of global health concern. *Lancet*. 2020;395(10223):470–3.
4. Hui DSC, Zumla A. Severe Acute Respiratory Syndrome: Historical, Epidemiologic, and Clinical Features. *Infect Dis Clin North Am* [Internet]. 2019;33(4):869–89. Available from: <https://doi.org/10.1016/j.idc.2019.07.001>
5. Azhar EI, Hui DSC, Memish ZA, Drosten C, Zumla A. The Middle East Respiratory Syndrome (MERS). *Infect Dis Clin North Am*. 2019;33(4):891–905.
6. Indonesia KKR. Pedoman Pencegahan dan Pengendalian Corona Virus Disease (Covid-19). 2020;0–115.
7. Cucinotta D, Vanelli M. WHO Declares COVID-19 a Pandemic. *Acta Biomed*. 2020;91(6):157–60.
8. Lofy KH, Wiesman J, Bruce H, Spitters C, Ericson K, Wilkerson S, et al. First Case of 2019 Novel Coronavirus in the United States. *N Engl J Med*. 2020;1–9.
9. Perlman S, Ph D. Edi t o r i a l Another Decade , Another Coronavirus. *N Engl J Med*. 2020;1–2.
10. Wang Y, Wang Y, Chen Y, Qin Q. Unique epidemiological and clinical features of the emerging 2019 novel coronavirus pneumonia (COVID - 19) implicate special control measures. *Med Virol*. 2020;92 (February): 568–76.
11. Dalziel BD, Kissler S, Gog JR, Vibound C, Bjornstad ON, Metcalf CJE, et al. Urbanization and humidity shape the intensity of influenza epidemics in U.S. cities. *Science* (80-). 2018;79(October):75–9.
12. Zhou P, Liu Z, Chen Y, Xiao Y, Huang X, Fan XG. Bacterial and fungal infections in COVID-19 patients: A matter of concern. *Infect Control Hosp Epidemiol*. 2020;41(9):1124–5.
13. Manohar P, Loh B, Nachimuthu R, Hua X, Welburn SC, Leptihn S. Secondary Bacterial Infections in Patients With Viral Pneumonia. *Front Med*. 2020; 7(August): 2013–6.
14. Golin AP, Choi D, Ghahary A. Hand sanitizers: A review of ingredients, mechanisms of action, modes of delivery, and efficacy against coronaviruses. *Am J Infect Control* [Internet]. 2020;48(9):1062–7. Available from: <https://doi.org/10.1016/j.ajic.2020.06.182>
15. Mahmood A, Eqan M, Pervez S, Alghamdi HA, Tabinda AB, Yasar A, et al. COVID-19 and frequent use of hand sanitizers; human health and environmental hazards by exposure pathways. *Sci Total Environ* [Internet]. 2020;742:140561. Available from: <https://doi.org/10.1016/j.scitotenv.2020.140561>
16. Indriyanti D. Implementasi Protokol Kesehatan Pada Petugas Puskesmas Di Masa Pandemi: Studi Kasus Puskesmas Cileungsi Kabupaten Bogor. *Inov Apar*. 2020;2(2):235–46.
17. Mahdy IF. Pemodelan Jumlah Kasus Covid-19 Di Jawa Barat Menggunakan Geographically Weighted Regression. *Semin Nas Off Stat*. 2021;2020(1):138–45.
18. Peraturan Menteri Kesehatan RI No 43. 2019; Available from: https://barnard.edu/sites/default/files/inline/student_user_guide_for_spss.pdf%0Ahttp://www.ibm.com/support%0Ahttp://www.sps.com/sites/dm-book/legacy/ProgDataMgmt_SPSS17.pdf%0Ahttps://www.neps-data.de/Portals/0/WorkingPapers/WP_XLV.pdf%0Ahttp://www2.psy
19. Tursina A dkk. Bunga Rampai Artikel Penyakit Virus Korona (COVID-19). *Kopidpedia* [Internet]. 2020;203–15. Available from: http://repository.unisba.ac.id:8080/xmlui/bitstream/handle/123456789/26743/fulltext_bc_16_feriandi_kopidpedia_fk_p2u_unisba_2020.pdf?sequence=1%0Ahttp://repository.unisba.ac.id
20. Herdiana D. Penanggulangan COVID-19 Tingkat Lokal Melalui Kebijakan Adaptasi Kebiasaan Baru (AKB) di Provinsi Jawa Barat COVID-19 merupakan bantuan sektoral yang tidak penanggulangan COVID-19 telah terjadi. *J Gov Innov*. 2020;2(2):131–56.
21. Anggraeni LD, Daryanti EI. Optimalisasi Perilaku Hidup Bersih dan Sehat Menuju Adaptasi Kebiasaan Baru. *J Kreat Pengabdian Kpd Masy*. 2020;3(02):495–500.

22. Carr AC, Maggini S. Vitamin C and immune function. *Nutrients*. 2017;9(11):1–25.
23. Gombart AF, Pierre A, Maggini S. Editorial: A review of micronutrients and the immune system—Working in harmony to reduce the risk of infection. *Nutrients*. 2021;13(11).
24. Maggini S, Pierre A, Calder PC. Immune function and micronutrient requirements change over the life course. *Nutrients*. 2018;10(10).
25. Wu D, Lewis ED, Pae M, Meydani SN. Nutritional modulation of immune function: Analysis of evidence, mechanisms, and clinical relevance. *Front Immunol*. 2019;10(JAN):1–19.
26. Gao Y-L, Lu B, Zhai J-H, Liu Y-C, Qi H-X, Yao Y, et al. Retracted: The Parenteral Vitamin C Improves Sepsis and Sepsis-Induced Multiple Organ Dysfunction Syndrome via Preventing Cellular Immunosuppression. *Mediators Inflamm*. 2017;
27. Romano M, Fanelli G, Albany CJ, Giganti G, Lombardi G. Past, present, and future of regulatory T cell therapy in transplantation and autoimmunity. *Front Immunol*. 2019;10(JAN).
28. Sassi F, Tamone C, D'amelio P. Vitamin D: Nutrient, hormone, and immunomodulator. *Nutrients*. 2018;10(11):1–14.
29. Wishart K. Increased Micronutrient Requirements during Physiologically Demanding Situations: Review of the Current Evidence. *Vitam Miner*. 2017;06(03).
30. Elste V, Troesch B, Eggersdorfer M, Weber P. Emerging evidence on neutrophil motility supporting its usefulness to define vitamin C intake requirements. *Nutrients*. 2017;9(5):1–16.
31. Nakoe MR, S NA, Mohamad YA. PERBEDAAN EFEKTIVITAS HAND-SANITIZER DENGAN CUCI TANGAN MENGGUNAKAN SABUN SEBAGAI BENTUK PENCEGAHAN COVID-19. *Jambura J*. 2020;2(2).
32. Kampf G, Todt D, Pfaender S, Steinmann E. Persistence of coronaviruses on inanimate surfaces and their inactivation with biocidal agents. *J Hosp Infect [Internet]*. 2020;104(3):246–51. Available from: <https://doi.org/10.1016/j.jhin.2020.01.022>
33. Ahmed K, Ahmed H, Ahmed FA, Ali AA, Akbar J, Rana J, et al. Analysis of anti-microbial and anti-biofilm activity of hand washes and sanitizers against *S. aureus* and *P. aeruginosa*. *J Pak Med Assoc*. 2020;70(1):100–4.
34. Ogilvie BH, Solis-Leal A, Lopez JB, Poole BD, Robison RA, Berges BK. Alcohol-free hand sanitizer and other quaternary ammonium disinfectants quickly and effectively inactivate SARS-CoV-2. *J Hosp Infect [Internet]*. 2021;108:142–5. Available from: <https://doi.org/10.1016/j.jhin.2020.11.023>
35. Bondurant SW, Duley CM, Harbell JW. containing benzalkonium chloride on human skin at 1 , 2 , and 4 hours after application. *AJIC Am J Infect Control [Internet]*. 2019;000:1–5. Available from: <https://doi.org/10.1016/j.ajic.2019.01.004>
36. Greenaway RE, Ormandy K, Fellows C, Hollowood T. Impact of hand sanitizer format (gel/foam/liquid) and dose amount on its sensory properties and acceptability for improving hand hygiene compliance. *J Hosp Infect [Internet]*. 2018;100(2):195–201. Available from: <https://doi.org/10.1016/j.jhin.2018.07.011>
37. Weinstein a, Editor S, Widmer AF. Replace Hand Washing with Use of a Waterless Alcohol Hand Rub ? *Clin Infect Dis*. 2000;31:136–43.
38. Singh P, Potlia I, Malhotra S, Dubey H, Chauhan H. Hand Sanitizer an Alternative to Hand Washing—A Review of Literature. *J Adv Oral Res*. 2020;11(2):137–42.